ECONOMIC OPENNESS, SOVEREIGN DEBT AND DEBT CRISIS: EVIDENCE FROM SUB-SAHARAN AFRICA

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Abstract

The concurrent high level of economic openness and external debt in Sub-Saharan Africa (SSA) has ignited questions on whether the debt problem in SSA is an openness problem. This thesis examines the relationship between openness and the likelihood of debt crisis occurrence in 46 SSA countries using panel data from 1980 to 2013. We also investigate the external debt accumulation effect of openness in a dynamic external debt model. From Our GMM estimation we found external debt to be an increasing function of openness initially and a decreasing function of openness over time. Using logit MLE, we found the external debt accumulation effect of openness to effectively translate into increased risk of debt crisis occurrence initially but over time, openness decreases the probability of debt crisis occurrence. Our results are robust to alternative measures of openness as well as changes in the definition of external debt and debt crisis.

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CHAPTER ONE

1.1 Introduction

Many developing countries in their pursuit of economic growth, sustainable development, and poverty alleviation, have implemented programs and policies recommended by the multilateral and bilateral institutions and other development partners. On the African continent and in particular Sub-Saharan Africa (SSA), popular among these programs include the Stabilization programs and the Structural Adjustment Program (SAP). Paramount among the preconditions and requirements of these programs was the liberalization of international trade. Notwithstanding the significant cross country variations in the degree and pace of openness, the general effect of these programs included more economic openness in the participating countries. In Sub-Saharan Africa, the average annual percentage increase in economic openness (measured by the volume of international trade to GDP) from 1980 to 2013 is approximately 25 percent. The ratio of volume of international trade to GDP was averagely 80 percent for Sub-Saharan African countries as at 2013 while the corresponding figure for the world is 62 percent. There is fairly high level of interaction between SSA countries and the rest of the world in terms of trade. While these programs were well intended and well thought, and generally believed to have aided the participating countries in their economic development process, they have had unintended impacts.

Apart from the welfare gains associated with open economies, myriad of empirical investigations have ascribed declining inflation to economic openness[1]. According to these researchers, the benefit of lower equilibrium inflation associated with open economies is due to less incentive to engineer surprise monetary policies in the presence of pre-commitments that accompany economic openness. Since the inquiry of Smith (1776) into the nature and causes of the wealth of nations, it has been observed that openness is growth enhancing through access to international markets and labour specialization which induces productivity increases. Frankel and Romer (1999) empirical work shows that a 1 per cent increase in trade to GDP Ratio leads to 1.5 per cent increase in income per person.

Due to resource gap in most developing countries, external borrowing has proven extremely useful as a source of finance for trade, developmental projects, and economic growth in these countries. As noted by Chenery and Strout (1966) most developing economies depend heavily on external resources to increase growth and per capita income. This mode of financing trade, developmental projects, and economic growth has with time led to the buildup of huge external debt by most developing countries especially those in SSA. With high degree and pace of economic openness and a concurrent high level of indebtedness (even with the Highly Indebted Poor Country {HIPC} Initiative), Fole (2003) alluded that the debt problem facing Sub-Saharan Africa (SSA) may essentially be a trade problem. Debt crisis in the developing world and SSA in particular appears not to have been comprehensively dealt with. This may partly be attributed to the lack of compelling empirical evidence gathered from a careful examination of the structural and fundamental

[1] See Rogoff (1985), Romer (1993), Terra (1998), Iyoha (1973), Lane (1997), Sachsida et al (2003), Ashra (2002), Muhammad and Batool (2006), Boschen and Weise (2003), and Bowdler and Malik (2005).

causes of the crisis. In particular, the impact of openness on the external debt of a country has been given less empirical attention in the literature. Research has noted the positive relationship between openness and economic growth[2]. High level of external debt beyond some defined threshold or optimal level has also been shown to be growth retarding[3]. However, the link between openness and the probability of sovereign debt default is yet to be generally established in the literature. This thesis will therefore examine the occurrence of debt crisis in SSA countries and assess the marginal effect of economic openness on the probability of occurrence of debt crisis.

While it is less obvious and quite remote to link the level of international trade in a country to banking and currency crisis, the proximity and direct linkages between international trade and debt level in a country could easily be constructed. In a simple open macroeconomic model, we may define current account deficit as equivalent to trade deficit plus net returns on claims from the rest of the world. Also, changes in external debt is equal to the current account deficit and net change in reserves. It follows that high current account deficit coupled with depleted reserves implies high external debt. Persistent current account deficit may lead to high external debt and consequently to debt crisis. In other words, liberalizing trade and facing deteriorating terms of trade implies worsening trade deficit. This coupled with already high interest payment in the case of SSA countries will reinforce the chronic and persistent current account deficit which together with dwindled reserves, translate into high external debt which consequently lead to increase in the probability of

[2] See Smith (1776), Harrison (1996), Frankel and Romer (1999), Frankel et al (1996), Afonso (2001), Dollar and Kraay (2004), and Wacziarg and Welch (2008).
[3] See Checherita-Westphal and Rother (2011), Greenidge et al (2013), Reinhart and Rogoff (2010), Smyth and Yu (1995), Wright and Grenade (2014), and Topalova and Nyberg (2010).

default. A particular example is the case of Latin American countries in the 1980s as noted by Long (1981) that they borrowed extensively and draw down their reserves to meet their huge current account deficit in the 1980s. This huge current account deficit and the extensive borrowing culminated into the Latin American debt crisis.

On the other hand, Brock (1984) argued that more open and free market oriented economies may turn to be associated with less debt burden relative to less free market and outward oriented economies. He noted that more open economies attract vital imports, technology, and investments needed for production of exports and development of the private sector. The relative trade openness of such economies may turn to make them attractive investment destinations; which strengthen their export sectors. Therefore, building a competitive and more revenue generating export sector help relatively open economies to improve liquidity and service their external debt consistently. Hence, the probability of default and debt crisis may decline with more economic openness. similarly, Laird and Nogues (1988) argue that trade openness will result in efficient resource allocation and improve the international competitiveness of the liberalizing country. Also according to Melitz (2003), trade liberalization leads to reallocation of factors of production and output within industries. He argues that exposure to international trade will concurrently induce the more productive firms to enter into the export market while forcing the less productive firms to exit. This resource reallocation resulting from opening up to trade improves the international competiveness of the country as a whole and its revenue generation capabilities. It can therefore be deduced that the net effect of openness should be high economic growth and high national income that may be used among other things to service external obligations.

With persistent current account deficit particularly in the developing world and in an era of trade liberalization and globalization, it is necessary to examine whether trade openness has reinforced the chronic and pervasive high level of debt in the developing world, particularly among SSA countries.

Empirical literature on this debt crisis has tended to concentrate on the impact and the consequences of debt crisis. The literature has to a larger extent established empirically the output losses associated with debt crisis and the impact duration of debt crisis. For instance, Furceri and Zdzienicka (2012) estimated impact duration of 8 years and output falls of 10 percent. Their results also suggested that debt crisis are detrimental than the effect of banking and financial crisis. De Paoli et al (2009) estimated 10 years duration of debt crisis with an associated 5 percent output decline. Others have also investigated the severe impact of the occurrence of sovereign default on a nation. Such investigations concentrated on the increase in borrowing cost, the macroeconomic impact of changes in sovereign credit rating and the decline in international trade as a result of the sovereign default. Borensztein and Panizza (2009) estimated an increase in cost of borrowing by 400 basis points. Bahaj (2014) also noted that on average, a 100 basis points increase in sovereign borrowing cost will produce a 2 percentage points decline in industrial production growth and add 0.9 percentage points to the unemployment rate; based on data and empirical works on the Euro zone. Using traditional gravity model, Rose (2005) predicted 8 percent per year decline in bilateral trade following sovereign default. Brock (1984) envisage the possibility of international trade crisis with high probability of sliding the world back to autarky if debt crises are persistent and pervasive in occurrence. According to Brock (1984), the mechanism works through diminishing export credit to

defaulting countries. This may translate to less exports to defaulting countries from the rest of the world; who in effect also import less in order to balance trade. The resulting effect is international trade crisis and less open international trade. The impact and consequences of debt crisis have far reaching implications. An assessment of the probability of debt crisis occurrence in this era of globalization and trade will be informative and beneficial to participating countries.

1.2 Background

In this sub-section, the historical background of SSA debt crisis is discussed with emphasis on the competing theories that attempt to explain and trace the origin of the crisis. Some stylized facts of economic openness and external debt are examined. We also observe the trend of SSA external debt and economic openness for the period under consideration. The trend analysis reveal high level of average external debt and fairly high level of average economic openness. We next discuss the composition of external debt as well as analyze some selected debt burden indicators. The composition shows that nearly three quarter of SSA external debt are owed to official creditors. This composition has remained fairly stable. The burden indicators reveal an increasing inability to serve external obligation.

1.2.1 Historical Origin of SSA Debt Crisis

According to Fole (2003), understanding the historical origin of the African debt crisis is a prerequisite to understanding the African debt problem and recommending viable solutions. Ikejiaku (2008) noted that the origin of the African debt crisis can be generally

viewed from two broad development theories; the Dependency Theory and the Liberal Economic Theory. Proponents of the dependency theory maintain that the debt crisis emanate from the extreme dependence of SSA countries' economies on international competitive economic conditions over which they have little or no control. The theory presents the notion of a two state world; the Center (wealthy states) and a Periphery (poor states). The periphery states basically developed their economic structures and institutions as natural resource extractors which are exported in their raw state to the Center states for processing and exported back to the Periphery states. The circle and the direction of flow of activities turn to make the Periphery states extremely vulnerable to external commodity price shocks as seen in the oil price hikes of the 1970s which peak at 1973-74 and 1978-79. As noted by Sandbrook (1982), the manner in which dependent territories were integrated into the global division of labour generated an inherent tendency for economic stagnation of these dependent territories. Therefore, the dependency theory predicts that the Periphery states will source loans and other forms of financial assistance from the Center states in an attempt to improve their situation. However, the conditions tied to the loans eventually push them into a vicious cycle of "debt trap" (Payer, 1974). The Center states noticing the needs of the Periphery states, condition the loans to fortify their interest and ensure a continuance of the cycle. As captured by the words of George Washington (the first U.S. Presidents), "it is madness for one nation to expect disinterested help from another – the U.S does not have friends but interest" (Ikejiaku, 2008).

The alternative view of the origin of the African debt crisis is the liberal economic theory. The central aim of economic liberalization is to increase the flow of foreign investment into the liberalizing country through the easing of trade and exchange

restrictions (Ikejiaku, 2008). Through economic liberalization and harmonization of political systems, the international development institutions/donors intended to have dwindled the resource gap that existed in developing countries (Biersteker, 1993). However, the institutions that championed this economic liberalization have intransigent ideological stands that may have worsened the resource gap. These institutions primarily the World Bank and the IMF have a package of preconditions that usually include trade liberalization, free market system, currency devaluation and austerity measures. According to Onimode (1989), the IMF preconditions which show little or no sensitivity to the peculiar underdeveloped state of the economies involved, turn to threaten their very survival. The application of these conditions as embedded in the Stabilization Programs and the Structural Adjustment Program to SSA countries and the attendant outcomes may have given more credence to the liberal economic view of the source of SSA debt crisis. As noted by Ikejiaku (2008), the application of devaluation to Zambia in 1985, Ghana and Nigeria in 1986 shows little reward. Therefore, in the view of the liberal economic theory, the very process of liberalization which included economic openness and free market system inter alia have tended to plunge SSA countries into enormous debts and a consequent debt crisis.

1.2.2 Trend of SSA External Debt and Openness

Irrespective of which school of thought is considered, the trend and trajectory of external debt in SSA countries has been worrisome as indicated in *figure 1.1* below. From 1980 to 1988, total external debt as a percentage of GNI persistently trended upwards sharply. This trend is mainly attributed to the two oil price hikes of the 1970s which peak at 1973-74 and

1978-80 (Danso, 1990; UNCTAD, 2004; Greene and Khan, 1990). The rise in the oil price not only negatively affected the trade balance of net oil-importing countries, it also caused fiscal crisis in these countries. Particularly, the oil-price shock of 1978 – 1980 coincided with sharp rise in world real interest rates and also preceded the 1981 – 1982 global recession; which depressed demand for developing countries exports coupled with deteriorating terms of trade and balance of payment crisis. According to Greene and Khan (1990), the terms of trade for SSA countries in 1987 was 24 percent below the 1980 level while export earnings in dollars remains virtually stagnant. SSA countries like many developing countries at that time resorted to external borrowing to finance the fiscal and external imbalances.

The trend then took a downward turn between the period 1988 and 1991 and thereafter assumes its increasing trend pinnacling at 131.82 percent in 1994. The dip between 1988 and 1991 may have been due to short term effect of the Stabilization Program and the Structural Adjustment Program. Over the period 1980 to 1996, SSA countries total external debt as a percentage of GNI average at 90.61 percent. The period after 1996 saw a generally declining trend in the sub-regional external debt. This may be strongly attributed to the HIPC initiative which started in 1996 and run for the remainder of the sample period. 32 of the 46 countries in SSA to be considered in this study have been or are currently part of the HIPC initiative. Further, these 32 countries accounted for 86.38 percent of the US$76,388 million HIPC total committed funds. Notwithstanding the huge intervention by the HIPC initiative, the average debt of SSA countries from 1997 to 2013 is 71.78 percent. The upshot of the historical trend on SSA debt is persistently high with overall average of about 81.19 percent. It is also apparently evident that it usually takes

external and decisive efforts from the international community to reduce the debt level only to be built upon by the region.

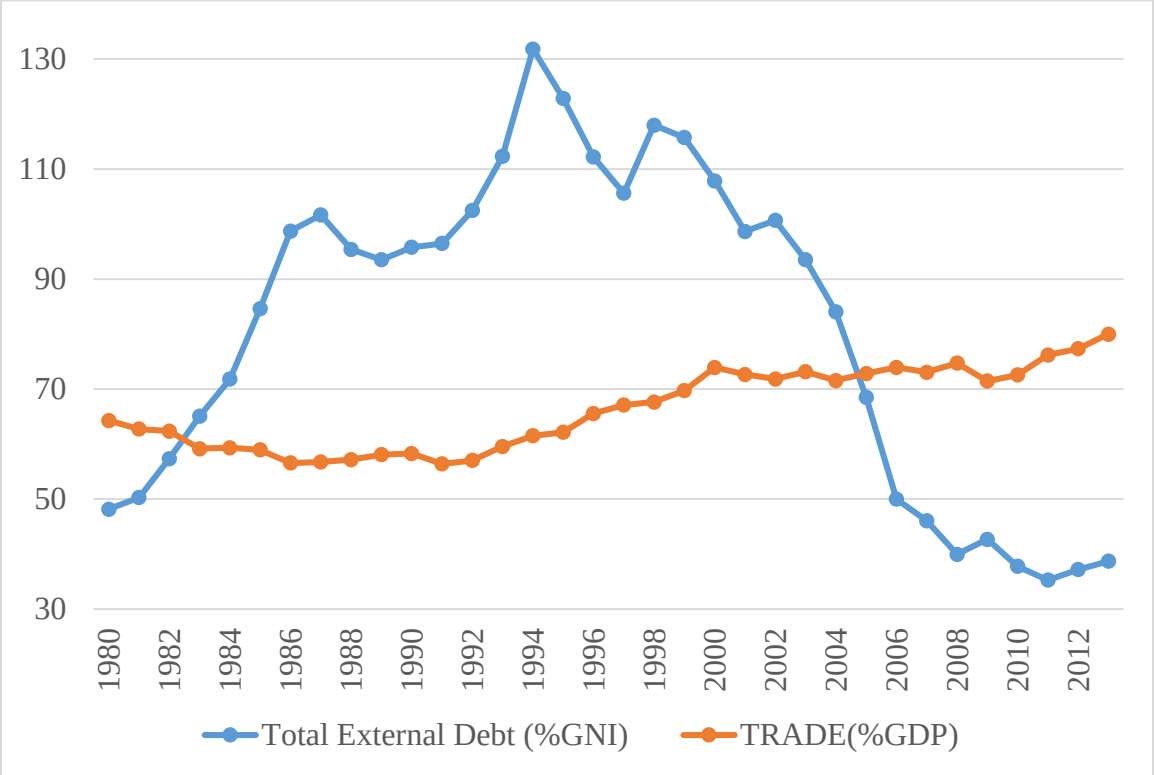

Figure 1.1: Trend of total external debt (% GNI) and economic openness from 1980 to 2013

Economic openness has an upward trend for most part period under consideration with an average of about 66.34 percent of GDP. SSA countries have on the average seen approximately 25 percent growth in openness from 1980 to 2013. Prior to the 1980s, most SSA countries after independence embarked on import substitution and protectionist trade policies. This trade orientation coupled with the twin oil price shocks of 1973-74 and 1979-80 and the global recession of 1981-82 may have explained the almost flat trend of trade openness from 1980 to the mid 1980's. With these harsh global conditions, the African

continent like many others experienced severe economic crisis. Consequently, and being driven by the desperate need for convertible currencies to service their external debt obligations, most SSA countries embrace the IMF and the World Bank market oriented policy recommendations usually referred to as "Structural Adjustment Programs (SAP)" (UNCTAD, 2008). As earlier noted, participating countries had to embark on trade liberalization policies and in some cases devalue their currencies as part of the preconditions of SAP. In addition, the establishment of the World Trade Organization (WTO) in 1995 with an enshrined clause of multilateral trade obligations for African member countries may have been the reason for the gradual upward trend of trade openness in the sub region (UNCTAD, 2008). Finally, SSA trade openness has been trending upwards from the mid 1990's as a result of new partnerships with the emerging markets (especially China) and budding intraregional trade (IMF, 2015).

In *Figure 1.2* below, scatter plot of Economic openness (*TRADE*) and external debt is presented. The plot shows a generally negative association between economic openness and External debt. The correlation coefficient between economic openness and external debt is -0.48. This shows that there exists quite a significant negative relationship between these two variables.

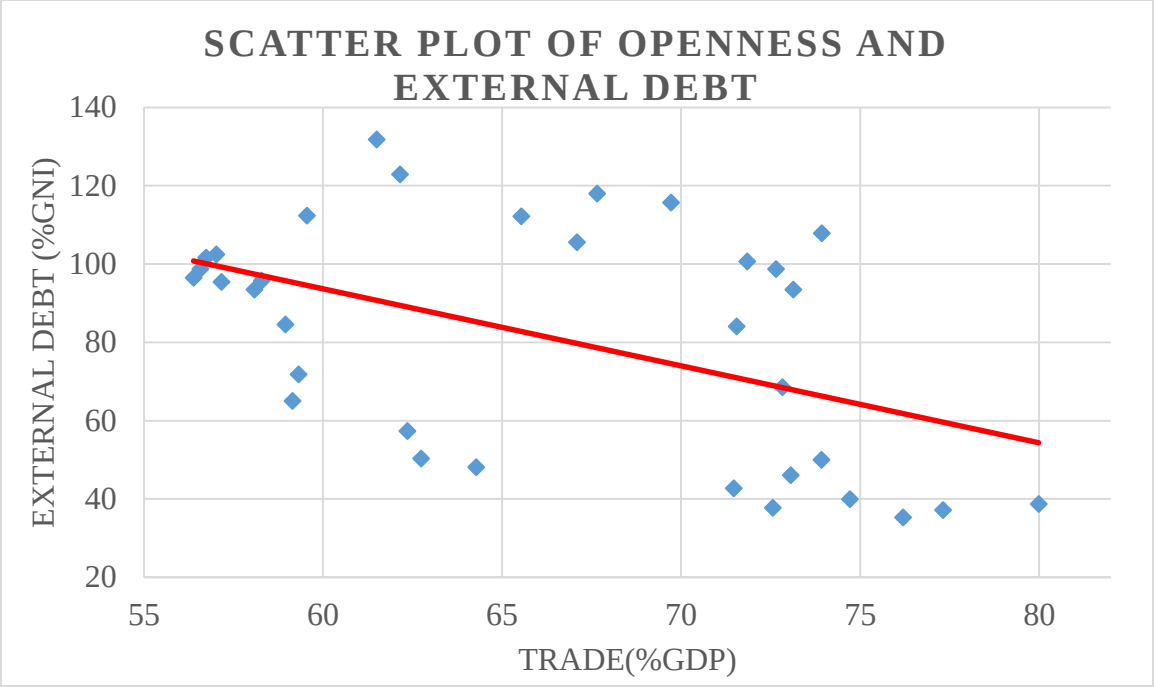

Figure 1.2: Scatter Plot of Openness and External debt

1.2.3 Composition of External Debt

The composition and structure of Africa's debt is presented in Table 1.1 below. The table present period average figures in percentages from which some interesting patterns can be inferred. For the period under consideration, a significant proportion of the African debt is made up of loans from official creditors. Between the period 1980 and 1989, official creditors accounted for 64.34 percent of total external debt (PPG). This figure increased by 16.85 percent to a period average of 75.18 percent between 2000 and 2013. Official creditors include loans from international organizations (multilateral loans) and loans from governments (bilateral loans). For the entire Africa, it is also observed that loans from private creditors on average has reduced over the period under consideration. From a period average of 35.66 percent in the 1980's, loans from private creditors has declined to 24.82 percent between 2000 and 2013. African governments have maintained closer ties with

individual countries in the context of bilateral loans which account for over 45 percent of external debt over the three decades. Figures also portray the growing significance of loans from multilateral institutions such as the IMF, World Bank and regional development banks.

Table 1.1: Composition of external debt in Africa (1980 – 2013)

	1980 - 1989	1990 - 1999	2000 - 2013
	Figures are period Average percentages		
Africa			
Bilateral Debt / External Debt(PPG)	46.80	49.78	41.34
Multilateral Debt / External Debt(PPG)	17.54	26.75	33.84
Official creditors / External debt (PPG)	64.34	76.54	75.18
Private creditors / External debt (PPG)	35.66	23.46	24.82
SSA			
Bilateral Debt / External Debt(PPG)	45.23	48.36	36.77
Multilateral Debt / External Debt(PPG)	21.90	30.99	36.00
Official creditors / External debt (PPG)	67.12	79.35	72.77
Private creditors / External debt (PPG)	32.88	20.65	27.23
North Africa			
Bilateral Debt / External Debt(PPG)	49.06	53.50	55.66
Multilateral Debt / External Debt(PPG)	10.80	16.25	27.68
Official creditors / External debt (PPG)	59.86	69.75	83.34
Private creditors / External debt (PPG)	40.14	30.25	16.66

Source: Researcher's computation based on data from the World Bank's WDI.
Note: Official Creditors comprise of Bilateral and Multilateral creditors. Total external debt is the sum of debt owed to Official and Private Creditors.

The composition of debt in SSA has closely parallel the trend and composition of debt in Africa. More succinctly, SSA debt composition has largely driven the composition of debt in Africa. SSA debt structure is one of strong dominance of official creditors relative to private creditors. The period average figures also show more bilateral loans relative to multilateral. Further, the declining dominance of bilateral loans in external loans to Africa and the increasing significance of multilateral loans is well depicted by the data.

The sample period average of private creditors' loans to Africa is 27.98 percent while that of SSA is 26.92 percent. In comparison to their North African counterparts, (with an above average of 29.02 percent) there has been relatively more private capital flows to North Africa than to SSA countries on the average. This seems to lend credence to the assertion of Fole (2002) that private capital flows are positively correlated with the level of development. Quite conclusively, the composition of SSA debt is characterized by significant debt owed to bilateral and multilateral creditors. Also the composition of external debt has remained fairly stagnant in pattern for the period under consideration.

1.2.4 Debt Burden Indicators

Table 1.2 below presents some selected debt burden indicators for the African continent. For the continent as a whole, it is evidently clear from table 1.2 that there exist high average debt burden on African countries. Apart from the increasing amount of public and publicly guaranteed total external debt stock, there are substantial increases in principal arrears and interest arrears coupled with declining interest payments. These undeniably point to increasing inability to service external obligations and depicts a continent under debt stress with increasing probability to default. This conclusion is not far fetch but obvious when a detail perusal of the indicators is undertaken. In particular, the average debt to GDP ratio is over 60 percent between 1980 and 2013. Total external debt stock as a percentage of total exports of goods and services is on average 931.58 percent. Basically, the amount of foreign exchange generated from exports is woefully inadequate to settle external borrowing. Also, total interest payment as a percentage of exports and as a percentage of total external debt have both fallen drastically over the decades. Concurrently, accumulated

interest arrears as a fraction of GDP, exports and total debt stock are unavoidably on the ascendency.

Table 1.2: Africa Debt burden indicators (1980 – 2013)

	1980 - 1989	1990 - 1999	2000 - 2013
	Period average		
Africa			
Total External Debt Stock (PPG, million US$)	3084.19	4985.17	4809.3
Principal Arrears (PPG, million US$)	192.56	686.91	453.70
Total Interest Payment (PPG, million US$)	126.31	163.68	127.00
Interest Arrears (PPG, million US$)	115.10	349.19	263.41
Total External Debt Stock / GDP (%)	51.93	82.38	50.66
Total External Debt Stock / Exports of Goods and Services (%)	403.52	1324.43	1066.8
Principal Arrears / GDP (%)	3.94	18.98	10.87
Principal Arrears / Exports of Goods and Services (%)	45.64	563.93	688.03
Principal Arrears / Total External Debt Stock (%)	5.48	13.71	9.65
Total Interest Payment / Exports of Goods and Services (%)	6.42	5.51	2.77
Total Interest Payment / Total External Debt Stock (%)	2.98	2.01	1.68
Interest Arrears / GDP (%)	1.88	11.61	7.75
Interest Arrears / Exports of Goods and Services (%)	22.75	264.76	334.67
Interest Arrears / Total External Debt Stock (%)	2.81	6.62	7.43
Total Arrears / Total External Debt Stock (%)	8.11	19.89	20.40
Total Arrears / Exports of Goods and Services (%)	68.39	828.68	1022.7

Source: Researcher's computation based on data from the World Bank's WDI.

Table 1.3 below partitioned the African debt burden indicators into Sub-Saharan Africa (SSA) and North African (NA). Quite interestingly, when the debt burden indicators of SSA are compared with their NA counterparts, it becomes clear that most of the African debt problem emanates from the debt burden of SSA. In NA, the average principal arrears as a fraction of GDP in the 1980s was 3.07 percent. This proportion has declined to an insignificant figure of 0.08 percent between 2000 and 2013. For the same period and

indicator, SSA period average in 1980s was 4.02 percent and the average between 2000 and 2013 is now 11.81 percent.

Table 1.3: SSA and NA Debt burden indicators (1980 – 2013)

	1980 - 1989	**1990 - 1999**	**2000 - 2013**
	Period average		
Sub-Saharan Africa (SSA)			
Total External Debt Stock (PPG, million US$)	1867.63	3526.36	3672.73
Principal Arrears (PPG, million US$)	138.24	731.56	490.55
Total Interest Payment (PPG, million US$)	63.21	79.25	81.51
Interest Arrears (PPG, million US$)	89.56	373.92	285.71
Total External Debt Stock / GDP (%)	50.45	84.85	52.80
Principal Arrears / GDP (%)	4.02	20.59	11.81
Principal Arrears / Exports of Goods and Services (%)	48.19	612.78	747.84
Principal Arrears / Total External Debt Stock (%)	6.63	20.59	13.79
Total Interest Payment / Total External Debt Stock (%)	2.75	1.73	1.48
Interest Arrears / GDP (%)	1.91	12.60	8.42
North Africa(NA)			
Total External Debt Stock (PPG, million US$)	16086.20	21471.27	17879.86
Principal Arrears (PPG, million US$)	778.71	177.05	29.99
Total Interest Payment (PPG, million US$)	783.82	1096.15	638.80
Interest Arrears (PPG, million US$)	390.24	67.50	7.02
Total External Debt Stock / GDP (%)	68.59	53.96	26.01
Total External Debt Stock / Exports of Goods and Services (%)	303.81	205.69	77.36
Principal Arrears / GDP (%)	3.07	0.50	0.08
Principal Arrears / Exports of Goods and Services (%)	16.96	2.13	0.26
Principal Arrears / Total External Debt Stock (%)	3.88	0.85	0.18
Total Interest Payment / Total External Debt Stock (%)	5.51	5.20	3.96
Interest Arrears / GDP (%)	1.59	0.19	0.02

Source: Researcher's computation based on data from the World Bank's WDI.

Average interest arrears as a percentage of GDP in SSA has been trending upward with a period average of 8.42 between 2000 and 2013. The corresponding figure in NA is unbelievably 0.02 percent though both sub regions started with a fairly similar period averages of 1.91 and 1.59 percent respectively for SSA and NA in the 1980's. Clearly, the debt problems of Africa stem from the debt problems of SSA. Also, the debt burden indicators of SSA depicts an increasing inability to honour external obligations, an extremely vulnerable sub region with high probability and actual rate of defaults and debt crisis.

1.3 Thesis Objectives

The definition of debt crisis as well as the assessment of the output reduction effect of debt crisis has been well established in the literature. Attempts have also been made to estimate the impact duration of debt crisis. Significant empirical investigations aim at determining the debt servicing capacity of a country and estimating the probability of rescheduling have also been noted in literature. Nearly all of those empirical works use debt burden indicators as predictors of the probability of rescheduling. An area which have had less quantitative research is the assessment of the structural causes of debt crisis and in particular the contribution of economic openness to external debt accumulation and the incessant debt crisis. Hence, the main objectives of this thesis are as follows; firstly, the thesis seek to determine the effect of economic openness on the level of external debt for SSA countries. This will allow us to ascertain whether economic openness results in the accumulation or reduction of external debt of the sample countries. Secondly, we assess the marginal effect of economic openness on the probability of occurrence of debt crisis in the SSA countries.

In assessing the marginal effect of openness on the probability of debt crisis occurrence, we first investigate the occurrence of debt crisis in these countries using a multidimensional definition of debt crisis. The Majority of the previous empirical studies have used rescheduling of debt as an indication of debt servicing difficulties. Efforts have therefore been directed toward estimating the probability of rescheduling. However, there are instances where countries have recorded fewer or no rescheduling but faced significant financial challenges. For instance, Easton and Rockerbie (1999) noted that Argentina recorded fewer rescheduling of debt from 1985 to 1988 than Chile yet Argentina was in greater financial difficulties than Chile.

There have been less empirical studies using SSA data. Also, debt management and the amount of external debt accumulated is a worrying issue for the region and its international development partners. For instance, Danso (1990) noted that there has been a growing international awareness that Africa is suffering from increasingly acute debt problems. Lekomola (2010) observed that external indebtedness is one of the greatest problems being encountered by SSA countries in recent times. Indicative of the need and the desire of both the sub region and its international development partners to find a sustainable solution to the high and pervasive external debt problem, 32 of the 46 SSA countries under consideration in this region have been granted debt forgiveness under the HIPC initiative. According to UNCTAD (2004), there however appears to be an emerging consensus that many African countries continue to suffer from a debt overhang despite the HIPC Initiative and various interventions in the context of the Paris Club. For the period under consideration, the sub region has eliminated significant trade barriers and liberalized its trading regime. This outward orientation and in pursuant to the requirements of the

various regional and multilateral trading agreements, the region has fairly opened up its economy to international trade. These make the sub region a suitable candidate to assess the impact of trade openness on debt crisis and hopefully discover some of the fundamental causes of the recurrent debt problem in the region. To the best of our knowledge, the economic openness debt crisis nexus is yet to be comprehensively and empirically assessed in the manner and context in which this thesis intends to perform.

1.4 Thesis Contribution

The world is currently highly globalized with an outburst of formations and rectifications of regional trading agreements. There is also a general advocacy for more regional integration coupled with the significant reduction of barriers to trade. However, according to Greene (1989) virtually all discussion on developing countries external debt challenges have focused on middle income countries especially in Latin America with little concentration on Africa and in particular Sub-Saharan Africa. An assessment of the openness- debt crisis link in SSA will equip these countries with the fore knowledge of their average debt sensitivity to openness. Especially, SSA countries should be able to ascertain the debt accumulation effect of openness as well as how much their probability of being in debt crisis alter due to a change in their openness level. Therefore, this thesis will augment the existing literature on the openness- debt crisis nexus as follows; Firstly, given the scarcity of empirical research on the openness - debt crisis link, this thesis will augment the existing literature with a comprehensive examination of an important issue and a recurring problem facing SSA countries. It is a problem which both the sub region

and its international development partners/donors seek a sustainable solution in order to accelerate and enhance the economic growth potentials of the region.

Secondly, this thesis will contribute to the literature by using a more extensive and current data set to conduct a detailed econometric analysis. This approach is contrary to the many studies in the literature which uses simple historical perspective to examine the debt crisis and international trade link. Admittedly, Frank and Cline (1971), Feder and Just (1977), McFadden et al (1985), Ngassam (1991) and Odedokun (1995) have undertaken empirical investigations to determine the causes of repayment problems and the probability of default. However, virtually all the previous studies on this important issue are limited either in term of number of countries used or the time period covered. Also with significant passage of time since the most recent empirical investigation on this subject matter, we are endowed with updated and quality data on external debt and international trade as well as presented with alternative definitions of external debt and closer proxy for economic openness. Also, these studies had their samples from across different continent. However, different continents may have different regional synergies and average behaviour with respect to external debt and trade openness. The regional synergies and average behaviours may be truncated by sampling across continents. As noted by Rahnama-Moghadam et al (1991), forming a sample from countries with similar socio-political, geographical, economic, and cultural characteristics is likely to be less contaminated by unmeasurable factors that affect economic activities. Employing modern econometric estimation techniques and using countries from SSA coupled with quality data and alternative definitions of major variables will be literature enriching. One of the few empirical studies that concentrate exclusively on SSA countries is Odedokun (1995). However, this thesis is

substantially different from Odedokun (1995) because it covers virtually all of the SSA countries over a longer period of more than three decades. It also uses alternative definitions of external debt and economic openness as well as employing a multidimensional definition of debt crisis that goes beyond just rescheduling of external debt. Constructing the dependent variable to depend solely on the sample countries' decision to reschedule or not, the Odedokun (1995) study is inherently limited at identifying real debt crisis. The countries certainly know of the negative connotation to the international capital market of a decision to reschedule. Using a definition that encompasses rescheduling, interest and principal arrears in excess of predefined thresholds will capture all the debt stress episodes.

1.5 Thesis Organization

The remainder of the thesis is organized as follows; Chapter two discusses relevant literature pertaining to the topic with the aim of relating the literature on economic openness, debt and debt crisis and pointing out the gap in literature that this study seeks to fill. Chapter three presents an exposition of the econometric models to be used and a detailed discussion of the variables in the model. The chapter will present two models; the first will be used to estimate the external debt accumulation effect of openness while the second will be used to examine the marginal effect of openness and other control variables on the probability of debt crisis occurrence. The challenges associated with estimating the model will be discussed. Data description and measurement will also be discussed in this chapter. In chapter four, the estimation results and the findings will be discussed. The chapter will also explain the meaning and implication of tests that has been conducted as

well as perform robustness test on the findings. In chapter five, the study will provide summary and conclusion. The chapter will also make policy recommendations derived from the findings and indicate any area of further studies.

CHAPTER TWO

Debt Crisis and Economic openness: A Review of the Literature

This chapter provides a brief overview of the relevant literature on the probability of debt crisis occurrence. The phenomenon of debt crisis has seen significant qualitative research and expression of historical prospective. That notwithstanding, quantitative research on debt crisis have in the past focused on determining debt servicing capacity and estimating the likelihood of debt servicing difficulties. Most of such empirical works used debt burden indicators such as debt service to export ratio, imports to reserves and amortization to debt.

One of the pioneering literature on the subject of debt servicing difficulties is Avramovic et al (1964). They used debt service ratios to identify three categories of variables responsible for short-term debt servicing capacity difficulties. According to them, one of such category of factors affecting short-term debt servicing ability is the fluctuating factors which includes exports, capital flows and imports induced by internal shocks. Another set of factors are the offsetting factors which include reserves, compensatory finance and compressible imports. The last category of factors are interest payments, amortization payments and essential imports. The study noted that this category of factors were the rigid factors. To evaluate the sustainability of debt policies, the study used amortization, interest, and export. The study recommended the use of long term debts as well as balancing the costs and benefits of long term debts to avoid short term debt servicing crisis.

An important shortcoming of using debt service ratio to predict debt servicing capacity according to Waheed (2004) is the lack of a direct linkage between debt service ratio and efficiency of the economy. Another challenge of the debt service ratio approach

is the concurrent coexistence of debt servicing problems and low value of debt service ratio. Waheed (2004) also noted that debt service ratio is not a crucial determinant of debt policies sustainability. Frank and Cline (1971) noted that the debt service ratio is not a very good indicator of a country's ability or inability to service its debt obligations; it merely indicates the proportion of foreign exchange earnings available to purchase imports. According to Waheed (2004) the shortcomings of the debt service ratio compelled subsequent empirical investigations after Avramovic et al (1964) to use other methodologies such as the discriminant, logit and probit analyses. Subsequent empirical investigations also concentrated on predicting the probability of rescheduling by employing the discriminant, probit or logit estimation techniques.

One of the first empirical studies to employ the discriminant analysis in predicting debt servicing difficulties was Frank and Cline (1971). Discriminant technique assumes the existence of distinct subpopulation. In their study, two subpopulations (rescheduling and non-rescheduling countries) were used. Their study used a sample of 26 countries from 1960 to 1968 to identify three variables most relevant to indicating the likelihood that a less developed country will encounter debt servicing difficulties. According to them, the ratio of debt service to export and the ratio of imports to reserves were positively related to debt servicing difficulties. They also found that decreasing likelihood of debt servicing crisis can be attributed to increasing amortization to debt ratio. In their study, the growth rate of export, income per capita, non-compressible imports as a fraction of total imports, the ratio of imports to GNP and exports fluctuation index were not observed as very significant in forecasting debt servicing problems.

Feder and Just (1977) made use of the logit model contrary to the discriminant approach employed by Frank and Cline (1971). They also used a more extensive time period and include more countries relative to Frank and Cline (1971). They used 4 countries from 1965 to 1972 as compared to Frank and Cline (1971) sample of 26 countries from 1960 to 1968. The findings of Feder and Just (1977) were however largely similar to the conclusions of Frank and Cline (1971). They found the debt service ratio and imports to reserves ratio to be increasing the probability of default and also amortization to debt ratio was observed to be decreasing the probability of default. Unlike Frank and Cline (1971), Feder and Just (1977) found income per capita and the growth of export to be significant and decreasing the probability of default. Noticing that the lack of regional representation is a major shortcoming of the Feder and Just (1977), Feder et al (1981) expounded on it by covering more countries and including regional representation. The regional representation included 21 countries of the Latin America and Caribbean, 9 from North Africa and Middle East and 11 from Asian. The rest were 4 advanced middle income countries and 11 from Sub-Saharan countries. In all, the study covered 56 countries over the period 1960 to 1976. They employed the logit model in their estimations. Similar to their predecessors, Feder et al (1981) found debt service to export and import to reserves ratios to be positively correlated with debt servicing capacity while GNP per capita as well as Forex inflow per debt service were decreasing servicing difficulties.

These previous empirical investigations have concentrated largely on explaining the probability of default or rescheduling with debt service ratios and debt burden indictors; they paid less attention to key structural characteristics of developing countries (Berg and Sachs, 1988). Consequently, Berg and Sachs (1988) examined the effect of key structural

characteristics of developing countries on the probability of rescheduling. The study found higher income inequality to have a significant positive association with the probability of rescheduling whereas outward orientation of trade regime decreased the probability of debt rescheduling. Prior to the empirical work of Berg and Sachs (1988), Callier (1985) and McFadden et al (1985) have used structural variables and found economic openness to have a decreasing probability of debt servicing problems. Further, Callier (1985) noted current account to GDP ratio, the difference in growth rate of GNP and GDP, share of investment in GDP and population to be negatively correlated with the probability of default

At the sub regional level, Lee (1983) examined various aspects of the external debt problems of Asian developing countries grouping them into Newly Industrializing Countries (NICs), Southeast Asia and South Asia. Apart from the traditional debt indicators and debt service ratios, he used the Critical Interest Rate (CIR) in the analysis. The CIR according to him is the maximum interest allowable on external debt without increasing the outstanding debt to GDP ratio. It is thus comparable to the real interest rate and able to gauge the long run debt servicing capacity of a country. According to the study, the debt servicing capacity of the Asian developing countries is affected by both domestic and external conditions. The study also concluded that efficient capital utilization and external domestic saving mobilization were two major determinants of the long run debt servicing capacity of the sample countries.

Ngassam (1991) is another regional study that concentrated exclusively on Africa. With a sample of 45 African countries from 1976 to 1987 and employing the logit estimation techniques, the study found debt service ratio, debt service payment to capital inflow, rate of domestic inflation and net government deficit to GDP ratio to be increasing

function of the probability of rescheduling. On the other hand, reserves to imports ratio and GDP growth rate decreased the probability of rescheduling. Though Ngassam (1991) recommended economic liberalization as a means of tackling the debt crisis phenomenon of African countries, the study did not attempt to estimate the quantitative impact of economic liberalization on the probability of rescheduling. One of the few empirical studies that concentrated largely on SSA countries is Odedokun (1995) using a sample of 35 SSA and 4 North African countries from period 1980 to 1990. Regarding the probability of external debt rescheduling in this sub region, the study found real export growth and the fraction of imports to GDP to be negatively associated with probability of rescheduling. Other structural factors which also decreased the probability of rescheduling were investment to GDP, economic growth and high per capita income. Consistent with previous empirical investigations, Odedokun (1995) also observed that existing debt burden increased the probability of rescheduling.

Another area of active research is the definition of debt crisis. This might be due to the difficulty and lack of clear cut definition of debt crisis. As noted by De Paoli et al (2009), it is by no means a trivial issue as it appears. Debt crisis has been variously defined. In Moody's Investors Special Comment (2003), debt crisis is defined as sovereign default in which there is a missed or delayed disbursement of interest and (or) principal regardless of whether such payments were made within the grace period. In that Special Comment, sovereign default is also captured when a distressed exchange occurs. Such exchanges are evidence when a bondholder offers new security or package of securities that may effectively be characterized as diminished financial obligation. Also when the intended purpose of an exchange is to avert a default, sovereign default is deemed to have occurred

according to Moody (2003). Similarly, Standard and Poor (2003) defines default as when the obligor fails to make principal and (or) interest payment as scheduled on the debt issue agreement. Consequently, the Agency noted that for local and foreign currency bonds, notes, bills and securities of similar qualifications, default occurs when scheduled payment is not made on due date or an exchange offer is effected which contains less favourable terms than the original. Both Moody and Standard and Poor's therefore recognize restructuring and rescheduling debt as a distress sign of crisis or imminent crisis.

Detragiache and Spilimbergo (2001) measured the existence of debt crisis when arrears of principal or interest on external obligations to commercial creditors' excess 5 percent of total commercial debt outstanding or debt rescheduling and restructuring had occurred. McFadden et al (1985) and Hajivassiliou (1989, 1994) considered a crisis event to have occurred when arrears on interest exceed 0.1 percent of total external debt, or principal arrears were greater than 1 percent of external debt. Other conditions included rescheduling of debt and execution of an IMF upper tranche agreement. Rose (2005), counted a year of debt crisis when the Paris Club reached a restructuring agreement for the country. However, Pescatori and Sy (2004) recognized debt crisis to be the series of events culminating in a sovereign default or increase in a country's bond spread beyond predetermined threshold.

According to De Paoli et al (2009), debt crisis could be deemed to have occurred if there was actual default or rescheduling of debt with private creditors. Actual default was recognized when arrears on principal obligation toward external private creditors was at least 15 percent of total commercial debt outstanding or the arrears on interest of external obligation was at least 5 percent of total commercial debt outstanding. As demonstrated in

the literature, there do not appear to be a clear consensus on the definition of debt crisis. That notwithstanding, the trend has been to use a combination of recognition criteria that capture any possible debt crisis episode.

The identification of channels through which debt crisis may translate into severe output contraction is also another active area of research in the literature. Using a sample of 144 developing countries over the period 1980 to 2000 and employing the Tobit model, Gelos et al (2011) observed that after the occurrence of debt crisis, the affected country would usually be excluded from the international capital market for an average of about 4 years. Richmond and Dias (2008) also estimated exclusion from the international capital market to be 5.5 years for debt crisis that occurred in the 1980's, 4.1 years duration in the 1990's and lastly 2.5 years of exclusion for debt crisis in the 2000's. In effect, this period of exclusion from the international capital market will affect the country's ability to garner relevant resources for growth and development and thus the reduction in output.

The occurrence of debt crisis and sovereign default will indisputably increase the cost of borrowing to the affected nation and thus dwindle the availability of potential sources of finance for vital developmental projects. Borensztein and Panizza (2009) estimated that in the year following a sovereign default, there was an astronomical increase in borrowing spread by 400 basis points relative to tranquil times. Undeniably, this will culminate into output contraction. Rose (2005) predicted 8 percent per year reduction in bilateral trade following sovereign default occurrence. Therefore, another mechanism of output reduction ascribed to debt crisis is through the reduction in international trade.

The impact of debt crisis on a country cannot be over emphasized. Empirical investigations have established that debt crises are usually longer in duration relative to

currency and banking crises. The output contractions associated with debt crisis have also been observed to be significant. Majority of the current literature have relied extensively on debt burden indicators to predict probability of rescheduling. Hence the relationship between debt burden indicators and the probability of default or the debt capacity of a country has been well established. Some attempts have been made in the literature to establish the link between outward orientation or economic openness and the probability of debt crisis occurrence. Most of the previous quantitative research are however not extensive in time coverage. This current study spans over three decades. Also noted in the previous studies is that sample countries are drawn from less developed countries and usually sampled across various continents. This current study concentrate exclusively on SSA countries. Also lacking in most of the previous studies is the use of a multidimensional definition of debt crisis as well as employing alternative definitions of external debt and trade openness. Using a definition of debt crisis that embodied rescheduling, restructuring and interest and principal arrears beyond certain thresholds will be more comprehensive. "In spite of its obvious importance, the topic of Less Developed Countries indebtedness has not been the subject of much systematic investigation" (Heller and Frankel, 1982), especially with regards to the SSA sub region. Hence this study is very significant in the context of the literature on external debt and debt crisis in SSA.

CHAPTER THREE

3.1 Model Specification and Methodology

In this chapter, we present and discuss the econometric models to be used for the empirical analysis as well as provide detail explanation of the choice of variables used. We will present two models; one for assessing the contribution of economic openness to total external debt accumulation. The second model will be used for estimating the marginal effect of economic openness on the probability of debt crisis occurrence. The chapter will also present and discuss the estimation techniques and the challenges associated with estimating the models. The last section of the chapter will be devoted to data description and its sources.

3.2 The Model

We adopt a modified version of the model specification of Rahnama-Moghadam et al (1991) and Odedokun (1995) to examine the impact of economic openness on external debt accumulation as well as assessing the propensity of a country to be in debt crisis given economic openness. Contrary to both Rahnama-Moghadam et al (1991) and Odedokun (1995), we begin with an aggregate production function and show that the explanatory variables we include in our model have a theoretical functional relationship with our dependent variable. To begin with, suppose Q is the real output and K and L are the respective physical inputs of capital and labour, then the aggregate production function could be written as (Solow, 1956);

$$Q = F(K, L) \tag{1}$$

Consistent with standard Solow growth model assumptions, the production function is assumed to exhibit constant returns to scale (CRS) with respect to its inputs (Romer, 1996 pp 7 -12). The function is also assumed to exhibit diminishing marginal returns, that is $\frac{\partial F(.)}{\partial K} > 0, \frac{\partial F(.)}{\partial L} > 0$, $\frac{\partial^2 F(.)}{\partial K^2} < 0$ and $\frac{\partial^2 F(.)}{\partial L^2} < 0$. It is also assumed that the labour force is growing at a rate proportional to the rate of population growth.

We also adopt a modified version of Sachs (1984) and Greene and Khan (1990) definition of real national income. For the purpose of this exposition, real national income (Y) is defined as the difference between real national output (Q) and foreign debt payment. Foreign debt payment is defined to comprise of interest payment (rD) and principal repayment(ρD), where D is the total external debt stock, r is the interest rate and ρ is the fraction of principal due for repayment. That is:

$$Y = Q - (r + \rho)D$$

From equation (1) above, $Q = F(K, L)$, therefore:

$$Y = F(K, L) - (r + \rho)D \quad (2)$$

Taking time derivative of equation (2) above, we obtain:

$\dot{Y} = F_K\dot{K} + F_L\dot{L} - (r + \rho)\dot{D} - (\dot{r} + \dot{\rho})D$, which can be rearranged as

$$\dot{D} = \frac{1}{(r+\rho)}\left[F_K\dot{K} + F_L\dot{L} - (\dot{r} + \dot{\rho})D - \dot{Y}\right] \quad (3)$$

Also, total national saving (S_t) [the sum of government savings (S_g) and private savings (S_p)] is equivalent to total investment (I) and the current Account(CA) and in equilibrium, total saving is equal to the change in capital (Rogoff and Obstfeld, 1996). That is:

$$\dot{K} = S_t = I + CA \tag{4}$$

Hence substituting equation (4) into equation (3), we obtain

$\dot{D} = \frac{1}{(r+\rho)}\left[F_K(I + CA) + F_L\dot{L} \quad - (\dot{r} + \dot{\rho})D - \dot{Y}\right]$, which can be rewritten as

$$\dot{D} = \frac{1}{(r+\rho)}\left[f_k(I + X + M - 2M + NFI) + F_L\dot{L} - (\dot{r} + \dot{\rho})D - \dot{Y}\right]^4 \tag{5}$$

In equation (5) above, the change in total external debt $(\dot{D})$ is determined by investment (I), volume of trade $(X + M)$, two times the volume of imports ratio $(2M)$, Net Factor Income from abroad (NFI)[5], the growth in population$\left(\dot{L}\right)$, the change in total debt service $\left((\dot{r} + \dot{\rho})D\right)$ as well as the change in real income $\left(\dot{Y}\right)$. Also other determinants of $\dot{D}$ implicitly captured by equation (5) are the real effective exchange rate, real interest rate, and the rate of domestic inflation. Apart from population growth, domestic inflation, real interest rate and the real effective exchange rate, we express all the other variables as percentage of GDP since that is the conventional measure of most of these variables. Represent investment to GDP ratio by INV, the volume of trade as a share of GDP by $TRADE$ and the change in total debt service to GDP ratio by $CTDS$. Also denote the change in real income as a share of GDP by CY, the rate of growth of population by $POPGR$, the real interest rate by RIR, rate of domestic inflation by INF, and the real effective exchange rate by $REER$ so that:

4 Where $CA = X - M + NFI$

[5] (NFI) is insignificant for the group of SSA countries under consideration hence we omit this variable going forward.

$$\frac{\dot{D}}{GDP} = f(TRADE, INV, POPGR, CTDS, REER, CY, RIR, INF) \quad (6)$$

We represent all other variables apart from *TRADE* with Z, then equation (6) becomes;

$$\frac{\dot{D}}{GDP} = f(TRADE, Z) \quad (7)$$

Equation (7) provide us with the factors which affect the rate of change of total external debt over time. To assess the impact of economic openness and these other variables on external debt accumulation, we present economic openness in a dynamic external debt model. It is thought that the level of external debt accumulated at time t inter alia depends on the level of debt already accumulated in period $t-1$. We expect a significant feed from prior years in the determination of current level of debt, hence the relevance of a dynamic model. This model of debt presents current total external debt as a function of prior years' total external debt, economic openness and other control variables. That is

$$ED_{it} = \theta_0 + \theta_1 ED_{i,t-1} + \lambda Open_{it} + \tau' Z_{it} + \varepsilon_{it} \quad (8)$$

$$Z_{it} = (INV, POPGR, CTDS, REER, CY, RIR, INF, trend) \text{ and}$$

And $\varepsilon_{it} = \mu_i + \nu_{it}$

$$\boldsymbol{\{\forall\ i = 1, 2, 3, \ldots\ N\ and\ \ t = 1, 2, 3, \ldots T\}}$$

Where ED_{it} represents the level of external debt in country i at time t and $ED_{i,t-1}$ is the prior level of external debt. The main explanatory variable is the level of economic openness $\{Open_{it}\}$. Equation (8) also contains a set of control variables $\{\boldsymbol{Z_{it}}\}$ which exhibit sufficient time variation. These control variables are defined by the elements of $\boldsymbol{Z_{it}}$

which include investment share of GDP $\{INV_{it}\}$, population growth rate $\{POPGR_{it}\}$, change in total debt services to GDP ratio $\{CTDS_{it}\}$, real effective exchange rate $\{REER_{it}\}$, change in real income share of GDP $\{CY_{it}\}$, real interest rate $\{RIR_{it}\}$, rate of domestic inflation $\{INF_{it}\}$ and a $trend$ variable. By definition of economic openness, twice the imports to GDP ratio $\left(\frac{2M}{GDP}\right)$ will be highly correlated with openness. To avoid this multicollinearity problem, the imports to GDP ratio has been dropped from the set of control variables. ε_{it} is a composite stochastic disturbance term comprising of a country specific term (μ_i) and a time varying disturbance term (ν_{it}). Both μ_i and ν_{it} are assumed to be independent of each other and identically distributed among themselves; that is $\mu_i \sim IID(0, \sigma_\mu^2)$ and $\nu_{it} \sim IID(0, \sigma_\nu^2)$. Consequently, it is assumed that $\boldsymbol{\varepsilon_{it}}$ is normally distributed with a zero mean and a constant variance (σ^2) that is $\varepsilon_{it} \sim N(0, \sigma^2)$. Where $\sigma^2 = \sigma_\mu^2 + \sigma_\nu^2$. To examine the persistence effect of openness and the control variables on debt accumulation, we augment equation (8) with lags of the variables. We choose the second lag of openness as it is thought to be sufficient enough for the effect of openness on external debt to manifest. Also since we have included the interaction of openness with time in equation (9), we deem it not necessary to use deeper lags. The interaction term will capture the trend of openness over time. In equation (9) below, the parameter to be estimated are θ_0 , θ_1 $\lambda_1, \lambda_2,$ λ_3 and τ'.

$$ED_{it} = \theta_0 + \theta_1 ED_{i,t-1} + \lambda_1 TRADE_{it} + \lambda_2 TRADE_{i,t-2} + \lambda_3 TRADE_{it} trend + \tau' Z_{it} + \varepsilon_{it} \quad (9)$$

$$Z_{it} = \begin{pmatrix} INV_{it}, INV_{i,t-2}, POPGR_{it}, POPGR_{it} trend, CTDS_{it}, CTDS_{i,t-2}, \\ REER_{it}, REER_{i,t-2}, CY_{it}, CY_{it-2}, RIR, INF, trend \end{pmatrix}$$

And

$$\varepsilon_{it} = \mu_i + \nu_{it}$$

$$\{\forall\ \boldsymbol{i = 1, 2, 3, \ldots\ N\ and\ \ t = 1, 2, 3, \ldots T}\}$$

Once we assess the external debt accumulation effect of economic openness, we then proceed to examine extreme case; effect of economic openness on the probability of debt crisis occurrence. The occurrence of debt crisis is more of a probability event. Given certain conditions, the probability of a country experiencing debt crisis may be certain. In the absence of those qualifying conditions, we expect a zero probability of debt crisis. Therefore, our dependent variable which is debt crisis is limited to only values of zeros and ones. Put differently,

$$DC_{it} = \begin{cases} 1\ if\ z\ is\ true \\ or \\ 0\ if\ otherwise \end{cases} \qquad (10)$$

Where DC_{it} is debt crisis in country i at time t and z is the qualifying condition(s) or definition to be in debt crisis.

From equation (7), debt crisis is a function of economic openness and other control variables. That is;

$$DC_{it} = \alpha_0 + \beta TRADE_{it} + Z'_{it}\gamma + \varepsilon_{it}$$

$$= \alpha_0 + X'_{it}\theta + \varepsilon_{it} \qquad (11)$$

Where $X_{it} = (\ TRADE_{it},\ Z'_{it}\ )'$

$$Z_{it} = (INV, POPGR, CTDS, REER, CY, RIR, INF, trend) \text{ and}$$

$$\theta = (\beta, \gamma')'$$

And $\varepsilon_{it} = \mu_i + \nu_{it}$

$$\{\forall\ \boldsymbol{i = 1, 2, 3, \ldots\ N\ and\ \ t = 1, 2, 3, \ldots T}\}$$

Except that the equation (8) is a dynamic model, all the control variables in equation (8) are also included in equation (11). This allows us to assess both the debt accumulation effect and the marginal effect of debt crisis occurrence of the same variable. In other words, we examine the debt accumulation effect of these variables which may translate into changing the probability of debt crisis occurrence. To examine the marginal effect of prior years' openness and the other control variables on the probability of debt crisis occurrence, we extend the model in equation (11) to include five-year lag of openness as well as the other control variables. The choice of a five-year lag is due to the notion that it will take considerable time for accumulated debt to translate into debt crisis. it is also due to the fact that we drop the interaction effect; compelling deeper lags. The interaction effects are dropped due to the computational complications in estimating the marginal effects as well as the less informative nature of the interaction marginal effects (Greene, 2010). The augmented equation is as follows;

$$DC_{it} = \alpha_0 + \beta_1 TRADE_{it} + \beta_2 TRADE_{i,t-5} + Z'_{it}\gamma + \varepsilon_{it}$$

$$= \alpha_0 + X'_{it}\theta + \varepsilon_{it} \qquad (12)$$

Where $X_{it} = \left(TRADE_{it}, TRADE_{i,t-5}, Z'_{it} \right)'$

$$Z_{it} = \begin{pmatrix} INV_{it}, INV_{i,t-5}, POPGR_{it}, POPGR_{i,t-5}, CTDS_{it}, CTDS_{i,t-5}, \\ REER_{it}, REER_{i,t-5}, CY_{it}, CY_{it-5}, RIR, INF, trend \end{pmatrix} \text{ and}$$

$$\theta = (\beta_1, \beta_2, \gamma')'$$

And $\varepsilon_{it} = \mu_i + \nu_{it}$

$$\{\forall\, \boldsymbol{i = 1, 2, 3, \ldots\ N\ and\ \ t = 1, 2, 3, \ldots T}\}$$

The parameters to be estimated in equation (12) are therefore α_0 and θ.

As stated earlier, DC_{it} is a binary variable, therefore

$$E(DC_{it}|X_{it}) = 1.P(DC_{it} = 1|X_{it}) + 0.P(DC_{it} = 0|X_{it})$$

$$E(DC_{it}|X_{it}) = P(DC_{it} = 1|X_{it}) \quad (13)$$

Equation (13) above is predicting the probability of a positive outcome. In this regard, the probability of a positive outcome is the probability that a country is in debt crisis given X_{it}. Therefore, equation (12) will be used to predict the probability of being in debt crisis when a country opens up its economy given the other explanatory variables. Equation (12) also enables us to assess the impact of prior years' level of economic openness on the probability of default. This is significant because it will enable us to determine if economic openness has an instantaneous effect or a lag effect on the probability of debt crisis occurrence. The thesis therefore will be estimating the two models; the model in equation (9) as well as in equation (12).

In equation (9) and (12) above, in addition to openness and its lags, investment share of GDP is included as one of the major determinants of the probability of debt crisis occurrence. The inclusion of this variable is also backed by the theoretical exposition

presented earlier (see equations 6 and 7). If countries engage in low savings and investments, then they are unable to build up relevant level of capital to boost current and future productivity. The ability to generate steady and significant level of revenue to service both domestic and external debt obligation will be limited. This implies that all things being equal, there will be significant liquidity constraint leading to interest and principal arrears. High investment share of GDP should have the same effect in reverse, all things being equal. According to Easton and Rockerbie (1999), investment share of GDP will also control for changes in demand for foreign savings as a result of increase in principal and interest payment. Investments with significant and positive net present value (NPV) should be able to generate enough revenue to service any financing cost of such investments. In this case, the coefficient of investment is expected to be negative. On the other hand, and for SSA countries in particular, external borrowing may be used to finance non-viable projects for political reasons. If such investments were a significant portion of external borrowing, then the borrowers will be liquidity constrained and consequently default on principal and interest payment. Collier (1985) observed a negative relationship between the probability of default and share of investment in GDP.

The average population growth rate in SSA countries from 1960 to 1970 was about 2.49 percent. Over the next two decades, this regional average population growth rate increased to 2.82 percent while the period from 1991 to 2014 saw a slight decline to an average of 2.71 percent. With increasing population growth rate and lower effective utilization of potential arable land, there is bound to be insufficient food production to feed the growing population. Interestingly, significant portion of the used arable land is for cash crop production and agriculture production of food crop is under taken by the aged. The

impact is importation of food stuff. Also the growing population may mount pressure on the available infrastructure and the entire economy systems compelling persistent borrowing to sustain and supplement it. Collier (1985) noted that population and the probability of default were negatively correlated. However, in the peculiar situation of SSA countries as explained above, population growth rate is expected to increase the probability of debt crisis occurrence.

The change in real income to GDP ratio is included to control for the level of development in the sample countries. This will also indirectly proxy for the expanded debt capacity of the countries. It will also account for changes to terms of trade which is an implicit measure of the transmission of external shocks to sovereign borrowers' economy (Easton and Rockerbie, 1999). Growth in real income to GDP ratio should be easing the liquidity constraint of the countries; consequently, the study expects changes in real income to GDP ratio to be a decreasing function of debt default. The change in the total debt service to GDP ratio is the debt burden indicator variable which should capture the debt burden situation of the countries. According to Drehmann and Juselius (2012, p21), "…interest payments and debt repayments divided by income, the DSR captures the burden imposed by debt more accurately than established leverage measures, such as the debt-to-GDP ratio". In line with several of the previous empirical studies such as Odedokun (1995), Ngassam (1991), and Feder and Just (1977), change in total debt service to GDP is expected to have an increasing probability of debt crisis occurrence.

Interest rate is included to capture the terms of borrowing. Interest rate is the cost (aside other processing costs) of borrowing and the benefit of lending. Typically, countries in SSA have higher interest rates domestically relative to rates being charged by the

international capital market, multilateral financial institutions, and foreign development partners. Having a higher rate relative to the international rate may lead to trade deficit which has to be financed by claims from the rest of the world. Over time with improper debt management, the consequent debt crisis creep in. Interest rate as well as domestic inflation are expected to be positively correlated with the likelihood of debt crisis occurrence.

To account for the effect of changing international competiveness of the countries under consideration, real effective exchange rate is included. The effective exchange rate is a measure of a country's international competitiveness in terms of its foreign exchange rates that might not be observed by examining only individual exchange rates between the country's currency and other currencies (United Nations Conference on Trade and Development (UNCTAD), 2015). Effective thus implies that exchange rate changes are not measured against one particular currency but instead an average index of a whole basket of currencies, each weighted according to the issuing countries' respective importance as a trade partner (UNCTAD, 2015). Therefore, including real effective exchange rate in the model takes account of the price level variations among trading partners and also track the evolution of each country’s aggregate international competiveness. Suppose a country’s nominal exchange rate is constant and its trading partners inflate more relative to the country, then the relative competiveness of the country increases which might translate to increase national income. Real effective exchange rate is expected to have a decreasing probability on debt crisis occurrence.

The expected signs and magnitudes of the debt accumulation effect as well as probabilistic impact of economic openness on debt crisis are the subject matter of this

research. The signs could be negative or positive depending on the impact of economic openness and we do not form an a priori expectation as we seek to determine these signs and magnitudes empirically.

3.3 Estimation Techniques

Since *Equation (9)* is dynamic, the strict exogeneity assumption restricts the use of OLS for estimation. It is also clear that the presence of lag dependent variable as an explanatory variable either introduce or magnifies the effects of endogeneity. Consequently, using OLS for *Equation (9)* will turn to produce biased estimations. In line with recent development in empirical estimations and to address the above outline estimation challenges, we use the GMM estimator proposed by Arellano and Bond (1991) which controls for simultaneity and reverse causation. As noted by Daumal M and S. Özyurt (2011), the GMM estimator controls quite well for omitted invariant variables and corrects for the potential endogeneity of some regressors by using instruments.

To motivate the derivation of the Arellano and Bond (1991) GMM estimator, *equation (8)* is reduced to a simple autoregressive model with no regressors. The derivation of the estimator will follow Baltagi (2008) summary of the Arellano and Bond (1991) study.

$$ED_{it} = \theta_1 ED_{i,t-1} + \varepsilon_{it} \tag{14}$$

Where $|\theta_1| < 1$ and $\varepsilon_{it} = \mu_i + \nu_{it}$. Assume a random sample of N countries for T periods so that we have $ED_{i1}, ED_{i2}, \dots, ED_{iT}$. μ_i are the individual country fixed effect while ν_{it} are the time variant effect. The ν_{it} are assumed to exhibit finite moments such

that $E(\nu_{it}) = E(\nu_{it}\nu_{is}) = 0$ for $t \neq s$. In other words, assume the absence of serial correlation but not necessarily independent over time.

From equation (14), the difference equation below can be formed. This help eliminates the individual effects (μ_i).

$$ED_{it} - ED_{i,t-1} = \theta_1(ED_{i,t-1} - ED_{i,t-2}) + (\nu_{it} - \nu_{i,t-1}) \quad (15)$$

In equation (15) above, $(\nu_{it} - \nu_{i,t-1})$ is MA (1) with unit root. For instance, suppose $t = 3$, then equation (13) become;

$$ED_{i3} - ED_{i2} = \theta_1(ED_{i2} - ED_{i1}) + (\nu_{i3} - \nu_{i2})$$

and ED_{i1} becomes a valid instrument as it is highly correlated with $(ED_{i2} - ED_{i1})$ and exogenous with respect to $(\nu_{i3} - \nu_{i2})$ provided the ν_{it} are not serially correlated. For $t = 4$, equation (15) will be equal to

$$ED_{i4} - ED_{i3} = \theta_1(ED_{i3} - ED_{i2}) + (\nu_{i4} - \nu_{i3})$$

In this case, ED_{i2} and ED_{i1} are valid instruments for $(ED_{i3} - ED_{i2})$ since both ED_{i2} and ED_{i1} are not correlated with $(\nu_{i4} - \nu_{i3})$ as long as ν_{it} are not serially correlated. Proceeding in this manner and for T periods, the set of valid instruments will be $\left(ED_{i1}, ED_{i2}, ED_{i3}, \dots, ED_{i,T-2}\right)$.

The instrumental variable approach still does not account for the difference error term in equation (15). The variance- covariance matrix of this error term is

$$E(\Delta\nu_i \Delta\nu_i') = \sigma_v^2(I_N \otimes G) \quad (16)$$

Where $\Delta\nu_i' = \left(\nu_{i3} - \nu_{i2},\ \nu_{i4} - \nu_{i3},\ \nu_{i5} - \nu_{i4}, \dots,\ \nu_{iT} - \nu_{i,T-1}\right)$ and

$$G = \begin{pmatrix} 2 & -1 & 0 & \cdots & 0 & 0 \\ -1 & 2 & -1 & \cdots & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & 0 & \cdots & 2 & -1 \\ 0 & 0 & 0 & \cdots & -1 & 2 \end{pmatrix} \text{ is a } (T-2) \times (T-2).$$

Let M_i be the matrix of instruments for country i. Then matrix of instruments for N countries will be $M = [M_1', M_2', M_3', \ldots, M_N']'$. Since the instruments are orthogonal to the error term by construction, the moment condition is $E(M_i' \Delta v_i) = 0$.

If equation (15) is written in vector form and pre-multiple it by M', equation 15 below is obtained

$$M'\Delta ED = M'(\Delta ED_{-1})\theta_1 + M'\Delta v \tag{17}$$

To obtain the Arellano and bond (1991) one-step consistent estimator, perform GLS on equation (17).

$$\hat{\theta}_1 = [(\Delta ED_{-1})'M(M'(I_N \otimes G)M)^{-1}M'(\Delta ED_{-1})]^{-1}[(\Delta ED_{-1})'M(M'(I_N \otimes G)M)^{-1}M'(\Delta ED)] \tag{18}$$

When $M'(I_N \otimes G)M = \sum_{i=1}^{N} M_i' G M_i$ is replaced with $V_N = \sum_{i=1}^{N} M_i'(\Delta v_i)(\Delta v_i)' M_i$, the optimal GMM estimator for $N \to \infty$ and T fixed is obtained (Hansen, 1982). To operationalized this estimator, the residuals from the one-step estimation in equation (18) above is substituted for the differenced residuals (Δv). The resulting estimator is the two-step Arellano and Bond (1991) GMM estimator[6];

$$\hat{\theta}_{12} = \left[(\Delta ED_{-1})'M\left(\hat{V}_N\right)^{-1}M'(\Delta ED_{-1})\right]^{-1}\left[(\Delta ED_{-1})'M\left(\hat{V}_N\right)^{-1}M'(\Delta ED)\right] \tag{19}$$

[6] Provided v_{it} are $IID\ (0, \sigma_v^2)$, $\hat{\theta}_1$ and $\hat{\theta}_{1\,2}$ are asymptotically equivalent.

Now return to the simple autoregressive model in equation (14) and extend it by adding the exogenous variables x_{it} and assume that these regressors are all correlated with μ_i . Then the form of the optimal matrix of instruments will depend on whether x_{it} are strictly exogenous or predetermined. The entire preceding derivation of the Arellano and Bond (1991) estimator remains the same except that an adjustment to the principal diagonal of the matrix of instruments based on whether x_{it} are exogenous or predetermined is needed. This can be achieved by adding all of the strictly exogenous variables as instruments to each of the diagonal element of M_i. That is for those explanatory variables where $E(x_{it}\nu_{is}) = 0$ for all t and $s = 1, 2, 3, \dots, T$, the set of valid instruments added to each of the diagonal element of the matrix of instruments is $[x'_{i1}, x'_{i2}, x'_{i3}, \dots, x'_{iT}]$. For the predetermined variables that is $E(x_{it}\nu_{is}) \neq 0$ for $s < t$ and zero otherwise, $\left[x'_{i1}, x'_{i2}, x'_{i3}, \dots, x'_{i,(s-1)}\right]$ are included as additional instruments to diagonal element of M_i. As commonly the case in practice, this study however has a combination of both strictly exogenous and predetermined rather the extreme cases above. In any case, equation (17) will be modified as presented below;

$$M'\Delta ED = M'(\Delta ED_{-1})\theta_1 + M'(\Delta X)\beta + M'\Delta\nu \tag{20}$$

Where ΔX is a stacked $N(T-2) \times K$ matrix of observations on Δx_{it}.

Lastly, the one-step and two-step estimators of (θ_1, β') is given by

$$\begin{pmatrix}\hat{\theta}_1 \\ \hat{\beta}\end{pmatrix} = \left[(\Delta ED_{-1}\Delta X)'M\left(\hat{V}_N\right)^{-1}M'(\Delta ED_{-1}\Delta X)\right]^{-1}\left[(\Delta ED_{-1}\Delta X)'M\left(\hat{V}_N\right)^{-1}M'(\Delta ED)\right] \tag{21}$$

In equation (9), except population growth rate and the *trend* variable, all the other explanatory variables are deemed to be predetermined. Population growth rate and *trend*

are assumed to be strictly exogenous. To assess the exogeneity and validity of the set of instruments, we will conduct the Sargan and Hansen test of over identifying restrictions. We will also assess the assumption of no autocorrelation with the AR (2) test.

We now turn our attention to *equation (12)*. In estimating *equation (12)*, the Linear Probability Model (LPM) is simple to estimate. A LPM is a special case of binomial regression model and involve regressing a discrete dependent variable on a set of explanatory variables. The LPM have two obvious and significant drawbacks that makes it inappropriate in this circumstance. The first is the lack of guarantee that the fitted probabilities will be bounded between 0 and 1 (inclusive) as required by probability theorems. They could be less than zero or greater than one. Secondly, the marginal effect of any explanatory variable is constant. That is

$$\frac{\partial P(DC_{it}=1|X_{it})}{\partial X_{it}} = \theta \quad \text{for } \forall\, i = 1, 2, 3, \ldots., N \tag{22}$$

To overcome these challenges of the LPM, econometricians recommend the imposition of a cumulative distribution function (cdf) on *equation (12).* A cdf is any "function that gives the probability of a random variable being less than or equal to any specified real number" (Wooldridge, 2013 pp. 846). This imposition of the cdf will ensure that the fitted probabilities range from 0 to 1 as required by probability theorems. Also since cdf is nonlinear, the marginal effect is no longer constant. That is

$P(DC_{it} = 1|X_{it}) = G(\alpha_0 + X'_{it}\theta) + \varepsilon_{it}$ Where $G = cdf$ such that $0 < G(y) < 1$ for any real number y and

$$\frac{\partial P(DC_{it}=1|X_{it})}{\partial X_{it}} = \frac{\partial G(.)}{\partial X_{it}}\theta = [g(\alpha_0 + X'_{it}\theta) + \varepsilon_{it}]\theta \tag{23}$$

for all X_{it}. It is assumed that X_{it} is continuously differentiable, at least once. $g(.)$ is the probability density function (pdf). That is $g(x)$ is a function giving probabilities for different values of the random variable X. The marginal effect in equation (23) above can be computed in two ways; the first options is to compute the marginal effect at the means of all the predictors (denote as *MEM*). The second option is to compute the marginal effect as the average of the marginal effects for every observation (denote as *AME*). That is the *MEM* and *AME* for the ith continuous variable is given below by equations (24) and (25) respectively;

$$MEM_i = \theta_i g(\theta \bar{\boldsymbol{x}}) \tag{24}$$

Where $\bar{\boldsymbol{x}}$ is the vector containing the means of all the explanatory variables.

$$AME_i = \theta_i \frac{1}{n} \sum_{k=1}^{n} g(\theta x^k) \tag{25}$$

Where θx^k denotes the value of the linear combination of parameters and explanatory variables for the k^{th} observation. According to Greene (2003), the MEM and AME are asymptotically equal in large samples provided the functions are continuous with continuous first derivatives and the data is well behaved so that the law of large numbers apply. Unless otherwise needed for comparative analysis, all marginal effects in this study will be computed at the means of the explanatory variables.

The two most famous binary response models in this regard are the Logit and the Probit models. In the Logit model, $G(y)$ is a logistic function such that

$$G(y) = \frac{e^y}{1+e^y}$$

In a Probit model, $G(y)$ is a standard normal cumulative distribution function (cdf) generally defined as

$G(y) = \Phi(y) \equiv \int_{-\infty}^{y} \varphi(v)\, dv$ where $\varphi(v)$ is a standard normal density function expressed as

$$\varphi(y) = (2\pi)^{\frac{-1}{2}} e^{\frac{-y^2}{2}}$$

Both the logit and probit models measure the relationship between a categorical dependent variable and one or more independent variables by estimating probabilities of the successful occurrence of an event. The categorical variable may be binary or ordinal. The logit model however assumes a logistic function while the probit assumes a standard normal cumulative distribution function. Due to the normality assumption embedded in the exponential function of the probit model, economic researchers turn to favour the probit model. However, following the likes of Feder et al (1981), Callier (1985) and Ngassam (1991), we will use the logit model in its estimations. Probit model estimates will be reported only when comparative analysis of the logit and probit estimates are required for emphasis. Also "for estimating limited dependent variable models, maximum likelihood methods are indispensable" (Wooldridge 2013, pp587). Therefore, we will use the maximum likelihood estimation (MLE) of the logit model. According to Wooldridge (2013), this will automatically account for any heteroscedasticity.

In deriving the MLE, suppose N observations for all the variables. To obtain the maximum likelihood estimator, conditional on the explanatory variables, the density of DC_{it} given X_{it} is used. This can be written as the probability of observing any outcome. That is

$$L(DC_{it}|\boldsymbol{X_{it}};\boldsymbol{\theta}) = [G(\boldsymbol{X_{it}'\theta})]^{\boldsymbol{DC_{it}}}[1 - G(\boldsymbol{X_{it}'\theta})]^{\boldsymbol{1-DC_{it}}} \text{ for all } DC_{it} = 0, 1 \quad (26)$$

Where $\boldsymbol{X_{it}}$ is a vector and for simplicity, the intercept is absorbed into it. Equation (26) above is the likelihood function. To obtain a log-likelihood function for country i at time t, take log of the likelihood function above;

$$l_{it}(\boldsymbol{\theta}) = DC_{it} \log[G(\boldsymbol{X_{it}'\theta})] + (1 - DC_{it}) \log[1 - G(\boldsymbol{X_{it}'\theta})] \quad (27)$$

Since $G(.)$ is increasing, convex and strictly bounded between zero and one for probit and logit, $l_{it}(\boldsymbol{\theta})$ is well behaved for all values of $\boldsymbol{\theta}$. The log-likelihood function for the N observations for T times is given as;

$$l(\theta) = \sum_{i=1}^{N}\sum_{t=1}^{T} DC_{it} \log[G(\boldsymbol{X_{it}'\theta})] + \sum_{i=1}^{N}\sum_{t=1}^{T}(1 - DC_{it}) \log[1 - G(\boldsymbol{X_{it}'\theta})]$$
$$= \sum_{i=1}^{N}\sum_{t=1}^{T} l_{it}(\boldsymbol{\theta}) \quad (28)$$

Maximizing equation (28) with respect to θ, the maximum likelihood estimator of either the probit or logit is obtained. That is taking the first partial derivative of (28) with respect to θ and equate to zero (first order condition) will result in equation (29) below;

$$\frac{\partial l(\theta)}{\partial \theta} = \sum_{i=1}^{N}\sum_{t=1}^{T}\left[\frac{DC_{it}.g(\boldsymbol{X_{it}'\theta})}{G(\boldsymbol{X_{it}'\theta})} + \frac{(1-DC_{it}).(-g(\boldsymbol{X_{it}'\theta}))}{1-G(\boldsymbol{X_{it}'\theta})}\right]\boldsymbol{X_{it}} = 0 \quad (29)$$

Where the pdf ($g(.)$) is the partial derivative of the $G(.)$. In equation (29) above, if the value of θ is solved for, that will be the maximum likelihood estimator ($\hat{\theta}$). If $G(.)$ is the standard normal cdf, then $\hat{\theta}$ is the *probit estimator* while for $G(.)$ defined as the standard logit cdf, $\hat{\theta}$ is characterized as the *logit estimator*. $\hat{\theta}$ is consistent, asymptotically normal and asymptotically efficient if the distributional assumptions hold (Wooldridge 2013). $\hat{\theta}$ will enable us quantify the propensity of country i to be in debt crisis at time t for any of

the explanatory variables given the other explanatory variables. In estimating equation (12), we will first estimate a basic model involving only the contemporaneous effects of all the explanatory variables (equation (11)). This will make our estimation results comparable to most of the previous studies that do not capture any lag effect. This notwithstanding, our concentration will be the augmented model (equation (12)) which include both contemporaneous and appropriate lags of the variables.

3.4 Data Description and Measurement

The empirical analysis of this thesis will be carried out using panel datasets for the period 1980 to 2013 that comprises of 46 countries of Sub-Saharan Africa (SSA). The complete list of countries is presented in **Appendix A** (*Table A1*).

We measure economic openness as the proportion of volume of trade on GDP, where volume of trade is the sum of imports and exports at time t for country i. Quite recently, Squalli and Wilson (2006) argued that the above measure of economic openness only captures the intensity of trade and therefore do not include the full benefits and cost of economic openness. They constructed an index of openness which encompasses both the trade intensity and the relative importance of a country's world trade intensity. This composite trade intensity index (*CTI*) will be used as alternative measure of openness. The index is computed as

$$CTI_i = \frac{n(X+M)_i^2}{GPD_i \sum_{j=1}^{n}(X+M)_j} \tag{30}$$

Where $j = \{1, 2, \dots, n\}$ and $i \epsilon j$. j is the set of countries, X = Exports, M= imports and $\sum_{j=1}^{n}(X + M)_j$= total world trade. To smoothen the index and reduce heteroscedasticity in its pattern, we use the natural logarithm of the CTI $(lnCTI)$. To further assess the robustness of the estimation results, economic openness is also measured with net Foreign Direct Investment flow (*FDIF*) and the Stock of Foreign Direct Investment *(FDIS*). Data for FDI is obtained from the United Nations Conference on Trade and Development (UNCTAD). Data for GDP, imports, and exports are obtained from the United Nations Statistics Division.

Gross capital formation is used to proxy Investment. The Data for gross capital formation is obtained from UNCTAD. The gross capital formation figures are weighted by GDP to obtain the investment share of GDP. Real income (real GNI) data are from the United Nations Statistics Division. We calculate the annual change of this variable and divide it by GDP to obtain the change in real GNI share of GDP. Population data is from the World Development Indicators (WDI) of the World Bank. Total population according to the WDI is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship except for refugees not permanently settled in the country of asylum. Such refugees are generally considered part of the population of their country of origin. WDI uses midyear estimates.

We use a modified version of the definition of debt crisis by De Paoli et al (2009). Consequently, we define debt crisis as the occurrence of actual default or rescheduling of debt. Actual default is recognized when arrears on principal obligation toward external private creditors is greater than 15 percent of total commercial debt outstanding or the arrears on interest of external obligation is greater than 5 percent of total commercial debt

outstanding. Our choice of definition is based on striking a balance at the attempts made so far at defining debt crisis and the need to be less conservative with predefined thresholds. Debt crisis defined as above will be denoted by $DC1_{it}$. As shown earlier by the composition of external debt in SSA (see Table 1.1), nearly 75% of total external debt are debt owed to Official creditors. We thus verify the stability of our estimation results by defining debt crisis conditioned on the debt owed to Official creditors. That is debt crisis is defined as the occurrence of actual default or rescheduling of debt. Where actual default is recognized when arrears on principal obligation toward Official creditors is greater than 15 percent of total outstanding Official Creditors' debt or the arrears on interest of external obligation is greater than 5 percent of total outstanding Official Creditors' debt. This definition of debt crisis will be represented by $DC2_{it}$.

Using $DC1_{it}$, we present in **Appendix B** (*Table B1,* column 2) the number of rescheduling and (or) actual default episodes in all the selected countries for the entire sample period. The average occurrence of rescheduling or actual default episodes is approximately 27 out of a maximum of 34. This indicates high incidence of rescheduling or actual default in SSA countries. The average number of rescheduling is about 14 (*Table B1,* column 1) and there exist some countries that have never recorded any rescheduling of debt but have recorded significant number of actual defaults. This confirms that using rescheduling do not capture all debt stress episodes. In **Appendix B** (*Table B1,* column 3), we also present for each country the number of debt crisis episodes using $DC2_{it}$ definition. The average number of years in which the sample countries have experienced debt crisis as captured by the $DC2_{it}$ definition is approximately about 20 years.

Debt statistics and data are from the World Bank's WDI. Debt is defined to be public and publicly guaranteed total external debt stock (*EDPPG*). Public and publicly guaranteed debt comprises long-term external obligations of public debtors, including the national government, political subdivisions and autonomous public bodies and external obligations of private debtors that are guaranteed for repayment by a public entity. Long-term external debt is defined as debt that has an original maturity term of more than one year and that is owed to nonresidents by residents of an economy and repayable in currency, goods, or services. For test of robustness of the results, we will use an alternative definition of external debt; total external debt stock (*EDT*). According to WDI, total external debt is debt owed to nonresidents repayable in foreign currency, goods, or services. It is measured as the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity term of at most one year and interest in arrears on long-term debt. Total external debt services are defined as the sum of interest payment and principal repayment. The data for this variable is obtained from the World Bank's WDI. Total debt service is calculated as the sum of actual interest payment and principal repayment and the annual change in this variable as a fraction of GDP is used.

Data for inflation is from the World Bank's world Development Indicators. Our preferred measure of inflation is the annual growth rate of the GDP implicit deflator as this definition of inflation captures the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. Data for real interest rate is from the World Bank's WDI.

Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. Data for the real effective exchange rate is from the European think tank specialized in economics; Bruegel. This data set comprise of real effective exchange rate constructed for 178 countries using 67 trading partners(REER67) and 172 trading partners (REER172). The Bruegel REER67 and REER172 are CPI-based REER. For the group of countries and time period under consideration, the REER67 is more convenient due to its completeness in terms of country and years covered.

CHAPTER FOUR

4.1 Estimations and Econometric Results

Chapter three specified and discussed the model to be used to assess the relationship between economic openness and the probability of debt crisis. The chapter also specified and discussed a model for examining the buildup of external debt as well as the data for the econometric estimation. In this current chapter, we present and discuss the estimation results for these models. This will be done in two parts. The first part presents and discusses the GMM results for the relationship between external debt and economic openness. The relevant model for the first part of this chapter is equation (9) of chapter three. The Arellano and Bond test for second order autocorrelation (AR (2)), the Sargan test as well as the Hansen test for over-identifying restrictions are reported and analyzed. Results for alternative definitions of external debt are reported and compared.

In the second part of this chapter, results of the log-likelihood function specified in equation (28) of chapter three are used to estimate the marginal effect of economic openness on the probability of debt crisis occurrence. Using the Hosmer-Lemeshow (H-L) test and the Receiver- Operating Curve (ROC), the fit and predictive abilities of the models are respectively assessed. Results for alternative definitions of debt crisis and economic openness are also presented and compared. This help us assess the robustness of our estimation results and the conclusions thereof.

4.2 Economic openness and External Debt

Estimation results of the relationship between economic openness and external debt accumulation are reported and discussed in this section. Table 4.1 presents the GMM regression estimates and the relevant robust t-statistics (absolute values) in parentheses with external debt ($EDPPG$) as the dependent variable. As stated earlier, public and publicly guaranteed external debt ($EDPPG$) comprises long-term external obligations of public debtors, including the national government, political subdivisions and autonomous public bodies and external obligations of private debtors that are guaranteed for repayment by a public entity. The table also report both the Sargan and Hansen test of over-identifying restrictions. These tests assess the validity and efficiency of the GMM estimator. They individually test the validity of the set of instrumental variables with the assumption of no correlation between the instruments and the residuals. In other words, the instrument exogeneity condition is verified by both the Sargan and Hansen test. The null hypothesis of the tests claim that the instruments as a group are exogenous. With p-values of 0.934 and 0.536 respectively for the Sargan and Hansen test, we fail to reject the null hypothesis under each test. Therefore, the set of instruments are valid and the parameter estimates are robust. Table 4.1 also reported the AR (2) test for autocorrelation. Applied to the difference residuals, the AR (2) test null hypothesis claims no autocorrelation. Thus a high p-value is desirable. With a p-value of 0.435, we fail to reject the null. Therefore, we accept the assertion of no autocorrelation in the model.

The coefficient of the dynamic component of our estimation is less than one, positive, and statistically significant at 1% significance level. That is there exist positive

Table 4.1: Openness (measured by volume of trade) and Public and publicly guaranteed External Debt accumulation in SSA (1980-2013).

	Dependent Variable; External Debt PPG ($EDPPG_{it}$)
Variables	GMM Estimates
$EDPPG_{t-1}$	0.946***
	(23.68)
$TRADE$	0.289*
	(1.994)
$TRADE_{t-2}$	-0.346**
	(2.412)
$TRADE^{*}trend$	-0.00183
	(0.922)
INV	0.248
	(1.233)
INV_{t-2}	-0.239*
	(1.854)
CY	0.0284
	(0.183)
CY_{t-2}	-0.0675**
	(2.166)
$REER$	-0.00378
	(0.514)
$REER_{t-2}$	0.0130
	(1.170)
$POPGR$	3.078
	(1.597)
$POPGR^{*}trend$	-0.238*
	(1.936)
$CTDS1$	-1.290
	(1.023)
$CTDS1_{t-2}$	0.0568
	(0.756)
RIR	0.0497
	(0.975)
INF	0.00358
	(0.707)
$trend$	0.549*
	(1.738)
AR(2) test, p-level	0.435
Sargan test, p-level	0.934
Hansen test, P-level	0.536

***Note 1**: Absolute Robust t-statistics in parentheses*

***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

and significant correlation between the lag of public and publicly guaranteed total external debt ($EDPPG_{t-1}$) and current year's level of external debt ($EDPPG_t$). This confirms our claim of significant feedback from previous years in determining current debt level. With an average debt maturity of about 27 years for Official loans and approximately 4years for Private creditors loans to SSA countries, prior years' loans will contribute to current debt level both in terms of outstanding principal and interest. We estimate that for every 1 percentage point increase in prior years' debt level, current debt will increase by 0.946 percentage points.

The contemporaneous effect of economic openness ($TRADE$) as measured by the volume of trade to GDP $\left(\frac{X+M}{GDP}\right)$ is positively correlated with the amount of public and publicly guaranteed external debt ($EDPPG$). The parameter estimate is statistically significant at 10% significance level. A 1 percentage point increase in $TRADE$ is estimated to have a contemporaneous effect of 0.289% points increase in $EDPPG$. In most SSA countries, increasing the volume of trade in the short run may be attributed to the increased importation relative to export which translate to bigger trade and current account deficit. The worsening deficit position may be contained in the short run by borrowing from the rest of the world. Hence the increase in debt associated with the initial years of $TRADE$ in SSA.

However, the two-year lag of openness ($TRADE_{t-2}$) and the trend of openness over time ($TRADE^{*}trend$) both confirms that openness in the long run will be debt decreasing. It is estimated that a 1% point increase in $TRADE$ two years ago will decrease current period $EDPPG$ by 0.346% points. This estimate is significant at 5%. Quite interestingly,

the debt accumulation effect in the initial year of openness appeared to have been reversed in the second year of openness. That is the magnitude of the two-year lag is greater than the magnitude of the contemporaneous effect (0.346% points compared with 0.289% points) and they are opposite in signs. Though the interaction of openness and time is not statistically significant, it nonetheless suggests that in the long run, SSA countries may have imported enough technology and other raw materials to develop their export sectors and possibly become net exporters as well as increasing their revenue generating abilities. With possible increase in foreign earrings, SSA countries may borrow less leading to slower external debt accumulation. This is the argument advanced by Brock (1984) and Laird and Nogues (1988). This notwithstanding, the magnitude of the estimate (0.0183% points) as well as the lack of statistical significance of $TRADE^{*}trend$ may indicate that the debt reduction benefits of trade in SSA will in the long run even out.

It is estimated that a 1% point increase in investment share of GDP (INV) will generate 0.248% points increase in $EDPPG$. This estimate is however not statistically significant. However, a 1% point increase in the two-year lag of investment share of GDP (INV_{t-2}) will lead to 0.239% points decrease in $EDPPG$. This estimate is statistically significant at 10% significance level. Our results suggest that SSA countries source external loans to increase investments which initially leads to external debt accumulation. With time and as those investments begin to pay off through increasing GDP directly, creating employment and the other trickle down effects, the liquidity constraint is softened. This may then translate into less external borrowing.

The contemporaneous effect of economic development in SSA is to increase the amount of external debt. That is a 1% point increase in real income is associated with

0.0284% points increase in external debt. This estimate is however not statistically significant. However, a 1% point increase in real income two years ago turn to decrease external debt by 0.0675% points. Unlike the contemporaneous effect, this estimate is statistically significant at 5% significance level. It is also noted that the magnitude of the estimate for the lag effect is larger than the contemporaneous effect. This suggest that economic growth and development is not a quick fix for the debt problem in SSA; it is part of the comprehensive and long term solutions to the debt problem. In reducing the level of external debt, SSA countries will require sustained growth and development. All things being equal, with growth and development translating into increasing income, SSA countries may be self-sustaining thereby borrowing less from the rest of the world.

Appreciation of the local currency against the basket of foreign currencies is negatively correlated with $EDPPG$ while the two- year appreciation of the local currency is external debt accumulating. That is a 1% point increase in real effective exchange rate ($REER$) will generate 0.00378% points decrease in debt level, but a 1% point increase in real effective exchange rate a two years ago ($REER_{t-2}$) will result in 0.013% points increase in debt $EDPPG$. Both estimates are however not statistically significant. That notwithstanding, the result indicate that appreciation of the local currency appreciation has a temporal effect of reducing external debt. However, with inelastic supply of exports and high taste and preference for imported commodities, appreciation turn to be external debt accumulating with time. Appreciation of the local currency is thus not so beneficial to import dependent economies of SSA countries.

The contemporaneous effect of population ($POPGR$) is estimated to be positively associated with the level external debt. A 1% point increase in the growth of population

will result in a 3.078% points increase in the level of debt measured by $EDPPG$. This estimate is however not statistically significant. Population growth coupled with high unemployment in SSA countries turn to increase the dependency ratio. The pressure of population growth and its attendance effects on infrastructure and government expenditure may have translated into increased external borrowing. High population growth in excess of productivity growth may lead to sustain production deficit which may be catered for through imports. This channel also leads to increase external borrowing.

We also examine the impact of population growth over time in SSA. We estimate the interaction effect of population growth ($POPGR$) and $trend$ (time in years). The $POPGR^{*}trend$ estimate is significant at 10% level and negatively correlated with $EDPPG$. It is estimated that a 1% point growth in population over time will turn to reduce external debt by 0.238% points. This pattern can be attributed to the demographic dividend argument. As observed by Mason and Lee (2012), population growth changes and demographic dynamics may benefit a country through the first and second demographic dividends. Mason and Lee (2012) noted that the first dividend is the increase in per capita economic growth due to changes in support ratio while the second dividend is derived from the shifting of resources previously devoted to supporting a larger dependent population. Such resources may be diverted to expenditures on developing physical and human capital for economic growth. The support ratio is the number of people age 15-64 per every person aged 65 and above. This ratio describes the burden placed on the working population by the non-working elderly population. The United Nations World Population Prospects (2015) reports that the opportunity for demographic dividend are enormous in many parts

of the developing world including Africa. The negative correlation of $POPGR^{*}trend$ and $EDPPG$ may suggest a gradual realization of this demographic dividend in SSA over time.

$EDPPG$ is decreasing in change in total debt services to GDP ratio ($CTDS1$). However, the two-year lag of total debt service ($CTDS1_{t-2}$) turns to be increasing function of debt. This empirical trend may be attributed to borrowing to service debt obligations. Domestic inflation (INF) is also estimated to be increasing the level of debt in SSA. As expected, increases in real interest rate (RIR) would lead to an increase in external debt. We estimated that a 1% points increase in real interest rate will result in 0.0497% points increase in $EDPPG$. $CTDS1$, $CTDS1_{t-2}$, INF, and RIR are however not statistically significant. Table 4.1 also reports a positive and statistically significant (at 10%) *trend* component. $trend$ in this study is time in years. All things being equal, in SSA if a countries lived from year 1 to year 2, its external debt will increase by 0.549% points.

Table 4.2 below presents the GMM estimates of the relationship between economic openness and public and publicly guaranteed external debt ($EDPPG$) using the stock of Foreign Direct Investment ($FDIS$) to proxy economic openness. As observed in table 4.2, the parameter estimate for the lagged public and publicly guaranteed external debt ($EDPPG_{t-1}$) is still positive and significant at 1% significance level. The estimate is also less than one as desired.

Similar to the results in table 4.1 above, the contemporaneous effect of economic openness measured by the stock of Foreign Direct Investment ($FDIS$) is positive and significant at 1% level of significance. Also the lag effect of $FDIS$ ($FDIS_{t-2}$) is debt decreasing. $FDIS_{t-2}$ is significant at 1%. With this variation in definition, it is estimated

Table 4.2: Openness (measured by FDIS) and Public and publicly guaranteed External Debt accumulation in SSA (1980-2013).

	Dependent Variable; External Debt PPG ($EDPPG_{it}$)
Variables	GMM Estimates
$EDPPG_{t-1}$	0.922***
	(20.97)
$FDIS$	0.311***
	(6.539)
$FDIS_{t-2}$	-0.370***
	(5.047)
$FDIS^{*}trend$	0.00323
	(1.300)
INV	0.493
	(1.169)
INV_{t-2}	-0.537
	(1.455)
CY	0.427**
	(2.611)
CY_{t-2}	0.109
	(0.533)
$REER$	-0.0193
	(0.875)
$REER_{t-2}$	0.00632
	(0.501)
$POPGR$	5.190**
	(2.553)
$POPGR^{*}trend$	-0.349***
	(2.800)
$CTDS1$	-0.110
	(1.624)
$CTDS1_{t-2}$	0.374***
	(2.974)
RIR	0.240
	(1.526)
INF	0.0303
	(0.846)
$trend$	0.149
	(0.496)
AR (2) test, p-level	0.758
Sargan test, p-level	0.519
Hansen test, P-level	0.383

***Note 1**: Absolute Robust t-statistics in parentheses*

***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

that a 1% point increase in openness ($FDIS$) in SSA will increase the debt level by 0.311% points. If the stock of FDI had increased by 1% points two years ago, current debt level will be 0.370% points lower. Net inflow of FDI and the stock of FDI are essentially external borrowing for investment. In the year of FDI entry, they will increase the external debt of the destination countries. With time and as the investments generate revenue and produce goods and services that may either substitute imports or promote exports, FDI will be debt decreasing as estimated.

Generally, in table 4.2, all the explanatory variables have the same direction of impact and have either maintain or increase their significance level when compared to the estimation results in table 4.1. For example, the contemporaneous effect of population growth change from non-significant to 5% significance level while the trend of population growth with time is now significant at the 1% significance level. Also worth noticing about table 4.2 is the increase in statistical significance of the change in actual payment of interest and principal two years ago. This estimate is statistically significant at 1% significance level as compared to not being significant at all in table 4.1.

Table 4.3 below presents the GMM results for the relationship between economic openness and external debt when economic openness is measured by the natural logarithm of the Squalli and Wilson (2006) Composite Trade Intensity index ($lnCTI$). Generally, the signs of the parameter estimates remain the same as when economic openness is measured by the proportion of volume of trade to GDP. The statistical significance of the parameter estimates for all the variables except $lnCTI$ remains fairly stables.

Table 4.3: Openness (measured by CTI index) and Public and publicly guaranteed External Debt accumulation in SSA (1980-2013).

	Dependent Variable: External Debt PPG ($EDPPG_{it}$)
Variables	GMM Estimates
$EDPPG_{t-1}$	0.935***
	(22.71)
$lnCTI$	20.11**
	(2.294)
$lnCTI_{t-2}$	-18.95**
	(2.328)
$lnCTI^{*}trend$	-0.129
	(1.103)
INV	0.212
	(0.734)
INV_{t-2}	-0.323
	(1.441)
CY	0.193
	(0.909)
CY_{t-2}	0.129
	(0.997)
$REER$	-0.0169
	(0.647)
$REER_{t-2}$	0.00902
	(0.886)
$POPGR$	7.558**
	(2.046)
$POPGR^{*}trend$	-0.544**
	(2.416)
$CTDS1$	-0.896
	(1.484)
$CTDS1_{t-2}$	-0.195
	(0.866)
RIR	0.0857
	(1.028)
INF	0.00961
	(0.971)
$trend$	0.270
	(0.662)
AR(2) test, p-level	0.715
Sargan test, p-level	0.114
Hansen test, P-level	0.345

***Note 1**: Absolute Robust t-statistics in parentheses*

***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

A quiet interesting and significant observation in table 4.3 is the magnitude of the parameter estimate for economic openness ($lnCTI$). A 1% point increase in economic openness measured by the natural log of the Composite Trade Intensity index ($lnCTI$) will generate 20.11% points increase in $EDPPG$. This estimate is significant at 5% significance level. Also a 1% point increase in openness two years ago ($lnCTI_{t-2}$) will result in a 18.95% points decrease in current $EDPPG$. As reported in table 4.1 and 4.2, when openness is measured by the volume of trade and the stock of FDI, a similar 1% point increase in openness generate increase in external debt of less than 1% points. According to Squalli and Wilson (2006), using volume of trade $\left(\frac{X+M}{GDP}\right)$and other alternatives (like $FDIS$) to measure openness are one-dimensional measures; focusing only on what proportion of a country's income is generated from international trade. In other words, openness measured by the volume of trade fail to take into account a country's openness to total world trade. In the view of Squalli and Wilson (2006), the volume of trade measure of openness biased downward the impact of economic openness on a country. The CTI therefore considers the proportion of a country's income from international trade as well as the importance of the country in total world trade. This may account for the significant difference in magnitudes between the $lnCTI$, $FDIS$ and $TRADE$ as reported in tables 4.3, 4.2 and 4.1 respectively.

Notwithstanding the difference in the magnitudes of the parameter estimates between $lnCTI$ and $TRADE$, the direction of the effect on external debt remains the same. Irrespective of whichever measure of economic openness is used, we found external debt to be an increasing function of openness initially and a decreasing function of openness in later years. This clearly substantiate the robustness of our results. Our findings also shed

light on the seemingly anomaly of concurrent high level of economic openness and external indebtedness. We found that in the short run, high level of economic openness would lead to increase level of external debt but in the long run economic openness should be debt reducing.

So far in this section, we have measured external debt by total public and publicly guaranteed external debt ($EDPPG$). In table 4.4 below, the results when external debt is measured by total external debt (EDT) are presented. EDT is the sum of public, publicly guaranteed, private nonguaranteed long-term debt, use of IMF credit and short-term debt. Basically EDT is more comprehensive in measuring the indebtedness of a country than $EDPPG$.

With this extended definition of external debt (EDT), the contemporaneous effect of a 1% point increase in economic openness as measured by the volume of trade to GDP ($TRADE$) is to increase EDT by 0.744% points (table 4.4 column 2). Also a 1% point increase in $TRADE$ two years ago ($TRADE_{t-2}$) is estimated to cause a 0.892% points decrease in current EDT level. The estimates for $TRADE$ and $TRADE_{t-2}$ are both statistically significant at 10% and 5% significance levels respectively. In general, the signs, statistical significance and the magnitudes of the estimates are fairly the same as has been observed when external debt is measured by $EDPPG$. Column 3 of table 4.4 presents the results when economic openness is measured by FDIS. The results are fairly similar to when measure openness by the volume of trade with either EDT or EDPPG as the dependent variable. This indicates that the impact of economic openness on external debt is stable and fairly robust to alternative definitions and measurements of economic openness and external debt.

Table 4.4: Openness (measured by volume of trade (TRADE) and FDIS) and Total External Debt accumulation in SSA (1980-2013).

	Dependent Variable: Total External Debt (EDT_{it})	
Variables	*TRADE*	*FDIS*
EDT_{t-1}	0.965***	0.909***
	(25.58)	(15.92)
$TRADE$	0.744*	-
	(1.938)	
$TRADE_{t-2}$	-0.892**	-
	(2.106)	
$TRADE^{*}trend$	-0.00156	-
	(0.215)	
$FDIS$	-	0.800***
		(6.849)
$FDIS_{t-2}$	-	-0.646***
		(6.370)
$FDIS^{*}trend$	-	-0.00241
		(0.395)
INV	0.555	0.820
	(1.124)	(1.176)
INV_{t-2}	-0.508*	-0.843
	(1.711)	(1.432)
CY	0.183	0.627
	(0.543)	(1.306)
CY_{t-2}	-0.124*	-0.257
	(1.786)	(0.760)
$REER$	-0.00255	-0.00325
	(0.205)	(0.0823)
$REER_{t-2}$	0.0117	-0.0131
	(0.656)	(0.492)
$POPGR$	6.080*	7.135**
	(1.856)	(2.357)
$POPGR^{*}trend$	-0.546***	-0.904*
	(4.498)	(1.854)
$CTDS1$	-2.301	-0.219*
	(1.283)	(1.805)
$CTDS1_{t-2}$	-0.311**	0.393
	(2.056)	(1.420)
RIR	0.0842	0.178
	(1.597)	(1.352)
INF	0.000136	0.000858
	(0.0370)	(0.0842)
$trend$	1.109*	1.306
	(1.847)	(1.370)
AR (2) test, p-level	0.962	0.218
Hansen test, P-level	0.618	0.674

4.3 Economic openness and probability of Debt Crisis

We have just determined that economic openness significantly affect the amount of external debt accumulated by SSA countries. We will now proceed to determine the extent to which economic openness affect the probability of debt crisis occurrence in SSA. In proceeding, we estimate equation (11) of chapter three. This model capture only the contemporaneous marginal effect of economic openness and all the other variables. The estimation results are presented in **Appendix C** (Table C1 and C2) and confirm the findings of previous empirical studies that the contemporaneous marginal effect of openness is negatively associated with the probability of debt crisis occurrence. Notable among these empirical studies include Callier (1985), Berg and Sachs (1988), McFadden et al (1985) and Odedokun (1995). Since our main aim is to assess the marginal effect of both the contemporaneous and lag effect of economic openness and the other control variables, we concentrate on equation (12) of chapter three. As noted by Wooldridge (2013) and Greene (2003), the coefficients of the logit and probit models do not have direct economic/statistical interpretation. The main objective of this study is to estimate and analyze the marginal effects (ME) of the independent variables on the probability of debt crisis occurrence. Hence we will concentrate on the marginal effects and report all corresponding direct coefficients of the logit and (or) probit models in ***Appendix C***. The estimation results for the marginal effect of economic openness on the probability of debt crisis occurrence are presented in table 4.5 below. We report comparative marginal effects calculated at the means of all predictors (*MEM*) and the average marginal effects (*AME*) in column two and three of table 4.5 respectively. The *MEM* is calculated using equation (24) while the *AME* is computed with equation (25). As noted in table 4.5, for every variable,

the *AME* overestimated the marginal effect by approximately 36%. As stated earlier in chapter three, this study uses the *MEM* in its analysis. Unless otherwise stated, all marginal effects are calculated at the means of the predictors. Table 4.5 also report the Hosmer-Lemeshow (H-L) test of the goodness of fit for our model. The null hypothesis of this test claims that there is evidence of lack of fit of the model. The p-value of 0.7432 implies that we reject the null hypothesis. We thus conclude that our model exhibit significantly good fit.

The contemporaneous marginal effect of economic openness is positively associated with the probability of debt crisis occurrence while the five-year lag effect is negatively related with the probability of the debt crisis occurrence. Economic openness is measured as the sum of imports and exports as a fraction of GDP ($TRADE$). Debt crisis ($DC1$) is defined as the occurrence of actual default or rescheduling of debt. Actual default is recognized when arrears on principal obligation toward external private creditors is greater than 15 percent of total commercial debt outstanding or the arrears on interest of external obligation is greater than 5 percent of total commercial debt outstanding. The contemporaneous marginal effect of $TRADE$ is not statistically significant while the five-year lag effect is statistically significant at 5% significance level. We estimate that the contemporaneous marginal effect of openness is to increase the probability of debt crisis occurrence by 0.0204 while a 1% point increase in openness five year ago will decrease the probability of debt crisis in current period by 0.110. In other words, SSA countries experience increased risk of debt crisis in the initial years of openness but will have decreasing probability of debt crisis for 1% increase in openness in later period. This pattern is consistent with our observation in the previous section where external debt is an

Table 4.5: Economic openness and Debt Crisis in SSA (1980-2013); MEM and AME for DC1

	Dependent Variable: Debt crisis (DC1*it*)	
	MLE; Logit Marginal Effects	
Variables	MEM	AME
TRADE	0.0204	0.0278
	(0.441)	(0.441)
$TRADE_{t-5}$	-0.110**	-0.150***
	(2.522)	(2.635)
INV	-0.281***	-0.384***
	(2.719)	(2.838)
INV_{t-5}	0.0466	0.0637
	(0.765)	(0.774)
CY	-0.0255	-0.0349
	(0.350)	(0.351)
CY_{t-5}	-0.158*	-0.215*
	(1.773)	(1.741)
CTDS1	-0.0622	-0.0849
	(0.530)	(0.531)
$CTDS1_{t-5}$	0.0317	0.0432
	(0.251)	(0.251)
POPGR	0.0278***	0.0379***
	(2.811)	(3.166)
$POPGR_{t-5}$	0.0213***	0.0290***
	(2.861)	(2.961)
REER	-0.0480*	-0.0655*
	(1.681)	(1.665)
REER	0.0631**	0.0862**
	(2.309)	(2.311)
INF	0.295***	0.402***
	(4.533)	(3.605)
RIR	0.602***	0.822***
	(5.463)	(4.898)
trend	0.00270**	0.00368**
	(2.408)	(2.539)
H-L test; P-Value	0.7432	0.7432
Observations	849	849

***Note 1**: Absolute Robust t-statistics in parentheses*

***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

increasing function of openness initially and a decreasing function of openness with the passage of time. Most SSA countries in their initial years of opening up their economies experience increased imports relative to exports. They thus experience significant current account deficits and an increase in borrowing from the rest of world in the years following openness. In subsequent years, though high proportions of the increased imports are finished goods for direct consumption, there are also importations of technology and raw materials for industrial production. These will turn to boost the export sector and the revenue generating abilities of SSA countries. With the foreign earnings generated from exports, external obligations can be serviced thus reducing the probability of reschedule or default of external debt. This is the argument advanced by Brock (1984) and Laird and Nogues (1988).

The estimated contemporaneous marginal effect (ME) for investment share of GDP (INV) has a decreasing probability of debt crisis occurrence. The estimated ME is statistically significant at 1% significance level. The decreasing probability of debt crisis occurrence associated with the contemporaneous marginal effect of investment share of GDP is consistent with the findings of Callier (1985). Odedokun (1995) also finds negative correlation between investment and probability of debt rescheduling. The direction of the impact of increasing investment share of GDP on probability of debt crisis is supported by economic theory. Increase in investment will increase national income directly. It will also have an indirect multiplier effect through increase employment and increase in government tax revenue. All things being equal, the total effect of increasing investment will lead to increase in national income and a consequent increase in national liquidity. External debt obligations can then be met with increase income and liquidity.

The marginal effect of the five- year lag of investment (INV_{t-5}) however has an unexpected positive sign. That is if INV_{t-5} increase by 1% point, the probability of debt crisis occurrence will increase by 0.0466. This estimate is also not statistically significant. This notwithstanding, the sign reversal may be indicative of the realization effect. Investments may be appraised to have a positive net present value but due poor management, corruption and abandonment of these projects when there is a change in government, the investments eventually turn to be non performing. Consequently, loans with which these investments were undertaken may be defaulted as they are not generating enough revenue to service the interest and principal repayment. Hence the increased risk of debt crisis occurrence associated with investment after five years.

The marginal effect of the contemporaneous change in income (CY) which is our proxy for level of development negative and not statistically significant. However, the marginal effect of the five-year lag of a change in income (CY_{t-5}) is statistically significant at 10% significance level. It is estimated that a 1% point increase in the level of income five years ago is associated 0.158 decrease in the probability of debt crisis occurrence. Though the marginal effects of both CY and CYt_{t-5} are decreasing the probability of debt crisis occurrence, the impact of the marginal effect of CY_{t-5} is quantitatively larger than that of CY (-0.0255 compared to -0.158). This could substantiate the claim that SSA countries requires consistent growth and development as one of the means to address the persistent debt problem in the region. Change in total debt service ($CTDS1$) is defined as the change in actual payment of interest and principal repayment. The contemporaneous marginal effect of $CTDS1$ decrease the probability of debt crisis albeit not statistically significant. Interestingly, the five-year lag of change in total debt service ($CTDS1_{t-5}$)

increase the likelihood of debt crisis in SSA. That is a 1% point increase in the actual payment of interest and principal five year ago increase the probability of debt crisis in current period by 0.0317. This estimate is also not statistically significant. A possible reason for this observed pattern could be that the increase in payment of actual debt services in prior years were undertaken with borrowed funds. The average grace period of new external Official debt commitments to SSA countries is approximately 7years while that of private debt commitments to SSA is about 2years. The average grace period of new external loans (both Official and Private debt) in SSA is about 5years[7]. This implies that if SSA countries borrowed to service debt obligations, the new loans obligations will increase the risk of debt crisis after about 5 years. Hence the observed pattern.

The contemporaneous marginal impact of population growth ($POPGR$) on the probability of debt crisis occurrence is estimated to be positive. The estimated marginal effect is statistically significant at 1% significance level. When population growth in SSA increase by 1% point, the probability of debt crisis increase by 0.0278 . The United Nations World Population Prospects (2015) reports Africa to be the fastest growing major area, growing at a rate of 2.55% annually from $2010 - 2015$. High population growth will increase the total number of people who must be supported on limited resources base (Lee and Mason, 2013). It will also increase the incidence of rural urban migration and a consequent pressure on available urban infrastructure. Population growth will thus lead to an increase in government expenditure. In the case of SSA countries where there is high unemployment coupled with high population growth, the cumulative effect will be increase in the budget deficit. Financing of the persistent deficits may lead to sustained external

[7] Calculated using data from the World Bank's World Development Indicators(WDI)

borrowing and the accumulation of debt as noted in the previous section. The accumulation of external debt debt over time may translate into increase probability of debt crisis occurrence. The ME of the five-year lag of population growth ($POPGR_{t-5}$) is probability increasing and statistically significant at 1%.

Table 4.5 above also reported the contemporaneous marginal effect of real effective exchange rate ($REER$) and its five-year lag effect ($REER_{t-5}$). As noted earlier, $REER$ is defined as the foreign price of a unit of local currency. A unit increase in $REER$ is thus an appreciation of the local currency against the basket of foreign currencies. In other words, $REER$ is a measure of the international competitiveness of SSA countries relative to their trading partners. Increasing the international competitiveness of SSA countries decreases the probability of debt crisis occurrence as expected. The parameter estimate is significant at 10% significance level. However, $REER_{t-5}$ is increasing the likelihood of debt crisis and more statistically significant than the contemporaneous effect (5%). It is also observed that the absolute value of the marginal effect for $REER_{t-5}$ is larger than the absolute magnitude of the contemporaneous marginal effect ($REER$). That is a 1% appreciation of the local currencies of SSA countries will generate a marginal effect of -0.048 for $REER$ and 0.0631 for $REER_{t-5}$. This suggest that a sustained appreciation of the local currency relative to the foreign currency will in the long run lead to debt accumulation and subsequent debt crisis. As already noted in the previous section, appreciation may be good for exporting economies but not import dependent economies of SSA.

The estimated marginal effect of domestic inflation (INF) on the probability of debt crisis is positive as expected and significant at 1% significance level. We estimate that a 1% point increase in domestic inflation (as measured by the GDP deflator) will increase

the probability of debt crisis by 0.295. This estimate is however slightly lower in magnitude than Ngassam (1991) estimated range of 0.472 to 0.6106 increase in probability associated with increase in domestic inflation for SSA countries. High inflation indicates economic instability and rising cost of living. With average inflation of 49.82% from 1980 to 2013 for SSA countries, public sector workers' unions demand wages and salaries increase citing the rising cost of living. The high inflation and the consequent cost of living concerns have led to high public sector wage bill for SSA countries. According to OECD Economic Surveys (2013), much of the increase in government expenditure in South Africa came through increases in public sector wage bill. The increase in the wage bill translate into increase fiscal deficit which may compel external borrowing. As noted by Osinubi et al (2006), government borrowing to finance budget deficit has led to high external debt in Africa.

A 100 basis points increase in the real interest rate (RIR) increase the probability of debt crisis occurrence by 0.602. This estimate is statistically significant at 1% significance level. The sign of the RIR is consistent with this study's a priori expectation and economic theory. Increase in interest rate implies that domestic borrowing may become expensive relative to foreign borrowing. Also the increase in the interest rate will lead to an increase in net inflow of capital from the rest of the world if we assume that the increase has caused domestic interest rates to be higher than international credit market rate. The cumulative effects will be an increase in external borrowing. All things being equal, an increase in the interest rate is also an increase in the interest liabilities of the relevant countries. With already high level of debt in SSA and the limitedness of resources, such increases will increase the chances of rescheduling and (or) defaulting of debt service

obligations. According to Mistry (1991), high positive real interest rates in the 1980s compounded the African debt servicing problem and led to accumulated debt burden. It is also found that there is a statistically significant positive $trend$ effect albeit its magnitude is quite insignificant. $trend$ is time in years. Holding all things constant, the passage of time increases the likelihood of debt crisis. That is holding debt from year 1 to year 2 increases the probability of debt crisis by 0.0027.

In table 4.6 below, comparative marginal effects are reported for different definitions of debt crisis. As stated earlier in chapter three, debt crisis can be defined as the occurrence of actual default or rescheduling of debt. Actual default can be when principal arrears exceed 15% of total commercial debt outstanding or interest arrears are more than 5% of total commercial debt outstanding. When actual default is quantified as above, we denote debt crisis by $DC1$. An alternative definition of actual default is when principal arrears as a proportion of total outstanding Official debt exceed 15% or interest accrued is greater than 5% of total outstanding Official creditors' debt. When this alternative definition is used, debt crisis is denoted by $DC2$. Table 4.6 column 2 reports marginal effects for $DC1$ while column 3 presents the corresponding marginal effects for $DC2$. As observed in table 4.6, generally, for every explanatory variable, the sign of the marginal effects under $DC1$ and $DC2$ are the same. Also the statistical significance of the parameter estimates remain stable across these alternative definitions of debt crisis. The magnitudes of the marginal effects under $DC2$ are slightly larger (in absolute terms) than their counterparts for $DC1$. To assess the superiority of the model under $DC1$ and $DC2$, we use the Receiver-Operating Curve (ROC). The ROC graphs the sensitivity (on the vertical axis) versus one minus the specificity (on the horizontal axis) for each model. Sensitivity

Table 4.6: Openness (measured by volume of trade) and alternative definitions of Debt Crisis (DC1 and DC2) in SSA (1980-2013); logit regression Marginal Effects.

	Dependent Variable: Debt Crisis (DC1*it*, DC2*it*)	
	MLE: Logit Marginal Effects	
Variables	DC1	DC2
TRADE	0.0278	0.0649
	(0.441)	(0.698)
$TRADE_{t-5}$	-0.150***	-0.185**
	(2.635)	(2.145)
INV	-0.384***	-0.957***
	(2.838)	(4.796)
INV_{t-5}	0.0637	0.342***
	(0.774)	(2.712)
CY	-0.0349	-0.0510
	(0.351)	(0.422)
CY_{t-5}	-0.215*	-0.351**
	(1.741)	(2.329)
CTDS1	-0.0849	-
	(0.531)	
$CTDS1_{t-5}$	0.0432	-
	(0.251)	
CTDS2	-	-0.0329
		(0.147)
$CTDS2_{t-5}$	-	0.457
		(1.462)
POPGR	0.0379***	0.0776***
	(3.166)	(3.784)
$POPGR_{t-5}$	0.0290***	0.00455
	(2.961)	(0.237)
REER	-0.0655*	-0.128***
	(1.665)	(2.822)
$REER_{t-5}$	0.0862**	0.0180
	(2.311)	(1.292)
INF	0.402***	0.583***
	(3.605)	(4.319)
RIR	0.822***	0.853***
	(4.898)	(3.976)
trend	0.00368**	0.00460**
	(2.539)	(2.520)
Observations	849	849

***Note 1**: Absolute Robust t-statistics in parentheses*

***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

is the fraction of observed positive outcome cases that are correctly classified while specificity is the fraction of observed negative outcome cases that are correctly classified. One minus specificity is the proportion of observations misclassified as positive outcomes. The ROCs for $DC1$ and $DC2$ are presented in *figure 4.1* and *4.2* below;

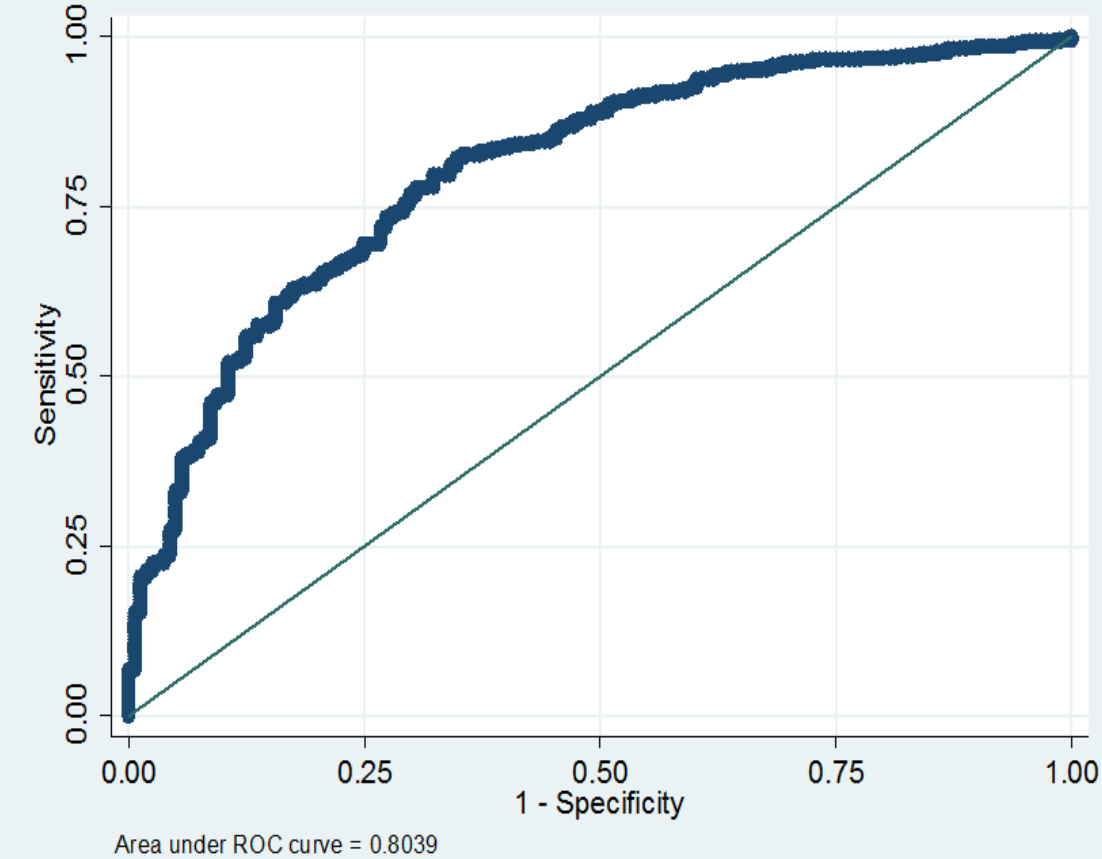

Figure 4.1: ROC for model with DC1

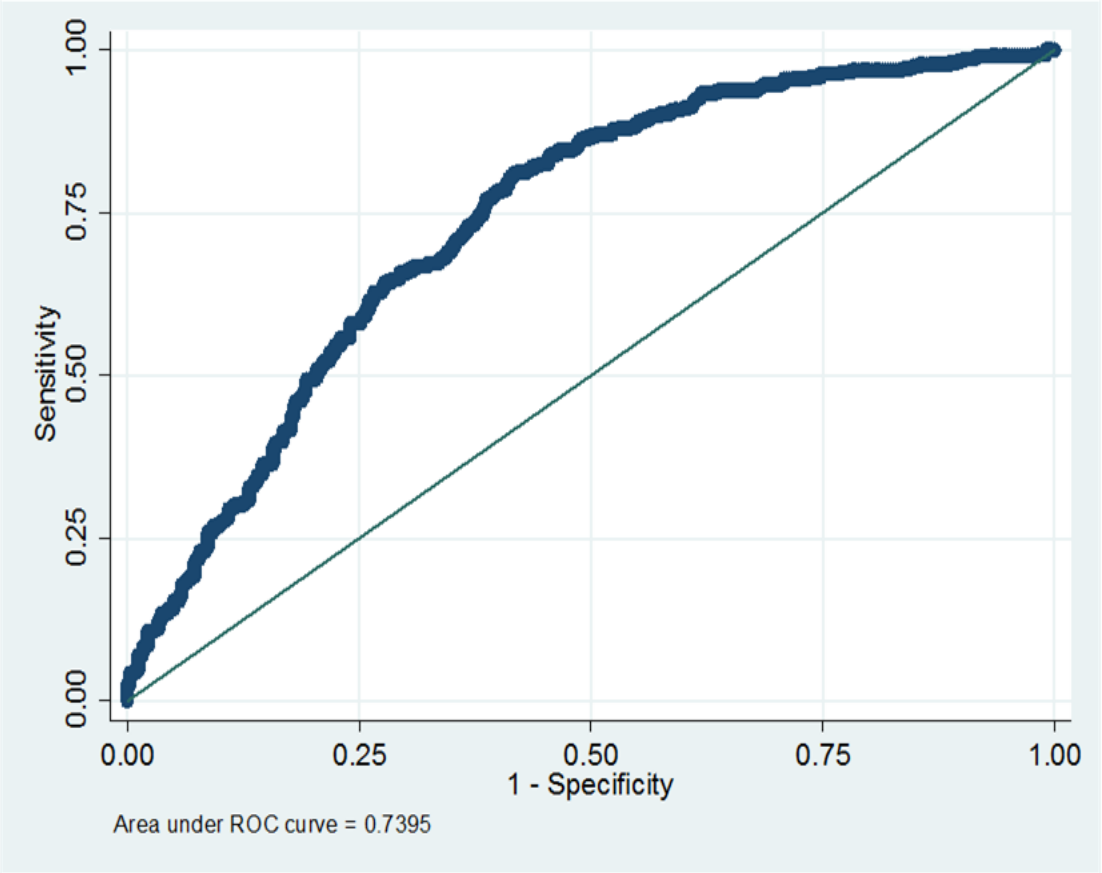

Figure 4.2; ROC for model with DC2

A model with no predictive power will be on the 45^0 line. The greater the predictive power, the more bowed the curve and the larger the area under the curve. Therefore, the area under the curve is usually used as a measure of the predictive power of the model (Peng and So, 2002). A model with no predictive abilities (a random model) has an area of 0.5 and a perfect model has an area of 1. As shown by the *figure 4.1* and *4.2* above, the area under the curve for the model with $DC1$ is 0.8039 while that of $DC2$ is 0.7395. Using either the model with $DC1$ or $DC2$ gives a fairly good predictive ability but that of $DC1$ is obviously better.

In table 4.7 below, the marginal effects of $DC1$ occurrence using alternative measures of openness as standard in the literature are reported. In column 2 of table 4.7, economic openness is measured by the Stock of Foreign Direct Investment ($FDIS$) in an economy. Column 3 uses Net Inflow of Foreign Direct Investment ($FDIF$) to proxy economic openness. Similar to using the volume of trade to GDP ($TRADE$) as a measure of openness, the contemporaneous marginal effects for both $FDIS$ and $FDIF$ are positively correlated with the probability of debt crisis occurrence. Unlike $TRADE$, the contemporaneous marginal effects both $FDIS$ and $FDIF$ are statistically significant at 1% significance level. A 1% point increase in the *FDIS* will increase the probability of debt crisis occurrence by 0.231 while a corresponding 1% increase in $FDIF$ increase the probability of debt crisis occurrence by 0.799. The net inflow of FDI to SSA countries is essentially borrowing from the rest of the world. Thus increasing the net inflow essentially increase external debt and therefore increasing the risk of debt crisis occurrence. If FDIs are presumed to be long term investment as is usually the case, then increasing the stock and net inflow of FDI will certainly be debt accumulating without a corresponding immediate returns to service the increased debt in the short term. Hence the increased likelihood of actual default or rescheduling of debt obligations associated with both $FDIS$ and $FDIF$ at the level.

As shown in column 2 of table 4.7 below, the marginal effect of increasing the stock of FDI five year ago ($FDIS_{t-5}$) is negatively correlated with the probability of debt crisis. In other words, for every 1% increase in the stock of FDI five years ago, the probability of debt crisis occurrence (associated with that increase in the current period) decrease by 0.129. This estimate is significant at 1% significance level. The negative marginal effect of $FDIS_{t-5}$ may be attributed to the potential for FDI to crowd out imports if they

Table 4.7: Openness (measured by FDIS and FDIF) and Debt Crisis (DC1) in SSA (1980-2013); logit regression marginal effects.

	Dependent Variable; Debt Crisis (DC1*it*)	
	MLE: Logit Marginal Effects	
Variables	FDIS	FDIF
FDIS	0.231***	-
	(3.912)	
$FDIS_{t-5}$	-0.129***	-
	(3.292)	
FDIF	-	0.799***
		(4.110)
$FDIF_{t-5}$	-	0.394**
		(2.189)
INV	-0.406***	-0.427***
	(4.143)	(4.408)
INV_{t-5}	-0.00891	0.0122
	(0.152)	(0.213)
CY	0.0265	-0.0137
	(0.430)	(0.224)
CY_{t-5}	-0.105	-0.117
	(1.316)	(1.573)
CTDS1	-0.340**	-0.0216
	(2.015)	(0.130)
$CTDS1_{t-5}$	-0.148	-0.0249
	(0.573)	(0.0451)
POPGR	0.0352***	0.0313***
	(3.362)	(3.327)
$POPGR_{t-5}$	0.0275***	0.0232***
	(3.747)	(3.418)
REER	-0.0502**	-0.0474**
	(1.974)	(2.019)
$REER_{t-5}$	0.0325	0.0435**
	(1.610)	(2.010)
INF	0.307***	0.309***
	(5.175)	(5.497)
RIR	0.632***	0.603***
	(6.005)	(5.948)
trend	-0.000664	-0.000818
	(0.683)	(0.936)
Observations	827	849

***Note 1**: Absolute Robust t-statistics in parentheses*
***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

are imports substituting FDI. Also, export promoting FDI may boost the foreign exchange earnings capabilities of the destination countries which may reduce the likelihood of debt crisis. FDI may also increase employment with multiplier effect on national income. The long run and cumulative effect could be an increase in national income and liquidity with which external debt obligations can be met. This empirical observation of the contemporaneous FDIS increasing the risk of debt crisis occurrence while its five-year lag tends to be debt crisis reducing is significant for SSA countries. It confirms that FDIS is part of the long term solutions to the debt problem SSA and not a short term fix.

With the exception of the trend component, table 4.7 also confirms that the signs and statistical significance of the marginal effects are stable irrespective of whether economic openness is measured by the volume of trade as a fraction of GDP ($TRADE$), Stock of Foreign Direct Investment ($FDIS$) or Net inflow of Foreign Direct Investment ($FDIF$). The area under the ROC of $DC1$ with $OPEN$, $FDIF$ and $FDIS$ are virtually the same. They are $0.8039, 0.8056$ and 0.8036 respectively for $TRADE$, $FDIF$ and $FDIS$.

Measuring economic openness by $FDIS$, the signs and statistical significance of the marginal effects under alternative definitions of debt crisis remains the same. This suggest that the results are fairly robust to variations in the definition of economic openness and debt crisis. Table 4.8 below reports the marginal effects when openness is measured with $FDIS$ under $DC1$ and $DC2$. Therefore, irrespective of the measure of economic openness and the definition of debt crisis used, we found the contemporaneous effect of economic openness to increase external debt and effectively translate into increase in probability of debt crisis occurrence. The persistence effect of economic openness is however external debt reducing as well as decreasing in probability of debt crisis occurrence.

Table 4.8: Openness (Measured by FDIS) and alternative definitions of Debt Crisis (measured by DC1 and DC2) in SSA (1980-2013); logit regression Marginal effects.

	Dependent Variables: Debt Crisis (DC1 and DC2)	
	MLE; Logit Marginal Effects	
Variables	DC1	DC2
FDIS	0.231***	0.687***
	(3.912)	(5.415)
$FDIS_{t-5}$	-0.129***	-0.307***
	(3.292)	(3.204)
INV	-0.406***	-1.442***
	(4.143)	(6.120)
INV_{t-5}	-0.00891	0.334**
	(0.152)	(2.148)
CY	0.0265	0.0396
	(0.430)	(0.301)
CY_{t-5}	-0.105	-0.314*
	(1.316)	(1.897)
CTDS1	-0.340**	-0.269
	(2.015)	(0.314)
$CTDS1_{t-5}$	-0.148	-0.817
	(0.573)	(1.613)
POPGR	0.0352***	0.0989***
	(3.362)	(4.409)
$POPGR_{t-5}$	0.0275***	0.0175
	(3.747)	(0.848)
REER	-0.0502**	-0.176***
	(1.974)	(3.589)
$REER_{t-5}$	0.0325	0.0184
	(1.610)	(1.236)
INF	0.307***	0.648***
	(5.175)	(4.511)
RIR	0.632***	0.930***
	(6.005)	(3.855)
trend	-0.000664	-0.00194
	(0.683)	(0.948)
Observations	827	827

***Note 1**: Absolute Robust t-statistics in parentheses*

***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

CHAPTER FIVE

5.1 Summary and Conclusion

Economic openness has been recognized to be growth enhancing since the work of Smith (1776). Apart from the welfare gains associated with having variety of goods and services to choose from, empirical investigations have shown that openness leads to technology transfer, increase in income and ultimately accelerate economic growth and development. These and other benefits of openness have propelled many sub regions including Sub-Saharan Africa (SSA) to pursuit policies that engender more economic openness. Partly due to outward orientation policies, SSA has recorded a fairly high level of economic openness over the period 1980 to 2013 with an average openness of more 65% of GDP and a period average increase of approximately 25% from 1980 to 2013. Over the same period, SSA has witness rapid growth and a consequent high level of external indebtedness even with many external policy interventions such as High Indebted Poor Country (HIPC) Initiative. The average external debt as a percentage of GNI for SSA countries from 1980 to 2013 is approximately 82%.

With high degree and pace of economic openness and a concurrent high level of indebtedness, some researchers have argued that the debt problem facing SSA countries may essentially be a trade problem (Fole, 2003). This thesis has assessed the external debt accumulation effect of economic openness as well as determine marginal effect of economic openness on the probability of debt crisis occurrence in SSA countries. For robustness check we investigated the occurrence of debt crisis in developing countries using a multidimensional definition of debt crisis.

We estimated the external debt accumulation effect of economic openness in a dynamic external debt model for which we present the following salient findings. We noted a strong feedback in the buildup of external debt where prior years' external debt contributed significantly in the determination of current period external debt. our GMM estimation also reveals that economic openness in SSA initially increase the level of external debt but become debt reducing in later years. We estimated that public and publicly guaranteed external debt (EDPPG) will increase by 0.289% points for every 1% point increase in openness while a 1% point increase in openness two years ago will result in a 0.346% points decrease in current level of EDPPG. The interaction of openness with trend (time in years) is also negatively correlated with the level of external debt. We also observed that this empirical trend is stable across alternative measures of openness such as Stock of Foreign Direct Investment (FDIS) and the Squalli and Wilson (2006) composite Trade Intensity (CTI) index. However, the latter do have a significantly larger magnitude than any of the other openness measure that we have used. The effect of openness on external debt in SSA is also robust to changes in the definition of external debt. The direction of the impact of economic openness on external debt buildup is the same irrespective of whether we define external as public and publicly guaranteed or as broadly as total external debt.

We also found the level of development in SSA to initially increase the level of external debt while over time, economic development turns to mostly be associated with decreasing the external debt stock of these countries. This suggest that in the short run SSA countries rely on external borrowing to finance trade, developmental projects and economic growth. In the long run however, economic growth and development is

anticipated to be self-sustaining as well as translating into reduced external borrowing. The impact of population growth has been observed to increase the external debt while the interaction of population growth with time is external debt reducing. The positive association between population growth and external debt accumulation is indicative of the many challenges of high population growth rate in SSA. However, this high population growth rate also comes with enormous opportunity for demographic dividend as observed by the World Population Prospects (2015). We observed the change in actual payment of interest and principal repayment are not significant in reducing the level of external debt. This is quite compelling to conclude that SSA countries borrow to service external obligations.

We further assessed the effective translation of the external debt accumulation effect of economic openness into probability of debt crisis occurrence and made some interesting empirical observations from our estimation results. Consistent with the estimated external debt accumulation effect of economic openness, we observed that the immediate marginal effect of economic openness on the probability of debt crisis occurrence is positive irrespective of the measure of economic openness that we used. We also found prior years' level of economic openness to be a decreasing function of the probability of debt crisis occurrence.

Investment in SSA is observed to initially increase the probability of debt crisis occurrence while the persistence effect of investment is decreasing the risk of debt crisis occurrence. The marginal effect of current level of development as well as previous years' level of development in SSA are both negatively correlated with the likelihood of debt crisis occurrence. We also found that the marginal effect of change in total debt services is

initially negative but experience a sign reversal for its lag effect. This empirical trend we noted may be due to borrowing to service external obligations.

Population growth, rate of domestic inflation and real interest rate are estimated to be positively correlated with the probability of debt crisis occurrence in SSA. We noted that the estimated marginal effects as summarized above are mostly statistically significant and robust to alternative measurement of economic openness. Our estimates are also quite stable with respect to changes in the definition of debt crisis. Using the Receiver Operating Curve (ROC), our model exhibits reasonable good predictive abilities. The area under the curve; which is the conventional measure of the predictive power of the model is as high as 0.8039 out of a perfect area of 1.

5.2 Policy Recommendations

The outcome of our empirical investigation suggest that economic openness is positively correlated with the likelihood of debt crisis occurrence in the short run but negatively correlated with the probability of debt crisis occurrence in the long run. Therefore, economic openness is not necessarily the problem of the African debt quagmire as well as not a panacea of the vicious debt trap of Africa. SSA countries should embrace openness to international trade without compromising traditional sources of increasing real income per capita. They should also pursuit prudent economic management policies that minimizes the impact of shock from inflation, interest rates and exchange rate on external debt and more importantly the economy as a whole.

Policies that harness the high potential demographic dividend of the region will be beneficial in reducing the short and long run level of external debt. Such policies should be geared toward developing the economy to absorb changes in the support ratio. More generally, any such policies should create employment opportunities as well as aid the country to gradually transition from large social intervention expenditure. Government will also be required and should be committed to channeling resources previously committed to supporting a large dependent population to economic development if any such change in the demographic structure occur. In the long run, such policies should lead to an effective realization of the so called demographic dividend.

SSA countries should channels investment into sectors of the economy and projects with significant short and long run net positive returns. Our empirical results confirm that investment share of GDP increases external debt in the short run while in the medium to long run, investment tend to insignificantly decrease the probability of debt crisis as well as the level of external debt. Investing in viable projects and making investment play a significant role in reducing debt will also generate other trickling down effects including but not limited to sustain revenue generating abilities, reducing unemployment and ultimately increase economics growth and development.

REFERENCES

Adam, Smith. *An Inquiry into the Nature and Causes of the Wealth of Nations*. 5 ed, *Edwin Cannan's Annotated Edition*. London: Methuen & Co., Ltd. Library of Economics and Liberty, 1776.

Afonso, Óscar. "The Impact of International Trade on Economic Growth." *NBER Working Paper* 106 (2001).

Arellano, Manuel, and Stephen Bond. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *The review of economic studies* 58, no. 2 (1991): 277-97.

Ashra, Sunil. "Inflation and Openness: A Study of Selected Developing Economies." *Indian Council for Research on International Economic Relations. Working Paper*, no. 84 (2002).

Bahaj, Saleem A. "Systemic Sovereign Risk: Macroeconomic Implications in the Euro Area ": London School of Economics and Political Science, LSE Library, (2014).

Baltagi, Badi. *Econometric Analysis of Panel Data*. Vol. 1: John Wiley & Sons, 2008.

Biersteker, Thomas J. *Dealing with Debt: International Financial Negotiations and Adjustment Bargaining*: Westview Press, Oxford, 1993.

Borensztein, Eduardo, and Ugo Panizza. "The Costs of Sovereign Default." *IMF Staff Papers* 56, no. 4 (2009): 683-741.

Boschen, John, and Charles Weise. "What Starts Inflation: Evidence from the Oecd Countries." *Journal of Money, Credit, and Banking* 35, no. 3 (2003): 323-49.

Bowdler, Christopher, and Adeel Malik. "Openness and Inflation Volatility: Panel Data Evidence." *University of Oxford. Working paper* (2005).

Brock, William. "Trade and Debt: The Vital Linkage." *Foreign Affairs* 62, no. 5 (1984): 1037-57.

Callier, Philippe. "Further Results on Countries' Debt-Servicing Performance: The Relevance of Structural Factors." *Weltwirtschaftliches Archiv* 121, no. 1 (1985): 105-15.

Checherita-Westphal, Cristina, and Philipp Rother. "The Impact of Government Debt on Growth: An Empirical Investigation for the Euro Area." *Revue économique* (2011): 1015-29.

Chenery, Hollis, and Alan Strout. "Foreign Assistance and Economic Development." *The American Economic Review* 56, no. 4 (1966): 679-733.

Danso, Alex. "The Causes and Impact of the African Debt Crisis." *The Review of Black Political Economy* 19, no. 1 (1990): 5-21.

Daumal, Marie, and Selin Özyurt. "The Impact of International Trade Flows on Economic Growth in Brazilian States." *Review of Economics and Institutions* 2, no. 1 (2010): 1-25.

De Paoli, Bianca, Glenn Hoggarth, and Victoria Saporta. "Output Costs of Sovereign Crises: Some Empirical Estimates ": Bank of England, 2009.

Detragiache, Enrica, and Antonio Spilimbergo. "Crises and Liquidity; Evidence and Interpretation." International Monetary Fund, 2001.

Dollar, David, and Aart Kraay. "Trade, Growth, and Poverty." *The Economic Journal* 114, no. 493 (2004): F22-F49.

Drehmann, Mathias, and Mikael Juselius. "Do Debt Service Costs Affect Macroeconomic and Financial Stability?" *BIS Quarterly Review September* (2012).

Easton, Stephen T, and Duane W Rockerbie. "What's in a Default? Lending to Ldcs in the Face of Default Risk." *Journal of Development Economics* 58, no. 2 (1999): 319-32.

Feder, Gershon, and Richard Just. "A Study of Debt Servicing Capacity Applying Logit Analysis." *Journal of Development Economics* 4, no. 1 (1977): 25-38.

Feder, Gershon, Richard Just, and Knud Ross. "Projecting Debt Servicing Capacity of Developing Countries." *Journal of Financial and Quantitative Analysis* 16, no. 5 (1981): 651-69.

Fole, Alemayehu Geda. *Finance and Trade in Africa: Macroeconomic Response in the World Economy Context*: Palgrave Macmillan, 2002.

———. "The Historical Origin of African Debt Crisis." *Eastern Africa Social Science Research Review* 19, no. 1 (2003): 59-89.

Frank, Charles, and William Cline. "Measurement of Debt Servicing Capacity: An Application of Discriminant Analysis." *Journal of International Economics* 1, no. 3 (1971): 327-44.

Frankel, Jeffrey, and David Romer. "Does Trade Cause Growth?" *American economic review* (1999): 379-99.

Frankel, Jeffrey, David Romer, and Teresa Cyrus. "Trade and Growth in East Asian Countries: Cause and Effect?" *National Bureau of Economic Research* No. 5732 (1996).

Furceri, Davide, and Aleksandra Zdzienicka. "How Costly Are Debt Crises?" *Journal of International Money and Finance* 31, no. 4 (2012): 726-42.

Gelos, Gaston, Ratna Sahay, and Guido Sandleris. "Sovereign Borrowing by Developing Countries: What Determines Market Access?" *Journal of international Economics* 83, no. 2 (2011): 243-54.

Greene, Joshua. "The External Debt Problem of Sub-Saharan Africa." *Staff Papers (International Monetary Fund)* 36, no. 4 (1989): 836-74.

Greene, Joshua, and Mohsin S Khan. *The African Debt Crisis*: Initiatives Publishers, 1990.

Greene, William. "Testing Hypotheses About Interaction Terms in Nonlinear Models." *Economics Letters* 107, no. 2 (2010): 291-96.

Greene, William H. *Econometric Analysis*. 5th ed: Prentice Hall International , London, 2003.

Greenidge, Kevin, Roland Craigwell, Chrystol Thomas, and Lisa Drakes. "Threshold Effects of Sovereign Debt: Evidence from the Caribbean." *International Research Journal of Finance And Economics*, no. 107 (2013): 61.

Hajivassiliou, Vassilis. "Do the Secondary Markets Believe in Life after Debt?" In *Dealing with the Debt Crisis*, 276, 1989.

Hajivassiliou, Vassilis A. "A Simulation Estimation Analysis of the External Debt Crises of Developing Countries." *Journal of applied econometrics* 9, no. 2 (1994): 109-31.

Hanif, Muhammad, and Irem Batool. "Openness and Inflation: A Case Study of Pakistan." *Pakistan Business Review* 7, no. 4 (2006).

Hansen, Lars Peter. "Large Sample Properties of Generalized Method of Moments Estimators." *Econometrica: Journal of the Econometric Society* (1982): 1029-54.

Harrison, Ann. "Openness and Growth: A Time-Series, Cross-Country Analysis for Developing Countries." *Journal of Development Economics* 48, no. 2 (1996): 419-47.

Heller, Robert, and Emanuel Frenkel. "Determinants of Ldc Indebtedness." *Columbia Journal of World Business* 17, no. 1 (1982).

Ikejiaku, Brian-Vincent. "Africa Debt Crisis and the Imf with a Case of Nigeria: Towards Theoretical Explanations." *Journal of Politics and Law* 1, no. 4 (2008): 2.

International Monetary Fund. "Regional Economic Outlook: Sub-Saharan Africa; Navigating Headwinds, in World Economic and Financial Surveys." In *International Monetary Fund*, 0258-7440: International Monetary Fund,, 2015.

Iyoha, Milton Ame. "Inflation and" Openness" in Less Developed Economies: A Cross-Country Analysis." *Economic Development and Cultural Change* 22, no. 1 (1973): 31-38.

Laird, Sam, and Julio Nogues. "Trade Policies and the Debt Crisis, World Bank Working Paper Wps 99." The World Bank, 1988.

Lane, Philip R. "Inflation in Open Economies." *Journal of International Economics* 42, no. 3 (1997): 327-47.

Lee, Jungsoo. "The External Debt-Servicing Capacity of Asian Developing Countries." *Asian Development Review* 1, no. 2 (1983): 66-82.

Lee, Ronald, and Andrew Mason. "Population Change and Economic Growth in Africa." *National Transfer Accounts Bulletin*, no. 6 (2013).

Lekomola, Maleshoane. "The African Debt Dilemma: An Overview of Magnitude, Causes, Effects and Policy Options." *Journal of American Science* 6, no. 3 (2010): 63-69.

Long, Millard. "External Debt and the Trade Imperative in Latin America." In *Export Diversification and the New Protectionism: The Experience of Latin America*, 280-302: Bureau of Economic and Business Research, University of Illinois at Urbana-Champaign, 1981.

Mason, Andrew, and Ronald Lee. "Demographic Dividends and Aging in Lowerincome Countries." National Transfer Accounts Working Paper. Honolulu: East-West Center, 2012.

McFadden, Daniel, Richard Eckaus, Gershon Feder, Vassilis Hajivassiliou, and Stephen O'Connell. "Is There Life after Debt? An Econometric Analysis of the Creditworthiness of Developing Countries." *International debt and the developing countries* (1985): 179-209.

Melitz, Marc. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71, no. 6 (2003): 1695-725.

Mistry, Percy. "African Debt Revisited: Procrastination or Progress?" *African Development Review* 3, no. 2 (1991): 99-148.

Moody's Investors Service Special Comment. "Sovereign Bond Defaults, Rating Transitions, and Recoveries (1985-2002)." 2-53, 2003.

Ngassam, Christopher. "Factors Affecting the External Debt-Servicing Capacity of African Nations: An Empirical Investigation." *Review of Black Political Economy* 20, no. 2 (1991): 45-64.

Odedokun, Matthew. "Analysis of Probability of External Debt Rescheduling in Sub-Saharan Africa." *Scottish Journal of Political Economy* 42, no. 1 (1995): 82-98.

OECD. "Oecd Economic Surveys: South Africa 2013." *OECD Publishing* (2013).

Onimode, Bade. *The Imf, the World Bank and the African Debt*. Vol. 2: Zed books London, 1989.

———. *A Political Economy of the African Crisis*: Zed Books with the Institute for African Alternatives London, NJ, 1988.

Osinubi, Tokunbo Simbowale, Risikat Oladoyin S Dauda, and Oladele Emmanuel Olaleru. "Budget Deficits, External Debt and Economic Growth in Nigeria." *The Singapore Economic Review* 55, no. 03 (2010): 491-521.

Payer, Cheryl. *The Debt Trap: The Imf and the Third World*: Penguin Books Ltd, Middlesex, 1974.

Peng, Chao-Ying Joanne, and Tak-Shing Harry So. "Logistic Regression Analysis and Reporting: A Primer." *Understanding Statistics: Statistical Issues in Psychology, Education, and the Social Sciences* 1, no. 1 (2002): 31-70.

Rahnama-Moghadam, Mashalah, Hedayeh Samavati, and Lawrence J. Haber. "The Determinants of Debt Rescheduling: The Case of Latin America." *Southern Economic Journal* 58, no. 2 (1991): 510-17.

Reinhart, Carmen, and Kenneth Rogoff. "Growth in a Time of Debt." *American Economic Review* 100, no. 2 (2010): 573 - 78.

Richmond, Christine, and Daniel Dias. "Duration of Capital Market Exclusion: Stylized Facts and Determining Factors." *Department of Economics, University of California, Los Angeles* (2008).

Rogoff, Kenneth. "Can International Monetary Policy Cooperation Be Counterproductive?" *Journal of International Economics* 18, no. 3-4 (1985): 199-217.

Rogoff, Kenneth, and Maurice Obstfeld. *Foundations of International Macroeconomics*. Cambridge, Massachusetts: MIT Press, 1996.

Romer, David. "Openness and Inflation: Theory and Evidence." *Quarterly Journal of Economics* 108, no. 4 (1993): 869-903.

Romer, David. *Advanced Macroeconomic* 4ed: Mcgraw-hill, 1996.

Rose, Andrew. "One Reason Countries Pay Their Debts: Renegotiation and International Trade." *Journal of development economics* 77, no. 1 (2005): 189-206.

Sachs, Jeffrey. *Theoretical Issues in International Borrowing*: International Finance Section, Department of Economics, Princeton University Princeton, 1984.

Sachsida, Adolfo, Francisco Galrão Carneiro, and Paulo Loureiro. "Does Greater Trade Openness Reduce Inflation? Further Evidence Using Panel Data Techniques." *Economics Letters* 81, no. 3 (2003): 315-19.

Sandbrook, Richard. "The Politics of Basic Needs." *London: Heinmann. and Barker, J.(1985) The politics of Africa's economic* (1982).

Smyth, David, and Yu Hsing. "In Search of an Optimal Debt Ratio for Economic Growth." *Contemporary Economic Policy* 13, no. 4 (1995): 51-59.

Solow, Robert. "A Contribution to the Theory of Economic Growth." *The quarterly journal of economics* (1956): 65-94.

———. "Technical Change and the Aggregate Production Function." *The review of Economics and Statistics* (1957): 312-20.

Squalli, Jay, and Kenneth Wilson. "A New Approach to Measuring Trade Openness." *Economic & Policy Research Unit Working Paper*, no. 06-07 (2006).

Standard & Poor's. "Ratings Performance 2002." In *Default, Transition, Recovery, and spreads*, 87-100, 2003.

Sy, Amadou, and Andrea Pescatori. "Debt Crises and the Development of International Capital Markets (No. 04/44)." International Monetary Fund, 2004.

Terra, Cristina. "Openness and Inflation: A New Assessment." *Quarterly Journal of Economics* (1998): 641-48.

Topalova, Petia, and Dan Nyberg. "What Level of Public Debt Could India Target?": International Monetary Fund, 2010.

United Nations, Department of Economic and Social Affairs:, and Population Division. " World Population Prospects: The 2015 Revision, Key Findings and Advance Tables ", no. Working Paper No. ESA/P/WP.241 (2015).

United Nations Conference on Trade and Development (UNCTAD). 2015 [cited 17th July 2015]. Available from http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=32085.

———. "Economic Development in Africa; Debt Sustainability: Oasis or Mirage?": united Nations, 2004.

———. "Economic Development in Africa; Export Performance Following Trade Liberalization: Some Patterns and Policy Perspectives." United Nations Conference on Trade and Development (UNCTAD), 2008.

Wacziarg, Romain, and Karen Horn Welch. "Trade Liberalization and Growth: New Evidence." *The World Bank Economic Review* 22, no. 2 (2008): 187-231.

Waheed, Abdul. "Foreign Capital Inflows and Economic Growth of Developing Countries: A Critical Survey of Selected Empirical Studies." *Journal of Economic Cooperation* 25, no. 1 (2004): 1-36.

Williams, Richard. "Using the Margins Command to Estimate and Interpret Adjusted Predictions and Marginal Effects." *Stata Journal* 12, no. 2 (2012): 308-31.

Wooldridge, Jeffrey M. *Introductory Econometrics: A Modern Approach*. 5 ed: South-Western Cengage Learning, 2013.

Wright, Allan, and Kari Grenade. "Determining Optimal Public Debt and Debt-Growth Dynamics in the Caribbean." *Research in Applied Economics* 6, no. 2 (2014): 87-115.

APPENDIX A.

Table A1; List of selected SSA countries.

Angola	Gabon	Rwanda
Benin	Gambia, The	Sao Tome and Principe
Botswana	Ghana	Senegal
Burkina Faso	Guinea	Seychelles
Burundi	Guinea-Bissau	Sierra Leone
Cabo Verde	Kenya	Somalia
Cameroon	Lesotho	South Africa
Central African Republic	Liberia	Sudan
Chad	Madagascar	Swaziland
Comoros	Malawi	Tanzania
Congo, Dem. Rep.	Mali	Togo
Congo, Rep.	Mauritania	Uganda
Cote d'Ivoire	Mauritius	Zambia
Djibouti	Mozambique	Zimbabwe
Eritrea	Niger	
Ethiopia	Nigeria	

APPENDIX B.

Table B1; Rescheduling and Actual Default Episodes of the selected SSA countries

Country	Rescheduling Episodes	Rescheduling or Actual Default episodes(DC1)	Rescheduling or Actual Default episodes(DC2)
Angola	17	20	20
Benin	12	31	17
Botswana	0	7	0
Burkina Faso	15	30	15
Burundi	7	30	7
Cabo Verde	5	25	5
Cameroon	20	29	22
Central African Republic	20	34	29
Chad	13	34	21
Comoros	9	33	22
Congo, Dem. Rep.	20	34	31
Congo, Rep.	23	30	28
Cote d'Ivoire	25	30	30
Djibouti	9	34	10
Eritrea	3	14	3
Ethiopia	12	22	15
Gabon	18	22	22
Gambia, The	10	30	10
Ghana	12	25	12
Guinea	24	34	27
Guinea-Bissau	17	33	31
Kenya	10	25	10
Lesotho	0	2	0
Liberia	10	34	34
Madagascar	25	34	33
Malawi	15	26	15
Mali	12	33	15
Mauritania	24	34	30
Mauritius	0	0	0
Mozambique	19	30	29
Niger	24	31	25
Nigeria	15	23	23
Rwanda	9	26	9

Sao Tome and Principe	13	29	25
Senegal	27	30	27
Seychelles	8	26	14
Sierra Leone	26	34	34
Somalia	6	34	32
South Africa	1	1	1
Sudan	17	34	34
Swaziland	0	18	6
Tanzania	18	34	34
Togo	24	34	31
Uganda	21	34	22
Zambia	24	33	32
Zimbabwe	2	15	14
AVERAGE	***14***	***27***	***20***

Source: Researcher's computation based on data from the World Bank's WDI.

APPENDIX C.

Table C1: Economic openness and Debt crisis; estimated coefficients of basic model.

	Dependent Variable: Debt Crisis (DC1*it*)		
	Maximum Likelihood Estimates		Linear Prob. Model estimates
Variables	Logit	Probit	LPM
TRADE	-1.071***	-0.615***	-0.0273
	(5.197)	(5.154)	(0.785)
INV	-2.699***	-1.586***	-0.279***
	(4.204)	(4.463)	(3.082)
CY	-0.660	-0.403	-0.282***
	(1.024)	(1.064)	(2.941)
CTDS	-0.473	-0.358	-0.149
	(0.329)	(0.361)	(0.915)
POPGR	0.297***	0.177***	0.149***
	(3.474)	(3.987)	(8.721)
REER	0.140	0.0838	0.0893***
	(1.330)	(1.445)	(3.263)
INF	4.614***	2.658***	0.0110*
	(4.566)	(5.020)	(1.772)
RIR	7.732***	4.567***	0.207**
	(5.954)	(6.409)	(1.966)
trend	0.0486***	0.0280***	0.0187***
	(4.988)	(5.193)	(12.48)
Observations	996	996	996
R-squared	-	-	0.778
Hosmer-Lemeshow test; P-value	0.2146	0.4906	-

***Note 1**: Absolute Robust t-statistics in parentheses*
***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

Table C2- Economic openness and Debt crisis; estimated marginal effects of basic model

	Dependent Variable: Debt Crisis (DC1*it*)		
	MLE; Marginal Effects		LPM Marginal Effects
Variables	Logit MEM	Probit MEM	OLS
TRADE	-0.110***	-0.121***	-0.0273
	(4.491)	(4.590)	(0.785)
INV	-0.277***	-0.312***	-0.279***
	(3.796)	(4.129)	(3.082)
CY	-0.0677	-0.0793	-0.282***
	(1.001)	(1.049)	(2.941)
CTDS1	-0.0485	-0.0704	-0.149
	(0.329)	(0.361)	(0.915)
POPGR	0.0305***	0.0348***	0.149***
	(2.866)	(3.386)	(8.721)
REER	0.0144	0.0165	0.0893***
	(1.305)	(1.416)	(3.263)
INF	0.473***	0.523***	0.0110*
	(8.014)	(8.140)	(1.772)
RIR	0.793***	0.899***	0.207**
	(7.741)	(8.114)	(1.966)
trend	0.00499***	0.00551***	0.0187***
	(3.978)	(4.287)	(12.48)
Hosmer-Lemeshow test; P-value	0.2146	0.4906	-
Observations	996	996	996

***Note 1**: Absolute Robust t-statistics in parentheses*

***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

Table C3: International trade Openness and Debt Crisis in SSA (1980-2013); logit regression coefficients for DC1

	Dependent Variable: Debt Crisis(DC1*it*)
	Maximum Likelihood Estimation
Variables	Logit
$TRADE$	0.228
	(0.441)
$TRADE_{t-5}$	-1.227***
	(2.595)
INV	-3.148***
	(2.800)
INV_{t-5}	0.522
	(0.777)
CY	-0.286
	(0.351)
CY_{t-5}	-1.766*
	(1.734)
$CTDS1$	-0.696
	(0.531)
$CTDS1_{t-5}$	0.354
	(0.251)
$POPGR$	0.311***
	(3.135)
$POPGR_{t-5}$	0.238***
	(2.839)
$REER$	-0.537*
	(1.690)
$REER_{t-5}$	0.707**
	(2.304)
INF	3.299***
	(3.672)
RIR	6.744***
	(5.052)
$trend$	0.0302**
	(2.531)
Observations	849

***Note 1**: Absolute Robust t-statistics in parentheses*
***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

Table C4: Openness (measured by volume of trade) and alternative definitions of Debt Crisis (DC1 and DC2) in SSA (1980-2013); Logit regression coefficients.

	Dependent Variable: Debt Crisis (DC1*it*, DC2*it*)	
	Maximum Likelihood Estimator; Logit	
Variables	DC1	DC2
$TRADE$	0.228	0.320
	(0.441)	(0.698)
$TRADE_{t-5}$	-1.227***	-0.914**
	(2.595)	(2.127)
INV	-3.148***	-4.721***
	(2.800)	(4.567)
INV_{t-5}	0.522	1.690***
	(0.777)	(2.666)
CY	-0.286	-0.252
	(0.351)	(0.422)
CY_{t-5}	-1.766*	-1.732**
	(1.734)	(2.292)
$CTDS1$	-0.696	-
	(0.531)	
$CTDS1_{t-5}$	0.354	-
	(0.251)	
$CTDS2$	-	-0.162
		(0.147)
$CTDS1_{t-5}$	-	2.255
		(1.457)
$POPGR$	0.311***	0.383***
	(3.135)	(3.609)
$POPGR_{t-5}$	0.238***	0.0225
	(2.839)	(0.237)
$REER$	-0.537*	-0.634***
	(1.690)	(2.769)
$REER_{t-5}$	0.707**	0.0891
	(2.304)	(1.290)
INF	3.299***	2.878***
	(3.672)	(4.128)
RIR	6.744***	4.211***
	(5.052)	(3.830)
$trend$	0.0302**	0.0227**
	(2.531)	(2.483)
Observations	849	849

***Note 1**: Absolute Robust t-statistics in parentheses:*

***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

Table C5: Openness (measured by FDIS and FDIF) and Debt Crisis in SSA (1980-2013); logit regression coefficients for DC1 model.

	Dependent variable: Debt Crisis (DC1*it*)	
	Maximum Likelihood Estimator; Logit	
Variables	FDIS	FDIF
FDIS	2.762***	-
	(3.914)	
$FDIS_{t-5}$	-1.535***	-
	(3.323)	
FDIF	-	10.35***
		(4.037)
$FDIF_{t-5}$	-	5.104**
		(2.136)
INV	-4.851***	-5.532***
	(4.377)	(4.589)
INV_{t-5}	-0.106	0.158
	(0.152)	(0.213)
CY	0.316	-0.178
	(0.429)	(0.224)
CY_{t-5}	-1.258	-1.518
	(1.292)	(1.549)
CTDS1	-4.065**	-0.279
	(2.005)	(0.130)
$CTDS1_{t-5}$	-1.766	-0.323
	(0.578)	(0.0451)
POPGR	0.420***	0.406***
	(3.683)	(3.674)
$POPGR_{t-5}$	0.328***	0.300***
	(3.614)	(3.356)
REER	-0.599**	-0.615**
	(2.023)	(2.082)
$REER_{t-5}$	0.388*	0.563**
	(1.685)	(2.114)
INF	3.666***	4.009***
	(3.910)	(4.097)
RIR	7.550***	7.813***
	(5.287)	(5.282)
trend	-0.00792	-0.0106
	(0.671)	(0.909)
Observations	827	849

***Note 1**: Absolute Robust t-statistics in parentheses*
***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*

Table C6: Openness (Measured by FDIS) and alternative definitions of Debt Crisis (measured by DC1 and DC2) in SSA (1980-2013); logit regression coefficients.

	Dependent Variable: Debt Crisis	
	Maximum Likelihood Estimator: Logit	
Variables	DC1	DC2
$FDIS$	2.762***	3.190***
	(3.914)	(5.316)
$FDIS_{t-5}$	-1.535***	-1.425***
	(3.323)	(3.218)
INV	-4.851***	-6.698***
	(4.377)	(6.139)
INV_{t-5}	-0.106	1.554**
	(0.152)	(2.142)
CY	0.316	0.184
	(0.429)	(0.301)
CY_{t-5}	-1.258	-1.460*
	(1.292)	(1.887)
$CTDS1$	-4.065**	-1.251
	(2.005)	(0.314)
$CTDS1_{t-5}$	-1.766	-3.796
	(0.578)	(1.608)
$POPGR$	0.420***	0.459***
	(3.683)	(4.416)
$POPGR_{t-5}$	0.328***	0.0813
	(3.614)	(0.850)
$REER$	-0.599**	-0.819***
	(2.023)	(3.565)
$REER_{t-5}$	0.388*	0.0857
	(1.685)	(1.242)
INF	3.666***	3.010***
	(3.910)	(3.957)
RIR	7.550***	4.319***
	(5.287)	(3.570)
$trend$	-0.00792	-0.00900
	(0.671)	(0.942)
Observations	827	827

***Note 1**: Absolute Robust t-statistics in parentheses*
***Note 2**: ***, ** and * represents 1%, 5% and 10% significance level respectively*