

Domestic Debt Exhaustion: The Robin Hood Trigger Theory

By

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Abstract

Government securities represent a substantial proportion of Caribbean governments' debt profile. The ease of liquidity creation (especially by issuing treasury bills) on the securities market can increase governments' supply of debt securities beyond their own risk appetite. Notably in the Caribbean, governments have routinely depended on borrowing new money to repay their maturing short-term debt (i.e. roll-over). The spill-off effect is an unplanned expansion in domestic debt, an increase in government debt default probability and/or a shift in the distribution of wealth, through the use of taxes. The spillover effects dampen the usefulness of debt securities.

This study offers two theories to explain the unintentional outcome of the spill-off effect: 'Domestic debt exhaustion' and the 'Robin Hood Trigger'. Domestic debt exhaustion can cause a debtor to stop making payments on its domestic debts but proceed to contract further debt. Continuous financing with little or no return on investment is a significant risk. These can activate the 'Robin Hood Trigger'; that is the creation and use of sophisticated, innovative tax mechanisms and tools to raise revenue and create fiscal space. The theories are formalized with the use of a simplified version of Diamond (1965) Overlapping Generations Model. This study finds that roll-over exacerbates the creditors' risk of default and puts forwards 14 recommendations for managing the unintentional consequences.

Keywords: domestic debt, fiscal policy, securities market, roll-over, financial system, overlapping generations model.

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1.0 Introduction

Governments of the Caribbean region have developed an over-reliance on raising short and long-term funds through domestic debt capital; namely, the issuing of securities (i.e. treasury bills and bonds). The stock of government securities is relatively substantial across the four major regional Caribbean stock exchange markets. On the Barbados Stock Exchange, Government and State Enterprises/Agency bonds account for 90% of the total bonds in issue. More than 75% in Jamaica Stock Exchange, the Eastern Caribbean Stock Exchange (ECSE) and Trinidad and Tobago Stock Exchange are accounted for by government (Pemberton, C.M.S, Stewart A.L & Watson PK, 2005).

One of the most active markets in the Caribbean is the Regional Governments Securities Market (RGSM); securities are traded using the platform of the ECSE. In 2016, the RGSM raised EC\$1,093.8m in treasury bills and bonds from 51 auctions, representing 95% of the securities issued on the ECSE during that year. The governments of St. Lucia and St. Vincent and the Grenadines have been the most active participants in the RGSM. They account for 31.4 per cent and 31.7 per cent of the value of auction, respectively.

Government securities represent a considerable proportion of the Eastern Caribbean governments' domestic debt, particularly during the year 2016. An estimated 87.5 per cent of Saint Lucia's new domestic debt was financed with bonds and treasury bills.² In the case of Grenada, domestic securities accounted for 87 per cent of domestic debt.³

The growth in government securities reflects both demand and supply side factors. The supply side factors revolve around the strong growth in credit and changes in the savings behaviour of consumers. It also mirrors governments' endeavour to finance expansion, engage in new projects and secure deficit financing for budget support. Positive demand influences include: low inflation and good bond ratings, good economic prospects, low taxes and regulations that are not too costly.

² Government of St Lucia Economic and Social Review 2016

³ Government of Grenada Quarterly Public Debt Bulletin December 2016

The main observable demand drivers in the Eastern Caribbean have been attractive interest rates for private investors. The returns on government treasury bills have been 2 percent higher than the medium savings rates at banks. Additionally, investment in securities has been one of the key alternative savings mechanisms for those with excess liquidity such as commercial banks. Commercial banks hold sizeable shares of government debt securities and they account for 50% of the value of bids. Banks in the Eastern Caribbean are prohibited from investing in real estate, as stipulated by the New Banking Act (2015). Hence, the securities market has become one of the preferred alternatives. Portfolio diversification and statutory requirements are other drivers. Some insurance companies are required to hold a certain amount of government securities in their portfolio.

Domestic government debt is not a clear solution for closing the fiscal gap. It carries its own risks, and burdens the economy through its potential impacts on the financial system. The rise in the level of capital stock raised by governments on the domestic market might be harmful. It represents the use of a powerful instrument - public debt issuance - to balance monetary expansion. This could cause demand pressure and price increases in the domestic markets. If the financial sector is underdeveloped then it would increase the sensitivity of financial systems to capital account crises, primarily because large fiscal deficits can decrease the efficiency of the financial sector.

Private credits provided by banks would be crowded-out if government is the main credit source. The increasing share of the bank credit absorbed by the public sector increases the risk of slowing financial development (Hauner, 2009). This is not particularly an issue in the Eastern Caribbean since its commercial banks do not issue securities. What is particularly problematic in the Eastern Caribbean is the emerging trend of governments resorting to treasury bills as a way of funding fiscal deficit.

Debt securities mainly act as an instrument for minimizing the cost of borrowing, increasing government's ability to better manage its debt portfolio and managing its currency risks, maturity structure and liquidity risk. In essence it is used as a risk management tool. The ease of liquidity

creation (especially by issuing treasury bills) on the securities market can increase governments' supply of debt securities beyond their own risk appetite. This has caused governments, notably in the Caribbean, to routinely depend on borrowing new money to repay their maturing short-term debt (i.e. roll-over).

The practice of roll-over whereby matured debt are 'rolled-over' by issuing new ones to pay holders of maturing debt instruments is particularly evident in the securities market. The spill-off effect is an unplanned expansion in domestic debt, an increase in government debt default probability and/or a shift in the distribution of wealth through the use of taxes. The spillover effects dampen the usefulness of debt securities.

This research uses an unconventional 'two pronged approach' to offer a theory to explain the unintentional outcome of the spill-off effect. The literature review is presented in Section 2. The first proposition, 'Domestic Debt Exhaustion,' is presented Section 3. The second proposition is the 'Robin Hood Trigger' and is outlined in Section 4. Both propositions are formalized in Section 5 with the use of an overlapping generations model (OLG). The Policy recommendations are characterized in Section 6. Conclusions are then drawn in Section 7.

3. Literature Review

This paper directly relates to six different strands in the literature: (i) the importance of short-term debt; (ii) rollover risk; (iii) the determinants of default; (iv) debt maturity; (v) interest on debt; and (vi) inflation. Most of the literature discussed herein point exclusively to the same conclusion, that is, roll-over exacerbates the creditors' risk of default.

The interaction of deteriorating macroeconomic fundamentals and high levels of short-term debt played a significant role in recent crises. Brutti (2011), Mengus (2013) and Gennaioli et al. (2014) focus on the role of domestic financial development together with domestic and external government debt. They found that government default can have a significant impact on domestic bondholders.

The dominance of short term securities greatly increases rollover risk in countries with large outstanding domestic debt stocks. Research on roll-over risk by Leland (1998) and He and Xiong (2012a), notes that when short-term securities mature and firms issue a new bond with the same face value, coupon rate and maturity at market price, then the principal of the maturing instrument can be higher or lower. Short-term debt financing therefore exposes the firm to rollover risk and to rollover losses. Leland and Toft (1996) numerically illustrate that shorter debt maturity can lead a firm to default at a higher fundamental boundary.

The issuance of short term government debt instruments, increases rollover risk, and may be a major source of systemic risk (Asogwa, 2005). There are two approaches linking short-term debt with the vulnerability to financial crises. The first approach is well illustrated in Diamond (1991). The literature states that short term debt increases rollover risk during crises, because creditors will be reluctant to renew maturing credit lines as collateral values drop and financial conditions deteriorate (Diamond 1991). The higher likelihood of crisis stems, not from the short-term debt, but from the illiquidity and potentially low creditworthiness of the investment being financed. (Diamond and Rajan (2001a), p. 40.)

One strand of literature on financial firms argue that changes in collateral values can lead to dramatic changes in debt capacity when firms' short term debt needs to be frequently rolled over (Acharya, Gale, and Yorulmazer 2011). The main argument emerging here is that rollover risk effectively arises anytime short-term debt is used to fund long-term projects. Revenues may not be available to repay short-term debt until the project is completed. The use of short-term debt to fund long-term projects is attractive because, if managed to avoid a default, it tends to lower the cost of borrowing. In contrast, an alternative view by Merton (1973), Longsta and Schwartz (1995) states that default on debt occurs when its asset value falls below its debt level.

A study by Acharya, Gale, and Yorulmazer (2011) show that the high rollover frequency associated with short-term debt can lead to diminishing debt capacity. Debt rollover exposes the firm to liquidity risk in bond markets, deteriorating liquidity and exacerbates default risk. Arellano and Ramanarayanan (2012) study a quantitative model with default risk in which the

government balances the incentive benefits of short-term debt and the hedging benefits of long-term debt.

Faraglia, Marcet and Scott (2012) use tax schedule to alter consumption growth. They argue that this channel can help influence interest rates and the debt financing costs. This channel is referred to as interest rate twisting. Interest rate on short-term debt is usually lower than that on long-term debt because, other things being equal, it is easier to assess a borrower's ability to repay in the short term than in the long term, and long-term debt carries greater interest-rate risk. On the contrary in the Eastern Caribbean short-term domestic rates (T-bills and bonds range between 5-7 percent) are higher than external long-term (1-35 per cent CDBOR).

Debt maturity plays an important role in determining the firm's rollover risk since firms with shorter average debt maturity or more short-term debt face greater default risk. As pointed out by many observers (e.g., Brunnermeier (2009) and Krishnamurthy (2010)), the heavy use of short-term debt financing such as commercial paper and overnight repos is a key factor in the collapse of Bear Stearns and Lehman Brothers.

3.0 Domestic Debt Exhaustion

The 'Domestic Debt Exhaustion' concept herein defines an event that occurs when the debtor stops making payment on its debt but continues spending even after being overwhelmed by the amount of debt incurred. This event has been occurring in some Caribbean economies, particularly in the Eastern Caribbean namely Grenada, Saint Lucia and St. Vincent and the Grenadines.

There has been a notable growth in the issuance of treasury bills in the Eastern Caribbean, particularly in Saint Lucia and St Vincent and the Grenadines. It reflects the practice of rolling over maturing securities. Case in point, St Lucia's domestic debt represented 52.09 percent of total central government debt stock, in 2013 (see Figure 1). The domestic portfolio at the time comprised six, eight and ten year bullet bonds which was \$975 million or 58.6 percent of the domestic portfolio; amortized bonds were \$463 million or 27.8 percent and Treasury Bills, Notes, and loans were \$225 million or 13.5 percent (see Figure 2). The largest component of

domestic debt comprises instruments with short to medium term maturities exposing the portfolio to considerable refinancing and roll-over risk.

Presumably, there is a possibility that refinancing risk and market risk will be triggered by the rolling over of debt securities. Refinancing risk is closely associated with roll-over. It implies that when securities mature, the principal and interest would be paid for with the cash from the issuance of new securities. This is a signal of financial imbalance, that is, future debt obligation of government is different from its future income stream. Government's appetite for consumption expenditure should therefore adjust downwards. The uncontrollable effect has been an expansion in government spending and as a consequence leads to 'Domestic Debt Exhaustion'.

The Government of Saint Lucia has experienced to date the highest value of roll-over within the Eastern Caribbean; a total of EC\$465.7m in treasury bills and EC\$239m of bullet bonds matured in 2016 were rolled over.⁴ Although the Government of Saint Lucia has been rolling over a substantial portion of its existing bonds and treasury bills, its estimated spending for the financial year 2016 was expected to be funded through borrowing. In 2014, Grenada had made EC\$207m in principal repayment, of this amount EC\$120m were T-bill rollovers.

Being highly exposed to roll-over risk, governments may have to increase taxes or cut spending in order to reduce the deficit. If the government borrows more, this can cause interest rates to increase. This is because it requires increased interest rates in order to attract investors to buy the extra debt. Issuing more Treasury bills would create more "rollover risk according to Acharya, Gale, and Yorulmazer (2011).

Two elements of market risk emerge from roll-overs. Firstly, government is expected to pay higher interest rates to attract new buyers. Secondly, it is highly likely that the number of bidders will fall. This would force governments to use cash on hand to pay-off securities that are due. The worse-case scenario is default on debt; the uncertainty surrounding the ability to service debts and obligations. As seen in the explicitly in 2012, the government of Grenada failed to pay

⁴ Government of Saint Lucia Economic and Social Review 2016

the coupon due on September 15, 2012 on its US\$193 million bond, which had a maturity date of 2025.⁵ By the year 2013 the government defaulted on its international bond. The country also defaulted on a local currency bond due in 2025. Unwittingly, the government managed to issue EC\$12m (US\$4.4m) in treasury bills to local investors in order to meet a missed coupon on the 2025 bond within its grace period.⁶

4. The Robin Hood Triggers

‘Domestic debt exhaustion’ can cause a debtor to stop making payments on its domestic debts but proceed to contract further debt. Continuous financing with little or no return on investment is a significant risk. These can activate the ‘Robin Hood Trigger’; that is the creation and use of sophisticated, innovative tax mechanisms and tools to raise revenue and create fiscal space. There are 2 aspects of the ‘Robin Hood Trigger’ theory; they are haircuts and redistribution i.e creating/raising taxes to arrest the cost of public debt.

Some investors particularly 'unsophisticated' small scale investors, such as private individuals, are the ones mostly affected by the process of bailouts. In many cases, governments become ‘too big to fail’. Therefore, whether or not a proposed restructure package is unattractive to holders of securities, they will accept the new terms of the agreement. For instance, in 2015 Grenada’s government reached an agreement to restructure EC\$262m of bond that it had defaulted on in 2013. Bond holders agreed to a 50% haircut in the original value of the defaulted bonds.⁷ Likewise, St Kitts and Nevis defaulted on the payment of millions of dollars to its bond holders and were forced to take a haircut of at least 50% on its creditors. The debt situation could have escalated very quickly but the outcome depended largely on how investors reacted to the breach.

Regarding the second ‘Trigger’ which is redistribution, much of it has focused on the introduction and use of value added taxes (VAT). A practical more recent example can be seen in Saint Lucia’s 2016/17 fiscal year budget. It was anticipated that the budget would be financed with recurrent revenue of \$1.073 billion comprising a Tax Revenue of \$958 million (89.3 per

⁵ The Gaurdian Newspaper. See <http://www.guardian.co.tt/business/2012-10-10/grenada-defaults-us-dollar-bond>

⁶ The financial Times. <http://www.reuters.com/article/markets-credit/grenada-seeks-to-overhaul-finances-restructure-2025-bond-idUSL1N0C7BU720130315>

⁷ The wall street journal. April 2015

cent of revenue). In 2015/2016 the country earned \$346.37 million dollars from VAT. The Government noted that for every 1% reduction in VAT Revenue, the country loses \$7.0 million dollars.⁸

In addition to taxes, redistribution can be pursued through social transfers and social expenditure. Different taxes have different impacts of distribution. Generally, personal income taxes and property taxes are progressive (increasing equality), corporate taxes are U-shaped (regressive for small and large companies and progressive for medium-sized companies), and indirect taxes are regressive. High and sustained levels of inequality, especially inequality of opportunity, can entail large social costs. Governments need to be meticulous when using the tax instruments. Any recourse to tax reform should take into account the possible impact on economic growth.

Bailout heavily favours governments, giving them the opportunity to reschedule/restructure debt, leaving taxpayers with most of the risk. A considerable amount of attention has to be devoted to how government can create a coherent plan for generating productive investments and maximizing returns on taxpayers' investments.

5. Formalizing the Theory

The proposed theory spans different seminal works on overlapping generations (OLG); Samuelson's (1958), Diamond (1965), Sargent and Wallace (1981), Auerbach and Kotlikoff (1987), Aguiar and Gopinath (2006) and Arellano (2008), and Di Casola P and Sichlimiris S (2014). Using OLG this paper demonstrates that under certain conditions such as increasing cost of servicing debt, governments would target its creditors by rolling over debt, defaulting on debt or by imposing higher taxes on individuals and businesses. Having developed the model, the following propositions will be presented.

⁸ Government of Saint Lucia Budget 2016.
<http://www.govt.lc/media.govt.lc/www/pressroom/news/attachments/address-to-the-nation-on-the-date-for-the-2016-general-election0.pdf>

5.1 Assumptions and Propositions

- Government spending will increase with roll-overs. Payment on its debt will stop, but will continue spending even after being overwhelmed by the amount of debt incurred.
- Debt cannot be rolled forever without end. The refinancing need will exceed the aggregated endowment, hence, government imposes taxes to close the gap.

5.2 Structure of the Model

The economy consists of a small open endowment economy populated by domestic consumers and a government who issues one-period non-contingent t-securities (bills and bonds). The model notes that the government lacks commitment and can easily roll-over discriminately on domestic debt. The basic mechanism of the OLG model is driven by the life choices of representative individuals as well as the utility function that governs preferences at any given period and throughout their lifetime. Such a setup permits the model to project the accumulation and transfer of wealth over time and across generations.

5.3 The Model

The dynamics of the model are illustrated using a simplified version of the Diamond (1965) two-period OLG model, consisting of firms, households and government. Individuals supply labour to firms and receive wages in return, then allocate their wages to either consumption or saving. Since individuals are also the owners of firms, savings are invested in terms of capital. In this simple model, the amount of capital created in one period is consumed in full in the next period.

(i) Agents

Individuals born at time t live for two periods. Consider an economy consisting of two-period lived overlapping generations. People in the first period of their life are called young and in the second period of their life old.

Let N_t denote the population of young individuals in period t and assume that the population (young and old cohorts living in the economy) remains constant at $2N$. The population is assumed to grow at a constant rate n , i.e. $N_t = (1 + n)$.

In each period $t \geq 1$, N_t individuals are born. The economy starts in period 1. The generations born in periods $t \geq 1$ are called future generations. In addition, in period 1 there are N_0 people born in time 0 called the initial old. In any period $t \geq 1$, two generations live- N_t young and N_{t-1} . Total population at time t is

$$N_t + N_{t-1}. \quad (1)$$

There is only one perishable or non-storable good. Each individual when young receives an endowment of the consumption good equal to y . Old receive nothing. Thus the total availability or supply of good at time t is yN_t . During the first stage of their life, individuals are young and they supply one unit of labour to the firm in return for a fixed wage w_t . A young individual allocates her after-tax labour income between consumption c_t and savings s_t , where savings take the form of physical capital that can be used by firms or invest in government securities.

Thus in period t a young individual faces the constraint:

$$w_t = c_t + s_t \quad (2)$$

Each individual would like to consume in both periods of their life has preferences defined over time-dated consumption (C_1, C_2) where C_T denotes the consumption of output by generation $t=1,2,\dots$ in the i th period of life. Agents care about consumption when young c_t^{yon} when young and consumption c_t^{old} when old. For simplicity, assume additive separable preferences:

$$u(C_1, C_2) = u(c_t^{yon}) + u(c_{t+1}^{old}) \quad (3)$$

Let preferences be represented by the utility function:

$$u(C_1, C_2) = u(c_{1t} + \beta c_{2t}) \quad (4)$$

Over their lifetime, individuals maximize utility from consumption

$$\max_{c_1, c_2, s_t} \{u(c_{1t} + \beta c_{2t})\} \quad (5)$$

$$\text{Subject to } c_{1t} \geq 0, c_{2t} \geq 0 \quad (6)$$

The coefficient β represents the “impatience” discount factor. We assume that the utility function $u(\cdot)$ is continuous and twice differentiable in the set of non-negative real numbers, and has characteristics $u'(c) > 0, u''(c) < 0$ and $\lim_{c \rightarrow 0^+} u'(c) = +\infty$.

A young worker on date t pays taxes τ_t^{yon} to the government, while an old worker pays taxes τ_t^{old} . The consumer budget constraint become: would lead

$$c_t^{yon} + \frac{c_{t+1}^{old}}{1+r_{t+1}} = w_t - \tau_t^{yon} - \frac{\tau_t^{old}}{1+r_{t+1}} \quad (7)$$

Then optimal consumption is determined by combining the budget constraint with the Euler equation

$$u'(c_t^{yon}) = \beta(1+r_{t+1})u'(c_{t+1}^{old}) \quad (8)$$

Let

$$s_t^{yon} = w_t - \tau_t^{yon} - c_t^{old} \quad (9)$$

Equation (8) denote per capita saving by the young of date t . In old age they will have a per capita saving rate of

$$s_{t+1}^{old} = r_{t+1}s_t^{yon} - \tau_{t+1}^{old} - c_{t+1}^{old} \quad (10)$$

(Equation (8) implies that saving is income minus consumption). From the budget constraint and (8), however,

$$c_t^{old} = (1+r_t)(w_{t-1} - \tau_{t-1}^{yon} - c_{t-1}^y) - \tau_t^{old} = (1+r_t)s_{t-1}^{yon} - \tau_t^{old} \quad (11)$$

Equation 7 rewritten to apply to time period t becomes:

$$s_t^{old} = r_t s_{t-1}^{you} - \tau_t^{old} - c_t^{old} = r_t s_{t-1}^{you} - (1+r_t)s_{t-1}^{yon} = -s_{t-1}^{yon} \quad (12)$$

Equation 11 implies that what the young generation saves are simply consumed (dissave) while old. As a result, the capital stock on any date equals the amount saved by the previously young:

$$K_t = N_{t-1} S_{t-1}^{yon} \leftrightarrow k_t = \frac{S_{t-1}^{yon}}{1+n} \quad (13)$$

Where K denotes capital stock. $k \equiv K/N$. Those who are old at time date t consumes this capital completely during t , leaving the contemporaneous young to put aside the next periods capital stock K_{t+1} through their own savings.

Assume that $u(C_1, C_2) = \ln C_1, C_2) u(c)$ and let $F(K, N) = AK^\alpha N^{1-\alpha}$. The Euler equation can then be written as:

$$C_{t+1}^{old} + \beta(1 + r_{t+1})c_t^y \quad (14)$$

(ii) *The Government*

The role of fiscal policy is introduced to address the redistributive assumption. Fiscal policy is used by government to transfer resources to reduce their saving of the old. Fiscal policy is a way for the government to ensure there are voluntary transfers from the infinitely lived generations.

Assume the government issues one-period bonds and treasury bills to finance its consumption of goods next period. Also assuming that the government always honours its debt (assuming only the young are interested in holding government debt). The return on debt must be the return on private lending, r_{t+1} . If the price of one-period debt (bonds and treasury bills) is d_t in period t , d_t must be given by:

$$1 = d_t(1 + r_{t+1}) \quad (15)$$

$$\frac{1}{q_t} = 1+r_{t+1} \quad (16)$$

If the government issues b_t units of bonds in period t there are four ways it can finance repayment of the debt in period $t + 1$:

- Tax the young of generation $t + 1$ a total of $\tau_{t+1}^{yon} = b_t$ units;
- Tax the old of generation t a total of $\tau_{t+1}^{old} = b_t$ units;
- Issue b_{t-1} units of bonds that raise a total of b_t units; or
- Some mix of the above three.

The government budget constraint:

$$q_t b_t = b_{t-1} - \tau_t^{yon} - \tau_t^{old} \quad (17)$$

Some individuals must be willing to buy the debt. The budget constraint of the old (who hold b_{t-1} units of bonds) would therefore lead to:

$$c_t^{old} = w^{old} - \tau_t^{old} + b_{t-1} \quad (18)$$

And the budget constraint of the young:

$$c_t^{yon} = w^{yon} - \tau_t^{yon} + d_t b_t \quad (19)$$

Therefore, the net demand for bonds (i.e., aggregate savings) is equal to

$$d_t b_t = w^t - \tau_t^{yon} - c_t^{yon} \equiv S_t^{yon} \quad (20)$$

In equilibrium the government has a financing need, hence its supply bonds is given by

$$d_1 b_1 = b_{t-1} - \tau_t^{yon} - \tau_t^{old} \quad (21)$$

The demand for bonds is met by the young generation given by

$$S_t^{yon} = w^{yon} - \tau_t^{yon} - c_t^{yon} \quad (22)$$

Market clearing in the bond market now requires that

$$w_t^{yon} - \tau_t^{yon} - c_t^{yon} = s_t^{yon} = b_{t-1} - \tau_t^{yon} - \tau_t^{old} \quad (23)$$

$$c_t^{yon} = s_t^{yon} = w_t^{yon} - \tau_t^{old} - b_{t-1} \quad (24)$$

$$s_t^{yon} = d_t b_t \quad (25)$$

Debt b_{t-1} and transfer to the old τ_t^{old} , cannot be too large since $c_t^{yon} \geq 0$

The derivations of Equations 1-25 thus applied to test the prepositions and assumptions.

Proposition 1: Government spending will increase with roll-overs. Payment on its debt will stop, but will continue spending even after being overwhelmed by the amount of debt incurred.

(iii) Rolling Over the Debt

The model assumes that if government set all future taxes τ_t to zero if it rolls over the debt then:

$$\begin{aligned} d_t b_t &= b_{t-1} \\ &= \frac{b_t}{1+r_{t+1}} \\ \rightarrow b_t &= (1+r_{t+1})b_{t-1} \end{aligned} \quad (26)$$

The equilibrium condition for young investors is expanded to reflect the rollover by considering period t to t_j :

$$s_t^{yon} = d_t b_t = \frac{b_t}{1+r_{t+1}} \quad (27)$$

$$s_{t+1}^{yon} = d_{t+1} b_{t+1} = \frac{1}{1+r_{t+2}} * (1+r_{t+2})b_t = b_t = (1+r_{t+1})b_{t-1} \quad (28)$$

$$s_{t+2}^{yon} = d_{t+2} b_{t+2} = \frac{1}{1+r_{t+3}} * (1+r_{t+3})b_{t+1} = b_{t+1} = (1+r_{t+2})(1+r_{t+1})b_{t-1} \quad (29)$$

$$s_{t+j}^{yon} = (1+r_{t+3}) \dots (1+r_{t+2})(1+r_{t+1})b_{t-1} = b_{t-1} * \prod_{k=1}^j (1+r_{t+k}) \quad (30)$$

A government can roll over funding from $t \dots t + j$ faces (Equations 26-30). In other words, with rollover the government can spend progressively more in $t + 1 \dots t + j$ respectively.

Proposition 1 proof: When debt is rolled over three outcomes are possible:

Outcome 1: The outcome of debt is constant over time since $r_{t+k} = 0$ for all k . Then

$$b_{t+j} = b_t \quad (3)$$

Outcome 2: Government debt goes to zero in the long-run, hence the equilibrium becomes stationary since $r_{t+k} \leq \bar{r} < 0$ for all k and $r_{t+k} > -1$. Then

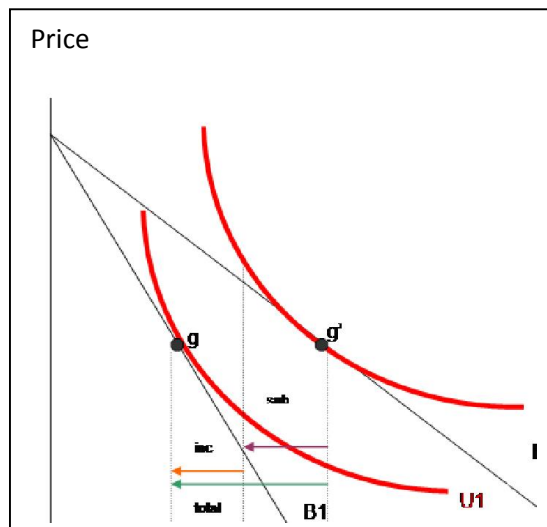
$$b_{t+j} = b_{t-1} * \prod_{k=1}^j (1 + r_{t+k}) \leq b_{t-1} * \prod_{k=1}^j (1 + \bar{r}) = b_{t-1} * (1 + \bar{r})^j \quad (32)$$

As time elapse

$$0 \leq \lim_{j \rightarrow \infty} b_{t+j} \leq b_{t-1} * \lim_{j \rightarrow \infty} (1 + \bar{r})^j = 0 \quad (33)$$

Outcome 3: Government debt cannot be in equilibrium since it goes to infinity. Eventually the refinancing need will exceed the aggregate endowment of the young generation. In this case government must revert to redistribution.

Figure: Roll-overs are accompanied by increases in government consumption allocation.



Due to roll-over the price of x (debt securities) decreases since there is no extra interest cost. The price decreases, causing the budget line to shift from $B1$ to $B2$. The government changes its consumption from the bundle of x and y represented by point g to the bundle represented by point g' . The movement from g to g' represents the total effect of the price change. Consumption of x goes up from x_1 to x_2 for two reasons. The substitution effect occurs because x is now less expensive relative to y ($B1$ is steeper than $B2$). The income effect of the price change occurs because real income has increased. Government consumption g is on a lower indifference curve than g' . The total effect is the substitution effect plus the income effect.

Proposition 2: Debt cannot be rolled forever without end. In such cases, refinancing need will exceed the aggregated endowment, hence government imposes taxes to close the gap.

Proposition 2 proof: See equation (30) if $r_{t+k} \geq 0$ then debt cannot be rolled-over forever without end. It must then finance its debt with lump-sum taxes.

(iv) Financing Debt with lump-sum taxes

Government operating in deficit must issue debt b_t to finance its spending g_t and repay the interest and principal in subsequent periods. The constraints of the government are

$$b_t + \tau_t = (1 + r_b)b_{t-1} + g_t \quad (34)$$

Where τ_t tax is raised in period t and r_b is the rate of interest payable on government bonds. Individuals' labour income will decrease by the amount of the tax.

$$w_t - \tau_t = c_t + s_t \quad (35)$$

As a consequence public debt, private savings and investments in new capital are lower. The ripple effect would be an overall depletion of economic growth, development, social sector

deterioration and unsustainable debt. Government must therefore have to invest in more productive activities and in assets that can easily converted.

6. Discussion and Policy Recommendations

Rollover risk makes debt default more likely as debt cannot be rolled forever. Domestic financing sources will eventually dry up. Moreover, government redistribution mechanisms such as taxes and other transfers among others, do not have infinite levels. Governments should therefore pay greater attention to managing that risk. When aggregate debt burden grows, the costs associated with rollover risk implies that it would be difficult for government to smooth taxes. If government borrows short-term debt by issuing short-term securities, it must levy taxes to pay off the maturing debt or roll over the debt by reissuing short-term bonds (Greenwood R., Hanson S, Stein Jeremy, 2010). Roll over risk leads to real costs as it makes future taxes more volatile.⁹

This research puts forward a variety of proposals for managing the unintentional consequences of 'Domestic Debt Exhaustion' and the effects of the 'Robin Hood Trigger' on individual, households i.e. infinitely lived generations. The recommendations are presented in no particular priority order.

Recommendation 1:

Improve the efficiency of the debt profile: Government must improve the efficiency of its portfolio either by reducing cost for a given level of risk or reducing risk for a given level of cost. Managing the risk in the securities market requires government to focus on four main aspects of the debt issuance decision: the purpose of borrowing, cost incentives, the market characteristics that motivate participants such as size, payment structure and tenor and its ability to forecast future returns and ensure risk is controlled.

⁹ See eg. Barro (1979), Lucas and Sokey (1983), Bohn (1990), Angeletos (2002) and Aiyagari, Marcet, Sargent and Seppala (2002).

Non-parametric techniques such as the Data Envelopment Analysis (DEA) can be used to analyze the efficiency of public spending. The DEA approach is based on a linear combination of input and outputs in order to specify the efficiency frontier.

According to DEA methodology, the general relationship can be given by the following function for each country i (Afonso et al., 2006, p. 21):

$$Y_i = f(X_i) \quad i = 1, \dots, n \quad (37)$$

where we have Y_i a composite indicator reflects output measure; spending (X_i) and the country's inputs i . If $Y_i < f(X_i)$ then there is inefficiency.

Recommendation 2:

Extend the maturity structure of securities: Government can progressively extend the maturity of securities by consolidating existing debt into a number of larger debt issues and creating standardized securities with conventional maturities. This can help to create an appropriate match between the liabilities and assets.

Recommendation 3:

Securities should be indexed to inflation: Inflation can motivate investors to demand higher interest rates. The expectation of higher inflation, other factors held constant, will cause borrowers to issue more bonds. This shifts the supply curve rightward, and bond prices down (and yields up). According to the Fisher's theory, if the inflation expectation increases while nominal interest rate stays the same, the real interest rate must decrease. Governments may resort to inflation to achieve fiscal sustainability. In the presence of modest price stickiness the role of inflation is minor. The approach is more likely to be effective when issuing long maturity bonds. ECCU governments do not issue inflation indexed bonds. The majority of fiscal adjustments have been achieved through changes in taxes.

Recommendation 4:

Establish and develop a Secondary Market: A strong primary market in government securities requires support from a liquid and efficient secondary market. One major constraint is the non-existence of a secondary market.

Recommendation 5:

Hedge the government's fiscal position: Interest rates and currency swaps should be used to hedge government's position. Debt managers should be able to assess how a portfolio should be structured on the basis of cost-risk criteria so as to hedge the government's fiscal position from various shocks.

Recommendation 6:

Specify a strategic risk tolerance benchmark: It also requires government to identify its desired structure or composition of a liability (and asset) portfolio in terms of financial characteristics such as currency and interest mix, maturity structure, liquidity, and indexation. It is a management tool that requires the government to specify its risk tolerance. The distance from the default indicator specified in Equation (38) can be used to specify its risk tolerance.

Distance from default:

$$DDF = M - P \tag{38}$$

If:

$$DDF > 0 \text{ Investment is safe}$$

$$DDF < 0 \text{ Investment is unsafe}$$

Where M denotes maturity and P payback period is calculated mathematically by:

$$P = \frac{\text{Initial Investment}}{\text{Cash inflow per period}} \tag{39}$$

Recommendation 7:

Set up a monthly bail-out fund: It may be useful if the return from the borrowed funds can be realized on a monthly basis. The returns can be placed into a bail-out fund. Monies for the

funds should also be derived from taxing brokers and investors. Sinking fund - setting aside some of its earnings to retire its debt - can reduce debt load over time, but is not desirable for t-bills since the time to maturity is too short to allow government to gain returns from its investments.

Recommendation 8:

Government should undertake more productive borrowing: Government investments are not always productive. If the government borrows to finance infrastructure investment, it can help boost the supply side of the economy and enable higher economic growth. If growth improves, then there will be higher tax revenues to pay back the debt. However, if the government is borrowing to pay pensions or welfare benefits, then there is no supply side improvement, and it will be harder to pay back the debt.

Government must consistently evaluate and monitor the efficiency and productivity of its investments. Two useful indicators for undertaking such are total factor productivity (TFP) and the Tornqvist index.

The Tornqvist index method can be used to calculate productivity; that is, the total factor productivity (TFP). It is derived by taking the weighted sum of the rates of change of components of output or input quantities, over time. The index is defined by:

$$\ln \left[\frac{TFP_t}{TFP_{t-1}} \right] = \sum_i \frac{1}{2} (R_{it} + R_{it-1}) \ln \left[\frac{Y_{it}}{Y_{it-1}} \right] - \sum_i \frac{1}{2} (S_{jt} + S_{jt-1}) \ln \left[\frac{X_{jt}}{X_{jt-1}} \right]$$

(38)

Where X is input, Y output and S are output revenue shares and ln the natural logarithm operator.

The TFP can be defined as:

$$TFP = \frac{Q}{I}$$

(40)

Where Q is the quantity of outputs and I the quantity of inputs.

Recommendation 9:

Reduce reliance on securities issuance for budget support: A significant portion of the supply of securities in the Eastern Caribbean has been for budget support. If the capital is re-circulating there is no effect on the monetary aggregate. Budget support is controversial but it is an effective tool. The issues with budget support lies with the impending fiduciary risk. Fiduciary risk – DFID defines fiduciary risk as the risk that funds are not used for the intended purposes; do not achieve value for money; and/or are not properly accounted for. The realisation of fiduciary risk can be due to a variety of factors, including lack of capacity, competency or knowledge; bureaucratic inefficiency; and/or active corruption.

Recommendation 10:

Increase investment in liquid assets: Assets must be easily converted through an act of buying or selling without causing a significant movement in the price and with minimum loss of value. An essential characteristic of a liquid market is that there are ready and willing buyers and sellers at all times. An illiquid asset is an asset which is not readily saleable due to uncertainty about its value, or lacking a market in which it is regularly traded.

Recommendation 11:

Invest in assets that can provide an equal or greater return: If assets are held together with debt, they are effectively debt financed. To some extent it might be possible to use assets so as to hedge risks on the liability side of the government balance sheet or budgetary spending or revenue risks more generally. It is not clear though that a combination of debt and debt financed financial assets would allow for more efficient management of yields and risks of the government's balance sheet than holding no assets at correspondingly reduced gross debt. Sovereigns can almost always sell sufficient assets to service their debts

Recommendation 12:

Privatisation of selected government assets: Privatization not only reduces gross debt but may also boost economic growth, provided that certain conditions are met. In particular, privatisation should be accompanied by appropriate regulatory provisions addressing market failures that may exist in areas operated by public firms.

Recommendation 13:

Improve the attractiveness of the investment environment: Consideration should also be given to allowing investors from outside the Caribbean region to invest in its securities market. Borrowing becomes more attractive when general businesses conditions are favourable, taxes are low, regulatory costs are low or the economy expands. These conditions are not always very attractive in the Eastern Caribbean.

Recommendation 14:

Greater Private-Public Sector collaboration: Governments might find it easier to source liquid capital for new projects but certain projects are better off managed by the private sector.

The above 14 recommendations can be quite useful, although quantitative easing (“QE”) is the most popular way to reduce the cost of borrowing. In general, central banks can engage in QE by buying Treasury securities indirectly. This is however essentially the equivalent of money printing ie. “monetizing the debt” . This process reduces the government’s cost of borrowing but governments would face negative consequences, such as inflation. This study does not recommend QE since governments would face negative consequences, such as inflation from an increase in the monetary base that would result from printing money to pay its debt.

7. Conclusion

The government debt portfolio should comprise both short and long term securities in appropriate proportions. If the overall portfolio is dominated by short term debt, the government is vulnerable to a sudden increase in interest rates due to frequent rollovers which leads to increased domestic interest payments. Furthermore, if the rollover amounts are quite large, the government is also faced with the risk of defaulting on servicing the debt, due to unavailability of adequate funds.

Default risk is the uncertainty surrounding governments' ability to service debts and obligations. The maturity structure of debt is a critical element of crisis prevention. Most securities issued in the region are Treasury Bills (T-Bills), hence few have extended their maturity profile. Short-term debt in excess of short-term liquidity increases countries' vulnerability to financial crises. The risk of crises rises with the share of short-term borrowing by domestic banks.

The effect of domestic public sector debt or any public debt for that matter acquired through securities depends largely on the purpose of the lending and level of return on the borrowed funds; these impact governments' ability to repay. Efficiency and productivity play an important role in achieving the core objectives of issuing debt. They should be guided by best practices: issuing strategy based on regular auctions and the issuance of benchmarks. In the absence of productive spending, there is a substitution effect which entails government reverting to taxes to off-set expenditure and fatigue government willingness to repay. This is the activation the 'Robin Hood Trigger'.

Reference

- Acharya, Viral, Douglas Gale, and Tanju Yorulmazer, 2011, Rollover risk and market freezes, *Journal of Finance* 66, 1177–1209.
- Afonso, A. & Jalles, J. T., 2013. Growth and productivity: The role of government debt. *International Review of Economics & Finance*, 25, 384–407.
- Asogwa, R.C., (2005). Domestic Government Debt Structure, Risk Characteristics and Monetary Policy Conduct, Evidence from Nigeria. Retrieved from: <http://www.imf.org/external/np/res/seminars/2005/macro/pdf/asogwa.pdf>:
- Dar, A. Amirkhalkhali, S. (2002), “Government size, factor accumulation and economic growth: evidence from OECD countries”, *Journal of Policy Modeling*, 24, 679-692.
- Diamond, D.W., Rajan, R.G., 2001a. Banks, short-term debt and financial crises: theory, policy implications and applications. *Carnegie-Rochester Conference Series on Public Policy* 54, 37–71.
- Checherita-Westphal, C. and Rother, P. (2012), «The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area», *European Economic Review*, 56(7): 1392-1405.
- Diamond, D.W., Rajan, R.G., 2001a. Banks, short-term debt and financial crises: theory, policy implications and applications. *Carnegie-Rochester Conference Series on Public Policy* 54, 37–71.
- Eichengreen, Barry and Ricardo Hausmann, “Exchange Rate and Financial Fragility in New Challenges for Monetary Policy, Kansas City; Federal Reserve Bank of Kansas City, 1999:
- Eggertsson, Gauti B., Neil R. Mehrotra, and Jacob Robbins. 2017. “A Model of Secular Stagnation: Theory and Quantitative Evaluation.” Mimeo. Brown University.
- Faraglia, E., Marcet, A. and Scott. A (2012) ”Debt Management and Optimal Fiscal Policy with Long Bonds”, *BIS Papers* no.65, ‘Threat of Fiscal Dominance?’, May 2012
- Emran, M. S., & Farazi, S. (2008). *Government Borrowing and Private Credit: Evidence from Developing Countries*. World Bank Working Papers.
- Emran, M. S., & Farazi, S. (2009). *Lazy Banks? Government Borrowing and Private Credit in Developing Countries*. Institute for International Economic Policy Paper Series, WP-2009-9.
- Jeffrey B. Liebman and Neale Mahoney (201). *Do Expiring Budgets Lead to Wasteful Year-End Spending? Evidence from Federal Procurement*.

Hauner, D. (2006). Fiscal Policy and Financial Development. IMF Working Paper, WP/06/26.

Mohatny, M.: Improving liquidity in government bond markets: what can be done?, BIS Papers, No 11,

<http://www.mfa.go.th/interet/ACD/asianbond/liquidity.pdf>

Pemberton, C.M.S, Stewart A.L & Watson PK (2005). Improving the Effectiveness of the Market for Bonds in the CARICOM sub region. Social and Economic Studies, 54(4): 166-201.

Preferential regulatory treatment and banks' demand for government bonds * (2014). De Nederlandsche Bank NV,. Working Paper No. 433

https://www.dnb.nl/binaries/Working%20Paper%20433_tcm46-310158.pdf

Summers, L., 2000. International financial crises: causes, prevention, and cures. The American Economic Review 90, 1–16.

Teles V K and Cesar Mussolini C. (2014). Public debt and the limits of fiscal policy to increase economic growth. European Economic Review 66: 1–15.

Government of Saint Lucia (2013). Medium Term Debt Management Strategy For the period 2013/14-2017/18. Prepared by the Debt and Investment Unit Office of the Director of Finance Department of Finance, Economic Affairs & Social Security.

Eastern Caribbean Central Bank (2017). Presentation on the Regional Government Securities Market.

Figure 1: Value and Number of Bids by Investor Type

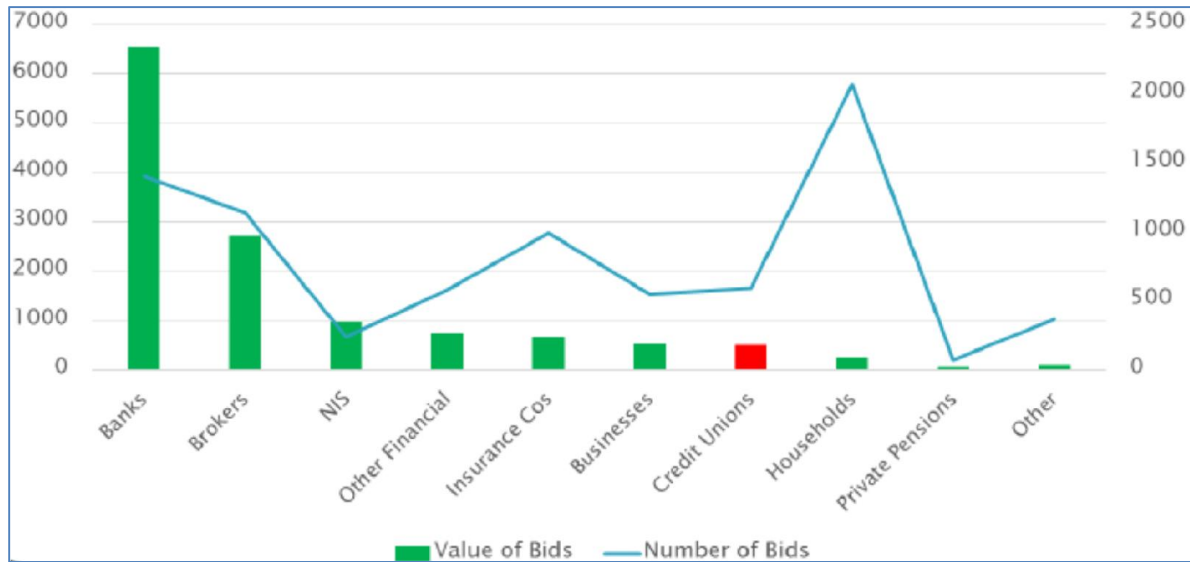


Figure 2: Average Treasury Bill rate on the RGSM compared to the Minimum Savings Rate

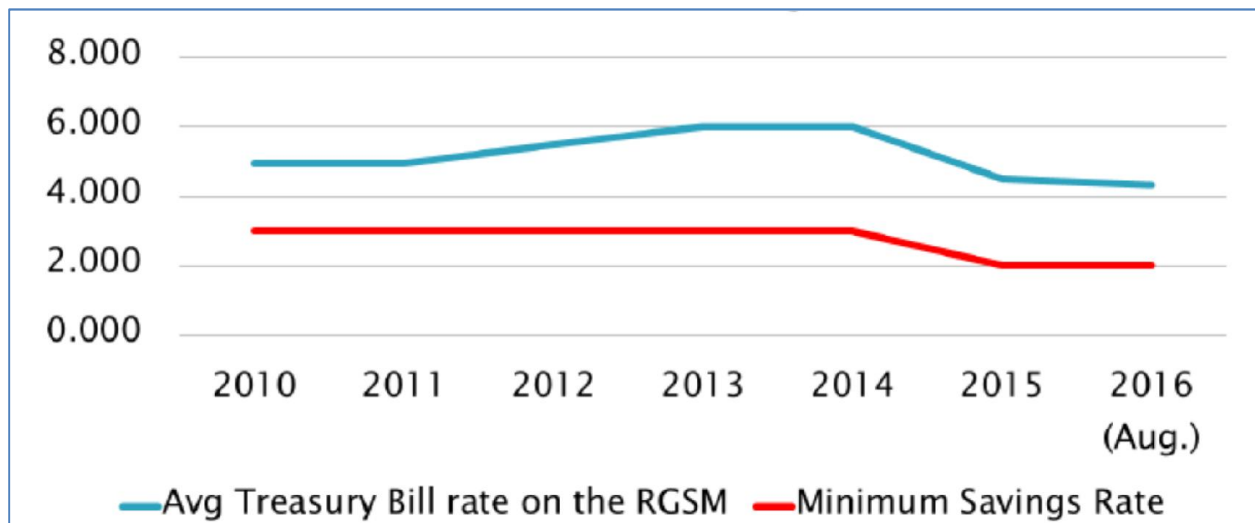


Figure 3: Debt-to-GDP ratio 2010-2015 Eastern Caribbean Countries

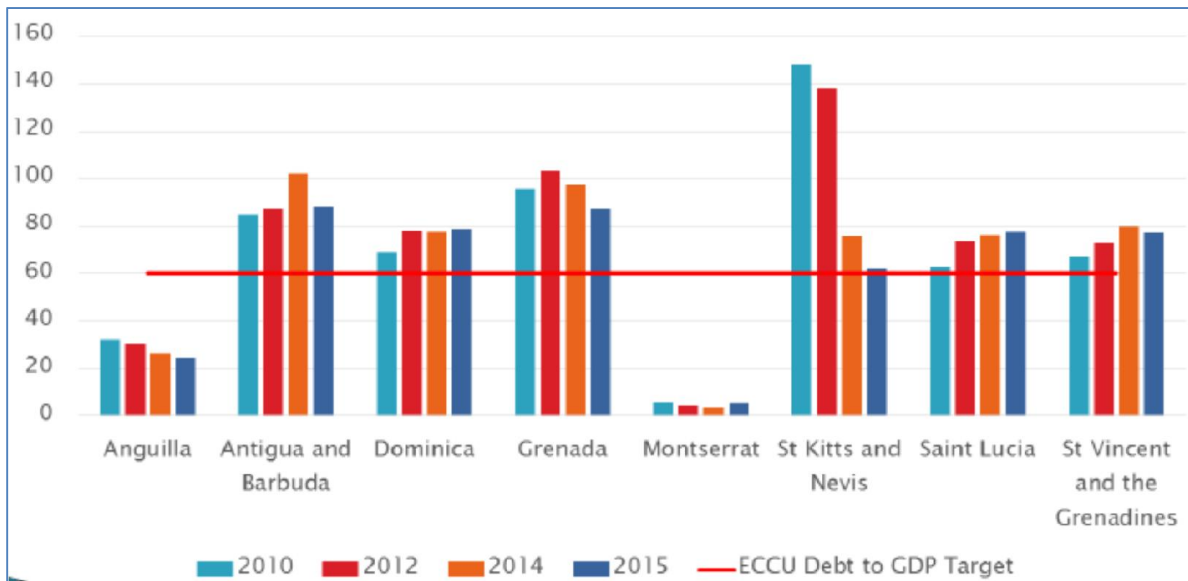


Figure 4: Domestic Debt Composition Saint Lucia 2013

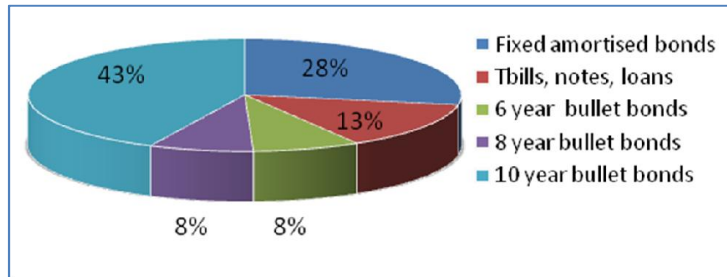


Figure 5: Government of Saint Lucia Central Government Debt Stock 2013

