EXTERNAL DEBT PROFILE AND ITS SUSTAINABILITY: EVIDENCE FROM A PANEL OF SELECTED EAST AFRICAN COUNTRIES

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This is to certify that the thesis prepared by TolasaAlemayehu, entitled as*: External Debt Profile and its Sustainability: Evidence from East African Countries using IGBC Approach,* and submitted in partial fulfilment of the requirements for the degree of Master of Science in Economics (international Economics) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Dedication

This work is dedicated to God Almighty the creator of the universe.

Declaration

I, Tolasa Alemayehu Basha

Declare that the thesis entitled “*External debt profile and its sustainability: Evidence from a panel of selected east African countries”*

And the work presented in the thesis are both my own, and have been generated by me as a result of my original research. I confirm that:

- This work was done wholly while in candidature for a masters’ degree at this (Addis Ababa) University.
- Where any part of this thesis has previously been summited for a degree or any other qualification at this or any other institutions, this has been clearly stated.
- Where I have quoted from the work of other’s, the source is always given.

With the exceptions of such quotations, this thesis is entirely my own work.

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List of Abbreviations

ADF	Augmented- Dicky-Fuller
AEO	African Economic Outlook
AfDB	African Development Bank
EAC	East African Countries
AFRODAD	African Forum and Network on Debt And Development
IDA	International Development Assistance
IGBC	Intertemporal Government Budget Constraint
IMF	International Monetary Fund
HIPC	Highly Indebted Poor Countries
LICs	Low Income Countries
MDRI	Multilateral Debt Relief Initiatives
OECD	Organization of Economics and Co-operation Development
OPEC	Organization of Petroleum Exporting Countries
PPG	Public and Publicily Guaranteed Debt
PVBC	Present Value Borrowing Constraint
REO	Regional Economic Out Look
SSACs	Sub-Saharan African Countries
UNCTAD	United Nations Conference On Trade And Development
WDI	World Development Indicators

Abstract

The aim of this paper is to empirically examine the sustainability of East African countries external debt over the period 2000-2016. For this purpose, this empirical analysis makes a use of various unit root test (i.e., univariate unit root test, panel unit root test and co-integration) test by taking the possibility of cross sectional dependence in to account. The intertemporal government budget constraint provides a test based on both stationarity and the cointegration relation between government revenues and expenditure including interest payments on external debt. Tests for stationarity and then cointegration between revenue and expenditure are based on recently developed panel data methods that offer increased power over existing time series techniques. Unlike existing panel studies on this topic, this study utilizes techniques that enable the examination of sustainability for individual panel members. The first stage of the investigation relies on a novel approach to unit root testing whereby tests for stationarity are conducted within a seemingly unrelated regression framework. The second stage involves the estimation of the long-run relationship between the revenue and expenditure by a range of recently developed panel data techniques advocated by Pedroni. Using a panel of nine EAC countries for the study period 2000-2016, the results from these techniques suggest that sustainability is present in four countries at most (Kenya, Eritrea, Sudan and Tanzania). These results confirmed with existing individual unit root and cointegration tests that indicate external sustainability for aforementioned countries.

The study deduces that the external debt of EAC countries is unsustainable or weakly sustainable so they should exploit their domestic resources instead of going for the foreign resources and encourage saving and investment environment in their countries

CHAPTER ONE

INTRODUCTION

1.1 Background and Motivation

The problem of foreign debt has been a major and persistent setback for the African economy. As most African countries in debt are still under developed, they therefore, depend on foreign loans to reach their development objectives, and stepped up investment in infrastructure which is critical to achieve sustained growth and development.

Transformation of economic structure requires a large inflow of external financial resources in a short period of time. Foreign finance can contribute to the acceleration of economic growth and structural transformation by assuaging crucial bottlenecks in the process of development. According to Mankiw (2004), an external debt enables a nation to get things from other sources without having to give anything in return for the time being. LDCs obtain a capital inflow from abroad when institutions and individual in other countries give grants or make loans or equity investments to pay for a balance on goods and services deficit (import surpluses).

This inflow of foreign funds enables a country to spend more than it produces, import more than it exports, invest more than it saves and thus, fills the gaps that limit development. But eventually, the borrowing country must service the foreign debt. Paying back the loan requires a country to produce more than it spends, save more than it invests and exports more than it imports (Nafzger, 1997; Lerner, 1961).

It is all too clear that today, Sub-Saharan Africa's external debt burden has grown so heavy and become so intractable that, realistically, there is little hope for significant social and economic advancement on the continent unless meaningful and effective measures are urgently put in place to alleviate it. As the African Common Position correctly recognizes, the problem of external indebtedness is a major manifestation of the economic distress and social retrogression that have characterized the continent in the present decade and which continues with worrisome severity. As this situation has persisted, it has become increasingly evident that only sustained measures taken to stimulate economic growth can effectively resolve the formidable problems linked to external indebtedness which confront the region.

The economic and social conditions in SSA continue to be a cause of great concern to all of us. Throughout this two decade(after the received debt relief under HIPC initiatives and MDR initiatives), low or declining rates of output growth, combined with high rates of population growth, have resulted in falling levels of per-capita output in areas such as food production; and simultaneously, to a rapid and alarming deterioration of the environment. Declining export earnings, due mainly to unfavorable movements in the terms of trade, have led to a severe compression of imports in many countries and the curtailment or suspension of a wide range of social services, including especially health and education expenditures. Balance of payments deficits, in many cases financed through external borrowings, have widened, as export revenues have failed to rebound after what initially seemed to be a temporary shortfall.

As a result, SSA's budget deficit in these two decade has, on average, been some 11% of its GDP, conspicuously higher than that of any other region. And, the strains on the region's external accounts have been exacerbated by reduced capital flows, which have fallen from as high as US$26billion annually in the early years of the millennium decade to about US$19billion on average in 2010 (AfDB, 2014). One critical reflection of these developments is the sharp rise in the region's total external debt to an estimated US$443billion at the end of 2013 compared to less than half that amount in the early 1990s. While it could be argued that the current level of external debt appears modest in relation to that of other developing countries as a whole and even more so when only commercial debt is considered, these verity of the burden is most objectively seen in the light of the very small production base and low capacity of many African countries to meet their debt service obligations, however small in relative terms.

According to IMF,2014, over the period 2000-2005, the ratio of SSA's external debt to total GDP became the highest of all the developing regions, and the ratio of actual debt service to exports of goods and services rose from about 20 percent to exceed 30 percent over the same period. This ratio is even higher in many low-income countries. Not surprisingly, the strains of meeting heavy debt service obligations continue to have a crippling effect on the majority of SS African countries, of which 22 are already classified as" either highly or moderately debt distressed". Unfortunately, it is surprising that all East African countries are found under this category (see table 3.3).

Unsustainable external debt, therefore, contribute to a potential downward spiral of negative basic transfer such as loss of foreign exchange and a net outflow of capital, decreasing foreign reserves and damaged development prospects. As it is pointed out by (Holman, 2001), a high levels of external debt which become unsustainable could cause a sudden reversal in capital flows or might necessitate adjustments in interest rates or exchange rates where as a sustainable external debt may indicate there is no incentive for the country to default on its external debts.

Such reversals can be highly disruptive because private consumption, investment, and government expenditure must be curtailed abruptly when foreign financing is no longer available and, indeed, a country is forced to run large surpluses to repay in short order what it borrowed in the past. This suggests that regardless of why a country has a budget deficit (and even if the deficit reflects desirable underlying trends) large and persistent deficits call for caution, lest a country experience an abrupt and painful reversal of financing.

It is evident that a lot of countries, both developed and developing, have run persistent large budget deficits which have been followed by severe crises, economic slowdowns and contagion effects. Central to the debate is the sustainability of those deficits. The question is thus, whether a country's external imbalances are justifiable and be considered as structurally normal and sustainable or whether there is need for fundamental policy shifts to correct them and evade crises.

The motivation of thesis is thus varied:

Firstly, due to the fact that– the poorest countries of Sub-Saharan Africa (low income countries, or LICs, according to the World Bank's classification) as general and East African countries in particular have bitter experience with external debt problems. It was only through donors' far-reaching debt relief (under the HIPC Debt Initiative granted in 1996 and 1999 and MDRI granted in 2004 that they managed to overcome the debt crisis of the 1980s to 1990s. The recent rise in external debt levels therefore needs close attention and some policy adjustments need to be undertaken if the crises of the 1980s and 1990s is to be avoided.

Secondly, Chronic budget deficits (see Appendix 1C) as well as growing external debt levels (see table 5.1 and figure 5.1) motivates this paper because of their potential to destabilize economies. According to Gupta et al. (2002), fiscal policies have far-reaching impacts on economic growth and human capital investments. Corsetti and Roubinni (1991) also believe that if inter-temporal budget constraints are not supported by empirical evidence, changes in policy or macroeconomics variables such as growth, inflation, and interest rates will occur at some moment in the future.

Thirdly, The knowledge whether external debt is on a sustainable track is important for East African countries in particular and all other developing countries in general in many respects. Fiscal authorities of a country want to keep external finances sustainable in order to give a healthy ground for economic growth in the country for years to come. If external finances is not sustainable, this affects the economy as a whole. This is evidenced by the fact that external finance accounts for a large part of GDP in most of these East African regions than other regions in Africa.

Fourth, the creditors of the government bodies also follow the sustainability of external debt closely. After all, their goal is to make profit and therefore they don’t want to pay too much for government bonds. In order to have idea of the risk premium they require for the bonds, these creditors, which are usually big institutions like IMF,WB, AfDB, IFI, IDA and etc, have to analyze the risks present in the external financing of the country. Thus, the study of sustainability of external debt is crucial for them too.

Therefore, in order to avoid any crises in the public sector and the economy at large, it is valuable for fiscal authorities to monitor the sustainability of external finances and inform politicians of any significant developments in that area.

1.2 Problem Statement

Low income countries face significant challenges in meeting their development objectives, while at the same time ensuring that their external debt remains sustainable. Given low income countries' reliance on official flows, debt sustainability depends largely on the willingness of official creditors and donors to provide positive net transfers through new financing (Arellano C. 2008). Nevertheless, high debt levels can be problematic as they may require debt restructuring and forgiveness which is disruptive and costly and the burden of a debt overhang may undermine urgent progress on policy reform.

External debt-servicing difficulties have historically afflicted SSA countries, as it is hampering the continent's economic growth as servicing external debt diverts scarce fiscal resources from crucial areas of spending for development and growth. As (AFRODAD, 2016) report shows, in 1999 it was estimated that "the Highly-Indebted Poor Countries (HIPCs) spent one third of their tax revenues in servicing their debts. In some countries such as Kenya (84 percent), C D'Ivoire (62 percent), Tanzania (48 percent) and Ethiopia (42 percent), this ratio was much higher.

For instance, as it is cited in AfDB report of (2016), in 2013, with an external debt of around $ 413bln, African countries spent about 40% of the continent's export earnings on servicing their external debt which is significantly higher than during the height of the African debt crises in the 1990s, when debt service at times was about 16% of export earnings.

Moreover, the study by Martin Rashen (2017), reveals that a rising share of revenues devoted to debt service payments weakens a government's ability to implement its own policies, resulted in a severe loss of ownership and brings government under pressure to renege on their debt-service obligations particularly as aid flows are often earmarked.

As vividly explained by Matthieu (2017), the issue has gained importance in developing countries as well as among political leaders, academic economists, and researchers in international institutions. Indeed, external debt sustainability has become a highly important topic for governments because it requires the adoption of responsible policies in order to assure macroeconomic stability.

As a result, a number of studies have been done by many economists and researchers to examine whether external debt of the country is sustainable or not, by applying different techniques and methodologies since the 1990s. Mixed results have been drawn i.e. some studies employed time series method to test whether the external deficit of a nation is sustainable or not (for example, Hamilton & Flavin (1986); Trehan and Walsh 1991; Husted 1992; Wickens and Uctum 1993; Fountas & Wu 1996; Sawada 1994; Coakley and Kulasi 1997; Fève and Henin 1998; Pattichis and Kanaan 2001; Jha 2003; Lau and Baharumshah 2003; Sun 2004; Berthomieu et al. 2004; Önel and Uctulu 2006; Yilanci and Özcan 2008; Kim et al. 2009; Boengiu et al. 2011), and came up with the result which is not consistent with inter-temporal external constraint in present-value terms, while other studies (Haile, 2005 ; Leachman and Francis 2000; Takeuchi 2010) have failed to draw the same result.

In addition to these studies, (Prohl & Schneider (2006), Ehrhart & Llorca (2008) used a panel unit root test and cointegration test model for the external debt sustainability across countries and found evidence that there is a long run relationship between deficits and public debt and concluded that fiscal policy is sustainable during the test period.

Even though, most of the empirical studies have focused on the United States and other industrial countries, a review of the literature on this topic suggests that there has been some coverage on developing countries (e.g. Bernhard G. Gunter, 2003 and Lau, 2007, 2010 and Lau and Baharumshah, 2009; Haile, 2005; Haile 2016; Daniel Hakyi et.et, 2016; Benno Ferrarini et.al, 2012) are few among the others.

This paper is motivated first of all by the fact that most of the existing empirical studies on external debt sustainability are focused on the USA and other industrial economies. Literature on African economies in this regard is thus largely limited to studies by the following – Haile, (2005) and (2016), Issler and Lima (2000), Bravo and Silvestre (2002), Koo (2002), Claeys (2007), Arghyrou and Luintel (2007), Bajo- Rubio et al. (2008) and Melecky (2012).

However, Study of external debt sustainability is not important only in the current situation in US and in the other developed countries. It has been also continuously pertinent issue in less developed countries. In emerging countries, the external sector is usually more fragile and even more prone to shocks (both internal and external) than in developed countries. This is because the external sector of these economies is more vulnerable to exchange rate fluctuations, commodity price fluctuations (like the price of oil and primary commodities for which they are known), changes in interest rate on government debt, sprees of high inflation and political turmoil.

Secondly, the paper focuses on East African region;

i) Which according to AfDB (2014), experiences a high growth performance and huge budget deficits that are compounded by extremely high levels of indebtedness which in turn renders economies in this region more vulnerable to external shocks than other regions.

ii) Whose public policy has been at the heart of international investors' concerns and stabilization programs, but whose public debt sustainability has remained largely unexplored and most vulnerable to external shocks and chronic budget deficits than other economies. To this end, this thesis consider a total panel of East African countries, which has never been used in the literature before as panel.

Thirdly, from the previous empirical literature on external debt sustainability in EACs it appears that only econometric time series methods have been employed to examine whether these governments effectively respect the inter-temporal budget constraint in present value terms.

However, no studies, to the best of knowledge of the author, have used recent panel econometric methods to assess external debt sustainability in EACs, as distinct from developing countries (see Prohl and Schneider 2006, Ehrhart and Llorca 2007).

Panel data analysis offers two important advantages in this regard. First, it helps avoid the recurrent problem of lack of data or a short dataset in EACs. In addition, the EACs engaged in reginal integration in comparison to other developing continents, with many countries belonging to several defferent agreements. Fo instance, East African Community (EAC) stablished in 2000 with an addition of Uganda and Burundi as new memebers in 2007. Moreover, in 2005, the EAC established customs union (EACU) and the future goals are to create a common market, monetary union and ultimately a political federation. In this case, the fiscal relations between EAC or EACU Member States may have become more closely tied across borders.

Consequently, tests of sustainability on each national fiscal policy turn out to be less insightful. The overall external debt sustainability in these unions should be tested instead. To this end, a simple test for external debt sustainability which is based on excluding Ponzi games as a viable option of government finance have been proposed. By ruling out ad infinitum borrowing to cover interest payments on outstanding debt, the government budget constraint implies a cointegration relation between real government expenditures, revenues and net interest payments. Analysing this relationship for each East African government's fiscal policy is awkward because of small sample problems. An examination of the overall external position of East African countries with panel techniques precisely allow us to overcome this problem.

More importantly, these studies have not tested the presence of cross-sectional dependence across panel units. Since the presence of cross-sectional dependence across countries can lead to bias in tests results (also called contemporaneous correlation), the existence of co-integration need to be tested after testing the presence of cross-sectional dependence in order to avoid spurious correlations. The present study tries to fill these gaps by estimating external debt sustainability in the panel of nine East African countries in a cointegration framework.

In accord with these statements, the problem of this research is set in terms of questions as follows:

- ✓ Why EAC have accumulated such large external debt to the extent that is threatening debt sustainability and development financing?
- ✓ Are EAC's meets debt sustainability conditions /IGBC criteria?
- ✓ Is there any long-run relationship among Government revenue, expenditure (including real interest payment on external debt) for EAc's?

1.3. Objectives of the study

1.3.1 General objective

The general objective of this study is to test the external debt sustainability using panel data of East African countries for which necessary data is available.

1.3.2. Specific Objective

Specifically this paper envisaged to:

- ✓ Examine the external debt trends and their key drivers for East African countries.
- ✓ Test for debt sustainability for East African countries by using Inter-temporal Government Budget Constraints Approach.
- ✓ Test the long-run relationship between government revenue and expenditure using cointegration techniques.

1.4 Significanceof study

This paper is of both theoretical and practical significance to the students, policy makers, the Debt Management Office (DMO), economists as well as the general public. Theoretically, this research work seeks to fill a gap in existing literature relating to East African region's foreign/external debt profile and management strategies. For instancs, the study takes into account cross sectional dependence among countries to test the external sustainability, which is supposed by Granger and Lee (1990) and has since been extended by Haldrup (1994), Engsted et al (1997) and (Llorca, M., 2017). It also considers a recent period, 2000 – 2016, which includes the impacts of the 2008–2009 global financial crisis on external debt sustainability over the panel.

Practically, this study attempts to provide vital information for future academic research bordering on the topic and other related issues/topics. The findings of this study will be relevance to policy makers, diplomatic personnel engaged in negotiating debt on behalf of these countries, as well as the Debt Management Office that is saddled with the responsibility of prudently managing the country in the region's debt in order to achieve the nation's objectives as regards to debt management.

1.5 Scope of Study

Using the data from 2000 to 2016, this study employs IGBC approach developed by Hamilton and Flavin (1986) to test whether the external debt positions EAC's is sustainable or not.

More importantly, this study restricts its analysis to nine East African countries, namely, Ethiopia, Kenya, Eritrea, Djibouti, Sudan, Uganda, Rwanda, Burundi and Tanzania partly because such external debt sustainability issues have not been analyzed in literature as the panel.

Moreover, neither the impact of external debt on the economy nor its determinants is empirically analyzed.

1.6 Limitation of the study

The Lender based approach/ IGBC approach which was chosen in this empirical analysis involves econometric testing of a set of historical time series data on government spending and revenue, to determine the existence of co-integration. However, these require long time series, a requirement that may be unrealistic in many developing countries, since data is relatively poor and limited with respect to time span and accuracy.

1.6.1 Overcome data limitations and build analytical capacities for the study

There are still considerable problems related to data availability. After many initiatives, especially related to debt management in African countries, it is surprising how little data on domestic debt and government revenues are publicly available. While IMF and the World Bank possess such data for most countries, especially with respect to heavily indebted poor countries in Africa, which they monitor on a regular basis, most of this data are not readily available to the public especially before 2000. For example, the World Development Indicators (WDI), Global Development Finance (GDF) databases and International Debt Statistics (IDS) contain no data on domestic debt and also have considerable gaps with regard to external debt for many countries. The unavailability of such data contributes to the exclusion of both domestic debt and some countries from the sample (South Sudan, Comoros, and Seychelles).

1.7 Organization of the Paper

The rest of this paper is organized as follows. Chapter II reviews the related theoretical and empirical literature. Chapter III highlights the trends of the external debt Profiles of East African countries. Chapter IV discusses about the methodology used to test the external debt sustainability. Section V provides the empirical analysis and discusses the results. Section VI concludes this paper with the main findings, policy implications.

CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.1 The Theory of External Government Debt

What makes sovereign debt different from private debt is that there is no well-defined procedure for enforcing sovereign debt contracts and for managing sovereign defaults. If a private borrower does not repay its debts, creditors have a well-defined claim on the borrower's assets. In the case of sovereign debt, the legal recourse available to creditors has limited applicability and uncertain effectiveness. The objective of this section is to provide a brief introduction to the economic theory of sovereign debt.

The principle of sovereign immunity, which derives from the equality of sovereign nations under international law, states that sovereigns cannot be sued in foreign courts without their consent.

However, sovereign immunity does not grant full protection to sovereign debtors, as a sovereign can decide to waive its immunity and agree to submit to the authority of a foreign court in the event of a dispute.

But even in these cases, sovereign debt remains difficult to enforce because creditors' ability to collect is limited by the fact that only assets located outside the sovereigns' borders can be legally attached and countries tend to hold most of their assets within their borders.

Given this limited ability to enforce sovereign debt contracts, why do lenders lend and why do sovereigns repay? How can a market in which contracts cannot be enforced exist? Eaton and Gersovitz (1981) address these questions by building a model in which creditors have no ability to enforce repayment whatsoever and their only means of punishing defaulters is the denial of future credit.

Under the assumption that debtors want to smooth consumption but cannot store their output, they show that, under certain conditions, the threat of permanent exclusion from future credit is a sufficient condition for repaying. In the model of Eaton and Gersovitz, the maximum amount of sustainable debt is positively related to the variance of output and the country's preference for smoothing consumption.

The paper by Eaton and Gersovitz became the target of three types of criticism, all of which were anticipated by the authors. The first related to the assumption that default on repayment can be punished by denying the borrower future credit. The critics' main contention was that the threat of a permanent embargo on future lending is not credible, because it hurts potential future lenders too, and because once a borrower defaults, his ability to pay increases, thus giving incentives to creditors to resume lending.

The second criticism concentrated on the assumption that borrowing from international lenders is the only way in which countries can smooth consumption. Bulow and Rogoff (1989a) showed that if a country can purchase an insurance contract that delivers payments in low output states, the threat of credit denial loses its bite entirely.

The final criticism relates to the fact that reputation can only sustain an equilibrium with positive debt if there is a motivation (such as the desire to smooth consumption in response to output shocks) which makes a country wish to the credit markets in the indefinite future. In other words, reputation cannot sustain debt motivated by impatience to consume (implying a point at which the country must repay without ever borrowing again) or by the need to accumulate capital (Eaton, Gersovitz and Stiglitz, 1986).

Successive authors have addressed these criticisms, with varying success. A first group of authors made the assumption that the possibility of punishments would have a negative effect on the defaulter's trade flows (Sachs and Cohen, 1982; Bulow and Rogoff, 1989b; Fernandez and Rosenthal, 1990). But again, this type of punishment is credible only if, besides harming the defaulter, it also benefits the creditor. If blocking trade credit or imposing a trade embargo also hurts the creditor country, the threat is not credible and cannot sustain positive lending.

A second group of authors argued that positive lending can be sustained because insurance contracts á la Bulow-Rogoff are either not feasible or not optimal from the borrower 's point of view. Those who argue that such contracts are not feasible point out that financial institutions may not be able to commit to payments to defaulters, because past lenders could attempt to interfere with such payments (Cole and Kehoe, 1995; Eaton, 1996; and Kletzer and Wright, 2000). Perhaps more interestingly, Wright (2002) shows that there are conditions in which banks will find it optimal to collude to punish defaulters. This can lead to an equilibrium with positive lending even in a setting which allows for insurance contracts á la Bulow-Rogoff and assumes that the threat of credit denial is the only punishment for defaulters. Amador (2003) obtains a similar result by developing a political economy model, in which myopic governments, that are afraid of losing power, over borrow but do not default because they want to retain access to capital markets in case they return to power.

While the classic theory of sovereign debt focuses on the actions of non-residents, there is a more recent class of models that focuses on the domestic effects of the default. Because of these broader implications, positive lending can be sustained even when creditors have no way to punish defaulting countries. This could be the case, for example, if defaults are interpreted by economic agents as bad news for either the sovereign or the economy. Cole and Kehoe (1998) assume two types of governments: "honest" governments that always repay, and "normal" governments which sometimes do not repay. They show that if the government only deals with lenders, the Bulow-Rogoff result applies and no borrowing can be sustained by "normal" governments. If, however, there is another relationship in which the government's partners have incomplete information about the government's true type, the government may have the incentive not to default, because defaulting would damage the government's reputation vis-à- vis this second party.

2.2 Evidence On External Borrowing And Default

In most theoretical models of sovereign debt, countries borrow in order to transfer income from good to bad states of the world. While these models predict that debt flows should be countercyclical, there is evidence that private lending to sovereigns tendsto be procyclical (developing countries tend to borrow more in good times; see Levy Yeyati, forthcoming). There are three possible explanations for pro-cyclical lending. The first focuses on market failures and argues that pro-cyclicality is driven by the fact that during recessions developing countries lack access to international credit (Gavin and Perotti, 1997). The second explanation concentrates on political failures and suggests that pro-cyclicality is the result of conflict across various interest groups, wasteful spending pressures or the presence of corrupt politicians (Tornell and Lane, 1999; Talvi and Végh, 2005; Alesina, Campante and Tabellini, 2008). A third class of explanations relates to the nature of the output shock. While models in the spirit of Eaton and Gersovitz (1981) assume transitory output shocks, Aguiar and Gopinath (2006); and Rochet (2006) show that models with persistent shocks can generate procyclical borrowing even in the absence of political or capital market imperfections.

While the empirical evidence suggests that defaults tend to happen during periods of low economic growth (Levy Yeyati and Panizza, forthcoming; Tomzand Wright, 2007), the simplest sovereign debt models predict that we should never observe defaults during bad times because countries are only meant to repay during good times. By contrast, the evidence of countercyclical defaults is consistent with the predictions of more sophisticated models that assume persistent shocks (Aguiar and Gopinath, 2006; and Rochet, 2006).However, even these more sophisticated models greatly under predict the probability of default episodes (Aguiar and Gopinath, 2006). This failure may be due to the fact that while these models tend to focus on domestic factors as driving defaults, while default episodes can also be caused by exogenous changes in global credit cycles (for instance by global "Sudden Stop" episodes as described by Calvo, 2005). The idea that in addition to domestic factors, defaults are influenced by the behavior of creditors and international capital markets is consistent with the fact that default episodes tend to happen in clusters, typically after periods of market bonanza.

Defaults are almost never total. When a country cannot repay its debts, it enters in a negotiation process with its creditors and the outcome of this process determines the haircut involved in the debt restructuring process. Most default episodes involve official (bilateral and multilateral) creditors and private creditors. Whereas negotiations with official creditors usually take place within the "Paris Club", currently, there is no established mechanism for negotiations between a sovereign state and its private creditors.

In the 1970s and 1980s, the creditors of emerging market sovereigns tended to be banks and renegotiations were conducted through "bank advisory committees" consisting of representatives of the major bank creditors. After the Brady deals of the 1990s, emerging market countries started to borrow by issuing bonds in the international capital markets (mostly New York and London). The presence of a large number of bondholders with different size and institutional characteristics (from pension funds to individual retail holders) led to a situation in which creditors could not agree to any unified representation.

In the late 1990s and the first years of the new millennium, there was a widespread belief that these institutional changes would have negative implications. The argument was that the presence of a large number of heterogeneous bondholders would make coordination impossible and lead to protracted and litigious debt restructurings and substantial deadweight losses. This would increase the cost of debt crises for both creditors and debtors without having any ex-ante benefit in terms of expected willingness to pay. These preoccupations motivated several policy initiatives aimed at mitigating collective action problems in sovereign debt restructurings. Proposals ranged from issuing bonds with collective action clauses to establishing an international bankruptcy mechanism for sovereigns.

Despite the attention dedicated to these issues, the switch from syndicated bank loans to bonded debt does not, in fact, seem to have affected the costs of debt crises and made their resolution more difficult.

Borensztein, Levy Yeyati and Panizza (2006); and Benjamin and Wright (2008) show that the average default episode in the 1970s and 1980s was substantially longer than the average default episode in the 1990s. Among the main bond restructuring episodes since 1998 studied by Sturzenegger and Zettelmeyer (2007) only one (Argentina) lasted more than two years. Furthermore, in most of these recent cases (Argentina is again the main exception) creditor participation was above 90 per cent and both pre-and post-restructuring litigation has remained rare. There is also no evidence that recent bond restructurings have resulted in more"coercive" creditor treatment, that the practice of take-it-or-leave it offers has shifted bargaining power to debtor countries (Enderlein, Müller and Trebesch, 2008) or that the number of creditors or the type of instrument is correlated with the duration of the restructuring process (Trebesch, 2008). Finally, estimates of creditor losses on sovereign debt indicate that debt restructurings conducted through bond exchange offers since 1998 did not, on average, involve higher (if anything, slightly lower) haircuts than the negotiated Brady deals, which put an end to the debt crisis of the 1980s (Cruces and Trebesch, 2010).

In addition to the literature on the cyclical properties of defaults, there are numerous papers which study the determinants of sovereign defaults. Broadly speaking, these papers can be divided into two groups. The objective of the first group is to identify a series of early warning indicators that can be used to predict default episodes. Papers in this tradition, which date back to the work of Cline (1984) and McFadden et al. (1985), have found that the probability of a sovereign default is positively associated with higher levels of total debt and higher shares of short-term debt and negatively associated with GDP growth and the level of international reserves. Defaults are also related to more volatile and persistent output fluctuations, less trade openness and weaker institutions (Catao and Sutton, 2002; Manasse, Roubini and Schimmelpfennig, 2003; Van Rijckeghem and Weder, 2004; Kohlscheen, 2005; and Pescatori and Sy, 2007). A second group of papers tries to identify why some countries seem to be structurally more prone to default than others, and particularly on the role of debt structure.

2.3. Debt Structure And Debt Crises

Until recently, work on government debt (either domestic or external) focused on the total level of debt with limited attention being given to the role of debt structure. However, the crisis of the 1990s showed the importance of debt composition and highlighted the risks associated with short-term and foreign currency borrowing.

The debt level, often scaled by the country's GDP, is one of the most commonly used indicators of a country's ability to face its obligations. Since developing countries suffer from many debt crises, one would expect them to have much worse debt to GDP ratios than those of the advanced economies. However, this is not the case (Borensztein, Levy Yeyati and Panizza, 2006). On average, developing countries do not have levels of public debt that are substantially higher than those of the advanced economies. Take, for instance, the case of Japan which has a public debt well above 150 per cent of the country's GDP. And yet, the Japanese debt is considered to be safe and pays interest rates which are close to zero. Concurrently, developing countries often face debt crises with debt levels which are as low as 30 per cent of GDP (Reinhart, Rogoff and Savastano, 2003). The same holds true if one focuses on external debt. The United States has an enormous external debt, much larger than that of the average developing country. And yet, while there have often been worries about possible depreciations of the United States dollar, the United States government debt has traditionally been viewed as safe. Even today, after rises in government to GDP ratios of over 30 percentage points in countries such as the United States and the United Kingdom, treasury bonds in these countries carry an AAA credit rating and pay low interest rates.

There is empirical evidence that debt structure plays a role in explaining why developing countries suffer debt crises even at moderate levels of debt. For instance, the literature on "original sin" has focused on the currency composition of external debtand argued that the presence of foreign currency debt plays a role in reducing debt sustainability (Eichengreen and Hausmann, 1999; Eichengreen,

Hausmann and Panizza, 2003). Along similar lines, Detragiache and Spilimbergo (2001) show that the presence of short-term debt is correlated with the probability of a debt crisis. Focusing on currency and maturity composition helps explain why developing countries face frequent debt crises while a country like the United States faces no problems sustaining its debt. The difference is not due to where they borrow and how much they borrow, but to the fact that the United States can borrow long-term in its own currency and that developing countries have traditionally borrowed either short-term or in foreign currency.

While the correlation between debt structure and debt crises is fairly uncontroversial, economists are divided on the question of the causes of unfavorable debt structure and whether something can be done to alter the debt structure of developing and emerging market countries. There are essentially two views in the policy and academic debate (Borensztein et al., 2004). On the one hand, there are those who argue that the debt structure is not necessarily correlated to institutions and policies. According to this view, a country's inability to borrow in its own currency is mostly due to network externalities and historical accidents which have persisted (Eichengreen, Hausmann and Panizza, 2005). Many proposals for reforming the international financial architecture are rooted in this view. Proponents argue that the existing situation can be changed and that debt sustainability can be improved through the creation of new instruments and new institutions (see, among others, Eichengreen and Hausmann, 2005; Borensztein and Mauro, 2004).

On the other hand, there are those who focus on the role of policies and institutions and conclude that the status quo is just a reflection of a more fundamental credibility gap. Reinhart, Rogoff and Savastano (2003) thus argue that developing countries are "debt intolerant" because they lack the institutional set up to sustain even moderate levels of debt. According to this view, poor institutional quality affects debt sustainability because it leads to a misallocation of resources (possibly through corruption or just simple waste) and to bad policies. In turn, bad policies reduce ability to pay because they are associated with high macroeconomic volatility and low economic growth. Therefore, a bad debt structure is not the fundamental cause of debt crisis; it is simply a symptom of a deeper domestic problem (Burger and Warnock, 2006; Guscina and Jeanne, 2006; and Claessens, Klingebiel and Schmukler, 2007) find a correlation between debt composition and the quality of policies and institutions. With respect to policy prescriptions, this view maintains that the only way in which developing countries will be able to sustain higher levels of debt is by addressing the more fundamental problems, and in particular, by improving their institutions and legal frameworks. In the meantime, developing countries should maintain relatively low levels of debt. Whether or not making countries fit for better debt structure and higher borrowing capacity needs to take a long time is a subject of debate. On the one hand, institutions are persistent and hard to reform. On the other, there is plenty of evidence suggesting that countries that undertake decisive reform and build credibility over reasonably short periods of time – that is, a decade rather than a lifetime. Examples include de-dollarization experiences in countries such as Mexico, Israel and Poland.

In particular the different notions of debt sustainability existing in the literature can be distinguished into two classes: the notions based on the behavior of the borrower and the notions based on the behavior of the lender.

2.4. Thresholds For Sustainable Debt

The theoretical literature suggests that foreign borrowing has a positive impact on the investment and growth up to a certain threshold; beyond this threshold, however, its impact is adverse, giving rise to a "Laffer curve" type relationship between external debt, on the one hand, and investment and per capita income growth on the other (Claessens, 1990; Semmler and Sieveking, 2000). According to the IMF (2000), there are various indicators for determining a sustainable level of external debt. These indicators are primarily in the form of ratios and they aid policy makers in their external debt management duties. These indicators can be thought of as measures of the country's "solvency" in that they consider the stock of debt at a certain time in relation to the country's ability to generate resources to repay the outstanding balance. Examples of such indicators of debt management capacity include the debt to GDP ratio, foreign debt to exports ratio, government debt to current fiscal revenue ratio, share of foreign debt to total debt and short-term debt to total debt.

The IMF (2000) also notes that a second set of indicators focuses on the short-term liquidity requirements of the country with respect to its debt service obligations. These indicators are not only useful early-warning signs of debt service problems, but they also highlight the impact of the inter-temporal trade-offs arising from past borrowing decisions. Examples of liquidity monitoring indicators include the debt service to GDP ratio, external debt service to exports ratio and government debt service to current fiscal revenue ratio. The next set of indicators are more forward looking as they point out how the debt burden will evolve over time, given the current stock of debt and average interest rate. These dynamic ratios show how the debt burden ratios would change in the absence of repayments or new disbursements, indicating the stability of the debt burden.

An example of a dynamic debt management ratio is the ratio of the average interest rate on outstanding debt to the growth rate of nominal GDP. External debt sustainability can also be measured by the current account balance (IMF, 2000). If deficits persist, the country's external position may eventually become unsustainable as reflected by a rising ratio of external debt to GDP. In other words, financing of continually large current account deficits by the issuance of debts leads to an increasing debt burden. This undermines solvency and leads to external vulnerability from a liquidity perspective, owing to the need to repay large amounts of debt periodically (e.g., monthly, quarterly or bi-annually).

Different thresholds for external debt sustainability have so far been computed. The threshold for debt sustainability under the HIPC initiative is, for example, pegged at a debt to export ratio of 150% and a debt to GNI ratio of 250%. In their empirical study, Pattillo et al. (2002) compute debt thresholds by assuming that the HIPC initiative will halve countries' debt levels. They use year 2000's debt ratios as their benchmark values, and find that debt negatively affects per capita growth when debt-to-exports ratio is 160–170% and debt-to-GDP ratio is 35–40%.

More recently, Manasse and Roubini (2009) suggest that a fuller set of predictor variables for external debt management include, among others, the total external debt to GDP ratio, short-term debt to reserves ratio, real GDP growth, public external debt to fiscal revenue ratio, external financial requirements (current account balance plus short-term debt to foreign reserves ratio), exchange rate overvaluation, and exchange rate volatility. According to them, a relatively "debt safe" country type is described by a handful of debt management prerequisites: low total external debt (below 49.7% of GDP); low short-term debt (below 130% of reserves); low public external debt (below 214% of fiscal revenue); and an exchange rate that is not excessively appreciated (overvaluation below 48%). Manasse and Roubini identify three types of debt-related risks, which include solvency (or debt un-sustainability), illiquidity, and macro-exchange rate risks. The risk of unsustainable external debt is characterized by external debt in excess of 49.7% of GDP, together with monetary or fiscal imbalances, and large external financing needs that signal illiquidity. The liquidity risk is identified by moderate debt levels, in conjunction with short-term debt in excess of 130% of reserves, political uncertainty, and tight international capital markets. Macro-exchange rate risk types arise from the combination of low growth and relatively fixed exchange rates. Each of these risk types differs in their likelihood to produce a debt crisis.

In contrast to these preceding views on indicators of indebtedness, Caliari (2006)argues that these various indicators used to establish the debt thresholds are poor proxies for how an economy is faring and, particularly, how well a government is meeting its revenue needs to achieve human development goals. He contends that the HIPC initiative has been heavily criticized for relying mainly on debt-to-export and debt-service-to-export ratios as indicators for measuring sustainability of indebtedness. For instance, he finds that export revenue does not necessarily correlate with growth, poverty reduction rates or, more importantly, fiscal revenue. Furthermore, he notes that the chosen thresholds, being fixed numerical thresholds, are unable to capture the possible variation in a country's situations. Caliari recommends that human development imperatives take precedence over debt payments, with debt sustainability assessments geared towards ensuring that debtor countries are able to fulfil the financing requirements needed to meet both the human development and the millennium development goals.

2.5. The IMF and World Bank point of view on debt sustainability: the behavior- based approach

The IMF and the World Bank define the external debt sustainability of a country as its ability and willingness to "meet the current and future external debt service obligations in full, without recourse to debt rescheduling or accumulation of arrears and without compromising growth".

This concept of sustainability focuses on the behavior of the borrower (the borrower's willingness and ability to repay its debt "in full") rather than on the behavior of the lender (based on the lender's liquidity and investment alternatives).

The basic assumption underlying this notion is the following: "if a country has serviced debt of a certain level (defined as a percent of exports, GDP or fiscal revenues) and this level does not increase, it will be willing (otherwise it would have already repaid it) and able to continue to service the debt." (De Melo, 1990, p. 255).

According to this view, the signal of an unsustainable debt is clear: a country receiving external debt relief (in form of debt rescheduling or debt forgiveness) is in a situation of "excess" of debt. That is, the current debt level is higher that the sustainable one.

Given this assumption, the aim of economic theory is to suggest models and indicators that allow to find the so called "thresholds of solvency", that is to say the ratios of foreign debt with respect to GDP, exports or revenues under which the debt is sustainable and over which it is "excessive". Reached the thresholds of solvency, the debt is expected to remain sustainable if the debtor stabilizes these ratios through some appropriate fiscal and current account balances.

This approach is really problematic for the existence of a degree of freedom. To clarify this point, let's suppose that creditors are engaged in a debt relief initiative (as the HIPC initiative) in order to reduce the external debt of a country to sustainable levels. Then creditors have to decide when external debt may be considered "sustainable" (that is to say when it is not "excessive"). However, as we have seen, the fact that creditors decide to accord some debt relief measures is in itself the criterion to declare a situation of "excess debt". This reasoning is evidently circular and shows how the economic indicators connected with this notion of sustainability are in some way arbitrary.

This arbitrariness is inevitable once we don't consider the relationship between lender and borrower. Indeed, the decision of a debtor country to "meet current and future external debt service obligations in full" is not independent from the characteristics of this relationship. In particular, the contract fulfilment depends on the coordination strategies and the power relations between lenders and borrowers.

As a consequence it is possible to affirm that any definition of debt sustainability cannot be neutral, even if performed by international organizations. Further, if these organizations coordinate the creditors or are creditors themselves, the judgement on debt sustainability is performed by one part of the contested exchange. Even if this decision will favour not necessarily the interests of creditors, certainly the decision is taken by creditors.

2.6. The HIPC initiative and the arbitrariness of the thresholds of solvency

The Heavily Indebted Poor Countries (HIPC) initiative, promoted by the G - 8 Summit in 1996 and enhanced in 1999, entails coordinated actions by the international financial community, including multilateral institutions, to reduce the external debt burden of the most indebted countries to sustainable levels. The concept and the indicators of debt sustainability are crucial both in the definition of the eligible countries and in the determination of the appropriate debt relief.

The HIPC initiative, assuming the borrower based approach of the International Financial

Institutions, defines sustainability through the following debt indicators (related both to the fiscal and the external position). In the original framework a debt was regarded as being sustainable if the ratio of Net Present Value (NPV)of debt to exports was in the range of 200- 250 % or less and the ratio of debt service on exports was in the range of 20- 25 % or less. For particular open economies with a large export base there was also a fiscal indicator of NPV of debt to government revenues of 280 % or less. Debt relief for eligible countries aimed to reach these sustainable ratios.

After the Koln agreement the HIPC initiative has been "enhanced" and the thresholds of solvency have been lowered: the ratio of NPV of debt to exports ratio has been lowered to 150 % and the ratio of debt service to exports has been lowered to the range 15- 20 %. Moreover, if the ratio of exports to GDP is above 30 % and the ratio of fiscal revenues to GDP is above 15 %, a further threshold has to be respected: the ratio of debt to fiscal revenues has to be below 250%.

As underlined by Hjerthom (2000), it is widely asserted that the World Bank and the IMF have adopted these targets in an “ad hoc” manner without basis in analysis, or that they merely reflect a particular World Bank - IMF style of ‘common sense’.

In effect the only way to determine some thresholds of solvency on the basis of the behaviour of the borrower is to extract a rule from the past experience of the developing countries behaviour. The results are based on retrospective analysis of the incidence of rescheduling of non - HIPCs compared to their PV of debt-to-exports ratios in the preceding years.

Based on the earlier time period (NPV of debt-to exports ratios in 1991 -1993 and incidence of rescheduling in 1993-1997), for those countries with an NPV of debt-to-exports ratio below the 150 percent level the sustainability threshold under the enhanced HIPC framework -the incidence of rescheduling was only 12 percent. For the group of countries with NPV of debt-to-exports ratios between 150 and 200 percent, the incidence increased to 22 percent. For those with ratios over 200 percent, the incidence of rescheduling rose to 70 percent.

For the more recent period, the NPV of debt ratios between 1993 and 1995 are compared to incidence of rescheduling in the subsequent period 1995- 2000. In this sample the incidence of rescheduling for the group of countries with debt ratios between 150 and 200 percent increased slightly to 25 percent, while the incidence of rescheduling for the group of countries above 200 percent decreased markedly to 36 percent.

The limits of this analysis, and in general of the efforts to find “reasonable thresholds of solvency” from the past experience of debt (non) repayment are rather evident (see for example Cohen, 2000).

Firstly, the actual results may vary according to the time period considered. Secondly, countries differ in their ability to manage any given level of debt. Moreover, history is the result of the relationships between borrowers and lenders. Then, if we use the past behaviour of the borrowers to foresee their future ability and willingness to repay the debt, we are considering the borrowers and the lenders in the past international environment, that is to say characterized by the same strategic interactions and embedded in the power relationships.

This is an arbitrary use of history: the actual contract fulfilment by debtors is analysed on the basis of the past fulfilment. However the past contract fulfilment depends on the past characteristics of the relationship (that is on past power relations and past strategic interactions).

In fact the history of the HIPC initiative itself demonstrates that the “true thresholds of solvency” do not exist and that in the definition of “excess debt” there is a degree of freedom due to arbitrary choices. When, after the Koln agreement, the initiative was enhanced, the indicators were lowered not to apply a different economic analysis, but to accept the requests of NGOs and to face the broad cultural and political consensus for the forgiveness of poor countries debt.

Hjertholm (2000), starting from the idea that the HIPC sustainability targets are not well supported in analytical terms, suggests to adopt country - specific targets in such a way that it is possible to take in account that countries encounter debt service problems for a variety of reasons and at different levels of debt.

2.7. The Economic Sustainability Baseda Pproaches

The Economic Sustainability Perspective, also called the development perspective, looks at the channels through which debt burden blights the economic growth of debtor country. This approach basically analyses the inter-linkages between the fiscal deficit, inflation rate, exchange rate, investment, imports and exports or balance of payments, economic growth and external debt stock and external debt servicing. According to this approach, the debt burden blights the economic growth via two main channels which are Cash Flow Effect and Disincentive Effect.

2.7.1 The Cash Flow Effect

The Cash Flow effect refers to the obstruction in public investment and relegation in capital imports supplementary to public investment on account of augmented external debt servicing which ultimately perishes the economic growth and development in the country. Because the public investments most of the times, especially in cases of developmental projects, are complementary to the private investments that’s why decline in public investment crowds out the private investment. (Arnone et al, 2005)

2.7.2 Disincentive Effects

The disincentive effect can be justified with the help of debt overhang hypothesis and debt laffer curve. Both theories say that very high level of debt put negative effects or disincentive effects on the economic growth. Both theories are briefly discussed in this section.

- **Debt Overhang Hypothesis**

The Debt Overhang hypothesis was formulated and tested by the Krugman in 1988 for the first time and by Sach in 1989 after that. By the debt overhang they mean that a country's level of debt is much high that debtor country losses its ability to attract the new investment (domestic and foreign) due to the present inability to service its debts and prospects of sinking the investment returns fully or almost fully into future debt servicing. They believed that the current debt overhang puts disincentive effect on investment by discouraging the future investment and cause a huge deadweight loss. It further snatches the economic reform ability of debtor country. The debtor country remains fail to accumulate resources even the investment is beneficial for the country and can bring growth to the economy (Krugman, 1988). The Debt overhang theory establishes the negative relationship between the high debt and economic growth.

- **Debt Laffer Curve**

The Debt Laffer curve relates the level of debt to the GDP growth. It shows the inverted U relationship between the said two macroeconomic variables. In other words, according to this concept there is no linear relationship between the debt and GDP. The shape of the laffer curve reflects that there is a country specific threshold level of debt and if debt exceeds to that level will not only cap the growth process but also give a reverse gear to the economic growth of that country. So the debt is considered to be sustainable if it is lower than or at least equal to that threshold level.

2.8. The lender based approach / Intertemporal Budget Constraint (IBC)

As it has been previously mentioned, two basic perspectives exist on the issue of debt capacity, namely the borrower's perspective and the creditor's one. While the former is based on the characteristics of the debtor country's economy related to the willingness and ability to service foreign debt, the latter is concerned with the supply of external financing to a debtor country, and as such looks at the matter from the perspective of creditors.

The crucial issue of this approach is that a certain debt is sustainable if, given the expectations for the future scenarios the lenders will continue to finance the deficit of the debtor country (both fiscal and current account deficit). This perspective is normally adopted in the theoretical frameworks which analyze the sustainability of the external debt of a country (see for example Spaventa, 1987).

Econometrically, in literature, the external debt sustainability using IBC has been analyzed employing two distinct types of approaches. First is Unit root approach and second is a Cointegration approach. According to unit root approach, for a sustainable level of external debt, country's the external debt to exports ratio should be stationary or $I(0)$. Cointegration approach requires that the external debt stock and exports should be cointegrated.

2.8.1. The analytical framework

Let's consider an economy which has inherited from the past a domestic public debt /GDP ratio equal to $bo \geq 0$. Moreover let's suppose that, starting from period 1, this economy is characterized by a constant real interest rate r and by a constant real growth rate n. It is assumed that the future growth and interest rates are known with certainty. Moreover we suppose that government deficits are not monetized. Finally, we assume that lenders maximize their intertemporal utility over an infinite horizon.

Now suppose that in periods $T, \ldots, 2, 1$ the ratios between expenditures and GDP, on one side, and between the revenues and GDP, on the other, are respectively equal to $g1, g2, \ldots, gt$ and to $r1, r2, \ldots rT$

From the law of variation of the public debt, we can derive the debt level in every period. If the GDP is constant $(0 = n)$, we will obtain:

Eq. (2.1) $b_1 = g_1 - \tau_1 + (1 + r)bo$

$b_2 = g_2 - \tau_2 + (1 + r)b1 = g_2 - \tau_2 + (1 + r)(g_1 - \tau_1) + (1 + r)^2$

$b_3 = g_2 - \tau_2 + (1 + r)(g_2 - \tau_2) + (1 + r)^2 (g_1 - \tau_1) + (1 + r)^3 bo$

$b_T = g_T - \tau_T + (1 + r)(g_{T-1} - \tau_{T-1}) + \cdots + (1 + r)^{T-1} (g_1 - \tau_1) + (1 + r)^T bo$

Then in every period the debt level is equal to the level in the last period plus the interests accumulated plus (minus) the primary deficit (surplus) obtained in this period.

We can rewrite the expression of b_T in this way:

Eq. (2.2) $b_T = \sum_{t=1}^{T} (g_{t-\tau_t}) \ (1 + r)^{T-t} + (1 + r)^T b_o$

So the debt level at the end of time T is equal to the initia l debt level bo accumulated at the rate r for T periods plus the algebraic sum of primary deficits (surpluses) in every period t = 1,2,...,T, each of them accumulated at the rate r for $T - 1$ periods.

Let's suppose that we know the values of primary deficits (surpluses). The present value of bt will be:

Eq. (2.3) $\frac{b_T}{(1+r)^T} = \frac{\sum_{t=1}^{T} (g_{t-\tau_t})}{(1+r)^t} + b_o$

Now let's impose the "no- Ponzi Game" (NPG) condition: $\frac{b_T}{(1+r)^T} \rightarrow 0$ for $T \rightarrow \infty$, so that:

Eq. (2.4) $\frac{\sum_{t=1}^{T}(g_{t-}\tau_t)}{(1+r)^t} = b_o$

It is possible to demonstrate that the NPG condition follows immediately from the transversality condition of the lender's utility maximization proble m. That is, the NPG condition is an implication of lenders 'optimal behaviour (Cuddington, 1997).

The identity (2.3) indicates the intertemporal budget constraint for a constant level of production (0 = n). As long as the present value of the debt far into the future declines as the planning horizon expands, we are in the standard case of the finance literature: the value of an asset (here the country's debt) is equal to the present discounted value of all the dividends attached to it (here all future debt servicing given by τ_1- g_1, t =1,..., T). It is said to be worth its "fundamentals", and if the debt were traded on a secondary market, its market value would exactly match its face value.

The "no Ponzi game" condition states that the debt level must increase overtime at a rate smaller than the interest rate r. From an economic point of view this means that, if the government wants to place all the obligations needed to pay the debt service, the debt service cannot be financed entirely by new financing (debt obligations). Suppose that this condition is violated, so that the present value of the activities accumulated by savers will be positive over an infinite horizon. Then, individuals who maximize their intertemporal utility will not subscribe all the obligations because in that case they would renounce to consume a fraction of the lifetime wealth. So optimality in equilibrium models requires the respect of this solvency constraint. This constraint doesn't require that debt must be repaid in full: it requires simply that the present value of b_T must tend to 0 over an infinite horizon. This means that the current debt level can be positive and that it can grow indefinitely, even if at a rate smaller than r. In other words, this condition implies that the discounted sum of revenues in all periods must exceed the discounted sum of expenditures for an amount equal to the initial consistency of the debt.

Agenor and Montiel (1996, p. 123) argue that: "The government is solvent if the expected present value of the future resources available to it for debt service is at least equal to the face value of its initial [i.e. current] debt stock. Under these circumstances, the government will be able to service its debt on market terms. Solvency thus requires that the government's prospective fiscal plans satisfy the present -value budget constraint. "

So, in this framework, sustainability is reached if the existence of a positive debt is accompanied by the realization of primary surpluses over an infinite horizon. If this discipline is violated, the debt accumulation will become unsustainable and a rational optimizing saver will not subscribe the obligations emitted by the State.

2.9. Review of Empirical Literature on External Debt Sustainability

External debt sustainability is very hot topic of debate due the worldwide debt crisis. An extensive literature is available on this topic especially since 1980s. This section reviews the studies related to the external debt sustainability and its different aspects. Jafri (2008) analyzed the sustainability of Pakistan's external debt in medium term framework. Availing the Debt Sustainability Analysis (DSA) technique based on simple accounting approach, the author estimated the equation of evolution of external debt based on the data for the period of 1999 to 2008 and making projections for the period of 2009 to 2013. The ratio of country's non interest current account balance to GDP, nominal interest rate on debt stock, exchange rate, real GDP growth, inflation and the ratio of net non-debt creating capital inflows to GDP were considered the main component of evolution of external debt. Nominal value if external debt to GDP ratio was used as indicator for setting the threshold level. The author developed the different scenarios (baseline and two alternatives) for making projections.

Further the sensitivity test was conducted comprising of the comparisons of baseline path of debt to the paths of two alternative scenarios by assuming shocks in debt dynamic components and to the projections of six bounds. The results of the DSA predicted the growth in the external debt to GDP ratio in both, the small individual shock and large combined shock to the components of evolution of external debt, cases but the growth will remain in safe limits in the former case only and not in the latter case which demands the debt rescheduling.

Emilia and Emilian (2008), choosing Romania as the testing case, examined its public and foreign debt sustainability. Using the monthly data from January 1992 to December 2007, Phillips Perron Unit root test, cointegration and OLS regression were applied on two equations carrying the exports, imports , current account Deficit, trade deficit and lagged dependent variable as independent variables and external debt and public external debt as dependent variables respectively. The results of the study confirmed the weak sustainability of Romanian debts. Nwachukwu (2008) studied the implications of the Enhanced Heavily Indebted Poor Countries (HIPC) -Multilateral Debt Relief Initiative (MDRI)

Framework for external debt sustainability in 16 post completion point countries by checking that whether net present value of their external debt will, by the end of 2015, trim down to sustainable level of 150 percent of their exports with the help of growth with debt model. The author observed that total external debt to export ratio, till 2015, will shrink down to the 176 percent only if these countries enjoy relief under enhanced HIPC MDRI.

In 2009, Mehmood et al. calculated the debt ratios and derived the necessary and sufficient conditions for the sustainability of government and external debt of Pakistan rooted in two theoretical models.

Soaking up the annual data for the period of 1971 to 2008, the study resulted in the indication of unsustainable public and external debts as effect of not meeting only the sufficient condition for debt sustainability except few early years of new millennium.

Zanhier and Rossini (2009) reviewed the composition of current account and the sustainability of external debt. Utilizing the extension of usual approaches (Obstfeld and Rogoff, 1996) to solvency determination, distress of external debt of the economy was assessed. Operating with the yearly data from 1992 to 2003 and utilizing the Estimated Generalized Least Squares (EGLS) technique, Static panel of 19 countries was estimated to reexamine the impact of equity flows on the external debt of the countries.

Gunter et al. (2009) criticized the IMF and World Bank's debt sustainability framework which was presented for the analysis of low income countries by enunciating that it made the aforementioned countries prey of low debt – low growth circumstances and proposed the new concept of debt sustainability conducive to Millennium Development Goals by linking the economic debt capacity of a country to the social development position. They stressed on the importance of a country's level and extent of MDG achievement in deciding the limit of the country's external borrowing.

Workie (2011) empirically examined the debt sustainability and economic growth causality in European Union. The author utilized the data of 27

European countries for the time period from 1995 to 2010 and developed three non-overlapping panels, each of five year and applied the panel data approach for both the fixed effect model and the random effect model. The average growth rate of real GDP per capita was regressed against the ratio of debt as percentage of GDP and its square. Other independent variables incorporated in the model were education, government consumption, inflation, labor force growth, openness and research and development expenditure. The result of the paper suggested that the growth rate of GDP per capita was adversely affected by debt at high levels.

Porcil et al. (2011) presented a dynamic model based on Post Keynesian macroeconomics which is to deal with mechanism, conditions and monetary policy rules which are the basis of external debt crisis and its unsustainability and affect the growth and stability of the small developing economy which completely integrated to the world financial and good markets. The model focused on two kinds of policy rules i.e. inflation target and exchange rate target, both implemented via the Interest Rate Operations Procedure (IROP) which influenced the stability of the small open economy. The model inferred that in order to keep the economy away from external instability, strict monitoring of the evolution of exchange rate is crucial. The model further put forward that if the foreign and domestic interest rates tend to be very close to each other than the real exchange becomes more effective to stabilize the economy.

Muhanji and Ojah (2011) conducted analysis of the management and sustainability of foreign debts of African countries. Using the data for 24 African countries, the authors regressed the debt indicators against the various thresholds. Utilizing the data for the period of 1970 to 2008, the fixed effects method was applied on the model for estimation. The growth rate of GDP was entered as dependent variable in the model while the explanatory variables included the relative interest rate, lagged inflation, exchange rate, terms of trade, household consumption, consumption imports, investment imports, export, Debt to GDP ratio and debt to export ratio. The result of the study explored that Debt to GDP ratio rose if either a country's debt accumulated faster than the GDP or if external debt rose whilst GDP remained unchanged.

Haile (2016) studied the sustainability of Sudan's debt using two conventional approaches both econometric and non-econometric. In the first approach, He used an econometrics technique to test the stationarity using co-integration of government revenue and expenditures and found no evidence that the Sudan's public debt is on the sustainable path. He also carried out both a crude and more elaborate tests that focused on non-econometric approaches and the result suggests similar results in that Sudan's debt is not sustainable.

Nasir and Noman (2012) used three-step nonlinear framework for the assessment of external debt sustainability. In the first step, linearity property of foreign debt was verified by utilizing the general linearity Harvey and Leybourne (2007) test to determine the linearity property of external debt ratio and current account ratio(two measure of external debt sustainability) which requires the determination of order of integration of time series. In second step sustainability of nonlinear processes was tested by Kapetanio, Shin and Snell (2003) or KSS test and sustainability of linear processes was examined by Augmented Dickey Fuller (ADF) test and in the third step the ADF test was applied on the nonlinear processes and comparison between the results of two steps was established. The study resulted in the favor of nonlinear unit root test's better performance than the ADF test in determining the stationary property of series by providing the evidence of 36 debt and 55 current account ratios' non linearity and sustainability.

Adler and Sosa (2013) studied the external conditions as well as debt sustainability for the case of Latin America. They reported that growth-conducive external position of aforesaid country had boosted the economy in the 21st century. They further proposed the framework for the analysis of debt sustainability which along with the domestic factors took the external or global factors into account that captures the impacts of global crisis on the debt sustainability countries. The results of the study revealed that the external factors did not seem to be the concern of debt sustainability of Latin America, just domestic growth buffers especially the fiscal policy instrument are the source of concern.

Mehmood et al. (2014) conducted comparative analysis of external and public debt sustainability in the four major SAARC economies which include Pakistan, Bangladesh, India and Sri Lanka. The authors first compared the traditional debt ratios with the threshold levels and then derived the necessary and sufficient conditions of External and public debt sustainability. The results of the study showed that debt level of all studied economies were unsustainable. The reason of these unsustainable debt levels is the twin deficits.

After having the review of all relevant literature it is concluded that there is need for a study which analyze the external debt sustainability for all EAC countries. There is a gap in the literature for a study which conducts the analysis for each country individually and as whole.

CHAPTER THREE

EAST AFRICAN COUNTRIES EXTERNAL DEBT PROFILES

The East African sub-region, according to the United Nations Economic Commission for Africa (UNECA), has the following 14 countries: Burundi, Comoros, Democratic Republic of Congo, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Tanzania, Somalia, Uganda, Seychelles and South Sudan. It is also the region where the East African Economic (EAC) community is found. EAC is an inter-governmental organisation mandated to front the East African economic, social and political integration. The EAC is currently comprised of six member states namely Burundi, Kenya, Rwanda, Tanzania, Uganda and South Sudan. As one of the fastest growing regional economic blocs in the world, the EAC is widening its economic, political and social integration.

3.1. Economic Overview of East Africa

According to the African Economic Outlook (2017), East Africa is the fastest economic growing region in Africa and continued to lead in 2016 with an estimated growth of 5.3%. Economic growth of the EAC region has been faster than in the rest of Sub-Saharan Africa since 2005 and almost doubled the rates achieved in the previous 15 years (IMF, 2011).

The following figure shows the region registering high growth rates for 2013 (7.2%), 2014 (5.9%) and 2015(6.5%).

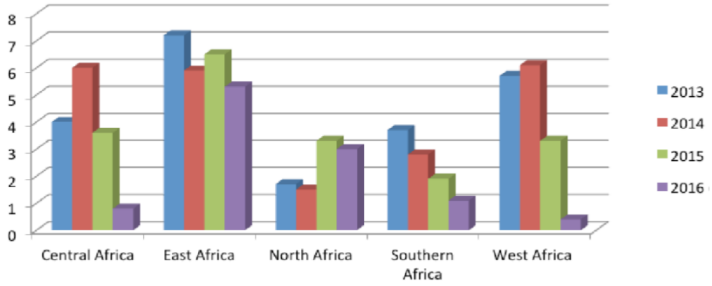

Figure 3. 1: Africa Economic Growth by region as % of GDP (2013 – 2016)

Source: African Development Bank Statistics, (2017)

The region`s economic growth has been driven mainly by Ethiopia and Tanzania which are amongst the fastest-growing countries in the world with growth between 6% to 10%. The rapid economic growth is due to strong performance in industry, construction, services, and information and communication sectors. Countries such as South Sudan have continued to record low growth rates but large support from donors has helped secure progress in peace and state building.

Despite the high economic growth in the region, public debt still remains one of the main economic policy challenges facing governments and could plunge the region into economic crisis.

3.2: Regional Debt Trends

A public debt refers to credit owed to both external and internal parties by Governments of independent countries. External debt is money owed to external creditors who are multilateral creditors (International Financial Institutions) or bilateral creditors who are essentially other countries and commercial creditors (World Bank 2015).On the other hand, domestic debt is money owed to holders of Government securities such as treasury bills and treasury bonds. Public debt is one of the macroeconomic indicators that forms a country's image in the international market and is an inward foreign direct investment flow determinant (Iberia et al, 2012).

The regional total debt stock as presented in Table 3.1 and Figure 3.2 below, shows an incremental trend from 2007 to 2015. Since 2007 the sub-regional debt stock has been rising steeply mainly driven by Ethiopia, Kenya and Tanzania who have been borrowing heavily since 2007 from international and domestic markets. At the end of 2015 the bulk of the sub-regional PPG external debt was owed by Ethiopia which held 31% of the debt, Kenya 24% and Tanzania with 17%. The least amount of external debt was held by Comoros which constituted about 0.16% of the total debt.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Burundi	1276	1234	394	382	363	411	398	404	408
Comoros	276	266	260	251	246	224	117	113	103
Congo, Dem. Rep	10905	10862	10880	4597	4022	4103	4470	4149	4155
Djibouti	653	680	737	622	651	642	673	820	1169
Eritrea	856	957	1013	1002	1014	952	896	829	782
Ethiopia	2571	2829	4819	6547	7945	9941	11886	15846	19467
Kenya	6244	6400	6731	6989	7771	9024	9830	13355	15324
Madagascar	1411	1717	1836	1982	2093	2191	2263	2294	2486
Rwanda	566	650	716	759	971	1045	1553	1877	2121
Somalia	1979	1983	1987	1990	1992	1985	1977	1913	1876
Tanzania	3181	3711	4640	5601	6438	7366	9112	9911	10690

Uganda	1571	1780	2247	2673	2963	3478	4064	4213	4873
Totals	31489	33070	36260	33395	36469	41362	47238	55723	63454

Table 3. 1: Total Debt Stock for East Africa Countries (US$ millions)

Data for Seychelles and South Sudan not available

Source: Compilation based on World Bank data, 2017

Figure 3. 2: Total External Debt Stock for East Africa (public and publicly guaranteed).

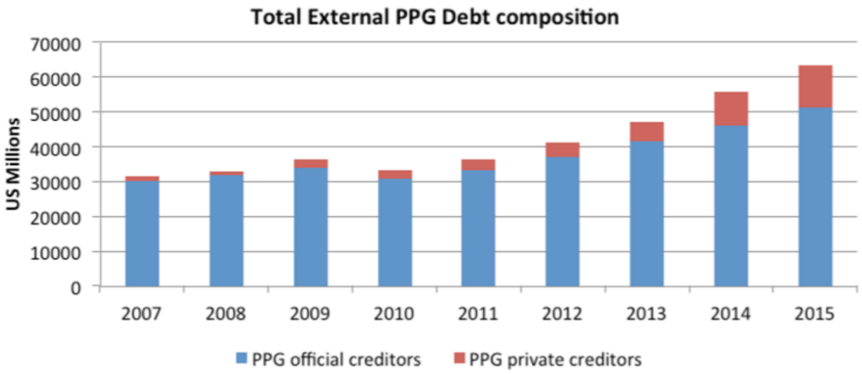

Figure 3. 3: Regional Composition of Total External Debt public and publicly guaranteed.

Figure 3.3 above shows a significant increase in the use of private creditors by East African countries from 2012 and beyond. In 2012 private creditors constituted 13% of total PPG and by 2015 this ratio had increased to 22% signaling the increase in commercial credit and the emergence of bond issuance from 2013 onwards.

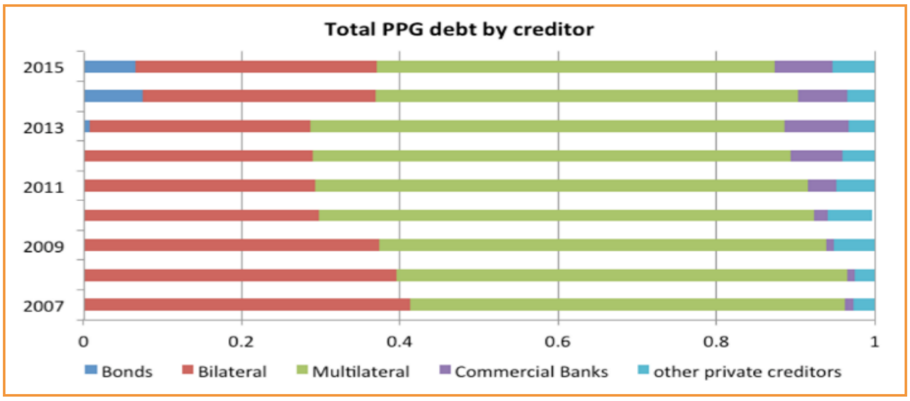

Figure 3. 4: Share of public and publicly guaranteed external debt, 2007-2015 in percentage

Source: World Bank data, 2017

As shown above in Figure 3.4, the regional external debt has mainly been concentrated in form of multilateral credit since 2007. The emergence of bond issuance only surfaced in 2013 with Rwanda and Tanzania being the first East African countries to tap in the international market with Kenya and Ethiopia subsequently issuing their first bonds in 2014.

3.3 Selected member countries' debts

In selecting countries for further debt analysis debt ratios which indicate potential debt related risks were used. Debt ratios are considered in conjunction with key economic and financial variables such as expected growth and interest rates, which determine their trend in medium-term scenarios. For the purposes of this debt profile 3 debt ratios, i.e. debt-to-exports, debt service-to-exports and debt-to-Gross National Income (GNI) ratio were considered.

The debt-to-exports ratio;- is the ratio of total outstanding debt at the end of the year to the economy's exports of goods and services. Debt to exports has the advantage that exports provide the basis for debt repayments. Debt to exports has the advantage that it is less volatile than other ratios hence allows a more meaningful inference of trends. This ratio is adopted as a measure of sustainability because an increasing debt-to-exports ratio over time, for a given interest rate, implies that total debt is growing faster than the economy's basic source of external income, signaling that the country may have problems meeting its debt obligations in the future. A growing ratio when the level of debt is already high indicates a greater burden of servicing the debt and may suggest that a country is on an unsustainable path.

The debt service to exports ratio;- is used as an indicator of debt sustainability because it indicates how much of a country's export revenue will be used up in servicing its debt and how vulnerable the payment of debt-service obligations is to an unexpected fall in export proceeds. The higher the share of short-term credit is in the overall debt, the larger and more vulnerable the annual flow of debt service obligations. Debt service ratios may rise due to a fall in exports; fall in commodity prices, increased borrowing and higher interest rates.

The external debt to GNI indicator;-measures the liabilities of the public sector for external debt of a country in relation to its total income (GNI). Although external borrowing is a method of supplementing savings and financing the investment gap in a country, an unsustainable debt burden will ultimately hinder development.

For individual country analysis, the analysis was based on countries whose debt ratios are signaling that debt service difficulties are likely to occur. These are countries whose external debt: to exports is above 150%, external debt to GNI is above 50% and debt service to exports is above 5%. In most cases countries with high external debt to exports ratio and external debt to GNI ratios have a rising debt service ratio which is regarded as a sign of an imminent debt crisis.

Debt sustainability analysis using the above external debt ratios revealed that Djibouti and Burundi are currently high risk debt distress countries. Although countries such as Kenya and Tanzania have been experiencing a steep upward trend in their external debt since 2007 this is financing infrastructure development which addresses bottlenecks and will ultimately boost sustainable economic growth. Most of the East African countries exhibited low and moderate risk debt scenarios.

Ethiopia's total external debt stock in 2000 was US$8.0 billion, one of the highest total among the HIPC countries. More than two thirds of the long-term debt is owed to bilateral creditors, with the largest proportion of US$5.5billion owed to Russia. Just over one quarter of long- term debt is owed to multilateral institutions, mainly the World Bank's IDA and African Development Bank, with a relatively small amount due to private creditors. In 1998 Ethiopia paid US$119million in debt service, less than 20% of the full US$612million debt service due.

Initially Ethiopia was to be one of the first countries to gain HIPC Initiative assistance, but the IMF has blocked the country's progress by declaring its last two ESAF structural adjustment programmes off-track twice, largely due to the conflict with Eritrea. Consequently as Ethiopia is not expected to have a new IMF programme or an interim PRSP in place, the earliest the country can expect HIPC assistance is at the end of 2001.

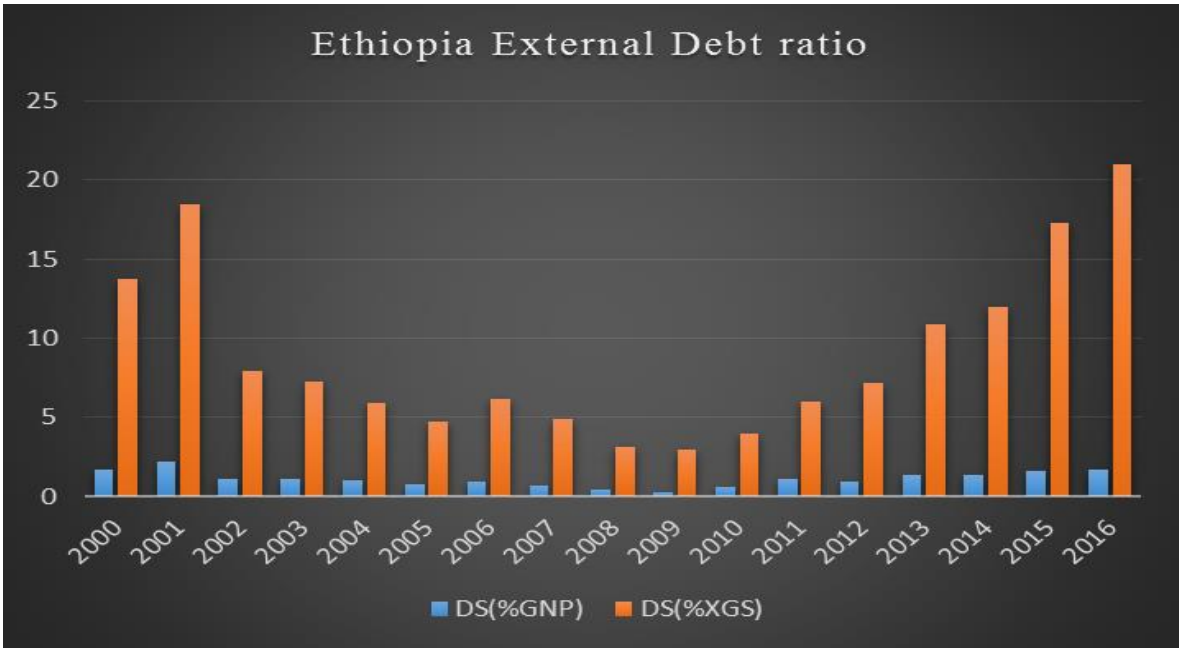

Figure3. 5: Ethiopia's External Debt ratios

Source: Author's Compilation based on World Development indicators, 2017

Despite benefiting from debt cancellation under the HIPC Initiative and MDRI which immensely reduced its external debt by more than 70% from $1,276 billion in 2007 to $363 million in 2011, Burundi continues to be a high-risk debt distress country. External debt in 2007 representing 1434% of exports has however been falling gradually over the years to a low of 248.6% in 2012 owing to the numerous debt reliefs that the country received. External debt to GNI reduced from 104.4% in 2007 to 20.3% in 2015. Burundi`s high risk of debt distress has mainly been exacerbated by the country`s extremely narrow export base (estimated at $165million in 2015) and prospects for graduating from the high-risk debt distress are hinged on the country`s ability to improve its export performance.

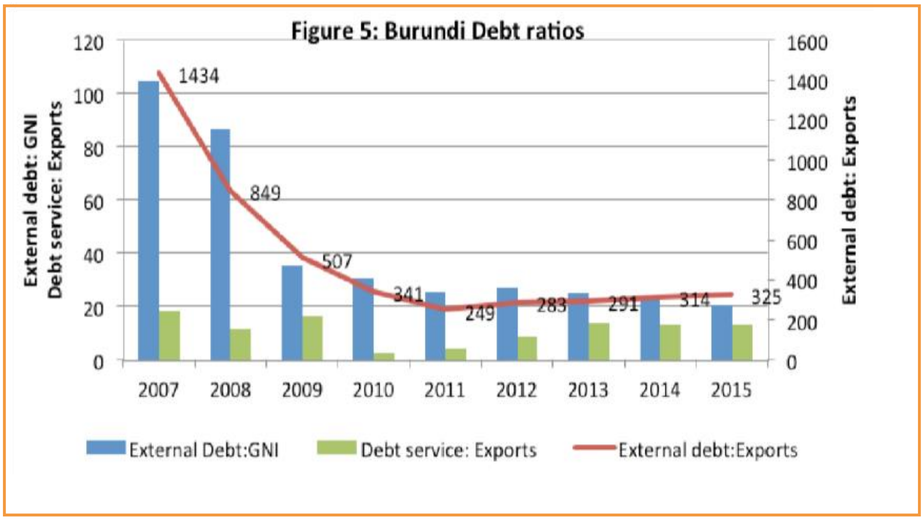

Figure3. 6: Burundi Debt ratio

Source: World Bank data, 2017

External debt in Djibouti has been on a growth trajectory since 2010 post debt relief from the Paris Club which slightly reduced its PPG external debt from $737million in 2009 to $622million in 2010. Debt service to exports subsequently fell slightly in 2010 to 7.9% from 8.3% in 2009. In 2007 external debt to exports was 237.7% which has gradually been falling over the years to 155.5% in 2013. This has mainly due to the improvements in GDP growth over the years. In 2013 the government contracted two large loans for the total amount of about US$900million which represented 60% of GDP and the external debt to exports has been rising since 2013 and stood at 193.4% in 2015. The loans were provided by the Export-Import Bank of China to finance investments projects of the construction of the Addis Ababa–Djibouti railway and a water pipeline from Ethiopia. The contraction of the nonconcessional loans in 2013 resulted in the increase in debt risks and further non-concessional borrowing will exacerbate the country`s already high risk of debt distress.

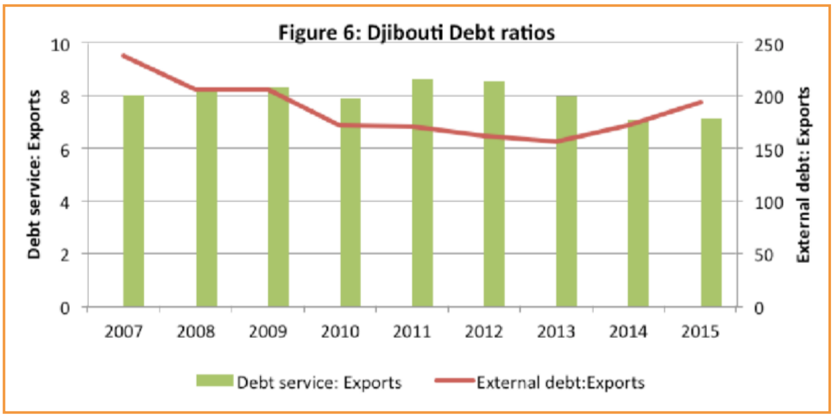

Figure 3. 7: Djibouti's debt ratio
Source: World Bank data, 2017

Kenya's external debt is relatively of large size compared to other sub-regional countries and has been constituting a large part of its total public debt. It has been rising gradually over the years since 2010 when it was 720.2 billion Kenyan shillings and constituted 54% of total public debt. Figure 3.8 below provides an overview of the public debt trends in Kenya. At the end of 2016 domestic debt stood at 1.930 trillion Kenyan shillings ($18.7 billion) and accounted for about 50% of total public debt and about 26% of GDP.(Central Bank of Kenya). Kenya has been borrowing from foreign market mainly to cover its budgetary deficits.

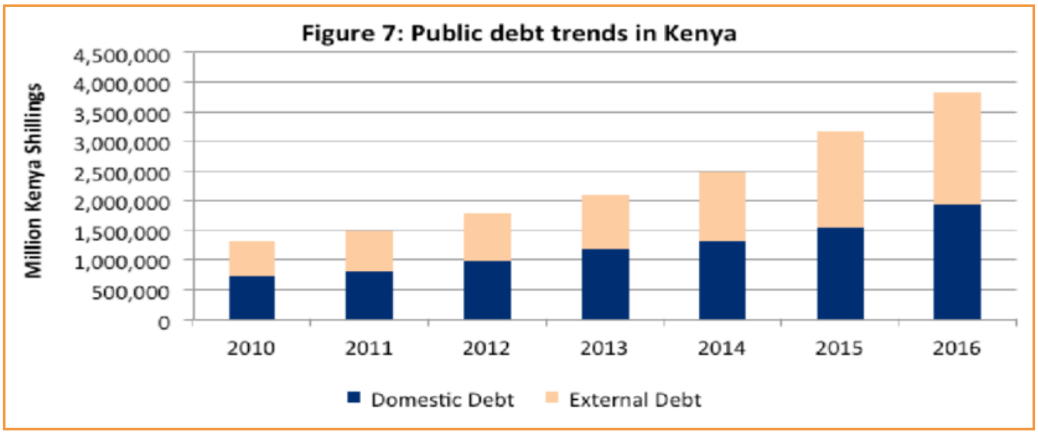

Figure 3. 8: Kenya Public debt trends

Source: Compiled from World Development Indicator, 2017

Uganda: introduced treasury bonds in 2004 and since then the stock of domestic debt has been on the rise due to the need to mop up excess liquidity from the banking system to avoid inflationary pressures. Domestic debt stood at 1.262billion Ugandan shillings in 2004 but had risen to 6.178 billion Ugandan shillings by 2010. Between 2012 and 2016 domestic debt increased by 76% to reach a high of 14.401 billion Ugandan shillings in 2016. Domestic debt at 8.170 billion Ugandan shillings in 2012 represented 13.3% of the country`s GDP, and by the end of 2016 the domestic debt to GDP ratio had slightly increased and stood at 17%.

Rwanda's external debt has been rising although on a slower pace compared to domestic debt (Figure 9).In 2009 domestic debt was $311.2 million which represented 5.9% of the country`s GDP and 29.7% of public debt. By the end of 2014 domestic debt had risen by 80.7% to 562.6 million, 23.2 % of GDP. The country`s domestic debt has been increasing due to the Government's cash flow needs, and funding of the Energy, Water and Sanitation Authority (EWSA) projects funded through loan facility with Bank of Kigali.

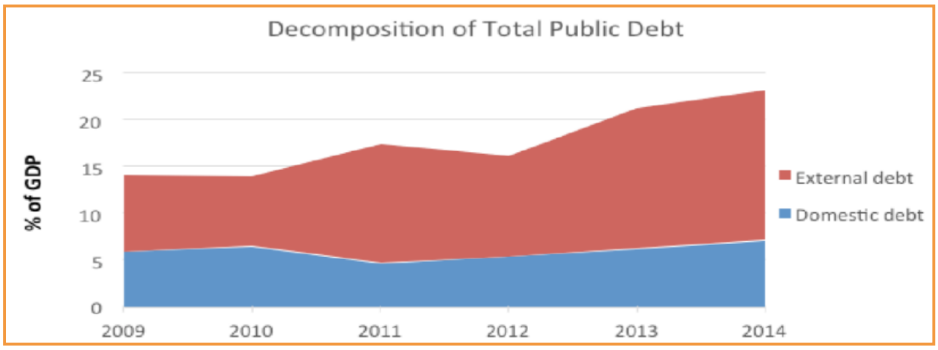

Figure 3. 9: Decomposition of Debt Stock for Rwanda, 2009-2014

3.4. Drivers of Public Debt Accumulation

The key drivers of public debt accumulation in the region are declining official development assistance especially grants, increased budget deficits and the need to finance infrastructure developments. Traditional sources of credit are shrinking and new options with harder terms are emerging, such as new bilateral lenders. Commercial lenders have increased especially sovereign bonds issuances. The new bilateral lenders are attractive because they provide relatively larger amounts of financing without policy and other related conditionality.

A number of EAC countries issued large Eurobonds and these are drastically increasing external debt, which may compromise the gains on debt sustainability. By end of 2014, Ethiopia, Kenya, Rwanda and Tanzania, had issued Eurobonds worthy US$4Billion dollars, as shown in Figure 3.2. None of the East African countries issued international bonds in 2015 and 2016.

Table 3. 2: East African Countries Cumulative Sovereign Bond Issuance 2013–2014 USD Millions.

Country	2013	2014	TOTAL
Ethiopia	-	1,000	1,000
Kenya	-	2,000	2,000
Rwanda	400	-	400
Tanzania	600	-	600
TOTAL	1, 000	3,000	4,000

Source: IMF, 2017

The preparation period for bonds issuance can be long, usually more than 1 year, requiring considerable resources for global advertising and road shows. Repayment costs might also rise if the currency depreciates. East African countries are issuing bonds mainly to finance infrastructure investments, restructure debt, and establish sovereign benchmarks to help develop the sub-sovereign and corporate bond market. Ethiopia, Rwanda and Tanzania used the bond proceeds for infrastructure development projects whilst for Kenya besides infrastructure investments used part of the proceeds for budgetary purposes and paying off syndicated loans. There has been debate in Kenya with regards to the lack of transparency and accountability on the prudent use of the bond proceeds.

Sovereign bond carry significant risks. These include exchange rate, interest rate and liquidity risk. Different types of bonds carry different types and levels of risk. Exchange rate risk is high for bonds denominated in "hard currency" – such as US dollars, Euro, Japanese Yen or GB pounds - and low for those in local currency. Interest rate risk is high for bonds issued with floating interest rates and low for those with fixed interest rates. This is because for bonds with floating interest rates if the rate increases payments increase. All bonds that have been issued to date have high exchange rate risk because they are denominated in hard currency (US dollars).

3.5. Regional Outlook For Debt Sustainability

According to debt sustainability assessments done jointly by World Bank and IMF for low income countries in 2015/2016 the majority of East African countries were classified as having either low or moderate risk of debt distress as shown in Figure 10 above. The high risk countries in the region are Burundi and Djibouti. AFRODAD debt sustainability results also yielded similar results to those of the World Bank and IMF.

Low Risk	**Moderate Risk**	**High Risk**
Tanzania **Kenya** **Rwanda** **Uganda**	Comoros Ethiopia South Sudan	Burundi Djibouti

Table 3. 3: Debt sustainability analysis in East Africa countries - Assessing risks of debt distress 2015/16

Source: Joint World Bank-IMF Low Income Countries Debt Sustainability Analysis

CHAPTER FOUR

METHODOLOGY AND MODEL SPECIFICATION

This section lays down the methodology adopted for the analysis of debt sustainability in East African countries and also discusses about data collection and data sources. The sustainability of debt emerged as a crucial phenomenon as large deficit and rising external debt are held by most of developing countries including those of East African countries. This scenario has endangered the solvency of the government and give rise to concerns about the precision of the budgetary polices. The sustainability tells whether budgetary polices are taking government away from solvency or towards solvency. Therefore sustainability implies that fiscal policies are adopted in a way that inter temporal budget constraint are satisfied or not. This implies that present market value of the external liabilities is equal to the discounted sum of upcoming expected primary surpluses.

4.1. Sample and Data Set

The sample consists of nine East African countries (Ethiopia, Eritrea, Kenya, Djibouti, Burundi, Sudan, Uganda, and Rwanda, Tanzania). These countries are of special interest because of the amount of external debt being recorded in this region, their very low per capita incomes and their general dependence on only a few primary commodities for export earnings. Most these countries have experienced severe economic setbacks during last decade as a result of the weakness in primary commodity markets. In addition, more than half have required debt rescheduling or incurred arrears on debt service obligations since 1990s. The sample period is 2000 - 2016, based on the availability of comparable data, especially on expenditures (source: World Bank, 2004, 2014, 2017,). While previous expenditure data are available for a number of these countries (see, for example, World Bank, 1996, 1998-99), they are not strictly comparable with those from recent sources. Unfortunately, the data from previous source contains only sporadic or discontinuously reported relevant statistics for previous years, so that panel-data estimation could not appropriately be conducted for the years before 2000. The data source used for all variables comes from World Development indicator (WDI) data base unless stated otherwise. All datas are adjusted for exchange rate.

In addition, the use of panel data, enables us to perform the analysis that would have not been possible with small number of observations and presumably to obtain better estimates.

4.2. Theoretical Framework and Model Specification

There is a large literature on the government inter-temporal budget constraint. The general conclusion is that fiscal policy is sustainable if the government budget constraint holds in present value terms. In other words, the current debt should be offset by the sum of expected future discounted primary budget surpluses. The approaches used to analyze sustainability of fiscal policy consist in testing if the public debt and/or budget deficit is a stationary process.

Sustainability: formalization

To define debt sustainability in a very simple form, the world is considered deterministic, where all uncertainty regarding future behavior of relevant variables is disregarded. In this setting, a debt is sustainable when the present value of future revenue flows minus debtor expenses can pay for all that has been contractually agreed.

The theoretical framework used here to investigate the sustainability of the panel of East African external debt position follows Hamilton and Flavin (1986). According to the authors, a necessary and sufficient condition for sustainability is that the discounted debt should be a stationary zero-mean process.

The inter-temporal government budget constraints is the set of all sequences of taxes and expenditures that guarantees that the contractual promises associated with the government's debt will be met. It is, however, useful to split the description of the budget constraints into two parts: the government flow constraint and the transversality condition. The combination of these two will then be shown to be equivalent to the present value representation.

As a starting point of the analysis, Hamilton and Flavin (1986), investigate the one-period government intertemporal budget constraint, which can be written in nominal terms as follows;

Eq. (4.1) $B_{t+1=}\ (1 + r_t)B_t + G_{t+1} - T_{t+1}$; where B_t is the value of government debt at moment t; r_t is the interest rate in t; T_t and G_t are government revenues and expenditures in t.

For each period (in this case, a period corresponds to one year, since this is what is relevant from the budget standpoint), public debt evolves according to the above expression.

Obviously, this equation must hold to all periods. Therefore, in the following period:

$B_{t+2=}\ (1 + r_{t+1})B_{t+1} + G_{t+2} - T_{t+2}$

Recursively substituting in (1) leads to,

$B_{t+2=}\ (1 + r_{t+1})[\ (1 + r_t)B_t + G_{t+1} - T_{t+1}] + G_{t+2} - T_{t+2}$

i.e $B_t = \frac{B_{t+2}}{(1+r_{t+1})[\ (1+r_t)} + \frac{T_{t+2}-G_{t+2}}{(1+r_{t+1})[\ (1+r_t)} + \frac{T_{t+1}- G_{t+1}}{(1+r_t)}$

The process can be continued to any t+s time and express:

$$Eq. (4.2) \quad B_t = \frac{B_{t+s}}{\prod_{v=1}^{s}(1 + r_{t+v-1})} + \sum_{v=0}^{s} \frac{T_{t+v} - G_{t+v}}{r_v}$$

Recursively solving the equation lead to the following inter-temporal budget constraint:

$$Eq. (4.3) \quad B_{t=} \sum_{s=1}^{\infty} \frac{R_{t+s}-G_{t+s}}{\prod_{j-1}^{5}(1+r_{t+s}\ )} + \lim_{s\to\infty} \prod_{j=1}^{s}\ (\frac{B_{t+s}}{1+r_{t+j)}}$$

To drive the implications of equation (4.3) for the government conduct of fiscal policy, there are two assumptions. The first assumption is that the real interest rate is stationary with an unconditional mean given by r. Secondly, the real supply of bonds does not grow, on average, at a rate in excess of the average rate of interest. These two assumptions imply that

$$Eq. (4.4) \qquad \lim_{s\to\infty} \frac{B_{t+s}}{(1+r)^s}$$

Equation (4.4) states that the debt stock, when measured in present value terms. Vanished in the limit. By definition, this excludes Ponzi financing. It also implies that the government does not have the option of running perpetual primary deficits.

However, as noted by Hamilton and Flavin (1986), equation (4.3) and equation (4.4) do not necessarily excludes a permanent conventionally- measured budget deficit. As long as the deficit are such that the debt stock grows at a rate that is less than the rate of interest the equation will be satisfied. Given this equation, it follows that the inter-temporal budget constraint equation (4.1), can be written as:

$$\text{Eq. (4.5)} \quad G_{ti-}\ R_{ti} = \sum_{s=0}^{\infty} \frac{1}{(1+r)^{s-1}} (\Delta R_{ti-}\Delta G_{ti} + \mathrm{r}\Delta B_{t+s-1}\ )$$

Where Gt represent the total government spending on goods and services, transfer payments and interest on debts or $Gt = Gt + rBt - 1$. Hakkio and Rush (1991), assume that the Rt and $Gt + (1 + r)Bt- 1$ are both non-stationary variables of $R_t = \alpha_1 + R_{t-1} + \varepsilon_{1t}$ and $G_t = \alpha_2 + G_{t-1} + \varepsilon_{2t.}$ Consequently, expression (3.5) can be conveniently rewritten as

$$Eq. (4.6) \quad G_t = \alpha + R_t + \lim_{s\to\infty} \prod_{j=1}^{s}\ (\frac{B_{t+s}}{1+r_{t+j)}} + \varepsilon_t$$

Where $\alpha = \frac{1+r}{r}(\alpha_1 - \alpha_2)$ and $\varepsilon_t = \sum_{s=0}^{\infty} \frac{\varepsilon_{1t}-\varepsilon_{2t}}{(1+r)^{s-1}}$. Equation (4.6) forms the basis for testing the hypothesis of sustainable fiscal deficit. If the transversality condition for the budget constraint holds and the limit term in (4.6) is zero, we obtain

$$Eq. (4.7)\ R_{ti} = \alpha + \beta G_{ti} + \mu_{ti}$$

Along with the null hypothesis of b= 1 and t is a stationary process (Trehan and Walsh, 1988; Quintos, 1995 and Kalyoncu, 2005). Equation (4.5) has been widely used as the basis to assess the sustainability of government's intertemporal budget constraint in the literature.

The inter-temporal budget constraint, under the no-Ponzi scheme rule, imposes restriction on the time series properties of government revenue and expenditure. These follows from the specification of the right hand side of equation (4.5). This will be stationary as long as government expenditure, revenue including interest payment on external debt are all stationary in their first difference. The stationary property restricts the extent to which G_t *and* R_t can deviate from each other time. The idea is to establish if there is co-integration between R_t, revenue and G_t, government expenditure.

In particular, if G_t *and* R_t are I (1), they will be co-integrated. Intuitively, as it is pointed out by (Trehan and Walsh, 1988; Quintos, 1995 and Kalyoncu, 2005) cointegration implies that if there is an error correction mechanism pushing government finances towards the level required by the intertemporal budget constraint, evidence of external debt sustainability position for that particular country is revealed. In the absence of cointegration, the error correction mechanism will not operate and there is no likelihood that equation (4.5) will hold.

To establish the sustainable position of equation (4.7), integration and co-integration test need to be conducted. If both series in equation (4.7),i.e., if R_{ti} and G_{ti} are found to be stationary in level I(0), the sustainable condition is satisfied. Meanwhile, if the tested equation is found to be non-stationary variable, a further cointegration test is employed. As pointed out by (Hakkio and Rush (1991)), a necessary condition for the economy to be obeying its intertemporal budget constraint. As such, a panel unit root test has been employed as a preliminary test before proceed to cointegration test.

Thus, panel unit root test results provide either both variables are integrated at order zero, I(0) or order one, I(1). If the two variables are found to be integrated at order zero, I (0), the intertemporal government budget constraint is hold, suggesting a sustainable position. While if both variables are integrated at order one the process will proceed to cointegration test. If both variables are found to be cointegrated at order one, I(1), this could interpreted as country's is obeying their intertemporal budget constraint suggests of a sustainable external position. While in the absence of cointegration relationship between the two variables, the external debt of a country is found to be on unsustainable position.

By using the same approach on intertemporal budget constraint, Hakkio and Rush (1991) also demonstrate that if government revenue and expenditure are non-stationary variables in levels, the conditions $0 < \beta \leq 1$, is sufficient condition for the budget constraint to be obeyed. β represents the coefficient of Gt. In addition, the condition of $0 < \beta \leq 1$ explain that as long as the coefficient lies between zero and one, it indicates that an increase in Gt, is associated with an increase in Rt wich at least more than zero and equal to one. However, when revenues and expenditures are expressed as a percentage of GDP or in Per-capita terms, it is necessary to have $\beta = 1$ in order for the trajectory for the debt to GDP not to diverge in an infinite horizon. This indicates that the increase in Gt is equal with growth in Rt. This condition could be explained as a sustainable external position where the two series are not drift. By contrast, if $\beta < 1$, then the hypothesis of sustainability become violated. This means that the economy will fail to satisfy its budget constraint where grows in expenditure (Gt) is not been supported with the same growth in revenue (Rt).

4.3. Estimation Procedure

For testing external debt sustainability which is based on IGBC, the test starts with panel unit root tests to assess the order of integration of the variables. The panel unit root tests are based on Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003) which allows for panel homogeneity as well as ADF and PP-Fisher tests by Maddala and Wu (1999) which allows for the panel heterogeneity across units to the coefficient on the lagged variables. In addition, the test proposed by Hadri (2000), with null of no unit roots is also conducted.

Then estimation of the results proceeds to the cointegration test if both variables are found to be integrated at order one, $I(1)$. The panel test for cointegration for this analysis will follow Pedroni (Engle-granger based) , Kao (Engle-Granger based) and Fisher (Combined Johnson) test.

In addition, a panel fixed effect (FE) and random effect (RE) estimators have been used to estimate the model.

4.4. Panel Unit root Test

A panel unit root test is used to determine the stationarity status of all the variables under consideration or to determine the order of integration. Recent literature suggests that panel based unit root tests have higher power than unit root tests based on individual time series.

To provide the robustness check on the stationariy of the variables, this thesis makes the use of various methods of panel unit root tests. This paper thus, employs panel tests which are based on Levin et al. (2002), Im,Pesaran and Shin (2003) and Hadri (2000). In particular, Levin et al,(2002) test suppose a common unit root under the null hypothesis, while Im, Pesaran and Shin (2003), allow for individual unit roots.

What it follows, consider a simple model that follow an AR (1) process:

Eq. (4.8) $y_{it} = \rho_i\, y_{it-1} + x_{it}\delta i + \varepsilon_{it}$

Where, I =1,2,3,...N cross-section units ; in this case (N =9) and y_{it} series that are observed over period t = 1,2,3,...T; which is in this case 17, X_{ti} is exogenous variables , ρ_i is the autoregressive coefficients and ε_{it} is the error term where the null hypothesis is unit root and the alternative hypothesis is level stationary as follows:

$H_O: \rho_i = 0$

$H_a: \rho_i < 0$

The Levin et al. (2002) panel unit root test assumes homogeneous autoregressive coefficient between individual for all cross-section unit, i. The tested hypothesis tests the null of non-stationary and homogeneous across unit.

This test is more relevant on the panel of moderate size and it depends upon on the independent assumptions across individuals.

Meanwhile, Im et al, (2003) test proposed a panel unit root test that allows for heterogeneity across individual unit root and residual serial correlation in the model.

Eq. (4.9) $\Delta y_{it} = \rho_i\, y_{i,t-1} + \sum_{j=1}^{\rho i} \beta_{ij}\ \Delta y_{it-j} + x'_{it}\delta i + \varepsilon_{it}$

Where i 1, 2,3,...N the cross sectional unit (9) and and t 1,2,3,....T time period (17). In other words, ρ_i may vary across cross section. Thus, Im et al, (2003) test involves pooling and averaging (mean) of ADF statistics for each cross section unit with the null of;

$H_O: \rho_i = 0$

For all i, against the alternative of ;

$\rho_i < 0$ i 1,2,...N

$H_a:$ $\rho_i = 0$ for i=N_1 +1,...N

In addition, Im et al,(2003) also propose the use of group mean $\bar{t}$ where the t-statistics are from each ADF that is estimated (by averaging) across the panel. Thus, the t=statistics test is;

Eq. (4.10) $\bar{t}_{NT} = \{\sum_{I=1}^{N} t_{iT\ (\rho i)}\}/N$

Where $\bar{t}_{NT}$ is assumed to be independent, independent, identically distributed (i.i.d) and has finite mean and variance. In addition, Im et al also demonstrates that their test has better finite simple performance than the Levin et al, (2002).

Meanwhile, Hadri (2000) drives a residual based Lagrange Multiplier (LM) procedure to test the null of stationary against the alternative of unit roots in a panel data. In addition,the test is an extension of to the panel data of the Kiwiatkowski, Phillips, Schmidt and Shin (KPSS) for the individual series. What it follows, Hadri (2000) consider the following model;

Eq. (4.11) $y_{it} = r_{it} + \varepsilon_{it}$

Where $r_{it} = r_{i,t-1} + u_{it}$ is a random walk. And the $u_{it}$are i.i.d. $(0,\delta^t{}_u)$.

Under the null hypothesis ($H_O : \delta^t{}_u = 0$), y_{it} is stationary around the level (r_o) against the alternative of unit root ($H_a : \delta^t{}_u > 0$). The (LM) statistics is given by:

Eq. (4.12) LM = $\frac{1}{N}\sum_{i=1}^{N}\left(\frac{\frac{1}{T^2}\sum_{t=1}^{T} S_{it}^2}{\hat{\delta}_{\varepsilon}^2}\right)$ Where S_{it} is the cumulative sums of residuals. While Hadri (2000) Suggests an alternative LM test that allows for heteroscedasticity across i,

Eq. (4.13)LM = $\frac{1}{N}\sum_{i=1}^{N}\left(\frac{\frac{1}{T^2}\sum_{t=1}^{T} S_{it}^2}{\hat{\delta}_{\varepsilon,i}^2}\right)$

Hadri panel unit root test experiences a significance distortions in the presence of autocorrelation if there is no unit root.

4.5. Panel Co-integration Test

When the first difference of a non-stationary process is stationary, the process is said to be integrated of order one, denoted I (1). When a linear combination of several I (1) series is stationary, the series are said to be cointegrated (Engle and Granger 1987). We test for cointegration because cointegration implies that the I (1) series are in a long-run equilibrium; they move together, although the group of them can wander arbitrarily.

The popular Engle–Granger residual-based test for cointegration has low power when applied to a single time series but has good power when statistics from many individual panels are combined.

The Kao tests, the Pedroni tests, and the Westerlund tests implemented in combine statistics computed for each individual in the panel, thereby producing a test with higher power.

Furthermore, the limiting distribution of the combined test converges to a standard normal distribution after appropriate standardization, whereas tests for cointegration based on a single time series have nonstandard distributions.

All cointegration tests are based on the following panel-data model for the I (1) dependent variable

y_{it} Where i = 1,...,N denotes panel(individual) and t = 1,...,Ti denotes time:

Eq. (4.14) y_{it} = $\beta_i X_{it}'$ + $Z_{it}'\gamma_i$ + ε_{it}

For each panel $i,$ each of the covariates in xit is and $I(1)$ series. All the tests require that the covariates are not cointegrated among themselves. The Pedroni and Westerlund tests allow a maximum of seven covariates in $Xit.\beta_i$ denotes the cointegrating vector, which may vary across panels. γ_i is a vector of coefficients on zit , the deterministic terms that control for panel-specific effects and linear time trends. ε_{it} is the error term.

Depending on the options specified with $xtcointtest$, the vector zit allows for panel-specific means, panel-specific means and panel-specific time trends, or nothing. By default, $zit = 1$, so the term $zit = 1$ represents panel-specific means (fixed effects). If trend is specified, Z_{it}' = (1, t) so $Z_{it}'\gamma_i$represents panel-specific means and panel-specific linear time trends. For tests that allow it, specifying no constant omits the $Z_{it}'\gamma_i$ term.

The tests share a common null hypothesis that yit and xit are not cointegrated. $xtcointtest$ tests for no cointegration by testing that et is nonstationary. Rejection of the null hypothesis implies that eit is stationary and that the series yit and xit are cointegrated. The alternative hypothesis of the Kao tests, the Pedroni tests, and the all panels version of the Westerlund test is that the variables are cointegrated in all panels. The alternative hypothesis of the some panels version of the Westerlund test is that the variables are cointegrated in some of the panels.

Generally, the above steps can be summarized by the following figures

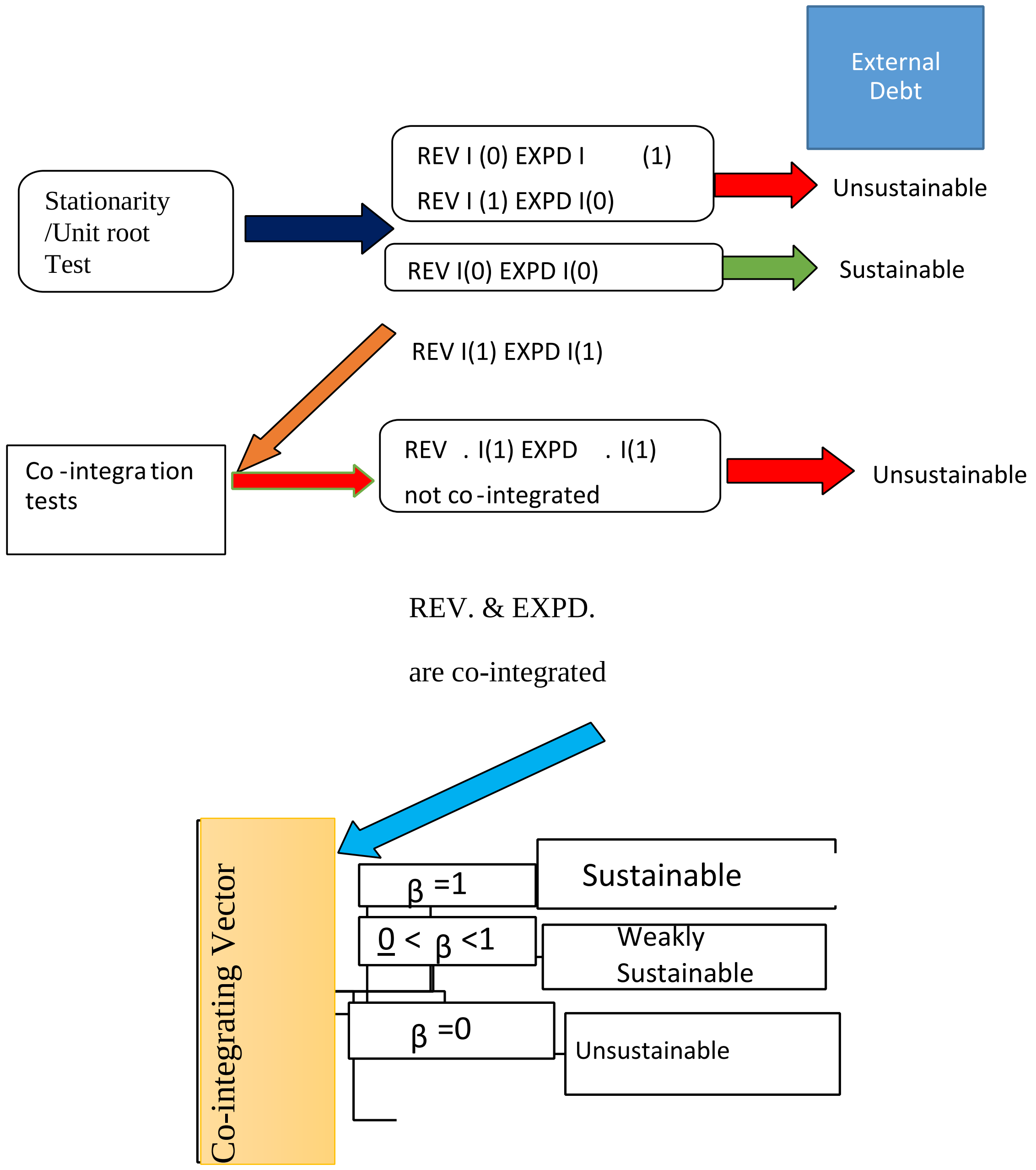

Figure 4. 1: Summary of Econometric Approach

CHAPTER FIVE:

RESULTS AND DISCUSSIONS

5.1 Analysis based on external debt ratio

5.1.1 Evolution of core external debt indicators, 2000-2016

EAC's total external debt stock, which was US$ 4.15 billion in 2000, had jumped to US$ 4.713 billion in 2003 and US$ 4.954 billion in 2004 before dropping to US$ 3.6 billion in 2006. From 2007 onwards, the total external debt stock for these countries have increased steadily and by 2016, their total external debt stock amounted to US$ 9.88 billion (table 5.1 and figure 5.1 below). Note that between 2000 and 2016, the external debt stock increased by US$5.73 billion or at an average annual rate of 138.07 percent. To draw out more concretely the changing structure of the region's external debt and the flows of repayment arising out of those debts we can look at the debt service for all panel countries. Associated with the rising external debt stock has been a crushing debt service burden. From a level of US$1.3 billion in 2000, the total external debt service on external debt rose to US$1.45 billion in 2004 and then dipped to US$ 1.15 billion in 2006 (due largely to rescheduling and some amount of debt forgiveness).

By 2016, the total external debt service of the sample countries amounted to US$ 4.3billion (increased by 230.3 percent). This shows that the actual aim behind taking debt which is to seek development is being depressed by debt service payments because it is eating up most of the resources rather than development. The debt service ratio (measured by the ratio of actual debt service payments to exports of goods and services), which was a mere 5.4 percent in 2000, jumped to 18.3% in 2005 before falling to 14.7 percent in 2006 (figure 5.4 below)

However, many debt indicators of these countries have on aggregate improved during the study period. As a result of strong overall GDP and export growth during the period from 2000 to 2008, coupled with the results of the debt relief initiatives of the 1990s and early 2000s, debt ratios for developing countries as a whole and the sample countries in particular improved substantially over the period. Total debt stocks to GNP decreased from 75.15 percent in 2000 to 40.338 percent in 2006 and steadily declines then after. The ratio of debt service to exports shrunk from 22 per cent in 2000 to just below 9 percent in 2008. However, the period 2009 to 2016 is marked by a renewed rise in both ratios, as total debt to GDP crept up to 25.5 percent by 2015 and debt service to exports increased to 11.5 per cent.

EAC's external debt to GDP ratio has improved markedly over the period and in particular during the early 2000s. The improvement was largely driven by debt relief and the commodities price boom. Total debt to GDP stood at 59 per cent in 2000, peaked at 61 per cent in 2002, and followed a downward path until 2011, by which point it had fallen to 21 per cent. Since 2011, there has been a modest but steady increase in the ratio, reaching 27 per cent in 2015. The debt service to exports ratio was never particularly high for the region, peaking at 12 per cent in 2001 and dropping to single digits since 2003. However, since bottoming in 2010 at 3.7 per cent, the debt service to exports ratio has more than doubled and stood at 8.8 per cent in 2015, reflecting a steep slump in the prices of commodities that constitute the main export revenue for the region. The period since 2000 was marked by an important increase in international reserves, from $35 billion in 1990 to a peak of $202 billion in 2013, and a corresponding improvement in the reserves to short -term debt ratio from 110 per cent in 2000 to 368 per cent in 2013. As the commodity boom has reversed in recent years, the amount of international reserves decreased to $170 billion in 2016, and the ratio of reserves to short -term debt worsened, to 291 per cent.

According to AFORDAD, 2015, mainly due to the commodity boom of the early 2000s and recent resource discoveries throughout Africa, many African countries experienced double -digit growth rates in exports. These led to low debt–export ratios, which may not properly reflect their longer term payment capacities, especially in cases where the resources extracted by mostly multinational corporations provided very little revenues to the Government.

Year	Ethiopia	Kenya	Burundi	Eritrea	Djibouti	Rwanda	Sudan	Uganda	Tanzania	Total
2000	5516257000	6148248000	1125866000	329695000	297695000	1289759000	16076004000	3535146000	7186028000	41504698000
2001	5745842000	5496282000	1093541000	432797000	299614000	1299043000	15030792000	3768225000	6509288000	39675424000
2002	6552441000	6097000000	1232211000	540750000	358434000	1452035000	16130971000	4019809000	7144025000	43527676000
2003	7281810000	6716482000	1348343000	656093000	395028000	1555053000	17297666000	4578283000	7306170000	47134928000
2004	6624003000	6916407000	1357933000	760244000	459647000	1670720000	18335821000	4790127000	8626963000	49541865000
2005	6229313000	6486772000	1287890000	757209000	486492000	1526467000	17563364000	4461213000	8400040000	47198760000
2006	2280741000	6681910000	1371906000	822736000	566133000	433569000	18453917000	1300725000	4096161000	36007798000
2007	2655245000	7538434000	1409727000	896726000	812247000	619217000	19743364000	1653064000	5029477000	40357501000
2008	2904266000	7659361000	1390284000	997784000	846327000	688908000	20291672000	2292857000	6009852000	43081311000
2009	5416187000	8549248000	607228000	1050652000	897022000	861367000	21067009000	2763177000	7685361000	48897251000
2010	7334516000	8847568000	620920000	1041547000	778534000	906314000	22286340000	2974599000	8893151000	53683489000
2011	8610052000	10162730000	604411000	1055238000	779098000	1215707000	21148417000	3262582000	10012876000	56851111000
2012	10461905000	11893745000	667316000	994095000	811674000	1262534000	21796532000	3779371000	11588075000	63255247000
2013	12575129000	13836037000	683609000	945386000	828276000	1693564000	22471572000	8739157000	13140981000	74913711000
2014	16327986000	16969376000	690170000	907681000	949533000	2021860000	21762241000	8952316000	14352454000	82933617000
2015	20139846000	19764038000	625980000	873145000	1233236000	2240624000	21403615000	9925262000	15504686000	91710432000
2016	23062955000	22324987000	632780000	796402000	1706359000	2783188000	21082004000	9946994000	16474516000	98810185000

Table 5. 1: External Debt Stock Evolution

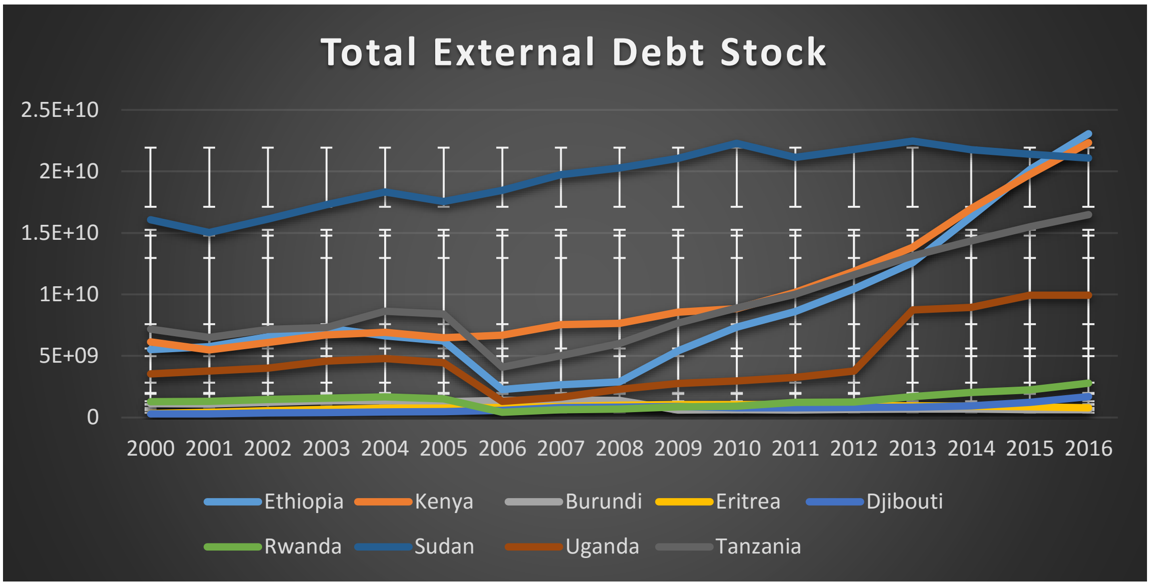

Figure 5. 1: External Debt Evolution in a panel of East African Countries (2000 – 2016)

Specifically, if we consider the external debt evolution by country (Figure 5.1 above), we notice that five countries (Sudan, Kenya, Ethiopia, Tanzania and Uganda) have a high level of external debt (more than 30% of GDP) specially from 2007 onwards, whereas the remaining countries from the sample (Eritrea, Rwanda Djibouti and Burundi) have a low level of external debt (less than 20% of GDP). Thus, in the five aforementioned countries, external debt grew sharply from 2000 to 2016 except in the year 2006/2007, whereas all the other countries in the panel reduced their external indebtedness over these years, sometimes at a sustained pace (by more than 20 percentage points of GDP for the Burundi, Sudan; by more than 30 percentage points of GDP for Ethiopia, Rwanda, Tanzania and Uganda; and even by more than 50 and 60 points of GDP for Eritrea and Djibouti respectively).

Year	Ethiopia	Kenya	Burundi	Uganda	Tanzania	Djibouti	Eritrea	Sudan	Rwanda	Total	Avr.
2000	1.693358	4.714503	2.558585	1.243265	1.674625	2.157326	0.647948	2.145101	2.117679	18.95239	2.105821
2001	2.237414	3.781436	2.715977	0.900157	1.416716	2.019096	0.919853	1.935645	1.241709	17.168	1.907556
2002	1.10015	4.081503	2.9157	1.178597	0.978099	1.739833	1.364456	1.052795	1.144074	15.55521	1.728356
2003	1.083776	3.943605	3.860149	1.361436	0.77124	2.109659	1.373022	1.707732	1.231594	17.44221	1.938024
2004	1.00661	2.246462	9.949815	1.338518	0.957121	2.164134	1.868144	1.65668	1.300647	22.48813	2.498681
2005	0.759339	2.886534	3.638646	1.963311	0.803576	2.281338	2.025429	1.628881	1.105233	17.09229	1.899143
2006	0.91539	1.673095	1.579588	1.03	0.480124	1.319185	1.167524	0.902853	0.85712	9.924879	1.102764
2007	0.677595	1.435836	1.3476	0.552545	0.342311	0.962744	0.558308	0.893097	0.619453	7.389489	0.821054
2008	0.409882	1.15211	1.221277	0.530744	0.268168	1.762206	1.176015	0.71818	0.299285	7.537867	0.837541
2009	0.318536	1.051079	1.153309	0.402108	0.576892	2.660049	1.181125	0.991658	0.214603	8.549359	0.949929
2010	0.615955	1.007873	0.216303	0.319873	0.612404	2.093287	1.086863	0.81495	0.254051	7.02156	0.780173
2011	1.104247	1.042735	0.437611	0.320611	0.421956	2.192862	0.857173	0.826625	0.298381	7.502201	0.833578
2012	0.998019	1.175791	0.852528	0.300342	0.411074	2.392263	1.373022	0.580339	0.310485	8.393863	0.932651
2013	1.39716	1.187771	1.191853	0.3709	0.351462	2.684824	1.217872	0.656751	0.526779	9.585374	1.065042
2014	1.379201	2.062732	0.943192	0.781881	0.500517	2.286605	1.258053	0.350085	0.714194	10.27646	1.141829
2015	1.623171	1.320289	0.850021	0.368482	0.714192	2.593547	1.298235	0.589813	1.359567	10.71732	1.190813
2016	1.724286	1.599496	2.051905	3.598231	1.094153	2.681407	1.338416	0.342473	1.628954	16.05932	1.784369

Table 5. 2: External Debt Service (%GNP) (2000 -2016)

Source: Author's Calculation based on World Bank's World Development Indicator,2017

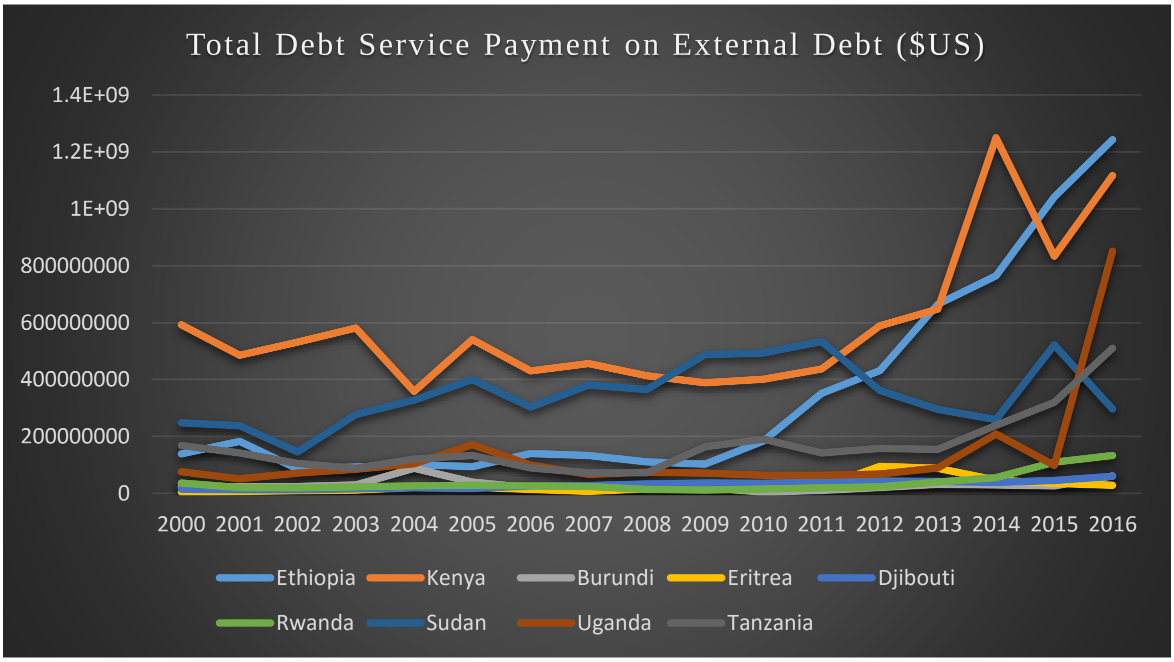

Figure 5. 2: Total external debt service payment by EAC countries (2000 – 2016)

Year	Ethiopia	Kenya	Burundi	Uganda	Tanzania	Djibouti	Eritrea	Sudan	Rwanda	Total	Avr.
2000	13.73932902	21.01969864	40.85524625	10.56408824	11.93189437	6.905115515	0.105442803	13.47288845	25.72982871	144.323532	16.035948
2001	18.45030967	15.87806201	50.77564105	7.060018977	7.824390473	5.211140465	1.02356	13.74981226	11.83948939	131.8124243	14.64582492
2002	7.955384614	16.35357852	60.09772691	9.799159599	5.322950903	5.266951612	0.226920423	6.912565328	14.4978198	126.4330577	14.04811752
2003	7.262707011	15.83950213	64.20220909	9.805357532	3.919799696	5.66507458	2.924733224	10.7180549	15.34830397	135.6857421	15.07619357
2004	5.907478024	8.281794901	134.788016	8.853845482	4.4700362	6.911646103	5.29842137	8.528583062	12.9588092	195.9986303	21.77762559
2005	4.759271479	9.984234399	40.51750872	10.78984134	4.363262207	5.546843787	4.28599725	7.977150581	10.85402199	99.07813175	11.00868131
2006	6.189515136	7.128186272	20.42537945	5.52471115	2.531001746	7.66434624	5.95336276	5.021516148	6.729974163	67.16799307	7.463110341
2007	4.901995902	6.323839434	18.50947106	2.62684521	1.725503144	8.007306359	6.994081878	3.980090526	4.990202022	58.05933554	6.451037282
2008	3.142673976	4.880101128	11.98044176	2.340752406	1.272770409	8.146417086	8.034800997	2.999875607	2.004699076	44.80253245	4.978059161
2009	3.002888511	5.136213115	16.59608365	2.113582937	3.069739709	8.321956382	9.075520115	5.656967075	1.903790678	54.87674217	6.097415797
2010	3.948792422	4.400624993	2.396394791	1.799837284	2.914539667	7.870126671	10.11623923	4.18412337	2.078907829	39.70958626	4.412176251
2011	6.045527608	4.319411408	4.208517603	1.474575613	1.870876438	8.6497183	11.15695835	4.834405499	1.922694341	44.48268516	4.942520574
2012	7.185085571	5.256689949	8.91410043	1.36028079	1.797532652	8.564821966	12.19767747	7.047872773	2.006907645	54.33096925	6.036774361
2013	10.84625596	5.911132399	13.75873671	1.679869264	1.797139388	7.988764009	13.23839659	4.8725204	3.047832715	63.14064744	7.015627494
2014	11.95879864	11.06748835	13.26251255	4.38329178	2.740314825	7.07773712	14.27911571	4.287362554	4.203409958	73.26003148	8.140003498
2015	17.31508615	8.791658401	13.44267164	2.004891164	3.590718972	7.139122676	15.31983483	10.6081436	7.147204733	85.35933216	9.484370239
2016	21.00731336	10.61954438	31.71653726	18.82338578	5.433829061	6.987012976	16.36055394	6.392698498	8.286712932	125.6275882	13.95862091

Table 5. 3: External Debt Service (%XGS) (2000 – 2016

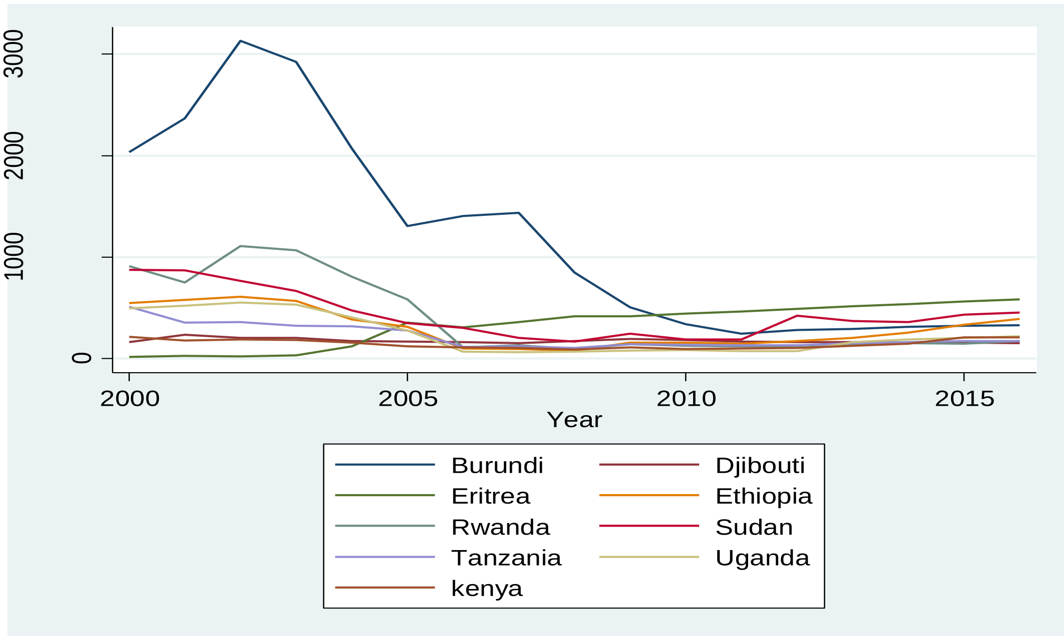

Figure 5. 3: External Debt Service as a percentage of Export of goods and services (2000-2016)

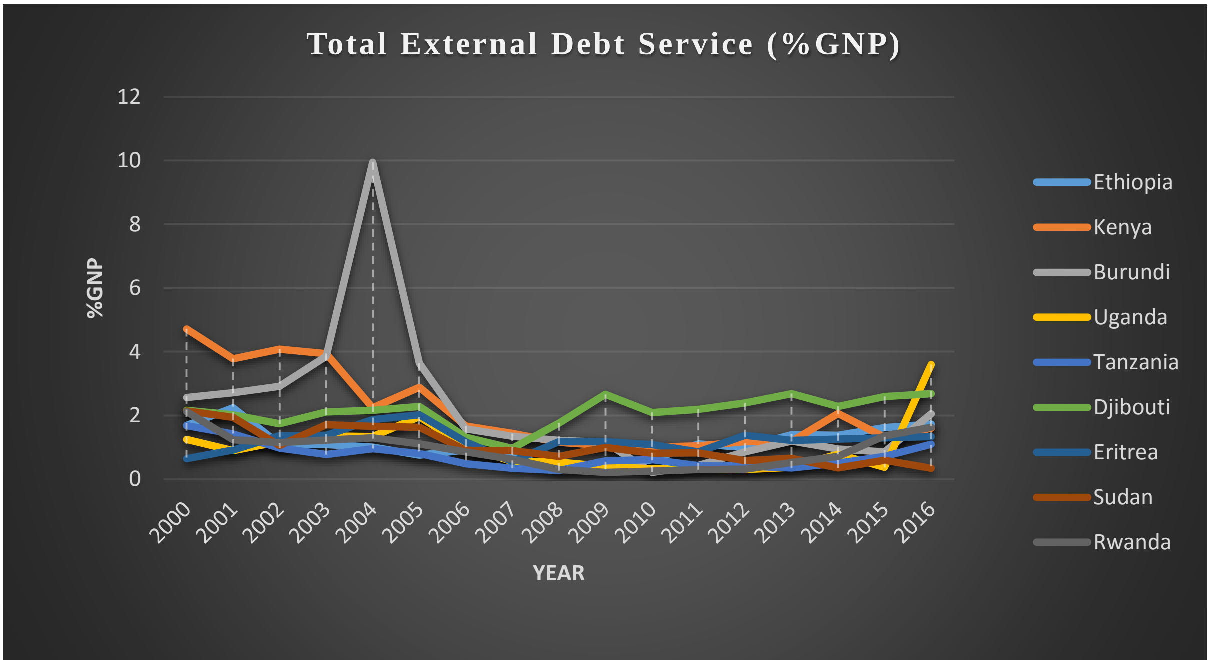

Figure 5. 4: External debt service payment as % GNP (2000 – 2016)

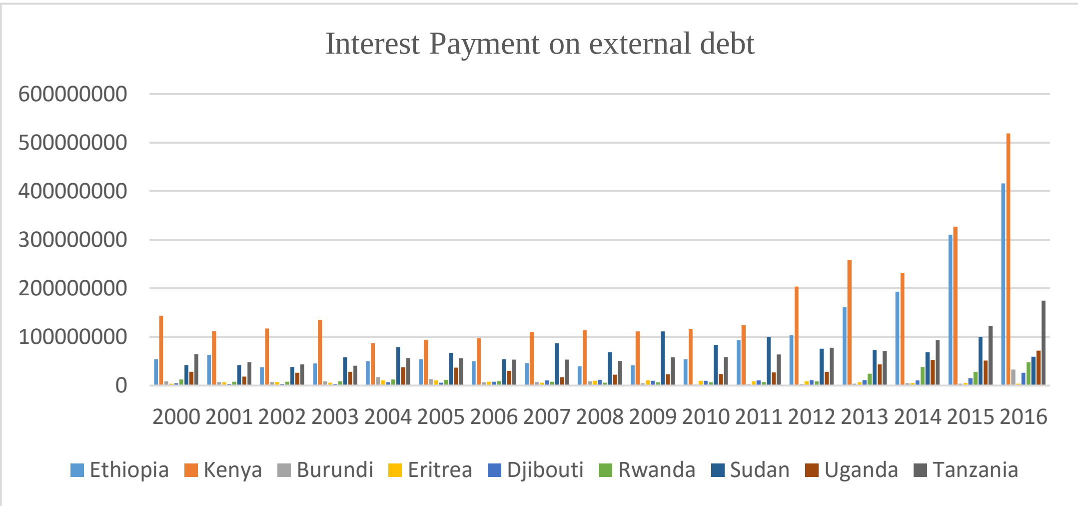

Figure 5. 5: Interest Payment on external Debt sample countries (2000 - 2016)

EAC's external debt is mostly long term (see the following figure). Long term external debt has grown steadily since the 2000s to 2005, where it fluctuated for almost ten years, before climbing steeply again from 2014 till the present. Short term debt currently makes up less than a sixth of the region's external debt. Historically, the majority of the region's external debt has been owed by the public sector, as the external borrowings of the private sector have been negligible. However, a small increase was noted in 2004 and a recent steeper increase is visible since 2006. The structure and composition of the external debt of EAC shows that the largest component historically has been official bilateral debt of the public sector and official multilateral debt (WDI, 2017).

The same source reveals that, although slightly decreasing in importance, they remain dominant, with increased proportions of external debt being held by the public sector in the form of bonds; this is marginally surpassed by the private sector external bank borrowing. The ability of the private sector to borrow on the capital markets is close to zero.

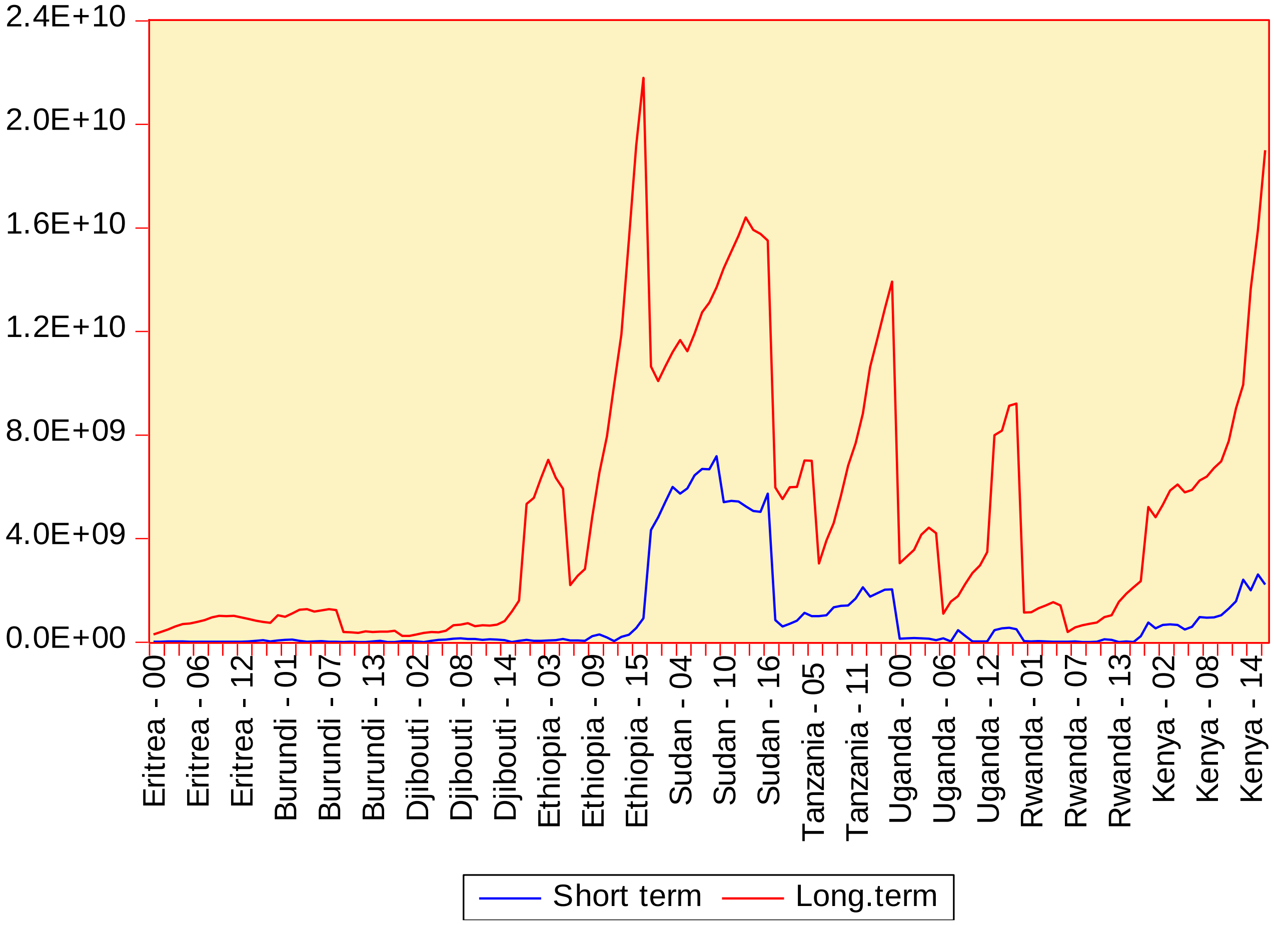

Figure 5. 6: Maturity structure of external debt stock $US billion

5.2. Econometrics Analysis for External Debt Sustainability

To examine the debt sustainability issue using the present value budget constraint approach, the stationarity of the data series is checked by applying the unit root test to the time series of revenue, expenditure and debt. After establishing the stationarity of the series, cointegration between revenue and expenditure (inclusive of interest payments) is tested. Finally stability tests are applied to detect the stability of the cointegration vector overtime.

As a first step, the visual plot of the time series of revenue and expenditure is presented in Figure 5.7, it is shown that the two series have trended upward and visually these series are found to be non-stationary.

There are three main types of techniques to check the status of countries regarding the external debt sustainability that are univariate unit root tests, panel unit root tests and panel cointegration tests. In this section, following to Nasa (2009) various univariate unit root tests and panel unit root tests have been employed to check the time series properties of series in order to know about the robustness of the results.

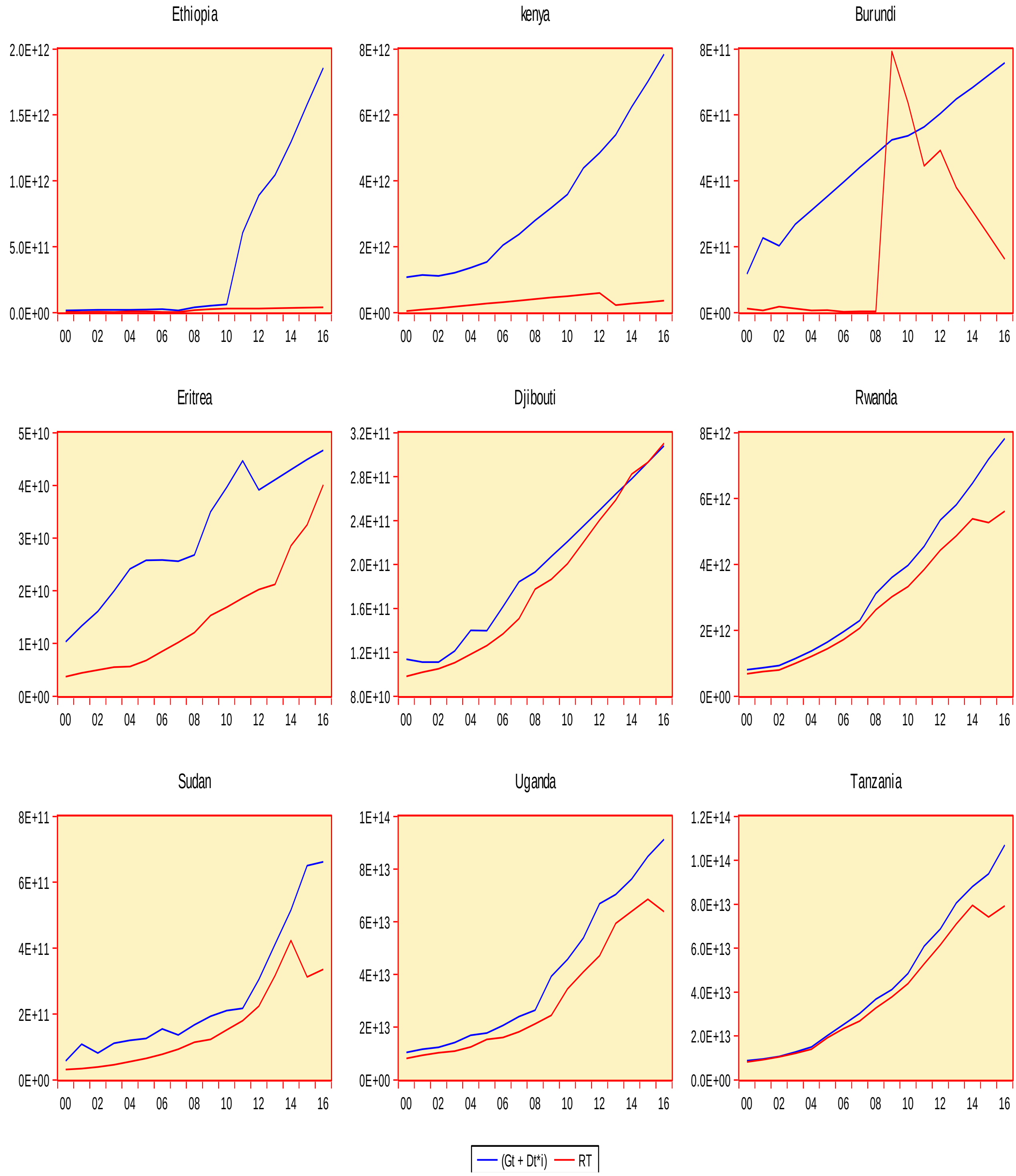

Figure 5. 7: Graphical representation of the variables under consideration for individual cross – section trends

5.2.2 Univariate Unit Root Approaches

Table 5.1 provides descriptive statistics for the variables used. The median (and mean) level of total expenditure is higher than it is for total revenue. Those external debt variables are unstable relative to the external balance, as suggested by the higher standard deviations. The analysis begins by examining the persistence in the variables of interest. To this end, an augmented Dickey–Fuller unit-root test and the Phillips-Perron test (PP test) were applied to the revenue (REV) and expenditure (EXPD) variables to assess the external debt sustainability of each EAC country and to make sure that the results of this research are robust and reliable.

The unit-root test statistics for all series fail to reject the unit-root null at level except for revenue at the 10% significance level for Uganda. Hence, the unit-root tests suggest that East Africa's external stance does not satisfy the IBC over the sample period considered and the fiscal authority for these countries has to change the course of its fiscal policy.

Table 5. 4: Descriptive statistics, 2000-2016

	GT	RT
Mean	1.03E+13	8.12E+12
Median	6.62E+11	2.41E+11
Maximum	1.07E+14	7.94E+13
Minimum	1.03E+10	2.35E+09
Std. Dev.	2.23E+13	1.82E+13
Skewness	2.648319	2.593438
Kurtosis	9.194934	8.775487
Jarque-Bera	423.5012	384.1572
Probability	0.000000*	0.000000*
Sum	1.58E+15	1.24E+15
Sum Sq. Dev.	7.53E+28	5.03E+28
Observations	153	153

*Notes: * indicates significant at the 10% level. Max and min refer to maximum and minimum value, respectively. SD indicates the standard deviation of the series, and ADF is the augmented-Dickey Fuller unit-root test. The values in parentheses refer to length lag selected based on modified Akaike information criterion.*

The above graphs (figure 5.7.) indicate that both variables have been growing over time; therefore, the test for the unit root hypothesis is conducted with the inclusion of a trend (with a constant). If the unit root hypothesis is rejected, the variables are trend stationary.

Table 5. 5: Summary of Unit Root Tests (2000-2016)

Country	Variables		ADF -test		PP -test	
			t-statistic	Prob.	t-ststistic	Prob.
Ethiopia	Revenue	Level	0.021457	0.9456	-2.206988	0.4546
		1st Difference	-3.146461	0.0460**	-2.159217	0.0338**
	Expenditure	Level	-0.164949	0.9873	2.544020	0.9999
		1stDifference	-1.955971	0.3006	-1.837331	0.3499
Kenya	Revenue	Level	-1.981586	0.2909	-1.643409	0.7284
		1st Difference	-3.888444	0.0008*	-4.640708	0.0116**
	Expenditure	Level	-0.544506	0.9680	-0.523024	0.9695
		1stDifference	-4.099181	0.0307**	-10.23315	0.0000*
Burundi	Revenue	Level	-1.789894	0.3714	-1.842592	0.6363
		1st Difference	-4.086185	0.0079*	-4.156679	0.0260**
	Expenditure	Level	-2.673459	0.6820	-1.989186	0.2879
		1stDifference	-10.83241	0.0000*	-9.624434	0.0000*
Djibouti	Revenue	Level	-2.407159	0.3624	2.791528	0.9999
		1st Difference	-3.528379	0.0727***	-3.510368	0.0748***
	Expenditure	Level	0.807719	0.9899	1.651628	0.9989
		1stDifference	-4.005865	0.0356**	-6.207558	0.0009*
Eritrea	Revenue	Level	*1.187282*	*0.9997*	1.738149	1.0000
		1st Difference	-4.042611	0.0393**	-3.324976	0.0838***
	Expenditure	Level	-3.336300	0.1009	-2.233898	0.4417
		1stDifference	-3.654487	0.0650***	-3.380894	0.0291**
Rwanda	Revenue	Level	1.072837	0.9951	-2.639743	0.2698
		1st Difference	-2.952223	0.0628***	-2.681330	0.0628***
	Expenditure	Level	-2.681998	0.2566	-4.458048	0.0144**
		1stDifference	-3.548299	0.0732***	-4.761534	0.0095*
Sudan	Revenue	Level	1.833692	1.0000	-0.182524	0.9229
		1st Difference	-4.538528	0.0152**	-4.013941	0.0090*
	Expenditure	Level	-0.220648	0.9854	-0.212461	0.9857
		1stDifference	-3.584473	0.0664***	-3.584473	0.0664***
Uganda	Revenue	Level	-2.768804	0.0896***	-1.773739	0.6692

		1st Difference	-1.837690	0.3497	-1.743334	0.3914
	Expenditure	Level	-1.625055	0.7361	-1.653836	0.7238
		1st Difference	-2.701847	0.2528	-3.740783	0.0516***
Tanzania	Revenue	Level	0.747537	0.9891	0.639798	0.9860
		1st Difference	-2.974983	0.0603***	-2.956494	0.0623***
	Expenditure	Level	-1.346130	0.8365	-2.839604	0.2049
		1st Difference	-5.347931	0.0062*	-3.958733	0.0361**

*Note: *, **, *** denotes significant at 1%, 5% and 10% respectively.*

Source: Author's calculation based on WDI data base, 2017

The result from the table reveals that both the ADF and PP tests indicate that both revenue and expenditure are non-stationary in levels, but stationary in first differences with the exceptions of Ethiopia and Uganda. In other words, REV and EXPD are $I(1)$ variables. Therefore the analysis proceeds to investigation of co-integration.

Having confirmed unit root presence in all data series and the findings of stationarity in the first difference, the next step was a Johansen's cointegration procedure. It was applied to determine the long-run equilibrium relationship. Johansen's cointegration multivariate procedure is used to establish whether the variables are cointegrated in the long run. The likelihood ratio indicates one co-integrating equation at 5% significance level for Kenya, Eritrea, Sudan and Tanzania. In other words, it accepts the alternative hypothesis of having one co-integrating vector. Since the test statistic for the respective countries is (34.844), (35.917), (32.06) and (32.54605) which is greater than the 95% critical value (25.872) of the likelihood ratio test, it is possible to reject the null of no co-integrating vector. The maximum Eigen value test also confirms the rejection of the null hypothesis.

Therefore, both maximum Eigen value and likelihood ratio indicate that there is one co-integrating equations at 5% significance levels for aforementioned countries (see Table 5.6 – 5.13. below)

Analysis for Kenya:

The graph of REV suggests it may be stationary. But, results for the ADF and PP test confirm that as both series contains a unit root. Given that REV is I (1) and EXPD is (1), the sustainability of external debt must be checked through co-integration analysis and the result is summarized below.

Table 5. 6: Tests for cointegration between revenue and expenditure (Kenya)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.781367	31.84444	25.87211	0.0080**
At most 1	0.452614	9.039012	12.51798	0.1780
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.781367	22.80543	19.38704	0.0153**
At most 1	0.452614	9.039012	12.51798	0.1780

*Both trace test and Max-eigenvalue test indicates 1 cointegrating eqn (s) at the 0.05 level; * and ** denotes rejection of the hypothesis at the 0.05 level*

Source: Author

Table 5. 7: Tests for cointegration between revenue and expenditure (Djibouti)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.539850	11.82711	15.49471	0.1654
At most 1	0.012196	0.184063	3.841466	0.6679
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.539850	11.64305	14.26460	0.1248
At most 1	0.012196	0.184063	3.841466	0.6679

**Both trace test and maximum Eigen-value test indicates no co-integration eqn.*

Table 5. 8: Tests for cointegration between revenue and expenditure (Tanzania)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized	Eigenvalue	Trace	0.05	Prob.**

No. of CE(s)		Statistic	Critical Value	
None *	0.822385	32.54605	25.87211	0.0063*
At most 1	0.356991	6.623953	12.51798	0.3854
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.822385	25.92210	19.38704	0.0049*
At most 1	0.356991	6.623953	12.51798	0.3854

Both Trace test and Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level

* denotes rejection of the hypothesis at the 0.01 level

Table 5. 9: Tests for cointegration between revenue and expenditure (Uganda)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.469496	15.56643	25.87211	0.5277
At most 1	0.332245	6.057515	12.51798	0.4530
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.469496	9.508914	19.38704	0.6712
At most 1	0.332245	6.057515	12.51798	0.4530

Trace test and Max-eigenvalue test indicates no cointegration at the 0.05 level

** denotes rejection of the hypothesis at the 0.05 level*

Table 5. 10: Tests for cointegration between revenue and expenditure (Sudan)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.821430	32.05990	25.87211	0.0075*
At most 1	0.339363	6.218260	12.51798	0.4331
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.821430	25.84164	19.38704	0.0050*
At most 1	0.339363	6.218260	12.51798	0.4331

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level

** denotes rejection of the hypothesis at the 0.01 level*

Table 5. 11: Tests for cointegration between revenue and expenditure (Eritrea)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.857666	35.91747	25.87211	0.0020*
At most 1	0.359124	6.673787	12.51798	0.3798
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.857666	29.24368	19.38704	0.0013*
At most 1	0.359124	6.673787	12.51798	0.3798

Both Trace test and Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level

** denotes rejection of the hypothesis at the 0.01 level*

Table 5. 12: Tests for cointegration between revenue and expenditure (Burundi)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.528443	18.17485	25.87211	0.3323
At most 1	0.368679	6.899113	12.51798	0.3551
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.528443	11.27574	19.38704	0.4854
At most 1	0.368679	6.899113	12.51798	0.3551

Max-eigenvalue test indicates no cointegration at the 0.05 level
** denotes rejection of the hypothesis at the 0.05 level*

Table 5. 13: Tests for cointegration between revenue and expenditure (Rwanda)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.585877	13.22419	15.49471	0.1068
At most 1	2.19E-05	0.000328	3.841466	0.9876
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.585877	13.22387	14.26460	0.0725
At most 1	2.19E-05	0.000328	3.841466	0.9876

Max-eigenvalue test indicates no cointegration at the 0.05 level

** denotes rejection of the hypothesis at the 0.05 level*

According to the above tables, both the maximum eigenvalue and trace test indicate no co-integration at the 5% significant level for four countries (Djibouti, Uganda, Rwanda and Burundi), while, the test fails to reject the hypothesis of no co-integration at the same level of significance for Kenya, Tanzania, Eritrea and Sudan. This implies that, external external debt was unsustainable over the sample period for Djibouti, Uganda, Rwanda and Burundi and sustainable for the latter mentioned countries.

5.3. Panel Unit Root Results

Panel unit root tests can be classified into two groups, depending on whether they account for cross sectional dependence or not. The first generation panel unit root tests (Im, Pesaran, and Shin 2003; Maddala and Wu 1999; Choi 2001) have been criticized because they assume cross-sectional independence. This hypothesis is rather restrictive and unrealistic since macroeconomic time series exhibit significant cross-sectional correlation among countries in a panel (Baltagi 2008), and co-movements of economies are often observed in the majority of macroeconomic applications of unit root tests (Hurlin and Mignon 2005). The presence of cross-sectional correlation of errors in panel data applications in economics is likely to be the rule rather than the exception (Chudik and Pesaran 2015). Moreover, correlation across units in panels may have significant consequences on the first generation of tests assuming cross-sectional independence. When applied to cross-sectionally dependent panels, such panel unit root tests can generate substantial size distortions (O'Connell 1998). As a result, alternative (second generation) panel unit root tests (Bai and Ng 2004; Chang 2002, 2004; Choi 2002; Moon and Perron 2004; Phillips and Sul 2003; Pesaran 2007) have been proposed to take into account cross-sectional dependence.

However, according to Baltagi, cross-sectional dependence is a problem in macro panels with long time series (over 20-30 years). This is not much of a problem in micro panels (few years and large number of cases). In whatever it follows, the results of the Pesaran (2004) and Breusch-Pagan LM (2008) test of cross-sectional dependence are shown in Table 5.14 and 5.15 below. Both tests are used to test whether the residuals are correlated across entities. Cross-sectional dependence can lead to bias in tests results (also called contemporaneous correlation). The null hypothesis is that residuals are not correlated.

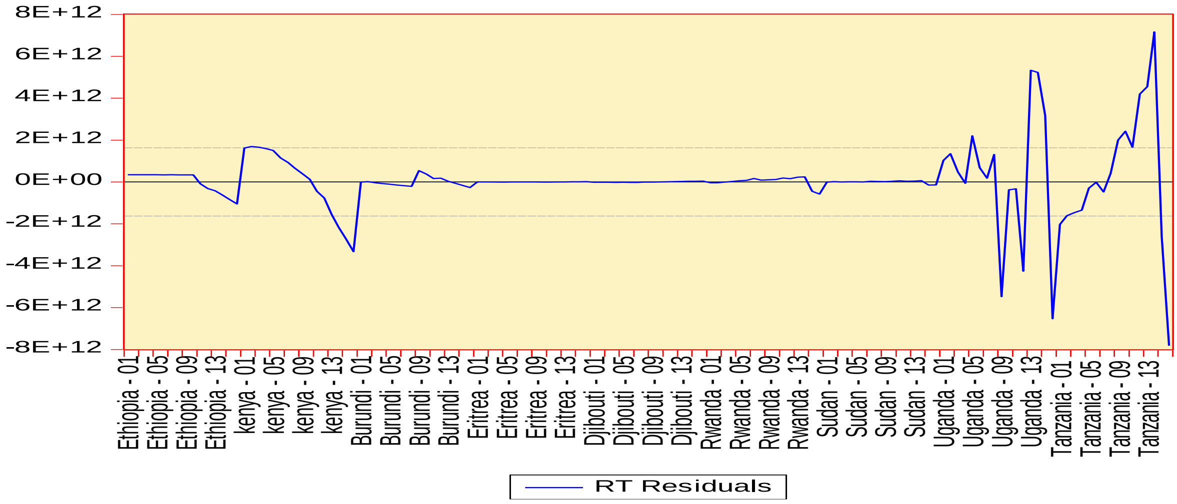

Figure 5. 8: Graphical representations of residuals

Table 5. 14: Testing for cross-sectional dependence: Using Pasaran CD test

Pesaran's test of cross sectional independence = 1.388, Pr = 0.1651	
	Indicates no cross – sectional Dependence at all significant level (i.e. 1, 5, 10) percent.
Average absolute value of the off-diagonal elements = 0.442	

Table 5. 15 Results for Breusch-Pagan LM test of independence:

	__e1	__e2	__e3	__e4	__e5	__e6	__e7	__e8	__e9
__e1	1.0000								
__e2	-0.1133	1.0000							
__e3	-0.4818	0.5039	1.0000						
__e4	0.4042	-0.3731	-0.7678	1.0000					
__e5	0.4143	-0.4333	-0 .6716	0.9515	1.0000				
__e6	0.4522	0.1239	-0.5418	0.8374	0.7324	1.0000			
__e7	-0.3162	-0.0164	-0.1217	0.3295	0.2769	0.3792	1.0000		
__e8	0.2783	-0.9546	-0.6128	0.5070	0.5647	0.0588	0.0501	1.0000	
__e9	0.1426	-0.9692	-0.5086	0.4106	0.4945	-0.0563	0.0838	0.9626	1.0000
Breusch-Pagan LM test of independence: chi2(36) = 166.881, $\boxed{\text{Pr = 0.1963}}$									
Based on 17 complete observations over panel units									

Indicates no Cross –Sectional Dependence

Both of the above test confirms to Baltagi (2008), where cross –sectional dependence is not much of a problem in micro panels (few years and large number of cases). Likewise, in both tests, the null hypothesis of no cross sectional dependence across entities cannot be rejected at a reasonable significance level (1, 5 and even 10 percent) for the panels'.

Had cross-sectional dependence be present Hoechle suggests ether to use Driscoll and Kraay standard errors or second generation panel unit root test proposed by (Bai and Ng 2004; Chang 2002, 2004; Choi 2002; Moon and Perron 2004; Phillips and Sul 2003; Pesaran 2007).

The graphs in 5.2.1 indicate that both variables have been growing over time; therefore, the test for the unit root hypothesis is conducted with the inclusion of a trend (with a constant). If the unit root hypothesis is rejected, the variables are trend stationary. The Akaike Information Criteria (AIC) was used to select the optimal lag length.

Table 5. 16: Panel unit root test: Summary (2000 – 2016)

Series: Revenue (RT): at Level		
Method	Statistic	Prob.**
Null: Unit root (assumes common unit root process)		
Levin, Lin & Chu t*	-0.98409	0.1625
Breitung t-stat	4.86785	1.0000
Null: Unit root (assumes individual unit root process)		
Im, Pesaran and Shin W-stat	2.07852	0.9812
ADF - Fisher Chi-square	13.3264	0.7718
PP - Fisher Chi-square	18.8132	0.4034
Series: Revenue at first difference (D (RT))		
Method	Statistic	Prob.**
Null: Unit root (assumes common unit root process)		
Levin, Lin & Chu t*	-6.1906207	0.0079*
Null: Unit root (assumes individual unit root process)		
Im, Pesaran and Shin W-stat	-3.5855956	0.00016815*
ADF - Fisher Chi-square	43.300557	0.00072555*
PP - Fisher Chi-square	43.124676	0.00076839*
Series: Expenditure (GT): Level		
Method	Statistic	Prob.**

Null: Unit root (assumes common unit root process)		
Levin, Lin & Chu t*	8.89347658	1.0000
Hadri LM test	20.7595	0.0000*
Null: Unit root (assumes individual unit root process)		
Im, Pesaran and Shin W-stat	9.75931617	1.0000
ADF - Fisher Chi-square	8.38497875	0.97233736
PP - Fisher Chi-square	3.19032463	0.99995565
Series: D(GT): First Difference		
Method	Statistic	Prob.**
Null: Unit root (assumes common unit root process)		
Levin, Lin & Chu t*	-11.2483	0.0000*
Hadri LM test	0.6766	0.2493
Null: Unit root (assumes individual unit root process)		
Im, Pesaran and Shin W-stat	-7.63529	0.0000*
ADF - Fisher Chi-square	72.2663	0.0000*
PP - Fisher Chi-square	90.707	0.0000*

Note: * Denote rejection of the null hypothesis at 1% significance level.

* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Automatic selection of lags based on SIC. Newey-West bandwidth selection using a Bartlett kernel

Source: Author'

As it is shown on the above table, all test statistics are found to reject the null hypothesis at 1 percent significance level for Rt and Gt at first difference for all countries. In consensus with the other panel unit root results, the Hadri LM stationary (2000) panel unit root test reveals evidence of rejection of the null of stationary (at 1 percent significance level) at level for all countries. Furthermore, the test could not find any evidence to reject the null at first difference suggesting that both expenditure and revenue are I (1) variables.

Thus, the reported results confirmed that the government expenditure and revenue including an interest payment on external loan variables are first difference variables, I (1) for all countries.

5.4. Results of Panel Co –integration Test

In the third step, provided that both revenue and expenditure are found to be non-stationary, it is relevant to investigate whether these two trade variables are cointegrated. Cointegration between these variables is a necessary condition for external sustainability. Panel cointegration tests can be carried out using either tests proposed by Pedroni (1999, 2004) or error correction tests suggested by Kao Residual Cointegration test, and/or Johansen Fisher Panel Cointegration test. Pedroni's (1999, 2004) first generation panel unit root test suggests seven test statistics for the null hypothesis of no cointegration, with four panel cointegration statistics and three group mean cointegration statistics (Table 5.4.1 below).

Table 5. 17: Pedroni Residual Cointegration Test

Within Dimension				
	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	7.410513	0.0000*	4.119062	0.0000*
Panel rho-Statistic	1.15265	0.8755	1.266714	0.8974
Panel PP-Statistic	1.687347	0.9542	1.168001	0.8786
Panel ADF-Statistic	-2.121765	0.0169**	-1.044933	0.148
Between- Dimension				
	Statistic	Prob.		
Group rho-Statistic	1.514921	0.9351		
Group PP-Statistic	0.170197	0.5676		
Group ADF-Statistic	-2.264102	0.0118**		

*Note: * and ** represents rejection of null hypothesis at 1% and 5% respectively.*

Except for the panel variance test, the Panel ADF-Statistic and Group ADF-Statistic tests, all the tests fail to reject the null hypothesis of no cointegration between revenue and expenditure at the 5% significance level.

The findings imply that in a panel perspective, external debt is not sustainable in the long run in a panel of EACs'. Moreover, using Kao Residual Cointegration test, all the panel tests reject the null hypothesis, so external debt is sustainable, too, in some panels (seeTable 5.4.2 below)

Table 5.4.2 Kao Residual Cointegration Test

	t-Statistic	Prob.
ADF	-5.760281	0.0000*
Residual variance	4.21E+24	
HAC variance	3.70E+24	

*Note: * indicates rejections of the null hypothesis at 1% significance level*

Kao's residual panel cointegration tests take no cointegration for all countries in the panel as the null hypothesis.

Table 5. 18: Johansen Fisher Panel Cointegration Test

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-Eigen test)	Prob.
None	62.47	0.0000*	56.96	0.0000*
At most 1	23.21	0.1825	23.21	0.1825
Individual cross section results				
Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
Hypothesis of no cointegration				
Ethiopia	23.0914	0.1068	16.6108	0.121
Kenya	31.8444	0.008*	22.8054	0.0153*
Burundi	18.1749	0.3323	11.2757	0.4854
Eritrea	35.9175	0.002*	29.2437	0.0013*
Djibouti	29.1341	0.0189**	17.5081	0.0918***
Rwanda	23.3269	0.1004	14.288	0.2354
Sudan	32.0599	0.0075*	25.8416	0.005*
Uganda	15.5664	0.5277	9.5089	0.6712
Tanzania	32.546	0.0063*	25.9221	0.0049*

*Note: *, ** and *** denote rejection of the null hypothesis of no cointegration at the 1%, 5% and 10% significance levels, respectively.*

Source: Author's calculations.

5.5. Estimation of the coefficients of Interest

After having tested and highlighted the external debt positions in EAC by using stationarity properties of the variables and cointegration test, we can now estimate the coefficient β of the equation (4.7) also known as the "sustainability coefficient" – to assess its level. This involves estimating the cointegrating relationship between government gross revenue and government gross expenditure plus interest payments on external debt. To do this, the Panel Dynamic OLS (PDOLS) method developed by Mark and Sul (2003) was employed. Indeed, the PDOLS estimator is known in the literature to be more efficient for estimating a cointegration relationship between variables in panel data framework than other competing estimators as the OLS and FMOLS (Fully Modified OLS) methodologies (see Kao and Chiang, 2000). To control inference problems of standard panel estimators, the PDOLS procedure consists in augmenting the cointegrating relationship with leads and lags of the first difference of the explanatory variables. The estimation, focus on whether the coefficient of interest (β) is equal to one, less than one or between zero and one (β = 1, β <1) or 0< β<1). The results of the PDOLS estimations are presented in tables 5.5.1 below.

Table 5. 19: Results from panel cointegration regression

bandwidth)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GT	0.279494	0.470126	0.594509	0.5532

Long-run covariance estimates (Bartlett kernel, Newey-West fixed

As it can be observed from the above table, there is a clear evidence that even though Panel cointegration result suggests that external debt is sustainable for the panel countries as a whole, panel cointegrating regression estimation indicates that the value of sustainability coefficient is less than 1 (one), which implies that external debt is weakly sustainable.

Table 5. 20: Individual coefficients from DOLS method.

	Constant	**Coef. of G_t**
Ethiopia	-1.45E+10	-0.49233
Kenya	2.13E+11	0.8489
Burundi	8.91E+11	-15.5358
Eritrea	-1.20E+10	0.439977
Djibouti	6.27E+09	0.492047
Rwanda	1.49E+11	0.117008
Sudan	-4.16E+10	0.959762
Uganda	3.79E+11	0.098167
Tanzania	2.18E+12	0.41537

As shown from the above table, even though the limited time span should induce some care in the interpretations of results concerning the long-run properties of times series for individual country, the result comes in support of the evidence obtained from panel regresion analysis.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

This chapter presents the summary of the findings, conclusions, recommendations and possible areas for further study.

6.2. Summary of findings and Conclusions

In this study, various econometric techniques useful to examine the sustainability of external debt have applied. Various univariates and panel unit root test have been applied to selected data of 17 years for nine EAC economies. Three different techniques were applied. The first was the univariate unit root tests (ADF and PP) to know the external debt sustainability of individual countries and found that all the countries are facing the unsustainable level of debts which was evident from their non-stationary series of revenue and expenditure. The second type of tests, panel unit root tests (LL, Fisher-ADF, and IPS), were applied to assess the external debt status of EAC countries as a whole and found that the external debt of the EAC economies as a whole was sustainable which is incompatible with the results of previous test. The third type of tests includes time series and panel cointegration based approaches and found that there was no long run relationship observed between revenue and expenditure for the each of the panel countries except Kenya, Eritrea, Sudan and Tanzania which mean that five countries has the unsustainable external debt except the four aforementioned countries and EG-residual based panel cointegration approach declared their external debt unsustainable as a whole. The results of residual based panel cointegration approach are preferred as its results are consistent with the individual country results and it is concluded that the external debt of EAC countries is unsustainable. On the basis of results, it can be said that the surpassing external debt is leading the EAC economies toward the low level of growth and retarding development in the economies.

6.3 Policy Implications

In order to avoid unsustainable levels of external debt, the policy which is aimed of cutting current expenditures is not feasible due to their complex development strategies. Instead These countries may create the economic environment attracting the foreign investment which supplements not only the countries capital stock by filling the saving investment gap but also removes fiscal and budget deficits. The borrowing countries can substitute external borrowing with the internal borrowing. They can utilize their externally borrowed resources in productive and development purposes so that the profits and better repayment capacity can make the debt sustainable leading to substantial growth as well as removes from the disincentive effect and attracts investment. The country should export more and try hard to stable the currency to commodity (general price level) as well as currency to currency exchange rate, should adopt measures to increase the domestic saving and investment rates, should borrow from the sources having the less volatile and low interest rate.

In addition to the above recommendation, there is need for governments in the region to strengthen and implement prudent debt management strategies to mitigate the effects of the rising debt on the economy. For countries such as Ethiopia, Burundi, Djibouti, Uganda and in some case Rwanda and Burundi with rapidly rising external debt there is need for containment of the fiscal deficit and further medium-term consolidation efforts are also needed to limit and eventually reverse the rise in external debt.
Moreover, for countries with a narrow export base there is need for the economic and hence export diversification in order to widen the revenue base and reduce external borrowing for the country to move out of debt distress.

6.4. Suggestions for further research.

The study sought to test the sustainability of the external debt in Ethiopia, Kenya, Eritrea, Djibouti, Sudan, Burundi, Rwanda, Uganda and Tanzania. Therefore, similar study can be conducted on other African countries for comparison purposes.

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Appendexes

Appendex 7A

Results from panel co-integration Regresion (with out trend or constant)

Null Hypothesis: No cointegration Trend assumption: No deterministic intercept or trend	
Alternative hypothesis: common AR coefs. (within-dimension)	

				Weighted Statistic	
		Statistic		Prob.	Prob.
Panel v-Statistic		14.53355	0.0000	0.440345	0.3298
Panel rho-Statistic		-2.841603	0.0022	-0.254354	0.3996
Panel PP-Statistic		-1.689792	0.0455	0.067274	0.5268
Panel ADF-Statistic		-3.595186	0.0002	-0.25238	0.4004
Alternative hypothesis: individual AR coefs. (between-dimension)					
		Statistic	Prob.		
Group rho-Statistic		1.353829	0.9121		
Group PP-Statistic		0.738782	0.77		
Group ADF-Statistic		-0.235591	0.4069		
Automatic lag length selection based on SIC with a max lag of 3					
Newey-West automatic bandwidth selection and Bartlett kernel					

Johansen Fisher Panel Cointegration Test
Trend assumption: Linear deterministic: No trend
Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	54.81	0.0000	57.53	0.0000*
At most 1	15.35	0.6380	15.35	0.6380

Individual cross section results

Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
Hypothesis of no cointegration				
Ethiopia	16.6185	0.1337	15.8869	0.1275
Kenya	19.3410	0.0125**	18.7330	0.0092*
Burundi	10.6677	0.2328	10.6272	0.1739
Eritrea	17.1328	0.0281**	13.6174	0.0631***
Djibouti	11.8271	0.1654	11.6430	0.1248
Rwanda	13.2242	0.1068	13.2239	0.0725
Sudan	16.2862	0.0379**	15.2182	0.0352**
Uganda	9.6523	0.3084	8.9059	0.2941
Tanzania	23.8483	0.0022*	23.6901	0.0012*

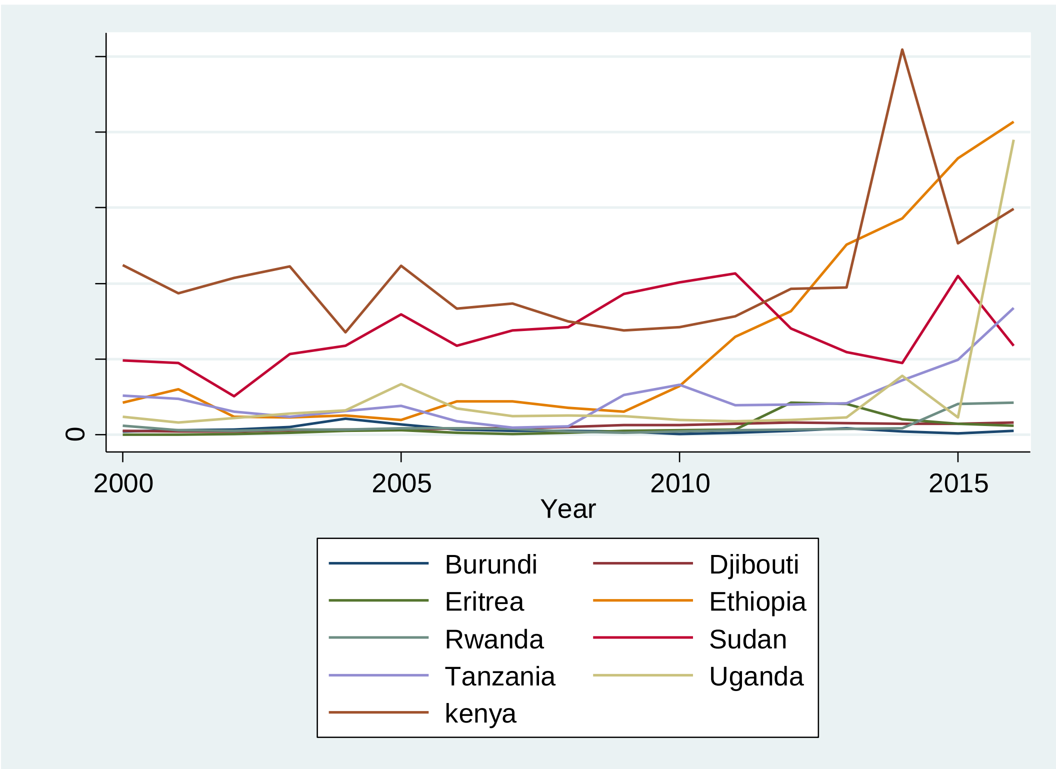
Note: *, **, *** Respectively indicates rejections of the null hypothesis at 1%, 5% and 10%

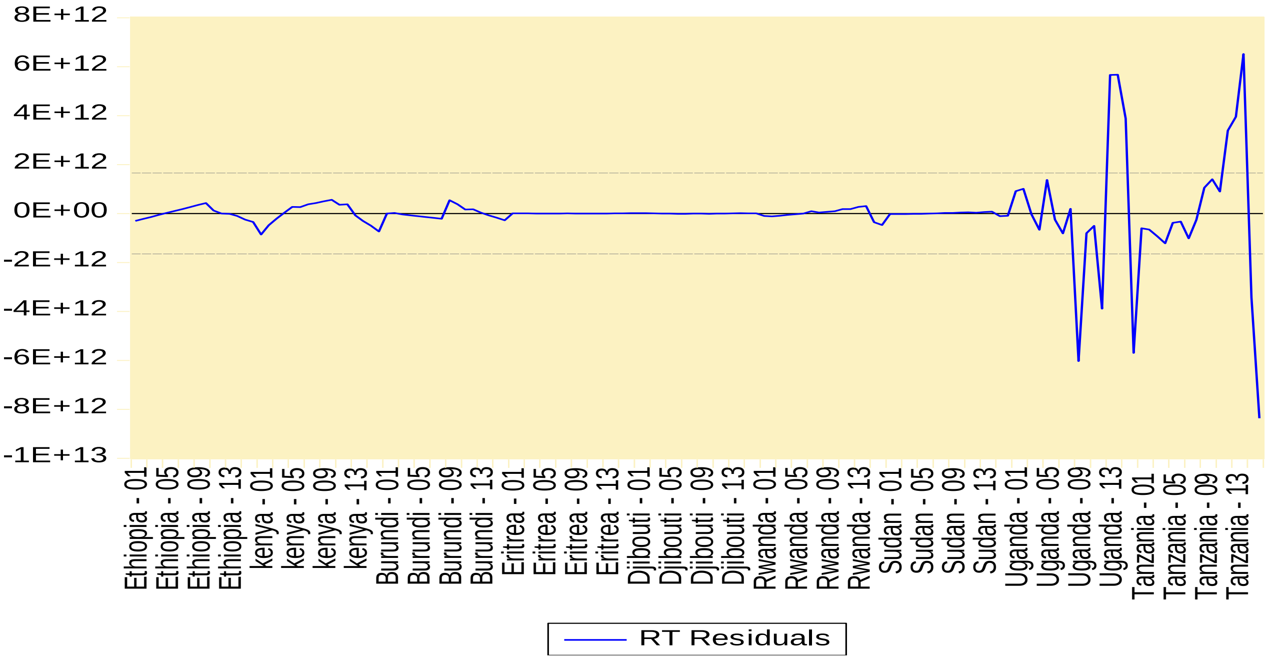
Appendix 1B

Table: Principal Payment on External debt

year	Ethiopia	Kenya	Burundi	Eritrea	Djibouti	Rwanda	Sudan	Uganda	Tanzania
2000	84721000	4.49E+08	9434000	493000	10659000	24253000	1.97E+08	47757000	1.04E+08
2001	1.2E+08	3.74E+08	12145000	685000	8881000	12855000	1.9E+08	32525000	94742000
2002	48525000	4.14E+08	14011000	2606000	9977000	11558000	1.02E+08	45286000	61590000
2003	47183000	4.46E+08	21413000	5831000	12725000	13760000	2.15E+08	56563000	47793000
2004	51600000	2.71E+08	42748000	10355000	13487000	14305000	2.36E+08	65741000	63994000
2005	39824000	4.47E+08	27177000	11775000	11850000	16848000	3.19E+08	1.35E+08	77353000
2006	89406000	3.34E+08	13673000	6200000	18475000	17779000	2.36E+08	69820000	36081000
2007	87936000	3.47E+08	11292000	1669000	17082000	16159000	2.76E+08	49507000	19719000
2008	71687000	2.99E+08	11292000	6531000	21818000	8615000	2.84E+08	52104000	22258000
2009	61699000	2.77E+08	8509000	11270000	26703000	5311000	3.73E+08	49024000	1.05E+08
2010	1.3E+08	2.85E+08	2445000	13294000	25712000	8388000	4.03E+08	40150000	1.32E+08
2011	2.59E+08	3.13E+08	5823000	14010000	29106000	12294000	4.26E+08	36863000	78319000
2012	3.28E+08	3.86E+08	10217000	86016000	32382000	13945000	2.81E+08	39559000	80885000
2013	5.03E+08	3.89E+08	18291000	81355000	31745000	15268000	2.19E+08	46047000	83125000
2014	5.72E+08	1.02E+09	8701000	41161000	28910000	17934000	1.89E+08	1.56E+08	1.45E+08
2015	7.32E+08	5.06E+08	4799000	29913000	29811000	81624000	4.19E+08	46739000	1.98E+08
2016	8.28E+08	5.98E+08	10608000	24321000	33670000	85348000	2.36E+08	7.79E+08	3.35E+08

Figure; Principal Payment by Sample Countries





Residual Graph

Panel Contemporaneous (Between cross-section) covariance									
	Ethiopia	Kenya	Burundi	Eritrea	Djibouti	Rwanda	Sudan	Uganda	Tanzania
Ethiopia	1.85E+20	1.15E+21	2.33E+21	1.31E+20	9.16E+20	2.25E+22	1.46E+21	2.70E+23	3.28E+23
Kenya	1.15E+21	2.29E+22	2.52E+22	7.05E+20	5.57E+21	1.44E+23	6.14E+21	1.32E+24	1.95E+24

Burundi	2.33E+21	2.52E+22	6.27E+22	1.16E+21	9.33E+21	2.46E+23	1.31E+22	2.56E+24	3.43E+24
Eritrea	1.31E+20	7.05E+20	1.16E+21	1.10E+20	7.21E+20	1.74E+22	1.17E+21	2.12E+23	2.55E+23
Djibouti	9.16E+20	5.57E+21	9.33E+21	7.21E+20	4.99E+21	1.22E+23	8.15E+21	1.48E+24	1.79E+24
Rwanda	2.25E+22	1.44E+23	2.46E+23	1.74E+22	1.22E+23	3.01E+24	2.01E+23	3.62E+25	4.42E+25
Sudan	1.46E+21	6.14E+21	1.31E+22	1.17E+21	8.15E+21	2.01E+23	1.45E+22	2.50E+24	2.99E+24
Uganda	2.70E+23	1.32E+24	2.56E+24	2.12E+23	1.48E+24	3.62E+25	2.50E+24	4.52E+26	5.36E+26
Tanzania	3.28E+23	1.95E+24	3.43E+24	2.55E+23	1.79E+24	4.42E+25	2.99E+24	5.36E+26	6.51E+26

Appendix 7C

Comparisons of revenue and expenditure

Country	Gross Expenditure	Total Revenue	Delta	Delta%
Ethiopia - 00	1.45E+10	5.41E+09	9.10E+09	168.10%
Ethiopia - 01	1.69E+10	3.36E+09	1.35E+10	402.80%
Ethiopia - 02	2.00E+10	4.88E+09	1.52E+10	311.10%
Ethiopia - 03	2.10E+10	4.02E+09	1.70E+10	424.00%
Ethiopia - 04	2.02E+10	7.63E+09	1.25E+10	164.00%
Ethiopia - 05	2.18E+10	7.71E+09	1.41E+10	182.60%
Ethiopia - 06	2.45E+10	2.69E+09	2.19E+10	813.90%
Ethiopia - 07	1.66E+10	3.34E+09	1.33E+10	398.60%
Ethiopia - 08	4.09E+10	1.72E+10	2.36E+10	137.20%
Ethiopia - 09	5.13E+10	2.55E+10	2.58E+10	101.20%
Ethiopia - 10	6.19E+10	2.89E+10	3.30E+10	114.30%
Ethiopia - 11	6.05E+11	3.00E+10	5.75E+11	1916.50%
Ethiopia - 12	8.90E+11	2.89E+10	8.61E+11	2980.50%
Ethiopia - 13	1.04E+12	3.16E+10	1.01E+12	3198.00%
Ethiopia - 14	1.29E+12	3.44E+10	1.26E+12	3663.60%
Ethiopia - 15	1.58E+12	3.71E+10	1.54E+12	4156.30%
Ethiopia - 16	1.86E+12	3.99E+10	1.82E+12	4556.80%
Kenya - 00	1.07E+12	4.32E+10	1.03E+12	2385.50%
Kenya - 01	1.14E+12	8.88E+10	1.05E+12	1186.20%
Kenya - 02	1.11E+12	1.34E+11	9.77E+11	727.50%
Kenya - 03	1.21E+12	1.80E+11	1.03E+12	573.60%
Kenya - 04	1.36E+12	2.25E+11	1.13E+12	503.10%

Kenya - 05	1.53E+12	2.71E+11	1.26E+12	465.00%
Kenya - 06	2.05E+12	3.17E+11	1.73E+12	546.40%
Kenya - 07	2.38E+12	3.62E+11	2.01E+12	556.10%
Kenya - 08	2.80E+12	4.08E+11	2.39E+12	586.00%
Kenya - 09	3.18E+12	4.53E+11	2.73E+12	602.60%
Kenya - 10	3.59E+12	4.99E+11	3.09E+12	619.20%
Kenya - 11	4.38E+12	5.44E+11	3.84E+12	704.90%
Kenya - 12	4.85E+12	5.90E+11	4.26E+12	721.90%
Kenya - 13	5.39E+12	2.25E+11	5.17E+12	2292.40%
Kenya - 14	6.24E+12	2.71E+11	5.97E+12	2203.40%
Kenya - 15	7.02E+12	3.17E+11	6.70E+12	2116.30%
Kenya - 16	7.85E+12	3.62E+11	7.48E+12	2066.60%
Burundi - 00	1.17E+11	1.24E+10	1.05E+11	844.90%
Burundi - 01	2.26E+11	6.59E+09	2.20E+11	3339.20%
Burundi - 02	2.02E+11	1.79E+10	1.84E+11	1028.30%
Burundi - 03	2.68E+11	1.21E+10	2.56E+11	2109.30%
Burundi - 04	3.10E+11	5.92E+09	3.04E+11	5139.80%
Burundi - 05	3.53E+11	7.10E+09	3.46E+11	4874.20%
Burundi - 06	3.96E+11	2.35E+09	3.94E+11	16778.80%
Burundi - 07	4.40E+11	3.64E+09	4.36E+11	11982.60%
Burundi - 08	4.82E+11	3.58E+09	4.78E+11	13361.50%
Burundi - 09	5.24E+11	7.93E+11	2.69E+11	-33.90%
Burundi - 10	5.36E+11	6.37E+11	1.01E+11	-15.80%
Burundi - 11	5.64E+11	4.45E+11	1.19E+11	26.80%
Burundi - 12	6.04E+11	4.92E+11	1.12E+11	22.70%
Burundi - 13	6.49E+11	3.80E+11	2.69E+11	70.80%
Burundi - 14	6.83E+11	3.07E+11	3.75E+11	122.10%
Burundi - 15	7.21E+11	2.35E+11	4.86E+11	206.70%
Burundi - 16	7.59E+11	1.63E+11	5.96E+11	366.60%
Eritrea - 00	1.03E+10	3.70E+09	6.64E+09	179.50%
Eritrea - 01	1.33E+10	4.41E+09	8.92E+09	202.40%
Eritrea - 02	1.61E+10	4.94E+09	1.11E+10	225.10%
Eritrea - 03	2.00E+10	5.49E+09	1.45E+10	263.50%
Eritrea - 04	2.42E+10	5.62E+09	1.85E+10	330.20%
Eritrea - 05	2.58E+10	6.80E+09	1.90E+10	279.00%
Eritrea - 06	2.59E+10	8.51E+09	1.74E+10	204.00%
Eritrea - 07	2.56E+10	1.02E+10	1.54E+10	151.50%
Eritrea - 08	2.68E+10	1.21E+10	1.47E+10	122.10%
Eritrea - 09	3.50E+10	1.53E+10	1.97E+10	128.90%
Eritrea - 10	3.96E+10	1.69E+10	2.28E+10	134.80%
Eritrea - 11	4.47E+10	1.86E+10	2.60E+10	139.90%
Eritrea - 12	3.91E+10	2.03E+10	1.89E+10	93.20%
Eritrea - 13	4.11E+10	2.12E+10	1.98E+10	93.50%
Eritrea - 14	4.30E+10	2.85E+10	1.45E+10	50.60%

Eritrea - 15	4.49E+10	3.25E+10	1.24E+10	38.10%
Eritrea - 16	4.66E+10	4.01E+10	6.54E+09	16.30%
Djibouti - 00	1.14E+11	9.80E+10	1.57E+10	16.00%
Djibouti - 01	1.11E+11	1.02E+11	9.20E+09	9.00%
Djibouti - 02	1.11E+11	1.05E+11	6.02E+09	5.70%
Djibouti - 03	1.21E+11	1.11E+11	1.05E+10	9.50%
Djibouti - 04	1.40E+11	1.18E+11	2.14E+10	18.10%
Djibouti - 05	1.40E+11	1.26E+11	1.36E+10	10.80%
Djibouti - 06	1.61E+11	1.37E+11	2.48E+10	18.20%
Djibouti - 07	1.84E+11	1.51E+11	3.34E+10	22.20%
Djibouti - 08	1.93E+11	1.78E+11	1.55E+10	8.70%
Djibouti - 09	2.07E+11	1.86E+11	2.06E+10	11.10%
Djibouti - 10	2.21E+11	2.01E+11	2.01E+10	10.00%
Djibouti - 11	2.35E+11	2.20E+11	1.47E+10	6.70%
Djibouti - 12	2.49E+11	2.41E+11	8.74E+09	3.60%
Djibouti - 13	2.64E+11	2.59E+11	5.37E+09	2.10%
Djibouti - 14	2.78E+11	2.82E+11	4.53E+09	-1.60%
Djibouti - 15	2.93E+11	2.93E+11	1.23E+08	-4.20E-04
Djibouti - 16	3.08E+11	3.10E+11	2.47E+09	-0.80%
Rwanda - 00	8.02E+11	6.76E+11	1.26E+11	18.60%
Rwanda - 01	8.60E+11	7.42E+11	1.18E+11	15.90%
Rwanda - 02	9.31E+11	7.97E+11	1.34E+11	16.80%
Rwanda - 03	1.14E+12	9.93E+11	1.52E+11	15.30%
Rwanda - 04	1.37E+12	1.21E+12	1.66E+11	13.80%
Rwanda - 05	1.64E+12	1.44E+12	1.99E+11	13.80%
Rwanda - 06	1.96E+12	1.72E+12	2.46E+11	14.40%
Rwanda - 07	2.29E+12	2.07E+12	2.29E+11	11.10%
Rwanda - 08	3.12E+12	2.62E+12	4.95E+11	18.90%
Rwanda - 09	3.61E+12	3.02E+12	5.90E+11	19.50%
Rwanda - 10	3.97E+12	3.32E+12	6.50E+11	19.60%
Rwanda - 11	4.55E+12	3.85E+12	7.06E+11	18.40%
Rwanda - 12	5.35E+12	4.44E+12	9.16E+11	20.70%
Rwanda - 13	5.81E+12	4.86E+12	9.47E+11	19.50%
Rwanda - 14	6.46E+12	5.39E+12	1.07E+12	19.90%
Rwanda - 15	7.20E+12	5.27E+12	1.93E+12	36.60%
Rwanda - 16	7.82E+12	5.62E+12	2.20E+12	39.20%
Sudan - 00	5.74E+10	3.15E+10	2.58E+10	82.00%
Sudan - 01	1.08E+11	3.41E+10	7.38E+10	216.40%
Sudan - 02	8.12E+10	3.90E+10	4.22E+10	108.30%
Sudan - 03	1.11E+11	4.61E+10	6.48E+10	140.70%
Sudan - 04	1.20E+11	5.53E+10	6.50E+10	117.40%
Sudan - 05	1.26E+11	6.46E+10	6.12E+10	94.80%
Sudan - 06	1.55E+11	7.78E+10	7.70E+10	98.90%
Sudan - 07	1.36E+11	9.25E+10	4.32E+10	46.70%

Sudan - 08	1.67E+11	1.14E+11	5.28E+10	46.40%
Sudan - 09	1.93E+11	1.22E+11	7.08E+10	57.80%
Sudan - 10	2.11E+11	1.51E+11	5.94E+10	39.20%
Sudan - 11	2.17E+11	1.80E+11	3.71E+10	20.70%
Sudan - 12	3.05E+11	2.24E+11	8.06E+10	36.00%
Sudan - 13	4.12E+11	3.16E+11	9.57E+10	30.20%
Sudan - 14	5.16E+11	4.23E+11	9.23E+10	21.80%
Sudan - 15	6.50E+11	3.12E+11	3.38E+11	108.10%
Sudan - 16	6.62E+11	3.35E+11	3.27E+11	97.50%
Uganda - 00	1.04E+13	8.17E+12	2.27E+12	27.80%
Uganda - 01	1.16E+13	9.36E+12	2.20E+12	23.50%
Uganda - 02	1.23E+13	1.03E+13	2.05E+12	19.90%
Uganda - 03	1.42E+13	1.08E+13	3.32E+12	30.70%
Uganda - 04	1.69E+13	1.24E+13	4.47E+12	35.90%
Uganda - 05	1.78E+13	1.54E+13	2.40E+12	15.60%
Uganda - 06	2.06E+13	1.61E+13	4.54E+12	28.30%
Uganda - 07	2.40E+13	1.82E+13	5.80E+12	31.90%
Uganda - 08	2.64E+13	2.12E+13	5.20E+12	24.50%
Uganda - 09	3.93E+13	2.45E+13	1.49E+13	60.60%
Uganda - 10	4.56E+13	3.45E+13	1.11E+13	32.30%
Uganda - 11	5.39E+13	4.09E+13	1.29E+13	31.60%
Uganda - 12	6.68E+13	4.71E+13	1.97E+13	41.90%
Uganda - 13	7.03E+13	5.94E+13	1.09E+13	18.30%
Uganda - 14	7.62E+13	6.39E+13	1.23E+13	19.20%
Uganda - 15	8.48E+13	6.85E+13	1.63E+13	23.70%
Uganda - 16	9.13E+13	6.39E+13	2.74E+13	42.90%
Tanzania - 00	8.71E+12	8.15E+12	5.58E+11	6.80%
Tanzania - 01	9.49E+12	9.10E+12	3.94E+11	4.30%
Tanzania - 02	1.07E+13	1.04E+13	2.40E+11	2.30%
Tanzania - 03	1.26E+13	1.21E+13	5.20E+11	4.30%
Tanzania - 04	1.49E+13	1.40E+13	9.03E+11	6.50%
Tanzania - 05	2.01E+13	1.91E+13	1.01E+12	5.30%
Tanzania - 06	2.51E+13	2.33E+13	1.84E+12	7.90%
Tanzania - 07	3.02E+13	2.68E+13	3.42E+12	12.80%
Tanzania - 08	3.67E+13	3.28E+13	3.98E+12	12.20%
Tanzania - 09	4.11E+13	3.77E+13	3.37E+12	8.90%
Tanzania - 10	4.84E+13	4.38E+13	4.56E+12	10.40%
Tanzania - 11	6.08E+13	5.28E+13	8.07E+12	15.30%
Tanzania - 12	6.87E+13	6.14E+13	7.28E+12	11.80%
Tanzania - 13	8.05E+13	7.10E+13	9.53E+12	13.40%
Tanzania - 14	8.80E+13	7.94E+13	8.58E+12	10.80%
Tanzania - 15	9.37E+13	7.41E+13	1.96E+13	26.40%
Tanzania - 16	1.07E+14	7.92E+13	2.78E+13	35.10%