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ABSTRACT

This paper examines the effect of fiscal policy shocks on macroeconomic output in Barbados. Various attempts at the analysis of fiscal policy have sought to establish the relationship between the tools of fiscal policy and macroeconomic variables. In this paper we estimate the impact of exogenous fiscal policy shocks on economic output. One form of analysis that is increasing in popularity and found to be suitable for research in fiscal policy is the vector auto-regressive framework. We therefore propose to remain in this tradition in modelling the effects of fiscal policy.

Keywords: Fiscal Policy, Structural Vector Autoregression

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1. Introduction

In accordance with the established theory on the subject, increases in government spending will have an expansionary impact on economic growth, whereas tax increases should produce the opposite reaction. This point has however been argued by some researchers who have found evidence of contractionary government spending. Nevertheless the theoretical construct of expansionary government spending and contractionary tax increases continues to hold and has been established by a number of authors utilising a variety of theoretical models from those based on the neo-classical school to the neo-Keynesian framework.

This paper aims to estimate the relationship between fiscal policy and output in Barbados, and provide evidence of the strength and persistence of fiscal shocks on economic output in Barbados. To this end we construct a structural vector autoregressive model of the Barbadian economy for the period 1983 to 2006.

The (SVAR) approach has been applied extensively to the study of monetary shocks. However, more recently it has also been applied to the analysis of fiscal policy due to its ability to simulate the dynamic responses of fiscal policy shocks. The model has also gained favour in light of the new interest generated in the macroeconomic effects of fiscal policy. This is even more so for the small open economy case of Barbados, where fiscal policy plays an important role in economic stability

Application of the SVAR approach to developing countries have however been constrained by difficulties in sourcing the high frequency data essential for the proper implementation of the identifying restrictions of the model. The availability of quarterly data in developed countries, compared to an absence of the required data series in developing countries is a significant determinant of the application of the approach towards developed countries and the scarcity of the approach towards small countries¹.

¹ Perotti (2007) provides a thorough discussion of the issues involved in analyzing fiscal policy in developing countries.

In this paper we focus on estimating the macroeconomic effects of government spending. The identification of fiscal shocks in our system is based on a Choleski decomposition of the variables in the model. The exogenous shocks identified are employed to estimate the reaction of output to fiscal shocks. These responses are shown through impulse response functions, which allow us to study the time effects of fiscal policy shocks on output.

Our results confirm that positive exogenous shocks to government expenditure are associated with a positive response of real GDP. Further, our findings revealed that the response of real output to increases in government expenditure was not very strong and had its effect died out rather quickly.

The rest of the paper is presented as follows. Section 2 presents a literature review of comparable studies. Section 3 discusses the theoretical aspects of our model. Section 4 presents the econometric model. Section 5 presents the results of the analysis, and we end with a brief conclusion in section 6.

2. Literature Review

In the wide scope of studies on the impact of fiscal policy on macroeconomic variables, the structural vector autoregressive (SVAR) system has proven to be a popular approach for estimating the effects of fiscal shocks. In applying this approach the choice of identifying restriction used is an important decision made by the researcher. The frequently cited paper by Blanchard and Perotti (2002) examined the impact of shocks to fiscal policy on the United States economy. The authors utilized quarterly government spending and taxation as the fiscal elements in a three variable SVAR model, which also included real GDP. They use institutional information present in the tax and transfer system to identify the exogenous fiscal shocks and estimate the response of output. Critical to their modelling strategy was their assumption that at a quarterly frequency, the response of government spending to other macroeconomic variables is zero. This assumption allows for the identification of exogenous fiscal shocks that do not possess any discretionary component. The ability to identify such unanticipated exogenous shocks has

been advanced as a major advantage of this approach. The authors' results revealed that government spending lead to an expansion in output while increases in taxation were associated with a decrease in output in the United States.

In investigating the impact of monetary and fiscal policy on the U.S. economy Neri (2001) also used a SVAR model. Results of the study revealed that though the effects of monetary and fiscal policy were statistically significant, they were not important sources of shocks to real GDP and prices. The author also examined the effects of estimating a fiscal model without including a monetary variable and vice versa. It was revealed that improved results were obtained when both fiscal and monetary variables were included in the specification.

In a similar paper, Favero and Giavazzi(2007) used a SVAR to examine the effects of fiscal shocks in the U.S. economy during the period 1960 to 2005, while allowing for a direct response of taxes, government spending and debt service payments to the level of the public debt. The authors believed that a drawback of the analysis of fiscal shocks on output has been the failure to estimate a significant relationship between fiscal policy and the interest rate. The writers attributed this to models that fail to include a debt variable in their specifications, therefore neglecting to account for the response of government spending and tax policy to the level of debt. It was found that the inclusion of debt dynamics do influence the response of output and interest rates to shocks in fiscal policy.

In their study on Italy Giordano et al (2008) investigated the effects of fiscal policy on private GDP, inflation and the long-term interest rate. The empirical findings were based on a seven variable SVAR model that included the following parameters: real GDP, the real inflation rate, private employment, the ten year nominal interest rate, real government spending on goods and services, real government wages and real net taxes. The authors found that shocks to revenue had a negligible impact on the other variables included in their system, whereas shocks to government spending had positive influences on private GDP. Moreover, it was revealed that the impact of fiscal policy on private GDP had limited persistence and the effect tapered off very quickly over a few quarters.

An alternative to the methodology employed by the previously mentioned authors is that implemented by Ramey and Shapiro (1998) where dummy variables were used to identify shocks to fiscal policy². The authors used the narrative record and news about fiscal build-ups to identify shocks to government spending. The major benefit of this approach is the identifying of those shocks that they postulated as being truly exogenous to the system. However, this is subject to the ability of the researcher to accurately identify the date such exogenous shocks occurred. If a precise determination of the initiation of such Ramey-Shapiro shocks is possible then analysis can be performed without the drawback of using shocks that were anticipated by the economy. As such this method of restrictions are often described as identifying those shocks that are anticipated by the public.

A co-integrating vector autoregressive system was used by A. Jordan et al (2000) to investigate the role of monetary and fiscal policy in determining economic activity in three Caribbean countries: Barbados, Guyana and Trinidad and Tobago. The authors used a variation of the St. Louis equation, with government expenditure, net domestic assets, exports and real GDP as their choice of variables. They found that increases in government expenditure had a significant positive impact on output in the three countries in the short run. Of particular note, it was revealed that in the long run expansionary fiscal policy might lead to a contraction of output in Guyana.

3. Fiscal Policy in Barbados

The effectiveness of fiscal policy is judged by its capability to promote economic activity, maintain macroeconomic stability and facilitate an equitable redistribution of wealth while simultaneously maintaining efficiency and sustainability. In partnership with monetary policy, it is an option that countries have at their disposal to manage their balance of payments account, domestic price level and other elements of the macroeconomic environment. Of special interest to researchers is the ability of fiscal measures to influence economic output.

² Blanchard and Perotti (2002) also made use of this approach in one specification of their model to confirm the robustness of their results.

The neo-classical and the neo-Keynesian present opposing views on the path of the transmission of government spending on changes in macroeconomic variables. While in the Keynesian framework it is argued that changes in government spending impact output through changes in the level of aggregate demand, alternative views to this are evident in models developed to show that changes to government spending can influence consumption and economic activity through aggregate supply and wealth effects. Whatever the route of the transmission mechanism, it is broadly expected that expansionary fiscal policy would lead to positive changes in economic activity.

The ability of fiscal policy to influence economic growth is also determined by the role of the government in maintaining economic stability and the welfare of its citizens. In addition the potential crowding out and destabilizing effect that may occur with the implementation of policy as well as the sustainability of the fiscal deficit/surplus and the size of public debt also place a constraint on the ability and motivation of government to pursue certain policy.

In Barbados, the salaries and wages bill of the public sector is a significant share of public consumption. Such spending is expected to have an observable impact on the economy through its influence on aggregate demand. Capital expenditure in Barbados entails government spending mainly on education, health and infrastructural development, providing the foundation for economic growth and enhancing the country's attractiveness for investment.

Tax reform in Barbados has been a continuous process. In the early years between 1971-80, these reforms focused on facilitating economic growth and increasing employment opportunities, as well as being aimed at reducing the tax burden of residents, businesses and providing incentives to foreign companies wishing to set up business in Barbados.

Of particular note is the discretionary fiscal measures implemented in the late 1980s and early 1990s in response to destabilizing pressures in the economy. These policy decisions were initiated with the aim of sterilizing a rising current account deficit and a declining net international reserve position. On the expenditure side, an eight percent cut in public sector wages in 1991, a wage freeze in 1992, as well as an 11% reduction of the Government labour

force were the main features of adjustment. On the revenue side a stabilization tax of 1.5% to 5% was imposed on incomes, a consumption tax and a tax on luxury imports were also implemented. As a result of these fiscal measures the public balance moved from a deficit of 7% of GDP in 1990/91 to a surplus in 1992/93.

The most significant reform to the tax system of Barbados was the introduction of the value added tax (VAT) in January 1997. The VAT, was charged on all goods and services at a rate of 15% and 7.5% on hotel accommodation, with few exemptions and zero-ratings replaced eleven indirect taxes. At the time of its inception, the purpose of the VAT was mainly to provide an efficient system of collecting taxes on expenditure, which also allowed for easy administration. One disadvantage of this tax is that it increased the tax burden of low-income groups. The VAT was more than revenue neutral as it contributed approximately an increase of 36.3% in indirect tax revenue and an inflation rate of 7.7% in the year of its implementation.

Although fiscal policies are effective in propelling economic growth, situations arise where such policies causes indebtedness. The public debt level in Barbados increased more than forty fold since 1970, because of the fiscal policy stance adopted by the Government. Although capital expenditure, which strengthened the infrastructural base of the Barbadian economy, contributed to the fiscal disequilibrium over the period 1971 to 1980, rising recurrent expenditure in 1983-1990 also resulted in fiscal imbalances. These fiscal deficits averaged approximately 4.9% and 5.3%, of GDP, respectively during these periods. Conversely, after 1991 the deficits were lower averaging around 1.6% of GDP. These huge deficits forced the Government to borrow heavily on the international markets.

Notwithstanding the upward movement of the public debt as a percentage of GDP, it was found that since 1991 primary fiscal surpluses were registered. However, this was not the case in the early years during 1971 to 1998 as the economy registered persistent fiscal deficits averaging about 2% of GDP. In one measure of debt sustainability, a government is proven to be satisfying its inter-temporal budget constraint if it is found that a cointegrating relationship exists between the primary budget deficit and the debt to GDP ratio. Archibald and Greenidge (2002)

performed such a test of sustainability for Barbados, and concluded that public sector debt is indeed sustainable.

4. Methodology

4.1. The Model

In this paper we are modeling the impact of fiscal policy shocks on output. We construct a structural vector autoregression system to estimate the shocks to fiscal policy and the response of the macroeconomic variables included in our system. A SVAR in n variables can be represented as:

$$\beta_0 Y_t = \beta_0 \sum_{i=1}^n \beta_i Y_{t-i} + v_t \quad (1)$$

The reduced form of this model can be written as:

$$Y_t = \sum_{i=1}^n A_i Y_{t-i} + \varepsilon_t \quad (2)$$

It is assumed that the relationship between the structural residuals and the reduced form residuals is:

$$v_t = \beta_0^{-1} \varepsilon_t \quad (3)$$

Where ε is the vector of reduced form residuals.

4.2. The Data

In the above system, Y is a vector of variables that includes Gross Domestic Product (GDP), government spending (SPEN), taxation revenue (TAX), and the debt to GDP ratio (DEB). All of the included variables are in natural logarithms and have been deflated by the GDP deflator. In addition, the Tramo/Seats method was used to seasonally adjust the macroeconomic series prior to estimation. We have allowed for the inclusion of a debt variable in line with the theoretical relationship of fiscal policy and debt sustainability. The measure of government spending used is

total government expenditure less interest and transfers. Our tax variable is the total tax revenue collected by central government. A specification that includes government capital expenditure (GOV) as the measure of government spending has also been tested to observe the relative importance of the different categories of government spending. Quarterly data for the period 1983 to 2006 has been sourced from various issues of the Central Bank of Barbados Annual Statistical Digest and estimates of quarterly real GDP maintained by the Research department of the Central Bank of Barbados.

Tests for unit roots revealed that all of the macro variables in the model were $I(1)$. Further, the trace and eigenvalue tests for the cointegration did not indicate the presence of a cointegrating vector. With these results, a VAR model in first differences was estimated of a order of 3 lags, which satisfied diagnostic tests for normality and the absence of autocorrelation.

4.3. Identification

The identification of the structural form from the estimated reduced model requires that restrictions be imposed on the coefficient matrix β in the structural model. In this regard we adopt the assumption made by Blanchard and Perotti that it takes longer than a quarter for government spending to respond to output and other macroeconomic variables. Following the example of Fatas and Mihov (2001), exact identification of the system is achieved by the use of a Choleski decomposition, where the assumption of the lack of a contemporaneous relationship informs the order of the variables in the estimated model.

The order which our variables enter into the estimated VAR is as follows: GOV, DEB, GDP and TAX. This ordering specifies what we assume to be the most exogenous variable first, and effectively implies that both debt and GDP do not have a contemporaneous impact on government expenditure. It is assumed that while government expenditure does possess a contemporaneous effect on debt, the effect of GDP to debt is zero. Both debt and government expenditure have contemporaneous impacts on real output. These assumptions are considered to be feasible in the case of Barbados, and allow for the identification of the exogenous shocks to fiscal policy. Our analysis is supplemented by the use of impulse response analysis, that allow us

to measure and map the time path of the dynamic response of each variable in the system to a shock to a fiscal shock.

5. Results

It can be observed from table 1 and 2 that the response of fiscal policy shocks is positive though weak in Barbados. In table 1 where total government expenditure less interest and transfers is used as the measure of fiscal policy, the immediate response of output to a positive spending shock was found to be positive. After peaking at two quarters, the impact rapidly declined in significance and became negligible by the third quarter after the initial spending shock.

The response of the included variables to a shock to government capital expenditure is shown in figure 2. There is a significant positive response of real GDP to a one standard deviation shock to government spending in the first quarter. This impact declines by the third quarter, moving to match the response of this form of government expenditure, which after a strong positive response in the first quarter, declines in the second quarter and quickly fades in persistence by the third quarter. There is also an insignificant response of the debt to GDP ratio to a government spending shock in this instance.

Overall the evidence from our impulse response analysis suggests that shocks to government spending are short lived. The finding of a positive response of GDP to government expenditure is consistent with that of other authors using a SVAR approach. However unlike many of these studies where the effect of fiscal policy was found to be highly persistent, we did not find evidence of such persistence. It will be of interest to observe the extent of the substitution of government spending for private consumption and changes in import demand. If a fiscal expansion is associated with a precautionary reaction by households the impact on output will be diminished. Similarly the extent of a fiscal expansion on an economy's demand for imports will lower the output effect.

6. Conclusion

In this paper we examined the response of real output to fiscal shocks in Barbados for the period 1983 to 2006 using a SVAR methodology and impulse response functions to observe the effects of fiscal spending.

Our results depend on the ability of the model to capture those shocks that are truly exogenous to the system. The approach of using the SVAR approach to the estimation of fiscal shocks allows for a clearer estimation of such an effect. With the incorporation of quarterly data into our modelling strategy, our findings have provided an estimation of the response of real output to exogenous changes in government spending. Our results found that there was a positive, but weak response of government expenditure shocks on real output. Moreover, the length of persistence in most cases was found to be relatively small when compared to other studies.

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Appendices

Table 1: Unit Root Tests

Series		ADF	PP	KPSS
DEBT	<i>Level</i>	-1.91	-1.96	0.17 ⁺⁺
	Δ	-9.32***	-9.32***	0.20
GDP	<i>Level</i>	-1.47	-1.47	0.14 ⁺
	Δ	-8.77***	-8.76***	0.11
GOV	<i>Level</i>	-2.09	-2.66	0.14
	Δ	-13.27***	-13.24***	0.04
SPEN	<i>Level</i>	-3.39*	-3.40*	0.09
	Δ	-10.75	-11.40	0.06
TAX	<i>Level</i>	-1.02	-1.09	1.24 ⁺⁺⁺
	Δ	-19.86***	-27.28***	0.24

Notes: the table gives the results of the ADF test statistic, the PP test statistic and the KPSS test statistic. *, ** and *** are the MacKinnon critical values for rejection of the null hypothesis of a unit root at the 10%, 5%, and 1% levels respectively, for both the ADF and PP tests, while +, ++, +++ are the critical values for the LM test statistic of the KPSS test and denote rejection of the null hypothesis of stationarity at the 10%, 5%, and 1%, respectively (based upon the asymptotic results presented in KPSS (1992) Table 1, pp. 166). Δ denotes the first difference of the original series.

Table 1: Impulse Responses to a shock to Benchmark Government Spending

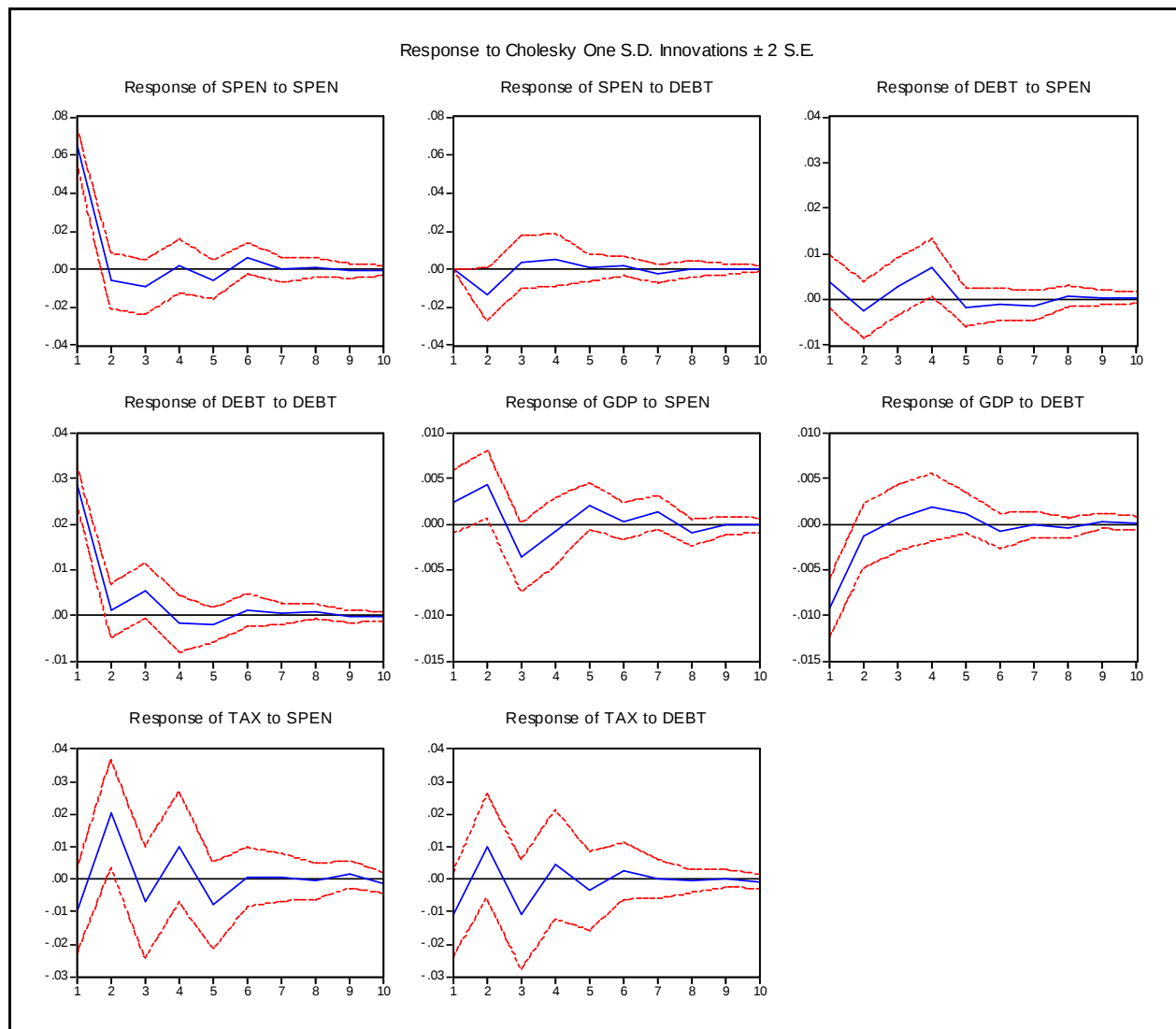


Table 2: Impulse Responses to a shock to Government Capital Expenditure

