A SVAR APPROACH ON FISCAL POLICY

The case of Spain

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ABSTRACT

This paper aims to estimate the impact on economic activity of government fiscal policy shocks in Spain, and it is done on a VAR frame of reference for a 20 year period.

Results show government spending shocks are highly persistent over time. Increases in both government spending and taxes are effective on stimulating economic activity on the short run. However, after two years, these shocks are found to have a less positive impact and dragging economic activity on the long term. Expenditure multiplier is found 4 times bigger than revenue multiplier after 2 years and it's more effective on stimulating the economy at a cost of increasing debt. Finally, fiscal policy is also found more effective when the economy is in the low cycle.

INTRODUCTION

Fiscal policy and its effects on output have always been a matter of discussion and discrepancy between economists. Last years with the crisis, maybe more than ever, fiscal policy has become one of the central debates. However, after all the debate since the beginnings of macroeconomics theory and after the lasts years of different fiscal policies, going from package stimulus that have raised debt to levels never seen before to austerity policies that have crippled economies but contained debt from rising, consensus is far from achieved. Both policies yet to be proven the best solution for each specific case, the debate still continue and it is far from end given its extreme complexity.

It is in this situation that a number of empirical studies, using different methodologies, have tried to compute these effects. The methodology used since Sim's critique in 1980 in the majority of those empirical studies is the vector autoregressive model (VAR) and variations of it, like the one used in this paper: the structural VAR. It is a multivariate linear time series model where each endogenous variable in the system is a function of lagged values of all endogenous variables. When fiscal authorities increase public spending (and debt) because they anticipate a reduction in private demand, if total output continues to fall for some time it would be a narrow minded conclusion to think that there's a negative relationship between government spending and output, and therefore a negative spending multiplier. But instead, one should realize that fiscal policy reacted endogenously to expected output. And that is the reason why we use structural vector autoregressive models, because the structural model isolates exogenous shocks and get responses of the endogenous variables in the model after the economy is hit by one of these shocks. At a first glance, VARs appear to be straightforward multivariate generalizations of univariate autoregressive models. At a second sight, they turn out to be one of the key empirical tools in modern macroeconomics (Del Negro and Schorfheide 2011). Given all these new empirical methodologies trying to analyze every aspect of fiscal or monetary shocks, that appear year to year, innovating and making nearly obsolete the ones used before, one would expect from economist to have reached a consensus about the size and determinants of fiscal multipliers. Far from this, there is yet no agreement of its effects on each macroeconomic variable. In fact, there's a quite large empirical literature using various approaches with various different results, especially relating the size of the automatic stabilizers estimated.

The objective of this paper is no other than to provide some new information to this debate, taking into account and following all the work made to date, studying the particular case of Spain between 1995 and 2016 like Castro and De Cos made 10 years ago. It is important to emphasize that, although through the paper the lector will see I give special importance and attention to the empirical methodology and analysis, it is just a tool to uncover some of the qualitative and quantitative effects of the fiscal shock. The real analysis is behind the scenes, in the dynamics of macroeconomics for both neoclassical and Keynesian theories. The decision to contribute to this debate is its extreme importance and relevance on establishing different economic policies and affecting our daily lives. Europe and Spain in particular have been applying the so called austerity, through tax increases and spending cuts, and nearly a decade later we are still starting to recover the standards of living of 2007. Policy makers have been listening and reading from austerity defenders like Reinhart and Rogoff that suggested fundamental reforms of our fiscal policy framework to entrench economic stability for the long term, but are those austerity policies any good on stimulating the economy? And if they are, are they effective on the long run or is there any counterproductive effect on the long term? Are spending shocks more effective than tax/revenue shocks? As Paul Krugman said "what the Reinhart-Rogoff affair shows is the extent to which austerity has been sold on false pretenses. For three years, the turn to austerity has been presented not as a choice but as a necessity. Economic research, austerity advocates insisted, showed that terrible things happen once debt exceeds 90 percent of G.D.P. But "economic research" showed no such thing; a couple of economists made that assertion, while many others disagreed. Policy makers abandoned the unemployed and turned to austerity because they wanted to, not because they had to". European institutions decided to confront the crisis with monetary policy and austerity rather than fiscal policy. This debate has strong implications and I hope uncovering both multipliers, one for each shock (spending and taxes), will give us some information to help us answer these questions. And these answers are not only the key to understand if we have responded this crisis with the correct tool but to help us deal with the ones that are to come and avoid the same mistakes.

LITERATURE REVIEW

As stated previously there are multiple methodologies and ways to measure fiscal multipliers. These are important for policy makers because they estimate the short-term impact of discretionary fiscal policy on economic activity. For exemple, Blanchard and Leigh (2013) found that underestimation of fiscal multipliers early in the crisis contributed significantly to growth forecast errors, and Eyraud and Weber (2012) found that this underestimation may lead countries to set unachievable fiscal targets, and miscalculate the amount of adjustment necessary to curb their debt ratio.

The size of fiscal multipliers is subject of a great debate given the importance argued before on designing economic policy. One of the basic economic justifications behind austerity measures or against expansionary policy is that increases in government spending would provoke a rise in public deficit, causing interest rates to rise and driving private investment out of the market, resulting on a reduction on economic activity, defeating its own propose of stimulating the economy. However, in 2012 the IMF recognized that they were too optimistic forecasting countries that had implemented austerity, while countries implementing fiscal stimulus were doing better against the crisis due to multipliers being bigger than expected. And this is related with the idea of Keynesian expansionary policy defenders that fiscal stimulus does not crow out private investment when the economy is far from operating at full capacity.

We will, in this initial part, follow Nicoletta Batini and others on their technical notes and manual for the International Monetary Fund (2014), in which they identify the size, determinants and use of fiscal multipliers in a both technical and educative way.

In their paper they point out that despite all the potential benefits, multipliers are not widely used by economist because the difficulties surrounding its estimation. Little consensus comes from the difficulty in isolating the direct impact on GDP of, for example, an increase on spending that through automatic stabilizers react to the cycle in a discretionary way. But there are other problems like data availability of high frequency data for a long time series required by model-based methods like structural vector autoregressive models, existent in only some advanced economies. About size, persistence and determinants, they summarize the main literature findings since the early 1990s.

For advanced economies, multipliers are found positive but below 1. A survey of 41 studies made by Mineshima and others (2014) show an average of 0.75 for the government spending multiplier during the first year while only a 0.25 for the tax multiplier. The paper focuses in the fact that multipliers can be greater than 1 when the economy isn't in "normal" circumstances like recessions. Results may also differ in studies that use other methodologies different than the VAR, since the "narrative approach" captures a greater tax multiplier. The narrative approach tries to identify exogenous fiscal shocks directly by looking at budget documents in order to solve the problems presented by structural VAR. The size of the spending multipliers in these studies are captured by looking at news about future military spending as a measure of exogenous policy because they argue that this spending is determined by wars and foreign policy and not by the state of the economy (Romer, 2011). Some of the results are presented in Table 1, elaborated from the IMF paper.

For the low income and emerging countries, it is unclear if the multipliers are higher or lower. Empirical studies suggest multipliers in these countries are smaller than in advanced economies and some that they are negative, especially on the long run and when levels of debt are high (IMF, 2008). Tax and spending multipliers estimated are very similar, between 0 and 0.5 on average, except for China being between 1.7 and 2.8 (Wang and Wen, 2013). Some factors are identified as increasing the multipliers:

- Monetary policy response is less effective.
- Automatic stabilizers are lower.
- Government debt tends to be lower.

And others, as decreasing:

- Precautionary saving may be larger in a more uncertain environment.
- Inefficiencies in public expenditure management and revenue administration.
- Economies are smaller and more open.

In this context, they distinguish 2 classes of determinants of the size of the multipliers in general. One related with the structural characteristics that in "normal" circumstances have an impact on the response to fiscal shocks; and the other related wi-

Table 1. Narrative Approach, first year multipliers.

Study	Country	Multiplier	Notes
TAX (1)			
Cloyne (2013)	UK	0.6	Maximum multiplier reached after 10 quarters (about 2.5).
Favero and Giavazzi (2012)	US	0.7	Maxim multiplier reached after 9 quarters (just below 1).
Guajardo and others (2014)	Panel of OECD countries	1	After two year, multiplier reaches about 3.
Hayo and Uhl (2014)	Germany	1	Maximum multiplier after 8 quarters (about 2.4).
Mertens and Ravn (2013)	US	1	Maximum multiplier reached after 8 quarters (about 2).
Romer and Romer (2010)	US	1.2	Maximum multiplier reached after 10 quarters (around 3).
SPENDING (2)			
Barro and Redlick (2011)	US	0.4 – 0.6	Lower multiplier for temporary spending changes, higher for permanent changes.
Hall (2009)	US	0.6	
Owyang, Ramey, Zubairy (2013)	US and Canada	US: 0.8 Canada: 0.4 – 1.6	Two year multipliers; high multiplier in Canada when high unemployment.
Ramey (2011)	US	1.1 – 1.2	Peak multiplier after 6 quarters.

(1) Response of output in percent following an exogenous tax shock of 1 percent of GDP. (2) Response of output in percent following an exogenous spending shock of 1 percent of GDP based on defense spending news: Barro (1917-2006), Hall (1930-2008), Owyang (US;1890-2010) (Canada;1921-2011), Ramey (1939-2008). Source: Batini, Nicoletta, et.al. "Fiscal Multipliers: Size, Determinants, and Use in Macroeconomic Projections (2014).

-th the conjunctural factors that modify multipliers, and it is obvious that some of these determinants are the ones identified as key to increasing or decreasing multipliers for low income and developing economies. Structural characteristics include:

- Trade openness; being the closest (lower propensity to import) the ones with higher multipliers.

- Savings rate: being the ones with higher marginal propensity to consume with higher multipliers. Marginal propensity to consume being lower in Europe than USA as a consequence of demographic conditions (older people consume less).
- Labor market rigidity; being the more rigid (stronger unions or market regulation) with rigid wages, the ones with higher multipliers.
- Size of automatic stabilizers; being countries with larger automatic stabilizers the ones with lowest fiscal multipliers.
- Exchange rate regime; being countries with flexible regime the ones who tend to a smaller multiplier.
- Debt level; being the high-debt countries with lower multipliers.
- Public expenditure and revenue management; being the multiplier lower in countries with difficulties to collect taxes and those who experience expenditure inefficiencies.

While conjectural factors are:

- State of business cycle; usually larger multipliers in downturns.
- Degree of monetary accommodation; multipliers can be larger when the shock hits the economy with a zero interest lower bound present.

With regard to the persistence of fiscal multipliers, most empirical studies agree the effect of shock lasts for a period of approximately 5 years, usually not having a linear shape but an inverted U, being higher in the second year than in the first. But it will always depend on the persistence of the fiscal shock, the type of instrument used, and conjectural factors such as cyclical position and monetary policy responses.

Given all of this, we can follow the indications made by the IMF on the called “bucked approach”, a method that will provide us guidance on the size of fiscal multipliers by using all the factors and characteristics previously mentioned. It is important to remark that this method should not be applied in a mechanical way, given it is an instrument for those countries where estimating the multiplier is more complicated. In the case of Spain:

Table 2. Score based on structural characteristics*

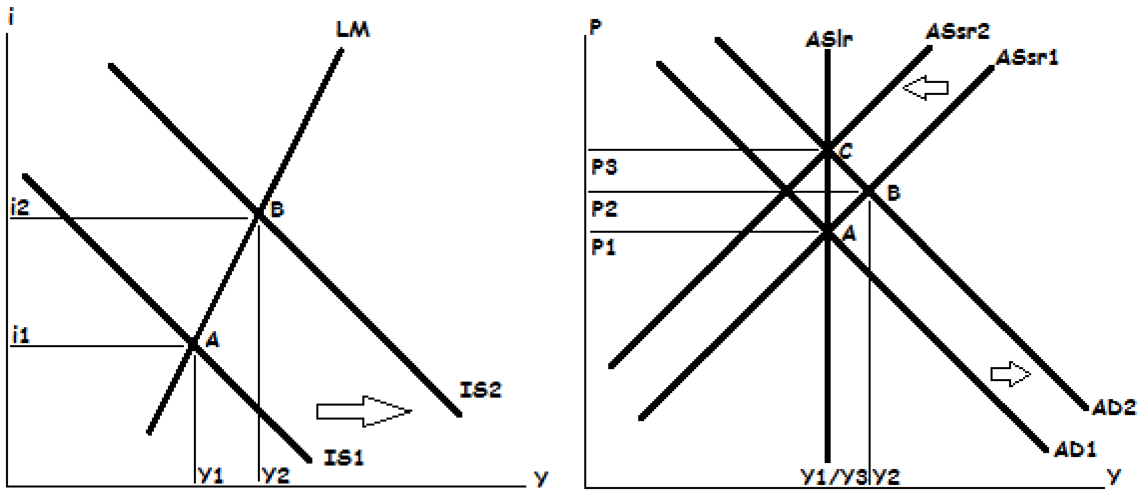
Relatively closed (Ratio of imports to GDP is below 30 on average over the last 5 years. In Spain is 29,75.)	1
Rigid Labor Market (Qualified as rigid for indicators like Botero and others, 2004.)	1
Small Automatic Stabilizers (Ratio of public spending to GDP below 40. In Spain is 42 aprox.)	0
Fixed Exchange Rate Regime (euro area considered floating)	0
Safe Government Debt (For developed economies is below 100% GDP. In Spain is on 100 but international agencies qualify it as "safe".)	1
Effective Expenditure/Revenue Management (PEFA)	1
Total Score	4

*non-zero if applies.

With a score of 4, it can be considered in "normal" times to have a high multiplier range between 0.7 and 1 in the first year. However, considering scoring of rigid labor and relatively closed are really close to be 0, it could as well be considered of a score 3 and have a medium range of 0.4-0.6. We can also consider the fact that the period studied has both expansion during the major part of the period and recession for a short period of time, so it's difficult to estimate if we should adjust down the result of the multiplier as having a moderate positive output gap or keep it as "normal". Overall, this being more intuitive than scientific, we may expect to find a multiplier between 0.4 and 1 for the first year.

One would also expect, as in Figure 1, that an increase in government spending would cause short term positive effects on output with an increase on inflation and interest rate that would finally result on the long run on a shift backwards to initial output, through private investment being substituted by public investment with the so called crowding effect, leaving only higher inflation behind.

Figure 1. IS-LM and AD-AS shifts on a ΔG



Other previous empirical studies, more related to the methodology used in this paper, have reached different results on these issues. Although each study has its own methodology and data, we can evaluate their results for a later contrast. Different countries and years studied share common ground on some points and differ in others. The following Table 3 concentrates the results of some of the previous analysis made by authors like Blanchard and Perotti that established the methodological bases for the following analysis.

All these analysis have the same results on the short term effects of an expenditure shock on GDP. Proving fiscal policy effective on the short run, they differ on the long run effects. The case of Spain is no exception, having a positive impact on the first quarters and later decreasing and becoming negative on the long run (Castro 2006).

It is also stated that public expenditure shocks are highly persistent and these results are consistent in other studies made for other OECD countries (Garlí et al. 2003). Prices move different and results aren't consistent even though one would expect from theory an increase in prices especially on the long run, following with the decrease on output.

Table 3. Effects of an expenditure shock on GDP and Prices.

	GDP				Prices			
Quarters	1st	4th	12th	20th	1st	4th	12th	20th
Expenditure shock – US								
Blanchard and Perotti (2002) 1947-1997	+	+	+	+				
Perotti (2004) 1961-2000	+	+	+	+	+	-	-	-
Perotti (2004) 1980-2000	+	+	-	-	+	-	+	+
Neri (2001) 1965-1996	+	+	-	-	+	+	+	+
Fatás and Mihov (2001) 1960-1996	+	+	+	+	-	-	-	-
Edelberg, Eichenbaum and Fisher (1998) 1948-1996	+	+	+		+	+	-	
Burnside, Eichenbaum and Fisher (1999) 1947-1994	+	+	+					
Mountford and Uhlig (2002) 1955-2000	+	+	-	-	-	-	-	-
Canzoneri, Cumby and Diba (2002)	+	+	+		-	+	+	
Expenditure shock – Germany								
Perotti (2004) 1961-2000	+	+	-	+	+	+	+	+
Perotti (2004) 1980-2000	+	-	-	-	+	+	+	+
Marcellino (2002) 1981-2001	+	+			-	-		

Source: Henry, J, P. Hernández de Cos and S. Momigliano (2004)

Finally, tax multiplier in those studies is usually found smaller than spending multiplier, sharing this in common with the narrative approach studies mentioned earlier.

DATA AND ECONOMETRIC METHODOLOGY

The sample used is a quarterly Spain data over the period 1995:1 – 2015:4 and all components are extracted from the Eurostat's Database. The model used in this analysis, following Perotti (2005) and Caldara and Kamps (2008), is a five-variable structural VAR model. These variables are (1) the log of seasonally adjusted real per capita government spending, understood as final general government consumption, ggs_t, (2) the log of seasonally adjusted real GDP per capita, yys_t, (3) inflation as the log difference of the price index for GDP, pp_t, (4) the log of seasonally adjusted real per capita taxes on production and imports less subsidies, as a proxy for net taxes, tts_t, and (5) the 3-month money market interest rate, ii_t.

As stated above, the methodology used is a structural VAR that uses restrictions imposed by economic theory to uncover the system. However, it is needed to have in mind that a SVAR is only a theoretical construct and as Sims (1980) said, it is an interpretation of historical data and it is non observable so it can't be estimated directly.

The structural form VAR model of order p is the following:

$$AX_t = \beta_0 + C(L)X_{t-1} + Be_t$$

where β_0 is a constant, C(L) is a fourth order lag polynomial, e_t is a vector of the structural shocks, $X_t = (ggs_t, yys_t, pp_t, tts_t, ii_t)$ is the vector containing the endogenous variables and A is a matrix describing the relation among the endogenous variables in time t, or in other words, the contemporaneous relation or elasticities between them. From the structural form we can multiply by A^{-1} in order to obtain the reduced form VAR to be able to estimate the model:

$$X_t = G_0 + G(L)X_{t-1} + u_t$$

where $G_0 = A^{-1}\beta_0$, $G(L) = A^{-1}C(L)$ and $Be_t = Au_t$. This last equation shows the relation between structural shocks e_t and the reduced form disturbances u_t.

As literature have already shown a vast amount of times, in order to estimate the VAR is condition sine qua non to impose a number of restrictions on the structural parameters and, doing this, we impose interpretations based on economic intuition, giving this statistical analysis an economical approach. In the empirical application of these models, one can choose what kind of approach fits better for the analysis: the recursive approach, the Blanchard-Perotti approach, the event-study approach, and others. In this particular case, I've chosen the recursive approach because it's less complex than the Blanchard and Perotti one, but empirical literature, for example Caldara and Kamps (2008), has shown that, surprisingly, the conceptual differences between both approaches have little effect on the results. For the sake of making an easy understandable econometric analysis and not to forget that this is just an empirical tool to get to the real analysis of the implications of fiscal policy, the recursive approach fits quite well.

The basics behind the recursive approach are that it implies a causal ordering of the endogenous variables used. In other words, we impose restrictions on the contemporaneous relations between them. In this case, as in the paper of Caldara and Kamps mentioned before, where they show both recursive and BP approaches, the ordering of the variables is represented here on this relation between structural and reduced form disturbances:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -\alpha_{yys\ ggs} & 1 & 0 & 0 & 0 \\ -\alpha_{pp\ ggs} & -\alpha_{pp\ yys} & 1 & 0 & 0 \\ -\alpha_{tts\ ggs} & -\alpha_{tts\ yys} & -\alpha_{tts\ pps} & 1 & 0 \\ -\alpha_{ii\ ggs} & -\alpha_{ii\ yys} & -\alpha_{ii\ pps} & -\alpha_{ii\ tts} & 1 \end{bmatrix} \begin{bmatrix} u_t^{ggs} \\ u_t^{yys} \\ u_t^{pp} \\ u_t^{tts} \\ u_t^{ii} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t^{ggs} \\ e_t^{yys} \\ e_t^{pp} \\ e_t^{tts} \\ e_t^{ii} \end{bmatrix}$$

It implies that the government spending does not react to the other variables in the same quarter, that output only reacts to changes in government spending, that inflation reacts contemporaneously to changes on government spending and output, that taxes are not affected in the same quarter to changes in the interest rate, and finally, that interest rate is affected by all shocks. The justifications for all of the assumptions of the model are the ones made also by some other economist before: government spending, unlike taxes, is unrelated to the business cycle; output and inflation have immediate impact on the tax base; and interest rates are affected by all because the central bank reacts on a function of output gap and inflation.

Before getting on the results of the specified model, it's important to clarify that the restrictions imposed in the recursive approach restricts matrix A to a lower triangular matrix with unit diagonal (allowing a Cholesky decomposition) and matrix B as an identity matrix. Given all of this, we can proceed with the analysis.

RESULTS

It seems reasonable that the number of lags to use is 4 being a quarterly data. A fast test using different criteria shows us that the approximated correct number for the VAR is, in fact, four as stated.

Table 4. VAR Estimation Results.

	ggs	yys	tts	ii	pp
ggs $_{t+1}$	1.313e+00*	0.066494	-1.38403	-0.027133	-0.0198329
yys $_{t+1}$	2.501e-01	1.522777*	7.92441*	0.200779	-0.1134377
tts $_{t+1}$	1.344e-03	0.001442	0.26478*	-0.15303	-0.0047706
ii $_{t+1}$	7.074e-02	-0.014950	-3.35663	1.363739*	0.2432037*
pp $_{t+1}$	-9.184e-02	0.160364	0.97208	-0.037933	0.0447960
ggs $_{t+2}$	2.027e-01	0.030588	0.50412	-0.042218	-0.0372785
yys $_{t+2}$	-3.480e-01	-0.446502*	-6.82110	0.219239	0.2380516
tts $_{t+2}$	4.840e-03	0.004925	-0.07843	0.007593	0.0055249
ii $_{t+2}$	-1.580e-01	-0.201322	5.99338	-0.630321*	-0.424122*
pp $_{t+2}$	1.173e-01	-0.009008	-1.09965	-0.039885	0.5625712*
ggs $_{t+3}$	-7.365e-02	-0.096292	-1.81965	0.003027	-0.0060833
yys $_{t+3}$	8.542e-02	-0.123249	2.64916	-0.613449*	-0.1126141
tts $_{t+3}$	4.647e-03	0.001538	-0.13516	-0.003272	-0.0067166
ii $_{t+3}$	6.558e-02	0.069444	-9.08547*	0.250340	0.3176671
pp $_{t+3}$	-1.134e-01	-0.192429*	1.48181	0.011184	0.1261114
ggs $_{t+4}$	-5.775e-02	0.001980	2.52582*	0.059510	0.0226921
yys $_{t+4}$	4.043e-02	0.002014	-3.05541	0.222179	0.0390505
tts $_{t+4}$	-6.559e-05	0.001094	0.40298*	0.003137	0.0003535
ii $_{t+4}$	7.842e-02	0.056207	3.33294	-0.037457	-0.1980444
pp $_{t+4}$	-6.100e-02	0.202391*	4.07218*	0.038011	-0.313350*

Summary of the VAR Estimation Results for each equation (appendix Table 1)

There are mixed results for each equation but we can see significant results in some variables for a 4 lag period. However, as what we are looking for are the impulse response functions of our structural model that will uncover the effects of a spending shock to our variables, we need to estimate our matrix A before, giving the following results.

Table 5. Estimated A matrix.

	ggs	yys	tts	ii	pp
ggs	1.00000	0.00000	0.000000	0.00000	0
yys	0.09699	1.00000	0.000000	0.00000	0
tts	0.10504	0.09712	1.000000	0.00000	0
ii	0.09959	0.09851	0.002037	1.00000	0
pp	0.09884	0.09828	-0.007628	0.09941	1

Here we can observe the elasticities or contemporaneous relations between variables. We see positive relations between an increase in spending and GDP, taxes, interest rates and inflation in the same quarter, while an increase in taxes or revenue has nearly no impact on both interest and inflation.

Impulse-Response functions for the SVAR estimated show the results of a spending shock for a 5 year period in appendix Table 3, and results of a tax shock in appendix Table 4.

First of all, as in previous literature, results in Figure 2 show shocks are highly persistent overtime.

Second, spending shocks are also within the results found before, resulting in a positive movement of GDP in the first year, and being stronger in the second year than in the first. The form of the effects is no linear, with a U inverted curve. This is also consistent with previous studies that say the impact usually reaches its peak on the 8^{th} - 12^{th} quarter and later decreases, having negative or no effect between the 4^{th} and 5^{th} year. Effects on taxes show a negative impact on the short term and a later stabilization, probably as a result of an increase in subsidies and expenditure in general of government, decreasing net taxes, and later stabilizing with the increase in output and probably because the increase in subsidies not being permanent, consolidating on previous levels after the initial shock. Contrary of what I believed, the effects on prices and interest rates are not positive and these results differ with Castro finding ten years ago. This may be caused because Castro's sample was previous in the major part to the integration of Spain in the euro and, obviously, previous to the 2008 crisis. Monetary policies of the European Central Bank might have caused the variation of the results on prices and interest because of its extreme control of inflation and the decrease of interest in the last years of the crisis, from 9% in 1995 to negative interests in 2015.

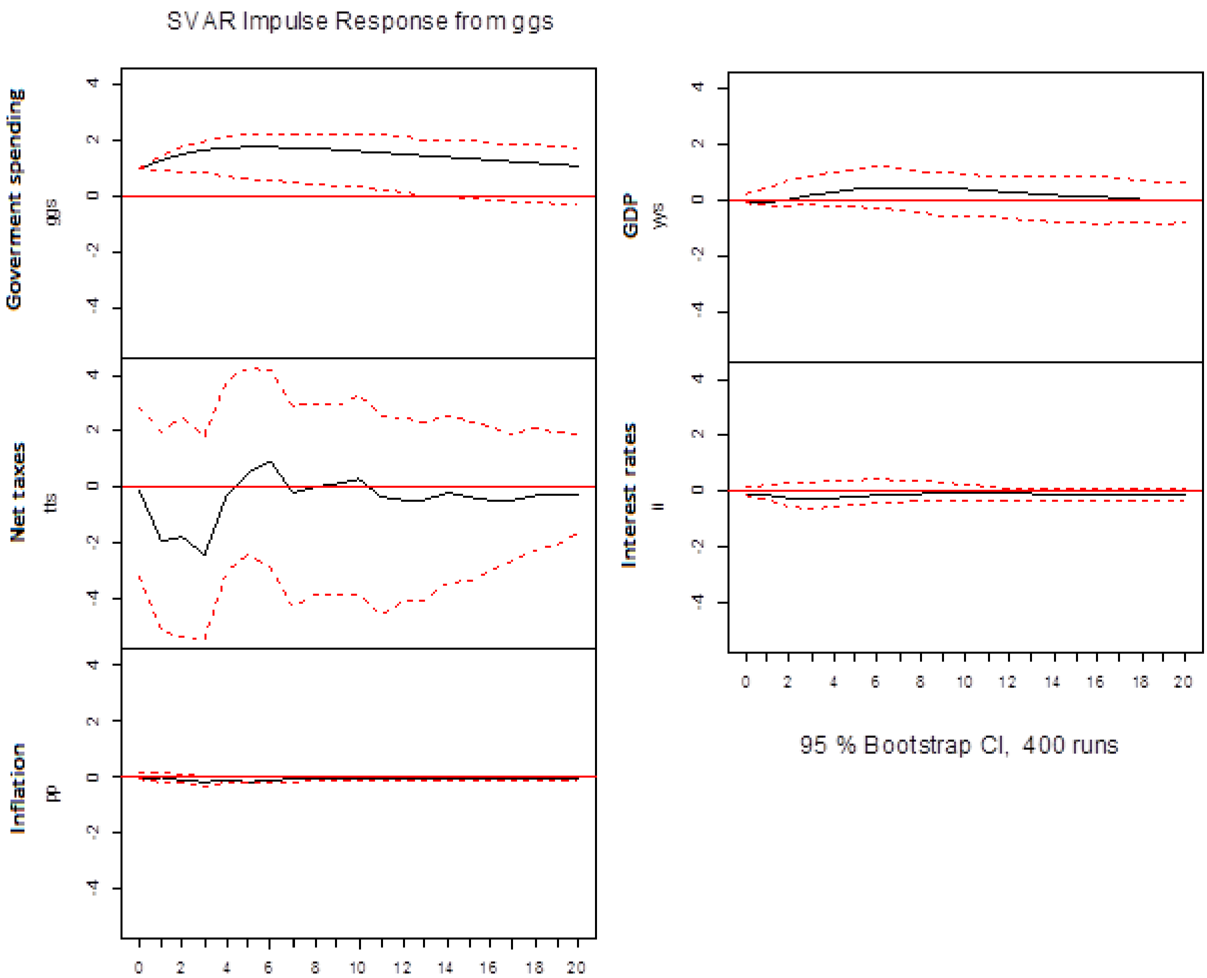
Third, tax shocks results are also similar of those found before but with an important variation: in the first year, its effects on output are the same than in the case of spending; only being lower in the medium-long run. In the second year after the shock, cumulative expenditure multiplier is nearly 4 times bigger than the revenue multiplier (Table 6). Tax shock effects on output also lose strength faster, having no effects after 3-4 years and negative effects after that. With regards to inflation and interest rates, revenue shocks have nearly no impact on both variables.

Table 6. Output multipliers for both fiscal shocks *

	4th quarter	8th quarter
Expenditure	0.37	1.74
Tax	0.38	0.44

*Cumulative response of Output to a 1 euro increase in spending/taxes. It is obtained as the ratio of e^(cumulative GDP change) to e^(initial fiscal shock).

Figure 2. Impulse-Response results of a spending shock*



*Graphs show the impact of an initial increase of a unit of government spending on all the variables during a period of 20 quarters (5 years).

Fourth and last, given that literature expose that in periods of recession multipliers are bigger, a quick study is made for a smaller sample between 1995 and 2007, previously to this crisis, even though the sample is quite small for a VAR procedure. Results show a smaller output multiplier for both fiscal policies, confirming that when the economy is in the low cycle, multipliers are bigger. From a theoretical perspective it makes sense given in recession the economy is far from full capacity and public stimulus doesn’t expel private investment.

CONCLUSIONS

Results obtained in this paper are very similar to the ones made before in other countries. Fiscal policy shocks are persistent for at least 4-5 years. Both fiscal policy shocks are effective on stimulating the economic activity on the short term. However, their efficiency decreases overtime, especially on the revenue shock. Cumulative expenditure output multiplier is 4 times bigger in the 2^{nd}, when it reaches its peak, than revenue multiplier. On the long term, similarly as in Castro 2006, after 5 years the effects of the initial shock on output is negative, earlier in the case of the tax shock. Given this results it is clear that increases in spending are more effective than tax cuts on stimulating the economy probably at a cost of increasing debt as literature suggest. Finally, this policy becomes especially important when economy is on the low cycle, because multipliers are smaller when the economy is close to full capacity.

These results are reasonable with the empirical literature previous mentioned. As we have seen in other studies made before and in consistency with macroeconomic theory, the tax multiplier or revenue multiplier is usually smaller than the spending multiplier, but in the case studied here there's no significant difference between both multipliers in the first year, meaning either expansionary policy (increase in government spending) or austerity (tax increase) are a good stimulus on the short term. On the long term results are close with those found by Castro (2006) showing that spending multiplier is a lot bigger, differing on less than 0.4 on the second year. It is also found a first year multiplier close to the boundaries found in the bucket approach and quite low compared to other studies. It also coincides with those studies on the persistency of the multiplier over time and with the fact that multipliers reach its peak on approximately the second year. As stated before, the effects on prices and interest rates are not positive and these results differ with Castro finding ten years ago. This may be caused because Castro's sample was previous in the major part to the integration of Spain in the euro and, obviously, previous to the 2008 crisis.

This significant difference between second year cumulative multipliers implies that expending shocks are more effective than spending than taxes on the long run. Multipliers being greater when the economy is on the low cycle also show the importance and relevance of using the adequate fiscal stimulus when recession hits the economy. Both results would uncover that the most adequate fiscal policy for Spain when recession hits its economy is an increase on spending. Given that no impact on inflation is found after an increase on spending, expansionary policies, by these results, are postulating as an adequate way to proceed by policy makers. However, there are other variables to be considered: expansionary policy is usually financed through increasing debt. We can't forget multipliers are only one of the factors that need to be considered when setting fiscal policy. For example, further analysis is needed in order to evaluate the long term effects on the economy if debt rises substantially as a consequence of increasing government spending in the way Reinhart-Rogoff sustained that there's an inverse correlation between debt and growth, and when debt reaches more than 90% of GDP the risks of a large negative impact on the long term growth become highly significant.

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APPENDIX

Table 1.

```
VAR Estimation Results:
=========================
Endogenous variables: ggs, yys, tts, ii, pp
Deterministic variables: const
Sample size: 80
Log Likelihood: 1547.223
Roots of the characteristic polynomial:
0.9487 0.9487 0.9455 0.9455 0.8332 0.8332 0.8173 0.7593 0.7593 0.7433
0.7433 0.6762 0.6762 0.6459 0.6459 0.4884 0.4113 0.4113 0.2366 0.2366
Call:
VAR(y = bp1, p = 4, type = "const")


Estimation results for equation ggs:
====================================
ggs = ggs.l1 + yys.l1 + tts.l1 + ii.l1 + pp.l1 + ggs.l2 + yys.l2 +
tts.l2 + ii.l2 + pp.l2 + ggs.l3 + yys.l3 + tts.l3 + ii.l3 + pp.l3 +
ggs.l4 + yys.l4 + tts.l4 + ii.l4 + pp.l4 + const

         Estimate Std. Error t value Pr(>|t|)
ggs.l1  1.313e+00  1.327e-01   9.895 3.82e-14 ***
yys.l1  2.501e-01  2.660e-01   0.940    0.351
tts.l1  1.344e-03  9.645e-03   0.139    0.890
ii.l1   7.074e-02  2.140e-01   0.331    0.742
pp.l1  -9.184e-02  2.052e-01  -0.448    0.656
ggs.l2 -2.027e-01  2.171e-01  -0.933    0.354
yys.l2 -3.480e-01  4.512e-01  -0.771    0.444
tts.l2  4.840e-03  9.814e-03   0.493    0.624
ii.l2  -1.580e-01  3.556e-01  -0.444    0.658
pp.l2   1.173e-01  1.948e-01   0.602    0.549
ggs.l3 -7.365e-02  2.171e-01  -0.339    0.736
yys.l3  8.542e-02  4.496e-01   0.190    0.850
tts.l3  4.647e-03  9.695e-03   0.479    0.634
ii.l3   6.558e-02  3.640e-01   0.180    0.858
pp.l3  -1.134e-01  1.804e-01  -0.629    0.532
ggs.l4 -5.775e-02  1.377e-01  -0.419    0.677
yys.l4  4.043e-02  2.637e-01   0.153    0.879
tts.l4 -6.559e-05  8.285e-03  -0.008    0.994
ii.l4   7.842e-02  2.313e-01   0.339    0.736
pp.l4  -6.100e-02  1.795e-01  -0.340    0.735
const  -2.019e-01  2.436e-01  -0.829    0.411
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1


Residual standard error: 0.005321 on 59 degrees of freedom
Multiple R-Squared: 0.999,      Adjusted R-squared: 0.9987
F-statistic:  3064 on 20 and 59 DF,  p-value: < 2.2e-16


Estimation results for equation yys:
====================================
```

```
yys = ggs.l1 + yys.l1 + tts.l1 + ii.l1 + pp.l1 + ggs.l2 + yys.l2 +
tts.l2 + ii.l2 + pp.l2 + ggs.l3 + yys.l3 + tts.l3 + ii.l3 + pp.l3 +
ggs.l4 + yys.l4 + tts.l4 + ii.l4 + pp.l4 + const

         Estimate Std. Error t value Pr(>|t|)
ggs.l1  0.066494   0.064852   1.025  0.30940
yys.l1  1.522777   0.130009  11.713  < 2e-16 ***
tts.l1  0.001442   0.004714   0.306  0.76070
ii.l1  -0.014950   0.104590  -0.143  0.88683
pp.l1   0.160364   0.100275   1.599  0.11511
ggs.l2  0.030588   0.106112   0.288  0.77415
yys.l2 -0.446502   0.220507  -2.025  0.04741 *
tts.l2  0.004925   0.004796   1.027  0.30870
ii.l2  -0.201322   0.173797  -1.158  0.25138
pp.l2  -0.009008   0.095192  -0.095  0.92493
ggs.l3 -0.096292   0.106093  -0.908  0.36777
yys.l3 -0.123249   0.219734  -0.561  0.57699
tts.l3  0.001538   0.004738   0.325  0.74657
ii.l3   0.069444   0.177883   0.390  0.69765
pp.l3  -0.192429   0.088156  -2.183  0.03304 *
ggs.l4  0.001980   0.067309   0.029  0.97663
yys.l4  0.002014   0.128886   0.016  0.98758
tts.l4  0.001094   0.004049   0.270  0.78793
ii.l4   0.056207   0.113051   0.497  0.62091
pp.l4   0.202391   0.087735   2.307  0.02459 *
const   0.390509   0.119073   3.280  0.00175 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Residual standard error: 0.0026 on 59 degrees of freedom
Multiple R-Squared: 0.9992,     Adjusted R-squared: 0.9989
F-statistic:  3718 on 20 and 59 DF,  p-value: < 2.2e-16


Estimation results for equation tts:
====================================
tts = ggs.l1 + yys.l1 + tts.l1 + ii.l1 + pp.l1 + ggs.l2 + yys.l2 +
tts.l2 + ii.l2 + pp.l2 + ggs.l3 + yys.l3 + tts.l3 + ii.l3 + pp.l3 +
ggs.l4 + yys.l4 + tts.l4 + ii.l4 + pp.l4 + const

        Estimate Std. Error t value Pr(>|t|)
ggs.l1 -1.38403    1.44503  -0.958  0.34208
yys.l1  7.92441    2.89685   2.736  0.00821 **
tts.l1  0.26478    0.10503   2.521  0.01443 *
ii.l1  -3.35663    2.33049  -1.440  0.15507
pp.l1   0.97208    2.23433   0.435  0.66510
ggs.l2  0.50412    2.36438   0.213  0.83189
yys.l2 -6.82110    4.91335  -1.388  0.17027
tts.l2 -0.07843    0.10687  -0.734  0.46593
ii.l2   5.99338    3.87254   1.548  0.12705
pp.l2  -1.09965    2.12107  -0.518  0.60609
ggs.l3 -1.81965    2.36396  -0.770  0.44452
yys.l3  2.64916    4.89611   0.541  0.59049
tts.l3 -0.13516    0.10558  -1.280  0.20549
ii.l3  -9.08547    3.96359  -2.292  0.02548 *
pp.l3   1.48181    1.96430   0.754  0.45363
ggs.l4  2.52582    1.49978   1.684  0.09744 .
yys.l4 -3.05541    2.87185  -1.064  0.29170
tts.l4  0.40298    0.09022   4.466 3.65e-05 ***
```

```
ii.l4   3.33294    2.51901   1.323  0.19090
pp.l4   4.07218    1.95490   2.083  0.04159 *
const  -1.29215    2.65319  -0.487  0.62805
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Residual standard error: 0.05794 on 59 degrees of freedom
Multiple R-Squared: 0.8948,     Adjusted R-squared: 0.8592
F-statistic: 25.09 on 20 and 59 DF,  p-value: < 2.2e-16


Estimation results for equation ii:
===================================
ii = ggs.l1 + yys.l1 + tts.l1 + ii.l1 + pp.l1 + ggs.l2 + yys.l2 +
tts.l2 + ii.l2 + pp.l2 + ggs.l3 + yys.l3 + tts.l3 + ii.l3 + pp.l3 +
ggs.l4 + yys.l4 + tts.l4 + ii.l4 + pp.l4 + const

        Estimate Std. Error t value Pr(>|t|)
ggs.l1 -0.027133   0.080115  -0.339  0.73606
yys.l1  0.200779   0.160608   1.250  0.21619
tts.l1 -0.008430   0.005823  -1.448  0.15303
ii.l1   1.363739   0.129207  10.555 3.27e-15 ***
pp.l1  -0.037933   0.123876  -0.306  0.76052
ggs.l2 -0.042218   0.131086  -0.322  0.74854
yys.l2  0.219239   0.272406   0.805  0.42415
tts.l2  0.007593   0.005925   1.281  0.20503
ii.l2  -0.630321   0.214702  -2.936  0.00474 **
pp.l2  -0.039885   0.117597  -0.339  0.73569
ggs.l3  0.003027   0.131063   0.023  0.98165
yys.l3 -0.613449   0.271451  -2.260  0.02753 *
tts.l3 -0.003272   0.005854  -0.559  0.57830
ii.l3   0.250340   0.219750   1.139  0.25922
pp.l3   0.011184   0.108905   0.103  0.91855
ggs.l4  0.059510   0.083151   0.716  0.47701
yys.l4  0.222179   0.159221   1.395  0.16812
tts.l4  0.003137   0.005002   0.627  0.53302
ii.l4  -0.037457   0.139659  -0.268  0.78948
pp.l4   0.038011   0.108384   0.351  0.72706
const  -0.242482   0.147098  -1.648  0.10458
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Residual standard error: 0.003212 on 59 degrees of freedom
Multiple R-Squared: 0.9809,     Adjusted R-squared: 0.9744
F-statistic: 151.5 on 20 and 59 DF,  p-value: < 2.2e-16


Estimation results for equation pp:
===================================
pp = ggs.l1 + yys.l1 + tts.l1 + ii.l1 + pp.l1 + ggs.l2 + yys.l2 +
tts.l2 + ii.l2 + pp.l2 + ggs.l3 + yys.l3 + tts.l3 + ii.l3 + pp.l3 +
ggs.l4 + yys.l4 + tts.l4 + ii.l4 + pp.l4 + const

         Estimate Std. Error t value Pr(>|t|)
ggs.l1 -0.0198329 0.0752351  -0.264  0.79300
yys.l1 -0.1134377 0.1508245  -0.752  0.45497
tts.l1 -0.0047706 0.0054686  -0.872  0.38655
ii.l1   0.2432037 0.1213366   2.004  0.04963 *
```

```
pp.l1   0.0447960  0.1163303   0.385  0.70157
ggs.l2 -0.0372785  0.1231013  -0.303  0.76309
yys.l2  0.2380516  0.2558130   0.931  0.35587
tts.l2  0.0055249  0.0055644   0.993  0.32481
ii.l2  -0.4241228  0.2016237  -2.104  0.03969 *
pp.l2   0.5625712  0.1104336   5.094 3.86e-06 ***
ggs.l3 -0.0060833  0.1230794  -0.049  0.96075
yys.l3 -0.1126141  0.2549158  -0.442  0.66027
tts.l3 -0.0067166  0.0054970  -1.222  0.22662
ii.l3   0.3176671  0.2063639   1.539  0.12906
pp.l3   0.1261114  0.1022713   1.233  0.22243
ggs.l4  0.0226921  0.0780862   0.291  0.77237
yys.l4  0.0390505  0.1495225   0.261  0.79487
tts.l4  0.0003535  0.0046975   0.075  0.94026
ii.l4  -0.1980444  0.1311518  -1.510  0.13637
pp.l4  -0.3133503  0.1017819  -3.079  0.00315 **
const  -0.1314215  0.1381379  -0.951  0.34529
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Residual standard error: 0.003017 on 59 degrees of freedom
Multiple R-Squared: 0.7625,     Adjusted R-squared: 0.682
F-statistic:  9.47 on 20 and 59 DF,  p-value: 6.823e-12



Covariance matrix of residuals:
           ggs       yys        tts         ii         pp
ggs  2.831e-05 2.783e-06 -1.251e-05 -1.642e-06 -1.381e-07
yys  2.783e-06 6.762e-06  4.405e-06  1.561e-06  1.867e-06
tts -1.251e-05 4.405e-06  3.357e-03 -6.289e-06  2.676e-05
ii  -1.642e-06 1.561e-06 -6.289e-06  1.032e-05  4.087e-07
pp  -1.381e-07 1.867e-06  2.676e-05  4.087e-07  9.101e-06

Correlation matrix of residuals:
          ggs     yys      tts       ii        pp
ggs  1.000000 0.20116 -0.04058 -0.09604 -0.008602
yys  0.201158 1.00000  0.02924  0.18687  0.238028
tts -0.040580 0.02924  1.00000 -0.03379  0.153078
ii  -0.096041 0.18687 -0.03379  1.00000  0.042171
pp  -0.008602 0.23803  0.15308  0.04217  1.000000
```

Table 2.

```
SVAR Estimation Results:
========================

Call:
SVAR(x = var.bp1, estmethod = "direct", Amat = amat, Bmat = bmat,
    method = "BFGS")

Type: AB-model
Sample size: 80
Log Likelihood: -567.575
Method: direct
Number of iterations: 5
Convergence code: 0

LR overidentification test:
```

```
        LR overidentification

data:  bp1
Chi^2 = 4107.801, df = 5, p-value < 2.2e-16


Estimated A matrix:
        ggs     yys       tts      ii pp
ggs 1.00000 0.00000  0.000000 0.00000  0
yys 0.09699 1.00000  0.000000 0.00000  0
tts 0.10504 0.09712  1.000000 0.00000  0
ii  0.09959 0.09851  0.002037 1.00000  0
pp  0.09884 0.09828 -0.007628 0.09941  1

Estimated B matrix:
    ggs yys tts ii pp
ggs   1   0   0  0  0
yys   0   1   0  0  0
tts   0   0   1  0  0
ii    0   0   0  1  0
pp    0   0   0  0  1

Covariance matrix of reduced form residuals (*100):
        ggs     yys     tts      ii      pp
ggs 100.000  -9.699  -9.562  -8.984  -8.111
yys  -9.699 100.941  -8.784  -8.960  -8.138
tts  -9.562  -8.784 101.857   1.610   2.425
ii   -8.984  -8.960   1.610 101.774  -8.336
pp   -8.111  -8.138   2.425  -8.336 102.449
```

Table 3.

```
Impulse response coefficients
$ggs
           ggs          yys         tts          ii          pp
 [1,] 1.000000 -0.096991083 -0.09562034 -0.08984101 -0.08111075
 [2,] 1.289699 -0.093004069 -1.95523288 -0.16524340 -0.03385740
 [3,] 1.494208  0.030594905 -1.79399329 -0.26559370 -0.11582779
 [4,] 1.663572  0.158556053 -2.40453045 -0.32182141 -0.15759960
 [5,] 1.735844  0.265376017 -0.25862612 -0.26035237 -0.11460635
 [6,] 1.756627  0.376649420  0.49589496 -0.20823889 -0.15265964
 [7,] 1.760815  0.443718755  0.89530143 -0.17385718 -0.10500348
 [8,] 1.736194  0.465835074 -0.19592744 -0.14022453 -0.08681550
 [9,] 1.707960  0.474763167  0.02221111 -0.11070201 -0.06943640
[10,] 1.676520  0.447684739  0.12110004 -0.10307303 -0.05349226
[11,] 1.629727  0.406029247  0.27922229 -0.09770844 -0.04698093
[12,] 1.582539  0.355647390 -0.34690338 -0.10760330 -0.04264871
[13,] 1.533089  0.301893118 -0.45116112 -0.11559317 -0.04563015
[14,] 1.481000  0.248811513 -0.45960313 -0.12363844 -0.04899481
[15,] 1.424349  0.197580784 -0.23080536 -0.13010264 -0.05199091
[16,] 1.365214  0.150149135 -0.39010904 -0.13807658 -0.05559237
[17,] 1.305708  0.107159153 -0.45358103 -0.14294473 -0.05551344
[18,] 1.246157  0.068851098 -0.47246187 -0.14590148 -0.05740953
[19,] 1.186129  0.034810996 -0.30908281 -0.14661281 -0.05605623
[20,] 1.125587  0.004263241 -0.29422294 -0.14751925 -0.05516203
[21,] 1.065765 -0.021748399 -0.28824274 -0.14718514 -0.05313461


Lower Band, CI= 0.95
```

```
$ggs
             ggs         yys       tts         ii          pp
 [1,]  1.0000000 -0.09923084 -3.393930 -0.1555218 -0.09548932
 [2,]  0.9328436 -0.21121582 -4.925575 -0.3372418 -0.18939022
 [3,]  0.8414318 -0.19447393 -4.493753 -0.5338838 -0.24517111
 [4,]  0.7399977 -0.18379761 -5.338960 -0.5973341 -0.31163437
 [5,]  0.6554301 -0.24009233 -3.154031 -0.5594393 -0.22518834
 [6,]  0.5952194 -0.25227481 -2.705282 -0.4723243 -0.24055029
 [7,]  0.5192203 -0.28573760 -2.891324 -0.4412779 -0.18479280
 [8,]  0.4743893 -0.38948536 -4.096970 -0.3961469 -0.15801700
 [9,]  0.4057002 -0.43157401 -4.196415 -0.3702704 -0.12529830
[10,]  0.3413890 -0.50769815 -4.423877 -0.3715621 -0.12211627
[11,]  0.2914113 -0.55791444 -4.231922 -0.3671024 -0.12018404
[12,]  0.2388854 -0.66350693 -4.111549 -0.3787407 -0.11695639
[13,]  0.1789361 -0.74747208 -4.000212 -0.3923517 -0.12017502
[14,]  0.1017403 -0.84204285 -3.664932 -0.3844465 -0.12304138
[15,]  0.0212600 -0.91294849 -3.256813 -0.3779709 -0.11668479
[16,] -0.1058077 -0.91319978 -3.019909 -0.3765400 -0.11455039
[17,] -0.2123052 -0.94575592 -3.099127 -0.4029859 -0.10720110
[18,] -0.2755844 -0.93452413 -2.664957 -0.4002896 -0.10873048
[19,] -0.3186669 -0.91940466 -2.279056 -0.3807122 -0.10231019
[20,] -0.3762170 -0.85494264 -1.976736 -0.3803744 -0.09720409
[21,] -0.4236639 -0.80009507 -1.990287 -0.3654115 -0.08976058


Upper Band, CI= 0.95
$ggs
           ggs       yys      tts         ii          pp
 [1,] 1.000000 0.2400724 3.150301 0.10304535 0.117960401
 [2,] 1.480854 0.4302854 1.979774 0.15376885 0.131922415
 [3,] 1.754091 0.7288070 1.908639 0.24531435 0.086864357
 [4,] 1.930013 0.9516939 1.286500 0.26945555 0.051260341
 [5,] 2.057010 1.0648956 3.379607 0.38056440 0.054707173
 [6,] 2.139059 1.0744367 3.884329 0.40707279 0.024627404
 [7,] 2.243740 1.0498050 4.514330 0.40701119 0.037479460
 [8,] 2.251219 1.0487491 2.618039 0.34510220 0.044501468
 [9,] 2.240088 1.0358456 2.628072 0.31274037 0.051614702
[10,] 2.210904 1.0056220 2.637718 0.24660984 0.048128333
[11,] 2.211524 0.9576902 3.014710 0.19977272 0.046922327
[12,] 2.190686 0.8905978 2.185421 0.13194630 0.052180793
[13,] 2.153398 0.9219440 2.407952 0.10466355 0.037358551
[14,] 2.098520 0.8776883 2.467638 0.06931371 0.026321369
[15,] 2.029755 0.8851514 2.462723 0.07743041 0.022696086
[16,] 1.951333 0.7971458 2.264992 0.06106898 0.011387578
[17,] 1.956458 0.7740847 2.292603 0.07056799 0.013349016
[18,] 1.956805 0.7550359 2.073012 0.06632688 0.009873357
[19,] 1.940456 0.6958545 2.250587 0.07659417 0.013204861
[20,] 1.911877 0.6437783 2.347951 0.09542954 0.012656055
[21,] 1.833932 0.6314349 2.196622 0.10447198 0.016309725
```

Table 4.

```
Impulse response coefficients
$tts
               ggs          yys         tts            ii           pp
 [1,] 0.0000000000  0.000000000  1.00000000 -0.0020372057  0.007830476
 [2,] 0.0004805013  0.002728503  0.27922659 -0.0115049723 -0.004915256
 [3,] 0.0074072470  0.009237987  0.02947568 -0.0087572770  0.006124754
 [4,] 0.0160646411  0.018137854 -0.10275990 -0.0043179847 -0.005278462
 [5,] 0.0237947908  0.028471217  0.47677619  0.0035853594 -0.002083848
```

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 [6,] 0.0280203173  0.033118273  0.31991557  0.0053604519 -0.002442515
 [7,] 0.0319609551  0.039533302  0.15440756  0.0085409765 -0.001945806
 [8,] 0.0392153984  0.042924795 -0.08280603  0.0092610405 -0.001037301
 [9,] 0.0448330327  0.044893095  0.12942170  0.0131658767 -0.001581373
[10,] 0.0492628787  0.044384375  0.12399840  0.0132430944 -0.001150193
[11,] 0.0522925647  0.042034031  0.06825146  0.0124700959 -0.000640506
[12,] 0.0555907460  0.038890661 -0.11162792  0.0104421229 -0.001163117
[13,] 0.0585557861  0.034935820 -0.06993264  0.0095302254 -0.001074109
[14,] 0.0601692826  0.030083997 -0.04941133  0.0077547865 -0.002032192
[15,] 0.0604170415  0.024703013 -0.04049059  0.0056194661 -0.001688614
[16,] 0.0599895671  0.019077407 -0.12743115  0.0027745017 -0.002194627
[17,] 0.0591365112  0.013744902 -0.13258108  0.0006636824 -0.002195584
[18,] 0.0575534367  0.008400680 -0.11810654 -0.0014267183 -0.002528438
[19,] 0.0549744652  0.003360083 -0.08637447 -0.0033020179 -0.002488142
[20,] 0.0518316703 -0.001358507 -0.10882672 -0.0054382044 -0.002473232
[21,] 0.0483704359 -0.005430330 -0.11102980 -0.0070730937 -0.002400687


Lower Band, CI= 0.95
$tts
             ggs          yys         tts           ii           pp
 [1,]  0.00000000  0.000000000  1.00000000 -0.015807038 -0.004299963
 [2,] -0.01901478 -0.006991535 -0.01487715 -0.032965899 -0.017688656
 [3,] -0.02369783 -0.009787493 -0.22112911 -0.029938663 -0.005772965
 [4,] -0.02499133 -0.005859260 -0.35656486 -0.027088318 -0.019367305
 [5,] -0.02038597 -0.001640713  0.22703078 -0.018366828 -0.013240844
 [6,] -0.02338497 -0.003595457  0.01374583 -0.016347978 -0.011883410
 [7,] -0.02408060 -0.004221401 -0.18519892 -0.014231530 -0.010191527
 [8,] -0.02294693 -0.006493941 -0.40727738 -0.012002679 -0.007903707
 [9,] -0.02336845 -0.011604213 -0.15079459 -0.007969812 -0.007357987
[10,] -0.02005676 -0.013820541 -0.14520585 -0.007735759 -0.007453931
[11,] -0.01778632 -0.020259672 -0.23997192 -0.008403046 -0.005834814
[12,] -0.01812224 -0.028294398 -0.38606626 -0.009750163 -0.006201399
[13,] -0.01672555 -0.033251314 -0.32019681 -0.009207404 -0.006388012
[14,] -0.01926205 -0.038391987 -0.29202559 -0.010888518 -0.006938316
[15,] -0.02062860 -0.042969258 -0.25712211 -0.014233833 -0.005913381
[16,] -0.02150008 -0.048269524 -0.31195140 -0.017630310 -0.006455211
[17,] -0.02048052 -0.051750852 -0.29104415 -0.018759876 -0.005807409
[18,] -0.01984400 -0.053667026 -0.28170506 -0.022122036 -0.006110453
[19,] -0.02037580 -0.057032970 -0.23654186 -0.023556313 -0.005649796
[20,] -0.02291558 -0.058624569 -0.24960760 -0.024441016 -0.005476961
[21,] -0.02679382 -0.057344683 -0.20799803 -0.023557024 -0.005025061


Upper Band, CI= 0.95
$tts
             ggs        yys        tts          ii          pp
 [1,] 0.00000000 0.00000000 1.00000000 0.010670446 0.021130920
 [2,] 0.02023495 0.01249825 0.43258785 0.008479586 0.004787118
 [3,] 0.03717478 0.02635037 0.18703876 0.016465295 0.018549490
 [4,] 0.05275757 0.04201820 0.13048147 0.026395357 0.005968767
 [5,] 0.06495388 0.05890892 0.72647814 0.033676583 0.008775838
 [6,] 0.07481034 0.06872781 0.52881589 0.034411564 0.006579135
 [7,] 0.07998780 0.07780226 0.34870658 0.034575058 0.006187653
 [8,] 0.08751903 0.08212606 0.13613205 0.034397063 0.006425579
 [9,] 0.09731924 0.08276950 0.35041335 0.035890693 0.005840368
[10,] 0.10299844 0.08236182 0.32851113 0.032176936 0.004747957
[11,] 0.10716623 0.08256046 0.25531208 0.030488233 0.005786182
[12,] 0.10885892 0.08198921 0.07877375 0.026200666 0.003975780
[13,] 0.11522992 0.07791725 0.11647692 0.024555457 0.004119404
```

[14,]	0.11785582	0.07388433	0.14003428	0.021242181	0.002341990
[15,]	0.12063168	0.06696903	0.16337298	0.016935695	0.002552586
[16,]	0.11822421	0.06129115	0.04951589	0.014648719	0.001866407
[17,]	0.11738177	0.05403641	0.05507733	0.011718803	0.001613431
[18,]	0.11476888	0.04638625	0.05612828	0.009549108	0.001115318
[19,]	0.10880475	0.04283927	0.10403564	0.007197080	0.001407642
[20,]	0.10805398	0.03899499	0.04799687	0.004955528	0.001266416
[21,]	0.10085359	0.03244184	0.05883362	0.003481831	0.001326339

Table 5. Data

date	pop	gdp	gcn	gdp_deflactor	gcn_deflactor	taxes	yys	ggs	tts	pp	irate	ii
1995Q1	39652,04	112392,90	19942,80	63,87	66,51	8114,30	10,7005	8,9309	8,0721	0,024	9,020	0,090
1995Q2	39691,58	115923,60	20492,80	65,43	68,42	9860,50	10,7064	8,9288	8,2420	0,024	9,450	0,095
1995Q3	39740,79	119295,00	21068,10	67,01	70,32	10774,60	10,7099	8,9279	8,3055	0,024	9,560	0,096
1995Q4	39791,17	121444,70	21291,30	67,74	70,80	9686,00	10,7156	8,9304	8,1869	0,011	9,410	0,094
1996Q1	39820,35	124782,10	22022,00	69,16	73,17	9334,20	10,7213	8,9304	8,1285	0,021	8,710	0,087
1996Q2	39858,68	126010,20	22087,90	69,40	73,09	10931,00	10,7267	8,9335	8,2820	0,003	7,490	0,075
1996Q3	39905,44	127082,70	22230,20	69,31	72,97	11378,70	10,7352	8,9404	8,3221	-0,001	7,230	0,072
1996Q4	39952,52	127253,00	22277,00	69,13	72,68	10624,60	10,7380	8,9453	8,2550	-0,003	6,650	0,067
1997Q1	39980,02	127690,10	21984,20	68,60	71,44	10126,80	10,7484	8,9486	8,2140	-0,008	5,900	0,059
1997Q2	40022,51	128928,60	22113,50	68,60	70,82	11727,40	10,7570	8,9622	8,3597	0,000	5,360	0,054
1997Q3	40074,13	130105,80	22251,60	68,56	71,08	12069,70	10,7655	8,9634	8,3878	-0,001	5,260	0,053
1997Q4	40123,23	132911,40	22380,30	69,04	71,31	11764,40	10,7786	8,9647	8,3540	0,007	5,010	0,050
1998Q1	40152,41	133593,60	22666,30	68,73	71,63	10706,70	10,7874	8,9721	8,2635	-0,004	4,600	0,046
1998Q2	40188,07	136437,50	23043,50	69,62	71,96	12385,40	10,7947	8,9833	8,3954	0,013	4,360	0,044
1998Q3	40233,25	139128,50	23533,20	70,18	72,62	13606,70	10,8052	8,9939	8,4804	0,008	4,320	0,043
1998Q4	40282,53	142233,80	24101,70	71,00	73,39	13856,40	10,8144	9,0062	8,4857	0,012	3,730	0,037
1999Q1	40302,77	144646,00	24609,00	71,62	74,16	12353,00	10,8220	9,0160	8,3616	0,009	3,090	0,031
1999Q2	40337,91	147165,00	24824,00	71,79	74,19	14377,00	10,8361	9,0234	8,5101	0,002	2,630	0,026
1999Q3	40391,30	149830,00	25070,00	72,22	74,95	14944,00	10,8467	9,0218	8,5415	0,006	2,700	0,027
1999Q4	40446,68	152675,00	25577,00	72,74	75,65	15429,00	10,8570	9,0311	8,5649	0,007	3,430	0,034
2000Q1	40478,51	156687,00	26234,00	73,48	76,44	14381,00	10,8720	9,0453	8,4836	0,010	3,550	0,036
2000Q2	40526,39	159662,00	26563,00	73,96	76,62	16326,00	10,8831	9,0543	8,6028	0,007	4,280	0,043
2000Q3	40579,58	163320,00	27512,00	74,85	77,93	15874,00	10,8925	9,0711	8,5614	0,012	4,740	0,047
2000Q4	40633,07	166581,00	27804,00	75,51	78,39	15572,00	10,9022	9,0745	8,5322	0,009	5,030	0,050
2001Q1	40673,99	169924,00	28309,00	76,26	79,28	15593,00	10,9111	9,0801	8,5226	0,010	4,740	0,047
2001Q2	40720,45	173227,00	28676,00	77,13	79,45	16223,00	10,9178	9,0898	8,5497	0,011	4,590	0,046
2001Q3	40775,55	176614,00	29220,00	77,86	80,33	16605,00	10,9265	9,0961	8,5622	0,009	4,280	0,043
2001Q4	40894,21	179763,00	29696,00	78,70	80,46	17100,00	10,9305	9,1077	8,5780	0,011	3,450	0,035
2002Q1	41120,96	182451,00	30325,00	79,42	81,83	16548,00	10,9307	9,1064	8,5305	0,009	3,360	0,034

2002Q2	41319,42	185911,00	30729,00	80,32	82,30	17546,00	10,9334	9,1090	8,5729	0,011	3,450	0,035
2002Q3	41516,72	188834,00	31475,00	81,10	83,02	18058,00	10,9347	9,1195	8,5874	0,010	3,360	0,034
2002Q4	41736,98	192092,00	32032,00	81,88	83,37	17371,00	10,9368	9,1276	8,5337	0,010	3,120	0,031
2003Q1	41922,14	195924,00	33061,00	82,70	85,12	18380,00	10,9423	9,1340	8,5758	0,010	2,690	0,027
2003Q2	42112,80	198983,00	33298,00	83,42	84,52	19221,00	10,9445	9,1437	8,6072	0,009	2,360	0,024
2003Q3	42285,65	202523,00	33933,00	84,33	85,38	19715,00	10,9472	9,1483	8,6177	0,011	2,140	0,021
2003Q4	42464,33	206042,00	34396,00	84,92	85,62	20553,00	10,9532	9,1549	8,6482	0,007	2,150	0,022
2004Q1	42595,01	209415,00	36079,00	85,79	87,94	20346,00	10,9562	9,1729	8,6247	0,010	2,060	0,021
2004Q2	42746,77	213211,00	36425,00	86,67	87,39	21728,00	10,9604	9,1851	8,6767	0,010	2,080	0,021
2004Q3	42926,30	217455,00	37478,00	87,52	88,25	22705,00	10,9662	9,1996	8,7068	0,010	2,120	0,021
2004Q4	43168,61	221339,00	37835,00	88,53	87,98	23188,00	10,9667	9,2065	8,7107	0,012	2,160	0,022
2005Q1	43378,37	225739,00	39450,00	89,39	90,31	22611,00	10,9719	9,2174	8,6710	0,010	2,140	0,021
2005Q2	43584,79	230497,00	39871,00	90,35	90,14	25931,00	10,9773	9,2251	8,7925	0,011	2,120	0,021
2005Q3	43751,40	234589,00	40560,00	91,09	91,00	24192,00	10,9830	9,2289	8,7112	0,008	2,130	0,021
2005Q4	43935,89	239741,00	41209,00	92,13	91,23	26910,00	10,9891	9,2380	8,8021	0,011	2,340	0,023
2006Q1	44079,56	244843,00	42628,00	93,08	93,42	25808,00	10,9967	9,2449	8,7467	0,010	2,610	0,026
2006Q2	44248,11	249484,00	43086,00	93,87	93,23	27038,00	11,0032	9,2539	8,7811	0,008	2,900	0,029
2006Q3	44441,50	254757,00	44190,00	94,91	94,19	26064,00	11,0087	9,2646	8,7289	0,011	3,220	0,032
2006Q4	44672,92	258890,00	45025,00	95,55	94,35	30432,00	11,0129	9,2763	8,8720	0,007	3,590	0,036
2007Q1	44898,41	264021,00	46464,00	96,45	96,13	26459,00	11,0181	9,2841	8,7176	0,009	3,820	0,038
2007Q2	45116,20	268238,00	47124,00	97,21	96,02	27454,00	11,0213	9,2945	8,7420	0,008	4,070	0,041
2007Q3	45342,00	271917,00	48347,00	97,75	96,74	26061,00	11,0244	9,3076	8,6793	0,006	4,490	0,045
2007Q4	45587,40	276631,00	49107,00	98,59	97,00	28107,00	11,0276	9,3152	8,7409	0,009	4,720	0,047
2008Q1	45752,72	279465,00	51210,00	99,15	99,50	24479,00	11,0285	9,3280	8,5934	0,006	4,480	0,045
2008Q2	45913,12	280470,00	51899,00	99,45	99,44	21854,00	11,0255	9,3385	8,4735	0,003	4,860	0,049
2008Q3	46062,91	279626,00	52943,00	99,91	100,48	20913,00	11,0147	9,3447	8,4216	0,005	4,980	0,050
2008Q4	46203,92	276646,00	53469,00	99,85	100,13	24002,00	11,0015	9,3551	8,5569	-0,001	4,240	0,042
2009Q1	46270,65	271870,00	54467,00	99,72	101,08	20618,00	10,9840	9,3627	8,4048	-0,001	2,010	0,020
2009Q2	46334,46	269882,00	55010,00	99,96	101,15	17622,00	10,9728	9,3705	8,2440	0,002	1,310	0,013
2009Q3	46398,48	268670,00	55692,00	99,82	101,41	15054,00	10,9684	9,3789	8,0865	-0,001	0,870	0,009

2009Q4	46466,61	268612,00	55859,00	99,86	101,14	21393,00	10,9663	9,3831	8,4361	0,000	0,720	0,007
2010Q1	46495,74	269644,00	55678,00	99,95	100,60	22379,00	10,9686	9,3846	8,4796	0,001	0,660	0,007
2010Q2	46533,55	270089,00	55632,00	99,92	100,35	23404,00	10,9697	9,3855	8,5239	0,000	0,690	0,007
2010Q3	46578,94	270520,00	55346,00	100,04	99,75	23933,00	10,9691	9,3853	8,5440	0,001	0,870	0,009
2010Q4	46641,70	270660,00	55059,00	100,09	99,31	23843,00	10,9678	9,3832	8,5384	0,000	1,020	0,010
2011Q1	46669,64	269375,00	55372,00	100,02	99,61	22968,00	10,9632	9,3852	8,5012	-0,001	1,100	0,011
2011Q2	46706,52	268365,00	55114,00	100,13	99,43	23309,00	10,9575	9,3816	8,5140	0,001	1,420	0,014
2011Q3	46755,71	266863,00	54798,00	99,92	99,29	22327,00	10,9529	9,3762	8,4720	-0,002	1,560	0,016
2011Q4	46813,16	265810,00	54389,00	100,05	99,14	21426,00	10,9465	9,3690	8,4283	0,001	1,500	0,015
2012Q1	46797,41	263530,00	53341,00	100,02	98,95	23403,00	10,9385	9,3518	8,5172	0,000	1,040	0,010
2012Q2	46771,12	261005,00	52477,00	99,86	98,82	22182,00	10,9310	9,3374	8,4657	-0,002	0,690	0,007
2012Q3	46753,18	260630,00	51869,00	100,30	99,04	23922,00	10,9255	9,3238	8,5372	0,004	0,360	0,004
2012Q4	46743,91	257707,00	47549,00	100,13	91,99	24739,00	10,9162	9,3110	8,5727	-0,002	0,200	0,002
2013Q1	46680,21	258101,00	51133,00	100,66	99,51	24062,00	10,9138	9,3064	8,5411	0,005	0,210	0,002
2013Q2	46610,01	257678,00	50829,00	100,75	99,36	25111,00	10,9128	9,3035	8,5844	0,001	0,210	0,002
2013Q3	46553,36	257207,00	50620,00	100,50	98,85	24919,00	10,9146	9,3057	8,5803	-0,002	0,220	0,002
2013Q4	46529,36	258286,00	49791,00	100,68	96,85	25834,00	10,9176	9,3101	8,6152	0,002	0,240	0,002
2014Q1	46480,61	257843,00	51093,00	100,14	99,43	25415,00	10,9223	9,3107	8,6053	-0,005	0,300	0,003
2014Q2	46463,14	259284,00	50736,00	100,20	98,94	25165,00	10,9276	9,3089	8,5951	0,001	0,300	0,003
2014Q3	46454,73	260996,00	51015,00	100,28	99,46	26328,00	10,9336	9,3094	8,6397	0,001	0,160	0,002
2014Q4	46457,73	263037,00	49593,00	100,38	96,93	27035,00	10,9403	9,3068	8,6652	0,001	0,080	0,001
2015Q1	46443,76	266220,00	52210,00	100,67	100,10	26231,00	10,9498	9,3264	8,6324	0,003	0,050	0,001
2015Q2	46428,35	268988,00	52245,00	100,75	99,43	27745,00	10,9597	9,3341	8,6881	0,001	-0,010	0,000
2015Q3	46413,07	271762,00	52368,00	100,96	99,14	28159,00	10,9682	9,3397	8,7011	0,002	-0,030	0,000
2015Q4	46418,80	274220,00	51847,00	101,07	97,73	29005,00	10,9760	9,3439	8,7295	0,001	-0,090	-0,001