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Fiscal Multipliers in Malta

Ian Borg[1]

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[1] Ian Borg is a senior economist in the Bank's Economic and Monetary Analysis Department. The author would like to thank Mr John Farrugia, Dr Aaron Grech, Mr Brian Micallef, Mr John Caruana and Dr Bernard Gauci for valuable discussions, and an anonymous reviewer, for comments and suggestions. The views expressed are those of the author and do not necessarily reflect the views of the Central Bank of Malta. Any errors are his own.
Corresponding author: Ian Borg, Economics and Monetary Analysis Department, Central Bank of Malta.
Email address: borgi@centralbankmalta.org.

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Abstract

This paper employs a Structural Vector Autoregression approach à la Blanchard and Perotti (2002) to investigate the impact of discretionary fiscal policy shocks on key macroeconomic variables in Malta. In order to gauge the quantitative impact of fiscal policy over the period 1995 to 2012, impact and cumulative multipliers are calculated. The response of GDP to government expenditure shocks and its components is low on impact but larger than one cumulatively. Moreover, private consumption responds positively to shocks in government spending, while private investment declines after a positive innovation to government expenditure. On the other hand, increases in net-taxation generate lower multipliers than shocks to government spending. This paper concludes that disposable income is the primary channel through which fiscal policy affects the real economy.

JEL Classification: E32, E62, H20, H50

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1. Introduction

The recent global financial crisis and world recession have triggered a renewed interest in fiscal policy and its impact on economic activity. In part this mirrors the limitations of monetary policy as a sufficient demand-management tool when it hits the zero lower bound. Moreover, member states in a monetary union are unable to use monetary policy to correct for idiosyncratic shocks, and have to rely on fiscal policy as their only available demand-management instrument. It is thus vital to understand the macroeconomic dynamics in a country in response to changes in fiscal variables, because they might have a significant impact on policymaking and forecasting.

Economic theory does not offer a clear and common picture about the effects of changes in fiscal variables on the aggregate economy. Traditional Keynesian literature suggests that fiscal multipliers are positive and greater than unity due to the interaction between multiplier analysis and the principle of acceleration (Samuelson, 1939). However, neoclassical authors integrate more explicit microfoundations in their models and, by assuming that agents are rational and display Ricardian behaviour, they obtain low multipliers (Barro, 1974). Theoretical estimates derived from general equilibrium Real Business Cycle (RBC) models such as that in Baxter and King (1993) generally strengthened this view. The latter showed that under some assumptions, such as complete price flexibility and no investment adjustment costs, temporary changes in fiscal variables generate negative wealth and substitution effects such that the short-run impact on private consumption and investment is negative, and the long-run impact on output is lower than one. By introducing nominal rigidities, New Keynesian Models (NKM) created a consensus between the classical supply-side approach to macro modelling, and the traditional Keynesian demand approach. Although NKM do not necessarily predict that a fiscal policy easing is expansionary, they generally generate larger impacts than RBC models. For example, Christiano et al. (2011) showed that by introducing nominal and real rigidities, spending multipliers are positive and larger than one, both in normal times and periods of elevated economic stress.

A lack of consensus also exists in empirical literature, not only on the quantitative impact of fiscal shocks, but also on the qualitative effects. Primarily this reflects the lack of consensus with regard to the identification strategy that should be employed to identify fiscal shocks. On the one hand, recursive and Structural Vector Autoregression (SVAR) literature such as in Fatàs and Mihov (2001) and Blanchard and Perotti (2002) recover fiscal shocks either by statistical or economic restrictions. The seminal paper by the latter identifies fiscal shocks by taking advantage of decision lags in fiscal policy. They use quarterly data to be able to make the assumption that government expenditure does not respond to the cycle, and estimate tax elasticities a priori to account for the cyclical response of taxation to the business cycle. On the other hand, Mountford and Uhlig (2009) use a sign-restrictions approach by imposing restrictions on the shape of the impulse responses. The main objection raised against using SVAR models is that they do not incorporate anticipated effects, which can be significant in the implementation phase of fiscal policy. Ramey and Shapiro (1998) and Ramey (2011) for example, use narrative measures such as military build-ups and the Survey of Professional Forecasters to identify fiscal shocks.[2]

This paper seeks to investigate the mechanics of the fiscal policy transmission mechanism in Malta during the period 1995-2012, by assessing the qualitative dynamic impact of fiscal shocks on key macroeconomic variables, and by estimating the quantitative impact using output multipliers. In line with the fiscal multiplier literature, a fiscal shock is here defined as a random unanticipated dis-

[2] See Caldara and Kamps (2012) for an exhaustive treatment of these methodologies.

cretionary shock. The primary fiscal policy experiments included in this paper are shocks to government expenditure, and to tax revenue less transfers (referred to as net-taxation). After careful analysis of the literature and the availability of data in Malta, the identification strategy employed in this paper is a SVAR approach à la Blanchard and Perotti (2002).

In summary, positive shocks to government expenditure are found to have an expansionary impact on Gross Domestic Product (GDP) and private consumption, but contractionary effects on private investment. Impact expenditure multipliers are low and less than unity, but cumulative multipliers for GDP exceed one after around two years. In addition, positive shocks to net taxes generate statistically significant negative effects on GDP, private consumption, and private investment. Both impact and cumulative multipliers generated from net-tax shocks are below unity and lower than government expenditure multipliers. Finally, this paper finds that the composition of government spending matters in the short-run and in the medium-run. Government consumption generates higher impact multipliers than government investment, while government investment generates larger medium-run multipliers.

This study is divided as follows. The next section outlines the empirical methodology employed in this paper. The following section briefly describes the data, and the fourth section discusses the results. The last section concludes with some policy implications of the results.

2. Methodology

2.1 Summary of the different empirical approaches for identifying fiscal shocks

Fiscal shocks are surprisingly difficult to identify, with different strands of the literature devoted to solving this problem but with little or no consensus. Similar to the identification of monetary policy shocks, a number of authors have employed conventional SVARs using a recursive approach, the Blanchard-Perotti (2002) approach, or sign-restrictions as in Mountford and Uhlig (2009). A number of country–specific studies such as Giordano et al. (2007), Tenhofen et al. (2010), Castro Fernàndez and Hernández de Cos (2006), Burriel et al. (2010), Mançellari (2011), and Pereira and Wemans (2013), rely on the Blanchard-Perotti approach to identify fiscal shocks. Since SVARs require only a minimum set of assumptions, the latter methodology is simple enough to apply to different data sets.

However, VARs have found it challenging to account for fiscal foresight, which, if significant can lead to biased output multipliers. In general, fiscal foresight arises due to lags in the implementation of fiscal policy. Leeper et al. (2013) and Forni and Gambetti (2010) argue that conventional econometric methods such as identified VARs suffer from the drawback that the econometrician has less information than economic agents. Fiscal policy is usually defined by two types of lags – decision lags and implementation lags (Blanchard and Perotti, 2002). While decision lags are driven by the fact that it takes some time before policy itself reacts to shocks, implementation lags imply that fiscal policy decisions are usually announced significantly before actual implementation. In turn, Leeper et al. (2013) identify two types of lags in the implementation of tax legislation – inside lags and outside lags. The former describes the time lag between when the tax is initially proposed and passed, and the latter is the lag between when it is passed and implemented. With both the inside and outside lags, economic agents might already have enough information to make decisions well before the implementation of fiscal measures, but the econometrician who relies on current and past

shocks is unlikely to capture this anticipation satisfactorily. In other words, economic agents' response may precede the implementation of the policy measure itself.

Leeper et al. (2013) outline three popular approaches which attempt to account for fiscal foresight. The first is the narrative approach, which uses information sets outside of the VAR itself to identify fiscal shocks. In this vein, Ramey and Shapiro (1998) and Ramey (2011) derive measures of fiscal news on the basis of information about expected military buildups. In addition, Ramey (2011) makes use of the one period ahead forecast error of government spending growth derived from the Survey of Professional Forecasters (SPF). On the other hand, Romer and Romer (2010) try to identify exogenous revenue shocks on the basis of their reading of a number of government documents, and Mertens and Ravn (2013) expand on this by incorporating fiscal news identified from government documents into the VAR (calling it a proxy-SVAR), and by omitting tax changes that were implemented more than 90 days after becoming law. Narrative approaches are, however, not without their limitations since it is difficult to ensure that the measures of fiscal news are truly exogenous. Leeper et al. (2013) argue that theoretical and empirical models are often misaligned in their treatment of information flows, and that narrative measures are generally weak instruments of exogenous shocks.

Another strand conditions on asset prices, based on the assumption that asset markets are efficient and are therefore able to incorporate foresight. In order to include fiscal foresight, the asset utilised in this approach must be of a special type. In the United States, municipal bonds are exempt from federal taxesand hence, the spread between yields on these instruments and on Treasury bonds allows the econometrician to cater for foresight on federal fiscal data. Still, as Leeper et al. (2013) argue there are very few examples of these types of assets in other countries, which make the methodology quite challenging to use in different applied settings.

Finally, DSGE models, which can explicitly model fiscal foresight, are also quite popular in identifying fiscal shocks. Nevertheless, Leeper et al. (2013) argue that since modelers are required to make specific assumptions about information flows, different modelling assumptions can give very different results. Therefore, more parsimonious approaches such as a VAR are usually preferred.

2.2 Choice of identification

As already stated in the previous section, this paper employs the Blanchard-Perotti (2002) methodology in identifying fiscal shocks. This methodology has been utilised quite considerably in country-specific studies, and is generally accepted as a valid starting point in a context where literature about fiscal multipliers in a particular country is at its infancy. This is certainly the case for Malta since, to my knowledge no empirical study has yet focused on estimating fiscal multipliers in Malta.

Moreover, narrative approaches are generally very hard to implement for Malta. As explained above, the identification in the literature requires either periods of substantial military buildups, forecast errors from sources outside the VAR, or the analysis of government documents. The first method cannot be applied to Malta in the period under consideration in this paper, firstly because military expenditure averaged less than 2% of total government expenditure, and secondly because significant military buildups during this period cannot be identified. The second method is also quite difficult to implement since very few organisations forecast Malta's economy and most of these forecasts are too recent to be of any significant use. The Romer and Romer (2010) approach offers the best option for the inclusion of fiscal foresight, and this may be the subject of future work.

Conditioning on asset prices is also not very applicable for the case of Malta, partly due to the illiquidity of Malta's asset markets, and also due to the unavailability of the special types of as-

sets that can help in identifying fiscal news. Finally, while some examples of DSGE models for Malta do exist (see for example Micallef and Cyrus (2013)), work on estimating them is still under way, and it is therefore preferable to start with a simpler approach, based on the Blanchard-Perotti paper.

2.3 The Blanchard-Perotti approach: application to Malta

The estimation of the spending and tax multipliers requires the modelling of two basic blocks: a fiscal block and a macroeconomic block (Tenhofen et al., 2010). The reduced form VAR, specified in levels, as suggested by Blanchard and Perotti (2002) and Perotti (2004), can be written as:

$$Y_t = B(L)Y_{t-1} + AX_t + U_t \tag{1}$$

where $Y_t \equiv (G_t, Y_t, P_t, T_t)$ is the vector of endogenous variables; B(L) is an autoregressive lag polynomial; the vector $U_t \equiv (\mu_t^G, \mu_t^Y, \mu_t^P, \mu_t^T)$ consists of the reduced form residuals.; and X_t is a vector of deterministic variables.

The fiscal block in the baseline VAR includes government expenditure and net taxes. Government expenditure (G_t) is defined as the sum of government consumption and government gross fixed capital formation (GFCF)[3]. Net taxes (T_t) are defined as total revenues less transfers, subsidies, and interest payments. The difference between total government expenditure and net taxes is equal to the general government primary balance. Moreover, the macroeconomic block comprises of GDP (Y_t) as a measure of output,[4] and the GDP deflator (P_t) as a measure of prices. The deterministic variables included in X_t control for foreign prices, external demand, trends, and a dummy variable to cater for a spike in current transfers in the fourth quarter of 2003.[5] All variables are seasonally adjusted using X12 Arima, deflated with the GDP deflator, and enter in logs.

To determine the dimensions of the autoregressive lag polynomial B(L) various lag length selection criteria were used, such as the Akaike Information Criteria (AIC), the Hannan-Quinn (HQ), and the Schwartz Criterion (SC), all of which suggest that the optimal lag length is one. The autocorrelation LM test confirms that the null hypothesis of no autocorrelation cannot be rejected at lag length of one.

The VAR specified in equation 1 provides reduced-form residuals μ_t^g and μ_t^y, which represent linear combinations of different structural shocks (Burriel et al., 2010). Unless we are able to differentiate between the shocks, the impulse responses we get from a standard VAR would have no particular economic significance. In their seminal paper, Blanchard and Perotti (2002) explain that the reduced form residuals are a linear combination of three types of shocks: 1) the responses of fiscal variables to changes in GDP driven by the reaction of government to output fluctuations (for example an increase in government expenditure in response to a recession); 2) the presence of 'au-

[3] Government consumption and government GFCF will be used separately to investigate whether the composition of government spending shocks matters in terms of the immediate and cumulative effects on the economy.

[4] In section 4.3 GDP is replaced with private investment and private consumption as the primary macroeconomic variables of interest.

[5] The variables utilised as measures of foreign prices and external demand are estimates used as part of the Eurosystem projection exercises. These include the export prices of Malta's competitors and a world demand indicator constructed for Malta.

tomatic stabilisers' that bring about contemporaneous changes in fiscal variables in response to changes in output (for example: direct taxation increases contemporaneously with a rise in compensation to employees); 3) random discretionary fiscal shocks exogenous to the macroeconomy and uncorrelated with other structural shocks. We are interested only in the latter since we want to investigate the response of macroeconomic variables to random unanticipated discretionary fiscal policy shocks. Hence, an identification procedure must recover the third category of shocks by eliminating the first two. The reduced-form residuals can be expressed in the following way:

$$\mu_t^g \equiv \alpha_{gy}\mu_t^y + \alpha_{gp}\mu_t^p + \beta_{gt}e_t^T + e_t^g \tag{2a}$$

$$\mu_t^T \equiv \alpha_{ty}\mu_t^y + \alpha_{tp}\mu_t^p + \beta_{tg}e_t^g + e_t^T \tag{2b}$$

where e_t^g and e_t^T are the random discretionary fiscal policy shocks. In the Blanchard and Perotti (2002) approach these are recovered by using knowledge about how institutions work, which allows the econometrician to estimate the α_{ijs} and β_{ijs}. The α_{ijs} are the coefficients of the reduced-form residuals from changes to output and prices, while β_{ijs} are the coefficients of the residuals to the corresponding random discretionary fiscal shocks.

The use of quarterly data is crucial for the identification process as it exploits decision lags in fiscal policy. The fiscal policy decision-making process is rather long due to negotiations that have to take place with stakeholders and in parliament (Tenhofen et al., 2010). Hence, government is assumed to be unable to react within the quarter.

The coefficients included in equations (2a) and (2b) only reflect the second channel, that is, the automatic response of fiscal variables to macroeconomic changes. Estimation of these coefficients in the Blanchard-Perotti methodology is done by estimating contemporaneous tax and expenditure elasticities to GDP and prices. These are used to calculate the 'automatic stabilisers' in the economy (α_{ty}) which captures the automatic response of net taxation to GDP changes, and the elasticity of net taxation to prices (α_{tp}).

A tax elasticity is defined as the percentage change in a tax revenue item given a percentage change in its corresponding tax base. Moreover, in this paper the estimation of the overall net tax elasticity, which can be defined as the percentage change in total net tax revenue given a percentage change in GDP (α_{ty}), follows the Giorno et al. (1995) approach. This proceeds in two steps: firstly, elasticities of the individual tax revenue and transfer items with respect to their respective macroeconomic bases are estimated by simple OLS; secondly, an elasticity of the macroeconomic base to GDP is obtained, again by OLS.[6]

The estimated output elasticity of net taxes is equal to 1.41, which is very close to that estimated for the euro area by Burriel et al. (2010) of 1.54. Moreover, the estimated elasticity of net taxes to prices is equal to 1.3, which is also reasonably close to the Burriel et al. (2010) result of 1.14 for the euro area as a whole.

The coefficient α_{gy} in (2a) represents the within quarter elasticity of government expenditure to GDP. Since government expenditure is typically exogenous to changes in output during the

[6] For further details see appendix A.

quarter, α_{gy} is assumed to be equal to zero.[7] On the other hand, the elasticity of real government expenditure to prices (α_{gp}) cannot be assumed to be zero, since higher prices reduce the government's ability to buy contemporaneously. Following Mançellari (2011), government expenditure can be split into three main categories: compensation to employees, intermediate consumption, and government investment. The average shares of these in total government expenditure during the sample period under consideration are 61%, 24%, and 15%, respectively. Since investment projects are usually planned over a long horizon, it is hard to expect any within the quarter automatic response of real government investment to price changes. Thus, its elasticity is taken to be zero. Moreover, since most purchases of goods and services (such as spending on medical services) are fixed in volume terms within the quarter, real spending on these items does not respond contemporaneously, and hence the elasticity is fixed to zero. Conversely, while wages in Malta are indexed to the retail price index (RPI) through the cost of living adjustment (COLA), the adjustment is made annually, and nominal wages do not respond to quarterly inflation. Moreover, the public sector is almost entirely covered by collective agreements which specify annual rather than quarterly wage increases. As a result, a rise in prices reduces the spending on real compensation contemporaneously. As in Perotti (2004), Burriel et al. (2010), and Mançellari (2011) among others, the elasticity of the latter is fixed to -1. Multiplying these by the shares in total expenditure, α_{gp} is calibrated to -0.61.[8]

These priors allow us to obtain cyclically-adjusted fiscal shocks:[9]

$$\mu_t^{g,CA} = \mu_t^g - \alpha_{gp}\mu_t^p = \beta_{gT}e_t^T + e_t^g$$

$$\mu_t^{T,CA} = \mu_t^T - \alpha_{ty}\mu_t^y - \alpha_{tp}\mu_t^p = \beta_{Tg}e_t^g + e_t^T \quad (3)$$

The orthogonalisation of the structural shocks depends in part on setting a priori whether spending decisions come before tax decisions or vice versa. In the literature, (for example Perotti, 2004; Tenhofen et al., 2010; Castro Fernàndez and Hernández de Cos, 2006; and Burriel et al., 2010), it is usually assumed that government spending decisions come first. This paper follows the latter assumption by assuming β_{gT}=0. Estimates of the structural shocks were then obtained. The last step in calculating the fiscal multipliers was to obtain the impulse responses, which are a summary measure of the response of output to random unanticipated discretionary fiscal shocks.

Impulse responses obtained from the SVAR cannot be interpreted as multipliers, because these represent the response of a variable to a positive standard deviation innovation.[10] In order to calculate the impact multiplier, impulse responses are re-scaled such that the response of the response variable is to a one euro change in the policy variable. Together with the impulse responses,

[7] A simple OLS regression using annual data shows a strong relationship between government expenditure and GDP. However, there is no contemporaneous relationship between the two variables when using quarterly data. Since this paper utilises quarterly data, the contemporaneous elasticity between government expenditure and GDP can be plausibly assumed to be zero.

[8] This exercise is repeated for the different VARs which change the fiscal spending variable. For the VAR with government consumption, α_{gp}= -0.72, and for the VAR with government investment, α_{gp} = 0.

[9] See Burriel et al. (2010) for additional details.

[10] Graphs in appendix C are re-scaled as one percent shocks, but multipliers are further re-scaled as one-euro change shocks.

the 95th, 84th, and 68th percentile confidence intervals are reported to display the statistical significance of the impact and cumulative multipliers.[11]

2.4 Fiscal multipliers: definitions and calculations

The fiscal multiplier can be defined in various ways. In general it can be defined as the ratio of a change in output (ΔY_t) in response to a change in either government spending (ΔG_t), or the fiscal deficit as in Spilimbergo et al. (2009).Moreover, in empirical literature, such as that in Ilzetzki et al. (2013), Burriel et al. (2010) and Tenhofen et al. (2010), the measure of fiscal multipliers takes into account both the impact and the cumulative impact of shocks to fiscal variables on output. This allows us to trace the impact of shocks over time, since the economy may need time to respond fully to a one-time discretionary fiscal policy shock.

In VAR literature, the impulse responses are utilised to trace the dynamic effects of fiscal policy shocks. By transforming the VAR into a Vector Moving Average (VMA) model the impact spending multiplier can be written as:

$$\frac{\Delta Y_0}{\Delta G_0}\left(\frac{1}{\bar{G}/\bar{Y}}\right) \tag{4}$$

that is, the response of a macro variable at time 0, to a contemporaneous unanticipated shock in the policy variable.

Similarly the cumulative multiplier can be defined as:

$$\frac{\sum_{t=1}^{12}\Delta Y_t}{\sum_{t=1}^{12}\Delta G_t}\left(\frac{1}{\bar{G}/\bar{Y}}\right) \tag{5}$$

which is the cumulative change in the macro variable, divided by the cumulative change in the policy variable over 12 periods. A similar method was used for net taxes.

3. Data

3.1 Brief description of the data

The use of quarterly data poses some challenges since quarterly general government national accounts data based on ESA 95 are only available from 1999 for most European countries, and Malta is no exception. Given that the vector autoregression methodology requires a substantial amount of data points, the data set utilised in this paper spans the period 1995q1-2012q4. This is quite a small sample size when compared to those used in Blanchard and Perotti (2002), Perotti (2004) and Burriel et al. (2010), whose primary focus are the United States and the euro area as a whole. However, it is

[11] This paper follows the fiscal multiplier literature in discussing statistical significance using the 68th percentile (or one standard error band). Examples include Fatàs and Mihov (2001), Blanchard and Perotti (2002), Tenhofen et al. (2010), Caldara and Kamps (2012), and Ramey (2011). However, as the latter puts it, "some have appealed to the Sims and Zha (1999) for using 68% bands. However, there is no formal justification for this approach". Given our relatively small sample size, 68% bands are probably the most appropriate.

comparable to subsamples in the latter two papers, Giordano et al. (2007), Pereira and Wemans (2013), and Castro Fernàndez and Hernández de Cos (2006).

In the literature a number of approaches are taken to extend the data set. One method is to use cash data (for example Giordano et al., 2007 for Italy, and Tenhofen et al., 2010, for Germany) whose availability usually extends far enough in the past. On the other hand, authors such as Castro Fernàndez and Hernández de Cos (2006) to extend accruals-based national accounts data backward using adjusted cash data to get a longer data set that is consistent with accruals-compliant ESA 95.

The latter approach is taken in this paper. Nominal expenditure data for the period 1995-1998 are available in the old System of National Accounts (SNA), which are adjusted to obtain a data set consistent with ESA 95. Moreover, a number of tax revenue series consistent with ESA 95 already exist and are hence used. Other series which are unavailable are obtained by applying cash data to the official annual national accounts data. Thus, interpolation is kept to a minimum (see appendix B for more information).

Figure 1: Fiscal Variables

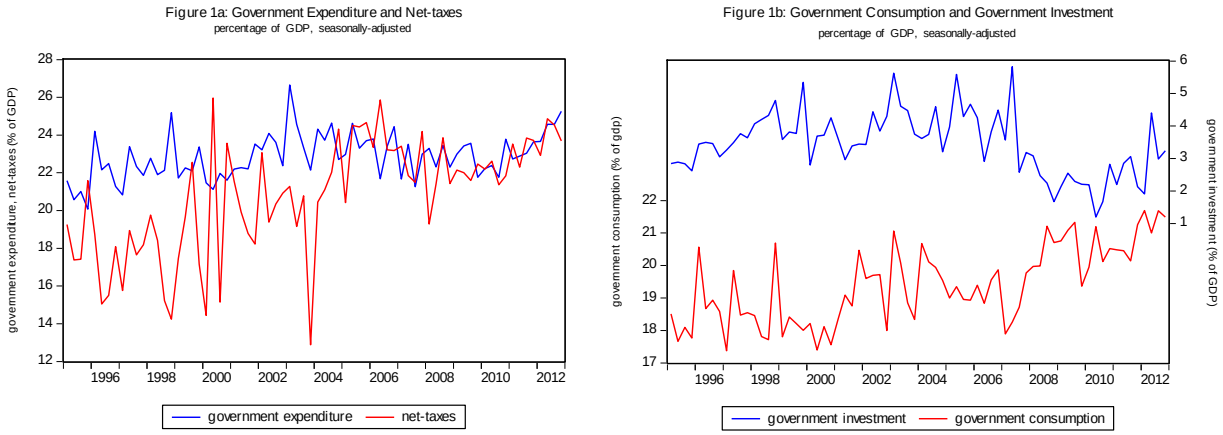


Figure 1a plots the seasonally-adjusted total government expenditure and net-taxation as a percentage of GDP. Despite the seasonal adjustment, the two series are quite (volatile, a feature quite common in Maltese data. With regard to fiscal data, volatility primarily reflects the irregular timing of cash payments and receipts as well as one-off transactions. For example, net-taxation declined substantially in the fourth quarter of 2003 due to a substantial increase in capital transfers as a result of a transfer related to a one-off financial transaction related to the dissolution of the Malta Drydocks and Malta Shipbuilding.

However, the variation of the series can also be attributed to a number of fiscal policy events. The period 1996-1999 exhibits the highest volatility especially in net-taxation. This primarily reflects a period of successive changes in government, which brought about significant changes in the indirect tax regime.[12] During the same period, the ratio of government expenditure to GDP rose significantly, which brought about deterioration in the primary budget balance. Subsequently, it improved but remained in deficit. A period of fiscal consolidation occurred between 2005 and 2007 during which Malta was in the Exchange Rate Mechanism II (ERM), prior to the adoption of the euro.

[12] Value Added Tax (VAT) was enacted in 1995, partly in preparation for EU membership. Following a change in government in 1996, this was removed and replaced by Customs and Excise Tax (CET). In 1998, another change in government took place, and VAT was re-introduced in 1999 (IMF, 1999).

The expenditure-to-GDP ratio declined and the net-tax-to-GDP ratio rose, resulting in three years of primary budget balance surplus. A period of low economic activity ensued in the following years due to the world recession, leading to low revenue and small primary deficits during 2008-2012.

Over the full sample period, both government expenditure and net taxes exhibit an upward trend, although a few breaks can be detected. According to the Zivot-Andrews test, the government expenditure exhibits a break in 2006, which corresponds to the fiscal consolidation that took place prior to the adoption of the euro. Similarly, the net-taxation series exhibits a break in 2006, also during the period in which Malta was in the ERM II.

Figure 1b plots the ratios of government consumption and government investment to GDP. Government consumption, which represents the largest category in total government expenditure, is primarily composed of the general government wage bill and intermediate consumption. As a result, the volatility exhibited in total government expenditure during the period 1996-1999 was driven primarily by significant variations in government consumption. On the other hand, the government investment to GDP ratio rose during the same period, and declined substantially in 2006 during a period of fiscal consolidation prior to the adoption of the euro. Tests for breaks in series show that similar to total government expenditure, both government consumption and government investment exhibit a break in 2006.

3.2 Unit root and cointegration testing

The endogenous variables were tested for stationarity, using the standard Augmented Dickey Fuller (ADF) test, and the Phillips-Perron test. The two tests give similar results, and establish that all variables are I(1) variables, that is, non-stationary in levels but stationary in first differences. Further tests indicate that all fiscal variables become stationary in the levels when the unit-root testing includes a deterministic trend.

The next step is to test for cointegration. The Johansen test for cointegrating rank is implemented, utilising an unrestricted constant and a restricted trend. On the basis of the trace statistic, all systems (i.e. those with government expenditure, government consumption, and government investment as the spending fiscal variable) have at least one cointegrating relationship. This implies that the system could be represented in Vector Error Correction (VECM) form. However, this paper does not aim to assess the long-run equilibrium of the endogenous system. Rather, the main intention is to investigate the short to medium-run responses of the relevant economic variables to shocks in fiscal variables. Hence, the impulse response function derived from a VAR specified in levels is employed as the main measure of fiscal policy.

3.3 Fiscal shocks

Figure 2 depicts the estimated fiscal shocks, derived as residuals from the baseline VAR, which tend to be associated with discretionary fiscal actions. Indeed, the period 1996-2000 exhibits a number of shocks both in government expenditure and net-taxation, a period which, as already highlighted above, coincided with changes in government administration that led to quick successive changes in the indirect tax regime. Figure 2a shows that a number of discretionary shocks to government expenditure also took place during this period. Subsequently, shocks to net-taxes and government expenditure turned negative in the period before 2004 and again before 2008 prior to Malta's accession to the EU and euro adoption respectively.

Figure 2: Estimated expenditure and revenue shocks

Figure 2a: Expenditure shocks

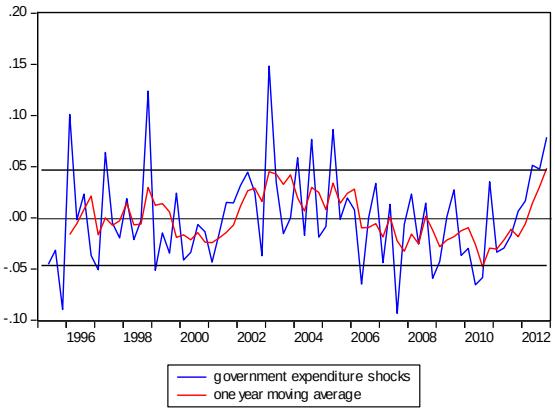
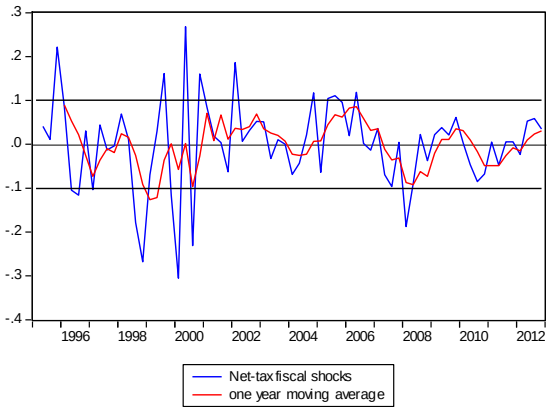


Figure 2b: Net taxes shocks



4. Results

4.1 Response to a government expenditure shock

The responses of the four endogenous variables to a one percent government expenditure shock are presented in figure 3 (Appendix C). In contrast to most of the literature (for example Blanchard and Perotti, 2002; Perotti, 2004; Burriel et al., 2010; and Castro Fernàndez and Hernández de Cos, 2006), the persistence of the shock of government expenditure in Maltese data is relatively low. Most of the shock takes place in the first quarter, and lasts for around 9 quarters until it becomes statistically insignificant. The lack of persistence in government spending is, however, similar to results obtained by Giordano et al. (2007) for Italy. Burriel et al. (2010) showed that government spending shocks were more persistent in the United States than the euro area, which was linked to the higher persistence of military spending shocks in the United States. Therefore, the low persistence in Malta's government expenditure shocks when compared to some of the literature could be partially explained by the relatively small portion of military expenditure in total government spending.

The contemporaneous response of GDP to a government expenditure shock is positive, which is in line with a priori expectations. It exhibits a hump-shaped response, peaking in the second quarter, and lasts for around two years. The persistence of the response in output mirrors that in government expenditure, but the dynamics reflect more complex interactions within the system.[13]

Meanwhile, the rise in GDP causes the price level to increase exhibiting a hump-shaped response, which lasts for around two and a half years. The hump-shaped response in prices is consistent with NKM literature, in that prices respond marginally at first but pick up substantially over time.

[13] The use of cumulative multiplier can be challenged on the grounds that that the government expenditure shock is not persistent. This lack of persistence in government expenditure drives the relatively low persistence in the response of output. However, as will be made clear later in this section, output still reacts quite strongly to the shock in government expenditure, implying that fiscal shocks are able to generate medium-run effects. Hence, it is appropriate to look at both contemporaneous and dynamic effects of fiscal policy.

Dynamic responses in GDP are partly assisted by the contemporaneous negative response of net taxes, which goes to zero immediately after the first quarter.[14] Such response of net taxation enhances the expansionary effects induced by the government expenditure shock as it pushes the primary balance further into negative territory. In analysing the results of similar shocks, Burriel et al. (2010) show that while net taxes rise on impact in the euro area in response to a government spending shock, those in the United States fall. These differences could be interpreted as divergences in the way fiscal packages are designed across countries. While some countries finance a rise in government expenditure by raising taxation to ensure fiscal sustainability, others prefer to use a mixture of government expenditure increases and tax cuts (or an increase in transfers) to stimulate the economy. The latter seems to be true for the case of Malta, at least with respect to the sample period under consideration. A simple analysis using OLS shows that the relationship between real net taxes and real government expenditure, after controlling for non-stationarity, is negative, albeit statistically insignificant at conventional levels. This suggests that in general, Malta's fiscal packages contained a mixture of government expenditure increases and tax cuts.[15]

A more interesting way to assess a country's fiscal policy transmission mechanism is to calculate the impact and cumulative output multipliers. The impact multiplier allows us to empirically investigate the immediate response of output (or any other macroeconomic variable) to a fiscal policy shock, which is most useful if government seeks to utilise fiscal policy to tame the business cycle. The cumulative multiplier on the other hand allows us to trace the actual impact of a random discretionary fiscal policy shock, since the economy may take some time to absorb the full impact of the initial shock (Ilzetzki et al., 2013).

A one euro increase in government expenditure in Malta leads to a 19c rise in output on impact. This implies that there is substantial crowding out on impact despite the contemporaneous negative response of net-taxation. While the range of multipliers found in the literature is quite wide, most seem to find evidence in favour of an impact multiplier which is less than one (see for example Burriel et al., 2010; Tenhofen et al., 2010; Giordano et al., 2007; Blanchard and Perotti 2002; and Perotti, 2004). However, an output multiplier of 0.19 is on the low side of these estimates, which might reflect the specific fundamentals of the Maltese economy.[16]

Firstly, one factor that may lead to small impact multipliers is the wealth effect, where consumers and investors expect future fiscal policy to be contractionary to correct for the initial expansion, which may lead them to cut down on their present consumption and investment demand (Leeper et al., 2011). Such Ricardian equivalence is modelled in both RBC and New Keynesian literature, but the extent to which this channel is prevalent depends on different modelling assumptions and economic fundamentals.

[14] The response of net-taxes depends crucially on the estimated β_{tg} – the response of taxes to government spending – which in this case is negative. If this value is calibrated to 0, the output multipliers would be much lower than those reported later in this section.

[15] These results have to be interpreted with caution. The evidence from OLS could be driven by accelerations in deficits in the beginning of the sample period. In later periods, especially since Malta's accession to the EU in 2004, more emphasis on fiscal sustainability may have reversed the above relationship between net taxes and government expenditure.

[16] Comparison with small and open economies would have been preferable given the characteristics of the Maltese economy, but, the literature in this area is scant.

Secondly, substantial crowding out is to be expected in a small open economy such as Malta, given the substantial import intensities in both production and consumption.[17] This is also in line with the empirical work of Ilzetzki et al. (2013) who found that there is a clear negative relationship between the size of the current-account to GDP ratio and the size of the spending multiplier.

The uncertainty with regards to the size of the impact spending multiplier is magnified when estimating the cumulative multiplier. Leeper et al. (2011) reports that theoretical literature at the time gave a range of values for the long-run multiplier that varied between -1.0 and 1.4. Ilzetzki et al. (2013) and Perotti (2004) in their cross-country studies also uncover similar uncertainty.

In this study, the cumulative output multiplier for Malta reaches 1.0 in the fourth quarter. This continues to rise, reaching 1.2 by the second year. Thus, while in the very short-run there seem to be significant crowding out effects, these are offset in the medium-run as successive cumulative changes in real output get consecutively larger and eventually exceed the initial shock.[18]

These results are similar to those obtained for Spain by Castro Fernàndez and Hernández de Cos (2006), Tenhofen et al. (2010) for Germany, and Giordano et al. (2007) for Italy. Nevertheless, Burriel et al. (2010) estimates cumulative multipliers that are less than one both for the euro area and the United States,[19] while Pereira and Wemans (2013) estimate significant crowding out effects to shocks in overall government purchases for the case of Portugal. The latter, however, get multipliers significantly larger than one when they shock compensation to employees.

The results warrant further explanation. Firstly, as explained above, Pereira and Wemans (2013) get cumulative multipliers that exceed one when shocking compensation to employees, which suggests that there is a strong disposable income channel in Portugal. Moreover, Leeper et al. (2011), emphasise that a higher fraction of hand-to-mouth consumers may lead to substantially larger responses of output to spending shocks over time. As shown in Grech et al. (2013) there is evidence which suggests that in Malta consumers have large marginal propensities to consume. This may imply that there is low financial development which leads to liquidity-constrained consumers. This brings about excess sensitivity of consumption to disposable income. At the same time, the dampening effect from increased savings due to Ricardian equivalence is relatively small. The dominance of the disposable income channel over the wealth effect leads to successive positive second-round effects. Hence, the cumulative multiplier is relatively high.[20]

Moreover, a large strand of literature is devoted to understanding the role the interdependence between monetary and fiscal policy plays in the value of the multiplier. Although many models exist that give contrasting views, most seem to agree that when monetary policy is accommoda-

[17] Using the OECD input-output tables, Malta is found to have the third largest intermediate input-output ratio in the euro area during the period mid-2000s, only after Ireland and Slovakia. The high import intensity of output that this implies is probably a factor behind the low impact multiplier.

[18] The response of employment to a shock in government expenditure is also positive. Given that hiring and firing is relatively low in Malta due to the small labour market and shortage of skills, additional employment due to a rise in government expenditure is likely to generate capacity effects, which partially explain the greater than one multiplier.

[19] The authors however qualify their results as being very dependent on the seasonal adjustment used. Indeed, they report that when they change their seasonal adjustment method they get cumulative output multipliers that exceed one. In our case, while seasonal adjustment does play a significant role in the value obtained, different methods do not impact upon whether the multiplier is larger or smaller than one.

[20] The response of private consumption to fiscal shocks will be investigated further in section 4.3.

tive,[21] the value of the spending multiplier is larger (see for example Krugman, 1998; and Eggertsson and Woodford, 2004; Woodford, 2011; and Christiano et al., 2011, among others). Indeed, Ilzeztki et al. (2013) finds that countries with fixed exchange rates have larger multipliers when compared to countries with flexible exchange rate regimes. An increase in government expenditure raises output and money demand, which in turn raises the interest rate. This attracts more foreign capital which puts pressure on the exchange rate to appreciate. If the central bank targets a fixed exchange rate, it would raise the money supply to halt the rise in the shadow exchange rate, enhancing in the process the expansionary impact of fiscal policy. Prior to the adoption of the euro on 1 January 2008, Malta had long adopted a fixed exchange rate regime system, and hence, in the sense described here, monetary policy had accommodated fiscal policy.

The specific features of the Maltese economy as a small-open economy could also explain the low impact multipliers and relatively high cumulative multipliers. Rodrik (1998) finds a positive relationship between government size and trade openness, and Alesina & Wacziarg (1998) finds that smaller countries have a larger share of government in GDP. The authors hypothesise that if small countries have larger share of trade openness, the government becomes very important in order to reduce external risk and to take advantage of economies of scale. As a result, while an increase in government expenditure may generate low economic activity in the short run, it would generate larger increases in GDP in the long run due to government's role in smoothing external risk and by generating positive economies of scale.

4.2 Response to a net-tax shock

Figure 4 (see appendix C) depicts the responses of the four endogenous variables to a one percent increase in net taxes. The shock is short-lived, lasting for only one quarter. Similar to Caldara and Kamps (2008), the shock peaks in the immediate period, and monotonically dies in the following periods. The lack of persistence contrasts with results obtained by Burriel et al. (2010) both for the euro area and the United States, but is similar to those obtained by Giordano et al. (2007) for Italy. Although the literature does not discuss the persistence of the initial shock, this has a significant impact on the dynamic response of the other variables in the system. While the initial rise in net-taxation is deficit-reducing, the primary balance does not improve substantially over time, which limits the cumulative impact on output.

The contemporaneous response of GDP to a one-percent increase in net taxes is negative and statistically significant. This is in line with a priori expectations as higher net-taxes reduce disposable income and funds available for investment, which translate into lower output. In addition, the response of output is U-shaped, which mirrors the dynamics generated by the government expenditure shock. It peaks in the second quarter and slows down monotonically thereafter, remaining statistically significant for around two years.

While the response in output is in line with theoretical expectations, the results in empirical literature are not always consistent. Indeed, in Castro Fernàndez and Hernández de Cos (2006), Giordano et al. (2007), and Tenhofen et al. (2010), the response of output is statistically insignificant and sometimes has the incorrect sign. This is sometimes caused by the response in government expenditure, which might rise in response to the increase in net taxes. In the case of Malta, however, government expenditure only increases marginally on impact and is statistically insignificant. Addi-

[21] Accommodative in this context does not necessarily mean expansionary, but it means that it is in the same direction as fiscal policy. Thus, it accommodates the fiscal policy transmission mechanism.

tionally, government expenditure falls and becomes statistically significant after a few quarters, possibly as a result of the reduction in GDP. The shock in net taxation is therefore deficit-reducing.

The reaction of prices to the shock in net taxes is negative but statistically insignificant on impact. Nevertheless, this negative response becomes statistically significant in the third quarter, and exhibits a prolonged U-hump-shaped response. The response of prices is also in line with expectations, as negative demand effects put downward pressure on prices.

Turning to the impact output multiplier, the response of output to a one euro increase in net taxes is very small, falling by 5c in the first quarter. The impact multiplier for Malta is relatively low when compared to countries such as the United States and the euro area in Burriel et al. (2010). However, when compared to Germany and Italy, in Tenhofen et al. (2010) and Giordano et al. (2007) respectively, this is relatively strong since in the latter two papers the output multiplier from a net tax shock is small and statistically insignificant. The tax multiplier is smaller than the spending multiplier, which is consistent with Keynesian literature, which purports that on impact the higher disposable income stemming from a tax cut is partially saved. This is also similar to other empirical findings, such as that in Blanchard and Perotti (2002) and Burriel et al. (2010) for the United States.

Unlike that in government expenditure, the cumulative response of output to a one euro shock in net taxes does not exceed one over the forecast horizon. In the first year, the response of output reaches -0.5, and gradually rises (in absolute terms) to -0.8 by the second year, after which it becomes statistically insignificant. This suggests that the deficit-reducing shock, by increasing taxes, does not crowd out private output enough to produce a decline in output greater than the initial shock.[22]

The literature exposes higher uncertainty with regards to the tax multiplier compared to spending multipliers, since the estimates vary widely across methodologies. Caldara and Kamps (2008) compare these methodologies and find "the estimated effects ranging from non-distortionary to strongly distortionary." These divergences could be traced to the estimation of the presence of automatic stabilisers (α_{ty}).

Notwithstanding these challenges, some explanation is warranted. One channel through which the impact on output may remain muted over the forecast horizon is the response of prices. Since the price level goes down due to adverse output effects, price competitiveness on the export side might improve. In turn, this could slow down the accumulated fall in output. Furthermore, as mentioned above, the persistence in net-tax shocks is very low, almost non-existent. Hence, the primary balance only improves contemporaneously, providing little support for persistent falls in output.

4.3 Responses of private consumption and private investment

RBC models such as that presented in Baxter and King (1993) predict that private consumption should fall after a positive shock to government spending due to negative wealth effects. IS-LM models on the other hand predict that private consumption should rise, since agents are assumed to behave in a non-Ricardian way. NKM models can generate both responses, depending on whether wealth or demand effects dominate. Empirical literature, however, generally finds a positive response of private consumption to government spending shocks. For example, Fatàs and Mihov (2001) find that increases in government spending are followed by strong and persistent increases in private consumption. Blanchard and Perotti (2002), Perotti (2004), Giordano et al. (2007), Tenhofen

[22] The impact on private consumption and private investment will be investigated further in section 4.3.

et al. (2010), and Burriel et al. (2010) get similar results. With regard to the response of net tax shocks, theoretical literature predicts negative responses of consumption, and empirical literature tends to confirm.[23]

The results for Malta are in line with Keynesian and NKM literature in that a one euro increase in government expenditure raises private consumption contemporaneously and the effects last for around two years.[24] Although the response in private consumption tracks very closely the response of GDP, unlike the latter, it peaks on impact and dies monotonically thereafter. These results confirm the earlier hypothesis that there is a significant disposable income channel in Malta, which Galí et al. (2007) formalise through rule-of-thumb consumers and unionised labour.

Meanwhile, the impact of net-tax shocks on private consumption mimics that in GDP, although, similar to the response to government spending, it peaks on impact. Similar to the response in GDP, the tax multiplier is smaller than the expenditure multiplier, which is consistent with the predictions of standard Keynesian literature.

There is less divergence between RBC and NKM literature with respect to the effects of government spending on private investment especially in the short-run. Both predict that higher public spending crowds out private investment since fewer resources would be available for private uses. However, NKM generate demand effects due to nominal and real rigidities, which reduce the negative impact on investment. Moreover, standard accelerator theory suggests that if increases in government spending raise demand, investment would respond positively and more-than-proportionally.

Empirical literature finds mixed results. Burriel et al. (2010) find negative effects on private investment in the United States but positive responses in in the euro area, suggesting that demand effects (and possibly productivity effects if the rise in government spending is mostly driven by government investment) dominate in the latter but not in the former. Blanchard and Perotti (2002) also find negative responses of private investment in the United States, but Giordano et al. (2007) find positive responses for Italy.

A one euro increase in government expenditure results in significant crowding-out effects on private investment in Malta, which falls on impact. This negative impact persists for around two-and-a-half years.[25]

Crowding-out effects on private investment in Malta could be partially explained by the large presence of state-owned enterprises captured in private Gross Fixed Capital Formation (GFCF), especially in non-residential investment.[26] An increase in government expenditure (and hence a rise in the deficit and debt-to-GDP ratio) reduces the resources available to finance projects by state-owned enterprises. Furthermore, it could also crowd out private construction expenditure. Hence, the response of private investment would be negative in the short to medium-run. Moreover, higher government spending in terms of an increase in wages would probably spill-over to the private sector, which makes the cost of private investment larger and hence less desirable.

[23] In some cases, however, responses of private consumption to net-tax shocks are very small and statistically insignificant. Examples of these include Giordano et al. (2007) and Tenhofen et al. (2010).
[24] Impulse responses are presented in appendix C, figures 5 and 6.
[25] Impulse responses are presented in appendix C, figures 7 and 8.
[26] Indeed, the impact of government expenditure on residential investment is marginally positive for around two and a half years, while the impact on non-residential investment is negative.

At the same time, the response of private investment to a net-tax-shock is negative on impact, albeit statistically insignificant, and lasts for 3 quarters.[27] This result is slightly puzzling since theoretical literature suggests that distortionary taxation would have significant adverse demand and supply-side effects. However, private investment in Malta is highly influenced by large projects by state-owned enterprises as well as by the investment decisions of foreign-owned firms, which may be less responsive to such shocks. Furthermore, in the last few years most of the rise in tax rates affected indirect taxes rather than corporate taxation. The former affect primarily private consumption, and hence there are few historical examples where the rise in taxation would have substantial distortionary impact on private investment.

4.4 Government expenditure components

As defined in previous sections, government expenditure is the sum of government consumption and government investment. The literature purports that the economic impact of changes in government consumption is different from that generated by government investment. A strand of the literature argues that government consumption is the superior tool as it creates production via the disposable income channel, while another strand presents the idea that government investment has a stronger long-run impact since it boosts the capital stock and hence is a perfect compromise between Keynesian counter-cyclical tools and supply-side policies (Perotti, 2004).

As in the case of aggregate shocks, RBC and NKM disagree on the sign of the impact response of output to government consumption and government investment shocks. In RBC literature the negative wealth effect from an increase in government absorption dominates, while in NKM literature demand effects dominate. Differences in the contemporaneous responses are driven almost completely by the response of real wages. The two main strands of literature, however, agree on the long-run effects, since both predict that output would respond positively. Baxter and King (1993) show that the response of output to an increase in public capital is higher than from an increase in current spending, since public capital makes private capital more productive.

Most empirical literature tends to confirm this (see for example Giordano et al., 2007; Tenhofen et al., 2010; and Burriel et al., 2010) with some important exceptions. Perotti (2005) finds no evidence in favour of the claim that government investment is superior to government consumption. Indeed he finds the reverse: government consumption shocks generate higher output response than government investment shocks in five OECD countries except Germany.

For the case of Malta government consumption is superior in the short-run, but, government investment creates higher cumulative multipliers.[28] The impact multiplier for government consumption is equal to 0.3 while that for government investment is equal to 0.1. The cumulative multiplier rises to 1.7 in response to government consumption, but it reaches 1.9 in response to government investment.

These results imply that government consumption is a better counter-cyclical tool, which confirms previous findings that the disposable income channel has been strong in Malta during the sample period under consideration. In addition, the relatively small impact multiplier of government investment might reflect the nature of the expenditure in the latter component. Whereas in other countries government investment tends to enhance the productive base, this does not seem to be

[27] These results are driven primarily by the non-residential component in private investment, whose negative response lasts for around two quarters. On the other hand, the negative response of residential investment, which depends primarily on domestic demand, lasts for more than 3 years.

[28] See appendix C, figures 9 and 10.

the case in Malta. This may be because government investment in construction crowds out private construction while government investment in machinery largely boosts imports. As a result, the government investment shocks would have only a marginal immediate impact on the real economy.

The disposable income channel seems to have effects even in the medium-run as the cumulative multiplier of government consumption continues to grow over time. This is partly supported by persistence in government consumption shocks. As Baxter and King (1993) show there is a positive relationship between the persistence of the initial shock and the size of the multiplier. On the other hand, output takes some time to start rising in response to a government investment shock, but over time, the rise in public capital tends to spill-over to private capital productivity as theory predicts. In the medium-run, government investment shocks generate a higher multiplier than government consumption shocks, in line with expectations that government investment has larger medium-run effects on output.

4.5 Robustness checks

Robustness is here assessed by estimating different output multipliers in response to government expenditure shocks and net-taxes, conditional on alternative specifications. Typically, VAR models can give very different results with small changes in the specification, and hence robustness is judged in terms of whether the point estimates change the main conclusions significantly. The main criteria are the sign of the multiplier, and whether the point estimate exceeds one. Table 3 shows different estimates for the cumulative output multipliers derived from various alternative specifications of the VAR, compared to the baseline. As shown in the Table, the range of estimated multipliers under alternative specifications is quite wide, but the main conclusions rarely change significantly, except for the test involving changes in the lag length.

Table 3: Robustness checks to cumulative output multipliers

Expenditure Shocks			**Net-tax Shocks**	
	4-quarters ahead	**8-quarters ahead**	**4-quarters ahead**	**8-quarters ahead**
Baseline	1.0	1.2	-0.5	-0.8
cons. deflator (all)	1	1.1	-0.3	-0.5
net-taxes = cons. def, & gov. exp = gov. exp deflator	1.4	1.7	-0.6	-0.8
2006 structural break	1.3	1.6	-0.3	-0.5
different seas. adj.	1.1	1.2 - 1.3	(-0.3) - (-0.4)	(-0.4) - (-0.7)
lag length (2 and 3)	0.2 - 0.4	0.1 - 0.7	-0.2	(-0.2) - (-0.3)
sub-sample stability (99 - 03)	0.8 - 0.9	1.1 - 1.4	-0.5	(-0.7) - (-0.8)
diff. gov-price elas.	1	1.2 - 1.3	-0.5	(-0.7) - (-0.8)
diff. tax-output elas.	0.7-1.2	1.0 - 1.4	(-0.3) - (-0.7)	(-0.4) - (-0.9)

In order to test whether the choice of the GDP deflator, to change nominal variables to real, has any significant effect on the estimated multipliers, the baseline VAR was re-run against two alternative specifications. In the first specification, the GDP deflator was replaced with the consump-

tion deflator for each endogenous variable, while in the second, government expenditure was deflated using a government expenditure deflator, net-taxes were deflated using consumption deflator, and GDP was deflated using the GDP deflator. In each case, the estimated cumulative output multipliers for the 4th and 8th quarter are relatively close to baseline estimates. The primary differences in the first specification relate to the multipliers estimated in response to net-tax shocks, which are significantly lower in absolute terms than the baseline. On the other hand, responses to government expenditure shocks are above baseline for the second specification.

As shown earlier, a structural break can be detected in 2006 both for government expenditure and net-taxes, prior to the adoption of the euro, which led to significant fiscal consolidation. In order to assess whether this episode changed the way output responds to fiscal shocks, a dummy variable starting in 2006 was included. Cumulative output multipliers in response to government expenditure shocks are significantly higher than baseline, and significantly lower in response to net-tax shocks. Nevertheless, the main conclusions still hold, as output multipliers generated from government expenditure shocks are larger than those from net-tax shocks, and exceed one in the medium-run.

In order to assess robustness against alternative seasonal adjustment methods, the baseline model was re-estimated using firstly Tramo-Seats to seasonally-adjust the endogenous variables, and secondly using seasonal dummies. The results are not substantially different from those obtained using X12 ARIMA in the baseline VAR, especially in response to government expenditure shocks. However, when using seasonal dummies, the point estimate of the cumulative output multiplier in response to net-tax shocks declines to -0.4 from -0.8 in the baseline.

Furthermore, although qualitatively the impulse responses under different specifications of the lag-length do not change substantially, point estimates are somewhat sensitive to the lag structure. Indeed, both in response to government expenditure shocks and net-tax shocks, cumulative output multipliers decrease significantly when including the 2nd and 3rd lag. Moreover, impulse responses become statistically insignificant when including the 4th lag. This does not come as a surprise since the relatively short sample used in this paper implies that the loss of degrees of freedom when adding more lags is very costly, and increases the likelihood that estimators are imprecisely estimated.

It is also quite challenging to assess sub-sample stability given the short sample. Table 3 shows the range of point estimates conditional on different starting points in the sample, that is, the VAR was re-estimated with a sample starting in 1999, 2000, 2001, 2002, and 2003.[29] Surprisingly, the range of estimates is relatively narrow, implying that there is some degree of sub-sample stability. Moreover, the cumulative output multipliers in response to government expenditure shocks become less and less dependent on the contemporaneous negative response of net-taxes reported earlier in this section.

Finally, the baseline VAR was re-estimated using different elasticities of government expenditure to price (α_{gp}) and net-taxes to output (α_{ty}). As in Caldara and Kamps (2012), the value of the estimated multipliers could be significantly affected by the estimation of automatic stabilisers (α_{ty}). This could result from different methodologies applied to the estimation of tax elasticities to their macroeconomic base, and the elasticity of the macroeconomic base to GDP. Hence, in order to ensure robustness, this paper re-estimated the multipliers obtained for a government expenditure

[29] Further shortening of the sample becomes impossible. Standard error bands become very wide when starting the sample from 2004.

shock and net-tax shock on output for alternative values of the automatic stabilisers, by calibrating α_{ty} to values between 0 and 2. Additionally, given that the elasticity of government expenditure to prices (α_{gp}) can be imprecisely estimated, this paper re-estimated the multipliers for values between 0 and 1. As shown in Table 3, the range of estimated multipliers for different values of α_{gp} is quite small and comparable to the baseline. However, a wide range of point estimates are obtained for alternative α_{ty}, especially in response to net-tax shocks. Nevertheless, while there is considerable uncertainty surrounding the point estimates, the general conclusions of the baseline results hold. Output multipliers generated by a government expenditure shock remain higher than 1 by the 8th quarter and larger than multipliers in response to net-tax shocks.

5. Conclusion and policy implications

By employing a Structural VAR approach à la Blanchard and Perotti (2002), this paper investigated the dynamic effects of fiscal policy in Malta during the period 1995 – 2012. A number of fiscal multipliers were estimated to calculate the quantitative impact of shocks to government spending and taxes on output, private consumption and private investment. The results for Malta were compared with those obtained for other countries in similar studies, and analysed within the context of a number of competing theories. Several robustness checks indicate that in general the main conclusions hold for alternative specifications of the VAR, except when lag lengths are changed. This allows us to draw a number of general conclusions about how the Maltese economy responds to fiscal shocks.

In general, the response of GDP to a discretionary shock to government spending is positive and lasts for around two years. Impact multipliers are small and lower than one, implying that in the very short run increases in government spending generate substantial crowding out effects. At the same time, the impact multipliers generated by government consumption shocks are larger than those obtained from aggregate government spending shocks and government investment shocks. This suggests that there is a substantial disposable income channel in Malta. Indeed, the cumulative multipliers exceed one, which indicates that the crowding out effects caused by negative wealth effects tend to dissipate over time due to the dominance of the disposable income channel. Furthermore, a rise in aggregate government expenditure has a positive impact on private consumption and a negative one on private investment both on impact and cumulatively.

Within the sample period under investigation, the cumulative multipliers generated from government investment shocks are statistically different from those obtained from government consumption shocks. Hence, the combination of supply-side and demand effects created by government investment shocks generated a higher quantitative impact on output compared to shocks to government consumption.

Meanwhile, the response of output to a rise in net-taxes is negative on impact and lower (in absolute terms) than the impact response generated by an expenditure shock. The response of GDP lasts for around two years but the cumulative multipliers do not exceed one. Indeed, while the impact on private consumption of a rise in net taxes is negative and statistically significant, the impact on private investment is marginal, further enhancing the view that the main channel through which the fiscal policy transmission in Malta operates is disposable income.

The results obtained in this paper need to be interpreted with caution. Burriel et al. (2010) and Perotti (2004) show that the implied dynamic effects of fiscal policy change when varying the sample period. In addition, Christiano et al. (2011) and Auerbach and Gorodnichenko (2012) demon-

strate that the effects of fiscal policy on the real economy depend largely on the stage of the business cycle, and hence, policymakers must understand the current economic environment before making predictions about the quantitative impact of their fiscal policy decisions. The results in this paper should therefore be considered as a historical account of fiscal policy during the sample period under consideration.

Furthermore, the real effects of fiscal policy depend in part on the sustainability of public finances. Corsetti et al. (2012) demonstrate that high sovereign borrowing costs can spill-over to private borrowing, which leads to the possibility that fiscal consolidations can be expansionary. The ECB has generally been of this view during the recent economic crisis in the euro area, suggesting that well-designed consolidation can have strong favourable effects on GDP in the long-run if a particular country is suffering from high debt-to-GDP ratios (ECB, 2012). Utilising a panel VAR of 17 countries, Nickel and Tudyka (2013) find that fiscal multipliers are smaller in times of high debt. Meanwhile, Farrugia and Grech (2013) analyse debt sustainability in Malta and conclude that government debt in Malta seems to be sustainable, but this conclusion depends on the assumption that fiscal consolidation takes place in the short to medium-run. Literature suggests that long-run debt sustainability is paramount in ensuring that the fiscal policy transmission mechanism remains effective during periods in which the government needs to employ fiscal measures as a counter-cyclical tool.

Finally, due to data limitations, the identification of fiscal policy shocks relied entirely on the Blanchard and Perotti (2002) approach, which, although quite popular, does not account for fiscal foresight in the implementation phase of fiscal policy. Leeper et al. (2013) showed that as a result of this, the econometrician may underestimate the tax multiplier. Other studies such as Ramey (2011) also demonstrate that fiscal foresight can also be very important in identifying government expenditure shocks.

Given the renewed interest in fiscal policy during the last few years, this subject is developing at a significant pace. Future lines of research that can be explored include the adoption of other existing empirical techniques. Narrative approaches such as that in Romer and Romer (2010) and Mertens and Ravn (2013) could be very promising in investigating the role fiscal foresight plays in the Malta's fiscal policy transmission mechanism. In addition, specific topics could be explored further such as the impact on the values of the fiscal multipliers after including debt dynamics, long-run interest rates, and disaggregating government expenditure and net-taxation further into their components.

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Appendix A: Constructing the output and price elasticities

To identify the SVAR we need to calculate the contemporaneous change in net-taxation to changes in output (α_{ty}), and the contemporaneous change in real net-taxes to changes in prices (α_{tp}). Following the Giorno et al. (1995) methodology we need to consider four categories of taxes: household direct income taxes (dirh), corporate taxes (dirc), social security taxes (ss), and indirect taxes (ind). Moreover, since unemployment benefits are also affected by the cycle, these are also considered.

Personal Income taxes

To derive the output elasticity of personal income tax, consider the following function:

$$T = t(WP)W(E)E(Y) \tag{A.1}$$

where total personal income tax revenue (T) is equal to the tax rate as a function of the real wage (WP), multiplied by a function of wage to employment €, and multiplied by a function of employment to output (Y). Taking logs and total differentiating we can write the following:

$$\frac{\partial T}{\partial y_t} = \left[\left(\frac{\partial t}{\partial w_t} + 1\right)\frac{\partial w_t}{\partial e_t} + 1\right]\frac{\partial e_t}{\partial y_t} \tag{A.2}$$

Let $\eta_{dirh,y}$ denote the elasticity of direct revenue (personal) to output ($\frac{\partial T}{\partial y_t}$), $\eta_{dirh,w}$ denote the elasticity of tax revenue to wages ($\frac{\partial t}{\partial w_t} + 1$), $\eta_{w,emp}$ denote the elasticity of wages to employment ($\frac{\partial w}{\partial e_t}$), and $\eta_{emp,y}$ denote employment elasticity to output ($\frac{\partial e}{\partial y_t}$), then we can represent A.2 as:

$$\eta_{dirh,y} = \left(\eta_{dirh,w}\,\eta_{w,emp} + 1\right)\eta_{emp,y} \tag{A.3}$$

The last term is the elasticity of output to employment, which captures the impact of cyclical variations in tax proceeds. and $\eta_{w,emp}$ is the employment elasticity of the wage rate.

By total differentiating A.1 with respect to prices, we can derive the price elasticity:

$$\eta_{dirh,p} = \eta_{dirh,w} - 1 \tag{A.4}$$

where $\eta_{dirh,p}$ is the elasticity of personal income taxes to prices.

Social Security Taxes

These are conceptually similar to personal income taxes. The output and price elasticities are the following[30]:

$$\eta_{ss,y} = \left(\eta_{ss,w}\,\eta_{w,emp} + 1\right)\eta_{emp,y} \tag{A.5}$$

[30] 'ss' means social security.

$$\eta_{ss,p} = \eta_{dirh,w} - 1$$

(A.6)

Corporate taxes

Consider the following function:

$$T = t(OP)O(Y)$$

(A.7)

where O is operating surplus, which is the assumed tax base for corporate tax revenue. Taking logs and total differentiating we get the following:

$$\frac{\partial T}{\partial y_t} = \left(\frac{\partial t}{\partial o_t} + 1\right)\frac{\partial o_t}{\partial y_t}$$

(A.8)

Let $\eta_{dirc,y}$ denote the elasticity of direct revenue (corporare) to output ($\frac{\partial T}{\partial y_t}$), $\eta_{dirc,gos}$ denotes the elasticity of direct taxes to gross operating surplus, and $\eta_{gos,y}$ denotes the elasticity of gross operating surplus to output, then:

$$\eta_{dirc,y} = \eta_{dirc,gos}\,\eta_{gos,y}$$

(A.9)

By total differentiating A.7 with respect to prices, we can derive the price elasticity:

$$\eta_{dirc,p} = \eta_{dirc,gos} - 1$$

(A.10)

Indirect taxes

These are conceptually similar to corporate income taxes[31]. The output and price elasticities are the following:

$$\eta_{ind,y} = \eta_{ind,c}\,\eta_{c,y}$$

(A.11)

$$\eta_{ind,p} = \eta_{ind,c} - 1$$

(A.12)

Unemployment benefits

Finally, the macroeconomic base for unemployment benefits is the number of unemployed, and the output and price elasticities are similar to those for corporate taxes and indirect taxes:

$$\eta_{unempb,y} = \eta_{unempb,unemp}\,\eta_{unemp,y}$$

(A.13)

[31] 'ind' means indirect taxes.

$$\eta_{unempb,p} = \eta_{unempb,unemp} - 1$$

(A.14)

Since unemployment benefits are a category of transfers, this is weighted by its share in total transfers to get output and price elasticities for transfers, denoted as $\eta_{trans,y}$ and $\eta_{trans,p}$ respectively.

Results

The elasticities were estimated by utilising a simple log-linear estimation of the budget variables to their base, and the base to output, on quarterly data[32]. Table 1 presents the results.

Table 1: Output and Price Elasticities

Individual Elasticities		Output Elasticities		Price Elasticities	
$\eta_{dirh,w}$	1.23	$\eta_{dirh,y}$	0.30	$\eta_{dirh,p}$	0.23
$\eta_{w,emp}$	0.46	$\eta_{ssc,y}$	0.26	$\eta_{ssc,p}$	0.00
$\eta_{emp,y}$	0.18	$\eta_{dirc,y}$	1.13	$\eta_{dirc,p}$	0.20
$\eta_{ss,w}$	0.80	$\eta_{ind,y}$	1.07	$\eta_{ind,p}$	0.45
$\eta_{dirc,gos}$	1.20	$\eta_{trans,y}$	-0.10	$\eta_{trans,p}$	-1.00
$\eta_{gos,y}$	0.94	$\boldsymbol{\alpha_{ty}}$	**1.41**	$\boldsymbol{\alpha_{tp}}$	**1.30**
$\eta_{ind,c}$	1.45				
$\eta_{c,y}$	0.74				
$\eta_{unempb,unemp}$	1.28				
$\eta_{unemp,y}$	-1.84				

This exercise is repeated for the different macroeconomic variables investigated throughout the study, that is, private consumption and private investment. The three individual elasticities which change are those that relate to output, that is, $\eta_{emp,y}$, $\eta_{gos,y}$, and $\eta_{c,y}$.

[32] The sample period utilised here is 2000q1-2012q4 since certain data for personal income taxes and corporate taxation are unavailable before 2000. However, given that a constant elasticity assumption is taken throughout this period, the results should not be very sensitive to the sample period. Dummy variables are used to take into account the impact of fiscal measures.

Appendix B: Data

Table 2: Data definitions and methodologies for interpolation		
Variable	**Definition**	**Notes**
Nominal GDP	Gross Domestic Product at current prices	
Real GDP	Gross Domestic Product at market 2000 prices	Data for 1995-1999 was obtained from an NSO publication entitled "National Accounts of the Maltese islands", and other press releases based on the old System of National Accounts (SNA). Growth rates derived from the old SNA were applied on the recent ESA 95 data.
GDP deflator	Nominal GDP/Real GDP	Implicit deflator, base year 2000
Government Consumption	Intermediate Consumption + compensation of employees + social transfers in kind + consumption of fixed capital - sales	Data was similarly obtained as in the case of Real GDP. Government consumption also exists annually based on ESA 95, and hence the quarterly profile obtained from the constant growth rate method was applied to the official annual series.
Government Investment	Government Gross Fixed Capital Formation	The quarterly profile for the period 1995-1999 was obtained using a rolling regression with capital expenditure obtained from cash data. This was applied to the annual ESA 95 gfcf.
Net-taxation	Indirect taxes + income taxes + SSC + other current transfers (rec) + capital taxes - social benefits - other current transfers - capital transfers - subsidies	
Indirect taxes	taxes on production and imports	Data available from 1990.
Income taxes	Current taxes on income and wealth	Data available from 1990.
Other current transfers receivable	other current revenue - property receivable	Quarterly profile for the period 1995-1998 is obtained by keeping the same share as in 1999.

Capital taxes	Capital taxes	Data available from 1990.
Social benefits	Social transfers in kind related to expenditure on products supplied to households via market producers	Data available from 1990.
Other current transfers	Other current transfers and investment grants	Quarterly profile for 95-98 was back casted using a rolling regression with grants obtained from cash data.
Capital transfers	capital transfers payable	Rolling regression with capital expenditure obtained from cash data.
Subsidies	Subsidies payable	Constant 1999 shares

Appendix C: Impulse Responses and Fiscal Multipliers

Figure 3: Response of output to a government expenditure shock

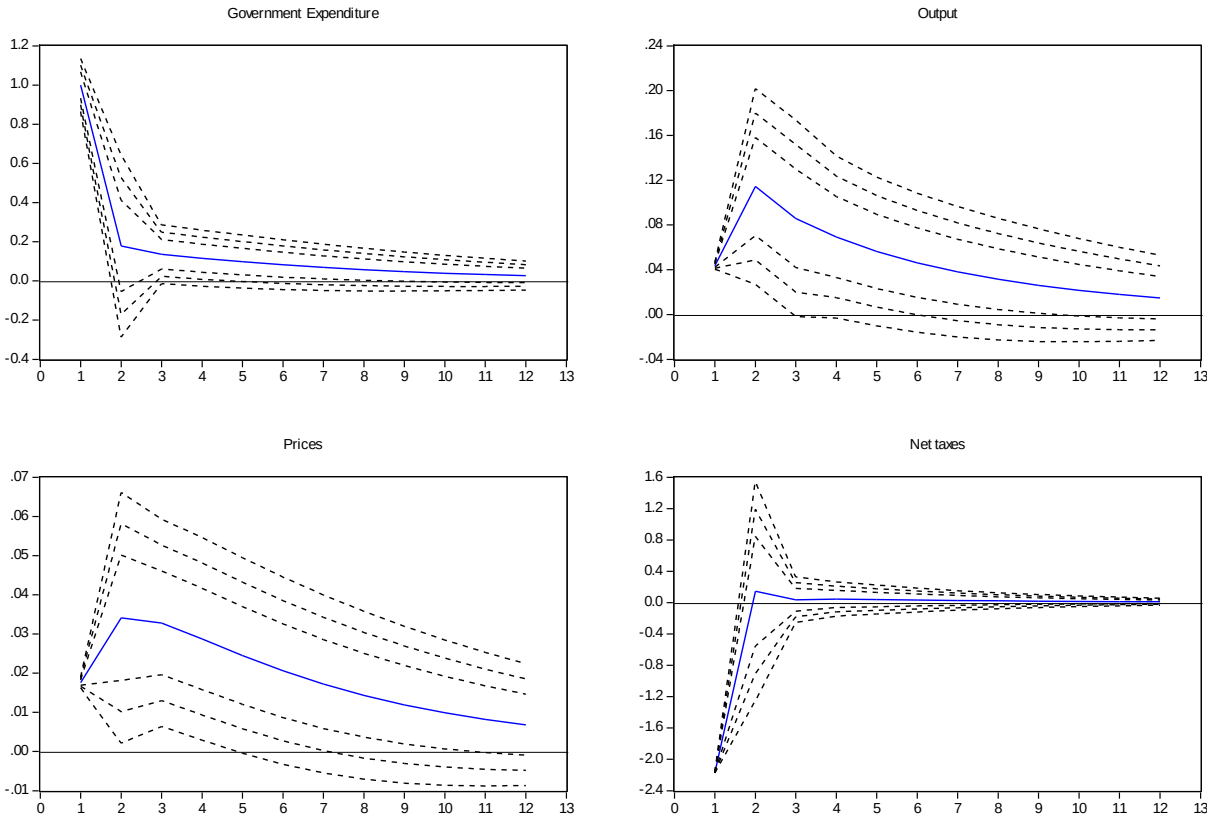


Figure 4: Response of output to a net-tax shock

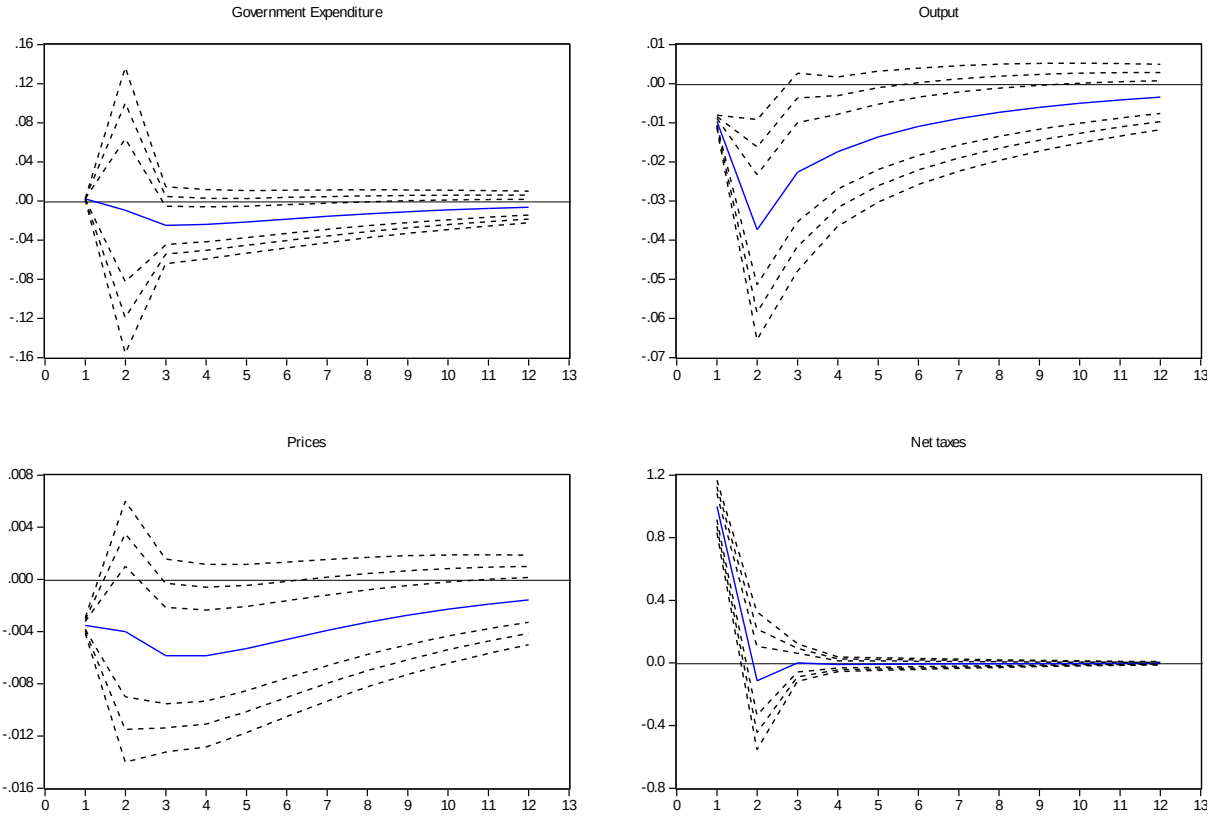
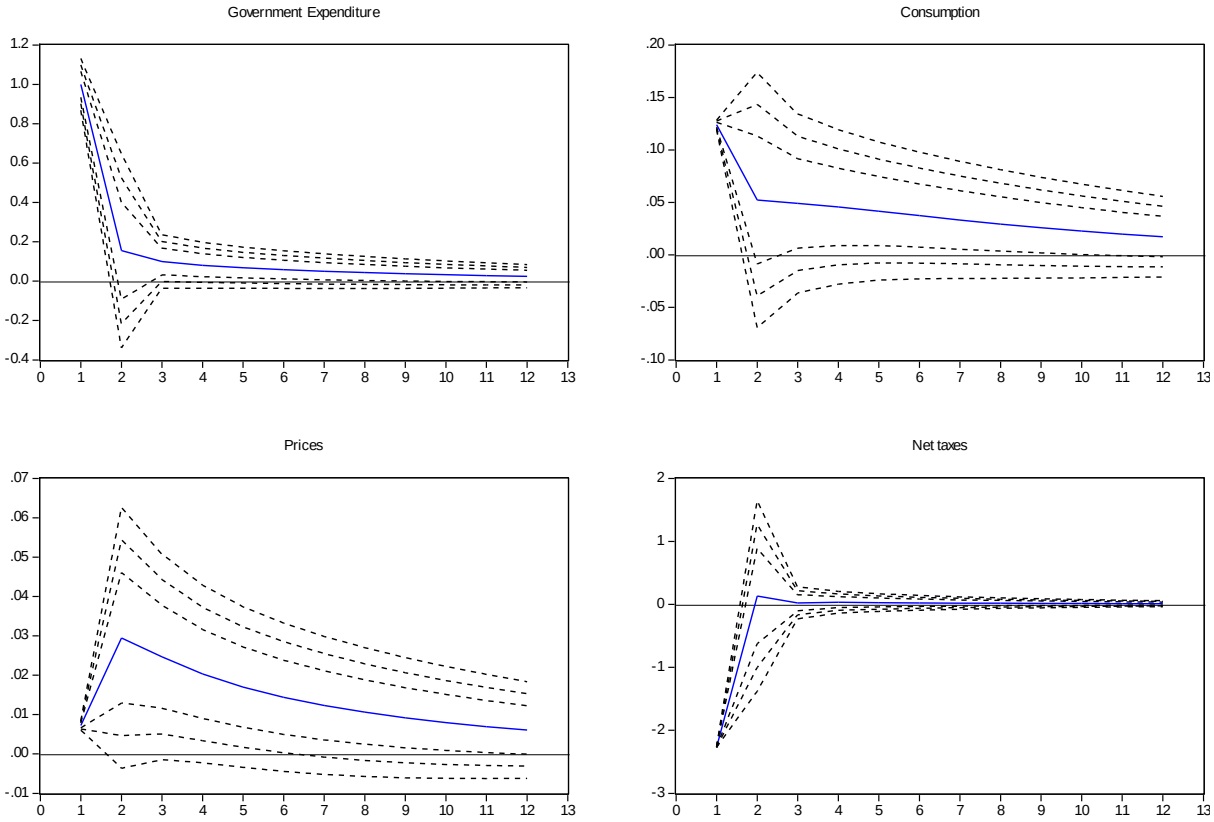


Figure 5: Response of consumption to a government expenditure shock



Dotted lines are the 95th, 84th, and 68th percentile confidence bands, and solid line is the response of each variable

Figure 6: Response of consumption to a net-tax shock

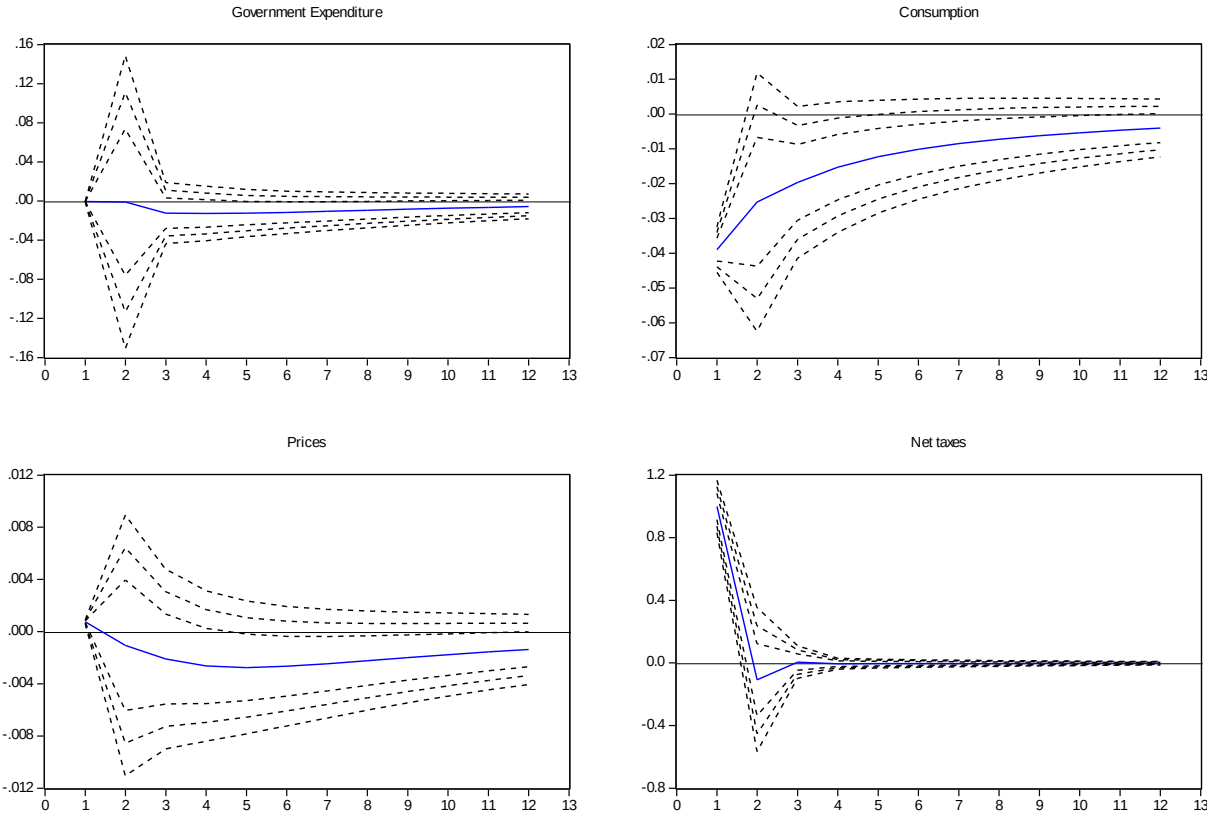


Figure 7: Response of investment to a government expenditure shock

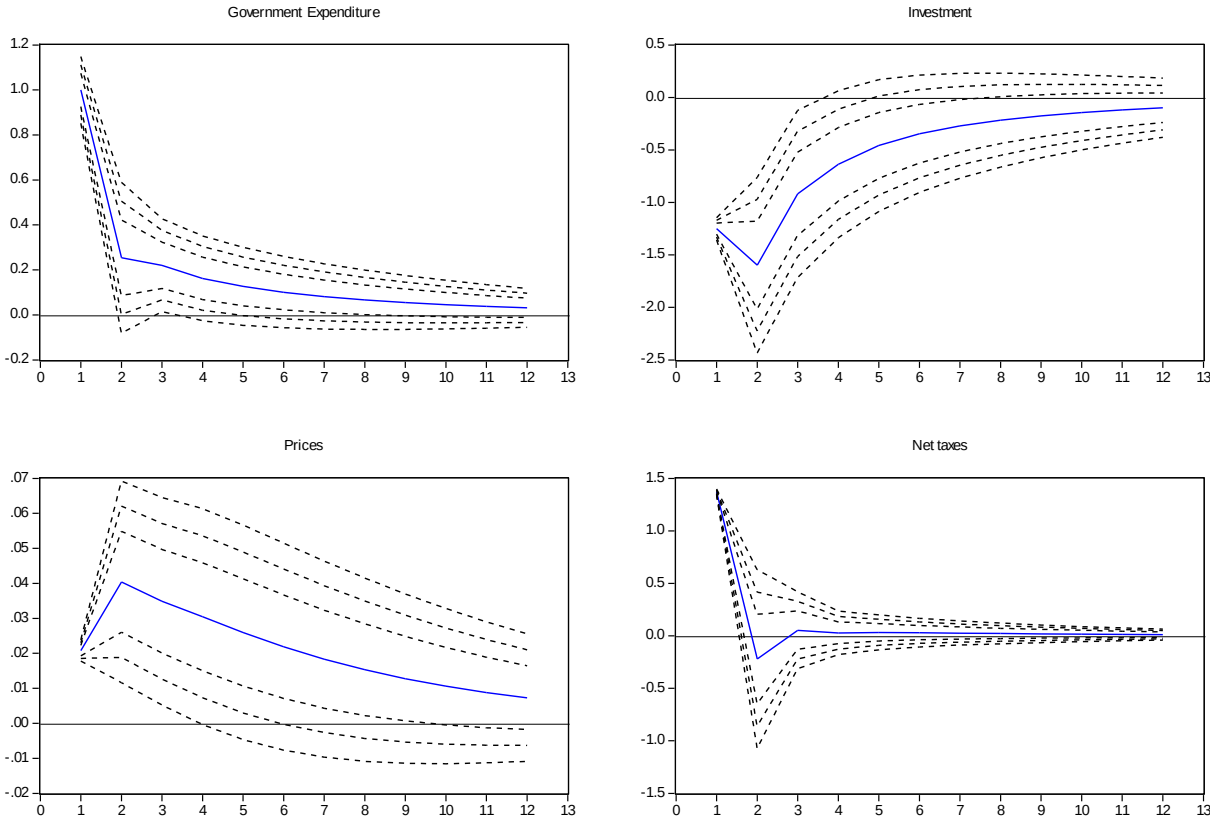
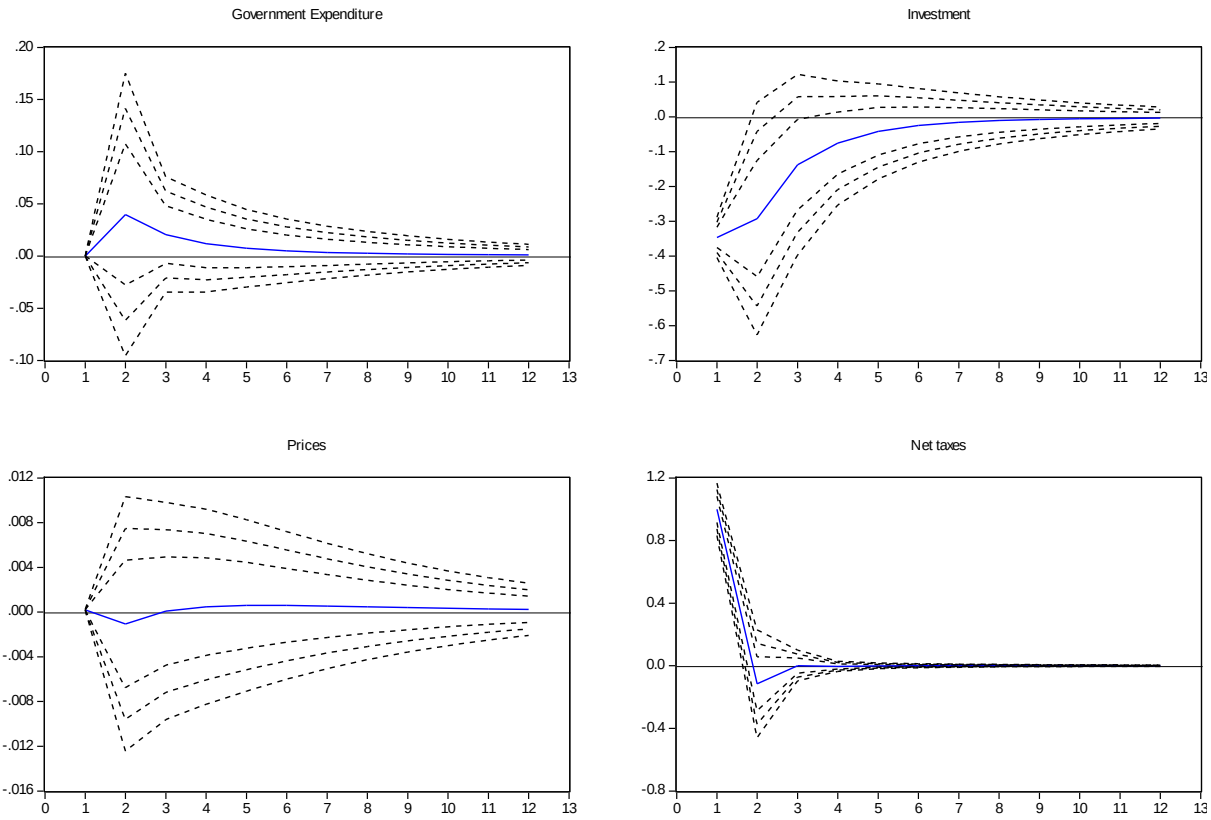
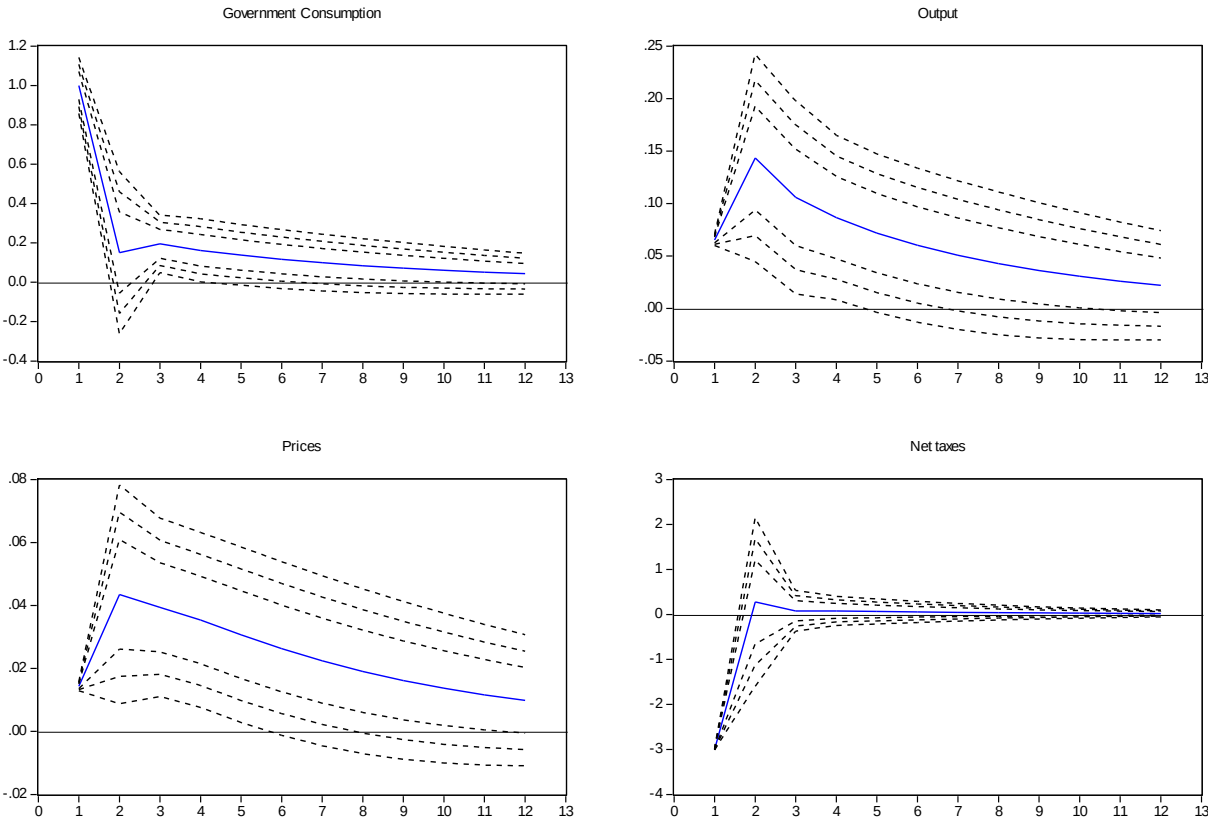


Figure 8: Response of investment to a net-tax shock



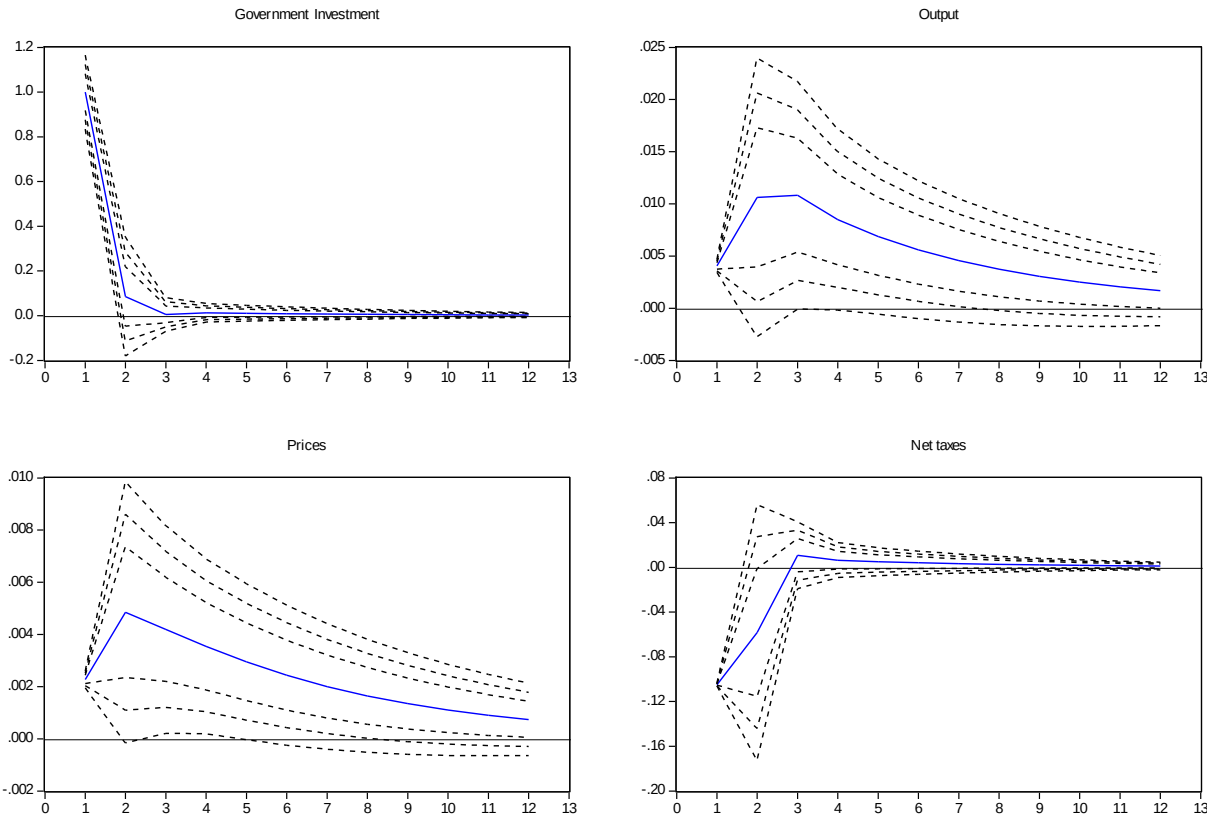
Dotted lines are the 95th, 84th, and 68th percentile confidence bands, and solid line is the response of each variable

Figure 9: Response of output to a government consumption shock



Dotted lines are the 95th, 84th, and 68th percentile confidence bands, and solid line is the response of each variable

Figure 10: Response of output to a government investment shock



Dotted lines are the 95th, 84th, and 68th percentile confidence bands, and solid line is the response of each variable