IBN HALDUN UNIVERSITY
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF ECONOMICS

MASTER THESIS

THE IMPACT OF EXTERNAL PUBLIC DEBT ON PER CAPITA INCOME: IN THE CASE OF COMMON MARKET FOR EASTERN AND SOUTHERN AFRICA (COMESA)

MAHAT MAALIM IBRAHIM

THESIS SUPERVISOR: PROF. RASİM ÖZCAN

ISTANBUL, 2020

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by

MAHAT MAALIM IBRAHIM

A thesis submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of Master of Arts in Economics

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APPROVAL PAGE

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Arts in Economics.

Thesis Jury Members

Title - Name Surname	Opinion	Signature

This is to confirm that this thesis complies with all the standards set by the School of Graduate Studies of Ibn Haldun University.

Date of Submission Seal/Signature

ACADEMIC HONESTY ATTESTATION

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name Surname: Mahat Maalim Ibrahim

Signature:

ÖZ

DOĞU VE GÜNEY AFRİKA (COMESA) ÜLKELEREİN: DIŞ KAMU BORÇUNUN REAL KİŞİ GELİRİ ÜZERİNDEKİ ETKİSİ

Yazar Mahat Maalim, Ibrahim
İktısat Yüksek Lisans Programı
Tez Danışmanı: Prof. Dr. Rasim Özcan
Mayıs 2020, 84 sayfa

Bu çalışmada, Doğu ve Güney Afrika ülkeleri (COMESA) için dış kamu borcu ile reel gelir arasındaki ilişki incelenmiştir. Çalışmada, 1990-2018 yılları arasındaki dönemi kapsayan panel veri seti kullanılmaktadır. En küçük karelar yöntemi, dinamik rassal etkiler modeli, dinamik sabit etkiler modeli, ve genelleştirilmiş moment yöntemi (GMM) modelleri uygulanmıştır. Kullanılan değişkenler şunlardır: reel kişi başı gelir, devlet borcu ödemeleri, kısa vadeli dış borç stok, dış borç stok (GSMH'nin yüzdesi), dış borç stok kamu garantisi, uzun vadeli dış borç stok, dış borç servisi, dış borç servisi (ihracatın yüzdesi), brüt sermaye oluşumu, işgücü, hükümet harcamaları ve reel enflasyon oranı. Tüm veriler Dünya Bankası Kalkınma Göstergelerinden (WDI) ve Uluslararası Para Fonu'ndan (IMF) alınmıştır. Söz konusu değişkenlerin seçiminde literatürdeki diğer çalışmalardan istifade edilmiştir. Regresyon analizinden önce, birkaç temel ve ön koşullu testler yapılmıştır. Yatay kesit bağımlılık testi, ikinci nesil birim kök testi, ikinci nesil eşbütünleşme testi, tek yönlü ve iki yönlü sabit etkiler ve rassal etkiler testi, değişen varyans ve otokorelasyon testi, eğim homojenlik testi ve araçsal uygunluk ve geçerlilik testileri yapılmıştır. Elde edilen sonuç göre, çoğu modellerin açıklayıcı değişkenlerin kişi başı reel geliri ile ters ilişkiye sahip olduklarına göstermektedir. Başka bir deyişle, gittikçe artan dış borç birikimi, Doğu ve Güney Afrika (COMESA) ülkelerinin ekonomik büyümesini üzerindeki etkisi negatiftir.

Keywords: Brüt Borç; Bütçe Açığı; COMESA; Dynamik Panel; Ekonomik Büyüme; GMM.

ABSTRACT

IMPACT OF EXTERNAL PUBLIC DEBT ON PER CAPITA INCOME: IN THE CASE OF COMMON MARKET FOR EASTERN AND SOUTHERN AFRICA (COMESA)

Student Name Mahat Maalim, Ibrahim
MA in Economics
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This study examines the relationship between external public debt and real per capita income growth of Common Markets for Eastern and Southern African countries (COMESA). The study uses panel data covering the period between 1990-2018. We applied dynamic random effect, dynamic fixed effect, and generalized method of moments (GMM) models. Following the literature, we focus on variables of real per capita income (as a proxy for growth), gross general government debt, short-term external debt stock, external debt stock (% of GNI), external debt stock guarantee, long-term external debt stock, gross capital formation as an instrument for physical capital, labor force, real inflation rate, trade openness, external debt service, and debt service percentage of export. Our explanatory variables are gross government debt, short-term external debt stock, external debt stock (% of GNI), external debt stock guarantee, long-term external debt stock, debt service percentage of export, and external debt service, while the rest are used as control variables. Data come from the World Bank Development Indicators (WDI) and the International Monetary Fund (IMF).

Keywords: Budget Deficits; COMESA; Dynamic Panel; Economic Growth; Gross Debt; GMM.

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Mahat Maalim Ibrahim

ISTANBUL, 2020

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LIST OF SYMBOLS AND ABBREVIATIONS

EXDGNİ	External debt stock (%GNI)
FDI	Foreign direct investment, net inflows (% GDP)
GCON	General government final consumption expenditure (% GDP)
GROD	General government gross debt (Debt-to-GDP ratio)
İNC	Natural logarithm of real GDP US dollars constant (2010)
INF	Real inflation rate.
İNV	Fixed capital formation Percentage (% GDP)
L	Labor force participation rate total pop. (15-64)
L.İNC	Lag of the natural logarithm of real GDP US dollars constant (2010)
LTD	Long-term external debt stock (Current $)
OPEN	Trade openness (export+import) /gross domestic product.
PPG	comprises long-term external obligations of public debtors
SHTD	Short term external stock (Current $)
TDBSER	Total debt service on external debt (current US$)
TDSERX	Debt service to exports (%)
Α	Intercept or the constant term
Β	Coefficient or the slope of the explanatory variables in the equations
Γ	Time fixed effect

CHAPTER I

INTRODUCTION

Sustainable economic growth, societal transformation, and development are the main priority and focus of every government, particularly those in developing countries. Accomplishing long-term health economic burgeon is not a cakewalk for the majority of those developing and low-income countries. Enormous investment, prudent fiscal policy, and moderate current account balance are the imperative factors that governments should maintain to realize their potential for sustainable economic burgeon and societal wellbeing. However, the majority of the countries, irrespective of their level of development, are plagued with a huge budget deficit due to excessive spending on unproductive projects, persistent current account deficit as a result of underproduction, and paltry revenue collection as a consequence of economic incapacity and massive tax evasion. According to Facchini (2018), there are 23 different explanations of public spending phenomena and seventy-eight different variables that affect public expenditure. In his paper Facchini (2018) summarized public spending theories into three main categories: "demand models, supply models, and constitutional models." The demand models, government expenditure, is determined by the electorates and the citizens; thus, government expenditure cannot go against the will of the electorates because they hold the government to account.

Contrary to the demand model, the supply model, governments do not consider the preferences of the people. The government is the most powerful institution, and the elected politicians become more powerful than those who elected them into office; consequently, the will of the bureaucrats supersedes the will of the citizens (Mueller, 2003; Facchini, 2018). The constitutional models are where the constitution prevents the government from unnecessary spending of public resources. There are bounded spending and restrictions that the government cannot overstep without compelling circumstances allowed by the constitution. A public budget deficit occurs when government expenditure supersedes and surpasses the revenue generated by the country. Therefore, to finance the public budget deficit and compensate for the inadequate income generation, and to achieve durable economic buoyancy in the long run, additional resources are required. One of the channels to acquire the required resources to stimulate growth is debt or borrowing. Governments, therefore, amasses and accumulate debt from different channels both external and local sources.

Governments can borrow from locals by selling government securities, bonds, and certificates, or they can apply debt for external sources. Nevertheless, inflationary and injudicious borrowing only exacerbates the already fledgling economy, mushrooming budgetary dearth, and tremendously expanding current account deficit of the most developing countries (Reinhart, & Rogoff, 2012). As suggested by Cecchetti et al. (2011), debt is a double-edged sword which, if it is not utilized prudently and keenly, leads to disastrous consequences of economic distress and crisis. Thus, "For individual households and firms, overborrowing leads to bankruptcy and financial ruin, but for a country, too much debt impairs government's ability to deliver essential services to its citizens".

Because the debtor is required by the creditor to fulfill specific responsibilities by repaying the debt services on time agreed upon during the contract, the principal, in addition to the interest rate, which might grow higher than the principal based on the period of the contract. The developing countries are afflicted by the inefficiency of capital formation due to persistent, perennial underproductivity, meager savings, and inadequate income generation. External debt, therefore, many times, is a hindrance and obstacle for internal capital formation of the developing countries. Expressed in another way, developing and the low-income countries' reckless accumulation and amassing of external debt could become an economic albatross around their neck in the future, which is not only difficult to disentangle and escape from, but also makes debt sustainability impossible and tedious. There is substantial evidence that external debt in developing countries just envenoms and magnifies their economic incapacity due to the perpetual debt servicing process, which blocks investment avenues. Therefore, It is challenging to detach and demarcate where prosperous economic buoyant begins and perpetual poverty ends. Voluminous empirical evidence and findings show that external debt's contribution to the economy of the developing countries is not only insignificant but also Burdensome and economic impediment (Nakatani & Herrera, 2007).

When the debt-to-GDP ratio exceeds the recommendations of the International Monetary Fund’s (IMF) and golden rule’s optimal threshold, which is 45% of the country’s GDP, investor's confidence about that country’s debt servicing repayment ability may reduce. Investors usually use the general government debt-to-GDP ratio to measure the government's capability to repay its debt in the future period, which creates various implications on government cost of borrowing.[1] Because as we said, “Government debt as a percent of GDP is used by the investors to measure the country’s capability to make future repayments of its debt, thus affecting the country’s borrowing costs and government bond yields.”[2] The IMF’s prescription regarding government debt says that public foreign debt-to-GDP ratio must not exceed 45% of the countries' GDP.

In this study, we inspect and investigate public external debt and per capita income nexus for COMESA economic organization. COMESA substituted the Preferential Trade Area (PTA), which was founded in the 1980s. In 1994, PTA was replaced with COMESA. The primary purpose of establishing COMESA was to improve trade and economic cooperation among the member states and to enhance human capital. Currently, COMESA consists of 21 member states, making it the largest free-trade economic organization in the continent with a population of 560 million. The COMESA member states are: “Burundi, Comoros, Congo, Dem Rep., Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Somalia, Sudan, Swaziland, Tunisia, Uganda, Zambia, and Zimbabwe.”

These countries rely heavily on external debt to finance their developmental projects like roads and railways, electricity and dams, infrastructure, and all other mega projects. Hence, they borrow continuously and consistently, which creates fear of the risk of debt crises. A plethora of empirical studies carried out in different countries suggests that debt and economic growth are inversely related. In contrast, others indicate that debt and economic growth have a positive relationship. Some others posit that there are no panacea economic prescriptions, but its country-specific issue which is affected by a variety of different factors. Depending on debt management and channels used, the impact might vary substantially and accordingly. Some studies

[1] https://tradingeconomics.com/government-debt-to-gdp

[2] Debt-to-GDP ratio is the measurement used by creditors to estimate country’s ability to repay its debt.

indicate while proper debt management can have a significant and substantial positive imprint on output growth in the short period, it has a negative influence on output growth in the future period due to private investment “crowding out effect.” Our work is to analyze and examine different literature on this topic and check the relationship between external public debt and per capita income of the COMESA countries. Our study is organized as follows. Introduction, objectives of the study, research question, contribution, literature review, methodology, results and discussion, and finally, conclusion then references.

In 1996, the World Bank, the IMF, and other bilateral and multilateral creditors initiated the “Heavily Indebted Poor Countries (HIPC) Initiative.”

The HIPC Initiative’s purpose is to prevent the developing countries from plunging into an abyss, uncontrollable and unsustainable debt load. The country’s debt burden is either decreased or canceled if the country fulfills serial, rigid, stratified, and complex conditions that are related to good governance, combating against corruption, increasing revenue generation, enhancing accountability, and transparency in public expenditure and prudent public financial management systems.

So far, 37 countries out of which 31 are from the African continent had benefited from the HIPC initiative of debt relief either partially or entirely.[3]

In the coming pages, we give a nutshell information about the COMESA countries that we are studying. The data in the coming figures are obtained from the Thomson Reuters database (*Eikon*, 2020).

Burundi: a small nation in east Africa, had its external debt of over US$ 1 billion canceled under the HIPC Initiative in 2007. The country has been afflicted upon a high poverty level, political instability, and conflict.[4] Figure 1.1 below illustrates Burundi’s general gross government debt, which is almost 60% of its GDP, which is much higher than the IMF prescription and debt threshold of 45% of the country’s GDP.

[3] https://www.worldbank.org/en/topic/debt/brief/hipc

[4] https://countryeconomy.com/national-debt/burundi

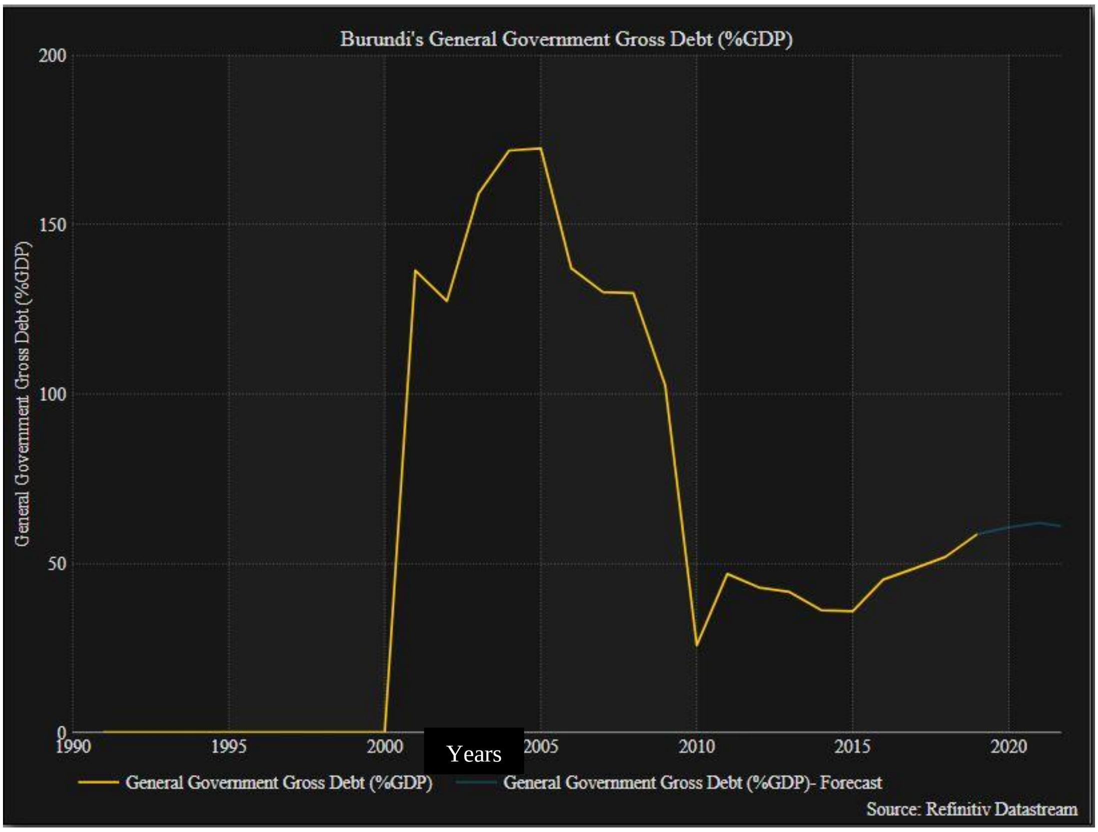

Figure 1.1. Burundi's General Government Gross Debt (Refinitiv Datastream)

Ethiopia: is the second-most populous country in Africa after Nigeria and one of the poorest countries whose leviathan amount of its population lives under the poverty line. In 2004, Ethiopia achieved the "HIPC Initiative" completion point, and in 2005, completed a multilateral debt relief process where more than US$ 1.3 billion of its debt was canceled. Although Ethiopia's external debt reduced at that time, the country's expenditure has skyrocketed and increased astronomically to finance its infrastructure development, which led to the accumulation of foreign debt again. Currently, Ethiopia's external debt stands more than 61% of its GDP, which is unsustainable in the long run.[5] Figure 1.2 reveals the historical general gross debt of Ethiopia. Although Ethiopia's gross debt was low compare to its debt ten years ago, it still stands 60% of its GDP, which is beyond sustainability and threshold.

[5] https://countryeconomy.com/national-debt/ethiopia

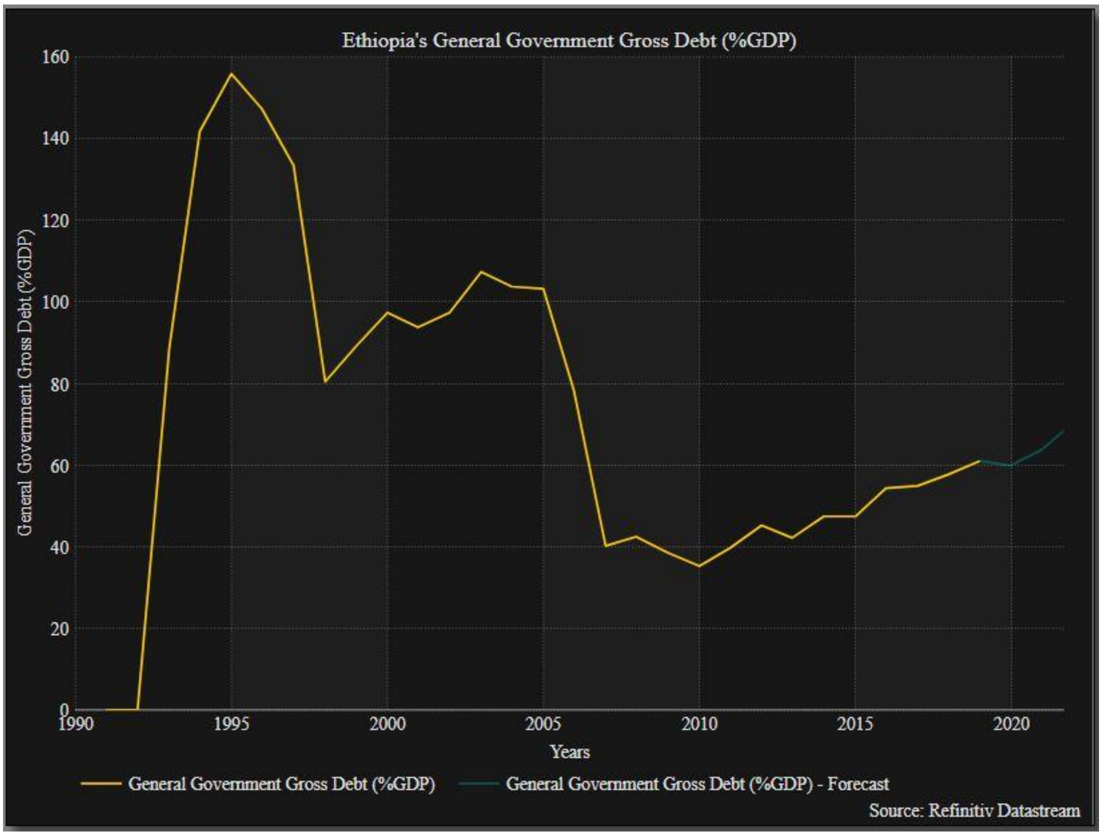

Figure 1.2. Ethiopia's General Government Gross Debt (Refinitiv Datastream)

Kenya: an economic hub of East Africa and one of the better countries in the continent, grapples with a massive and unbearable debt burden. The country is now in economic crisis due to what the famous Kenyan anti-corruption crusader John Githongo once called "mega corruption and looting" of the country's resources. Scholars and international financial institutions are warning the government about the debt crisis and unsustainability. The country has experienced high debt for the last four years. In 2019, Kenya's gross debt stood more than 61% of its GDP, and there is no sign of reducing it soon. It is highly expected that foreign debt accumulation increases substantially in the future.[6]

As depicted in figure 1.3 below, Kenya's public external debt trend is skyrocketing and increasing significantly for the last eight years. Furthermore, Figure 1.4 shows that the gross debt is beyond sustainability, and the prediction is also projecting a further increase.

[6] https://countryeconomy.com/national-debt/kenya

Figure 1.3. Kenya's Public External Debt (Refinitiv Datastream)

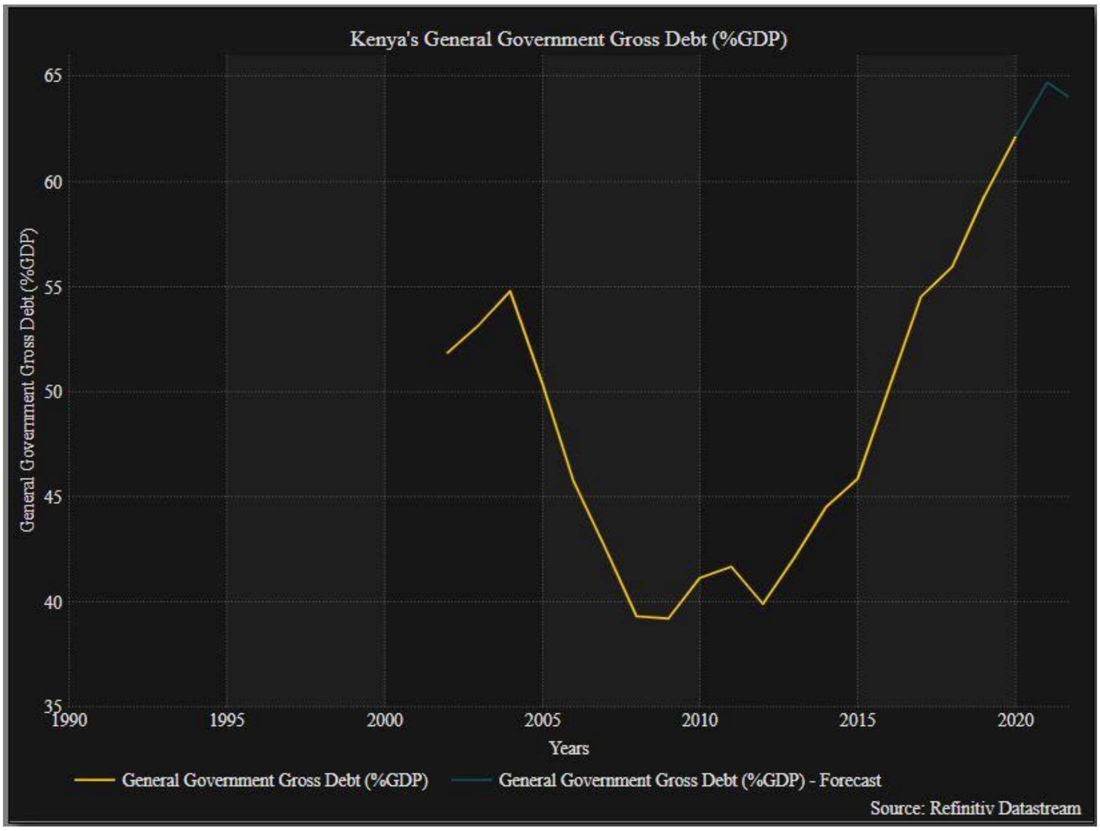

Figure 1.4. Kenya's General Government Gross Debt (Refinitiv Datastream)

Rwanda: the genocide of 1994 destroyed and damaged Rwanda's economy severely, which led to the accumulation of a monumental debt burden equivalent to more than 126% of its GDP. Roughly US$ 1.4 billion of its external debt has been canceled after applying for debt relief through the "HIPC Initiative" in the year 2000. Currently, Rwanda's foreign debt is in the sustainability range designated by the IMF, which is roughly 45% of countries' GDP. The latest numbers indicate that Rwanda's debt-to-GDP ratio is increasing steadily. The debt-to-GDP ratio is almost 52% of its GDP.[7]

Rwanda's debt started to rise after 2007, as figure 1.5 shows.

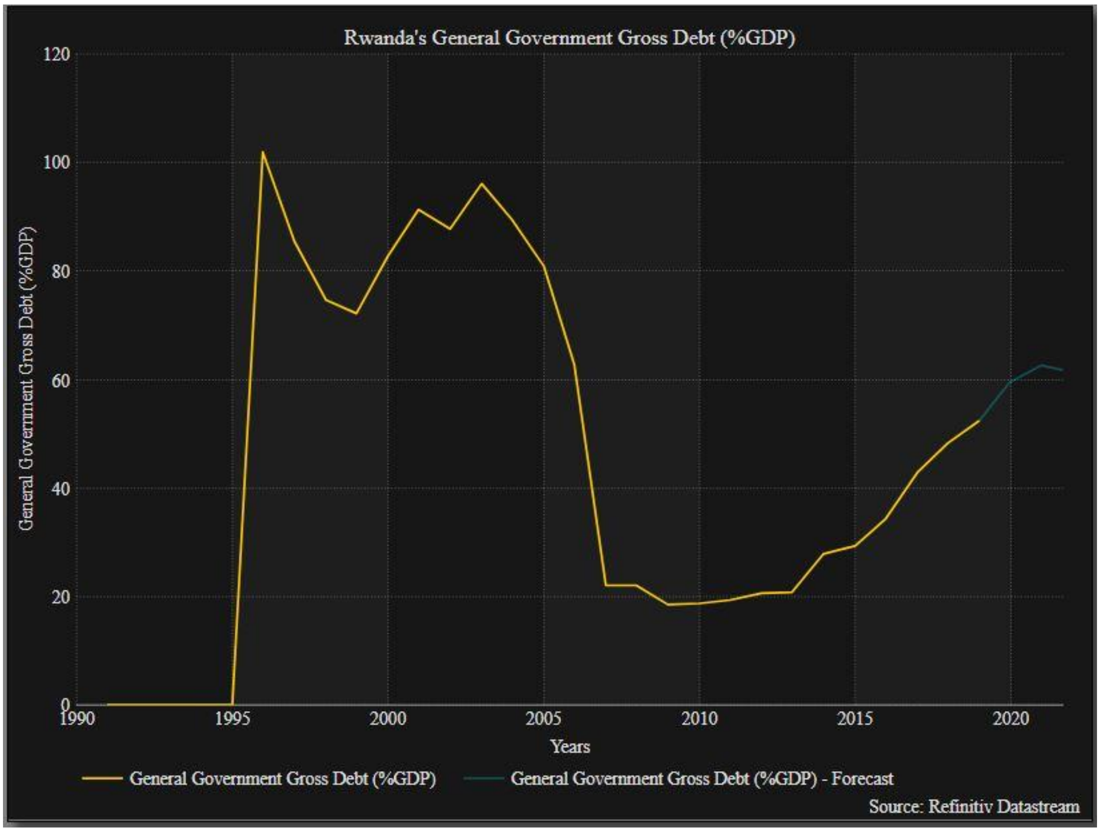

Figure 1.5. Rwanda's General Government Gross Debt (Refinitiv Datastream)

Uganda: has been amassing external debt as early as the 1970s. However, the benefits of that long-accumulated debt to the Ugandan economy is questionable. In the year 2000, Uganda was the first country that experimented with the "HIPC Initiative" and completed successfully. In 2006, Uganda achieved to meet the multilateral debt relief initiative requirements. The debt burden has been reduced drastically, and it was the first time the impact of the debt relief has been felt in Uganda's economy. However,

[7] https://countryeconomy.com/national-debt/rwanda

even after the debt cancellation and implementation of the free market, the poverty level has not been alleviated. Although Uganda's gross debt is not as high as some of its neighbors, it is still projected that the debt-to-GDP ratio might increase more than 45% of its GDP in 2020. The current debt-to-GDP ratio is about 39% of Uganda's GDP, as shown in figure 1.6 below.[8]

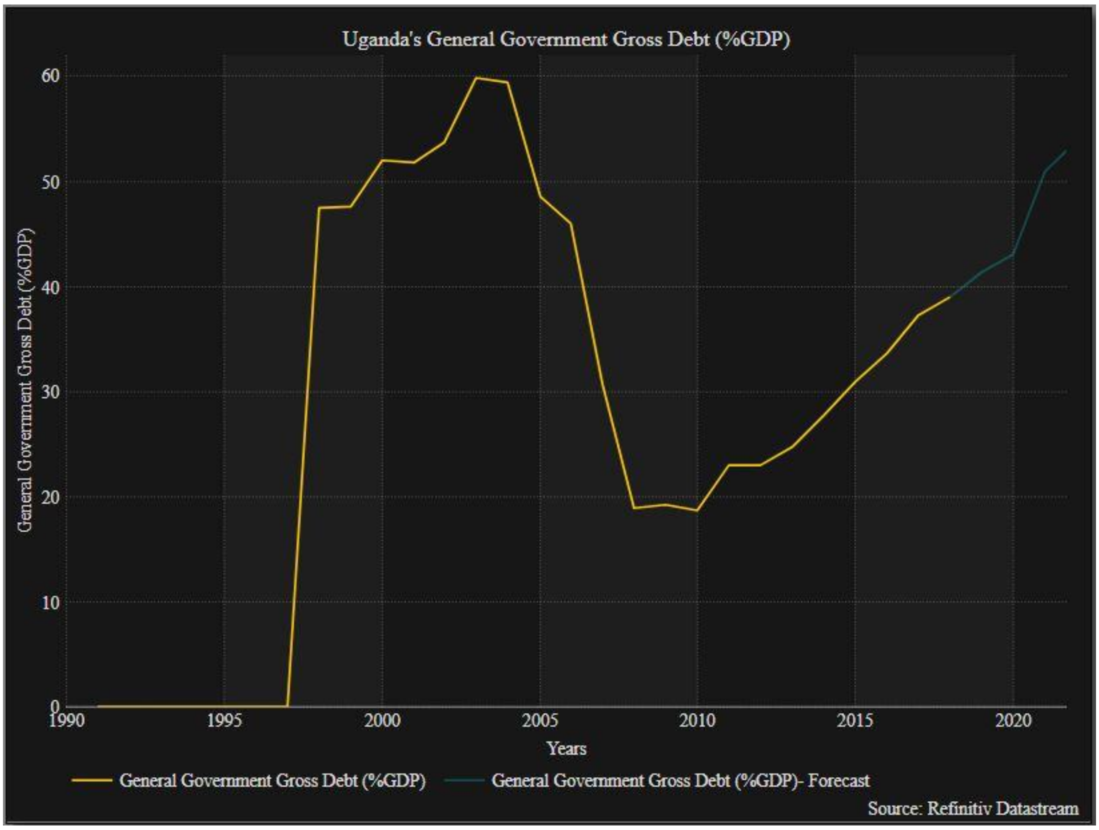

Figure 1.6. Uganda's General Government Gross Debt (Refinitiv Datastream)

Comoros: the small island in the middle of the Indian Ocean, has experienced a drastic decrease in its debt ratio over the years. The country's debt-to-GDP ratio came down from 108% of its GDP and US$ 941 of its per capita income ratio in the 1990s to 21% and US$ 298 per capita income ratio in 2018, respectively. Comoros' debt condition is much better in contrast to its COMESA comrades or other countries on the continent.[9]

Comoros' debt is very much below the threshold debt and, therefore, experiencing no debt distress, as shown in figure 1.7 below.

[8] https://countryeconomy.com/national-debt/uganda
[9] https://countryeconomy.com/national-debt/Comoros

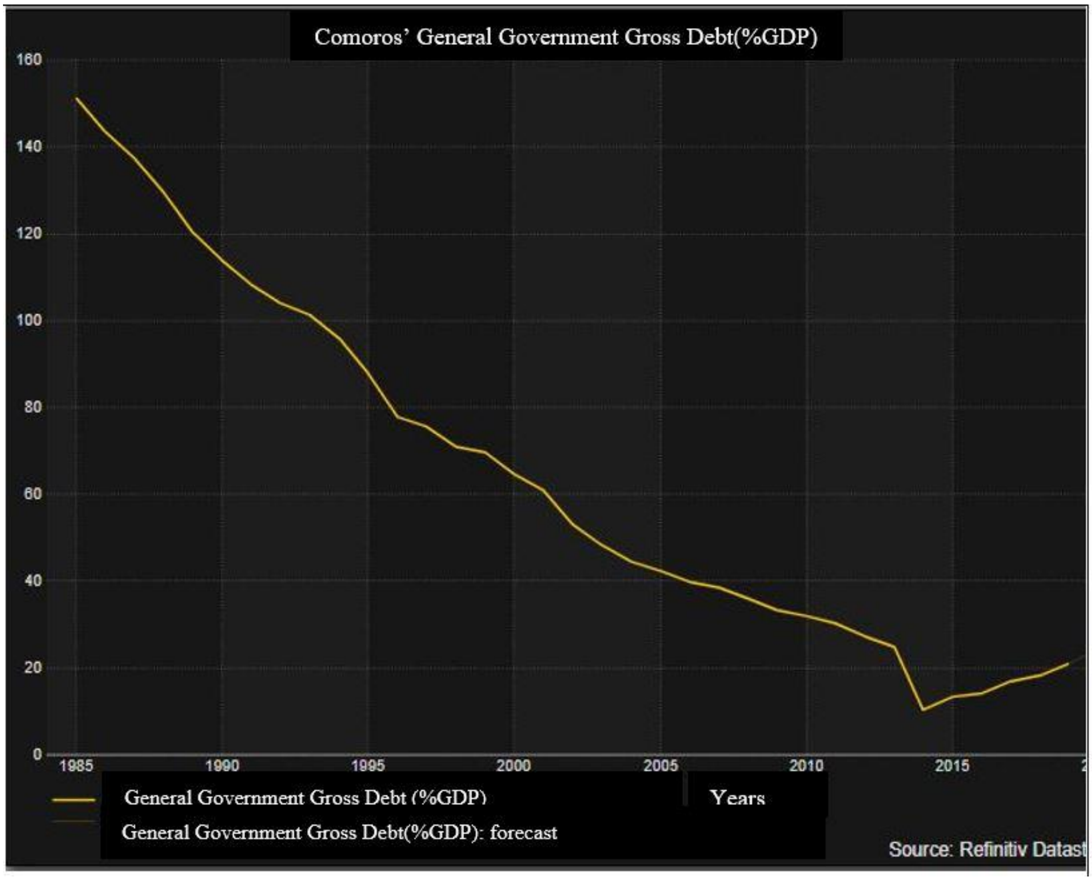

Figure 1.7. Comoros' General Government Gross Debt (Refinitiv Datastream)

Democratic Republic of Congo: better known as DRC, is a conflict-prone country that could not be able to achieve economic prosperity and a sustainable peace environment, despite its vast resource potential. DRC is the most affluent country on earth in terms of resources; however, it remains poor because of political instability. With a population of roughly 80 million, and meager GDP of around US$ 48 billion. Nevertheless, the country's foreign debt-to-GDP ratio has been decreasing all over the years. Thus, despite enormous and existential insecurity, corruption, and poor leadership, DRC's foreign debt remains very low, manageable, and sustainable compared to some member countries in the COMESA organization.[10]

Amazingly, DRC'S gross debt is one of the lowest among the COMESA countries, as depicted in figure 1.8.

[10] https://countryeconomy.com/national-debt/ Democratic Republic of Congo

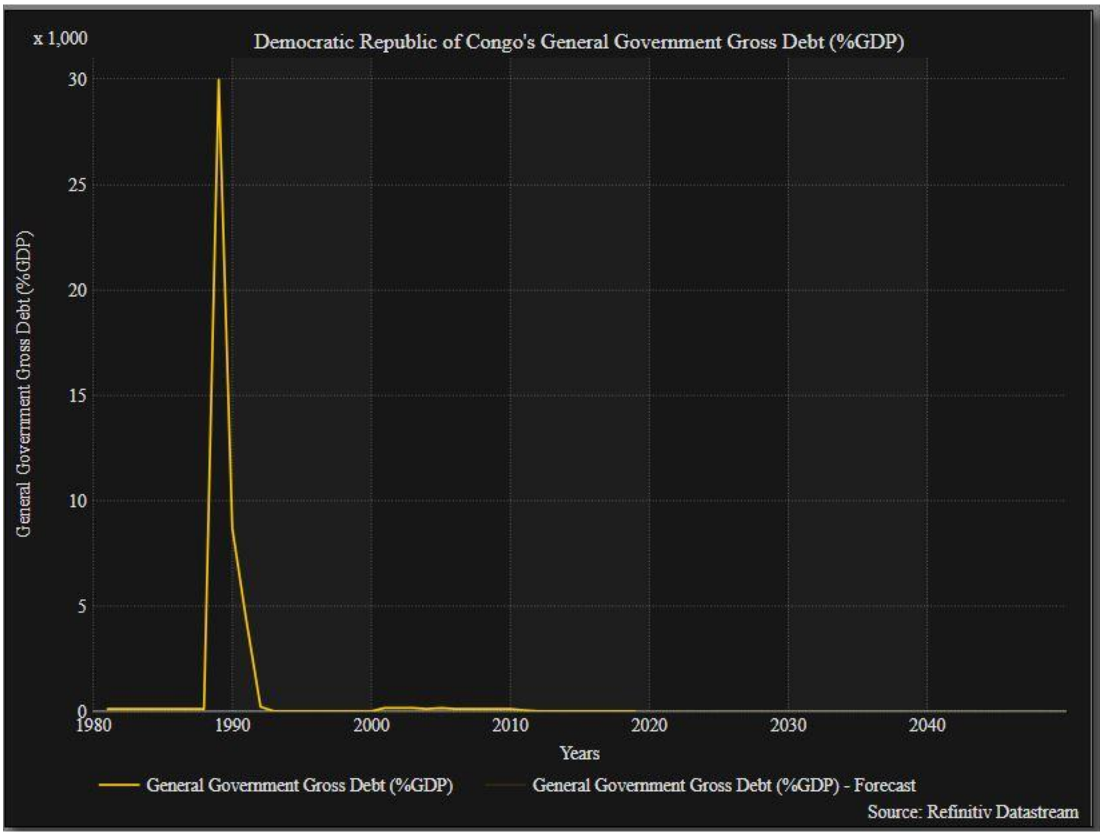

Figure 1.8. Democratic Republic of Congo's General Government Gross Debt (Refinitiv Datastream)

Egypt: which is not in eastern Africa geographically, has joined the COMESA organization in the year 1998. A country of a massive population of nearly 100 million, and a GDP of roughly US$ 250 billion, and per capita income of around US$ 2500. Egypt's current foreign debt-to-GDP ratio stands approximately 98%, almost twice higher than the debt threshold designated by the IMF. The country's debt ratio has been very high for the last 20 years, and there is no expectation that it will reduce in the future. Especially for the last six years, the economy of Egypt was in comatose due to political turmoil and military rule, which suppressed democratic voices and suffocated the economy.[11]

[11] https://countryeconomy.com/national-debt/egypt

As illustrated in figures 1.9 and 1.10 below, Egypt's gross debt is roughly 98% of its GDP. Almost twice higher than the prescribed debt threshold indicating that the country is at risk of a debt crisis, and the external debt is more than 80% of its GDP.

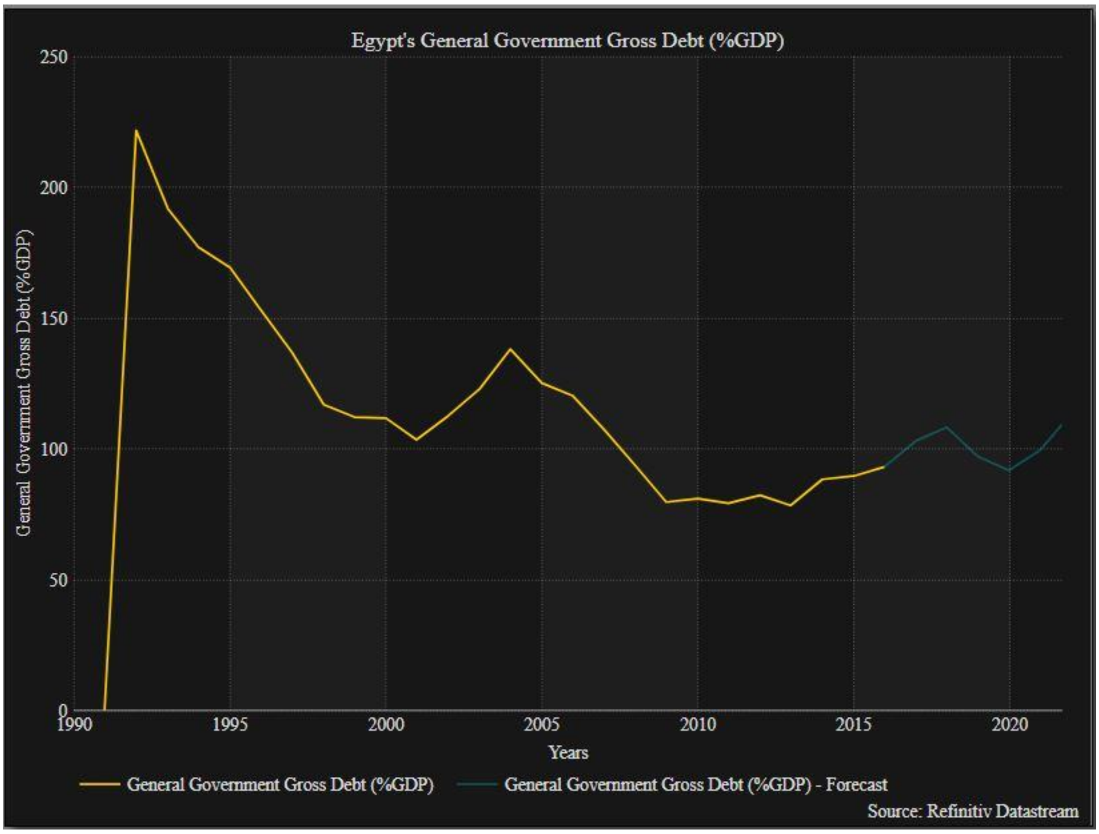

Figure 1.9. Egypt's General Government Gross Debt (Refinitiv Datastream)

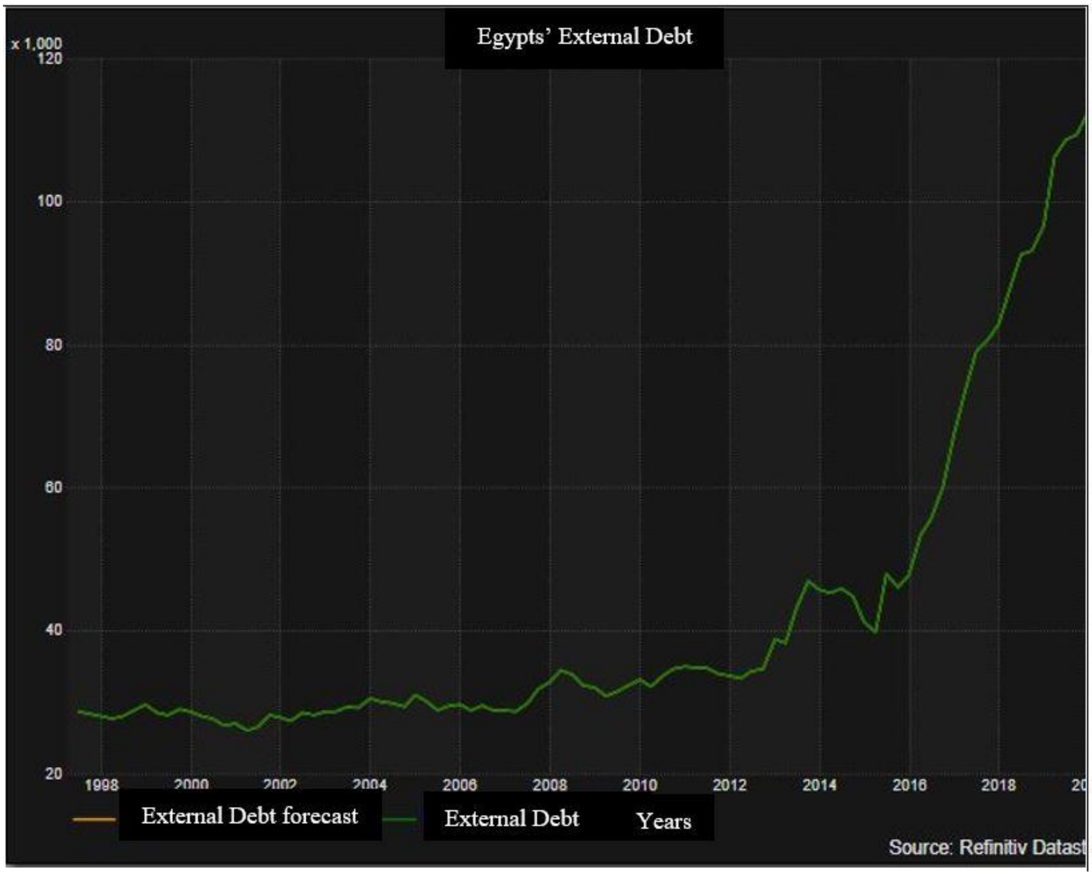

Figure 1.10. Egypt's External Debt (Refinitiv Datastream)

Eritrea: is a small country in the horn of Africa, with a population of about 6 million and paltry GDP of roughly US$ 6.5 billion.[12] Eritrea is a closed economy with a repressive regime. Since the secession from Ethiopia in 1992, after a bloody war, which consumed more than 2 million people, the country plunged into a dictatorial rule that plummeted the country's economy. In 2018, Eritrea's foreign debt-to-GDP ratio was more than 190% of its GDP, and the debt-to-per capita income ratio was US$ 690. Before 2010, the debt-to-GDP ratio was sometimes as high as 260% of the country's GDP.[13]

Figure 1.11 shows how Eritrea's Gross debt is beyond the recommended debt threshold, which is 45% of the country's GDP. For 2018, the debt-to-GDP ratio was almost 197% of the GDP, nearly four times higher than the debt sustainability threshold of 45% of the GDP.

[12] https://tradingeconomics.com/eritrea/gdp

[13] https://countryeconomy.com/national-debt/eritrea

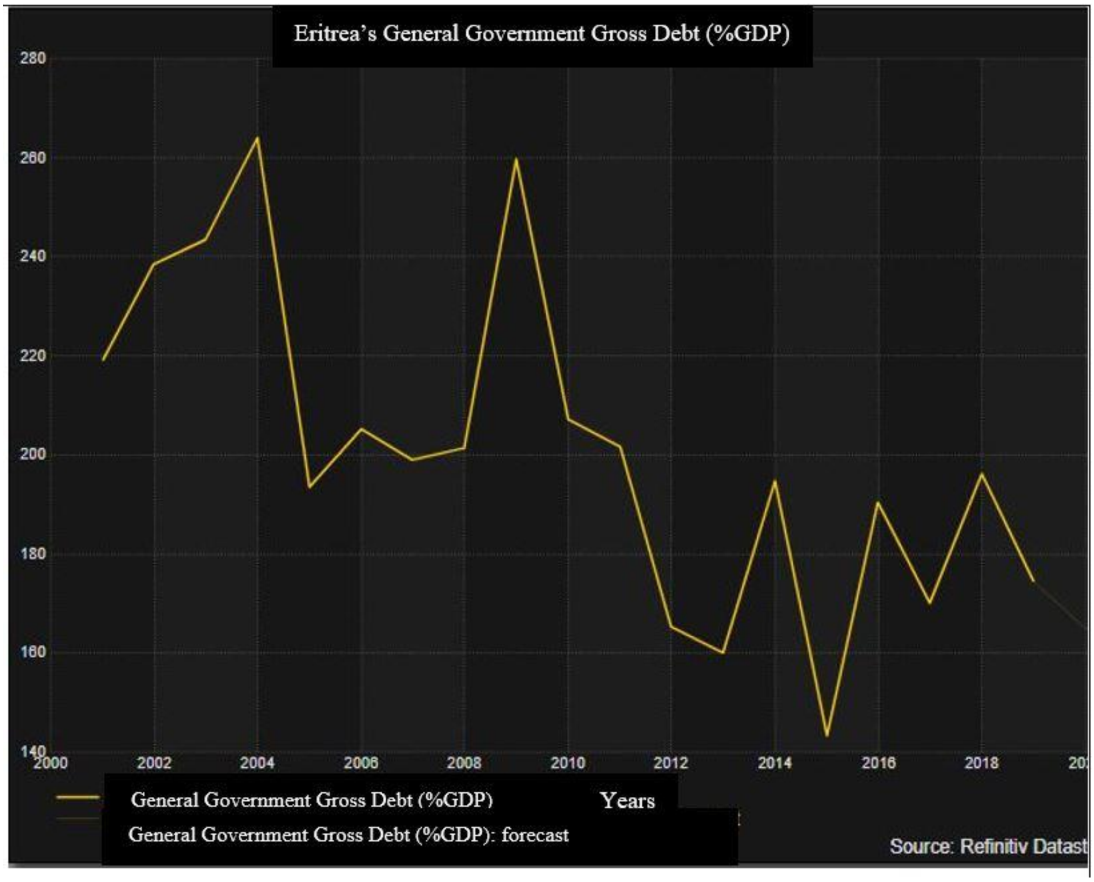

Figure 1.11. Eritrea's General Government Gross Debt (Refinitiv Datastream)

Mauritius: the small island found in the Indian Ocean is one of the smallest and least populous countries in Africa. With a population of approximately 1.200 million people and a GDP of about US$ 14.70 billion. Despite its small population and GDP size, Mauritius' government is one of the most efficient government in the continent with robust, active institutions. It is one of the least corrupt countries and has one of the best education and healthcare systems in Africa. It has GDP per capita of more than US$ 11.200. However, Mauritius' debt-to-GDP ratio is much higher than the recommended threshold of a maximum of 45% of the country's GDP. From the year 2010, the debt-to-GDP ratio was always above 50%, and for the last four years, the debt-to-GDP ratio was above 60%. In 2018, Mauritius' debt-to-GDP ratio was more than 65%. Thus, despite good governance and a stable economy, the country experiences a high debt burden.[14]

[14] https://countryeconomy.com/national-debt/mauritius

Mauritius's gross debt, as illustrated in figure 1.12, is roughly 67% of its GDP, and the prediction is indicating that gross debt will increase in the future.

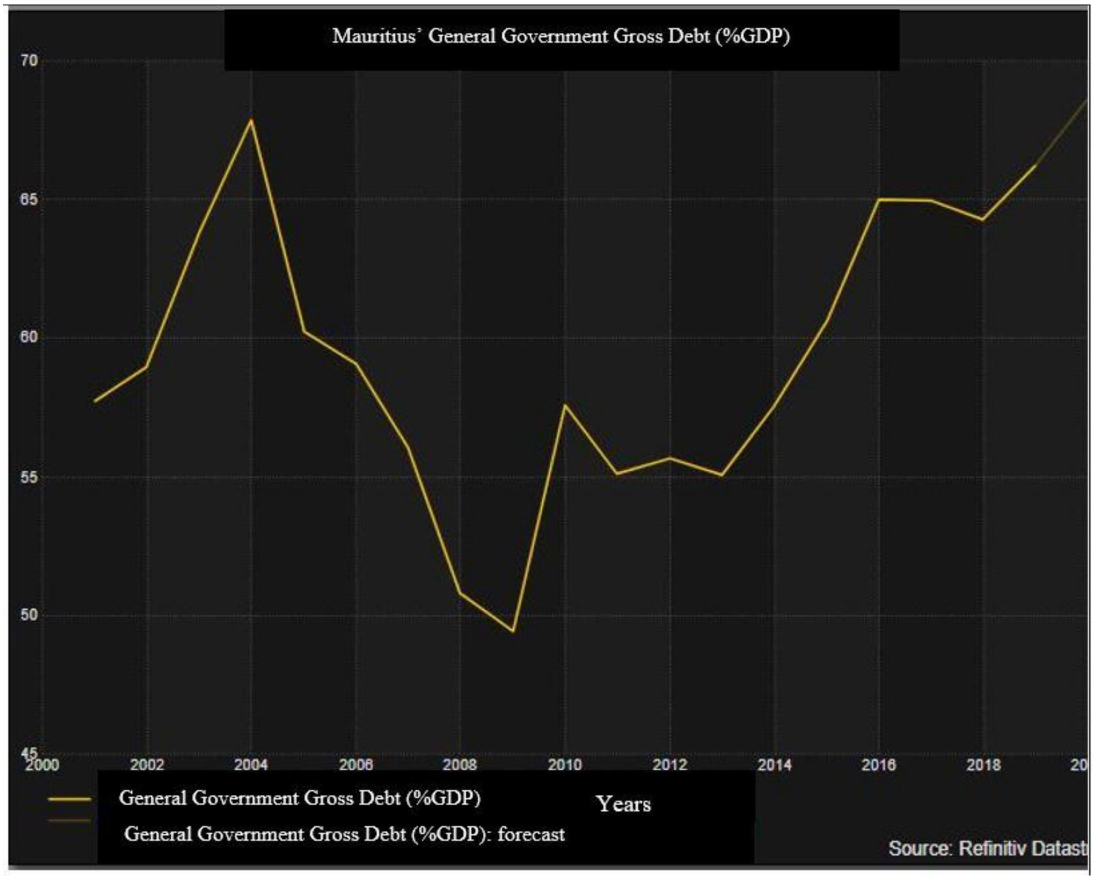

Figure 1.12. Mauritius' General Government Gross Debt (Refinitiv Datastream)

Madagascar: is an East African nation-state. Its GDP is about US$ 14 billion. The debt-to-GDP ratio was very high before the year 2000. However, after the year 2000, the ratio has reduced drastically, and since 2007, it remained within the recommended range by the IMF. In 2018, its debt-to-GDP ratio was 47% and per capita income ratio of US$ 210, which is moderate and manageable.[15]

Madagascar is one of the very few countries in COMESA whose gross debt is in the debt threshold. Figure 1.13 shows that the debt-to-GDP ratio is nearly 40% of its GDP.

[15] https://countryeconomy.com/national-debt/madagascar

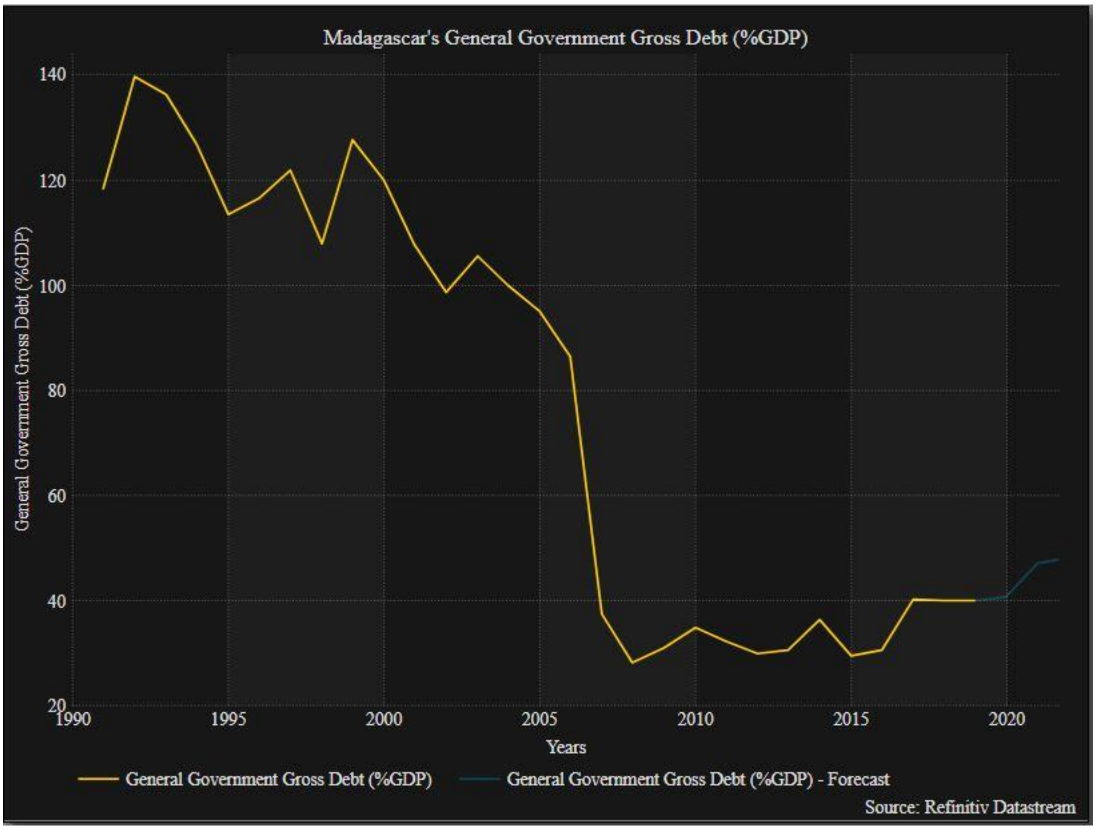

Figure 1.13. Madagascar's General Government Gross Debt (Refinitiv Datastream)

Malawi: has a population of approximately 20 million and a GDP of about US$ 7 billion. For the last six years, the debt-to-GDP ratio of Malawi has risen very sharply. With an average debt-to-GDP ratio of about 60%. Such a debt level is very unhealthy for a small economy like Malawi. However, the debt level has reduced after the year 2005. Before that, the debt-to-GDP ratio was more than 100%.[16]

As shown in figure 1.14 below, Malawi's gross debt is more than 60% of its GDP.

[16] https://countryeconomy.com/national-debt/malawi,

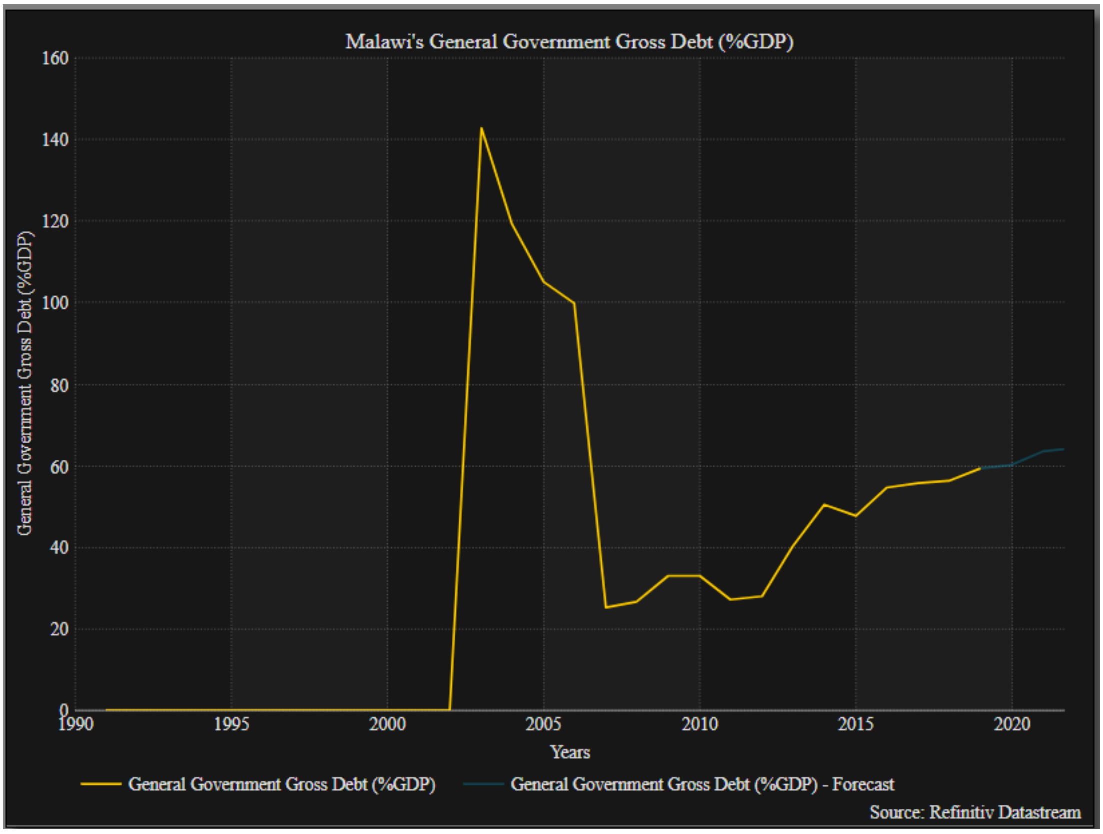

Figure 1.14. Malawi's General Government Gross Debt (Refinitiv Datastream)

Sudan: geographically, Sudan is in northern Africa, but also a member of the COMESA economic block. Sudan was the largest country in the continent before it was split into two and still is one of the largest countries in Africa, with a population of approximately 42 million people and a GDP of nearly US$ 45 billion and per capita income of US$ 977. Since 1990, Sudan's gross debt was extremely high and persistently rising every year. The highest was in 1992 when the foreign debt-to-GDP ratio hit 255%, and the lowest was in 2009, where the debt-to-GDP ratio was roughly 70% of its GDP. Under the military rule and sanctions by the west, the country's economy was brought to its knees and stagnated. In 2018, Sudan's debt-to-GDP ratio reached almost 160%. This is beyond the sustainability and manageability level.[17]

Currently, Sudan's Gross debt is as high as nearly 200% of its GDP, as revealed in figure 1.15 below. One of the highest gross debt in COMESA countries.

[17] https://countryeconomy.com/national-debt/sudan

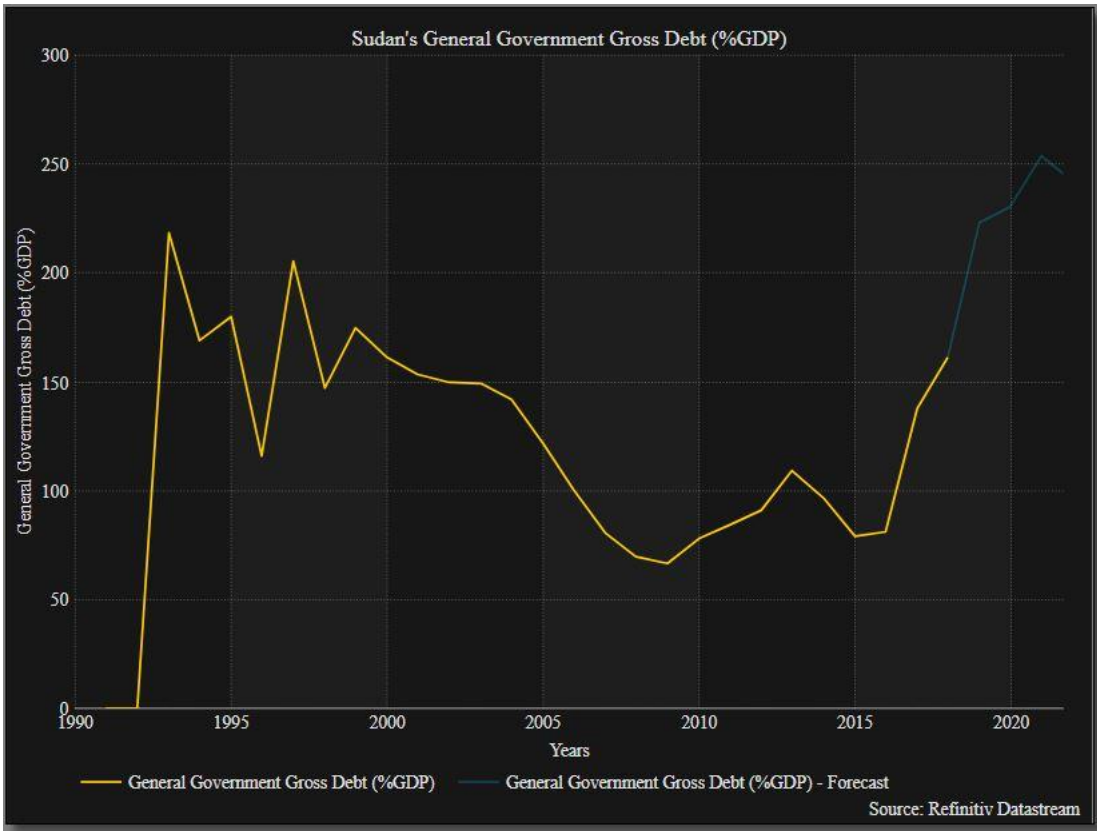

Figure 1.15. Sudan’s General Government Gross Debt (Refinitiv Datastream)

Tunisia: is also in north Africa but joined the COMESA economic block in 2017. Tunisia is a small country with 11 million population size and GDP of about US$ 40 billion, and per capita income of about US$ 3.400. Despite the uprising of the Arab Spring, which started over there in 2011, Tunisia remained a relatively stable and democratic country. From 1991-2006, Tunisia’s gross debt was higher than 50% of its GDP. However, after the year 2006, the debt-to-GDP ratio has stared reducing and remain below 50% until 2011. Nevertheless, there was a drastic increase for the last six years, where the debt-to-GDP ratio has reached more than 75% of the GDP.

We can observe in figure 1.16 below that Tunisia is out of the debt sustainability threshold, just like most other countries in the COMESA organization.

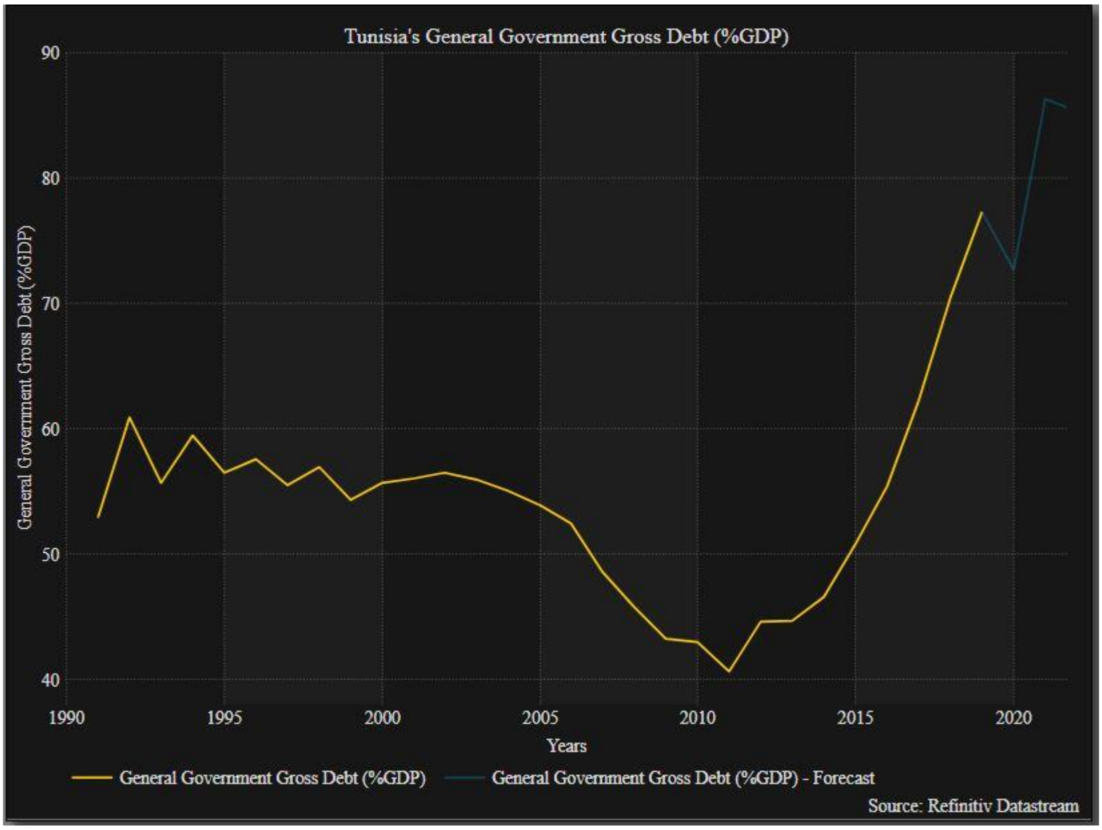

Figure 1.16. Tunisia's General Government Gross Debt (Refinitiv Datastream)

Eswatini: better known as Swaziland, is a small country inside South Africa. It has a population of about 1 million, and nearly US$ 4 billion GDP, and per capita income of about US$ 4100.

The gross debt-to-GDP ratio was always very low compared to all other countries in the COMESA economic block. The maximum that its debt-to-GDP ratio has ever reached since 1993 is in 2018, where the debt-to-GDP ratio has reached 35% of the GDP, which is much below the recommended debt threshold. Therefore, Eswatini is in good condition of debt management. Figure 1.17 below shows the time series of Eswatini's debt-to-GDP ratio.

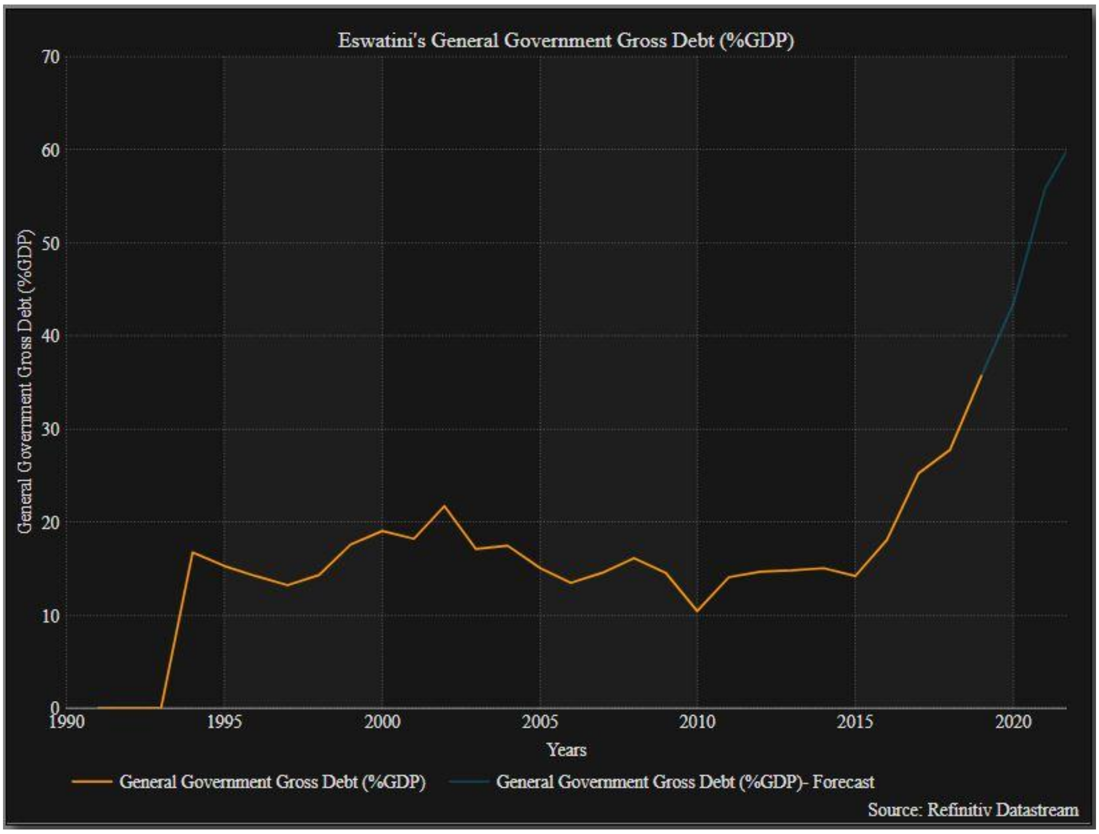

Figure 1.17. Eswatini's General Government Gross Debt (Refinitiv Datastream)

1.1. Objectives of the Study

- To enhance and contribute to the existing scholarly literature on debt and growth
- To critically analyze the impact of external public debt on per capita income of COMESA economic organization
- To explore the empirical literature objectively and extensively and choose the most appropriate method for our analysis
- Engaging, comprehensive contrast for the different methodologies used in the literature and their weaknesses
- To offer solutions and recommendations drawn from the analysis to the debt problems and crises.
- To investigate reasons for borrowing and external debt's economic implications of COMESA organization.

1.2. Research Questions

Several empirical studies conducted by different researchers in various parts of the world suggest that external debt is a perpetual economic problem in developing and low-income countries. However, those countries are continuously borrowing even though their capability to service the debt on time is very weak. Some of those countries are COMESA economic organization member states. Most of these countries benefited from the "HIPIC Initiative" program.[18] However, they keep on borrowing insistently, even though most of them are falling into the risk of debt crisis and distress due to wholesale borrowing and debt accumulation. Therefore, our research question is to explore and inspect the nexus between external public debt and real per capita income for the COMESA organization. Is debt contributing to their economic burgeoning, or is it an economic impediment.

1.3. Contribution of the Research

This study aims to apply different econometric techniques and comparative analysis of public external debt and per capita income growth for the COMESA organization, using a vast number of control and explanatory variables covering the period between 1990-2018. Usually, most studies in the literature use a small number of variables, which are either look-alike or a bit different, but in this research, we combine all the explanatory and control variables used in the literature concerning public external debt and output growth and put them on the right side of our regression equation (make them independent variables). The study employs Ordinary Least Squares (OLS), dynamic random effect, dynamic fixed effect, and generalized method of moments (GMM) to be able to capture the dynamic adjustment phenomena and compare the different models. Most of the studies that applied fixed effect and random effect panel models based on their selection criteria between random and fixed effect estimators on the Hausman test, which is not appropriate. Hausman test is used for the endogeneity test; it's not for model selection technique. Expressed, in another way, the Hausman test is used to specify estimator identification, not model identification. Thus, it tells us whether fixed effects estimator is the convenient, proper estimation technique or

[18] https://www.worldbank.org/en/topic/debt/brief/hipc

random effect estimator is the proper one, but not fixed versus random effect models, which several research studies mistakenly applied. The fixed effect model is used when dealing with N number of individuals, for instance, N number of EU countries or N number of African countries or N number of Companies like Apply, Samsung, Google, e.tc. The inference drawn from the analysis of the studied individuals (in our case, COMESA countries) is only applicable specifically to those individuals, not the whole continent. Random effect estimation is applied when dealing with N number of individuals who are selected from a large population randomly, and the inference drawn from the analysis is not just for the N individuals but to the whole population in which the N individuals are chosen. Thus, the random effect model is appropriate for large survey household data.

Therefore, since we are dealing with N number of individuals **(**COMESA countries), the "fixed effect" model is applicable for our study. Due to the dynamic nature of the model, the lagged values of the dependent variable are added to the right side of the equation to capture dynamic adjustment. Therefore, GMM methods are also applicable to our analysis.

Additionally, most studies apply only the standard OLS regression or only Vector Error Correction Models, which are not suitable for such dynamic models. Lastly, as a result of scanty literature about COMESA economic organization, we shed light on the impact of external public debt on the economic growth of the COMESA countries using the abovementioned techniques and analysis.

CHAPTER II

LITERATURE REVIEW

2.1. Theoretical Aspect

The literature concerning this topic of debt and economic growth comprises of two parts: empirical literature and theoretical one. We first deal with the theoretical propositions and then review the empirical approaches and findings. In the contemporary global economies, debt became an instrumental tool for augmenting and anchoring local budget deficit. It is an essential component of almost every country's growth constituent. Although every country requires debt in one way or another, at least in the developmental stage, the intensity and the magnitude of debt and its fiscal burden are what disturbs and irate many. The inevitability of debt is, therefore, recognized and appreciated in that regard.

To begin with, the first part of the literature Elmendorf & Mankiw (1999), posits that public external debt relates growth positively in the short-term. However, this short period's positive impact will be eliminated if the optimal threshold or the inflection point is superseded or surpassed. Neoclassical theory tells us that regardless of the positive influence of public debt on economic take growth in the short-term, the long-run impact of public external debt on economic growth is negative. In other words, even though public external debt triggers a positive response on growth in the short-term if debt surpasses the golden rule, any further accumulation of debt leads to a grim reverse influence on growth due to the “crowding-out” effect; which implies outsourcing and curbing private investment. In the future period, government savings fall, and the rise of private savings isn’t enough to compensate for the public investment’s decline, which brings down the economy and creates an inverse impact of public external debt on economic growth. Application of distortionary tax and uncertainty of public budget deficit may even exacerbate the problem (Elmendorf & Mankiw, 1999). Succinctly growth and debt have a negative relationship in the long-term (Cecchetti et al., 2011). Achieving positive responses between public external debt and growth is very difficult unless the economy has a strong capacity that can withstand debt burden and budget deficit.

Nevertheless, some scholars have debated this view and criticized it strongly. People like Checherita-Westphal & Rother (2012) have asserted that there is no panacea “debt” solution for all countries, but instead, it’s a matter of country-specific phenomena. They argued that everything depends on debt management, priority spending, and the quality of policies applied and implemented. Other scholars like DeLong & Summers (2012) suggest that public external debt influences economic growth positively, on condition that it is appropriately managed and directed to potentially productive public investment.

Emerging and “developing countries” are rising their “external debt” due to insufficient investment and lack of savings, and therefore, they borrow to keep their economies alive (Chenery & Strout, 1966). In addition to that, a lack of investment and savings, public budget deficit, and insufficient government revenue could act as a catalyst for accumulating and inhibiting external debt (Gohar *et al*. 2012).

2.2. Empirical Literature Review

Hadhek & Fatma (2000) studied “debt” growth nexus in 19 “developing countries” from 1990-2011 by employing a “dynamic panel” approach. Their findings indicate external public debt % of GNI, and also “total” external debt, and “gross government debt” affects the economic growth of the 19 countries negatively.

Joseph B.M. & Fanneh (2019) studied west African countries. Their study focused on 1970-2017. By dividing their countries into Francophone (France speaking countries) and Anglo-phone (English speaking countries), they found that “gross government debt” affects the economic growth of both regions (French-speaking region and the English-speaking region) negatively and significantly. However, public external debt % of GNP, has a negative impact only on the growth of Anglophone countries in West Africa (Ebrima k. Ceesay & et al. 2019).

Kharusi & Ada (2018) worked on Oman’s “debt” growth relation from 1990-2015. They applied ARDL, co-integration, and (ECM) models. Their result suggests “debt” contributes to Oman’s economic growth negatively and with high intensity. K. M.

Guei (2019) analyzed the debt, growth relationship of 13 emerging countries from the years 1990-2016 using the panel ARDL approach. He found that there are no tangible long-run implications of “debt” on economic growth.

Nevertheless, debt influences the growth of the 13 emerging countries significantly, negative in the short-term. Schclarek (2014) found that there is no significant relationship between gross public debt and economic growth for industrialized countries. In contrast, the relationship between total “external debt” and economic growth is negative for developing countries. Employing the ARDL model, Dauda et al. (2013) have investigated the nexus between “external debt” and the economic growth of Malaysia. They investigated threshold existence to check the optimality condition of “external debt,” and they found no relationship between “external debt” and Malaysia’s economic growth up to the optimal level. However, after the optimal level, pursuing “external deb” leads to a negative impact on economic growth.

Examination by Lof & Malinen (2014) on “sovereign” debt relation to development and economic growth for 20 developed countries using the panel var model reveals that debt’s impact on GDP growth is insignificant and minimum, while on the opposite way, economic growth affects debt negatively. They suggest the reverse association existing between “sovereign debt” and economic development and growth is mainly driven by the growth’s negative sign on “sovereign debt.” Meanwhile, Safdari & Mehrizi (2011) study on Iran’s external debt and growth nexus demonstrate that external debt’s influence on Iran’s economic growth rate and private investment is significantly negative. Their findings are the exact opposite of that of Lof & Malinen (2014) in the developed countries. Furthermore, a study in Pakistan by Malik & Hayat (2010) using time series data from 1972-2005 attests economic growth of Pakistan is inversely related to external debt.

Another study by Maghyereh & Omet (2003) in Jordan uses a threshold examination of indebtedness and attests that 53% of the GDP is the optimum level of indebtedness. Beyond 53%, rising the indebtedness level influence Jordan’s economic growth negatively. Irons & Bivens (2010) argue that policy laxity rather than gross debt is the perilous and the most problematic factor that the United States economy is facing. They claim that both empirical and theoretical literature about debt and economic growth is plagued with deficiencies and flaws. Using the threshold technique with the

ARDL model Grennes et al. (2019) estimated debt and growth linkage of the United States and OECD countries. Their study covers from 1995-2014 and found that the United States and the OECD countries have a lower level of growth rate due to a high level of debt. They also asserted that the United States' growth was less than it would have been.

An endogenous growth model by Greiner (2008) reveals that uncontrol debt and lack of prudent policy hinders long-run sustainable economic growth. Unless the government is a creditor, the presence of the "crowding-out effect" has a long-term impact on economic growth. Contrary to voluminous literature that found negative and inverse co-existence between debt and economic growth and development, a study of six ASEAN countries indicates that there is a significantly positive relationship between public debt and economic growth of the ASEAN countries (Thao, 2018). Another study of 77 countries by Shuanglin & Sosin (2011) reveals a substantial negative impact of debt-to-GDP ratio for African countries, statistically insignificant, but the negative sign for industrializing and Latin American countries, and statistically insignificant, but positive relations for Asian and developing countries. They suggest that mismanagement and inefficiency utilization of debt creates an environment which is not conducive for economic growth. Another paper by Ezeabasili et al. (2011) further reveals inverse relationships between the economic growth of Nigeria and its "external debt." In their study, they employed ECM and the "Granger causality test." Yeboah et al. (2018) examined the relationship between the government's external debt and the economic growth of 51 African countries from the years 1980-2015. Their finding reveals gross government debt's contribution to GDP is significantly negative on the Studied African economies. They applied OLS and GMM methods. Some other studies like that of Panizza & Presbitero (2013) suggest that in the advanced economies, the implications of debt on economic development and growth is not clear, and the optimum threshold which further debt increase brings the economy down is not that robust.

Contrary to that, Fincke & Greiner (2014) studied some eight emerging markets in Africa, Asia, and Latin America, and the relationships between public external debt and per-capita growth and development were paramount significant. When explaining their findings, they argued that those countries are in a transition period, and therefore, they are experiencing high economic growth, making them absorb the negative impact of debt. In a neoclassical approach, Dombi & Dedák (2019) averred that public debt decreases economic growth in the long-term.

Moreover, they argue the implications of public debt on GDP is not a uniform effect but a country-specific issue where population growth rate and savings are the imperative factors. The study also shows that relatively stable optimum debt threshold for developed countries. Employing the instrumental variable method, Panizza & Presbitero (2014), in OECD countries, affirmed the presence of inverse relationships between economic output and public external debt. Nevertheless, they pinpointed that the negative relationships between output and public external debt are eliminated when the instrumental variable of debt is employed. In other words, when debt is instrumented, or proxied with a variable that represents or captures the influence caused by the intermingling of interest rate volatility and the debt of foreign currency. Using standard paned data models, Akram (2016) examined growth, debt, and poverty relationships for some selected South Asian countries from the period 1975-2010. His result averred that debt negatively affects or contributes to economic output and development of the South Asian countries. However, he suggests that debt has no tangible, substantial impact on the income of the individual; thus, its effect is uniform to the poor and the rich. Another study examined the nexus among growth, corruption, and debt. Using standard panel OLS and GMM methods for 77 countries using data ranging from 1990-2014, the study found that foraging public debt and economic growth and development have an inverse relationship for the highly corrupted countries while there are highly significant and robust positive relations for the highly transparent and less corrupt countries. He argues foreign public debt's impact on economic growth is just a function of corruption, mismanagement, opaqueness, and absence of accountability.

Égert (2015) carried out a non-linear threshold approach to check if the foreign debt has a negative non-linear influence on output growth when debt exceeds 90% of GDP. He concluded that the negative non-linear relationship between growth and debt is very sensitive to model selection and challenging. Further study by Veiga et al. (2016) attests that debt and output have a negative relationship. In other words, debt affects economic growth negatively. The study focused on 52 African countries from 1950-

2012. They further depicted that maximum output has been achieved when the debt falls below 60% of the GDP per capita growth and with an 8.25 inflation rate. Their result shows that when the debt falls between 60-90%, GDP growth falls about 1.32%. Also, it Falls further by 1.64%, when the debt-to-GDP ratio supersedes 90% of GDP. Subdividing countries into regions indicate that in north African countries, the highest economic development and growth is observed when the debt-to-GDP ratio falls under 30% of the GDP. For Sub-Saharan Africa, the highest economic growth rate and the highest per-capita growth rate is recorded when the debt-to-GDP ratio is between 30-60% of GDP. For the SADAC countries, the result is similar to that of North African countries. The highest output growth rate is observed when the deb to GDP ratio is under 30% of the GDP.

In a nutshell, a high level or large accumulation of debt leads to low economic growth and development. Francese et al. (2011) investigated Italia's foreign public debt implications on output growth from 1861-2009. The study affirms the hypothesis of the inverse relationship between GDP per capita growth and foreign public debt. Empirical research on Greece by Pegkas (2018) averred that Greece debt has a strong negative association with GDP growth. In particular, the study reveals the swelling of foreign debt after 2000 had a substantial influence on the growth rate and economic development. Before 2000, Greece debt was insignificant; however, the increases in debt after 2000 lead to a remarkable reduction in the output growth rate. A comparative study which focused on Nigeria and South Africa; the two Africa's economic heavy weight's debt and output growth asserts that inverse relationship between foreign debt and output growth rate of the two countries. The study employed a neoclassical growth model capturing the linearity and non-linearity impact of foreign debt on output growth. The result Suggests that South Africa has better debt management to enhance growth compare to Nigeria where debt contributes growth positively up to a certain level then take the reverse gear and affects the growth negatively.

A study on the 12 "Eurozone countries" from 1970-2012 by Checherita-Westphal & Rother (2012) reveals the non-linearity impact of public external debt on output growth with an inflection point after which gross debt relates to output growth negatively in the long-period when the debt-to-GDP ratio reaches 90-100% of the GDP.

CHAPTER III

DATA AND METHODOLOGY

Panel data analysis has been used to investigate the implications of external public debt on the per capita income of COMESA countries. Members in the COMESA organization are: "Burundi, Comoros, Congo Democratic Republic, Djibouti, Egypt, Eritrea, Eswatini (Swaziland), Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Somalia, Sudan, Tunisia, Uganda, Zambia, and Zimbabwe."

Although the name of the group suggests eastern and southern Africa, its more extensive than that, encapsulating and accommodating other countries which are neither in the east nor in southern Africa, like Egypt and Tunisia; therefore, its an economic block beyond geographical constraints and locations. COMESA is one of the largest economic blocks in the continent, accommodating a vast number of countries from east to south and from Central to north of Africa.

Models applied are panel data models. Panel data's benefits and convenience over conventional time-series and cross-section data analysis are numerous. Some superiorities of Panel data over time series and cross-section data are; "Controlling individual heterogeneity" in which both time series and cross-section data do not take into account. Ignoring individual heterogeneity in the data might lead to a serious unbiased result. It's challenging for macroeconomic data of different countries, regions, and continents with different political, geographical, and social circumstances and characteristics to be homogenous, and assuming that might lead to an erroneous outcome. Panel data, therefore, reduces that risk by considering individual slope heterogeneity. Secondly, panel data reduce multicollinearity among variables, adds more variability and information, enhances efficiency, and allows more degrees of freedom. Usually, time series models are widely afflicted by multicollinearity problems that panel data models reduce. The third advantage is that panel data can capture instability and changes in the data which cross-section data cannot detect.

Therefore, panel data is appropriate for robustly examining dynamic adjustment models.

The fourth advantage of panel data is, it tackles unit root or non-stationarity problems; hence, unlike time series models, avoids spurious regressions and specious outcomes. The fifth advantage is panel data techniques are applied when dealing with intricate, convoluted models like "technical efficiency" due to the imposition of fewer restrictions on a distributed lag models compare to usual "time series" models (Baltagi, 2006)

In our study, we employed Pooled "OLS, two-way dynamic random effect, two-way dynamic fixed effect" and GMM models. Particularly, the fixed effect panel GMM. The difference and system GMM is also applied for comparison purposes.

As mentioned by Baltagi (2006), the fixed-effect model is a proper specification technique if we are concentrating on a particular set or number of individual firms like Apple, Samsung, Paypal, Google, IBM, Ali Baba, etc. Additionally, it could be a specific number of countries, like the number of EU countries, or a set of numbers of OECD or OIC, or African countries or American states. However, the inferences will be only for those N individuals undertaken in the study (Baltagi 2006). Furthermore, the fixed effect is applied when the time dimension is larger than the individual dimension. Succinctly, as time increases, the fixed effect becomes more applicable. The within estimator is usually inconsistent; however, as time increases, the fixed effect, also known as within estimator, becomes consistent. Since we are dealing with N number of African countries COMESA, methodologically, panel "Fixed effect" model rather than "random effect" model becomes suitable and proper technique to employ.

Contrary to "fixed effect," the "random effect" model is a suitable technique for randomly drawn N individuals (firms, Countries, regions, or continents) from a large population, and the inference drawn from the studied or the selected individuals reflects not only the randomly selected individuals but the whole population. It's most appropriate for household and survey panel data analysis.

We used Stata software, which is the standard econometrics tool, to analyze our main dynamic panel fixed effect and GMM models. We carry out endogeneity, multicollinearity, and heteroscedasticity tests, which are the prerequisites for using

GMM estimation methods using Stata. Moreover, we used the Gauss software (student) version for pretest analysis, such as cross-section dependency among the individual countries for checking (average cross-section dependency across individuals), “second-generation unit root test” and “second-generation co-integration test.”

3.1. Cross-section Dependence Test

The initial step to commence with, before executing any estimation in panel data, is to test cross-section dependency among the individuals. Cross-section dependency means the relationships or cross-correlations across individuals over time. For instance, the GDP of Germany affects that of Turkey and vice-versa. Therefore, we have to test the presence of cross-correlations among the individuals (in this case, individual countries). The presence of cross-sectional dependency directs us to apply a second-generation unit root test. These are cross-section augmented Dickey-fuller (CIPS) tests (Pesaran, 2007), and $Z^{SPC}A$ and $Z^{LA}A$ tests Hadri & Kurozumi 2012), for testing unit roots in panel data. In the case of cross-section independence, we are directed to employ first generation unit root test (Levin Lin and Chu, I'm Pesaran and Shin, Maddala- and Wu, Choi, and Hadri). Therefore, It is apparent that the cross-section dependence test is the most important test, to begin with, panel data analysis. We applied the xttest2, Stata command, which is used to test the cross-correlation test when the time dimension is larger than the individual dimension, as in our case, and the bias-adjusted LM (LM_AD) test proposed by (Pesaran, Ullah, & Yamagata, 2008; Newton et al. 2009). The test result is found in table 4.4.

The CD test statistic is given in Pesaran (2004) is follows:

$$CD_{Lm_1} = T\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \qquad (3.1)$$

$$CD_{Lm_{2=}} \sqrt{\frac{1}{N\,(N-1}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T\hat{\rho}_{ij}^2 - 1) \qquad (3.2)$$

$$CD = \sqrt{\frac{2T}{N\,(N-1}}\left(\sum_{i=1}^{N-1}\ \sum_{j=i+1}^{N}\hat{\rho}_{iJ}^{2}\right)\overset{asy}{\sim} N(0,1)i,j = 1,2\,\ldots.N\ \ 3 \qquad (3.3)$$

The bias-adjusted version of this is

$$LM* = \sqrt{\frac{2}{N\,(N-1}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\ \right)\frac{\left((T-k)\hat{\rho}_{iJ}^{2}\right) - E\left((T-k)\hat{\rho}_{iJ}^{2}\right)}{var(T-k)\hat{\rho}_{iJ}^{2}} \qquad (3.4)$$

3.2. Unit Root

The widely celebrated paper of Granger & Newbold (1973), which elaborated the paramount significance of the variable's stationarity before running any regression, made unit root test a standard practice and an imperative prerequisite. The paper asserted that the series or their linear combinations have to be stationary to avoid the spurious outcome. Following that standard mainstay procedure, we carried out a unit root test in the series. Nevertheless, we employed a cross-section dependence test before the unit root test, as explained in the previous page. The rejection of the cross-section dependence null hypothesis, elaborated above, which is no cross-section dependence, gives us an indication that employing a second-generation unit root test is more appropriate than the first-generation unit root test, which does not consider cross-correlation among the individual series. Hadri & Kurozumi (2012) and Cross-section Augmented Dickey-fuller tests (CADF) delineated above are known as the second-generation unit root test. This group allows and considers cross-section dependence in the regression, while the first-generation unit root test takes no consideration into the presence of cross-section dependence. We, therefore, apply a second-generation unit root test. Below are the given mathematical formulas of Hadri & Kurozumi (2012) unit root tests. Tables 4.4, 4.5, and 4.6 contains the result of the CIPS, Hadri Koruzumi, and individual unit root test.

$$Z_{A}^{SPC} = \frac{\sqrt{N(\overline{ST}1 - \xi)}}{\varsigma} \qquad (3.5)$$

And

$$Z_A^{LA} = \frac{\sqrt{N}(\overline{ST}2 - \xi)}{\varsigma} \tag{3.6}$$

İn which

$$\overline{\mathbf{ST}}_1 = \mathbf{N}^{-1} \sum_{i=1}^{N} \mathbf{ST}_i^{SPC} \tag{3.7}$$

$$\mathbf{ST}_i^{SPC} = \frac{1}{\hat{\sigma}^2{}_{iSPC}\, T^2} \sum_{i=1}^{T} S_{it}^{*} \sum_{j=1}^{t} \hat{\varepsilon}_{ij} \tag{3.8}$$

$$\overline{\mathbf{ST}}_2 = \mathbf{N}^{-1} \sum_{i=1}^{N} \mathbf{ST}_i^{LA} \tag{3.9}$$

$$\mathbf{ST}_i^{LA} = \frac{1}{\hat{\sigma}^2{}_{ila}\, T^2} \sum_{i=1}^{T} S_{it}^{*} \sum_{j=1}^{t} \hat{\varepsilon}_{ij} \tag{3.10}$$

Note that

$\xi = 1/6$ *and also*

$\varsigma = 1/45$

$$\mathbf{CIPS} = \frac{\sum_{i=1}^{N} \mathbf{CADFi}}{\mathbf{N}} \tag{3.11}$$

3.3. One-way and Two-way Fixed Effect Test

As shown in table 4.7 and 4.8, we examine the presence of individual and time effects. There are three hypotheses to test: the first null hypothesis is that there is no individual and time effect in our data, and the alternative hypothesis says that there are both individual and time effects. The second null hypothesis is that there is no individual effect, and the alternative says that there is a presence of an individual effect. The third null hypothesis is that there is no time effect in our data, and the alternative is there is a time effect.

Testing for time and individual fixed:

H_0: $\mu_1 = \ldots = \mu_{N-1} \ldots = 0$ and $\lambda_1 = \ldots = \lambda_{T-1} = 0$

In this case, the restricted sum of squares residual (RRSS) shows the sum of squares residual of the Pooled OLS while the unrestricted the sum of squares residual (URSS) is that of the fixed effect Within regression.

$$\boldsymbol{URSS} =$$

$$\boldsymbol{F_1} = \frac{(\boldsymbol{RRSS} - \boldsymbol{URSS})/(\boldsymbol{N}+\boldsymbol{T}-\boldsymbol{2})}{\boldsymbol{URSS}/(\boldsymbol{N}-\boldsymbol{1})(\boldsymbol{T}-\boldsymbol{1})-\boldsymbol{K}} \sim \boldsymbol{H0F(N+T-2),(N-1)(T-1)-K} \quad \textit{\textbf{(3.12)}}$$

Now, we can test the presence of only individual effects while considering the time effect.

H_0: $\mu_1 = \ldots = \mu_{N-1} \ldots = 0$ $considering\ that$ $\lambda_1 = \neq 0$ for t $= 1, \ldots\ldots T-1$

Same as above, the URSS is the same as the fixed effect (Within) sum of squares residuals. But, the RRSS is the regression with only time-series dummies, as shown below.

$$(\mathbf{Y_{it}} - \overline{\mathbf{Y}}_{.\mathbf{t}}) = (\mathbf{X_{it}} - \overline{\mathbf{X}}_{.\mathbf{t}})\boldsymbol{\beta} + (\mathbf{V_{it}} - \overline{\mathbf{V}}_{.\mathbf{t}}) \quad \mathbf{(3.13)}$$

The F-statistics will therefore be;

$$\boldsymbol{F_2} = \frac{(\boldsymbol{RRSS} - \boldsymbol{URSS})/(\boldsymbol{N}+\boldsymbol{T}-\boldsymbol{2})}{\boldsymbol{URSS}/(\boldsymbol{NT}-\boldsymbol{N}-\boldsymbol{T}-\boldsymbol{K})} \sim \boldsymbol{H0\ F(N-1NT-N-T-K)} \quad \mathbf{(3.14)}$$

The next step is testing the presence of time effect while considering the presence of an individual effect, and this is just the exact opposite of what we did in the previous step.

H_0: $\lambda_1 = \ldots = \lambda_{T-1} \ldots = 0$ $considering\ that$ $\mu_1 = \neq 0;$ for i $= 1, \ldots\ldots (N-1)$

$$URSS\ is\ the\ same\ as\ the\ F_3\ below$$

Therefore, the F-statistic could be written as follows;

$$\boldsymbol{F_3} = \frac{(\boldsymbol{RRSS} - \boldsymbol{RSSUR})/(\boldsymbol{N}+\boldsymbol{T}-\boldsymbol{2})}{\boldsymbol{RSSUR}/(\boldsymbol{NT}-\boldsymbol{N}-\boldsymbol{T}-\boldsymbol{K})} \sim \boldsymbol{H0\ F(T-1),(N-1)(T-1)-K} \quad \textit{\textbf{(3.15)}}$$

Rejecting F_3 means that there is a time effect, and we have to add time dummies in our regression (Baltagi 2008). Table 4.7 contains the result of the one-way, two-way fixed effect test results.

For the random effect model, we start with the third null hypothesis, which tests the absence of both individual and time effect. The alternative is that both individual and time effects are present in the data. Since the probability value is less than a 1% significance level, we reject the null hypothesis of no individual and time effect at all levels and very strongly. Thus, there is at least one effect present in our data. The second null hypothesis is that there is no time effect, while the alternative hypothesis is that there is a time effect. The probability value has been rejected at a 10% significance level. Hence, we can conclude that the time effect is present in our data. The first null hypothesis tests no individual effect with an alternative hypothesis that there is an individual effect. We reject the null hypothesis of no individual effect since the probability value is less than a 1% significance level. From the three tests above, we can confidently conclude that both individual and time effects are present in our data. Therefore, we are eligible or justified to run a two-way random effect model.

Table 4.8 contains the one-way, two-way random effect test result for the random effect model.

3.4. Test for Heteroscedasticity and Autocorrelation

It is paramount significant to check simple assumptions of OLS before applying any econometric estimation. Because those assumptions are impractical and never met in reality, forcing one to carry out diagnostic tests and find out the appropriate estimation method based on the outcome of the diagnostic results. Failure to do so, one might end up applying wrong estimation techniques and consequently get bias, inconsistent and inefficient results, and misleading conclusions. Succinctly, applying econometric estimation techniques without conducting robust diagnostic investigations amounts to a specious outcome, misguided interpretations, erroneous conclusions, misleading and inappropriate recommendations.

Considering the abovementioned possibilities, we carried out diagnostic tests by checking the presence of iid in the data. Iid signifies, identically, independently distributed. In other words, we test the presence of heteroscedasticity and autocorrelation in the data. The absence of an iid condition has serious implications. Homoscedasticity, which signifies constant variance over time, is impractical and unlikely to happen. This assumption is rarely met or satisfied in real-time data. Variance is not always constant, and it may vary over time. Also, autocorrelation is not a practical assumption. The current series is always in one way or another related or depends upon its previous years.

The null hypothesis is homoscedasticity (constant variance across individuals over time), while the alternative is heteroscedasticity (inconstant/varying variance across the individuals over time). For the fixed-effect model, the heteroskedasticity LM test by Juhl & Sosa-Escudero (2014) is the most appropriate. Therefore, we applied their method for the heteroscedasticity test in the fixed-effect model. The result is in table 4.9.

3.4.1. Heteroscedasticity

The Juhl & Sosa-Escudero (2014) heteroscedasticity test for the fixed-effect model.

$$\mathbf{Y_{it}} = \boldsymbol{\alpha} + \mathbf{X_{it}}' + \boldsymbol{\upsilon}_{\mathbf{it}} \quad \textbf{(3.16)}$$

$$\boldsymbol{\upsilon_{it}} = \boldsymbol{\mu_{it}} + \boldsymbol{\nu_{it}} \quad \textit{\textbf{(3.17)}}$$

$$V_{it} \sim iid(0, \sigma^2)$$

$$\boldsymbol{E}(\ |\boldsymbol{X_i},\ \boldsymbol{Z_i},\ \boldsymbol{\alpha_i}) = \boldsymbol{\sigma^2}_{\boldsymbol{it}} = \boldsymbol{h}\,(\boldsymbol{Z^T}_{\boldsymbol{it}}\,\boldsymbol{\gamma}) \quad \textit{\textbf{(3.18)}}$$

Where h(.) is any strictly positive, twice differentiable function such that h (0) = 1, $h'(0) \neq 0$, and $\sigma^2{}_v$

V is a positive constant. $Z_{it} = X_i$ It is a vector of p of exogenous variables that may consider heteroscedasticity.

The null hypothesis of the Juhl and Escudero test that we use is as follows.

$$H_0;\ \gamma = \ 0 \quad errors\ are\ homoscedastic$$

$$H_0;\ \gamma \neq \ 0 \quad errors\ are\ heteroscedastic$$

$$LM = NTR^2 \qquad where\ R^2\ \ is\ the\ slope\ coefficient\ of\ determination\ in\ the\ regression$$

The Juhl & Sosa-Escudero (2014) test is derived from the well-known white test for heteroscedasticity.

3.4.2. Serial Correlation for Fixed Effect Model.

We used Baltagi & Li (1995) for the autocorrelation test for the fixed-effect model. This test is the most suitable and appropriate test for the fixed-effect model; however, it does not work in the random effect model. The LM test for Baltagi & Li (1995) can be found using the following mathematical formulas.

$$\boldsymbol{LM} = [\boldsymbol{NT^2}/(\boldsymbol{T}-\boldsymbol{1})]\ (\boldsymbol{\widetilde{V}'\widetilde{V}} - \boldsymbol{1}/\ \boldsymbol{\widetilde{V}'\widetilde{V}})^{\boldsymbol{2}} \qquad \textbf{\textit{(3.19)}}$$

The $\tilde{V}$ signifies the typical within residuals. The lm statistics are distributed asymptotically for T going to infinity as $\chi^2{}_1$ under the null hypothesis of no first-order serial correlation in the fixed-effect model. The result is in table 9.

3.5. Cointegration Among the Error Terms:

Another important test to confirm is cointegration among the series. As a result of the cross-section dependence presence in the data, we use a second-generation cointegration test (Westerlund, 2007; Westerlund, 2008). Westerlund (2007) is appropriate when error terms are cointegrated in a different level Like I (1), I (0), and Westerlund (2008) is used when error terms are cointegrated on the same levels. Like I (1), I (1). Second generation cointegration tests are appropriate when error terms are co-integrated in different orders.

Another advantage of this test is that it takes cross-sectional correlations among the series into account in which the first-generation cointegration test of Kao, Larson, and Pedroni do not consider. The results are in table 4.11 and 4.12, respectively. The null hypothesis of Westerlund (2007) and Westerlund's (2008) test are; absence of co-integration or absence of long-term equilibrium among the variables. On the other hand, the alternative hypothesis is the presence of co-integration or long-term relationships among the variables. Therefore, the null hypothesis will be rejected or not rejected accordingly.

3.6. Westerlund ECM Panel Cointegration Tests:

The cointegration test proposed by Westerlund (2008) is a more robust test than its previous tests, which perform very poorly due to low power statistical tests. Below are the calculations of the Durbin Hausman test statistics. The result is in tables 4.11 and 4.12, as we mentioned earlier.

$$DH_g = \sum_{i=1}^{n} \hat{S}_i \left(\tilde{\phi}_i - \hat{\phi}_i \right)^2 \sum_{t=2}^{T} \hat{e}^2_{it-1} \quad (3.20)$$

And

$$DH_p = \hat{S}_n \left(\tilde{\phi}_i - \hat{\phi}_i \right)^2 \sum_{i=1}^{n} \sum_{t=2}^{T} \hat{e}^2_{it-1} \quad (3.21)$$

Where

$$\hat{\phi} = \left(\sum_{i=1}^{n} \sum_{t=2}^{T} \hat{e}^2_{it-1} \right)^{-1} \sum_{i=1}^{n} \sum_{t=2}^{T} \hat{e}^2_{it-1} \, \hat{e}^2_{it} \quad (3.22)$$

Similarly,

$$\tilde{\phi} = \left(\sum_{i=1}^{n} \sum_{t=2}^{T} \hat{e}^2_{it-1} \, \hat{e}^2_{it} \right)^{-1} \sum_{i=1}^{n} \sum_{t=2}^{T} \hat{e}^2_{it} \quad (3.23)$$

$$\hat{e}_{it} = \sum_{t=2}^{T} \Delta \; \hat{e}_{it} \tag{3.24}$$

Now we will be testing whether;

$$\hat{e}_{it} = \quad \phi_i \, \hat{e}_{it-1} \; + \mathbf{error} \tag{3.25}$$

3.7. Slope Homogeneity Tests

$$Y_{it} \; = \lambda_i \, dt + \beta 1_i \, X_t + \beta 2_i \, X_{it} \; + \beta 3_i \, X_t + v_{it} \tag{3.26}$$

And

$$v_{it} = \theta i \, ft \; + \; \varepsilon_{it} \tag{3.27}$$

Equation 3.27 shows that coefficients of every variable are let on to be varied cross-sectionally (in our case, each country). In other words, slope heterogeneity has been allowed; hence, we carried out a hypothesis test regarding this assumption to confirm the presence of slope heterogeneity (Hashem Pesaran & Yamagata, 2008).

The mathematical formulas of the slope homogeneity test statistics employed are expounded and elaborated below, and the test result is in table 4.10.

$$\hat{\mathbf{S}} = \sum_{\mathbf{i}=1}^{\mathbf{N}} \left(\hat{\boldsymbol{\beta}}_{\mathbf{i}} - \hat{\boldsymbol{\beta}}_{\mathbf{WFE}}\right) \frac{\overline{'\mathbf{X}'} \, \overline{\mathbf{X}}}{\hat{\boldsymbol{\sigma}}^2{}_{\mathbf{i}}} \left(\hat{\boldsymbol{\beta}}_{\mathbf{i}} - \hat{\boldsymbol{\beta}}_{\mathbf{WFE}}\right) \tag{3.28}$$

$$\hat{\Delta} = \; N^{1/2} \, (2k)^{-1/2} (N^{-1}\hat{S} - K) \tag{3.29}$$

$$\tilde{\Delta} = \; N^{1/2} \, (2k)^{-1/2} (N^{-1}\tilde{S} - K) \tag{3.30}$$

$$\hat{\Delta}_{\,adj=} \; N^{1/2} \, \left(Var\left(\hat{Z}_{iT}\right)\right)^{-1/2} \; \left((N^{-1}\hat{S} - E\left(\hat{Z}_{iT}\right)\right) \tag{3.31}$$

$$\widetilde{\Delta}_{adj=} \; N^{1/2} \left(Var\left(\widetilde{Z}_{iT}\right)\right)^{-1/2} \left((N^{-1}\widehat{S} - E\left(\widetilde{Z}_{iT}\right)\right) \quad (3.32)$$

3.8. Estimators

The main characteristics which distinguish panel data equation from that of classical time series linear regression or that of cross-section models is that; panel data regression equation has two subscripts i and t. In which, i represents individual dimension, where individuals could be (a household, company, firm, country, region, or a continent) and t signifies time dimension, where time could be (seconds, minutes, hours, days, weeks, months, quarterly or yearly). The mathematical representation of the static panel model could be written as follows:

$$Y_{it} = \alpha + X'_{it}\beta + U_{it} \quad i = 1,...,N;\ t = 1,...,T \quad (3.33)$$

While if we are dealing with dynamic panel data, the mathematical representation of the dynamic panel data model could be written as follows:

$$Y_{it} = \alpha + Y_{it-1} + X'_{it}\beta + U_{it} \quad i = 1,...,N;\ t = 1,...,T \quad (3.34)$$

Where Y_{it} stands for the dependent variable, α represents for the intercept term, Y_{it-1} denotes the lag of the dependent variable or the previous values of the dependent variable, β represents for a K×1 vector of parameters to be estimated on the independent variables, and X_{it} denotes a 1 × K vector of observations on the independent variables, whereas t begins from $t = 1,.,t;\ i = 1,..N$.

The initial step of our analysis is the standard Pooled OLS regression. The Pooled OLS regression pulls all data together and ignores heterogeneity. The Pooled OLS regression equation of our model could be written as:

$$Y_{it} = \alpha + \beta_1 X_{it} + \beta_2 X2_{it} + \beta_3 X3_{it} + \beta_4 X4_{it} + \beta_5 X5_{it} + \beta_6 X6_{it} + \beta_7 X7_{it} + \beta_8 X8_{it} + \beta_9 X9_{it} + U_{it} \quad (3.35)$$

Where our Y_{it} stands for our dependent variable, which is Log of real per capita income of "country i" in "time t," $X1_{it}$ is debt service to exports of the country "i" at a time "t," $X2_{it}$ is external debt stock, of the country "i" in period "t," X3it stands for capital of the country "i" in period "t," X4it general government gross debt of certain country "i" in time t, X5it is the long-term external debt stock of the country "i" at in time "t," X6it represents public and publicly grantee debt of country "i" in period "t," X7it labor force participation rate of the country "i" in time 't," X8it represents final government consumption expenditure of country "i" in period 't," X9i is short-term external debt stock, αit denotes for the intercept term while βit represents the slope or the variables' coefficients, and Uit is the error term of the country "i" in time 't."

3.8.1. Fixed Effect Model:

We decompose the "fixed effect" model's error term (U_{it}), in equation (3.33) above, into an individual effect, and the unexplained part, which is the remaining portion of the error term. Since we split the error term into two components, it could be written as follows:

$$\boldsymbol{U_{it} = \mu_{it} + \nu_{it}} \qquad \textbf{\textit{(3.36)}}$$

Where μ_i represents individual specific-effect, which is unobservable and ν_{it} denotes the remaining or unexplained part of the error term. The equation above with two-way error component could be expressed as follows:

$$\boldsymbol{U_{it} = \mu_{i} + \lambda_t + \nu_{it} i = 1, \ldots, N; t = 1, \ldots, T} \qquad \textbf{\textit{(3.37)}}$$

Same as elaborated above, μ_i represents individual-specific effect, which is unobservable, ν_{it} stands for the unexplained part of the error term and λ_t represents the time effect, which is unobservable. In other words, λ_t is the excluded individual-invariant in the regression, which captures the time-specific effect. For instance, it captures and considers economic disruption caused by Corona-virus or Covid-19 in the current global economy as a whole, or the disruptions in the airline industry, or governments putting restrictions on exports of medical equipment like masks and disinfectants.

Substituting equation (3.36) into equation (3.33), we get equation (3.38) below.

$$\boldsymbol{Y_{it} = \alpha + X'_{it}\beta + \mu_{it} + \nu_{it}} \quad \textbf{\textit{(3.38)}}$$

The fixed-effect model with dummy variables, which is known as "least squares dummy variable "(LSDV), could also be represented as:

$$\boldsymbol{Y_{it} = X'_{it}\beta + \mu_1 D1_i + \mu_2 D2_i + \mu_3 D3_i + \cdots + \mu_N DN_i + \nu_{it}} \quad \textbf{\textit{(3.39)}}$$

Whereas, $D1_i$ stands for a dummy variable taking 1 for all observations for the first individual (in our case country 1) in the model or otherwise takes zero, $D2_i$ shows the dummy variable taking 1 for all observations of the second individual (in our case country 2) and or zero if not, and so on. The constant term α has been excluded to avoid the dummy variable trap.

3.8.2. Time Fixed Effect Model

Time "fixed effect" occurs when the dependent variable remains unchanged cross-sectionally but instead changes over time. When time fixed effect is present in the model instead of individual fixed effect, we assume the intercept remains unchanged across the individuals (countries in our case), at a particular point in time. Therefore, the equation could be represented as follows:

$$\boldsymbol{Y_{it} = \alpha + X'_{it}\beta + \lambda_{it} + \nu_{it}} \quad \textbf{\textit{(3.40)}}$$

In which λ_{it} denotes a time-varying constant which elaborates the explanatory variables affecting the dependent variable Y_{it}, which remains unchanged across the individuals, however, time-variant. Time "fixed effect" model with least squares dummy variable could be expressed as shown below:

$$Y_{it} = X'_{it}\beta + \lambda_1 D1_t + \lambda_2 D2_t + \lambda_3 D3_t + \cdots + \lambda_N DN_t + \nu_{it} \qquad (3.41)$$

The equation (3.41**)** above, the dummy variable $D1_t$, implies all observations of the first period taking value 1(the first year) or otherwise takes the value zero, dummy variable $D1_t$ Implies all observations of the second period taking value 1(the second year) or takes the value zero, if not, and the process continues for all the years. The distinction between time "fixed effect" and "individual fixed effect" is that time "fixed effect" describes time variation while individual fixed effect shows variations across individuals. The combination of time and individual "fixed effect" is known as the "two-way fixed effect" model. It contains both individual fixed effects and variations in time. The two-way fixed-effect model with dummy variables could be written as follows:

$$Y_{it} = X'_{it}\beta + \mu_1 D1_i + \mu_2 D2_i + \mu_3 D3_i + \cdots + \mu_N DN_i + \lambda_1 D1_t + \lambda_2 D2_t + \lambda_3 D3_t + \cdots + \lambda_N DN_t + \nu_{it} \qquad (3.42)$$

3.8.3. Generalized Method of Moments

Generalized Method of Moments (GMM), by Lars Hansen in his well-known eminent (1982) paper, which is an essential linchpin for econometric practitioners and textbooks for universities (Baum, Schaffer, & Stillman, 2008; Roodman, 2009). GMM is an appropriate specification technique in the presence of multicollinearity, endogeneity, and heteroscedasticity. Applications of dynamic panel data techniques have dramatically increased in the recent past. The steady rise of panel data techniques is plausible because most macroeconomic phenomena and variables are dynamic in one way or another. The rising of the dynamic techniques' applications are, therefore, practical and perceivable.

As evident in the literature and eloquently elaborated by Baltagi (2008), the error component in the dynamic model automatically correlates with the lagged dependent or the dependent variable, which is used as a regressor on the right-hand side of the equation. This happens even if there were no serial correlation or autocorrelation in the model before. Therefore, the fixed-effect model, though it eradicates individual fixed effects, serial correlation, or the autocorrelation, remains in the model producing inconsistent estimates. Besides, the fixed effect model assumes the absence of endogeneity, which is not practical. The fixed-effect model yields consistent parameter estimates of both the lagged dependent and the independent variables provided that the time dimension goes to infinity or increases.

Moreover, employing the dynamic panel GMM model invented by Arellano & Bond (1991) in model 3.29 yields profoundly and potentially bias output when the number of moment conditions is greater than the individual dimensions and instrumental variables are weak (Baltagi, 2008).

As mention above, the fixed-effect model or the within estimator yields acute inconsistent and inherent inefficiency in the presence of non-spherical errors (Aydemir & Guloglu, 2017). Hence, we use a fixed effect GMM estimator to overcome that non-sphericity problem existing among the error term and the lagged dependent variable. The fixed effect estimator has some superiority over dynamic GMM models: the two-step difference and system GMM (Arellano & Bond, 1991; Blundell & Bond, 1998). The first advantage of fixed effect GMM over the two-step difference and system GMM is that it doesn't assume homoscedasticity and absence of serial correlation. Secondly, it overcomes the problem of weak instruments, which is responsible for yielding inconsistency output in the fixed effect estimator model explained above by not using dynamic instruments.

In a nutshell, the fixed effect GMM estimator considers autocorrelation and heteroscedasticity, employs non-dynamic instruments which do not vary over time; hence, it eliminates problems caused by weak instruments as time dimension goes to infinity (Aydemir & Guloglu, 2017). We use current independent variables and the lagged dependent variable as instrumental variables.

Furthermore, we applied Kleibergen & Paap (2006) rank LM test and (Cragg-Donald (1993) F test to investigate the relevancy of the instrumental variables. Thus, "whether endogenous variables are correlated with instrumental variables." We also use Hansen J statistic (1982) to verify instrumental validity or if the error term and the instruments are correlated or not. All three tests, non-spherical characteristics of the error term, are considered by using the robust option to go to infinity (Aydemir & Guloglu 2017).

Mathematical equations of GMM are as follows:

$$\boldsymbol{Y = X\beta + \varepsilon \ where \ \varepsilon} \sim (\mathbf{0}, \boldsymbol{\Omega}^{*}) \qquad \textbf{\textit{(3.43)}}$$

This applies to the presence of no-spherical errors or the absence of iid. Spherical errors mean the presence of heteroscedasticity and autocorrelation or serial correlation in the series. The other condition is that moment conditions (L) should be greater than the number of parameters (K) or simply put, L>K.

$$\boldsymbol{Z'Y = Z'X\beta + Z'\varepsilon} \qquad \textbf{\textit{(3.44)}}$$

$$\boldsymbol{Var(Z'\varepsilon) = E(Z'\varepsilon\varepsilon'Z) = Z'E(\varepsilon\varepsilon')Z = Z'\Omega^{*}Z} \qquad \textbf{\textit{(3.45)}}$$

Therefore, the estimated Beta of GLS could be written as follows:

$$\boldsymbol{\widehat{\beta}}_{\boldsymbol{GLS}} = (\boldsymbol{X'\Omega^{-1}X})^{-\mathbf{1}} * (\boldsymbol{X'\Omega^{-1}Y}) \qquad \textbf{\textit{(3.46)}}$$

And from here estimated Beta of GMM could be written as follows:

$$\boldsymbol{\widehat{\beta}_{GMM}} = \left((\boldsymbol{Z'X})'(\boldsymbol{Z'\Omega^{*}Z})^{-\mathbf{1}}(\boldsymbol{Z'X})\right)^{-\mathbf{1}} \left((\boldsymbol{Z'X})(\boldsymbol{Z'\Omega^{*}Z})^{-\mathbf{1}}(\boldsymbol{Z'Y})\right) \qquad \textbf{\textit{(3.47)}}$$

There are two specific cases that GMM reduces to instrumental variables. These two conditions are:

1) İn the absence of heteroscedasticity, autocorrelation, or serial correlation.
2) When there are heteroscedasticity and autocorrelation or serial correlation, but L=K, thus the number of moment conditions (L) equals to the number of the parameters (k).

The first case when there is no heteroscedasticity and no autocorrelation or serial correlation:

$$\widehat{\boldsymbol{\beta}}_{GMM} = \left((\boldsymbol{Z'X})'(\boldsymbol{Z'\sigma^2Z})^{-1}(\boldsymbol{Z'X})\right)^{-1}\left((\boldsymbol{Z'X})'\,(\boldsymbol{Z'\sigma^2Z})^{-1}(\boldsymbol{Z'Y})\right) \qquad \textbf{\textit{(3.48)}}$$

$$= \left((\boldsymbol{Z'X})'(\boldsymbol{Z'\sigma^2Z})^{-1}(\boldsymbol{Z'X})\right)^{-1}\left((\boldsymbol{Z'X})'\,(\boldsymbol{Z'\sigma^2Z})^{-1}(\boldsymbol{Z'Y})\right) \qquad \textbf{\textit{(3.49)}}$$

This is the same as beta instrumental variables.

$$\widehat{\boldsymbol{\beta}}_{IV} = \left((\boldsymbol{Z'X})'(\boldsymbol{Z'\sigma^2Z})^{-1}(\boldsymbol{Z'X})\right)^{-1}\left((\boldsymbol{Z'\sigma^2Z})^{-1}(\boldsymbol{Z'Y})\right) \qquad \textbf{\textit{(3.50)}}$$

In short, the presence of spherical errors reduces the estimated beta of GMM to instrumental variables.

Second case When there are heteroscedasticity and autocorrelation or serial correlation, but L=K:

$$\widehat{\boldsymbol{\beta}}_{\mathbf{GMM}} = \left((\mathbf{Z'X})'(\mathbf{Z'\Omega^*Z})^{-1}(\mathbf{Z'X})\right)^{-1}\left((\mathbf{Z'X})'(\mathbf{Z'\Omega^*Z})^{-1}(\mathbf{Z'Y})\right) \qquad \textbf{(3.51)}$$

The second, third, and the fourth parts of the equation cancel out their K*K matrix, and therefore only the first and the last parts will be remaining.

$$= [\,(\boldsymbol{Z'X})'\,]^{-1}(\boldsymbol{Z'Y}) \qquad \textbf{\textit{(3.52)}}$$

This is the same as the estimated beta of the instrumental variable.

$$\widehat{\boldsymbol{\beta}}_{IV} = [\,(\boldsymbol{Z'X})'\,]^{-1}(\boldsymbol{Z'Y}) \qquad \textbf{\textit{(3.53)}}$$

However, when there is overidentification of the equation, and there are spherical errors, then GMM is applied. In addition to that, when the time dimension is larger than the individual dimensions or when time goes to infinite, panel fixed effect, GMM becomes the appropriate estimator.

Panel fixed effect GMM.

$$\boldsymbol{Y} = \boldsymbol{X\beta} + \boldsymbol{\varepsilon}, \boldsymbol{\varepsilon} \sim (\boldsymbol{0}, \boldsymbol{\Omega}^*) \tag{3.54}$$

$$\boldsymbol{Z'Y} = \boldsymbol{Z'X\beta} + \boldsymbol{Z'\varepsilon}, \boldsymbol{Var}(\boldsymbol{Z'\varepsilon}) = \boldsymbol{Z'\Omega^* Z} \tag{3.55}$$

$$\widehat{\boldsymbol{\beta}}_{\boldsymbol{GMM}} = \left((\boldsymbol{Z'X})'(\boldsymbol{Z'\Omega^*Z})^{-1}(\boldsymbol{Z'X})\right)^{-1}\left((\boldsymbol{Z'X})'(\boldsymbol{Z'\Omega^*Z})^{-1}(\boldsymbol{Z'Y})\right) \tag{3.56}$$

The panel fixed effect is as follows:

$$\boldsymbol{Y_{it}} = \boldsymbol{\alpha} + \boldsymbol{X'_{it}\beta} + \boldsymbol{U_{it}} \tag{3.57}$$

$$\boldsymbol{U_{it}} = \boldsymbol{\mu_{it}} + \boldsymbol{\nu_{it}} \tag{3.58}$$

Where the transformed equation is:

$$(\boldsymbol{Y_{it}} - \overline{\boldsymbol{Y}}_{\boldsymbol{it}}) = (\boldsymbol{X_{it}} - \overline{\boldsymbol{X}}_{\boldsymbol{it}})\boldsymbol{\beta} + (\boldsymbol{V_{it}} - \overline{\boldsymbol{V}}_{\boldsymbol{it}}) \tag{3.59}$$

In which

$$\boldsymbol{Y}^* = (\boldsymbol{Y_{it}} - \overline{\boldsymbol{Y}}_{\boldsymbol{it}}), \boldsymbol{X}^* = (\boldsymbol{X_{it}} - \overline{\boldsymbol{X}}_{\boldsymbol{it}}), \boldsymbol{Z}^* = (\boldsymbol{Z_{it}} - \overline{\boldsymbol{Z}}_{\boldsymbol{it}}) \ \boldsymbol{and} \ \boldsymbol{V}^* = (\boldsymbol{V_{it}} - \overline{\boldsymbol{V}}_{\boldsymbol{it}}) \tag{3.60}$$

$$\widehat{\boldsymbol{\beta}}_{\boldsymbol{PFEGMM}} = \left(\left(\boldsymbol{Z^{*\prime}X^*}\right)'\left(\boldsymbol{Z^{*\prime}\Omega^*Z^*}\right)^{-1}\left(\boldsymbol{Z^{*\prime}X^*}\right)\right)^{-1}\left(\left(\boldsymbol{Z^{*\prime}X^*}\right)'\left(\boldsymbol{Z^{*\prime}\Omega^*Z^*}\right)^{-1}\left(\boldsymbol{Z^{*\prime}Y^*}\right)\right) \tag{3.61}$$

3.9. Data Description

We utilized yearly data all extracted from World Bank Development Indicators (WDI). The data period is from 1990-2018. Focus variables are real per capita income, gross general government debt, short-term "external debt stock," external debt stock (%of

GNI), external debt stock guarantee, long term external debt stock, debt service to exports (%), total debt service on external debt, fixed capital formation, labor force participation rate, real inflation rate, trade openness, government consumption.

The natural logarithm has been employed for level variables, which are neither percentage nor ratio for convenience, easy analysis, and to reduce heteroscedasticity problems among the individual data. Gross capital formation, real inflation rate, "general government final consumption expenditure, and debt service to exports, external debt stock, are in a percentage form. Therefore, there is no need to apply the natural logarithm.

Real per capita income is our dependent variable, gross general government debt, short-term external debt stock, external debt stock percentage of GNI, debt service percentage of exports, total debt service on "external debt, external debt stock guarantee," and long-term external debt stock are our explanatory variables while "gross capital formation," "labor force participation rate," real inflation rate, openness, and government consumption are our controlled variables.

The equation of our main explanatory variables is as follows:

$$\boldsymbol{Y = \alpha + \beta_1 Ly_{it-1} + \beta_2 tdserx_{it} + \beta_3 exdgni_{it} + \beta_4 grod_{it} + \beta_5 Shtd_{it} + \beta_6 ltd_{it} + \beta_7 ppgd_{it} + \beta_8 tedserni_{it} + \beta_9 tedbt_{it} + \beta_{10} tedbser_{it} + \varepsilon} \qquad \textit{(3.62)}$$

The null and alternative hypothesis of our main independent variables is, therefore, as follows:

$H_0: \beta_1 = 0,$ meaning that gross general government debt affects not on real per capita income growth

$H_1: \beta_1 \neq 0,$ meaning that gross general government debt affects on real per capita income growth

$H_0: \beta_2 = 0$, that is to say, external debt stock contributes not on real per capita income growth

$H_1: \beta_2 \neq 0$, external debt stock contributes to real per capita income growth

$H_0: \beta_3 = 0,$ short term external debt stock affects not on real per capita income growth

$H_1: \beta_3 \neq 0,$ short term external debt stock affects real per capita income growth

$H_0: \beta_4 = 0$, long term external debt stock has not to influence on real per capita income growth

$H_1: \beta_4 \neq 0,$ thus, long term external debt stock influences real per capita income growth

$H_0: \beta_5 = 0$, which means external debt stock guarantee has nothing to contribute to per capita growth

$H_1: \beta_5 \neq 0$ that is external debt stock guarantee contributes to real per capita growth

$H_0: \beta_6 = 0$, which means debt service to exports has nothing to contribute to real per capita growth

$H_1: \beta_6 \neq 0$, which means debt service to exports has an impact on to real per capita growth

$H_0: \beta_7 = 0$, which means total debt service on external debt has nothing to contribute to real per capita growth

$H_1: \beta_7 \neq 0$, which means total debt service on external debt has an impact on real per capita growth.

The equation, including both explanatory and control variables, is also written as follows:

$$\begin{aligned} \boldsymbol{Y} = \boldsymbol{\alpha} + \boldsymbol{\beta_1 Ly_{it-1}} + \boldsymbol{\beta_2 Tdserx_{it}} + \boldsymbol{\beta_3 exdgni_{it}} + \boldsymbol{\beta_4 grod_{it}} + \boldsymbol{\beta_5 Shtd_{it}} \\ + \boldsymbol{\beta_6 ltd_{it}} + \boldsymbol{\beta_7 ppgd_{it}} + \boldsymbol{\beta_8 tedserni_{it}} + \boldsymbol{\beta_9 tedbt_{it}} \\ + \boldsymbol{\beta_{10} tedbser_{it}} + \boldsymbol{\beta_{11} L_{it}} + \boldsymbol{\beta_{11} gcon_{it}} + \boldsymbol{\beta_{12} inf_{it}} \\ + \boldsymbol{\beta_{13} open_{it}} + \boldsymbol{\beta_{14} K_{it}} + \boldsymbol{\beta_{15} HC_{it}} + \boldsymbol{\beta_{16} fdi_{it}} + \boldsymbol{\varepsilon} \end{aligned} \qquad \textbf{\textit{(3.63)}}$$

The “null hypothesis” of the control variables is:

$H_0: \beta_8 = 0$, which indicates fixed capital formation has no paramount relations with real per capita growth

$H_1: \beta_8 \neq 0$, meaning that fixed capital formation has paramount relations with real per capita growth

$H_0: \beta_9 = 0$ that is the population growth rate has nothing to do with real per capita income growth

$H_1: \beta_9 \neq 0$, which shows that population growth rate, has relations with real income per capita growth indeed

$H_0: \beta_{10} = 0$, real inflation rate has nothing to effect on real per capita income growth

$H_1: \beta_{10} \neq 0$, the real inflation rate has relation with real per capita income growth

$H_0: \beta_{11} = 0$, trade openness doesn't affect real per capita income growth

$H_1: \beta_{11} \neq 0$, trade openness affects real per capita income growth

$H_0: \beta_{12} = 0$, government consumption don't influence on real per capita income growth

$H_1: \beta_{12} \neq 0$, government consumption influences real per capita income growth

Countries in this study, as mentioned above, are those of COMESA economic organization. This organization consists of 21 countries, making it one of the largest economic blocks in the continent. Out of the 21 countries in the group, only 15 have full data available for the period of this study. The data of the six remaining countries are either not available or vastly missing, which is not possible for reliable analysis. For this reason, they were removed from the analysis. Those countries are Djibouti, Libya, Seychelles, Somalia, Zambia, and Zimbabwe. Additionally, we didn't include the corruption perception index in the regression.[19]

After running many regressions with several control variables in the literature, we come up with two parsimonious models, one with standard variables and another one

[19] Corruption perception index data was not fully available for all the countries, and was also inconsistent for the period between 1990-2018, therefore, due to this data inconsistency, we didn't included CPI in our regression analysis.

with an interaction term between debt variables and capital. Many variables were either insignificant or were having wrong signs; we, therefore, dropped them from the model. The two last models we run are, therefore, model 3.64 and 3.65 below. The model without interaction terms is as follows:

$$\begin{aligned} \boldsymbol{Y} = \boldsymbol{\alpha} + \boldsymbol{\beta_1 Ly_{it-1}} + \boldsymbol{\beta_2 Tdserx_{it}} + \boldsymbol{\beta_3 exdgni_{it}} + \boldsymbol{\beta_4 grod_{it}} + \boldsymbol{\beta_5 Shtd_{it}} \\ + \boldsymbol{\beta_6 ltd_{it}} + \boldsymbol{\beta_7 ppg_{it}} + \boldsymbol{\beta_8 tedserni_{it}} + \boldsymbol{\beta_9 tedbt_{it}} \\ + \boldsymbol{\beta_{10} tedbser_{it}} + \boldsymbol{\varepsilon} \end{aligned} \qquad \textit{(3.64)}$$

And the model with interaction terms is as follows:

$$\begin{aligned} \boldsymbol{Y} = \boldsymbol{\alpha} + \boldsymbol{\beta_1 Ly_{it-1}} + \boldsymbol{\beta_2 tdserx} * \boldsymbol{inv_{it}} + \boldsymbol{\beta_3 exdgni} * \boldsymbol{inv_{it}} \\ + \boldsymbol{\beta_4 grod} * \boldsymbol{inv_{it}} + \boldsymbol{\beta_5 Shtd} * \boldsymbol{inv_{it}} + \boldsymbol{\beta_6 ltd} * \boldsymbol{inv_{it}} \\ + \boldsymbol{\beta_7 ppg} * \boldsymbol{inv_{it}} + \boldsymbol{\beta_8 gcon_{it}} + \boldsymbol{\beta_9 Inf_{it}} + \boldsymbol{\beta_{10} open_{it}} \\ + \boldsymbol{\beta_{11} tdserx_{it}} + \boldsymbol{\beta_{12} exdgni_{it}} + \boldsymbol{\beta_{13} grod_{it}} \\ + \boldsymbol{\beta_{14} ltd_{it}} + \boldsymbol{\beta_{15} shtd_{it}} + + \boldsymbol{\beta_{16} ppg_{it}} + \boldsymbol{\beta_{17} inv_{it}} + \boldsymbol{\varepsilon} \end{aligned}$$

(3.65)

Table 3.1. Variables, abbreviations, and definitions

Abbreviation	Indicator	Definitions
INC	Real per capita income	“Sum of value added by all its producers.”
İNV	Fixed capital formation	Outlays of improvements to the economy's Fixed assets and net changes in inventory levels.
L	Labor force participation rate	The economically active population.
G.ROD	General government gross debt	All liabilities that require payments of interest or Principal at a specified date(s) in the future”.
OPEN	Trade openness	The sum of export and import over GDP
GCON	General government final Consumption expenditure	“All current government spending On the purchase of goods and services.”
İNF	Real inflation rate	Exchange rate decided by the “exchange market” or by “national authorities.”
EXDGNİ	External debt stock, (%GNI))	“Total external debt stocks-to-gross national income.”
LTD	Long-term external debt stock	“Debt that reaches one year’s extended maturity.”
SHTD	Short-term external stock	Debt with an initial maturity not exceeding one year.
TDSERX	Debt service to exports	The “sum of principal repayments and interest paid in currency, goods, or services.”
TDBSER	Total debt service on external debt	The “sum of principal repayments and interest actually paid in currency, goods, or services on long-term debt.”
PPG	External debt stock, public and publicly grantee	Comprises long-term external obligations of public debtors

Table 3. 2. Descriptions of the variables

Abbreviation	**Indicator**	**Source**	**Measure**	**Expected impact**
INC	Real per capita income	WORLD Bank	US$ based (2010)	
INV	Fixed capital formation	WORLD Bank	(% of GDP)	Positive
L	Labor force participation rate	WORLD Bank	(% of Pop. 15-64)	Positive
GROD	General government gross debt	WORLD Bank	Ratio	Negative
OPEN	Trade Openness	WORLD Bank	Ratio	Negative
GCON	General government final consumption expenditure	IMF	(% of GDP)	Negative
İNF	Real inflation rate	WORLD Bank	(%)	Negative
EXDGNİ	External debt stock	WORLD Bank	(% of GNI)	Negative
LTD	Long-term external debt stock	WORLD Bank	(Current US$)	Negative
SHTD	Short term external stock	WORLD Bank	(Current US$)	Negative
TDSERX	Debt service to exports	WORLD Bank	(% of export)	Negative
TDBSER	Total debt service on external debt	WORLD Bank	(Current US$)	Negative
PPG	External debt stock, public and publicly grantee	WORLD Bank	(Current US$)	Negative

CHAPTER IV

RESULTS AND DISCUSSION

Table 4.1. Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Y	435	6.796	1.003	5.102	9.267
tdserx	435	12.367	13.087	.105	134.803
exdgni	435	60.894	46.526	.512	284.168
exdgni	435	60.894	46.526	.512	284.168
grod	435	82.111	143.754	-7.014	2015
Ltd	435	21.561	2.389	0	25.095
ppgd	435	21.466	2.378	0	25.089
L	435	9140000	1.01e+07	92545	5.19e+07
gcon	435	88.813	23.34	0	148.508
Shtd	435	18.052	4.783	0	23.204

Table 4.2. Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Y	1.000									
(2) TDSERX	0.160	1.000								
(3) EXDGNİ	-0.316	0.364	1.000							
(4) EXDGNİ	-0.316	0.364	1.000	1.000						
(5) GROD	-0.118	-0.048	0.093	0.093	1.000					
(6) LTD	0.072	0.134	0.194	0.194	-0.097	1.000				
(7) PPGD	0.010	0.108	0.191	0.191	-0.090	0.991	1.000			
(8) L	-0.310	-0.068	-0.041	-0.041	-0.087	0.449	0.476	1.000		
(9) GCON	0.083	-0.022	-0.032	-0.032	0.184	-0.351	-0.346	-0.531	1.000	
(10) SHTD	-0.066	0.044	0.238	0.238	-0.056	0.610	0.642	0.356	-0.208	1.000

Table 4. 3. Matrix of correlations with significance levels

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Y	1.000									
(2)tdserx	-0.160***	1.000								
(3)exdgni	-0.316***	0.364***	1.000							
(4)exdgni	-0.316***	0.364***	1.000***	1.000						
(5) grod	-0.118**	-0.048	0.093*	0.093*	1.000					
(6) Ltd	0.072	0.134***	0.194***	0.194***	-0.097**	1.000				
(7)ppgd	0.010	0.108**	0.191***	0.191***	-0.090*	0.991***	1.000			
(8) L	-0.310***	-0.068	-0.041	-0.041	-0.087*	0.449***	0.476***	1.000		
(9) gcon	0.083*	-0.022	-0.032	-0.032	0.184***	-0.351***	-0.346***	-0.531***	1.000	
(10) Shtd	-0.066	0.044	0.238***	0.238***	-0.056	0.610***	0.642***	0.356***	-0.208***	1.000
*** p<0.01, ** p<0.05, * p<0.1										

Table 4.4. Cross-section dependence tests results

Cross-section dependence tests results				
Method:	**Constant**		**Constant and Trend**	
	Test ist.	**Prob.**	**Test ist.**	**Prob.**
CDLM1	147.565	0.004	152.268	0.002
CDLM2	2.937	0.002	3.262	0.001
CD	1.419	0.078	2.473	0.007
Bias-adjusted LM test	80.551	0.000	96.758	0.000
Bias Adjusted CD test for cointegration equation	5.747	0.000	5.747	0.000

As depicted in the table 4.4 above, both the cd Lm1 (Breusch & Pagan (1980)), cd LM2 (Pesaran 2004 CDlm), cd LM (Pesaran 2004 CD), and bias-adjusted cd test all indicates highly statistical significance at 1 percent level since probability value is less than 1%. Hence, we reject the null hypothesis and conclude that it is a cross-section dependence among the individual countries. We are, therefore, eligible to employ the second-generation unit root test. Usually, cd Lm1 and cd Lm2 are used when the time dimension is larger than the individual dimension, and the cd LM test is appropriate when time is shorter than the individual size. The bias-adjusted cd test is applicable for all since its adjusted. In our model, the time dimension is larger than individual components, and, in that regard, we can use the cd Lm1, cd Lm2, and the bias-adjusted cd test results revealing cross-section dependency. Succinctly, we allow cross-section correlation among the individual series.

Table 4.5. Panel unit root test results

Panel unit root tests results								
	CIPS intercept	**CIPS intercept + trend**	**ZA^{SPc} intercept**	**ZA^{la} intercept**	**ZA^{SPc} intercept + trend**	**ZA^{la} intercept +trend**	**LM_D intercept**	**LM_AD Intercept+ Trend**
Y	-1.969***	-2.496***	-1.151	8.463***	-0.991	2.658***	80.551***	96.758***
Tdserni	-2.4708	-2.573***	1.786***	2.560***	-1.159	-0.873	127.796***	106.433***
Exdgni	-2.9651	-2.8058***	-2.873	-2.609	-0.039	2.539***	78.468***	82.022
Tdbser	-1.1663***	1.750***	3.662***	36.093***	-2.711	-2.892	177.186***	122.090***
K	-2.4924	-2.7046***	-2.628	-2.107	-0.502	-0.255	154.103***	131.097***
Grod	-1.9791***	-1.9476***	12.930***	9.445***	4.009***	8.900***	126.023***	117.468***
Ltd	-0.9514***	-1.6087	4.281	-0.286	-0.458	-2.466	177.186***	123.775***
Shtd	-2.1685*	-2.2592	-1.983	-0.879	-0.748	-0.553	177.186***	113.813***

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4. 6. Panel individual unit root test result

TCADF test result				
Constant			Constant and Trend	
Countries	CADF test ist.	Critical value (%5)	CADF Test st.	Critical value (%5)
Burundi	-2.360	-3.36	-2.3605	-3.88
Con. dem.Rep	-3.126	-3.36	3.1263	-3.88
Comoros	-3.402**	-3.36	-3.4022	-3.88
Egypt	-0.5954	-3.36	-0.5954	-3.88
Eritrea	-2.602	-3.36	-2.6017	-3.88
Ethiopia	-2.478	-3.36	-2.4778	-3.88
Kenya	-1.021	-3.36	-1.0212	-3.88
Madagascar	-2.865	-3.36	-2.8646	-3.88
Mauritius	-2.229	-3.36	-2.2289	-3.88
Malawi	-2.024	-3.36	-2.0241	-3.88
Rwanda	-5.069**	-3.36	-5.0694**	-3.88
Sudan	-0.9335	-3.36	-0.9335	-3.88
Eswatini	0.2748	-3.36	0.2748	-3.88
Tunisia	-0.4063	-3.36	-0.4063	-3.88
Uganda	-0.7114	-3.36	-0.7114	-3.88
Cips ist	-1.970	-2.25	-1.9699	-2.76

Table 4.7. One-way and two-way fixed effect test

Fixed Effect Test				
H01: Absence of individual and time effects	F1(42,382)	201.30	ProbF1	0.0000
H02: Absence of individual effects	F2(14,382)	564.53	ProbF2	0.0000
H03: Absence of time effects	F3(28,382)	5.41	ProbF3	0.0000

As depicted in the table 4.8 below, the first null hypothesis of no individual and time effect has been strongly rejected since the probability value is less than all the significant levels of 1%, 5%, and 10%, respectively. Therefore, from the first null hypothesis, we conclude there is at least one effect, either an individual effect or time effect, and hence, we go to the second null hypothesis. Similarly, the second null hypothesis of no individual effect has been rejected with a strong effect. The probability value is less than all the specified significance levels, indicating there is an individual effect in our data. The third null hypothesis of no time effect has similarly been rejected, and therefore, there are both individual and time effects in our data. Consequently, we are eligible to apply the two-way fixed effect model, which includes both individual and time effect

Table 4. 8. One-way and two-way random effect test

H01: Absence of individual effects	LM1	2899.88	Prob.LM1	0.0000
H02: Absence of time effects	LM2	3.18	Prob.LM2	0.0748
H03: Absence of individual and time effects	LM	2903.06	Prob.LM	0.0000

The table 4.8 above contains a one-way, two-way random effect test result for the random effect model.

For the random effect model, we start with the third null hypothesis, which tests the absence of both individual and time effect. The alternative is the presence of individual and time effects. Since the probability value is much less than a 1% significance level, we reject the null hypothesis of no individual and time effect at all levels and very strongly. Thus, there is at least one effect present in our data. The second null hypothesis is there is no time effect, while the alternative hypothesis is there is a time effect. The probability value has been rejected at a 10% significance level.

The probability value is less than 10%; hence, we can conclude that the time effect is present in our data. The first null hypothesis tests the null hypothesis of no individual effect with an alternative hypothesis; there is an individual effect. We strongly reject the null hypothesis of no individual effect since the probability value is less than a 1% significance level. From the three tests above, we can confidently conclude that both individual and time effects are present in our data. Therefore, we are eligible or justified to run a two-way random effect model.

Table 4. 9. Heteroscedasticity and autocorrelation test.

Method: heteroskedasticity LM test by Juhl-Sosa Escudero (2014)		
H0: Homoscedasticity	P_value	0.0000
Method: Serial Correlation test by Baltagi & Lee (1995)		
H0: Absence of first-order serial correlation	P_value	0.0000

As illustrated in the table 4.9 above, the null hypothesis of homoscedasticity is strongly rejected due to the probability value of less than a 1% significance level, which means that there is heteroscedasticity in our data and no homoscedasticity. Thus, the variance across individuals' overtime is inconstant and changing. Put in another way, the identicality assumption of the ordinary least square is violated.

We then check the second part of the iid assumption, which is the independent distribution of the error term. We used the serial correlation test by Baltagi & Lee (1995), which is most appropriate in the case of the fixed-effect model for the autocorrelation test in the data. The null hypothesis of autocorrelation is that there is no autocorrelation or serial correlation in the series, and the alternative hypothesis is autocorrelation is present. As illustrated in the table 4.9 above, the probability value is less than all the significance levels, and hence, we reject the null hypothesis very strongly. Where the indication is the absence of iid in the data; in other words, the series is both widely heteroscedastic and strongly autocorrelated.

Table 4.10. Slope homogeneity tests

Test	***F***
$\hat{S}$	**423.5460*** **
$\widetilde{\Delta}$	**29181.1951*** **
$\widetilde{\Delta}_{adj}$	**34878.1993*** **
$\widehat{\Delta}$	**24.8611*** **
$\widehat{\Delta}_{adj}$	**1.0165**
Notes: ***Shows that statistics are significant at the 1% level of significance; **shows that statistics are significant at the 5% level of significance; *shows that statistics are significant at the 10% level of significance	

Table 4.11. Westerlund cointegration test

Westerlund test for cointegration among series	
Ho: No cointegration	
Ha: All panels are cointegrated	
Statistic	5.3062
p-value	0.0000

The first null hypothesis is no cointegration among the error, and the alternative is all panels are cointegrated. As illustrated in the table 4.11 above, we reject the null hypothesis of no cointegration very strongly by looking at the probability value, which is less than all the significance levels of 1%, 5%, and 15% that our series are cointegrated.

Table 4.12. Westerlund cointegration test

Method	**T- Statistic**	**P-value**
Gt	-2.634	0.792
Ga	-7.408	1.000
Pt	-12.781	0.001
Pa	-9.151	0.964

Table 4.12 contains the result of the Westerlund (2007) ECM panel cointegration tests. The null hypothesis is that the series are not cointegrated while the alternative hypothesis is series are cointegrated. The test gives two results, Durbin–Hausman Panel (DHP) and Durbin–Hausman Group. We have to reject at least one of them or both to have a cointegration among the series. As we can see in the table 4.12 above, we couldn't reject the Durbin–Hausman Group test, but we rejected Durbin–Hausman Panel (DHP) probability value, which implies that series are cointegrated. Hence, we are eligible to

run any estimator provided that other conditions and assumptions are satisfied.

4.1. Regression Result:

Table 4.13. Regression output

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Pooled OLS**	**Two-way DRE**	**Two-way DFE**	**Diff GMM**	**SYS GMM**	**FE GMM**
TDSERX	-0.0032***	-0.0032***	-0.0032***	0.0004	-0.0052	0.0008**
	(0.0009)	(0.0009)	(0.0009)	(0.0045)	(0.0141)	(0.0004)
EXDGNİ	-0.0016***	-0.0016***	-0.0016***	- 0.0040***	-0.0031	- 0.0004***
	(0.0003)	(0.0003)	(0.0003)	(0.0015)	(0.0044)	(0.0001)
İNV	0.0051***	0.0051***	0.0050***	0.0082	0.0174	0.0007**
	(0.0018)	(0.0018)	(0.0017)	(0.0076)	(0.0229)	(0.0003)
GROD	-0.0001*	-0.0001*	-0.0001*	-0.0001	0.0007	0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0015)	(0.0000)
LTD	0.0434***	0.0434***	0.0426***	0.0240	0.0366	0.0133*
	(0.0431)	(0.0431)	(0.0422)	(0.1682)	(3.3196)	(0.0078)
PPG	-0.4243***	-0.4243***	-0.4159***	-0.0617	-3.6467	-0.0179**
	(0.0432)	(0.0432)	(0.0423)	(0.2018)	(3.3972)	(0.0075)
L	-0.0076	-0.0076	-0.0061			
	(0.0086)	(0.0086)	(0.0084)			
GCON	0.0041***	0.0041***	0.0041***			
	(0.0009)	(0.0009)	(0.0009)			
SHTD	0.0098***	0.0098***	0.0099***	0.0068	-0.0242	-0.0002
	(0.0031)	(0.0031)	(0.0030)	(0.0168)	(0.0567)	(0.0006)
L.İNC			0. 0929***			0.0967***
			(0.1442)			(0.0163)
Constant	6.0732***	6.0732***	6.0690***		6.2279	
	(0.2072)	(0.2072)	(0.1367)		(5.0901)	
Observations	435	435	435	360	375	375
R-squared	0.5684	0.3653	0.403			0.948
Hansen J. Stat						0.8226

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(OLS, dynamic random effect, dynamic fixed effect, difference GMM, system GMM, and fixed effect GMM)

The following are the regression result analysis and interpretations.[20]

Table 4.13 above contains regression outputs of Pooled OLS, Two-way dynamic random effect, two-way dynamic fixed-effect, difference GMM, system GMM, and fixed effect GMM, respectively.

I will interpret the table output in a row rather than columns for the sake of simplicity and convenience. The first variable is:

TDSERX (total debt stock services percentage of exports) is highly significant at a 1% percent level in Pooled OLS, dynamic random effect, dynamic fixed effect, and 5% in the fixed effect GMM. However, difference and system GMM shows insignificant statistics. The coefficient indicates that a 1% increase in total debt stock services percentage of exports decreases real per capita income by approximately 0.32 % in Pooled OLS, random effect, fixed effect model, and 0.52 % in system GMM, respectively. This signifies that when debt increases, output per capita reduces due to the fall of the national savings. Difference GMM and fixed effect GMM shows a 1 % increase in total debt stock services percentage of exports increase real per capita income by approximately 0.04 % and 0.08 %, respectively. In economic terms, this means that the debt increase cause investment and national savings to rise up and consequently increases per capita output.

EXDGNİ (external debt stock percentage GNI) is significant throughout at a 1 percent significance level for all the models. External debt stock percentage GNI is one of the main target variables that measure the magnitude of countries' debt burden. The first three models of Pooled OLS, dynamic random, and the dynamic fixed effect indicate a 1 % increase in external debt stock percentage GNI decreases real per capita income by about 0.16%. Thus, public external debt reduces savings and block investments; hence, per capita output goes down. The last three models depict a 1 % increase in External debt stock percentage GNI reduces real income per capita by about 0.4%, 0.31%, and 0.04%, respectively. In short, the external debt stock percentage GNI has a negative relationship with income per capita in line with the previous findings and literature in all the models.

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[20] When interpreting the regression output, we interpreted them as a percentage form, rather than units or millions, since all the variables are in a percentage, ratio form.

INV (fixed capital formation percentage of GDP) is used as a proxy for investment, and it's one of the main control variables. The coefficients of the Fixed capital formation show highly significant with a positive sign for all the models except difference and system GMM, which reported positive coefficients but insignificant. According to the first three models, a 1% increase in the fixed capital formation increases real per capita income by approximately 0.51%, with a very strong significance level of 1% percent. The difference and system GMM reports insignificant but positive coefficients outcomes of 0.8 and 1.7, respectively. Meaning a 1% increase in the fixed capital formation increases real per capita income by about 0.82% and 1.7% in that order. In the last model, the fixed effect GMM reported result is both significant at a 5% significance level and also positive. Thus, a 1% increase in fixed capital formation increases real income per capita by approximately 0.07%. Therefore, the majority of the models are in line with the old and other findings of a positive relationship between per capita income and Fixed capital formation, and the result is as expected. Whenever investment increases, national savings rises; therefore, real per capita income also rises.

Grod (gross government debt percentage of GDP) is one of the main target variables. Usually, it's the primary variable that measures government debt burden and crisis susceptibility. The first four models reveal that gross government debt has a negative relationship with real per capita income. While the coefficients of the first three models are all significant at the 10% significance level, the fourth model is insignificant, although it has a negative coefficient. However, the last two models show positive coefficients but insignificant. Thus, a 1% increase in gross government debt, decrease real per capita income roughly 0.01% in the first four models, and 0.07% and 0.02% in the last two models. In general, gross government debt has a negative relationship with real per capita income. In the economic sense, this means that when gross government debt rises, real per capita income falls as debt obstructs investments, and resources are used as debt servicing rather than investment.

LTD (log of long-term external debt stock) is highly significant at a 1% level in the first three models and 10% in the last model, while the fourth and the fifth models are not significant. All six models display positive coefficients. The first three models show a 1% increase in the long-term debt stock, increases real per capita income by roughly 4.3 %. In comparison, the last three models indicate a 1% increase in the long-term debt stock, increases real income per capita by about 2.4%, 3.66%, and 1.33%, respectively. All the estimators indicate a positive relationship that exists between real per capita income and long-term debt stock, which is not in line with most of the previous literature. This means that the debt increases also increase real per capita output, which is not realistic and practical, at least in the COMESA countries due to debt mismanagement, misappropriation, and stealing on an industrial scale.

PPG (log of external debt stock public and publicly grantee) is highly significant at a 1% level in the first three models and a 5% level for the last model. In contrast, the fourth and fifth models show an insignificant result. The coefficient is negative throughout the models. The coefficient of all the models shows a 1% increase in external debt stock public, and publicly grantee decreases real per capita income roughly 42% in the first three models, 6.7%, 36%, and 1.7 % in the last three models, respectively. Thus, external debt stock public and publicly grantee has a positive relationship with real per capita income. İn other words, due to the negative impact of debt on investment, and savings real per capita income also falls, and hence negative relationships exist.

L (labor force participation rate) is used as a control variable. The result is dropped in the last three models since it was highly insignificant. However, the first three models show a negative coefficient of 0.07% decrease in real per capita income if the labor force participation rate increases by 1%. This is mainly due to massive unemployment and insufficient skills. İn COMESA countries, Unemployment is looming and beyond comprehension, and that is why it is affecting the real per capita income negatively.

GCON (government final consumption expenditure percentage of GDP) is used as a control variable. It shows a positive relationship with real per capita income in the first three models. We dropped it from the last three models due to high insignificance. Thus, a 1% increase in government consumption expenditure increases real per capita income per by about 0.041%. In economic theory, it can be negative or positive. The negative is due to the offset of the private investment by government expenditure, while at the same time, it can be positive if the debt is managed appropriately and efficiently.

SHTD (log of short-term external debt), as can be seen in table 4.13, the first three model's regression output shows positive and significant coefficients. The fourth model is positive but insignificant, while the fifth and the sixth models show a negative but statistically insignificant result. The first three regressions signify that a 1% increase in short-term external debt increases real per capita income by about 0.98% and 0.68% for the fourth regression output. The last two regression output shows a 1% increase in short-term external debt, decreases real income per capita by roughly 2.42%, and 0.02%, respectively. The simple Pooled OLS, dynamic random effect, dynamic fixed-effect model, and difference GMM show a positive relationship between short-term external debt and real per capita income. In short, an increase in the public external debt increases real per capita income. The more sophisticated and stronger system GMM and fixed effect GMM reveals a negative relationship existing the variables. This signifies that if short-term public external debt increases, real per capita income decreases. As we explained earlier, this is because of the debt's negative impact on savings and investment, which eventually causes real per capita income to decline, and fall.

L.INC (lag of the real per capita income) is strongly significant in both the dynamic fixed-effect model and the fixed effect GMM estimation. The indication is that the current real income per capita condition of a country highly depends on the countries' previous years' real per capita income and hence, is significant and positive as expected. Adding the lag of the dependent variable on the right-hand side of the regression equation is what makes our model dynamic. Therefore, we are just focusing on the dynamic models, which are the effect, dynamic fixed effect model, and the fixed effect GMM model.

Table 4.14. Interaction terms' regression output

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Pooled OLS**	**Two-Way DRE**	**Two-Way DFE**	**Diff GMM**	**SYS GMM**	**FE GMM**
TDSERX*İNV	0.0009*	0.0001	0.0000	-0.0025	-0.0127**	0.0000
	(0.0005)	(0.0000)	(0.0000)	(0.0040)	(0.0061)	(0.0001)
EXDGNİ*İNV	0.0003**	-0.0000	-0.0000	-0.0006	0.0033***	-0.0004
	(0.0001)	(0.0000)	(0.0000)	(0.0022)	(0.0011)	(0.0000)
GROD*İNV	-0.0001	-0.0014	-0.00004	-0.0004	-0.0001	-0.0001
	(0.0001)	(0.0000)	(0.0000)	(0.0010)	(0.0003)	(0.0000)
LTD*İNV	-0.1434***	-0.0044	-0.0077**	-0.1793	0.0897	-0.0050*
	(0.0450)	(0.0032)	(0.0033)	(0.3421)	(0.0918)	(0.0029)
SHTD*İNV	-0.0079***	0.0000	-0.0001	-0.0050	-0.0290	-0.0001
	(0.0019)	(0.0001)	(0.0002)	(0.0103)	(0.0228)	(0.0002)
PPG*İNV	0.1537***	0.0038	0.0078**	0.1220	-0.1456	0.0052*
	(0.0447)	(0.0032)	(0.0034)	(0.2380)	(0.0888)	(0.0028)
GCON	0.0039**	-0.0004***	-0.0007**	-0.0011	0.0026	-0.0007
	(0.0019)	(0.0001)	(0.0003)	(0.0112)	(0.0370)	(0.0010)
İNF	-0.0001	-0.0002	-0.0003	0.0004	-0.0017	-0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0010)	(0.0015)	(0.0000)
OPEN	-0.0069	0.0001	-0.0001	0.0117	0.0054	-0.0001
	(0.0059)	(0.0004)	(0.0005)	(0.0209)	(0.0450)	(0.0001)
TDSERX	-0.0226***	-0.0003	-0.0002	0.0279	0.2727**	0.0005
	(0.0074)	(0.0005)	(0.0006)	(0.1152)	(0.1311)	(0.0005)
EXDGNİ	-0.0104***	-0.0003**	-0.0003*	-0.0142	-0.1247***	-0.0004**
	(0.0020)	(0.0001)	(0.0002)	(0.0350)	(0.0430)	(0.0002)
GROD	0.0011	0.0001	0.0000	0.0052	0.0008	0.0000
	(0.0015)	(0.0001)	(0.0001)	(0.0148)	(0.0046)	(0.0001)
LTD	4.5533***	0.1038	0.2148***	1.7141	0.3149	0.1271**
	(1.0093)	(0.0734)	(0.0792)	(2.9747)	(0.6612)	(0.0622)
SHTD	0.1880***	-0.0007	0.0013	0.3002	0.3712	0.0020
	(0.0452)	(0.0033)	(0.0036)	(0.4206)	(1.0225)	(0.0055)
PPG	-4.7230***	-0.0905	-0.2077***	0.0000	0.0000	-0.1335**
	(1.0048)	(0.0732)	(0.0793)	(0.0000)	(0.0000)	(0.0605)
İNV	-0.0839	0.0156***	0.0009	1.2869	1.5393*	0.0003
	(0.0672)	(0.0051)	(0.0074)	(2.3459)	(0.8511)	(0.0085)
L.İNC		0.9961***	0.9229***			0.9718***
		(0.0035)	(0.0163)			(0.0226)
Constant	7.1192***	-0.2032***	0.4046***		0.0000	
	(0.8676)	(0.0747)	(0.1525)		(0.0000)	
Hansen J stat.				1.000	1.000	0.5084
Kleibergen-Paap rk LM				0.0000	0.0000	0.0000
Cragg-Donald Wald F				0.720	0.623	469.820
F-test (prob)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.4467	0.9489	0.9505			0.9499

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(OLS, dynamic random effect, dynamic fixed effect, difference GMM, system GMM, and fixed effect GMM)

The above table 4.14 contains the outcome of the interaction terms. According to previous research and literature, the interaction between capital investment and foreign debt has a significant impact on the per capita income. Therefore, we run the interaction regression between all the debt variables and capital. We run six estimation techniques, as illustrated in the table above 4.14. Starting from the first model, the simple Pooled OLS, dynamic random effect, dynamic fixed effect, difference GMM, system GMM, and fixed effect GMM models. Similar to the previous regression table 4.13, for the sake of convenience and simplicity, we interpreted the regression result in rows rather than columns. From now on, we use the table above when referring to table 4.14, instead of writing it again and again.

TDSERX*İNV (total debt stock servicers percentage of export*investment) displays a positive interaction slope all the estimators except the difference and system GMM models. Pooled OLS and system GMM show statistical significance of 10 percent and 5%, respectively. Dynamic fixed effect and fixed effect GMM displays a positive interaction slope but statistically insignificant, while the dynamic random effect estimator also reported a positive coefficient, but statistically insignificant. In the first two estimators, a 1% increase in the interaction between total debt stock servicers and investment increases real per capita income by roughly 0.09% and 0.01%, respectively. Dynamic fixed effect and fixed effect GMM results are not only zeros but also insignificant. Difference and system GMM indicates that if the interaction between total debt stock servicers percentage of export and investment increases by 1 percent, real per capita income reduces approximately 0.25 and 1.27 percent, respectively, due to the negative influence of debt on investment. Thus, public debt reduces national savings and subsequently decelerates real income per capita growth.

EXDGNİ*İNV (external debt stock percentage of GNI*investment) is the most crucial explanatory variable. The outcome indicates a mixed interaction slope of the external debt stock percentage of GNI and investment combined throughout the estimators. Models 1 and 5 (OLS, and system GMM) display positive coefficients, which is also statistically significant, where difference GMM is not significant. Models 2, 3, 4, and 6 (dynamic random effect, dynamic fixed effect, difference GMM, and fixed effect GMM) report negative coefficients, which are statistically insignificant. OLS and system GMM depicts the positive interaction of 0.03% and 0.33%, respectively, indicating that debt has a positive impact on investment. This contradictory result might be due to weak estimators because both OLS and system GMM is not unbias and consistent in this case. The dynamic random, and the dynamic fixed effect, Difference GMM, and fixed effect GMM estimation result indicate negative interaction. Thus, a 1% increase in the interaction between external debt stock percentage of GNI and investment decrease real income per capita by about 0.02%, 0.01%, 0.06%, and 0.01%, respectively. As a result of debt's negative impact on capital stock and investment, real per capita income declines. In short, the majority of the indicators show negative but not significant interaction results.

GROD*İNV (gross government debt percentage of GDP*investment) is also another essential explanatory variable. The estimation results in the table show that all the six models reported negative interaction between debt and real per capita income. However, non of the statistics reported is significant. In other words, there is a 0.01%, 0.014%, 0.04%, 0.04%, 0.01%, and 0.01% negative interaction between real per capita income and debt. Economically, this means that debt stymies and obstructs avenues of investment and, hence reduces per capita income growth.

LTD*İNV (long-term external debt stock*investment) is another significant target variable that is widely used in the literature to capture the impact of foreign debt on real per capita income. The result displayed in the table shows that all the estimators have negative interactions except system GMM, which shows a positive interaction slope where OLS, dynamic fixed effect, and fixed effect GMM are statistical significance at 1%, 5%, and 10% in that order. In comparison, Dynamic random effect and difference GMM reported negative interactions, but insignificant. The result indicates that there is 14.3%, 0.44%, 0.77%, 17.9%, and 0.5% negative interactions from models 1, 2, 3, 4, and 6 in that order. System GMM is an outlier here. İt shows an 8.9% positive interaction. Succinctly, the result avers the presence of negative interaction emanating from the external debt's blockade of investment, which in turn impedes economic take-off. Resources are directed to external debt servicing rather than long term investment.

SHTD*İNV (short-term external debt stock*investment) has a negative interaction slope for all the models except the dynamic random effect. However, models 3, 4, 5, and 6 have negative interaction slopes and are not statistically significant. OLS shows negative interaction and also significant results. A dynamic random effect is shown positive, but statistically inconsiderable. 1% increase in the interaction term between Short-term external debt stock and capital investment, decrease real per capita income by about 0.79%, 0.01%, 0.05%, 0.29%, and 0.01% for models 1, 3, 4, 5, and 6 in that order. In general, the majority of the estimators are indicating that the interaction term between Short-term external debt stock and capital has a negative relationship with real per capita income. İn economic terms, external public debt obstructs local capital stock and investment since a considerable amount of capital stock, which is supposed to be directed to investment, is used for external public debt servicing. This slows down economic growth if not stagnates.

PPG*İNV (total external debt stock public and publicly grantee*investment) reported result shows that all estimators except system GMM, have positive interaction slope coefficients. Only system GMM indicates a 14.56% existence of negative interaction. Models 1, 3, and 6 are showing statistically significant and positive interaction, while models 2 and 4 show a positive interaction slope, but inconsiderable statistically. OLS shows a 15.34% negative interaction between public external debt and real per capita income with statistical significance at 1% level. The dynamic random effect model shows that there is a 0.38% positive interaction but statistically is not significant. The dynamic fixed effect estimator shows a 0.78% positive interaction with statistical significance at 5% level. Difference GMM shows a 12.2% positive interaction; however, insignificant. Thus 1% increase in the interaction between public and publicly grantee debt and capital investment increases real per capita income by about 12.2%; however, statistically, it is not significant. System GMM as mentioned above, shows negative interaction meaning a 1% increase in the interaction term, decreases real per capita income roughly 14.5% but is not significant statistically. The fixed effect GMM interaction slope coefficient means that a 1% increase in the interaction term increases real income by approximately 0.52%, but insignificant. Economically, except for the system GMM, all other estimators show a positive relationship between the interaction term and real per capita income. Which means public external debt correlates positively with investment. This is counter and intuitive because debt management and policy implementations in these countries are not sound and prudent. The inconsistent might be the control variables or short data period.

Gcon (government final consumption expenditure %of GDP) is among the control variables. The regression output of the first and the fifth models are depicting a positive slope, and only the first model is significant statistically at a 5% level. On the other hand, models 2, 3, 4, and 6 show a negative coefficient where models 2 and 3 are significant at 1% and 5% significance level. Statistics of the dynamic fixed effect are significant at a 1% level, and the slope coefficient is negative. The Pooled OLS and the system GMM models show that a 1% increase in government final consumption expenditure increases real income by about 0.39% and 0.26%, while the dynamic random effect, dynamic fixed effect, and difference GMM shows a 1% increase in government final consumption expenditure, decrease real income by about 0.04%, 0.07%, and 0.11%. Fixed effect GMM shows a 1% increase in government final consumption expenditure decreases real per capita income by about 0.07%. In other words, the majority of the estimators show that government final consumption expenditure has a negative influence on real per capita income growth. Theoretically, it is expected to be negative since government or public expenditure offsets investment, hence, consistent with the literature and the theory.

INF (real inflation rate) is among the control variables used in the model. The reported result indicates that inflation affects real per capita growth negatively for all the models except difference GMM. However, the result shows insignificant statistics. From OLS to fixed-effect GMM estimators shows that when inflation rises by 1%, real per capita income declines nearly 0.01%, 0.02%, 0.03%, 0.017% and 0.01% respectively. For the difference GMM, when inflation rises by 1%, real per capita income increases by nearly 0.04%. In a nutshell, the coefficients of all the models are negative, indicating that inflation has a negative relationship with real income per capita. That is when inflation goes up or increases, real per capita income decreases.

OPEN (openness: export+import/GDP) is the variable that captures the total trade volume of a country and is used as a control variable. The result of the OLS, dynamic fixed effect, and fixed effect GMM estimators indicate negative coefficients, which means that openness is indirectly proportional to real per capita income. When openness increases, real per capita income declines. The dynamic random effect, difference, and system GMM reveal a positive slope coefficient, which means openness and real per capita income are directly proportional or, when openness rises, real per capita income rises. In the OLS, dynamic fixed effect and fixed effect GMM reported result, if openness increases by 1%, real income per capita will decrease by approximately 0.69 and 0.01%, respectively. For the dynamic random effect, difference, and system GMM, an increase of openness by 1%, causes real income per capita to increase roughly 0.01%, 1.17%, and 0.54% in that order. The results displayed by different estimators are contradictory; however, the negative relationship displayed by the stronger dynamic fixed effect and fixed effect GMM might be due to the high import volumes of the COMESA countries. Thus, the imports, which are the component of the trade volume, are much higher for all the countries compare to the export components causing the current account deficit for all the states, hence, negative coefficients. İn economic terms that mean when trade openness goes up, real per capita income goes down due to the negative impact that openness has on the trade export, which causes trade deficit.

TDSERX (total debt stock services percentage of export) the reported result shows that estimators are giving contradictory results. Models 1, 2, and 3 show a negative slope, while models 4, 5, and 6 are showing a positive slope. Additionally, only models 1 and 5 are statistically significant. OLS, dynamic random, and dynamic fixed effect shows a 1% increase in TDSERX, decreases real per capita income roughly 2.3%, 0.03%, and 0.02%, respectively, where OLS is statistically significant at 1% level. Thus, due to lack of investment, production is on a small scale, increasing the import and decreasing export, which finally reduces per capita growth. Difference GMM, system GMM, and fixed effect GMM show a 1% increase in Tdserx, increases per capita income about 2.79%, 27.3%, and 0.05%, respectively, where system GMM is significant at 5% level.

EXDGNİ (external debt stock percentage of GNI) is one of the essential target variables. The outcome indicates a negative slope for all the six estimators with high statistical significance except difference GMM, which is insignificant. Models 1, 2, 3, 5, and 6 (OLS, dynamic random effect, dynamic fixed effect, difference, system GMM, and fixed effect GMM) display negative coefficients with statistical significance. Thus, a 1% increase in external debt stock percentage of GNI decreases real per capita income, on average 1.04% in OLS, 0.03% for both dynamic random and fixed effect models,12.47%, and 0.04% for system and fixed effect GMM and they are all significant. Difference GMM shows that debt decreases real per capita income by 1.42% if debt increases by 1%, indicating that public external debt stock harms investment, hence, a negative influence on real per capita growth. In short, all the estimators show debts negative impacts on per capita income the same way that the majority of the models reported negative interaction between debt and investment.

GROD (gross government debt percentage of GDP) is one of the main target variables also. Usually, it’s one of the main variables that measure government debt burden and crisis susceptibility. All the coefficients of all the six models are all statistically insignificant; however, they have a positive coefficient. The result tells us that 1% increase in gross government debt, increase income per capita roughly 0.11%, 0.01%, 0.02%, 0.52%, 0.08%, and 0.03% respectively. In the economic sense, this means gross government debt has a positive relationship with real per capita income. Thus, when gross government debt increases, real per capita income also increases by the percentages mentioned above. This result is contradictory to the variables and the result of the gross government debt elaborated in the first model and its interaction term result, which are mostly negative. The differences might be due to the inclusion of several control variables and the interaction term in this model.

LTD (log of long-term external debt stock) all the six estimators display a positive slope. Models 1, 3, and 6 are highly significant at 1% and 5% level, while models 2, 4, and 5 are positive but insignificant. Models 1, 3, and 6 show a 1% increase in the long-term debt stock, increases real per capita income by roughly 45.5 %, 21.48%, and 12.7%, while models 2, 4, and 5 indicate a 1% increase in the long-term debt stock, increases real income per capita by roughly 10.38%, 17.2%, and 31.5% respectively. İn a nutshell, all the estimators indicate a positive relationship that exists between real per capita income and long-term debt stock, which is not in line with most of the previous literature. İt means when long term debt increases, real per capita income also increases; thus, long term debt has a positive impact on investment, which in turn increases output per capita. This is also contrary to the interaction term result, which is mainly negative. The discrepancies might be due to the control variables which are included in this model than the previous one and the addition of the interaction term.

SHTD (log of short-term external debt), as can be seen in the table above, all the model's regression output shows a positive coefficient except dynamic random effect, which depicts a negative coefficient, where only OLS is significant at 1 percent level. However, though most of the estimator's results are positive, only the OLS result is statistically significant. All the other five models are statistically insignificant. From OLS, dynamic fixed effect, difference GMM, system GMM, and fixed effect GMM, the result of the regression means that a 1% increase in short-term external debt increases real income per capita by about 18.8%, 0.13%, 30%, 37%, and 0.2% respectively. İn other words, when short term external debt increases, real per capita income increases. Thus, short term debt has a positive influence on investment and capital stock, which further influences real per capita income positively. On the dynamic random effect regression output shows a 1% increase in short-term external debt, decreases real income per capita income by roughly 0.07%.

PPG (log of external debt stock public and publicly grantee) is greatly significant at a 1% level in the OLS, dynamic fixed effect, and fixed effect GMM. Additionally, except for difference and system GMM, which reported negligible results, all other models have reported negative coefficients. The coefficient is negative throughout the models. The result of OLS, dynamic random effect, dynamic fixed effect, and fixed effect GMM shows a 1% increase in external debt stock public, and publicly grantee decreases real income per capita roughly 47%, 9%, 20.77, and 13.35%, respectively. Thus, in the economic sense, the external public and publicly grantee debt has a negative relationship with real per capita income. İf publicly grantee foreign debt increases, it causes investment to decrease and decline because resources will be directed to debt servicing instead of investment and long term production processes, hence, reducing real per capita growth. This is in line with the literature and the previous empirical findings.

İNV (gross capital formation percentage of GDP) this variable is used as a proxy and instrument for capital and investment in the literature, and we follow the literature, so gross capital formation is our proxy variable for capital investment. We use it as an interaction term, and we added the regression separately. As indicated in the table above, except for OLS, all the other five models reported positive coefficients of gross capital formation. However, only dynamic random effect and system GMM is significant statistically. The result from dynamic random effect, dynamic fixed effect, difference GMM, system GMM, and Fixed effect GMM suggest that a 1% increase in the gross capital formation increases real per capita income, on average 1.56%, 0.09%, 128.7%, 153.9%, and 0.03% respectively. Although the values are very high, the signs are in line with the literature. Therefore, when gross capital formation increases, investment increases, and consequently, real per capita income is expected to rise.

L.İNC (lag of the real income per capita) is the lag of the dependent variable. It is expected that the current real income depends on the previous real income, and therefore, we add the lag of the dependent variable on the right-hand as a regressor. The "dynamic random effect, dynamic fixed effect, and the fixed effect GMM all display greatly significant statistics at one percent level." Indicating and affirming the dynamicity of the model; thus, the current period's real per capita income dramatically depends on the lag or the previous period, as mentioned in the literature.

CHAPTER V

CONCLUSION

In conclusion, our research question is whether the external public debt has a substantial impact on the per capita income of 15 out of the 21 COMESA countries using real per capita income as a proxy for growth. Six states were excluded from the regression due to the unavailability of their data. We tested many variables, but final, we excluded some of them, such as FDI and schooling due to high insignificance and displaying irrelevant signs. We also run several necessary diagnostic tests before regressing the variables.

We carried out a cross-section dependency test, second-generation unit root test, cointegration test, one-way and two-way dynamic fixed effect, and one-way and two-way dynamic random effect test, heteroscedasticity test, autocorrelation test, slope homogeneity test, and instrumental relevancy and validity test.

Next, we run OLS, two-way dynamic random effect, two-way dynamic fixed effect model, two-step difference and system GMM, and fixed effect GMM models. We run two regressions: one with the standard variables without the interaction term, and the other with an interaction term between debt and investment. The majority of the result indicates that debt has negative implications on real per capita income. Most of the target variables like public and publicly grantee debt, external debt stock percentage of GNI, short term debt stock, and external debt service percentage of export all have negative relationships with real per capita income of the COMESA countries. In other words, accumulating more external debt reduces economic growth. Therefore, it behooves COMESA countries to reduce external debt accumulation to enhance their economic prosperity in the long run.

The deficiency or the shortcomings of this study is the missing of corruption perception index (CPI), which is believed to be an essential variable that should be included in the regression. The reason we didn't include the corruption perception index in the regression is that there was no consistent data or full data for CPI of these countries in the years 1990-2018. Further studies might focus on how public external debt, together with the corruption perception index, affects per capita income.

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APPENDIXES

APPENDIX A

```
--------------------------------------------------------
--Slope Hmogeneity Tests in Pesaran and Yamagata (2008)--
--------------------------------------------------------
 Swamy Shat        (eq.11)    =  423.5460 prob = 0.0000
The Delta tests at page 57
 Delta_tilde1       (eq.27)   =  29181.1951 prob = 0.0000
 Delta_tilde_adj1   (eq.29)   =  34878.1993 prob = 0.0000
 Delta_hat1         (eq.26)   =  24.8611 prob = 0.0000
 Delta_hat_adj1     (eq.29)   =   1.0165 prob = 0.1547
The Delta tests at page 58 for remark(3)
 Delta_tilde2       (eq.33-34)  =  17.3596 prob = 0.0000
 Delta_tilde_adj2   (eq.33-34)  =  20.2716 prob = 0.0000
 Delta_hat2         (eq.33-34)  =  24.8611 prob = 0.0000
 Delta_hat_adj2     (eq.33-34)  =   1.0165 prob = 0.1547
```

Figure A.1. Slope Homogeneity Tests in Pesaran and Yamagata (2008), output

```
CADF_statistics for each country
 -2.773
-0.7277
 -3.259
 -4.906
 -1.458
 -2.156
-0.3113
 -3.723
 -2.646
 -2.960
 -8.777
-0.4332
-0.3287
 -2.107
-0.8765
CIPS statistics for all countries= -2.496
CD Tests                          Stat     prob
cd Lm1  (Breusch,Pagan 1980)    152.268   0.002
cd LM2  (Pesaran 2004 CDlm)       3.262   0.001
cd LM   (Pesaran 2004 CD)         2.473   0.007
Bias-adjusted CD test            96.758   0.000
Bias Adjusted CD test for cointegration equation     5.747
P_value of Bias Adjusted CD test for cointegration equation     0.000
Hadri-Kurozumi test statistics
ZA_SPC= -0.991
```

Figure A.2. Cross-section dependency, Unit root, and Cointegration test result

CURRICULUM VITAE

Personal Information:

Name - Surname: Mahat Maalim Ibrahim
E-mail (1): mahat.ibrahim@ihu.edu.tr
E-mail (2): mahatmaalim@hotmail.com

Education:

2014-2018 BA in Economics, Sakarya University, Turkey

2018-2020 MA in Economics, Ibn Haldun University, Turkey

Experience:

March - June 2017 Marshall office of the regional office of the Lodz region in Brussels.

February– June 2017 European Mobility Placement for Open Innovation project (empl-oi)

September 2018 – May 2020, a Teaching assistant at Ibn Haldun University.