REM WORKING PAPER SERIES

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REM Working Paper 047-2018

August 2018

REM – Research in Economics and Mathematics
Rua Miguel Lúpi 20,
1249-078 Lisboa,
Portugal

ISSN 2184-108X

Fiscal Multipliers in the Eurozone: A SVAR Analysis*

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2018

Abstract

We compute the value of fiscal multipliers (for government primary expenditure, Income and wealth taxes and for Production and import ones) in the Eurozone countries since the creation of the currency union (2001Q1-2016Q4), and to understand how the values may vary according to the public debt level, the rhythm of economic growth and the output gap. Imposing quarterly fiscal shocks in the period 2000-2016, the results shown that the government expenditure had a positive effect on output, with an annual accumulated multiplier of 0.64 while the tax multipliers presented negative signs - the Income and wealth and the Production and import taxes stood at -0.10 and -0.32, respectively. Furthermore, the multipliers shown higher values for countries with higher levels of public debt (to small levels, the expenditure multiplier is close to zero and the tax multipliers seem to have positive signs), during recessions, and in countries with positive output gaps.

Keywords: Fiscal multiplier, Structural VAR, Fiscal policy
JEL Codes: B22; E62; H62; H63

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1. Introduction

According to the definition given by Spilimbergo et al. (2009), the fiscal multipliers (or Keynesian's multipliers) can be defined as the ratio of a change in output to a unitary exogenous change in the fiscal balance, which could be driven by a change in government expenditure or tax revenue. This effect assumes that, according to the Keynesian theory, an increase in fiscal balance stimulates the level of domestic consumption, GDP and the State's revenue, generating a cyclical dynamic. In turn, given an improvement in the budget balance, a recessive impact on economic activity might be expected.

In Brinca et al. (2016), is explained that the last Great Recession has brought the multipliers behave and, consequently, the effectiveness of fiscal policy, and its variation depending on the time and space factors, into debate in the economic research literature. When the crisis emerged, many countries took expansionist fiscal measures to stimulate their economies, hoping to generate impacts on demand and limiting job losses (Born et al., 2013; Zubairy, 2010). Nevertheless, the impact of the crisis on the multiplier's values seemed to be uncertain, especially on the relative stabilizing effects provided by the variation on government spending and tax cuts (Ilzetzki et al., 2011; Zubairy, 2010; Spilimbergo et al., 2009). Firstly, the uncertainty and mistrust in the economy appears to have increased precautionary savings, reducing the marginal propensity to consume and consequently, the size of multipliers. However, in the opposite side, the deleveraging process increased the number of liquidity-constrained agents and the accommodative behave of monetary institutions (with the short rates close to zero) which may have a positive impact on multipliers. Thus, without clear stabilizing effects, when the financial crises became a sovereign debt crisis, there was a shift from expansionary policies to austerity ones.

According to the traditional analysis based on Mundell-Fleming model, the fiscal multiplier is predicted to be close to zero in economies with floating exchange rates (government spending would generate pressure on interest rates, diminishing the net exports due to the currency appreciation and the increase of money demand, and offsetting the government spending effect), but larger in economies which are part of a currency union. Furthermore, the EMU countries were subjected to large fiscal adjustments, where the magnitude of the fiscal multipliers deserves a special attention (Born et al., 2013). Because of those reasons, the following research will be focus in the Eurozone countries since the creation of the currency union.

This paper is organized as follows. Section 2 is the literature review. Section 3 presents the methodology and the data. Section 4 reports the empirical analysis. Section 5 concludes.

2. Literature

2.1. Theoretical Perspectives

In Samuelson and Nordhaus (2010), the fiscal policy is described as a set of decisions or rules related to taxes, to government expenditure, and to the allocation of resources' decision concerning the public and private sector, in order to influence people's incomes and consumption, and provide incentives for economic decisions. However, the need of State intervention in the economic activity is not consensual. There are three core schools of thought concerning the budget deficits -the Neoclassical, the Keynesian and the Ricardian-, which will be briefly presented in the following sub-sections.

2.1.1. Neoclassical Perspective

The Neoclassical perspective assumes that economic agents will plan their consumption level over their life cycle, where fiscal deficits might change their projections, shifting costs to future generations. This theory is based on three central features: i) the consumption level must be determined through an individual intertemporal optimization problem, from where should be generated a market's interest rate; ii) agents have finite lifespans; and iii) market clearing is assumed in all periods (Bernheim, 1989).

In this context, as argued in Bernheim (1989), a positive consumption shock is expected to lead to a decrease in savings, an interest rate's stimulus, and consequently, to crowding out private capital accumulation. Moreover, according to Diamond (1965), the accumulation of public debt might depress the capital-labor ratio, since the rise of interest rates will stimulate additional savings and inhibit new investments.

Diamond (1965) also defends that the effect of temporary deficits on the economic activity is expected to be small and perverse, changing the agent's decisions. Since households plan their consumption level in a long-term horizon, a marginal increment on their wealth level is supposed to generate a limited impact on current consumption. If the fiscal stimulus were generated through a tax decrease, the result is expected (by the

author) to be close to its counterfactual, where a decrease in capital tax level would stimulate savings (due to a higher rate of return), and a decrease in labor income might induce an intertemporal substitution, leading to the same result (stimulates savings).

Also, Neoclassicists tends to focus on a cumulative deficit impact over a temporal interval rather than a year-on-year approach, defending that with a lower permanent deficit, is possible to achieve the same degree of stabilization of countercyclical fiscal policies (which intends to manipulate temporary shock to stabilize fluctuations around the full employment equilibrium), gravitating toward an equilibrium without accumulate high levels of public debt (Bernheim, 1989).

2.1.2. Keynesian Perspective

In the Keynesian perspective, is assumed that a share of economic resources is unemployed, and that a certain fraction of the population is liquidity constraint or economically myopic. Then, since that this kind of agents are expected to have a higher propensity to consume, a change on their income or taxes should have a significant impact on aggregate demand, leading consequently to second round effects: the so-called Keynesian multipliers. As those policies stimulates both national consumption and income, would not be perceived a hypothetical effect on savings neither on capital accumulation (Bernheim, 1989). Following this perspective, the size of government spending should vary over the business cycle, being more needed and effective during recessions than expansions, enhancing the need of policy activism to stimulate output during a deep recession. (Auerbach and Gorodnichenko, 2012).

As demonstrated in the Hicks-Hansen model (IS-LM), expansionist fiscal policies raise the demand for money, which may request a synchronization with monetary policymakers. If the money supply is flexible, the maintenance of interest rates might avoid an offset of fiscal multipliers. In addition, that intuition caused by interest rates doesn't seems to be so linear, since some authors supported the existence of a crowding-in effect on private investment provided by public ones, through the positive impact of public infrastructures on private investment productivity (Argimón et al, 1997).

However, the Neoclassicals economists appears to be very critics about this perspective, neglecting the importance of fiscal policy to mitigate market failures. As argued in Lucas (1973), government policies just use to make up market failures (as the unemployment), despite the effects of those troubles will remain fixed. In addition, they are sceptics about

the possibility that policy makers would apply contractionary measures, to promote counter-cyclical policies in order to mitigate cyclical fluctuations. Otherwise, once close to full employment, real deficits will crowd out private expenditure and inflationary pressures will emerge (Bernheim, 1989).

As argued by Blanchard and Perotti (2002), the neoclassical theory differs from the Keynesian one mainly in what concerns to government spending, since in several occasions, private consumption and GDP increased simultaneously with a decrease in government spending (non-Keynesian effects of fiscal policy). Whilst in the neoclassical model, a shock in government spending can raise private investment only if the shock is sufficiently persistent and taxes are sufficiently non-distortionary (the investment may fall otherwise), in a Keynesian model, investment increases if the accelerator effect prevails, and falls if the effect of a higher interest rate prevails.

2.1.3. Ricardian Perspective

Finally, as argued by Bernheim (1989), the Ricardian theory defends the existence of an inter-generational altruistic transfer system, where the consumption level is determined according to agent's resources and his descendants (dynastic resources function). This perspective predicts that fiscal deficits just shift its payment to future generations, and households will increase their savings, to match the present discounted values of future taxes and expenditures, avoiding effects to their children. Thus, the fiscal shock will have no real effects in economic activity.

However, this theory isn't so imminent in the economic literature, since it's based on strong assumptions, as: i) generations are linked through altruistic behaves; ii) consumers are rational and provident; iii) taxes are non-distortionary; iv) capital markets are perfect; v) there is no redistribution among families; and vi) government expenditure isn't able to generate value. Moreover, the amounts of transfers may depend on economic growth, the ratio of parents to children and the ratio of their wealth may vary across the population, and the agents doesn't know about their future income, what shows a lack of quantitative and empirical analysis regarding this perspective.

2.2. Fiscal Multipliers

2.2.1. Transmission Channels

In Brinca et al. (2016) it is shown that one of the main transmission channel between the fiscal policy and the economic activity, and consequently an important determinant of the value of fiscal multipliers, is the level of liquidity-constrained agents in the economy. When the constraints are higher, the marginal propensity to consume will increase making the magnitude of the fiscal multiplier also higher. In addition, high interest rates, increasing the net present value of the fiscal shock, may also be a liquidity factor that boost the value of multipliers.

Regarding the tax policy, Zubairy (2010) demonstrated that a decrease of 1 p.p. on labor taxes increases the output, the number of hours worked, the consumption and investment level. There is also a positive wealth effect generated by consumption, with an intra-temporal substitution effect leading consume and labor to rise due to the higher return of labor. The investment level is expected to increase due to the rise on capital return and its effects on labor supply.

If the decrease is on capital taxes, that would also result in more hours worked and a wage's rise. The after-tax return on capital might goes up, increasing the investment, and the intertemporal substitution would lead to a delay in consumption and to a raise in labor supply. The effect on consumption and labor on the equilibrium is not linear because soon the labor tax revenue will increase to pay the deficit incurred (Zubairy, 2010).

About the progressivity of the tax system, the reduction of wage inequality (as variation in permanent ability) appears to have a limited impact on the value of the multiplier, which, given the relevance of the fiscal system to the inequality of an economy, may raise doubts about its effectiveness. According to Brinca et al. (2016), a more progressive system may reduce the multiplier by reducing restrictions on credit, but it may also increase its value through a lower holding of assets and its impact on interest rates (less savings leads to higher interests). According to their results, countries with high wealth inequality have a significant positive response to an increase in government spending with a delay of two years, in opposite of what occurs in the more equal countries. In addition, the results also showed that the impact of fiscal measures sharply increases in response to a decrease in the capital / output ratio. They defend that when the tax levels

go up, the economy becomes poorer, with less capital, the interest rate increase and the wage rate decrease.

On the expenditure side, given an increase on public spending, the increase in demand will give to firms an incentive to reduce their markups to hook larger customer bases (Zubairy, 2010). This shift on markups might increase the labor demand, the wages and the output. Higher wages may lead the households to substitute leisure for consumption, offsetting the negative impact on wealth. In addition, there would be an expected increase on interest rate, and the intertemporal substitution effect (which have a negative impact on consumption) is supposed to be too small to decrease the consumption level. However, in a situation when the government spending is financed by lump-sum taxes, households would face a decreasing on wealth that consequently will generate an impact on consumption and in the number of hours worked.

According to Barrel et al (2012), one of the most affective aspects related to fiscal multipliers is the role of expectations. For example, government spending shocks use to generate pure sentiment effects, providing a stimulus for future changes in output (Auerbach and Gorodnichenko, 2012). Those kind of reactions affects the long-run interest rates, prices, exchange rates, salaries and inflation. Barrel's et al (2012) article points to a higher size of multipliers when the consumers are myopic. If consumers are forward looking, they will react to the expected values of future wealth. Then, they expect lower taxes in the future, making the consumption level higher than otherwise. If myopia premium shrinks to zero, the model comes close to a fully Ricardian model.

As argued by Zubairy (2010), the monetary policy is also crucial to determining the movements of interest rates, which plays a role in how the economy react to fiscal shocks. A higher nominal interest rate increases the spending and capital tax multipliers while the labor tax multiplier falls. The first two multiplier's cases can be explained since a higher value on nominal interest rate means that the monetary policy makers increased their real rates less rapidly, increasing the expansionary effects of fiscal measures. Although the inflation has a limited response to fiscal shock, if it increases, the largest effect occurs on labor tax multiplier with a negative sign. Labor tax cut lead households to increase labor supply, generating a fall in wages and lower marginal costs results in a fall in inflation.

Also, the fiscal expansions would be stronger if the monetary conditions were accommodative, i.e., if the nominal interest rate does not increase with a fiscal expansion

(not generating a crowding out of investment and consumption); if the exchange rate is fixed; and if the county's fiscal position after the stimulus is sustainable, where it will reduce the effects that the higher debt has on interest rates (Spilimbergo et al, 2009).

2.2.2. Determinants of Fiscal Multipliers

As defended by many authors (e.g. Zubairy, 2010 and Boussard et al, 2012), there is a nonlinearity of multipliers facing different types of measures, conditions and according their funding source. According to Boussard et al (2012), the main factors affecting the multipliers can be grouped as: i) Factors that lead households to base their consumption level on the current income (financial frictions); ii) the nature of the fiscal shock (credibility and duration); iii) composition of the fiscal shock; iv) structural features of each economy; v) monetary policies; and vi) exchange rate regime and the openness of the economy.

Ilzetski *et al* (2011), assessing the determinants of the value of fiscal multipliers, both in high-income and developing countries, realized that the value depends on the level of development of each country, where developing countries use to have higher multipliers than high-income ones, although negative at first moment and with a less persistent effect. About their debt level, the result showed that with a range of sovereign debts over 60 % GDP, the multipliers became no statistically different from zero, and the fiscal stimulus may have a negative impact on the long-run output.

According to the literature, the action of fiscal multipliers is larger if leakages are few (i.e., the stimulus generates less changes in savings or spent on imports). In addition to the liquidity constrains and wealth inequality issues, Spilimbergo et al (2009) also argued that the multipliers are maximized if the households have non-Ricardian behaviors, if the propensity to import is small (related to the dimension and openness of each economy), if the automatic stabilizers are small, and if the output gap is large, although when the unemployment is very low, the fiscal policy has limited overall effects.

The openness level also plays a role, where closed economies have long-run multipliers over the unity, while open economies can have negative multipliers on the short and long run. There are two reasons behind that: because a county with a low trade level may has high tariffs or barriers to trade, or because his economy is too large, despite his eventually high level of trade (the openness level is a relative indicator). Both factors may affect the magnitude of the multiplier independently (Ilzetski et al, 2011) because according to

Barrel et al (2012), the shock use to sped into other economies through trade market, where the degree of dependence of consumption on current income, and the speed of response (labor market flexibility) are crucial factors. Nevertheless, regarding the exchange rate regime, the capital mobility may accommodate the exchange rate in order to maintain the rate in parity. Also, an open economy uses to have smaller expending multipliers than tax-based because it cannot adjust the exchange rate. Thus, the higher the degree of openness of an economy, the lower multiplier is expected (Boussard et al, 2012).

According to Ilzetski et al (2011), countries under predetermined exchange rate regimes use to have long-run multipliers higher than 1 (note that under currency union, if the private demand rises along with the public demand, assuming that the net exports will remain unchanged, the multiplier will exceed the unity (Born et al, 2013)). Under flexible exchange rate, the multipliers are close to zero. The differences between responses to fiscal shocks are related with the degree of monetary accommodation. The results are consistent with the Mundell-Fleming model, and its results about the efficacy of fiscal policy. In Zubairy (2010) is argued that responses of monetary policy makers to shift the output from the steady state are important to determining movements on interest rates, which limits the impact of spending shocks. An accommodative policy is powerful to increase the impact of this kind of shock, however, less responsive monetary policy does not imply a larger simulative effect with all types of measures, where the case of labor tax cuts may be an example of the opposite.

On monetary policy rules and speed of action, Barrel et al (2012) studied the differences between when there is a monetary action in the first year, and the scenario where the interest rate is fixed in the first year. A faster response will reduce the fiscal multiplier in the first three years but raises the values in the subsequent ones. They also compare different monetary rules (two-pillar, price level target and Taylor rule), where Taylor multipliers are higher than price level ones, and both are higher than the two-pillar. Finally, they realized that at the zero lower bound, interest rates cannot fall, and then the output might fall 0.1 p.p. more than in the counterfactual scenario.

In Barrel et al (2012) it could be also found a 40-55% correlation (positive) between the country size and the multipliers, once a large economy is less open to imports than smaller economies in spite of the bigger impact on interest rates.

About the persistence of the measures, while temporary reductions in income taxes decrease the mistrust about the fiscal sustainability, with impact on risk premium (but use to have a small effect on consumption - forward looking perspective), temporary measures that trigger intertemporal reallocation (e.g. decrease on investment tax credits for firms), can have powerful effects. In addition, permanent measures generate higher multipliers than temporary ones when focused on income, while the reverse is truth when the measures are focused on prices (Spilimbergo et al, 2009). Overall, permanent multipliers are smaller than temporary ones, as they have a higher impact on long-term rates, generating consequently an increase in asset prices and investment (Barrel et al, 2012).

Auerbach and Gorodnichenko (2012) points the difference of the values between an expansion and a recession. The result predicts a bigger multiplier in recession (close to two) than in an expansion (close to zero). It can be justified arguing that the value of the multiplier may be higher because the government spending might be simultaneous with the economic recovery. In addition, the impact of government spending on total employment seems to be higher during recessions (particularly in private sector employment). However, the expenditure shock might stimulate inflation during expansions and generate deflationary responses during recessions.

Measuring the rigidity of labor market (using an index of protection of labor relations and another for labor market regulation), Auerbach and Gorodnichenko (2012) found that output responses during recessions increases when the rigidity in labor market is higher, which is consistent with the view that labor rigidity enhances the effectiveness of fiscal policy during recessions.

Corroborating with those perspectives, Riera-Crichtion et al (2014) studying OECD countries, argued that while in recessions the spending multiplier is 0.73, during expansions the value stands in 0.09 (and not significantly different from zero). Under countercyclical policies, during a boom the value is smaller because the reduction in government spending is offset by increases in consumption and net exports, and it would reduce inflationary pressures. On the other hand, in a recession, it has a positive and statistically significant effect on output, once there would be an increase in consumption and investment since net exports and inflation tend to decrease (consistent with the Keynesian theory).

However, Riera-Crichtion et al (2014) also realized that in many cases (44%) is observed pro-cyclical policy measures (related to public expenditure) rather than countercyclical ones. Since the economic response does not seem to be symmetric for both types of policies, the authors found evidences that in recessionary periods, the log-run fiscal multiplier can achieve the value of 2.3. Thus, computing the value of multipliers depending on the phase of business cycle and the type of policy adopted, they found that when there is a: i) decrease in government spending during an expansion: the multiplier is not different from zero at any horizon; ii) increase in government spending during an expansion: the multiplier is 1.13 (1.25 after 2 years); iii) decrease in government spending in a recession: 0.76; and iv) increase in government spending during a recession: 0.68 (2.28 after 2 years).

More than the orientation of fiscal policy, the value of fiscal multipliers also depends on the relation between the fiscal mechanism used and the reaction of the private sector. In this context, there seems to exist in the literature a crowding-in/crowding-out pattern effect of government spending and taxation. Blanchard and Perotti (2002) argued that private consumption is crowded out by taxation, and crowded in by government spending, which is difficult to reconcile with a neoclassical model and is consistent with a Keynesian model. On the opposite side, private investment is crowd out by both government spending and taxation, which implies a strong negative effect on private investment of a fiscal expansion, which is consistent with a neoclassical model. The root of this difference is based on the responses of investment to an increase on expenditure, which depends on the relative strength of the effects preceded from an increase both in output and interest rate, although in either theories increases in spending and taxes have opposite effects on investment. In Boussard et al (2012) it's argued that fiscal shocks lead to crowding-out effects (due to the interest rates) and to a fiscal multiplier above 1, but if the stimulus is large enough, the multiplier can be close to 1, since the marginal product of capital and the investment compensates the decrease on consumption.

The choose between government spending or tax cuts was studied by Barrel et al (2012) that said that multipliers generated by income taxes and benefit adjustments are small, since it may be offset by a temporary change in savings rate. The opposite occurs in spending cuts, where might be expected an impact on unemployment and on goods and services bought. Also, in Boussard et al (2012), is argued that usually, short-term multipliers are higher for expenditure shocks than for tax shocks, and because of that, is

argued that there is a fundamental trade-off between short-run pain and long-term gain. That issue can be increased by price rigidities, once firms can easily respond to shocks in aggregate demand by changing the output than changing the prices.

The importance of the monetary policy managing the reaction of interest rates is shown in Leeper et al (2011) where the expected inflation in the Taylor Rule can explain about 10% of impact multipliers. The Keynesian liquidity trap can be crucial, once if the nominal interest rates remains at zero lower bound, it should increase the spending multiplier to values well above 1.

The financial market development has an ambiguous effect on multipliers, depending on his effects on the level of liquidity constraints and the government's fiscal ability to finance his deficits (Spilimbergo et al, 2009), and the financial sector stress seems to have an insignificant effect (Blanchard and Leigh, 2013).

2.2.3. The Value of Fiscal Multipliers

In this sub-section we present a summary table of some of the principal literature contributions regarding the value of fiscal multipliers, both in short and long term, showing the differences of results depending on the methodology applied, the sample used, that type and signal of the shock, and other specific characteristics above discussed.

Table 1 – Multiplier's values in the literature

Article	Sample	Period	Method	Shock	Signal	Control Factor	Impact Multiplier	Cumulative Multiplier
Riera-Crichton, Vegh and Vuletin (2014)	OECD	1986-2008	LSDV (linear local projections)	Government Expenditure	:	:	0.31	0.40
					:	Expansion	0.09	0.09
					:	Recession	0.73	1.25
					:	Extreme Expansion	≈0	≈0
					:	Extreme Recession	1.25	2.08
					+	:	0.49	1.36
					-	:	≈0	≈0
					+	Expansion	1.13	1.25
					-	Expansion	≈0	≈0
					+	Recession	0.68	2.28
					-	Recession	0.76	0.79
Auerbach and Gorodnichenko (2012)	OECD	1985-2008	SVAR	Government Expenditure	+	:	:	0.31
			Direct Projections		+	:	:	0.46
			Direct Projections (FE)		+	Expansion	:	-0.20
			Direct Projections (FE)		+	Recession	:	0.46
Barrel et al (2012)	OECD	2010-2012	NiGEM	Government Consumption	-	Temporary Innovations	-0.63	:
				Indirect Taxes	+	Temporary Innovations	-0,09	:
				Direct Taxes	+	Temporary Innovations	-0,14	:
				Government Consumption	-	Permanent Consolidation	-0,58	:
				Indirect Taxes	+	Permanent Consolidation	-0,08	:
				Direct Taxes	+	Permanent Consolidation	-0,12	:
Born, Jüben and Müller (2012)	OECD	1985-2011	SVAR	Government Expenditure	+	Fixed Exchange Rate	1.25	1.00
					+	Floating Exchange Rate	0.45	0.55
Ilzetzki et al (2011)	20 High-income 24 Developing	1960-2007	SVAR	Government Expenditure	+	High-Income	0.37	0.80
					+	Developing	-0.21	0.18
					+	Predetermined Exchange Rate	0.09	1.50
					+	Flexible Exhange Rate	-0.30	≈0
					+	Open Econ.	0.02	1.29
					+	Closed Econ.	-0.28	-0.75
					+	High Debt	≈0	-2.30
				Government Investment	+	High-Income	0.41	1.15
					+	Developing	0.57	0.75
Zubairy (2010)	USA	1958-2008	DSGE	Government Expenditure	+	:	1.12	0.85
				Labor Tax	-	:	0.13	0.34
				Capital Tax	-	:	0.33	0.36
Blanchard and Perotti (2002)	USA	1960-1997	SVAR	Government Expenditure	+	:	0.84	1.29
				Taxes	+	:	-0.69	-0.78

3. Methodology and Data

As argued by Blanchard and Perotti (2002), the VAR approach may be one of the best-suited methods for the study of fiscal policy (contrary to monetary policy), for two reasons. First, fiscal variables move for several causes, including many exogenous (with respect to output) fiscal shocks. Second, decision and implementation lags in fiscal policy imply that, at high enough frequency, there is a little or no discretionary response of fiscal policy to unexpected contemporaneous movements in activity.

In order to assess the value of the multipliers from a shock in primary government expenditure and in tax revenue, distinguishing the taxes on Income and wealth and on Production and imports. All variables are presented in real terms, per capita, logarithms and, in exception to GDP, the variables are presented in differences to respect the unit root test. The estimation of the fiscal multiplier was based on the reduced-form VAR model with 4 lags (which verifies the stability condition):

$$\mathrm{A(L)}Y_t = u_t. \tag{1}$$

Here, Y_t denotes a vector containing the output and the fiscal variables, A(L) is an autoregressive lag polynomial and u_t represents a correlated error term. Then, the structural uncorrelated shocks ε_t were computed.

Thus, a SVAR model was designed using a recursive identification based on the Cholesky decomposition of the variance-covariance matrix of the reduced-form VAR shocks. Following this matrix, the first ordered shock would not react contemporaneously to any shocks in the system. The second one reacts only to the first shock, and so on. The four-variable VAR model equation has the following form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ \alpha_{yg} & 1 & 0 & 0 \\ \alpha_{iTg} & \alpha_{iTy} & 1 & 0 \\ \alpha_{pTg} & \alpha_{pTy} & \alpha_{pTiT} & 1 \end{bmatrix} \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^{iT} \\ u_t^{pT} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_t^g \\ \varepsilon_t^y \\ \varepsilon_t^{iT} \\ \varepsilon_t^{pT} \end{bmatrix}, \tag{2}$$

where g denotes the government expenditures, *y* the output, *iT* is the Income and wealth taxes revenue, and *pT* the tax revenue on Production and imports. Hence, the multiplier is given by $\frac{\sum_0^{t+3} \Delta y_t}{\sum_0^t \Delta (g/iT/pT)_t}$.

Thus, imposing a set of quarterly exogenous shocks (1 s.d. innovation) and assessing the response of GDP, the fiscal multiplier will be computed as an accumulated change in output to a quarterly variation in the fiscal variable.

4. Estimation and Results

We used four different country sample settings in the estimations to assess the value of the fiscal multipliers, and to understand how they may vary according to specific factors. In the baseline estimation, for the period 2001Q1-2016Q4, the sample is composed by Eurozone countries (EA19) with a dummy variable to exclude the countries while they were out of the EMU. In a second stage, a dummy for high levels of public debt will be included, with a threshold of 60% of GDP, to split the countries with amounts under and above this value. The third one will be focus on the GDP growth, in order to perceive how the multipliers might vary depending if the countries are in expansions or in recessions. For simplification, it was considered the annual growth (equal in all quarters of each year) and the recessions was understood as an annual decrease in GDP. Finally, in a last estimation, it will be added a dummy for the output gap (gap between the current GDP and the potential GDP – annual data from AMECO), differentiating countries with an output gap under and above their potential GDP.

The graphical representations of the impulse response functions are presented in the Appendix.

4.1. Baseline Estimation

Table 2 – Multiplier's estimation of the baseline sample

Fiscal Multipliers: +1 s.d. innovation shock			SVAR 4 lags
Variable	Characteristic	Period (quarters)	Multiplier
Primary Expenditure	:	4	0.64
Primary Expenditure	:	8	1.10
Income and Wealth Taxes	:	4	-0.10
Income and Wealth Taxes	:	8	-0.31
Production and Imports Taxes	:	4	-0.32
Production and Imports Taxes	:	8	-0.24

According to the results, the value of the primary expenditure (accumulated) multiplier is 0.64 facing a quarterly shock, in the EA19 between 2000 and 2016. In other words, in

response to a quarterly exogenous +1% shock in primary expenditure, the GDP is expected to increase 0.64% at the end of the first year (4 quarters). Moreover, the value is predicted to increase to 1.10 at the end of the second year.

An 1% increase in the Income and wealth taxes' revenue is supposed to have a recessionary impact on GDP of 0.10%, reaching 0.31% over 8 quarters.

Regarding an increase in Production and imports taxes revenue, the multiplier is expected to be -0.32, but contrary to the remaining shocks, will decrease its value at the end of the second year (-0.24).

One can also observe that primary expenditure has higher values for multipliers than taxes, showing a stronger impact on GDP, and appearing to be a more effective tool to deal with the business cycle. That could be explained by i) the direct impact on demand that an expenditure shock would generate, while a tax shock would be accommodated by a (lower than 1) price-demand elasticity, and ii) following the methodology applied, contrary to expenditure shocks, tax shocks do not have a contemporaneous impact on GDP.

4.2. Debt-Dependent Estimation

Table 3 – Multiplier's estimation of the debt dependent sample

Fiscal Multipliers: +1 s.d. innovation shock			SVAR 4 lags
Variable	Characteristic	Period (quarters)	Multiplier
Primary Expenditure	Debt > 60%	4	0.50
Primary Expenditure	Debt > 60%	8	1.04
Primary Expenditure	Debt < 60%	4	0.03
Primary Expenditure	Debt < 60%	8	1.90
Income and Wealth Taxes	Debt > 60%	4	-0.32
Income and Wealth Taxes	Debt > 60%	8	-0.97
Income and Wealth Taxes	Debt < 60%	4	0.24
Income and Wealth Taxes	Debt < 60%	8	0.71
Production and Imports Taxes	Debt > 60%	4	-0.60
Production and Imports Taxes	Debt > 60%	8	-1.15
Production and Imports Taxes	Debt < 60%	4	0.24
Production and Imports Taxes	Debt < 60%	8	1.83

Observing the results, it is observed that for countries with high levels of public debt, the primary expenditure multiplier is 0.51 (1.04 in the second year), the Income and wealth taxes multiplier is -0.32 (-0.97), and the Production and imports taxes is -0.6 (-1.15).

In the opposite scenario, with countries with a public debt lower than 60% of GDP, although the primary expenditure seems to be close to zero at the end of the first year (0.03), it shifts to 1.90 at the end of the second one. The tax multipliers seem to have positive signs. Whilst in the first year, both Income and wealth and the Production and imports taxes have the same value for the multiplier, 0.24, in the second year, the values increase to 0.71 and 1.83, respectively.

At least during the first year, the fiscal multipliers seems to be higher facing high levels of public debt since the effect on long-term interest rates is predicted to be higher (Spilimbergo et al, 2009) and the propensity to consume is higher under a liquidity constraint scenario (Brinca et al, 2016).

4.3. Growth-Dependent Estimation

Fiscal Multipliers: +1 s.d. innovation shock			**SVAR**
			4 lags
Variable	Characteristic	Period (quarters)	Multiplier
Primary Expenditure	Expansion	4	0.17
Primary Expenditure	Expansion	8	0.15
Primary Expenditure	Recession	4	1.28
Primary Expenditure	Recession	8	2.39
Income and Wealth Taxes	Expansion	4	-0.21
Income and Wealth Taxes	Expansion	8	-0.73
Income and Wealth Taxes	Recession	4	-0.04
Income and Wealth Taxes	Recession	8	-0.10
Production and Imports Taxes	Expansion	4	-0.67
Production and Imports Taxes	Expansion	8	-1.37
Production and Imports Taxes	Recession	4	-0.17
Production and Imports Taxes	Recession	8	-0.22

The results show that the primary expenditure multiplier is higher during recessions than in expansions, achieving values above unity in the first year (1.28), and above two in the second one (2.39), which corroborates with some literature that points to a higher effectiveness of public expenditure during recessions (e.g. Auerbach and Gorodnichenko, 2012). This might be understood due to a higher need of subsidies and transfers to agents with high levels of propensity to consume. In addition, while in an expansion, a

hypothetical decrease in public expenditure would be offset by the increase in consumption and net exports, in a recession, the expenditure would have a higher effect on output, increasing the consumption and investment when net exports tend to decrease (Riera-Crichtion et al,2014).

Contrary to the spending multipliers, the tax multipliers seem to generate a higher effect on GDP during expansions, where the Production and imports Taxes might have an impact over the unity in the end of the second year (-1.37). Once again, this type of taxes reveals stronger multipliers than the Income and wealth ones.

Notice that, this result supporting the Keynesian theory, shows that the fiscal policy is more effective when applying countercyclical policies, increasing expenditure during bad times, and searching for higher tax revenues during expansions.

Nevertheless, it is perceived that in the tables 4.2 and 4.3 that the impacts of quarterly fiscal shocks are substantially higher in highly indebted countries (at least in the first year) and the expenditure multiplier is much higher during recessions. That may call for a special attention concerning fiscal consolidations strategies (restrictive pro-cyclical policies) based in expenditure cuts, sometimes inherent to indebtedness processes.

4.4. Output Gap-Dependent Estimation

Fiscal Multipliers: +1 s.d. innovation shock			**SVAR**
			4 lags
Variable	Characteristic	Period (quarters)	Multiplier
Primary Expenditure	OutputGap > 0%	4	0.55
Primary Expenditure	OutputGap > 0%	8	0.41
Primary Expenditure	OutputGap < 0%	4	0.42
Primary Expenditure	OutputGap < 0%	8	0.77
Income and Wealth Taxes	OutputGap > 0%	4	-0.35
Income and Wealth Taxes	OutputGap > 0%	8	-0.54
Income and Wealth Taxes	OutputGap < 0%	4	-0.02
Income and Wealth Taxes	OutputGap < 0%	8	-0.22
Production and Imports Taxes	OutputGap > 0%	4	-0.50
Production and Imports Taxes	OutputGap > 0%	8	-0.08
Production and Imports Taxes	OutputGap < 0%	4	-0.02
Production and Imports Taxes	OutputGap < 0%	8	0.44

In countries when the outputs are above their potential GDP, i.e., when the output gap is positive, the primary expenditure multiplier is predicted to be, in average, 0.55,

diminishing it accumulated response until the end of the second year to 0.41. Regarding the tax multipliers, the Income and wealth one has an annual multiplier of -0.35 (-0.54) and in the Production and imports taxes the multiplier is higher, -0.5, but decreases significantly in the second year to -0.08.

In turn, countries with negative output gaps seem to have lower multipliers. The primary expenditure multiplier stood in 0.42 (0.77 in the second year), and for both the taxes multipliers it was estimated a multiplier of just -0.02 in the first year. Nevertheless, although the Income and wealth one increases in the second year to -0.22, the Production and imports taxes multiplier (perceived by a positive shock in revenue) appear to have a hardly understood expansionary value of 0.44.

5. Conclusions

According to the literature, the uncertainty and the non-linear responses of fiscal stimulus during the Great Recession has brought the sign and magnitude of fiscal multipliers into debate. Thus, this study intended to compute the value of fiscal multipliers, namely of government expenditure, Income and wealth and production and import taxes, in the Eurozone countries since the creation of the currency union. In addition, it was our aim to understand how those values may vary according to the level of public debt, the rhythm of economic growth and the output gap.

After sharing some contributions in the literature regarding the fiscal multipliers and the underlying theories, we conclude that, according to our estimations, during the period 2000-2016 the government expenditure had a positive effect on output, with an annual accumulated multiplier of 0.64 (1.10 after two years). The tax multipliers presented negative signs, in which the Income and wealth and the production and import taxes stood at -0.10 (-0.31) and -0.32 (-0.24), respectively.

Furthermore, for countries with high levels of public debt, the computed primary expenditure multiplier is 0.51, the Income and wealth tax multiplier is -0.32, and for the Production and imports taxes is -0.6, while with a public debt lower than 60% of GDP, the annual multiplier of primary expenditure seem to be close to zero (0.03) and the tax multipliers seem to have positive signs. The results shown that in the first year, both Income and wealth and the Production and imports taxes have the same value for the multiplier, 0.24. The difference between multipliers depending on the debt level might

has to do with the effect on long-term interest rates and the propensity to consume under a liquidity constraint scenario.

In addition, the primary expenditure multiplier seems to be higher during recessions than in expansions, achieving values above unity in the first year (1.28 comparing with 0.17 of expansions), reflecting the effectiveness of automatic stabilizers and supporting the Keynesian theory, where the fiscal policy is expected to be more effective when applying countercyclical policies. In the other hand, the tax multipliers seem to generate a higher effect on GDP during expansions, where the Production and imports taxes reveals stronger multipliers than the Income and wealth ones.

Lastly, countries with negative output gaps presented lower multipliers. The primary expenditure multiplier is predicted to be, in average, 0.42 (0.55 when positive) and for both taxes, it was estimated a multiplier of just -0.02 in the first year. When the output gap is positive, the Income and wealth multiplier is -0.35 and for Production and imports taxes is -0.50.

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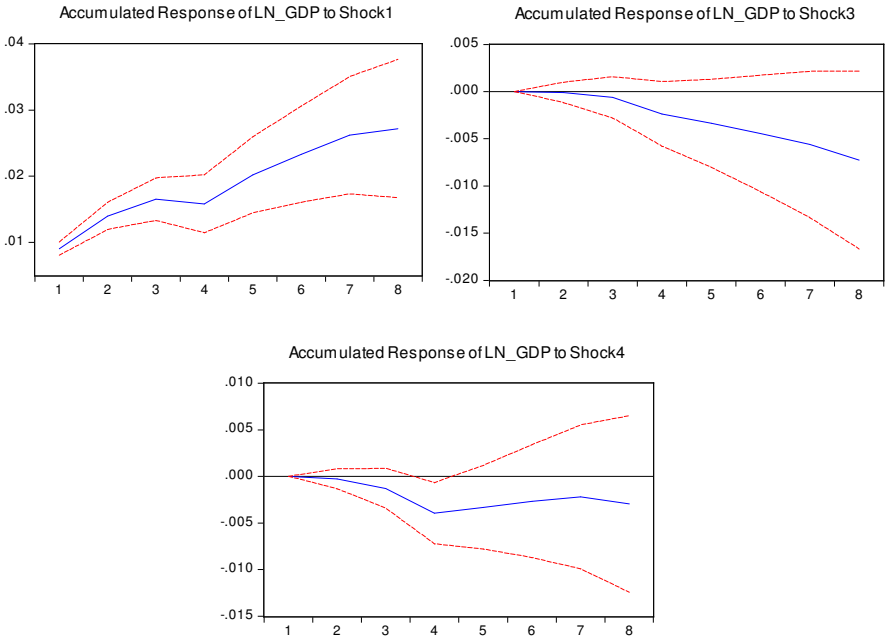
Appendices

Appendix A – Descriptive Statistics of Variables

	Mean	Median	Maximum	Minimum	Std. Dev.	Kurtosis	Observ.
GDP	25869.89	23243.31	83312.79	3157.75	15447.27	6.59	1292
Primary Expenditure	11001.61	9281.19	34560.62	694.56	6760.20	5.21	1256
Income and Wealth Taxes	3054.44	2285.14	12497.11	155.40	2353.46	5.89	1256
Poduction and Imports Taxes	3276.25	2913.73	10845.64	259.80	1917.74	6.58	1256
Debt	61.61	59.70	181.00	3.30	36.13	3.13	1289

Appendix B – Graphic Representation of the Estimations[2]

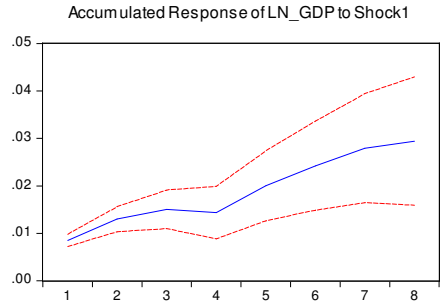
Baseline Estimation

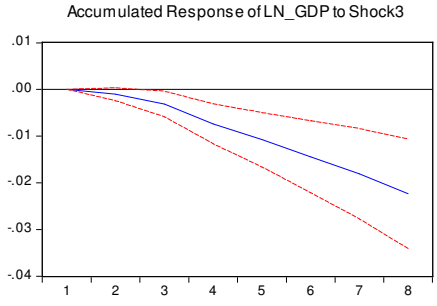


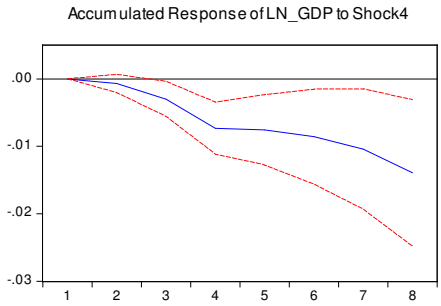
[2] Shock1: 1 S.D. innovation in the logarithm of Primary Expenditure;
Shock3: 1 S.D. innovation in the logarithm of Income and wealth taxes revenue (in differences);
Shock4: 1 S.D. innovation in the logarithm of Production and imports taxes revenue (in differences).

Debt-Dependent Estimation

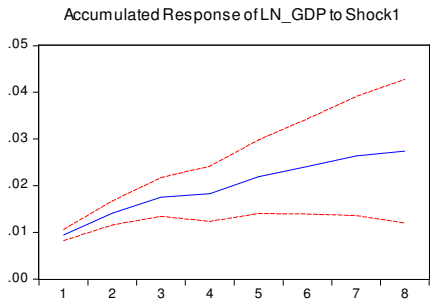
Public Debt > 60% of GDP

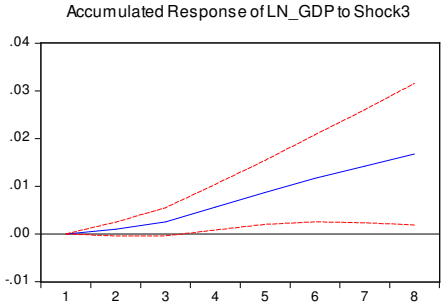


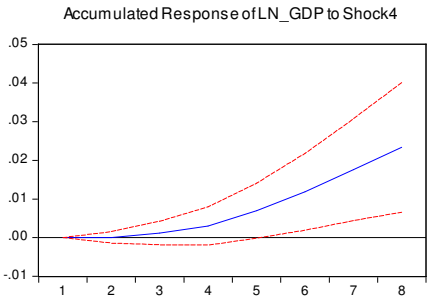




Public Debt < 60% of GDP

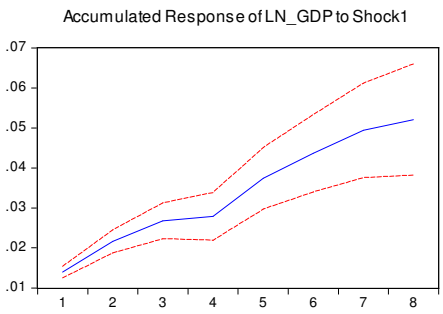


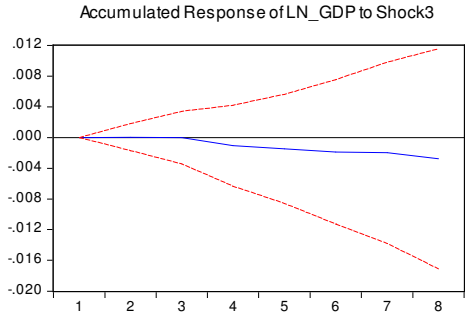


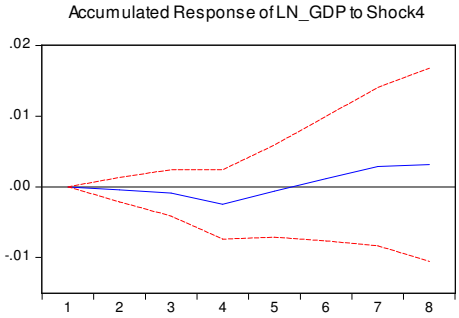


Growth-Dependent Estimation

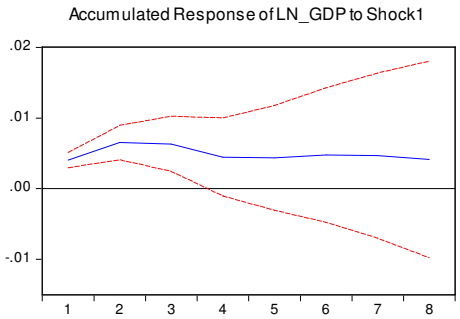
GDP Growth < 0%

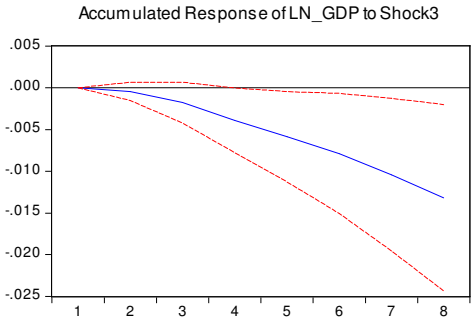


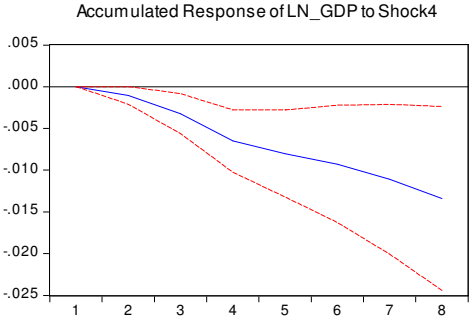




GDP Growth > 0%

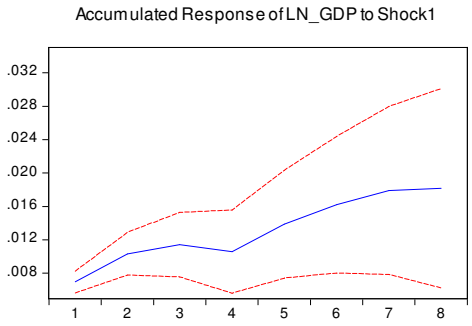


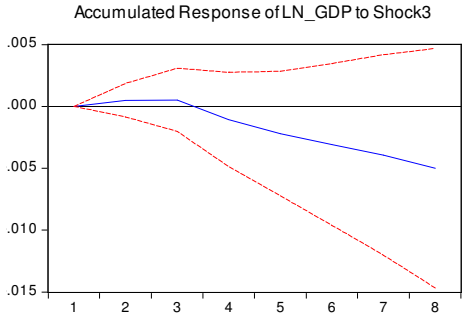


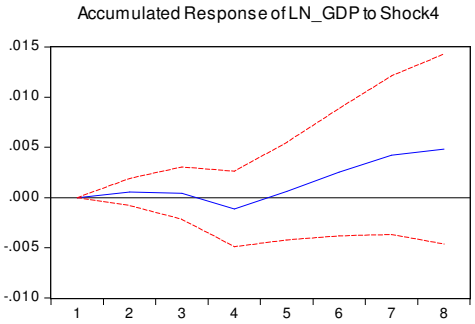


Output Gap-Dependent Estimation

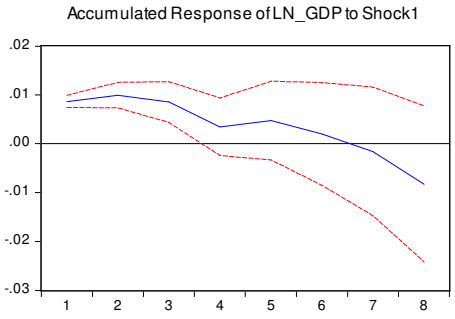
Output Gap < 0% Potential GDP

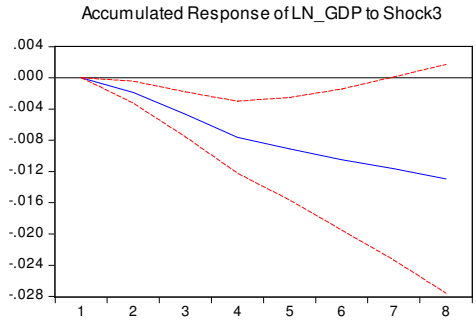


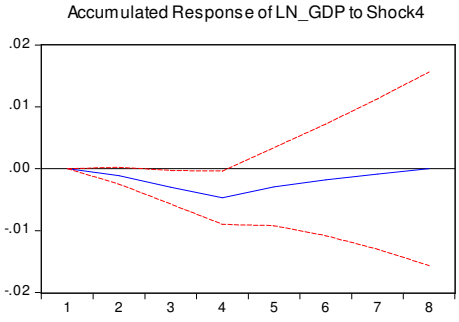




Output Gap > 0% Potential GDP

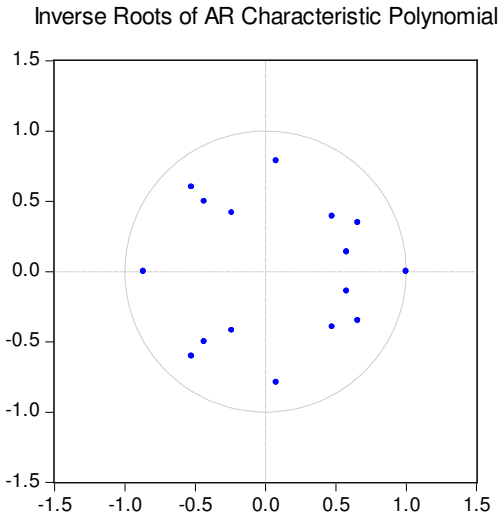




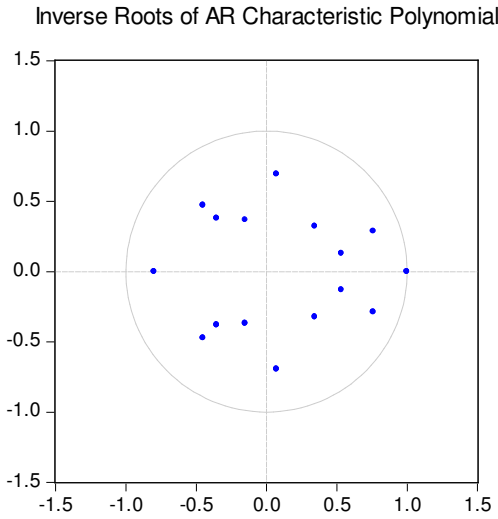


Appendix C – VAR Stability Condition Check

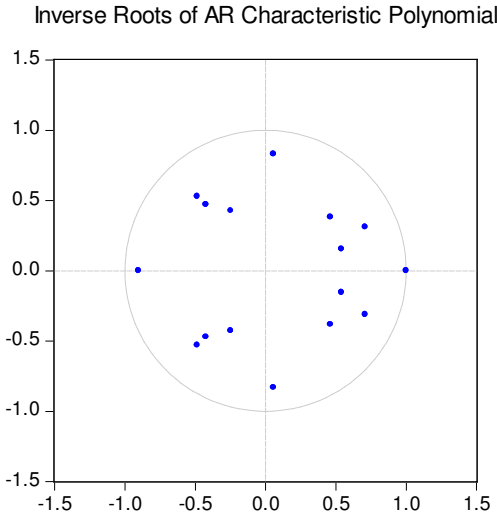
Roots of Characteristic Polynomial



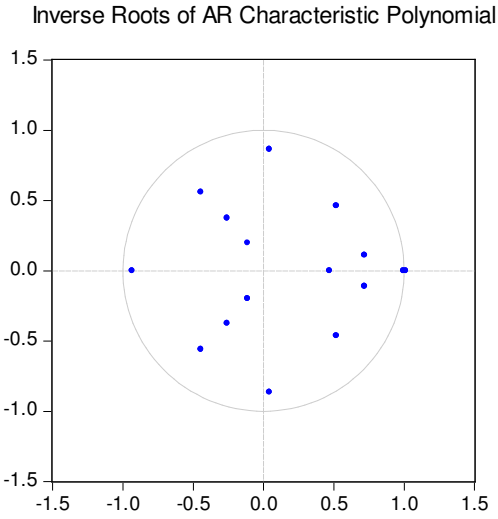
Baseline Estimation



Debt-Dependent Estimation



Growth–Dependent Estimation



Output Gap-Dependent Estimation