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Three states of fiscal multipliers in a small open economy

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Abstract

This research reviews the effects of fiscal expenditures on economic output in a non-linear fashion for the Barbados economy. Using the Markov-Switching methodology, fiscal expenditure multipliers are estimated for each stage of the business cycle. The data indicates that a three-regime model is the best fit – capturing recession, normal growth and boom periods. Our findings suggest that increasing capital expenditure is positively correlated with economic growth at all stages of the business cycle, while increasing current expenditure could have a negative impact on economic activity during recessionary and normal growth periods. Current expenditure is positively correlated with economic growth only when the economy is recovering rapidly. The results suggest that the impact of fiscal policies depend on the stage of the business cycle in Barbados, a small open economy with a fixed exchange rate.

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1. Introduction

Barbados recently suffered from the twin effects of low economic growth and widening fiscal deficits. Increasing fiscal expenditures led to substantial budget deficits, exacerbated by the onset of the international economic crisis. With no clear sign of an imminent return to robust economic growth alongside heightened levels of public debt, the Government of Barbados decided in August 2013 to undertake a fiscal consolidation program. Given the dominant role of the government in the Barbadian economy, fiscal austerity is generally expected to have a stifling effect on economic activity. However, this research proposes that the output effect of fiscal expenditure could vary depending on prevailing economic conditions. We investigate whether or not the effects of fiscal expenditure are determined by the business cycle in the small open economy of Barbados – a country defined by its fixed exchange rate regime.

Many developing and middle-high income countries are characterized by pro-cyclical fiscal policies – expansionary during good times and contractionary during bad times – possibly exacerbating economic contractions and provoking debt crises (Kaminsky *et al.* 2004). Interestingly, Tagkalakis (2008) and Christiano *et al.* (2011) suggest that these economic downturns tend to raise the government spending multiplier on economic output. However, both Ireland and Denmark were able to boost consumer confidence and investment during economic downturns by cutting public spending on transfers and salaries, returning their economies to growth in the process (Alesina *et al.* 1998). Combining this with Ramey's (2012) finding that increases in government spending in the US significantly lowered private spending, we see some symmetry to a dampened view on fiscal expenditure multipliers.

Ilzetzki *et al.* (2012) indicate that the effect of government expenditure depends on country characteristics. They propose that increased government spending has a smaller positive impact on output in both developing and open economies, a larger effect under fixed exchange rate regimes, and a negative effect on output in high-debt countries. Barbados falls into all of these categories. It is a very small open developing economy with a fixed exchange rate regime, chronic external account deficits and high debt levels. This makes it impossible to make *a priori* predictions concerning the nature of fiscal expenditure multipliers in Barbados. Traditional economic theory dictates that fiscal policy is a far more effective stabilization tool than monetary policy under Barbados' fixed exchange rate regime. This gulf is exacerbated by the importance macroeconomic authorities place on maintaining the value of the Barbadian dollar[1].

Recent research has sought to illuminate the specific context of the Barbadian economy. Bynoe and Maynard (2008) report expansionary fiscal policy as having a positive but small and fleeting impact on economic output, while Bangwayo-Skeete (2011) finds it to be ineffective in Barbados. Guy and Belgrave (2011) take into account the business cycle, but do not explicitly model the potential for fluctuating multiplier effects. These results indicate that the next logical step in the research should be to more deeply analyze fiscal multipliers over the business cycle. A number of recent works such as Koray *et al.* (2013) and Baum *et al.* (2012) depict the potential for nonlinearity in the relationship between fiscal expenditure and growth – a path this research will follow.

Relationships in a small island state such as Barbados can sometimes defy traditional economic theory, imposing strong weight on empirical evidence. This research models the relationship

[1] The Barbadian dollar is pegged to the US dollar at the rate of $1US = BDS$2 and is seen to be 'socially immovable' as the general consensus is that it should remain fixed until further notice.

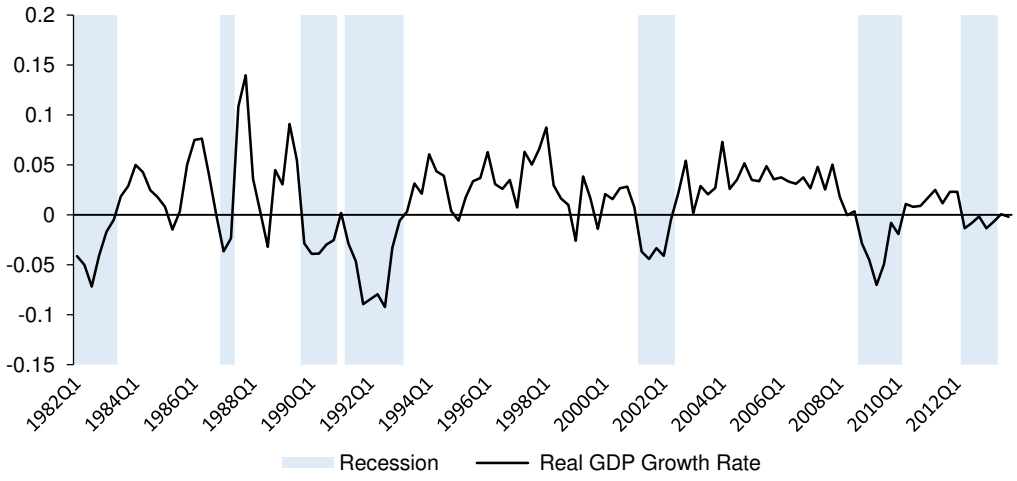
between the two main elements of fiscal policy and the real GDP growth rate using the Markov-Switching (MS) dynamic model (Hamilton, 1989). While the traditional linear Vector Autoregression (VAR) approach assumes that the effect of fiscal policy remains constant throughout the business cycle, this nonlinear approach allows for the possibility of multiple fiscal expenditure multipliers over the business cycle. This aids in determining whether fiscal policy should be conditioned on the current state of the economy.

Building on Barro and Ridlick (2009), the work by Koray *et al.* (2013) applies the MS methodology to the U.S. Their findings of regime-dependent expenditure multipliers are confirmed by Auerbach and Gorodnichenko (2012) and Kraay (2014), but contrast with the findings of Ramey and Zubairy (2014) under alternative assumptions. While the U.S. context does not directly apply to Barbados, these works provide methodological guidance and insight into how to robustly estimate the size and importance of fiscal expenditure multipliers. Barbados provides a unique result – displaying a best-fit model under three regimes, labelled tentatively as recession, normal growth and boom. The importance of this research lies in its timeliness in examining how fiscal expenditure affects the real GDP growth rate depending on the stage of the business cycle.

2. Data & Methodology

A recession is classified as two or more consecutive quarters of contraction in national real GDP (HM Treasury, 2012). The real GDP growth rate is displayed in Figure 1 for Barbados from 1982 until 2013, with the grey shaded areas depicting periods of recession.

Figure 1: Real GDP Growth and Recession in Barbados (1982-2013)



Hamilton (1989) proposed a Markov switching methodology that permits the changing of regimes through the use of an unobservable state variable that follows a first-order Markov chain. The empirical methodology is represented by:

$$y_t = \mu(s_t) + \beta_1(s_t)cx_{t-1} + \beta_2(s_t)ix_{t-1} + \delta_1 rev_{t-1} + \delta_2 i_{t-1} + \gamma_1 ap_t + \gamma_2 ur_t + \varepsilon_t \quad (1)$$

$$\mu(s_t) = \sum_{i=1}^{3} \mu^i \, 1\{s_t = i\}, \quad \sigma(s_t) = \sum_{i=1}^{3} \sigma^i \, 1\{s_t = i\}, \quad (t \in \mathrm{T})$$

The dependent variable y_t represents the real GDP growth rate, measured as the year-on-year change in national real GDP. The regime switching variables of interest in Equation (1) are cx (current expenditure) and ix (capital expenditure). These are measured nominally but brought to real levels by the GDP deflator and expressed as year-on-year growth rates. Quarterly data from 1982 to 2013 for each of these variables are sourced from the Central Bank of Barbados' database, providing us with 124 observations.

Government expenditures are typically categorized as either current expenditure or capital expenditure. Current expenditures typically recur on a periodic basis, and are usually made up of spending on items with short lifespans to be consumed. Barbados' current expenditure is mainly made up of transfers to statutory corporations, wages and interest payments. Capital expenditure is explained as spending on assets – long lasting items that will be used repeatedly in the provision of goods and services. Barbados' capital expenditure is heavily devoted to economic services designed to build productive capacity and includes spending on new roads and new buildings. Simply put, current expenditure will include all non-capital spending.

To ensure unbiased estimates we control for the general budget using current government revenue, represented by rev_{t-1} as suggested by Kneller *et al.* (1999). The short term interest rate (i_{t-1}) is included to capture any possible effects of monetary policy on growth. Other standard control variables used are population growth (ap) and the unemployment rate (ur).

Current expenditure and capital expenditure, along with the real constant, are the regime switching variables described by the unobservable state variable s_t. These regime indicators found in $\{s_t\}$ form a Markov chain on S following the transition probability $\mathbf{P}' = [p_{ij}]_{3\times3}$ in which:

$$p_{ij} = \Pr(s_t = j | s_{t-1} = i), \quad i, j \in \mathrm{S} \tag{2}$$

Each column in the transition matrix satisfies the condition $p_{i0} + p_{i2} + p_{i3} = 1$. This governs the random behaviour of the state variable, which in turn determines the random properties of the dependent variable y_t in conjunction with the innovations in ε_t. The value of $\{s_t\}$ in $\mathrm{S} = \{1,2,3\}$ indicate the unobserved state of the system at time t. The assumption of independence between sequences of $\{\varepsilon_t\}$ and $\{s_t\}$ implies that regime switches take place autonomously of the lagged values of $\{y_t\}$, where $\{\varepsilon_t\}$ represent errors with $\mathrm{E}(\varepsilon_t) = 0$ and $\mathrm{E}(\varepsilon_t^2) = 1$.

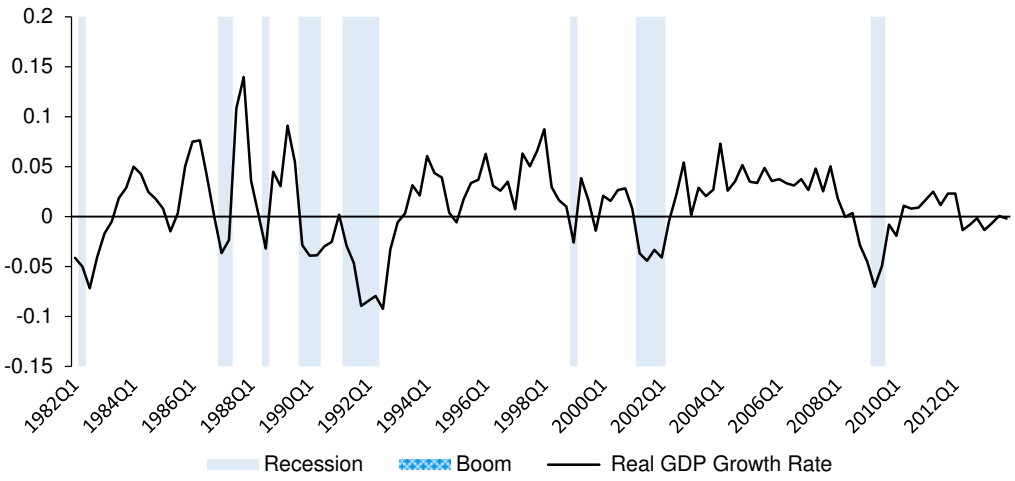
Each regime switching coefficient carries three values denoted by β_x^i, where $i = \{1,2,3\}$ represents the various states. The policy variables were lagged once to avoid possible endogeneity bias and estimated via maximum likelihood employing the expectation maximization process (Hamilton 1989, 1990).[2] Standard errors are corrected for serial correlation. The Markov Switching approach gives an analysis superior to linear models by investigating the possibility of nonlinear expenditure multipliers. Further, the single equation form of MS modeling is preferred to a MS-VAR due to the desire for parsimony and the data intensive nature of the MS-VAR model.

[2] The smoothing algorithm of Kim (1994) is used to assign probabilities to the unobserved state conditional on the information set and the Davies (1987) upper bound for the significance on the likelihood ratio is used to choose the optimal number of regimes (Table III).

3. Results

Table I presents the results of the maximum likelihood estimation of the model described in Equation (1). The Davies LR Test for the number of regimes indicates that the third regime proves a significantly better fit than one or two regimes (see Appendix). Figure 2 illustrates the regime classifications. Three regimes are identified and classified as Regime 0 (recessionary state), Regime 1 (normal growth state) and Regime 2 (boom state). Table I shows that the intercept for Regime 0 is negative (-0.040). The periods identified by Regime 0 closely align with the economic downturns identified by Downes *et al.* (2014). Each recessionary period is followed by a sharp increase in growth rates, captured under Regime 2. This regime described tentatively as 'boom' reflects periods of rapidly increasing growth rates rather than simply high growth rates as the traditional definition of 'boom' would indicate. The intercept under this regime (0.015) is substantially higher than the intercept under Regime 1 (0.030), which we describe as normal growth. The model suggests that by 2013 the country reached a state of normal growth. The significance of the regime switching coefficients and their divergence indicate that nonlinearity is vital to understanding the Barbados context.

Figure 2: Three-Regime Model of Real GDP Growth and Fiscal Multipliers in Barbados



The unique feature of this model lies in the additional explanatory power behind regime 2 – periods of rapidly increasing growth rates – that traditionally would fall under either the standard growth or recession classifications in a two-state model. The results indicate that both current and capital expenditures have a positive relationship with growth during boom periods – complementing the indication by Kaminsky *et al.* (2004) that government spending is typically pro-cyclical. In particular, the current expenditure multiplier is quite large during this regime, and thus has a very significant effect on driving rapid run-ups in the growth rate. It highlights the dominance of the government in driving economic growth through higher public wages and transfers during economic booms.

In contrast, the negative current expenditure multiplier historically evident under both normal and recessionary economic conditions shows that increasing the size of government spending can potentially serve to hinder economic growth during these periods. This model also suggests that capital expenditure can aid in driving increases in economic growth during any state of the economy. This effect is largest during boom periods and smallest during normal growth periods.

Table I: Maximum Likelihood Estimation Results

	Coefficient	Robust SE	t-value	Probability
rev_{t-1}	0.036	0.033	1.070	0.286
i_{t-1}	-0.096	0.057	-1.690	*0.094
ur_t	-0.483	0.139	-3.470	***0.001
ur_{t-1}	0.053	0.149	0.353	0.725
ap_t	-0.113	0.100	-1.120	0.263
ap_{t-1}	0.508	0.226	2.250	**0.027
c^R	-0.040	0.004	-9.120	***0.000
c^N	0.015	0.004	3.830	***0.000
c^B	0.030	0.006	4.870	***0.000
cx_{t-1}^R	-0.046	0.026	-1.790	*0.077
cx_{t-1}^N	-0.092	0.032	-2.890	***0.005
cx_{t-1}^B	0.198	0.089	2.220	**0.028
ix_{t-1}^R	0.022	0.007	3.220	***0.002
ix_{t-1}^N	0.014	0.004	3.630	***0.000
ix_{t-1}^B	0.075	0.025	2.960	***0.004
σ^R	0.006	0.002	3.460	***0.001
σ^N	0.018	0.002	7.730	***0.000
σ^B	0.024	0.006	3.860	***0.000
$p\{0\|0\}$	0.587	0.121	4.850	***0.000
$p\{0\|1\}$	0.096	0.037	2.590	**0.011
$p\{1\|1\}$	0.822	0.073	11.200	***0.000
$p\{1\|2\}$	0.399	0.114	3.490	***0.001

***, **, * represent significance at 1%, 5%, 10%. Regime switching variables are represented by a superscript with *R* denoting recession, *N* denoting normal growth, and *B* representing boom. See Table IV for variable definitions and sources.

4. Discussion & Conclusion

This research estimates nonlinear current and capital expenditure multipliers over the business cycle in a small open developing country with a fixed exchange rate and high public debt. The vastly asymmetric nature of the relationship governing economic growth and fiscal policy in Barbados is highlighted. Sparked by global economic difficulties in 2007, Barbados faced negative growth rates during 2008 and 2009. To counter, Barbados initially attempted a policy of fiscal consolidation through reduced capital expenditure and increased taxation, while seeking to maintain public sector employment. This strategy was unable to halt the anemic

growth that persisted since 2009. Faced with increasing pressure on the foreign exchange peg due to falling reserves, the fiscal authorities changed tack in March 2014 by opting to reduce the size of the public sector and shrink other current expenditures.

The results of this research indicate that increasing current expenditures might hinder growth during both recessionary and normal growth states. A positive relationship between current expenditure and real GDP growth is visible only during boom states. This positive relationship is likely driven by government increasing public sector employment and improving aggregate demand. The negative current expenditure multipliers uncovered are corroborated by Ilzetzki *et al.* (2012) and Alesina *et al.* (2002). Alesina *et al.* (2002) in particular found that cuts to government wages in Ireland and 17 other OECD economies had positive, non-Keynesian effects on both private sector investment and overall economic activity by reducing upward wage pressure on the private sector, particularly in unionized labor markets as exists in Barbados. Negative current expenditure multipliers during recession suggest that increasing public spending on wages and purchases of goods and services could possibly hamper the recovery process. If the government chooses not to expand or even cut current expenditures during recession, this could work to stabilize the government's deficit position while protecting foreign exchange reserves.

Importantly, this research also uncovers a positive relationship between capital expenditure and real GDP growth in every state. As expected, this effect is largest during rapid increases in economic growth rates. The capital expenditure multipliers during economic downturns and periods of normal growth are smaller, but are likely more important given smaller average real GDP growth rates in these states compared to boom periods. This suggests that capital expenditure is a significant contributor to economic growth during economic downturns and periods of normal growth. Public investment works to increase the growth potential of Barbados by building out economic capacity.

The transition matrix suggests that the economy only moves out of recession to stable growth via periods of rapid improvements in growth rates. The multiplier effects of capital and current expenditure are largest when the economy moves out of recession into the boom state. An expanding domestic economy requires greater employment via current expenditure to fuel further expansion, while greater capital expenditure serves to increase growth potential as the economy moves to a normal rate of growth. That the average durations of Regimes 0 and 2 (recession and boom) are substantially shorter than normal growth – 2.38 and 2.55 quarters versus 7.27 quarters – suggests that recession and boom are naturally short-lived evolutions. Flexibility to react to these events would be enhanced by the availability of fiscal space.

The results indicate that a judicious approach to current expenditure might not be harmful to economic growth, particularly during recession and normal growth periods. The positive capital expenditure multipliers are a sign that public investment could serve to increase growth rates, even during recessions. The expenditure multipliers for Barbados clearly depend on the current state of the economy. In future, a closer analysis of these results may even help to explain the slow growth rate in Barbados post-2009. This research adds another layer of information for policy makers to consider when formulating fiscal policy.

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6. Appendix

Table II: Transition Probability Matrix

	Regime 0 (Recession)	Regime 2 (Normal)	Regime 3 (Boom)
Regime 0 (Recession)	0.587	0.096	0.000
Regime 1 (Normal)	0.000	0.822	0.399
Regime 2 (Boom)	0.413	0.082	0.601

Table III: Davies LR Tests for Regimes

	H0=1;H1=2	H0=1;H1=3	H0=2;H1=3
LR	31.381	52.695	21.314
approx. upperbound	0.000	0.000	0.028

Table IV: Variable Names and Definitions

Symbol	Description
y	Year on year growth rate of Real GDP
rev	Government Revenue as percentage of Nominal GDP
i	Policy Rate of the Central Bank of Barbados
ur	Year on year change in Unemployment
ap	Year on year change in Adult Population
cx	Current Expenditure as percentage of Nominal GDP
ix	Capital Expenditure as percentage of Nominal GDP

All variables were sourced from the Central Bank of Barbados. Most are available freely on the Central Bank of Barbados' Online Statistical Database.

Table V: Regime Classification Based on Smooth Probabilities

Regime 0 (Recession)	Quarters	Avg. Prob.
1982(2) - 1982(2)	1	0.902
1987(1) - 1987(2)	2	0.861
1988(3) - 1988(3)	1	0.949
1989(4) - 1990(2)	3	0.952
1991(2) - 1992(2)	5	0.880
1999(1) - 1999(1)	1	0.893
2001(2) - 2002(1)	4	0.997
2009(2) - 2009(3)	2	0.998
Total: 19 quarters (14.96%) with average duration of 2.38 quarters.		
Regime 1 (Normal)	Quarters	Avg. Prob.
1983(2) - 1985(3)	10	0.846
1986(3) - 1986(4)	2	0.913
1988(1) - 1988(2)	2	0.998
1989(3) - 1989(3)	1	0.998
1991(1) - 1991(1)	1	0.921
1992(4) - 1997(3)	20	0.903
1998(2) - 1998(4)	3	0.887
1999(3) - 2001(1)	7	0.918
2003(1) - 2005(1)	9	0.790
2007(1) - 2009(1)	9	0.905
2010(1) - 2013(4)	16	0.880
Total: 80 quarters (62.99%) with average duration of 7.27 quarters.		
Regime 2 (Boom)	Quarters	Avg. Prob.
1982(3) - 1983(1)	3	0.920
1985(4) - 1986(2)	3	0.848
1987(3) - 1987(4)	2	0.999
1988(4) - 1989(2)	3	0.945
1990(3) - 1990(4)	2	0.824
1992(3) - 1992(3)	1	0.977
1997(4) - 1998(1)	2	0.702
1999(2) - 1999(2)	1	0.907
2002(2) - 2002(4)	3	0.922
2005(2) - 2006(4)	7	0.827
2009(4) - 2009(4)	1	1.000
Total: 28 quarters (22.05%) with average duration of 2.55 quarters.		