

MODELING OPTIMAL DEBT AND EXPENDITURE IN MALAWI: A DYNAMIC OPTIMIZATION APPROACH



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ABSTRACT

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This study models optimal debt and spending in Malawi using Dynamic Optimization Approaches. The study found that the economy of Malawi is not free from debt crisis, despite the benefits of Multilateral Debt Relief Initiative (MDRI) that was extended to Heavily Indebted Poor Countries (HIPC) in 2005. The optimal trends show that the country has been and remains vulnerable to debt and fiscal crises despite the various palliative measures that were introduced by International Monetary Funds (IMF), especially the Extended Credit Facility (ECF) offered the country in 2008, during the global financial crises.

Contribution/ Originality: This study uses new estimation method of dynamic optimization approaches in time series format to generate optimal trends for expenditures and debts in Malawi. This enables the country to weigh the size of expenditures and debts in each fiscal year to ensure efficient functioning of the country's fiscal system.

1. INTRODUCTION

Literature established that Malawi has historic fiscal crises which culminated into debt sustainability problem. Conceptually, fiscal position is sustainable if an economy is able to meet its financial obligations without resulting to engaging in additional deficit to service the existing debt. However, when this is not the case, the economy is said to suffer fiscal crises. In a study, Schick (2005) expresses that, fiscal sustainability would become a problem when there is gap between targeted debt level and the debt that would ensue if tax and spending policies were continued without change. Many developing countries including Malawi habitually engage in debt accumulation and uncontrolled fiscal deficit.

The debt management problem in developing countries including Malawi became paramount when loan repayment defaults accumulated into external debt crisis in most of the countries, especially in sub-Sahara Africa where the majority of heavily indebted poor countries are located. In the countries, the accumulation of debt was unprecedented, grappling with the issue of economic development problem which followed the crash of prices of

primary products in the world market. Savings became low and imported capital was required to augment local resources (Todaro, 1997). The debt levels were aggravated, as the crashed prices were followed with a rise in interest rate on loans, Jonathan (1990). The interest and debt service payment became problem. In an attempt to forcefully meet with the debt obligation, the huge debt servicing payment took away significant portion of domestic savings, thus creating serious balance of payment problems for the debtor countries. Economic growth remained unresponsive, with external reserves drawn down, while borrowing continued on upward trend. Debt servicing and loan repayment were not only burden to the immediate generation, but also to the future generations of borrower nations due to excessive decline in foreign exchange and stagnation in the private sector.

The case was the same in Malawi. Its debt crisis is traced to 1970s when the Malawi Congress Party who was ruling the country started to contract loans for development purposes and to meet balance of payment for inability to compete in the international market to finance its current account. Consequently, debt stock of Malawi reached US\$586.1 Million in 1999 and US\$ 2.6 billion in 1999 and further increased to US\$ 2.97 billion before the country benefited from the Multilateral Debt Relief Initiative (MDRI) in 2005, Centre for Social Concern (CSC) (2012). The post MDRI was expected mark a great relief on the debt trend of the country, however, evidences from literatures show that Malawi is one of the country's debt that hold unsustainable debt, Yang and Nyberg (2009). In a more recent article, Muhajji and Ojah (2011) lamented that a major problem is the inability to ascertain what constitute sustainable debt level before attempting to reverse the trend. In response to this argument, this article therefore models the optimal debt level for Malawi.

2. BRIEF LITERATURE REVIEW

The studies on developing and transitional economies show that, sustainability of debt depends on the structural flexibility and size of GDP. Borgersen and King (2014) argue that, among transition economies only those with relatively higher structural flexibility could sustain relatively higher debt-to-GDP ratios. However, the study acknowledged the size of debt relative to GDP a country could sustain depends on the economic structure, composition of growth, structural flexibility, and the prevailing incentives for restructuring. In furtherance, Tourinho *et al.* (2013) examines debt sustainability in Brazil and analyzes implications of allowing the country's fiscal policy to be primarily committed to the sustainability of debt. It is established that, the public debt was sustainable in the period considered. Also, Neaime (2015) examined the sustainability of public debt and exchange rate policies as well as, the relationship between current account and budget deficits in the emerging small open economy of Lebanon. The empirical results point to unsustainable debt and exchange rate policies. In the extended analysis of their findings, the study support the existence of a unidirectional causal relationship, in the short run, between the budget and current account deficits, indicating that rising fiscal deficits is putting more strain on the current account deficits and on the national public debt.

Chandia and Javid (2013) in another study examined detailed analysis of debt sustainability in the economy of Pakistan. They argued that, the issue of public debt is sustainable if the growth of debt is not greater than growth of GDP. In their analysis it is found that, the dynamic analysis of effects of government spending and revenue shocks on debt-to-GDP ratio and other macro-economic variables using Vector Autoregressive (VAR) model indicate that consumption and output reacts negatively to the innovations in government spending which refers to the similarity with Ricardian behavior. The long run relationship between surplus-to-GDP ratio and debt-to-GDP ratio is also estimated to confirm debt sustainability and the existence of long run association among the two series they considered. More so, Önel and Utuklu (2006) examine the solvency of Turkey regarding its external debts sustainability considering the economic crises Turkey faced in 1990s and 2000s, which raised concerns on the issue of external debt sustainability. Using the usual inter-temporal budget constraint, it is established that with or without considering any structural break, Turkish external debt is weakly sustainable.

Meanwhile, global financial crisis is the key reason why debt is aggravated in some countries. Georgescu (2014) in response to the rapid increase in the government debt during the persistence global financial crisis, examined the Romanian case. The study discovered sharp deterioration of the country's fiscal framework. Teică (2012) studied debt sustainability in selected Economic and Monetary Union and conclude that, ensuring debt sustainability can be achieved through a mix of fiscal and budgetary policies, which aim to reduce budget deficits and increasing primary surpluses and monetary policy measures in order to ensure stability. In some economies, debt sustainability appears to be a problem when it is even expected that it should not be, as shown in an analysis of the evolution of public debt to GDP ratio in Romania over the period of 2002 and 2013. Dumitrescu (2014) identified the main influence of and also performs sustainability analysis on both a finite and infinite time horizon. The paper found that, primary balance is consistent with debt sustainability under different scenarios and concludes that, current level of public indebtedness, alongside with the long term projections of the underlying factors of influence ensure the fulfillment of the obligations to the creditors which means debt in Romania as projected is sustainable.

So also, Marchesi and Missale (2013) examines the influence of debt sustainability on the decision of the donors in extending additional loan to the indebted countries and found no evidence of defensive lending but strong evidence of defensive granting. A significant negative reaction of net loans to the debt ratio indeed characterizes the decisions of both multilateral and bilateral creditors. The impact of lower loans on the budget of debtor countries is however accommodated through higher grants, in addition to debt relief. At the same time, Ferrarini (2008) argue that the New Debt Sustainability Framework (NDSF) of the World Bank and IMF is centered on the Country Policy and Institutional Assessment (CPIA) to suit the aid allocation mechanism of the International Development Association (IDA), but fails to deal effectively with the economic vulnerability of low-income countries. The study, thus, proposed a Contingency Debt Sustainability Framework (CDSF), which identifies the sources of vulnerability and compensates for exogenous shock and trend factors. As explained, the CDSF is suitable to effectively shield low-income countries from the main external causes that are undermining their achievement of debt sustainability. The validity of these in Malawi is a question expected to be answered by the article.

3. METHOD OF ANALYSIS

3.1. The Optimal Debt and Spending Model: A Dynamic Optimization Approach

The optimal control model adapted in this study is developed by Mayr (2010). It is relevant for economy with both domestic and external sources of income in terms of grant and aid. A portion of the foreign income is connected to the size of domestic expenditure, given the level of debt burden of the economy, while other component is given at random without specific modalities. The economy also engages in borrowing for deficit financing while the accumulated deficit financing builds up to debt. Mayr (2010) develops an optimal process of a modelled jurisdiction where the internally generated public revenue is as given by the predetermined target of the government; as such the internally generated public revenue is as given. However, the study modified the model to capture the features of the underdeveloped and developing economy such as Malawi. As such the model allows some other revenues are received externally, part of which is proportional to the public spending; as such it could be influenced by the government. Some other part of the external revenue is completely exogenous. This assumption implies that, public spending or budget can influence the external revenue in the future. For instance, Easterly (2002) argues that aid increases with debt. The implication of the derived model is that public spending at a particular time can be financed by the internally generated, external revenue or through borrowing at a specified constant interest rate.

An economy with internally generated public revenue ϑ_t is assumed to have a public spending g_t at time t . It receives external revenue e_t which may be in form of aid or grants determined externally. If e_t is assumed to be partly influenced by the government and other as exogenous, then;

$$e_t = \theta_t g_t + q_t \quad (1)$$

Where $\theta_t g_t$ is the component of the external revenue that is proportional to public spending while, q_t is the exogenous component. Meanwhile, $q_t > 0$; $0 < \theta_t < 1$

Since the total amount available for the public spending depends on the internally generated public revenue after the interest on the accumulated debt has been taken care of, thus the externally generated revenue depends on the wideness of gap between the accumulated debt and the current internally generated revenue, that is;

$$q_t = \phi_{qt}(b_t - \vartheta_t) \quad (2)$$

If $q_t > 0$ is to hold, the $b_t > \vartheta_t$ must hold, where b_t is the stock of debt in intensive form.

The (3.10) simply implies that externally generated revenue q_t increases in debt and decreases in the internally generated revenue. So also,

$$g_t = \phi_{gt}(\vartheta_t - rb_t) \quad (3)$$

Eq. (3) is used to achieve the objective c. It implies that, public spending decreases in both the debt stock and corresponding interest rate and increases in internally generated revenue

Any increase in debt stock could then be regarded as the short fall of all the generated revenue (both internal and external) to offset the expenditure in the economy, such as;

$$\dot{b}_t = (rb_t + g_t) - (\vartheta_t + e_t) \quad (4)$$

Where \dot{b}_t is the deficit spending to be generated through borrowing as an addition to the existing debt stock.

If (2) and (3) are substituted in (1), then;

$$e_t = \theta_t \phi_{gt}(\vartheta_t - rb_t) + \phi_{qt}(b_t - \vartheta_t) \quad (5)$$

It is noted that, the exogenously determined component of the external revenue q_t depends on the debt stock b_t , for instance, the decision of external creditor to grant debt relief usually depends on the meeting of a specified debt threshold as percentage of GDP or export. As such, the time path of ϕ_{qt} is critical to the analysis, such that, if $b_t < \bar{b}_t$, $\phi_{qt} = 0$ or if $b_t > \bar{b}_t$, $\phi_{qt} > 0$, given that \bar{b}_t is the threshold of debt.

Following the optimal control theory procedure, the public spending ϑ_{gt} serve as control variable to be chosen optimally, while taking care of its effect on the state variable of debt stock b_t . This eventually affects the budget constraint.

As such, government chooses the size of the revenue ϑ_{gt} to be spent on the country so as to maximize their utility. In this regards, utility is prepared as natural log of present value of the total spending ϑ_t specified in eq. (3), that is;

$$U = \int_{t=0}^{\infty} \ln[\vartheta_{gt} (\vartheta_t - r b_t)] e^{-rt} dt \quad (6)$$

Meanwhile, because debt b_t cannot grow indefinitely, we impose “no-ponzi game rule” in which

$$\lim_{s \rightarrow \infty} b_t e^{-rt} \leq 0 \quad (7)$$

There are two key roles being played by (6) in the process; first, it assumes that time preference rate is the same as interest rate. The second purpose is that, if ϑ_t is maintained over time, then there is no transfer-smoothing reason for further debt accumulation beyond the specified level. In such condition, a focus is shifted to the spending incentives that are due to external revenue alone.

Maximizing (6) subject to the specification in (2), (3), (4) and (7) and making the initial debt $b_0 = 0$, gives the optimal share of spending at a given time t as follows;

$$\vartheta_{gt} = \frac{1}{1-\vartheta_t} \left[1 + \vartheta_{qt} \left(\frac{b_t - \vartheta_t}{\vartheta_t - r b_t} + \frac{1}{r} \right) \right] \quad (8)$$

The eq. (8) implies that, the optimal spending increases in ϑ_t . This is logical, since revenue from external sources reduce the cost of spending proportionately. In the same way, the optimal spending also increases in the share of exogenous component of external revenue ϑ_{qt}

The size of public debt that arises from the spending rule, given that (8) is substituted into (1) through the use of (3) is;

$$b_t = \frac{\vartheta_t}{r} (1 - e^{-\vartheta_{qt} t}) \quad (9)$$

The eq. (9) is used to generate optimal debt for Malawi. The optimal debt model makes use of data series generated through simultaneous programming of (2), (3) and (8). The only parameter in the models is rate of interest r . The parameter r is generated through simulation of Special Drawing Right (SDR) interest rate. The SDR rate is selected over the LIBOR rate which is used in some other studies for two reasons. The currency on which the debt is denominated is no more a problem when SDR rate is used given that, it is a measure of basket of currency as designed. Secondly, IMF/World Bank prioritise the use of SDR rate for cross national comparison of analysis.

3.2. Simulation of Interest Rate

The interest rate simulation procedure follows two steps. First is the extraction of the covariance structure of shocks from the time series data. The covariance of shocks to r , is extracted from historical monthly SDR data over the period 2009–2012. The simulation is conducted 10,000 times over the period, thus enabling the exact confidence intervals around the “central” scenario. Shock is defined as the first difference in the monthly variable; i.e., for any variable x , the shock e at month m is defined as: $e_m \equiv x_m - x_{m-1}$

Modeling the shocks for the interest rate series in this way (i.e., as though interest rates were random walks) is consistent with the fact that a unit root for the variable cannot be rejected in the data. Armed with the covariance matrix of shocks, the next step is to construct the confidence intervals for the extracted values. We randomly draw monthly shocks to the variable over 2009 and 2012. The shocks are assumed to be jointly-normally distributed with mean zero. The drawn monthly shocks were added to yield annual shocks for the innovations to the interest rate.

Specifically, total annual shock at year t which is specified as $\varepsilon_t^r = \sum_{m=1}^{12} \varepsilon_m^r$. The annual shock is the sum of monthly (m) shocks to interest rate during the year t , where $m = 1$ is January of year t and $m = 12$ is December of year t . The interest rate is thus defined as the addition of the scenario value and the shock, such that $r_t = \bar{r}_t + \varepsilon_t^r$, where \bar{r}_t is the average rate of interest over the year. The process therefore generates a single value for each year.

The five values generated through the simulation are averaged for the final value of r used in generating the optimal values of debt

3.3. Definition of Variables and Sources of Data

The revenue ϑ is measured as revenue of government excluding grants, while government spending g is measured as general government final consumption expenditure. The two variables were generated through the World Bank’s Africa Development Indicator (ADI). The external revenue that is proportional to government spending $\theta_t g_t$ is measured as grants excluding technical cooperation; the exogenous external revenue q is measured as technical grants, while foreign debt b is measured as the external debt stock. They are sourced from the World Bank’s International Debt Statistics (IDS). All the variables were measured in current US dollars.

4. THE EMPIRICAL RESULTS

4.1. Interest Rate Simulation

The result as presented in figure 1 reveals differences in the annual interest rate during the 2009–2012. It is observed that the simulated mode values for each year are 4.5, 3.2, 4.6 and 1.8 percent for the years 2009, 2010, 2011 and 2012 respectively. The average rate which is also the value employed in generating optimal debt value for Malawi as derived through the simulation is 3.5 percent.

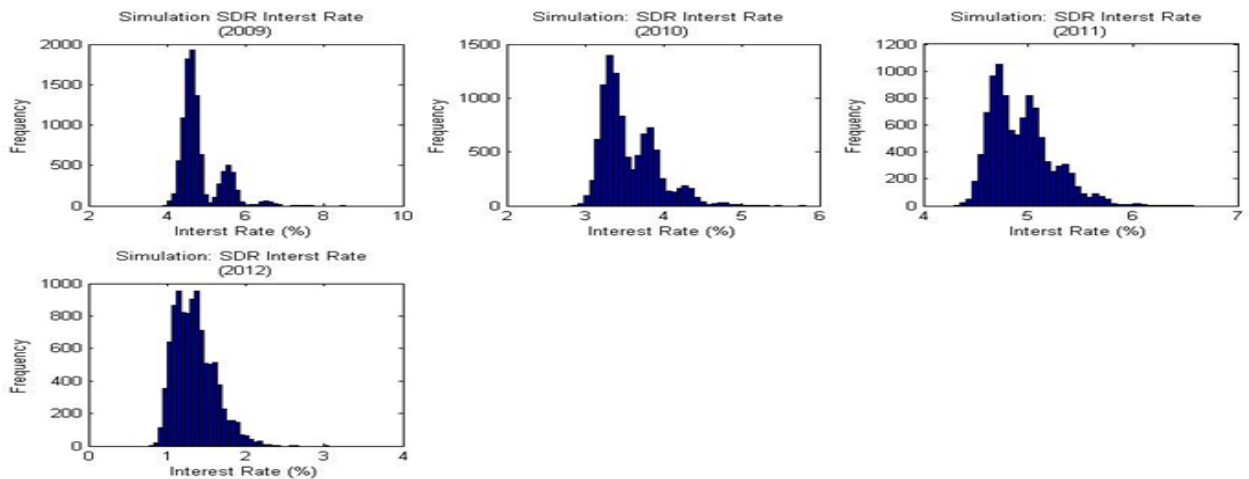


Figure-1. The Simulation Results of SDR Interest Rate

Source: Author's calculation using MATLAB software

4.2. Malawian Economy and Its Optimal Expenditure Pattern

Malawi is one of the poorest countries in the world. Poverty in Malawi remains considerably high and pervasive and millions of Malawians continue to live lives of deprivation and hardship, Madise (2009). Malawi is a landlocked country with a few natural resources other than its 15 million people. This means that the prospects and opportunities for economic development in Malawi are limited (ibid)

The country is predominantly agricultural, with about 90% of the population living in rural areas. Agriculture accounts for 37% of GDP and 85% of export revenues, CIA (2012). The economy depends on substantial inflows of economic assistance from the IMF, the World Bank, and individual donor nations. Holding to this, the country is vulnerable, not only to domestic shock and external shock associated to export price, but also to the shocks from the donor agencies, both multilateral and bilateral. This vulnerability is reflected in the expenditure pattern presented in figure 2. The optimal trends in fig. 2 and fig. 3 are generated through simultaneous simulation of eq. 2, 3, 8 and 9.

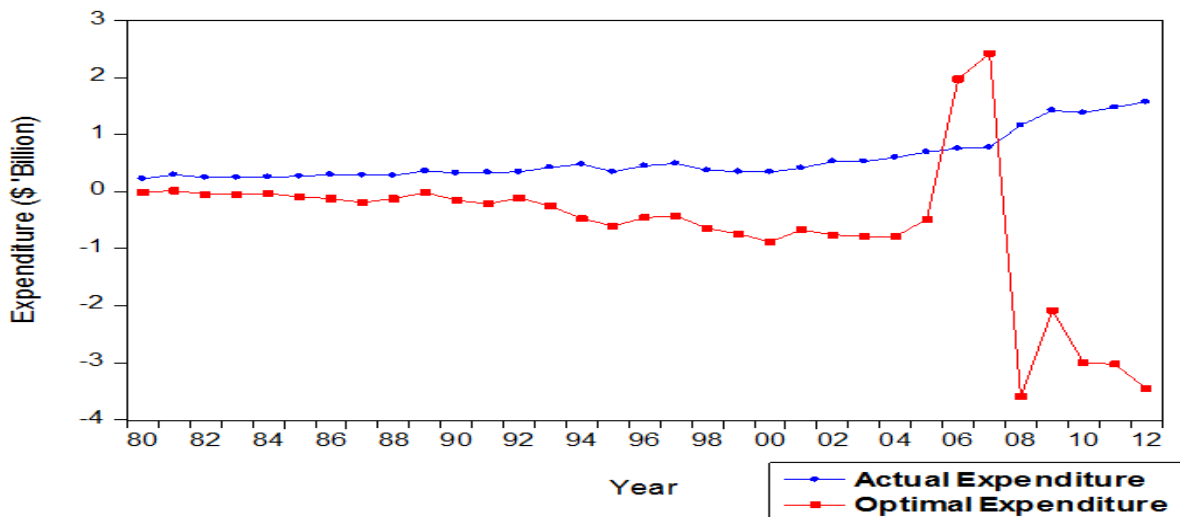


Figure-2. Actual and Optimal Expenditure Trend of Malawi (1980-2012)

Source: Estimation by the Authors

The trend of actual and optimal trend started apart with actual debt above the optimal debt trend, but over the years, the trend continue to diverge which implies the economy's fiscal position has been consistently weakened.

At some points, like other countries in sub-Saharan Africa, Malawi in attempt to revitalize the economy, undertook economic structural adjustment programs supported by the World Bank, the International Monetary Fund (IMF) and other donors since 1981. Broad reform objectives of the institutions include stimulation of private

sector activity and participation through the elimination of price controls and industrial licensing, liberalization of trade and foreign exchange, rationalization of taxes, privatization of state-owned enterprises, and civil service reform. It is unfortunate that the adjustment could not sail the country through the socio-economic limitation. As presented, the country has been underperforming in terms of its fiscal position over the years. Tracing the economic activities, the positive margin between the actual debt and suggested optimal trend was recorded in 2006 and 2007 purely for the huge grant released by the multilateral donors as a post MDRI commitment to help sail the country out of poverty and underdevelopment trap. However, the positive shock was short lived as the country negatively responded as shown in the following year 2008. The optimal spending trend has been seriously divergent since 2008. This is to show that the country is not experiencing fiscal probity.

4.3. The Optimal Debt Analysis

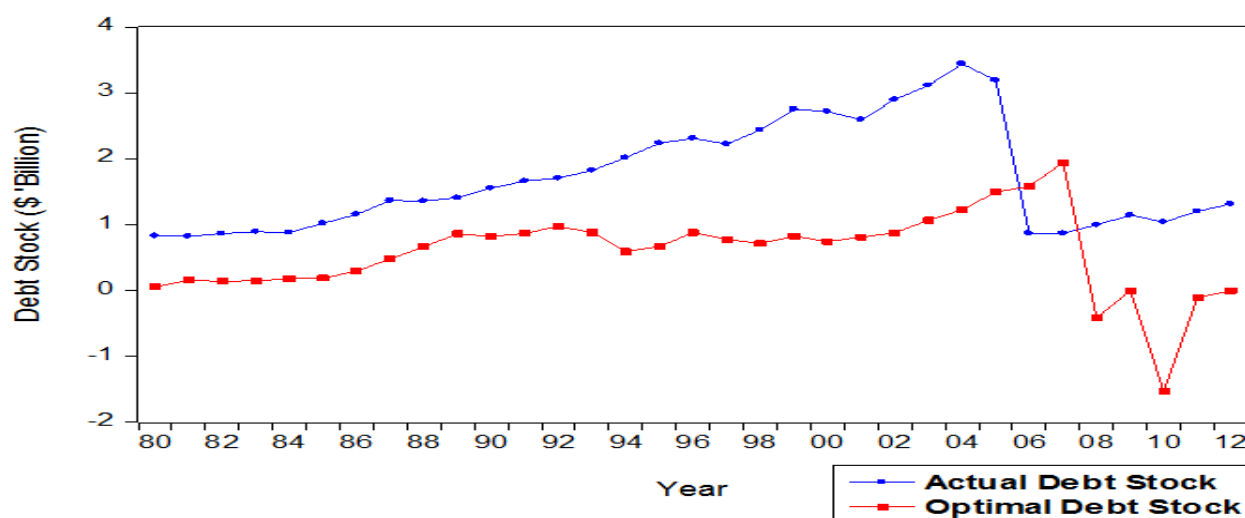


Figure-3. Actual and Optimal Debt Trend of Malawi (1980-2012)

Source: Estimation by the Authors

The debt trend presented in figure 3 above shows that, Malawi is experiencing debt crisis over the years. The only period when the debt level is below the optimal was 2006 when the HIPC's MDRI was granted to the country, unfortunately, the economy responded negatively and sharply to the initiative as the optimal debt trend diverge away from the actual trend. This is strong evidence that the economy is battling with debt unsustainability after it qualified for the relief.

In support of the presented trend, it was raised in an IMF, country staff report, that Malawi would have debt sustainability challenge after the projection shows that the ratio of debt to the debt sustainability indicators is consistently on the increase. The report stated further;

'Malawi's external debt sustainability may be severely affected.....the debt sustainability indicators cross their respective threshold (projection) as early as 2012 and continue to deteriorate thereafter. The period from which these historical averages are drawn include years of particularly poor macroeconomic performance including the emergence of domestic debt spiral and a severe food crisis. However they do indicate the range of shocks to which Malawi may be subjected'. IMF (2008)

In another account, it is explained that after Malawi reaching the HIPC Completion Point, its PV of debt-to-exports ratio dropped from 191 percent in 2005 to 39 percent in 2006. Debt service as a share of exports was expected to decline from 22 to 16.2 percent between 2005 and 2006. However, it was predicted that Malawi would nevertheless remain vulnerable to exogenous shocks. So also, the reality revealed that if government failed to implement reform strategy to enhance growth, diversify exports and to improve governance, Malawi's debt burden

indicators would increase steeply and the external debt stock indicators would breach their thresholds within ten years.

The above statement is adequate to explain the background to sharp digression of optimal debt from sustainable path immediately after the country qualified for the MDRI in 2006. It is however concluded that Malawi never experienced sustainable sub-optimal debt trend since 1980 up to 2012. More so, there is no indication through the optimal and actual debt trends that there could be debt trend below the optimal in the nearest future.

4.4. The Policy Implications

Malawi's debt and fiscal positions are not sustainable with actual debt and expenditure at each point far above the optimal debt level that the economy could sustain.

Malawi requires structural change in the management of the economy. The excessive dependence on donor income and foreign aid in the economic management and government budgetary plan makes the country vulnerable to external shocks. In achieving this, the continual export promotion of its economic base which is agriculture is crucial and needs to be invigorated. In addition to the basic step from internal restructuring of economic activities, the foreign organization and creditors should handle the problem of Burundi from peculiar perspective and address it uniquely. More so, complete cancellation of any form of debt owe to both the multilateral and bilateral creditors is fundamentally needed to assist the economy out of the depressive state of the macroeconomic performances.

The economy of Malawi is agrarian, with about ninety percent of the population living in rural areas. Agriculture accounts for about twenty nine percent of GDP and eighty five percent of export revenues mainly through the revenue from Tobacco. This implies that the economy has great potential in agriculture if explored. More so the economy needs diversification that could assist in reducing import and promotes export. This would assist in reducing pressure on the limited foreign exchange flow into the economy.

In a closer look into economy of Malawi, the country's debt and fiscal crisis is structural. For instance, despite that the country was not badly hit by the aftermath of the 2008 economic crisis because of abundant and cheaply priced food on the domestic market with exception of imported food stuffs, it nevertheless experienced severe trade imbalance, mostly because of poor tobacco sales and increased demand for imports but low foreign reserve.

Given this, Malawi was the first country to benefit from the Extended Credit Facility (ECF) of IMF (formerly known as Poverty Reduction and Growth Facility) which was offered in 2008. The overall purpose of the ECF loans was to prevent Malawi and other LICs from slipping back from the IMF macro-economic policy programmes as a result of the effects of the financial crisis and other related exogenous impacts. These ECF loans, are not holy, neither technically or necessarily intended as final definitive solutions to the financial crisis but as short term solution. Unfortunately, the loans add more to the economic sore of the country because as at 2012, a 2012 report of Center for Social Concern (CSC) shows that, the country had accumulated about US\$ 302 Million in loans under the ECF arrangement only within the four years.

The loan advancement and increase grant are not proving adequate for economic transformation, rather a complete overhauling of the domestic economic structure through a breakaway from the status quo of excessive dependent on the donors and other foreign assistant. In a more compelling intervention, the foreign assistance would be more useful as a tool of infrastructural facelift that would allow effective operation of the private sector and small and medium enterprise development through which the excessive dependent on import could be corrected for domestic substitution. The idea behind this assertion is to improve balance of payment and relieve pressure on the foreign reserve and allow preservation of the country's foreign exchange.

5. CONCLUSION

The economy of Malawi is not free from debt crisis, despite the benefit of Multilateral Debt Relief Initiative (MDRI) that was extended to Heavily Indebted Poor Countries (HIPC) in 2005. An optimal debt and expenditure

models in this article shows that the country has been and remain vulnerable to fiscal crises despite the palliative measure the country was offered during the 2008 global financial crisis, in which the country was the first to benefit from the ECF package of the IMF. This article therefore recommends structural change as against palliative measure in managing the fiscal and debt crisis in the country.

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