African Review of Economics and Finance | ISSN 2042-1478 | Volume 8 | Issue 2 | December 2016

Simulation analysis of alternative strategies for public debt issuance in Zimbabwe: Is there a trade-off?

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Abstract

This paper presents a simulation of alternative strategies for public debt issuance in Zimbabwe. The analysis is undertaken with a view to find a strategy that minimises the cost and risk of public debt under different scenarios of interest and exchange rate developments. The premise is that increases in debt service charges due to risky allocation of public debt can substantially change public debt dynamics. The risky allocation can derive from an excessive exposure of the government to exchange rate, interest rate and commodity price shocks. The results show a trade-off between a debt strategy that largely depends on more external concessional borrowing and a debt strategy aimed at increasing the share of domestic debt in the public debt portfolio for market development purposes. While the strategy that maximises recourse to external concessional borrowing was found to be desirable from a cost perspective, it proved to be less desirable from a risk perspective after taking into consideration the exchange rate effect. Moreover the conditions attached by international financial institutions and other official creditors to accessing concessional loans makes the strategy less desirable. The results, therefore, underscore the need for authorities to ensure a neat balance between external and domestic debt borrowing to ensure long-term public debt sustainability.

Keywords: Public debt management; Debt cost; Risk

1. Introduction

The 2008/09 global financial crisis and European sovereign debt crisis have demonstrated the importance of regular assessment and monitoring of fiscal vulnerabilities, including the sustainability of public debt. However, choosing the optimal composition of public debt in terms of maturity, instruments and currency remain the main challenge confronting policymakers faced with high public debt (Melecky, 2010). As part of managing a debt portfolio, debt managers face the complex task of choosing a debt strategy that minimises the cost of debt, subject to a prudent degree of risk. This is particularly so because public debt management decisions depend on numerous random factors, which are not under the control of the debt manager. These factors include the future behaviour of interest rates, exchange rates, commodity prices and other macroeconomic aggregates.

The ultimate objective of public debt management is to minimise the expected long term cost of debt subject to a prudent degree of risk associated with government borrowing strategies (IMF, 2003). Accordingly, to achieve this objective, it is essential to have an effective public debt portfolio which provides an appropriate benchmarking structure against which the performance of debt managers can be evaluated. According to Claessens et al. (1998), establishing an optimal public debt portfolio is equivalent to finding an optimal solution to a dynamic stochastic problem given the stochastic processes of exogenous variables such as exchange and interest rates. This approach is also similar to finding an optimal asset portfolio under investment theory as developed by Markowitz (1952) and further extended by Merton (1971), Breeden (1979) and numerous other authors.

A clear definition of cost and risk in public debt is, therefore, a pre-condition for determining an optimal public debt management strategy (World Bank and IMF, 2009). The cost and risk of public debt are affected by a variety of factors. The cost metric generally depends on country-specific factors such as the risk profile of public debt, market conditions, and methods used in measuring and reporting public debt. The cost metric is primarily influenced by the size of the government debt, interest rates, exchange rates and inflation.

An understanding of the costs and risks of public debt also enables debt managers to fully apply the debt management objective of minimising costs subject to a prudent degree of risk. This, however, requires an analysis of the risk of public debt by simulating future debt service cash flows (Valendia, 2002). The simulation provides an expected path for future debt service, which is associated with the notion of cost. It also identifies the potential deviation of debt servicing flows from that expected path due to shocks in interest rates, exchange rates or shortage of loanable funds in the domestic or international markets. The deviation of the debt servicing costs provides a measure of public debt risk.

Against this background, this paper attempts to assess the cost and risk trade-offs of alternative public debt issuance in Zimbabwe. The management of public debt assumed critical importance in Zimbabwe, due to the country's high level of public debt as well as the volatility witnessed in its external sector. The high levels of public debt have been cited as a drawback to sustained economic recovery in the country (IMF, 2012). The suspension of Zimbabwe from accessing credit from its traditional creditors, due to arrears on previously contracted debt, left the country with limited borrowing options compared to other countries in the low income category (Jones, 2011). This scenario presented the country with new and complex challenges to access funding at low cost subject to a prudent degree of risk. The government's borrowing requirement has, also remained extreme, reflecting the need to revive the industry, finance infrastructural deficit and for market development purposes (IMF, 2012). Consequently, the country has been relying on non-concessional loans and domestic debt, due to the public debt overhang (IMF, 2012). The debt overhang has to some extent, undermined the country's credit rating and its ability to attract foreign direct investment, as well as to mobilize direct budget and balance of payments support.

The adverse impact posed by the debt overhang highlights the importance of optimal public debt management policies to avoid the costly mistakes of accumulating high public debt levels. The decline in donor financing and borrowing restrictions from traditional creditors also increased the temptation for the country to borrow on non-concessional terms to meet developmental needs. However, the risks associated with non-concessional borrowing to finance these public investments are high. The country's reliance on non-concessional sources has been criticised by the IMF as posing a challenge of exacerbating the already precarious debt sustainability concerns as well as undermining the country's debt relief initiatives by its traditional creditors (IMF, 2012). The public debt challenge that Zimbabwe has experience since the inception of its crisis in 2001, calls for answers to the following questions. Is concessional borrowing the panacea to Zimbabwe's development agenda? What should be the public debt issuing policy in an environment where concessional loans are not forthcoming? Answers to these questions require an analysis of the cost and risks trade-offs in public debt issuance. This entail assessing the optimal composition of the country's debt, in terms of instrument type, currency and maturity.

Empirical evidence suggests the existence of some trade-off between domestic and external debt (Panniza, 2008). External debt allows governments to finance the fiscal deficit without creating money supply-driven inflationary pressures or crowding out domestic lending to the private sector (Calvo, 2005). However, external credit flows tend to be volatile, pro-cyclical and subject to sudden stops (Calvo, 2005). By providing not only financing but also foreign exchange, foreign borrowing may induce a real exchange rate appreciation, thus hampering competitiveness and possibly lowering investment and economic growth (Rodrik, 2008). External debt also creates additional constraints on monetary policy and exchange rate management. Haussmann (2003) found that external debt lowers the evaluation of solvency because it heightens the dependence of debt service on the evolution of the exchange rate, which is often volatile and subject to shocks and crises.

Despite the existence of a number of publications, no study has been undertaken to assess the cost and risk trade-offs of public debt issuance in Zimbabwe under conditions of limited borrowing options. This paper, thus provides an analysis of the cost risk trade-offs in public debt with a view to recommend a borrowing strategy that minimises the cost and risk of government borrowing. The rest of this paper is structured as follows: Section 2 reviews the evolution of Zimbabwe's public debt portfolio, including inherent risks; section 3 reviews the existing literature on optimal public debt strategies. The development of the model will be discussed in section 4. Section 5 discusses the optimal debt strategy and simulation results. The concluding remarks and policy implications are discussed in Section 6.

2. Overview of Zimbabwe's public debt portfolio

In the Zimbabwean context, external debt constitutes about 93 per cent of public debt stock, while domestic debt accounted for the balance as at end of 2012. Domestic debt remained consistently low in United States dollar terms for the greater part of the review period, mainly due to the effects of exchange rate variations on the quantity of debt stock. However, since the year 2000, there has been a general shift in the composition of public debt in Zimbabwe from external to domestic debt. This move was necessitated by the drying up of external sources of financing after the placement of Zimbabwe on lending restrictions by traditional creditors, notably the IMF and the World Bank (Jones, 2011).

This trend has, however, been consistent with developments in other developing and emerging market economies where domestic debt is increasingly becoming more pronounced (Panizza, 2008; Presbitero, 2012). According to Panizza (2008), developing economies traditionally used the domestic debt market as a residual only when they did not have access to external resources or to sterilise aid flows. Recent developments have, however, seen an increasing number of countries switching from external to domestic debts. This development poses the risk of trading a currency mismatch for a maturity mismatch since most developing economies find it difficult to issue long-term domestic debts at reasonable interest rates (Panizza, 2008). The composition of public debt has important implications for the government's choice of an optimal public debt portfolio. The maturity profile of public debt in particular, is relevant for the analysis of possible liquidity problems.

In terms of currency composition, Zimbabwe's public debt has been largely denominated in US dollar, which at the end of 2012 accounted for 30.8 per cent, and the Euro accounting for 29.47 per cent of the public debt. Other currencies accounted for the balance. The currency composition of Zimbabwe's public stock from 2004 up to 2012 is shown in table 1 below.

Table 1: Currency Composition of Zimbabwe's Public Debt

	2004	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
USD	27.63	27.73	28.71	27.84	29.47	30.38	30.02	30.34	30.37	30.75
Euro	33.49	33.75	31.57	33.21	33.80	32.59	33.22	31.43	29.39	29.47
Pound	5.84	5.99	5.97	6.36	5.91	4.46	4.80	4.75	4.50	4.51
SDR	0.38	0.38	0.39	0.39	0.38	0.37	0.37	0.37	0.35	0.35
Swiss Franc	0.43	0.44	0.43	0.43	0.43	0.46	0.46	0.52	0.49	0.50
Other	3.51	3.66	3.72	3.75	3.65	3.58	3.58	3.84	6.78	7.53
Yen	5.30	5.16	5.37	5.00	4.76	6.04	5.83	6.71	6.88	6.07
Multiple	23.42	22.88	23.83	23.02	21.60	22.13	21.72	22.04	21.24	20.82
Total	100	100	100	100	100	100	100	100	100	100

Source**:** World Development Indicators Database (2012)

Analysis of the currency composition of the debt and its maturity structure are relevant to assess the vulnerability of a country to a debt crisis (World Bank, 2005). This, in turn, determines the optimal public debt policy given cost-risk trade-offs. When looking at various time horizons, there is a need to assess the short term financing risks and also to consider debt composition, exchange rate risks and the degree of liquidity of financial assets in order to assess the scope for fiscal policy manoeuvres necessary to achieve a sound medium-term budgetary position. Hence, alongside the level of the debt ratio, analysis of the composition of public debt in terms of currency denomination is also justified.

The currency composition of public debt also plays an important role in the dynamics of public debt. In fact, even a modest ratio of public debt to GDP can obscure unsustainable public debt dynamics when a large share of public debt is denominated in foreign currency. When this is the case, countries are particularly vulnerable to exchange rate risk emanating from the devaluation of the domestic currency.

3. The Literature review

This section provides a review of theoretical and empirical literature on optimal public debt management. Debt managers need to have a view on the optimal structure of the public debt portfolio. According to Blommestein (2005a), debt managers should be able to assess how a public debt portfolio should be structured on the basis of cost-risk criteria so as to hedge the government's fiscal position from various shocks. The optimal public debt composition is, thus, derived by looking at the relative impact of the risk and costs of the various debt instruments on the public debt.

3.1 Optimal debt management strategy

The debt management strategy is defined as the manner in which a government finances an excess of government expenditures over revenues and any maturing debt issued in previous periods (Bolder, 2003). The literature on optimal public debt management is largely driven by the tax smoothing approach of Robert Barro (1995). Barro's optimal debt portfolio concentrated on two key guiding principles. The first is that it is preferable on risk and uncertainty grounds to fix the cost of servicing public debt in real terms. Secondly, since the government typically wants to borrow over the long term, it is preferable to issue longer-dated debt. The idea is that this removes fluctuations in financing costs arising from changes in the short-term real interest rate. In this regard, literature suggests that governments should seek the public debt portfolio with debt servicing costs that are negatively correlated with shocks that increase the amount of debt for public debt policy to be optimal. However, the literature on optimal public debt policy provides little practical guidance and remains silent as to the optimal composition of debt in terms of cost and risk trade-offs.

According to the neoclassical theory (Barro, 1979), government should avoid revising taxation too sharply and frequently, in an economy subject to shocks. Abrupt and frequent changes in the tax rate are inefficient because the deadweight cost of taxation is convex in the tax rate. According to this strand of literature, the public debt optimal policy implies that governments should run deficits in times of high-government-spending needs and surpluses when needs are low. The optimal public debt propositions are also embodied in the World Bank and International Monetary Fund Public Debt Guidelines (2001 and 2003), where the optimal debt portfolio is described as a powerful tool for representing the debt profile that the government desires to attain based on its trade-off between costs and risks.

A commonly used approach is to view an optimal public debt strategy that ensures a stable ratio of public debt to GDP (Blanchard et al. 1990). A related methodology assesses whether a certain strategy results in over-borrowing in the sense that its public debt stock exceeds the present discounted value of its expected future primary surpluses. These methodologies, however do not take into consideration the uncertainties faced by governments. As such, a more stringent approach to assessing optimal public strategy is to estimate the maximum debt level that the country can service under extreme but plausible market scenarios. IMF (2003) shows that countries with more variable tax revenues, less ability to adjust expenditure and a larger difference between the real interest rate and real growth rates are able to sustain lower public debt ratios.

3.2 Framework for determining optimal composition of public debt

The framework for determining the optimal public debt strategy stems from the common public debt management objective which is defined by the IMF and World Bank Guidelines (2001, p.2), as “the process of establishing and executing a strategy for managing the government’s debt in order to raise the required amount of funding, achieve its risk and cost objectives and to meet any other sovereign debt management goals the government may have set, such as developing, maintaining and controlling an efficient market for government securities". The main objective of public debt management is, therefore, to "ensure that the government's financing needs and its payment obligations are met at the lowest possible cost over the medium to long run, consistent with a prudent degree of risk (IMF, 2003).

The public debt cost minimisation objective was widely accepted by debt management authorities worldwide and included as a public debt management objective in associated strategies (Wheeler, 2004). Wolswijk and de Haan (2005) considered the most appropriate objectives of public debt management in stabilisation of the economy, development of financial markets, support to monetary policy, and minimisation of costs and risks caused, or by being connected with public debt. Similarly, the OECD (2000) identified four overall objectives for public debt management among its members in a survey of debt management structures conducted in 2000. These objectives are: to ensure the financing needs of the government; minimize borrowing costs; keep risks at an acceptable level; and support the development of domestic markets.

Bolder (2003) defined the public debt management objective as a typical optimal control problem with constraints imposed by governments, regional economic blocs and by market practices. The borrowing requirement is determined by fiscal policy which stipulates the targeted level of public debt taking into consideration sustainability issues. The commonly used concept of sustainability relates to solvency, which shows the ability of government to service its obligations in perpetuity without explicit default (Burnside, 2004). Burnside also considered fiscal sustainability by relating it to the government's ability to maintain its current policies while remaining solvent. By making use of these concepts, one can discuss the types and consequences of policy adjustments required to achieve an optimal public debt portfolio.

According to Bolder (2007), the stochastic component of the public debt management problem is represented by the evolution of interest rates and exchange rates, which represent the cost of borrowing and the primary balance which determine the borrowing requirement. The factors that determine the optimal debt strategy are, therefore, the initial stock of public debt, the state of the economy, interest rates and the primary balance. The government's borrowing requirement is a random function that depends upon time, interest rates and macroeconomic circumstances. The financing requirement at any given point in time depends upon the initial stock of public debt, the financing requirements of the government, the state of the economy and the debt strategy as shown in equation1 below:

$$F_t = R_t - G_t - C_t \quad (1)$$

Where F_t is the financing requirement, R_t is a government tax revenue in period t, G_t is government expenditure in period t and C_t is the public debt service in period t. From this equation, if government expenditure G_t and debt service costs C_t exceed tax revenue R_t in a given period, the government finance will show a deficit and the shortfall will be financed through borrowing. However, given the uncertainty in the movement of market variables, the volatility in public debt service, due to various risk factors is also a matter of concern to government as this will contribute to variability in the overall budget balance, thereby, contributing to a vicious cycle in the budget outlay. This variance circle can be represented following Bolder's approach (2007) as follows:

$$\mathrm{var}(F_t) = \mathrm{var}(PB_t) + \mathrm{var}(C_t) - 2\mathrm{cov}(PB_t, C_t) \quad (2)$$

The covariance between the primary balance, PB_t, defined as $R_t - G_t$ and debt service costs, C_t can either be positive or negative. A sufficiently positive covariance will reduce the debt service costs variability, while a sufficiently negative variance will exacerbate the risk with adverse implications on maintenance of public debt sustainability. This implies that government must chose a public debt structure with returns that positively co-vary with the primary balance to reduce the overall volatility in debt service, which is a proxy for risk in public debt management (Bolder, 2003). This means that the choice of an optimal public debt strategy trades off the risk and expected costs of debt service. A debt strategy that reduces the variability in the primary balance and the debt ratio for any given expected cost of debt service is desirable, because it reduces the probability of a fiscal crisis due to adverse shocks to the budget that in turn might trigger a financial crisis.

3.3 Empirical literature

Numerous studies have attempted to examine the optimal public debt strategies that ensure debt sustainability. Hahm and Kim (2004) showed that a trade-off exists between the debt-service-cost and risk of various debt strategies based upon the United States yield curves using a hypothetical public debt portfolio. The IMF and World Bank (2009) provided a medium term debt strategy (MTDS) analytical tool in an attempt to simulate the optimal composition of public debt. The tool is used to assess the cost and risk trade-offs of alternative public debt strategies under alternative developments of market scenarios (IMF, 2009). Melecky (2012b) provided a review of policy approaches to choosing the currency composition of foreign-currency debt. Gerard and Gilson (2001) showed in a simple two country model how an exchange rate regime can influence the optimal composition of the public debt. Melecky (2010) developed an empirical framework for use when deciding on the optimal currency composition of public external debt. The analysis is based on a set of synchronisation indicators of exchange rate volatility (Melecky, 2010).

Abbas (2005) noted that the lack of sovereign defaults in low income countries (LICs) is an indication that domestic debt is easier to service than external debt. Panizza (2008) noted that switching the sources of financing from external to domestic financing might reduce the risk of sovereign defaults. Other literature studies posits that domestic borrowing helps to sterilize foreign exchange inflows from foreign aid or natural resource-based exports, particularly in LICs (Christensen, 2005; Aiyar, Berg and Hussain, 2005). The IMF (2006) found that domestic debt accounts for nearly 21 per cent of total debt in a sample of 65 LICs but it absorbs 42 per cent of the total interest expenditure. Given its long-term nature, concessional external debt is also considered safer than domestic debt which often has short term maturity and is subject to rollover risk. The picture, however, changes when the exchange rate effect is taken into consideration.

The balance of costs and benefits of domestic borrowing in LICs could be reflected in the effect of domestic public debt on economic growth. There are however, few authors who have analysed the issue of optimal public debt (Abbas and Christensen, 2010). Abbas and Christensen (2010) found that domestic public debt has a positive impact on output growth provided that it does not exceed 35 per cent of bank deposits. Above this threshold, domestic debt undermines economic activity through crowding out effects and inflationary pressures. Despite the lack of clear-cut theoretical predictions regarding the optimal public debt strategy, high levels of public debt are a source of concern for developing, emerging and advanced economies. The need for an optimal debt strategy, that ensures maintenance of public debt at sustainable levels, accentuates the relevance of this research.

4. Methodology

The optimal composition of public debt was derived by simulating the future debt servicing cost and variability of debt service based on assumptions about Zimbabwe's macroeconomic outlook and its perspectives on borrowing options going forward. The simulations were done in a deterministic way without taking into consideration uncertainty, as is the case under stochastic simulation. The difference between the deterministic and a stochastic simulation approaches is the number of scenarios that are considered in each simulation approach. In a deterministic model, the number of scenarios would be bound to the imagination of the model users, and would be restricted to a short number of cases (UNITAR, 2008). The cost is given by the mean of all possible scenarios, while risk is computed as the dispersion of debt service around the mean (Valandia, 2002). This modelling approach provides a tool for quantifying the impact of alternative public debt strategies in terms of the cost and risk inherent in the public debt portfolio.

4.1 Cost indicators

The cost was measured as either the net present value of public debt servicing costs over the lifetime of debt, or as the average annual interest payments as a percentage of GDP. The nominal debt-service costs are typically used as a measure of the cost of public debt (IMF, 2009). However, in some cases cost to GDP is also considered explicitly. The underlying idea is, however, to examine the joint co-movements between the debt-service costs and the government budget. The government budget normally co-varies with GDP via both taxes and government expenditures. It is, thus, possible to examine whether the chosen debt strategy reduces the risks to the budget by typically having lower costs when government finances are strained. As such, the cost measure takes the smoothing of the budget and taxes directly into account in line with the tax smoothing approach.

The average annual interest cost was calculated on an annual basis as the sum of nominal interest payments and the exchange rate differentials in United States dollar, Euro and Japanese yen on an unrealized basis. As shown in Figure 1, the United States dollar, Euro and the Japanese yen are the most dominant currency in Zimbabwe's public debt portfolio. Algebraically, the total interest cost adjusted for exchange rate differentials was calculated following the IMF (2009) methodology as depicted in equation 3:

$$C_t = \sum_{j=1}^{m} e_{j,t}\, i_{j,t}^{FX} + i_t^{DX} + \sum_{j=1}^{m} D_{t-j}^{FX}\, \Delta e_{t,j} \qquad (3)$$

Where C_t= adjusted total nominal interest cost and $\sum_{j=1}^{m} D_{t-j}^{FX} \Delta e_{t,j}$ the capital gains/loss arising from the changes in the exchange rates associated with outstanding foreign currency debt, $e_{j,t} = j^{th}$ exchange rate between the domestic currency and foreign currency j, $i_{j,t}^{FX}=$ interest payments denominated in foreign currency j, and i_t^{DX}=local currency interest payments. In this paper the United States dollar was considered as the local currency. This is also consistent with the multi-currency regime introduced by the Zimbabwean government in 2009.

The cost measure was normalised in terms of units of nominal GDP to get a good indication of the true cost of public debt. Normalising the public debt cost ratio is consistent with the government's fiscal rules, in particular the sustainable investment rule, which relates the public sector net debt to nominal GDP (Pick and Anthony, 2006). This also provides a rudimentary way of capturing the asset liability management approach to government debt management in that the cost of government debt is related to the source from which the government secures its tax revenue, which is its principal asset.

4.2 Risk indicators

The risk indicator was defined as exposure to macroeconomic and financial shocks. The risk indicators were derived from the debt servicing costs under various scenarios of future interest and exchange rate shocks to the baseline scenario. The different scenarios were created without any random choices of the different future variation of market conditions. In line with the approach taken by the IMF (2009), the risk indicator was computed as follows:

$$Risk_t^k = C_t^{k,s} - C_t^{k,b} \tag{4}$$

Where $C_t^{k,s}$ is the total debt servicing cost under alternative scenarios and $C_t^{k,b}$ is the total debt servicing costs under a baseline scenario. The risk indicator was expressed either as a per centage of GDP, which is a measure of the debt repayment capacity. This risk indicator captures both the financing risk and the uncertainty in the financing or cash flow cost related to a given borrowing strategy. The risk was therefore assessed as the standard deviation of public debt cost, which measures volatility of debt service and is computed as follows:

$$\sigma_{C_t} = \left[\frac{1}{R-1}\sum_{i=1}^{N}\left(C_{ti} - \mu_t^{C_t}\right)\right]^{\frac{1}{2}} \tag{5}$$

Where σ_{C_t} = standard deviation of the debt cost ratio in period t, = debt cost ratio in period t for the i-th replication in the simulation and $\mu_t^{C_t} = \frac{1}{R}\sum_{i=1}^{N} C_{it}$ is the mean debt cost ratio in period t.

The risk factors, include adverse movements in interest rates, exchange rates and commodity prices. The risk factors are considered exogenous in the model since they are driven by factors beyond the control of the debt manager, including macroeconomic developments in the country and the rest of the world, changes in market sentiment, and other factors that give rise to unanticipated changes in market prices, such as a financial crisis.

4.3 Simulation approach

The optimal debt strategy was simulated based on the cost-risk trade-offs (Hahm and Kim, 2004). This approach entailed simulating the total financing needs and the expected debt service under alternative borrowing strategies. The analysis involved simulating the debt service cash flow for a 10 year period under alternative borrowing strategies. The simulation computed the public debt dynamics based on projected interest rate and a set of reference macroeconomic scenarios. The resultant average debt service cash flow, which is a cost measure was then plotted against the standard deviation of the projected cash flow (risk measure), to obtain an efficient set. The combination with the lowest cost and risk would then be regarded as the optimal public debt strategy.

The borrowing strategy can be formulated as a vector of weights which sum to unit as follows:

$$\sum wS_i = (wS1, wS2, \ldots \ldots \ldots \ldots wSN) = 1 \tag{6}$$

Where, $s_1 \ldots . s_N$ are alternative debt strategies and ws are the respective weights representing the proportion of each borrowing instrument in a particular public debt portfolio. The strategies involve a trade-off between issuing domestic debt or external debt in different currencies. There is also a trade-off on the maturity structure of each debt under each instrument category. The government's total financing need for a given borrowing strategy was simulated as follows:

$$F_{t+1} = PB_{t+1} + \text{Ø}R_{t+1} \tag{7}$$

Where F_{t+1}, is the period ahead financing requirements, PB_{t+1} is the next period primary budget deficit and $\text{Ø}R_{t+1}$ is the refinancing amount, where Ø is the fraction of refinancing (0 < Ø <1) and R_{t+1} is the sum of principals of maturing debt and interest costs to be paid in the year t+1 as shown below:

$$R_{t+1} = [(\alpha D_t^1 + iD_t^1) + (\alpha D_{t-1}^2 + i_{t-1}^2 D_{t-1}^2 + i_t^2 D_t^2) + (\alpha D_{t-2}^3 + i_{t-2}^3 D_{t-2}^3 + i_{t-1}^3 D_{t-1}^3 + i_t^3 D_t^3) + \cdots \ldots\ldots\ldots\ldots \alpha D_{t-n+1}^n + i_{t-n+1}^n D_{t-n+1}^n + i_{t-n+2}^n D_{t-n+2}^n + \cdots i_t^n D_t^n)] \quad (8)$$

The i_t^n is the interest rate on the N-year instrument issued in the year t. In this case, a constant fraction of the principal amounts of maturing debts as well as interest payments on all existing instruments is assumed to be refinanced every year, and the remaining fraction is repaid from the government budget. Under the borrowing strategy S, the actual issuing amount for N respective maturity loans in the year t+1 was computed as follows:

$$D_{t+1}^1, D_{t+1}^2, D_{t+1}^3, \ldots\ldots. D_{t+1}^N = F_{t+1}(wS1, wS2, wS3 \ldots\ldots.. wSN) \quad (9)$$

The total financing requirement for the period ahead, year t+2 and the actual issuing amount for each loan in the year t+2 under the time-invariant borrowing was also computed in a similar manner. It can however, be noted that at the end of year t and assuming that Ft+2 is a random variable as interest rates in the year t+1 cannot be observed at t. It can also be noted that the actual amount of issuance in the year t+2 is determined by the borrowing amount in the year t+1. The simulation process can be repeated until the year t+N, and a specific debt portfolio will emerge depending upon the path of term structures realised during N years and given a specific borrowing strategy. The average end period debt portfolios can then be summarised in a cost risk Cartesian plane. This presentation enables identification of the efficient portfolio conditional upon an existing debt portfolio.

The simulations however, depend on assumed borrowing strategy for the country as well as the realisation of the term structure of interest rates. The implicit interest rates defined as actual interest payments as a proportion of GDP were used as proxies for interest rates and future interest rates were assumed to follow the historical pattern. The exchange rates used were the cross rates between four major currencies that constitute Zimbabwe's public debt portfolio. These currencies are the USD, Euro, Japanese Yen and the British pound. Loans denominated in other currencies including domestic debt were all converted to USD.

4.2 Financing scenarios

Five alternative borrowing strategies were tested based on the country's historical borrowing pattern, its envisaged goal of developing the domestic debt market and its perspective on options for debt and arrears clearance strategy going forward (Government of Zimbabwe, 2010). Table 2 below shows the historical borrowing structure for Zimbabwe.

TABLE 2: HISTORICAL FINANCING SCENARIOS

	2007	2008	2009	2010	2011	2012	Average
Total ($million)	4 435.4	4 868.0	4 743.1	6 035.3	6 936.7	6 851.6	4 650.2
Multilateral ($million)	1 976.5	2 058.7	2 058.6	2 396.1	2 450.5	2 450.5	2 055.5
Bilateral $million)	1 994.1	2 360.2	2 213.5	3 083.3	3 307.2	3 307.2	2 214.1
Commercial ($million)	50.9	35.0	57.0	141.9	647.0	581.0	154.8
Domestic ($million)	414.0	414.0	414.0	414.0	532.0	512.9	225.8
Proportion in Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Multilateral (%)	44.6	42.3	43.4	39.7	35.3	35.8	45.9
Bilateral (%)	45.0	48.5	46.7	51.1	47.7	48.3	47.3
Commercial (%)	1.1	0.7	1.2	2.4	9.3	8.5	2.7
Domestic (%)	9.3	8.5	8.7	6.9	7.7	7.5	4.1

Source: Government of Zimbabwe (2012)

Based on historical borrowing structure and the countries' potential funding options, the borrowing strategies were formulated as shown in Table 3 below:

TABLE 3: ASSUMED FINANCING STRATEGIES (2013-2019)

Issuance Strategy	S1 %	S2 %	S3 %	S4 %	S5 %
Domestic	7	30	15	40	25
Commercial	3	5	35	10	25
Multilateral	45	40	25	25	25
Bilateral	45	25	25	25	25

Source: Researchers' estimates

The first strategy (S1), which is the baseline strategy, assesses the cost and risk characteristics of a debt strategy that largely comprise external concessional debt and a smaller proportion of domestic debt. The strategy entails rescheduling part of the outstanding external payment arrears by treating them as new concessional loans. It is assumed that the rescheduling will be conducted under the Paris Club Naples terms where 3 per cent the outstanding debt will be cancelled and the remaining 67 per cent will be rescheduled, consistent with the strategy adopted by the Zimbabwean Government in its debt strategy document dubbed the Zimbabwe Accelerated Arrears Clearance and Debt Strategy (Government of Zimbabwe, 2010).

The second strategy (S2) assesses the cost and risk characteristics of the government's desire to develop the domestic debt market; consequently reducing the recourse to concessional external debt, the proportion of which has been declining gradually. This strategy appears to be more realistic against the background of subdued external support and indications of no immediate commitments by external creditors to assist the country. Zimbabwe has been relying on domestic debt issuance since 2000 when external financing dried up following suspension of donor support due to economic sanctions (Jones, 2011).

The strategy, therefore, entails developing the domestic debt market activity which has been subdued since the introduction of the multiple currency system in 2009. Reliance on domestic debt issuance is desirable as it helps to promote a liquid market for domestic securities, thus benefiting local investors who may have a bias towards investing in domestic securities.

The third strategy (S3) assesses the cost and risk characteristics of venturing into commercial external debt flows compounded by issuance of an international bond, against the background of declining concessional debt flows across the globe. The strategy is also based on tapping diaspora savings from Zimbabweans in the Diaspora. The government has already signalled its intention to issue a Diaspora bond in the medium to long term (Government of Zimbabwe, 2009). The country has also been eligible to contract external loans at commercial rates given its blend rating with the World Bank.

The fourth strategy (S4) assesses the cost and risk characteristics of trying to address the exchange rate risk in the public debt portfolio by increasing the proportion of domestic debt and lengthening the maturity of domestic currency debt. The strategy is based on encouraging non-residents to participate in the domestic local market.

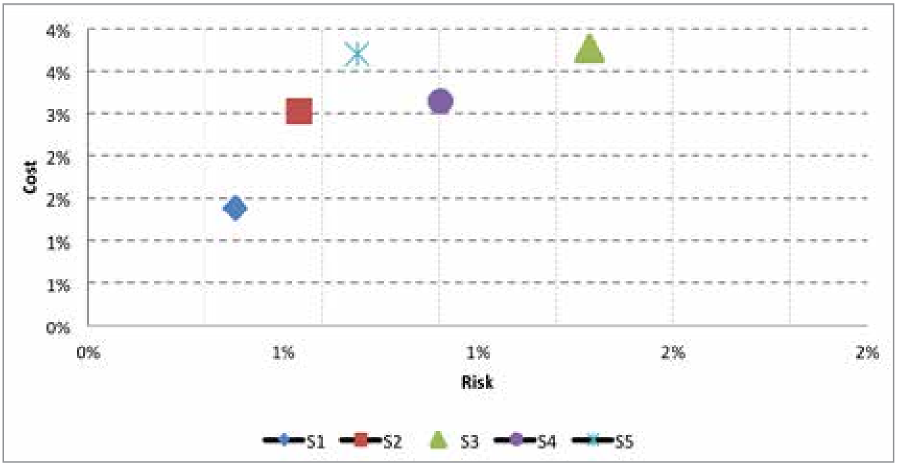
The fifth strategy (S5) assesses the public debt cost and risk characteristics of a hypothetical well balanced debt strategy based on the existence of domestic debt flows and concessional and commercial external debt flows in equal proportions. The strategy is consistent with the need to diversify financing sources in a bid to mitigate the rollover risk and some of the volatility in budget execution associated with uncertainty in the timing of disbursement of concessional loans.

5. Simulated results and analysis

This section outlines the results of the simulation analysis for alternative strategies for public debt issuance. The simulations were conducted assuming time-invariant borrowing strategies over the debt management horizon. This was mainly done for numerical tractability, and taking into account that the public debt management horizon is typically longer. The strategies were compared based on the scatter plot of the estimated average long-term cost proxied by the average of Interest payment to GDP and the net present value of public debt to GDP for each strategy.

The simulations were undertaken according to the end 2012 outstanding public debt structure and the projected primary balance assuming a once off arrears clearance in the form of debt rescheduling and or forgiveness. Under this arrangement, the outstanding stock of arrears estimated at US$4.5 billion in 2012, effectively becomes a new loan with new terms. By conducting several iterations of the simulation for each of the borrowing strategies, the results shown in Figures 1 and 2 below can be obtained for all periods in the space of the mean and standard deviation. This in turn will facilitate the identification of the efficient portfolio set conditional upon the initial public debt portfolio.

Figure 1: Cost-risk trade-off: average annual interest payment



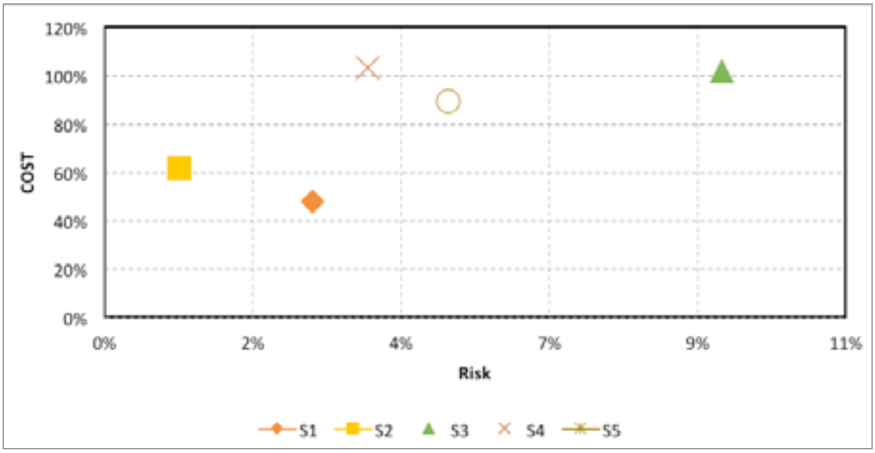
Source: Researchers' own computation

The results from the scatter diagram in Figure 1 show the baseline public debt strategy (S1), composed mainly of concessional external debt to be the preferred public debt composition using the average annual interest expenditure to GDP as a cost measure. The debt composition entails maximisation of concessional borrowing to help maintain public debt at sustainable levels. Beaugrand et al. (2002) in a study of Central and West African countries, showed that external debt at a concessional rate is preferable to domestic debt at market rates even in the presence of a high probability of a large devaluation.

However, this public debt composition, while desirable, is not feasible given the prolonged isolation and suspension of Zimbabwe from accessing loans from traditional external creditors due to arrears. Moreover, reliance on concessional financing is also not desirable given the conditions attached by international financial institutions and bilateral creditors on such kinds of loans. Availability of concessional loans primarily depend on the economic and political environment of the country and on whether the government is committed to good policies, institutions and governance. Although the conditions may help the country in economic management, they have a potential of stifling growth especially in cases where the country is directed on where to spend the borrowed funds.

The other public debt compositions are simulated to be higher cost, a significant factor given the limited fiscal space faced by the Zimbabwean government under the multi-currency regime. The implied venture to tap into the international bond market and lengthening the maturity of domestic debt loans requires an increase in reserve buffers to mitigate associated rollover risk. The results show a different picture when the net present value of Debt to GDP is used as a cost measure. This is shown in Figure 2 below.

FIGURE 2: COST- RISK NPV OF DEBT TO GDP



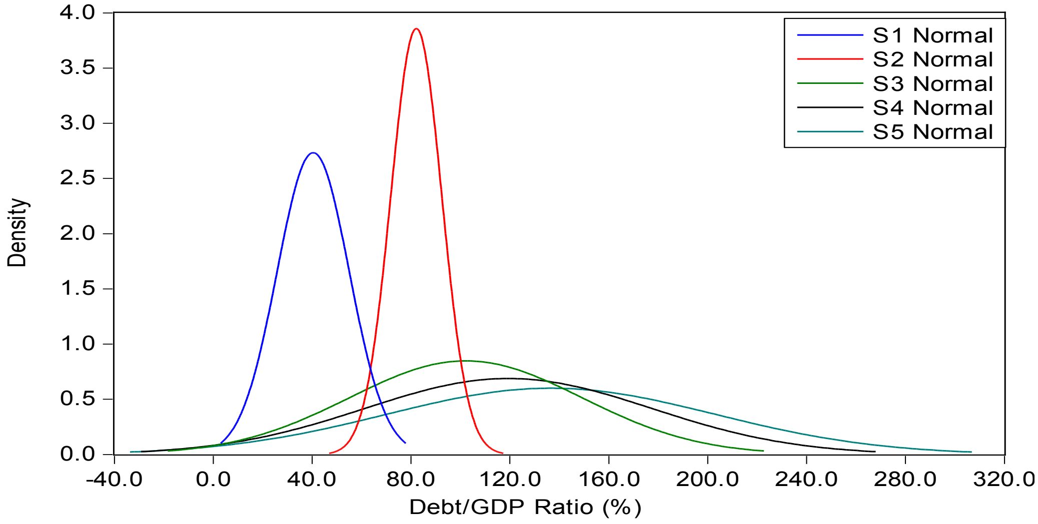
Source: Researchers' own computation

The results using the net present value of public debt to GDP as a cost measure show a trade-off between a debt strategy with more external debt and the one with more domestic debt. While the strategy with more concessional external debt remain preferable from a cost perspective, it proved to be riskier than a debt composition with more domestic borrowing for market development purposes. The results are consistent with empirical findings. Calvo (2005), Campos, Jaimovich and Panizza (2006), showed that external debt is not always desirable to domestic debt since it tends to be volatile and subject to sudden stops, emanating from a creditor's perception about a debtor country's credit rating. The results also support the notion that countries in the LICs are exposed to exchange rate risk since they are not in a position to borrow abroad in their own currency. This phenomenon has been referred to as the "original sin" by Eichengreen and Hausmann (2005).

5.1 Distributions of the simulated mean and variance

The results were also expressed in terms of distributions of the mean and standard deviation as shown in Figure 3 and 4 below:

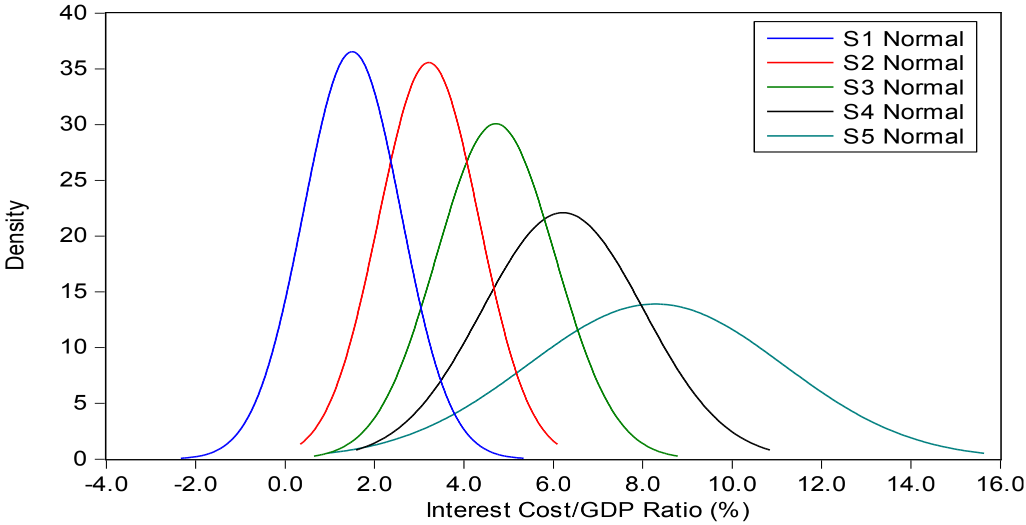
FIGURE 3: DISTRIBUTION OF NPV OF DEBT/GDP FOR ALTERNATIVE STRATEGIES



Source: Researchers' own computation

The results illustrated in Figure 3 show a narrow distribution for the debt strategy consisting of more domestic borrowing for market development purposes. This again confirms the market development strategy to be less risky than the debt strategy with more external borrowing. The cost of debt, however, remains higher for domestic debt, with a simulated mean debt to GDP ratio of around 80 per cent compared to about 40 per cent for external debt. The strategy with more concessional debt, therefore, implies a relatively low cost but high risk debt structure, compared to the market development public debt structure. The low risk is reflected by the narrow distribution and high peaks of the market development distribution. The high risk under the debt strategy with more concessional debt reflects the effects of the exchange rate risk embedded in external debt. The results are however, different when the average interest payments are used as a cost measure. This is illustrated in the Figure 4 below:

Figure 4: Distribution of interest cost/ GDP ratio of alternative strategies



Source: Researchers' own computation

The distribution of the concessional loan strategy shows a lower cost of about 0.75% of GDP, while that of market development shows about 3%. In terms of risk assessment, the debt strategy with concessional debt remains highly preferred as shown by a narrow distribution and there is no trade off. This reflects the impact of high interest cost of domestic financing as opposed to external borrowing which traditionally carries low interest rates. The switch to domestic borrowing, however, presents important trade-offs that needs to be taken into consideration. Domestic borrowing can improve the efficiency of the allocation of national savings if mobilised resources are used to fund public investment (Abbas and Christensen, 2010).

In the case of Zimbabwe, increasing the proportion of domestic debt may not be feasible under the multi-currency regime given the country's limited ability to influence monetary aggregates. The market development can only become feasible if the country's fiscal position strengthens, providing some scope to absorb the higher interest cost. The strategy of increasing the share of the domestic debt in public debt also requires the country to pursue prudent macroeconomic policies to help reduce the cost, by reducing the credit risk premium. There is also the need to create sufficient fiscal space to accommodate the higher costs. Mechanisms should also be put in place to ensure proper coordination between public debt management and other macroeconomic policies.

Overall, the simulation analysis shows that strategy (S1), which maximizes the recourse to concessional debt, should be the preferred public debt strategy for Zimbabwe in the medium term as long as authorities can expedite the re-engagement process with international financial institutions. However, given the sustained limited access to external concessional loans and the slow process of re-engagement with traditional creditors, the market development strategy could be re-evaluated, particularly if the country's fiscal position strengthens, providing some scope to absorb the additional interest costs from domestic debt issuance. The downside risk, however, is that investors may not be willing to invest in the government paper given the perceived high country risk. There is, however, scope to develop the domestic market by taking advantage of captive investors such as insurance companies and pension funds. The investor base will gradually expand as confidence and credibility increases.

The most efficient strategy S1 from a cost risk perspective, therefore, imply that the optimal public debt level for Zimbabwe should be in the range of 45-60 per cent. The findings are consistent with debt ratios found in most countries and proposed by different regional economic blocks. A number of countries have followed the 60 per cent debt-to-GDP ceiling under the European Stability and Growth Pact, while a number of countries have clustered around the more stringent 40 per cent of GDP. Although the simulated debt target may not be optimal in the strict sense of optimality, they provide levels of indebtedness that are prudent and sustainable under the assumed growth trajectory of a country. Ultimately, the optimal or preferred choice of a particular debt strategy depends on the government's risk appetite/tolerance and any other developmental aspirations the government might be pursuing.

6. Conclusion and policy recommendations

This paper endeavoured to assess the potential trade-offs between cost and risk of alternative public debt issuance strategies in Zimbabwe. An optimal portfolio entails finding a debt strategy that minimises the debt servicing cost and risk under alternative scenarios of interest rates and borrowing strategies. The results from the simulation analysis show a trade-off between a debt strategy with more concessional debt and the one with more domestic debt for market development purposes.

The results show that the market development strategy may be desirable from a risk perspective if the stock-flow adjustments on exchange rate changes are taken into consideration. This result demystifies the notion that external concessional borrowing is always preferred to domestic borrowing. Given Zimbabwe's sustained limited access to external concessional loans and the slow process of re-engagement with traditional creditors, the market development strategy could be re-evaluated, particularly if the country's fiscal position strengthens, providing some scope to absorb the additional interest costs from domestic debt issuance. There is also scope for the country to develop its domestic debt market by taking advantage of captive investors such as insurance companies and pension funds.

Although, in practice it is difficult to establish the optimal public debt strategy with a high degree of accuracy, the results from this study, provide information that would allow cost-risk comparisons of public debt issuance and increases knowledge of the options and constraints facing debt management operations in Zimbabwe. The analysis can also be used to illustrate the medium to long-term conditions under which prospective public debt issuance strategies would lead to desirable outcomes of minimising costs subject to a prudent degree of risk. This is necessary to avoid the costly errors of accumulating public debt to unsustainable levels.

Overall, the optimal choice of a particular debt strategy depends on the government's risk appetite/tolerance and any other developmental aspirations the government might be pursuing. As such, a consideration of other qualitative factors such as the government risk tolerance also needs to be taken into consideration to develop an optimal public debt issuance strategy. Most importantly, however, is the requirement to determine how stable the simulation results are over time. The optimal level of public debt depends on the nature of shocks affecting the economy. Consequently, it seems further analysis will be required in the future to determine the effects of macroeconomic shocks on public debt dynamics.

Biographical Notes

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Acknowledgements

The authors' would like to express profound gratitude to the Economic Research Southern Africa (ERSA) for their valuable comments that have helped to shape this paper. We also acknowledge the comments and suggestions from the reviewers and editors of this Journal, Prof. Paul Alagidede and Dr. Franklin Obeng-Odoom for their valuable comments and feedback.

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