THE EFFECTS OF BUDGET DEFICIT ON FIXED INVESTMENT IN SELECTED AFRICAN COUNTRIES

by

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DECLARATION

I declare that **THE EFFECTS OF BUDGET DEFICIT ON FIXED INVESTMENT IN SELECTED AFRICAN COUNTRIES** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

PRETTY SESHOKA **2022**

FULL NAMES **DATE**

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ABSTRACT

The primary goal of this study was to investigate the effects of budget deficit on fixed investment using annual data for the period 1990-2017 in selected African countries namely, Cameroon, Namibia, Ghana, Egypt, Seychelles, Mauritius, Botswana, Lesotho and South Africa. The study employed panel unit root tests including the Augmented Dickey-Fuller test, Philips Perron test and Levin Lin and chu test. The tests revealed that all the variables are integrated at 1^{st} difference. The study further employed the Panel ARDL bounds test to examine the relationship between budget deficit, fixed investment, money supply and inflation. The empirical findings indicated that a long run relationship exists between the variables of interest. Furthermore, the results revealed that the budget deficit has a negative and statistically significant effect on fixed investment. A one percent increase in the budget deficit, ceteris paribus, leads to a reduction in fixed investment by 44 percent in the long run. The findings further postulated a bidirectional causal relationship between budget deficit and fixed investment, between money supply and fixed investment and between fixed investment and inflation. It was evident in the research that indeed the budget deficit is a problematic macroeconomic policy in African countries. Policy makers should limit high government expenditures as they contribute to increased and persistent budget deficits which crowd out private investment.

Key words: Budget deficit, Gross fixed capital formation, Panel ARDL, Dumitrescu Hurlin panel causality.

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ACRONYMS

AEO	: African Economic Outlook
SARB	: South African Reserve Bank
ARDL	: Autoregressive Distributed Lag
ADF	: Augmented Dickey Fuller
BD	: Budget Deficit
CEMAC	: Central African and Monetary Community
CPI	: Consumer Price Index
ECM	: Error Correction Model
FDI	: Foreign Direct Investment
GDP	: Gross Domestic Product
GFCF	: Gross Fixed Capital Formation
HIPC	: Highly Indebted Poor County
IDC	: Industrial Development Corporations
IMF	: International Monetary Fund
IRF	: Impulse Response Function
LLC	: Levin, Lin and Chu
MS	: Money Supply
PSIA	: Poverty and Social Impact Analysis
PP	: Phillips-Perron
VAR	: Vector Autoregression
VD	: Variance Decomposition
VECM	: Vector Error Correction Model

CHAPTER 1

INTRODUCTION TO THE STUDY

1.1. INTRODUCTION AND BACKGROUND

The association between the budget deficit and fixed investment has been studied by various scholars including Jahromi and Zayer, 2008; Kiptui, 2005; Traum and Yang, 2010; Kaakunga, 2003; Ahmed and Alamdar, 2018; Asogwa and Chetachukwu, 2013. Several scenarios have played out as well as conclusions reached regarding the association amongst the budget deficit and private investment in different countries. Most studies carried out, including both time-series and panel studies, found that the effect of budget deficits on private investment remains ambiguous. Considering this, it is important to note that it is the role of each country to obtain the macroeconomic objectives of full employment, price stability, sustainable economic growth, and sovereign debt.

The main reasons are to control high levels of the budget deficit and flexible exchange rates. Based on earlier studies and current macroeconomic statistics, it is evident that most countries have struggled to manage to achieve these objectives. That gave an interest to investigate the effects of budget deficit on fixed investment to ensure that countries achieve long term stable economic success. Both public and private investment drive employment and enable countries to earn potential national income (Saaed and Hussain, 2014; Tsamis and Georgantopoulos, 2011; Molocwa, Choga and Mongale, 2018).

A fiscal deficit occurs when a country's government expenditure exceeds government revenue. The deficit emanates from increased government expenditure, inadequate revenue sources and high debt levels. Other authors raised concern over the fact that large and persistent fiscal deficits lead to extensive debts. Thus, it remains crucial for a country to maintain its budget deficit on an optimum level as it plays a big role in the financial, economic, and political stability matters of a country (Manamba, 2017).

Previous studies (i.e., Ahmed and Alamdar, 2018; Traum and Yang, 2010) which examined the relationship between budget deficit and private investment found that there is a negative relationship between budget deficit and fixed investment. High budget deficits are an issue that is faced by many countries and is the reason behind the low investment, higher interest rates and inflation worldwide. Moreover, the issue of budget deficit coupled with other economic ills such as huge national debts, low levels of investment and current account deficit are factors that are mostly found in African countries. This does not bode well for Rating Agencies and thus the reason for continuous downgrades. The aftermath of investment downgrades includes slow economic growth, low infrastructure spending and few competitive markets towards European countries and other international countries (Ogundipe, Ojeaga, and Ogundipe, 2014). For instance, in 2018, Lesotho had a debt to GDP ratio of 39.3% and budget deficit ratio of -4.0%, Mauritius 63.9% debt-GDP and -3.5% deficit, Seychelles had 59.9% debt-GDP and a surplus of 1.0, South Africa 55.7% debt-GDP and -4.6 deficit (IMF, World Economic Outlook database, 2018).

According to Bhasela and Bakela (2018), an economic activity involving high levels of capital formation and domestic savings are pre-conditions for sustained economic growth in any given economy. Akinola and Omolade (2013) note that foreign direct investment alone is not sufficient to finance capital formation. Following 1970 Africa was the only major region to ascertain declines in investment and savings per capita. GDP accounted for an average of 13 per-cent during the 1990s, with the savings rate of any African country being the lowest in the world. Development challenges that Africa is faced with include low income, low savings, slow growth and falling trade shares (Babatunde, 2012).

Previous research has confirmed that most African countries are vulnerable to challenges of high budgets deficit and find it difficult to meet the macroeconomic objectives of their respective countries. Another reason for focusing on these countries is the availability of data, the African countries in question are Egypt, Lesotho, Namibia, Cameroon, Ghana, Seychelles, Mauritius, Botswana and South Africa. It further enlightened that since most of these countries gained independence some continued becoming fragile towards foreign and international countries as they were adjusting to new structural changes. After the global financial crisis in 2008/2009, the

vulnerability resulted in inflationary pressures and high dependence on the government. Since then, the government became somewhat the sole provider to bail out itself and its dependants.

Most studies have based their research on the relationship between fixed investment and economic growth, the effects of budget deficit on economic growth, investment and corruption. The proposed study will differ from other studies as it focuses on the effect of budget deficit on fixed investment. The hypothesis is to investigate whether the budget deficit is the cause of low fixed capital formation in Sub-Saharan African countries. The studies of Eisner (1989) and De Long and Summers (1991 and 1992) stated that fixed investment induces an increase in economic growth. The proposed study will also contribute to the existing literature for the advantage of other researchers who will embark on the same investigation as well as guide policy makers in making sound decisions in their consistent government spending and borrowing which in turn suppress the growth of the economy. The analysis will employ the Panel ARDL methodology, cointegration analysis and the Dumitrescu Hurlin test to further elaborate on the links between the main variables of the study for the period 1990 to 2017.

1.2. STATEMENT OF THE PROBLEM

Most of the African countries have been proven to be troubled by budget deficits in the past years (Suresh & Gautam, 2015; Easterly, 1994). These are the countries that are characterised by people surviving under poor living conditions due to lack of employment, poverty and wars. Countries experiencing budget deficits in government usually fall into poor employment, poor state investment and therefore little or no economic development. These conditions hit hard on the economic state of the country. These countries usually grow at a slower rate than their potential growth rate hence fixed investment should be encouraged to finance the maintenance of the capital goods. Capital formation boosts production: hence it impacts how fast a country's economy grows (Jhingan, 2005).

The gross fixed capital formation statistics have constantly averaged a percentage share value of below the 25% mark in Africa (Babatunde, 2012). That on its own forces continents which are determined to achieve rapid economic growth on focusing on achieving or recording higher share in their gross fixed capital formation aspect. Relative to Africa's challenges is that its general government final consumption expenditure is high and has been high for many years. Similarly, to the Harrod Domar model which states that, when investment is stipulated, it will lead to economic growth in the economy. According to Salai-i-Martin and Subramanian (2003), high public spending worsens and slows a country's economic growth. The argument tends to hold very strongly for public investment and public consumption, however public consumption is way worse and creates more damage to a country's economy. This is hardly shocking as a result of public consumption, which does not tend to own direct positive effects on the economic process. Salai-i-Martin and Subramanian (2003) argue that it should be financed through an added tax which in turn could have a detrimental effect on growth.

When public debt is issued excessively to finance the budget deficit, this negatively affects private investment through the crowding-out effect depending on the rate of saving of the country. For example, if the saving rate is low and the country has been struggling to boost it, public debt will continue to increase as a matter of consistent borrowing. A country with a high rate of saving that exceeds its domestic investment opportunity does not experience any financial backlog in terms of its own investment and can easily finance its fiscal deficits (Eisner, 1989). It is in this regard that there is a need for a study on the impact of budget deficits on fixed investment.

1.3. RESEARCH AIM AND OBJECTIVES

1.3.1. Aim of the study

The aim of this study is to investigate the consequential effects of budget deficit on fixed investment in selected African countries namely Lesotho, Botswana, Namibia, Cameroon, Mauritius, Ghana, Seychelles, Egypt and South Africa for the period 1980 to 2017.

1.3.2. Objectives of the study

- To investigate the influence of budget deficit on fixed investment in selected African countries.
- To examine the causal relationship between budget deficit and fixed investment.

1.4. RESEARCH QUESTIONS

- What are the effects of budget deficit on fixed investment in selected African countries?
- What is the causal relationship between budget deficit and fixed investment in selected African countries?

1.5. SIGNIFICANCE OF THE STUDY

The association between macroeconomic variables and the budget deficit is of paramount importance to policymakers. It helps the government in making sound decisions in terms of its expenditures and wise investment deals that will generate returns for its estimated spending. The study can also help other researchers who will be embarking on the same kind of study and also policy makers who can come up with a different set of strategies to good business deals with this kind of interaction between the budget deficit and fixed investment.

The budget is strongly connected with crucial government laws and is extremely enlightened. About, 66.6% of spending is budgeted and spent on programs whose roles are to recognise constitutionally authorised social rights. South Africa's fiscal system in most developing countries is recognised as the country that can redistribute resources from the rich to the poor and working families. The proposed study will also investigate the effect of inflation on investment as is it generally known that inflation has a detrimental effect on investment as it reduces the purchasing power of the currency of different countries in concern.

1.6. DEFINITION OF CONCEPTS

- **Budget Deficits:** refers to the inability of the government to meet its expenditure needs. To put this in context, when government spending outweighs generated revenue, the government incurs a budget deficit (World

Bank, 2010). Government revenue comprises tax revenue, grants, sale of assets and public fines while government expenditure consists of civil servants' wages, capital spending, total debt, transfers and subsidies.

- **Fixed investment:** can be defined as the acquisition of fixed assets or the enhancement of existing fixed assets. In literature, fixed investment is usually proxied by gross fixed capital formation (Bakare, 2011, OECD manual, 2009).
- **Money Supply:** refers to the total quantity of money held by the public at any given point in the economy. This also includes the introduction of new electronic money in the economy (Keynes, 1936). The money supply is usually categorised as M1, M2 and M3.
- **Inflation:** is defined as the general rise in the price of goods and services in an economy as a result of too much money in circulation or an increase in money supply, usually is measured by the Consumer Price Index and the Producer Price Index (IMF, International Financial Statistics, 1976).

1.7. ETHICAL CONSIDERATIONS

The study will utilise secondary data which is an incorporation of quantitative statistical data from the World Bank. Adherence to the rules of plagiarism as is of paramount importance will be exercised and there is no need for ethical clearance. Furthermore, the study will be conducted in accordance with the University of Limpopo’s rules and regulations.

1.8. STRUCTURE OF THE STUDY

The paper is organized into several chapters and subsections.

- The first Chapter is the Orientation and background of the study, where it reviews the background of both the problem and area of study.
- Chapter 2 discusses the Overview of the selected area of study and trends of the budget deficit and fixed investment.
- Chapter 3 outlines the theoretical and empirical literature related to the researched topic.
- Chapter 4 discusses the estimation techniques and the type of methodology applied in the analysis.

- Chapter 5 describes the data and interprets the results found.
- The last chapter, Chapter 6, summarises, concludes, outlines recommendations and areas of future research.

CHAPTER 2

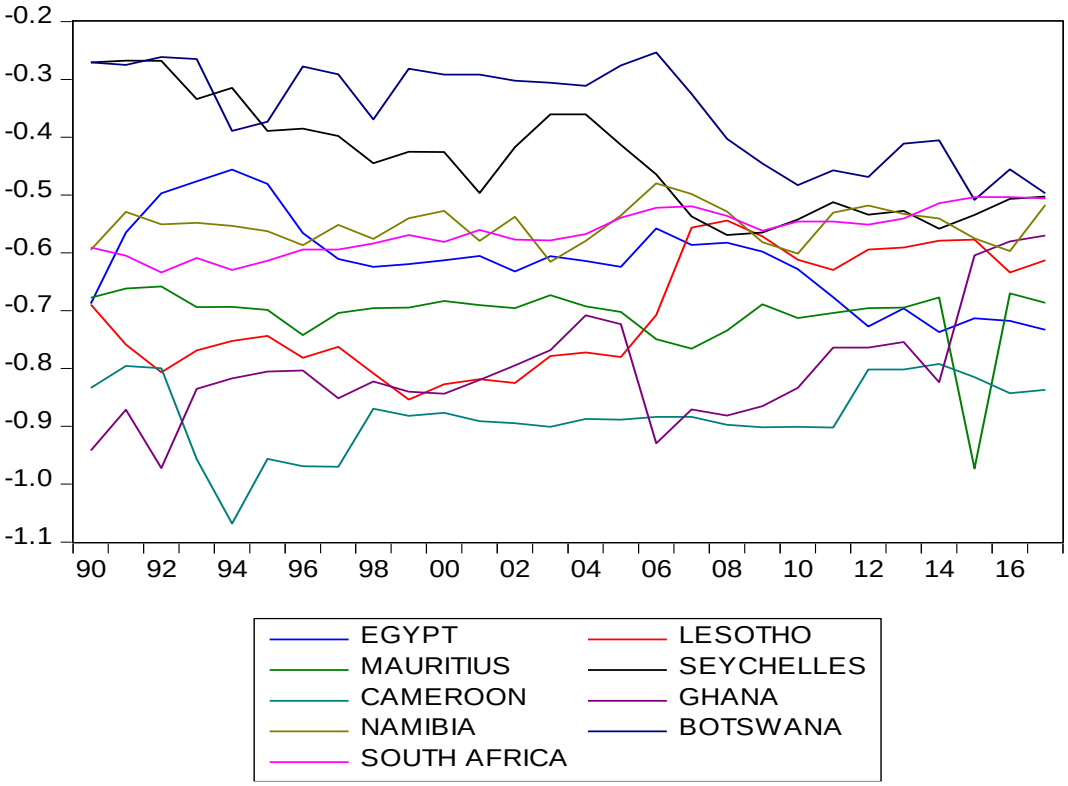
OVERVIEW OF VARIABLES IN 9 SELECTED AFRICAN COUNTRIES

2.1. INTRODUCTION

This chapter reflects the overview of the variables used in the model for the period 1990 to 2017 in nine selected African countries, namely Egypt, Mauritius, Cameroon, Namibia, Lesotho, Seychelles, Ghana, Botswana and South Africa. It is an analysis and interpretation of the overview of budget deficit as a proportion of GDP, fixed investment as a proportion of GDP, money supply as a proportion of GDP and inflation as a proportion of GDP.

2.1.1. Overview of the budget deficit

Figure 2.1: Analysis of budget deficit



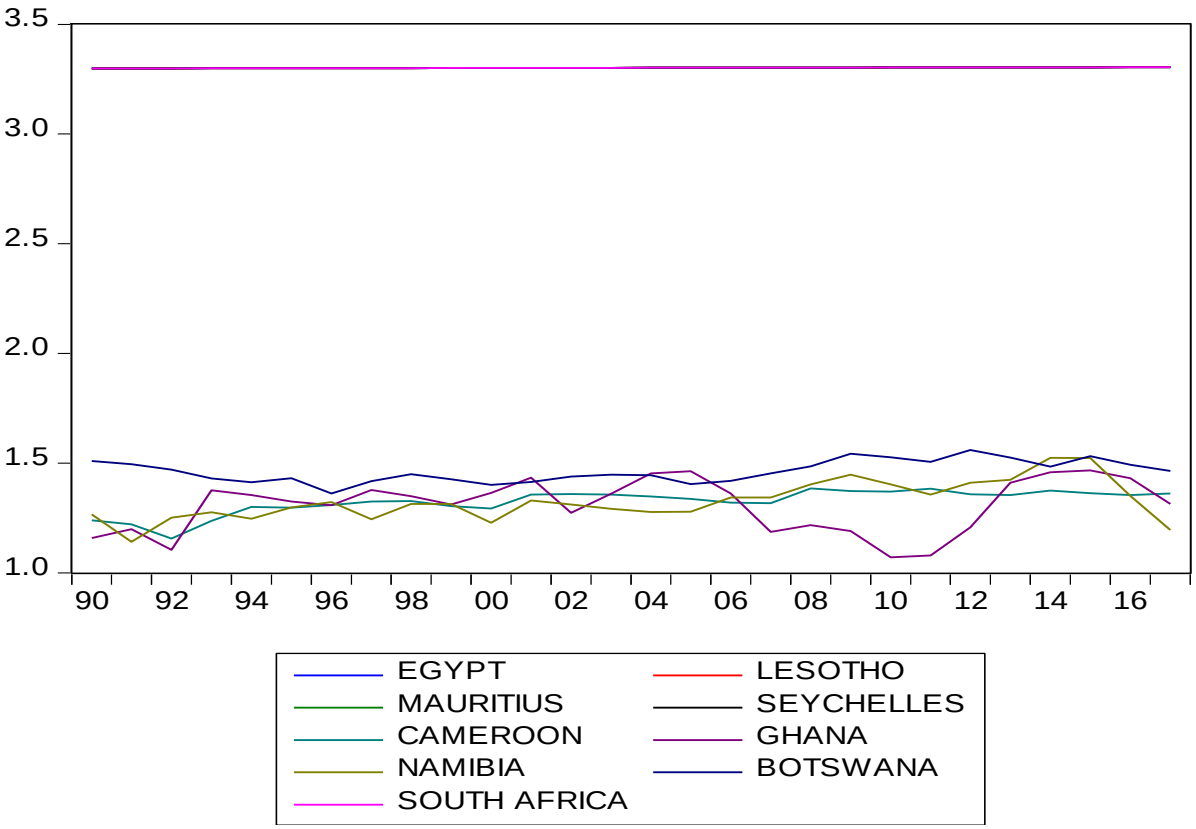
Source: E-views 9.0 output

In figure 2.1 the overview of budget deficit presented showed that only Botswana and Seychelles had acceptable rates of budget deficit even if they were recording a budget deficit because they were showing rates of below -0.5 whereas the remaining seven African countries were above -0.5 for the period 1990 to 2016. The reason behind the increments which took place is because of the high oil prices which rose the food

prices that affected most Southern African countries in the last decade (World Bank, 2018). The gradual significant deepening in 2015 for the Mauritian economy was because of the global high oil prices which led to a budget deficit record of -1.0% rate to finance the oil imports. Similar responses are seen in Ghana during the period 1992 and 2006 and in Cameroon during 1994 seemed to prevail.

2.1.2. Overview of fixed investment

Figure 2.2: Analysis of fixed investment



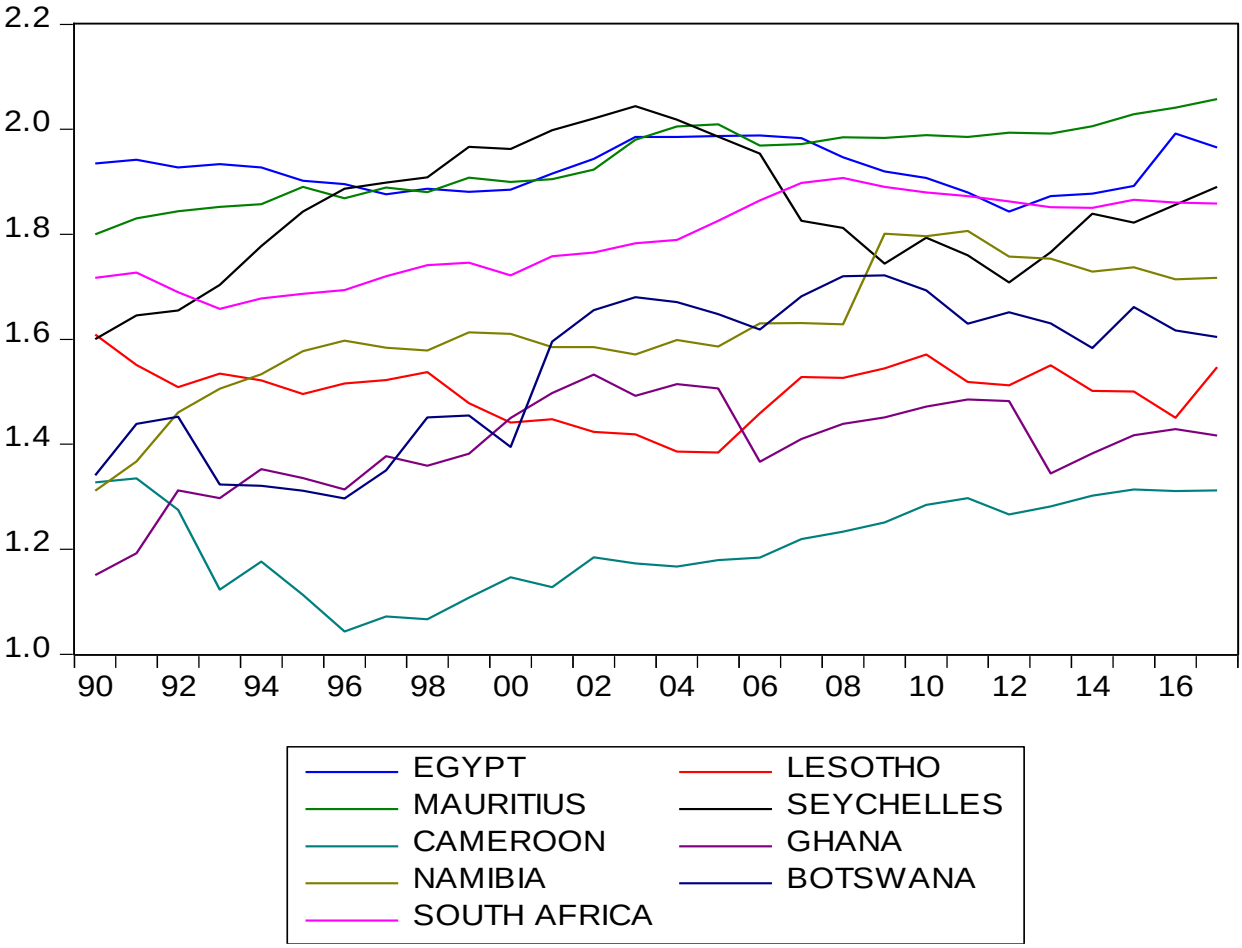
Source: E-views 9.0 output

Looking at the overview of the fixed investment, South Africa showed a positive and constant percentage of around 3.4, from the 1994 transition to democracy until 2016. It compiled an average of 3.3% of GDP per annum from 1994 to 2012 with a remarkable 1.4% of improvement from 1980 to 1993. This was because of the elevated contribution of 29% of a total fixed investment adjusted to GDP over the stipulated period (IDC, 2013). Other countries indicated a constant behavioural trend around 1.5 percent of GFCF except for Ghana which showed a gradual decline between 2010 and 2012 resulting from the delays of executing investments which led

to a withdrawal by investors from the United States, leaving the investments to be diluted by 15% in developing countries' mutual funds and this had consequential negative effects on the Ghanaian economy as is one of the developing countries in Africa but it started gaining conscious from 2012 maintaining a constant trend until 2016 (World Bank, 2014).

2.1.3. Overview of money supply

Figure 2.3: Analysis of money supply



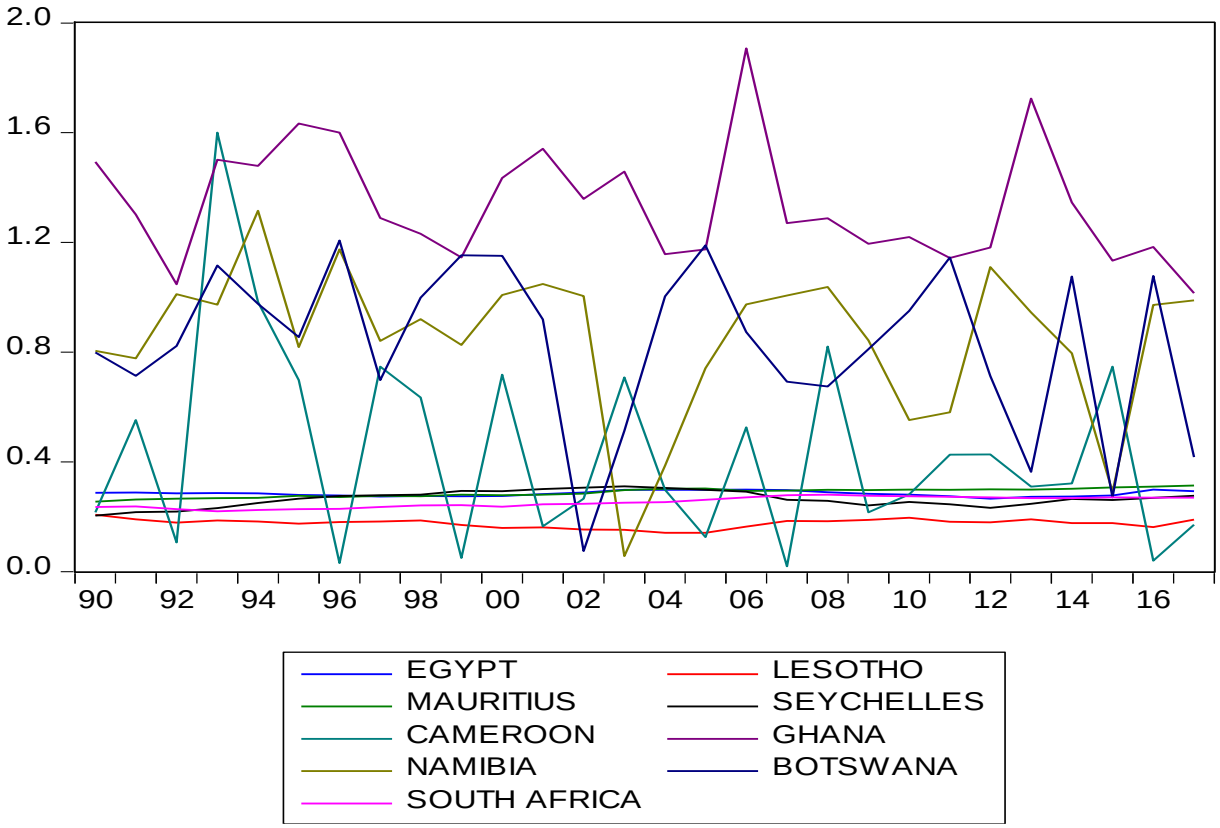
Source: E-views 9.0 output

In this overview, a trend of money supply results revealed that all nine selected countries display a fluctuating trend of money supply in their economies. The trends were lying between the percentage of 2.0 and 1.2 from 1990 to 2016 which is a crate of money supply circulation except for Cameroon which is in contrary with other countries as it displayed a decline of money in circulation in its economy because of higher interest rates and less disposable money in the hands of the consumers thereby

restricting spending (Cameroon Development Update, 2014), where it dropped from 1.3% to 1.1% in 1993 to 1996. Botswana shows a significant increase from 2000 until 2016 simply because of inheriting second-lowest external debt in the Southern African countries, implying an increase in the supply of money which in turn decreases interest rates and its stable macroeconomic environment enabled the government to pay off its debts (World Bank, 2018). The upward trend from 2009 to 2016 in the Mauritian economy as shown in the diagram above was triggered by the 3-4 percent growth of its GDP and helped spur its economy in a positive direction (African development bank, 2018).

2.1.4. Overview of Consumer price index

Figure 2.4: Analysis of consumer price index



Source: E-views 9.0 output

The controlled inflation in South Africa below 0.4 percent indicates a result of a stable macroeconomic environment with inflation under the 7 percent convergence threshold (IMF, 2018). Similarly, the same result prevailed for Botswana, Namibia, and Cameroon as they lie between the controlled inflation rates. On the contrary, Ghana shows two periods in which the country suffered major hits in 2006 and 2013

respectively, the first hit was towards the 2008/9 global crisis which Ghana at the time was one of the vulnerable countries facing political and economic challenges which one of them was high food and oil prices as well as high government spending financing import costs.

2.2. COUNTRY SPECIFICATION

In this context, the review is put on the world macroeconomic issues which have an impediment on the economy of the specified nine selected countries as well as outlining the positive impact these economic issues have on the respective African economies. Studies have been carried out to investigate the major variables that affect each country's economic outlook which was the reason for this study to specify how these selected countries reacted to the harsh economic crises and had to undergo the research because the focus was not merely on high performing economies but as well as on low performing economies. The overview is on all nine specified African countries for the period 1990 to 2017.

2.2.1. Egypt

Egypt is one of the countries in Africa that heavily depend on its agricultural sector and is rich in agricultural productivity to maintain its economic growth. In 2001 and 2002 the economy experienced the September attacks just like other countries, the damage resulted in reduced revenues from tourism, oil and the Suez Canal and the slowness of the economy which marked the economic growth at a rate of 2.3% and remained the same in 2003, since then the GDP growth averaged about 7% from 2005 to 2007. From the period 1999 to 2001 the investment stood at 18.3% from a decline of 16.9% of GDP. The overall investment rate was 18.5% of GDP in 2002/2003 but the rate was below 20.5% of GDP for the 1998 and 1999 periods. During the 2005 to 2007 period total investment averaged between 18.7% and 21.6% of GDP mainly because of increases in domestic invest, public sector investment, private sector investment just to mention a few, since from then it has experienced fluctuating rates of investments in the country The problematic macroeconomic policy is the fiscal policy, were the budget deficit has been growing steadily from 1996 to 1998 with a rate of 3% compared with the 5.5% of GDP in 2000/2001 until it reached 6.4% of GDP in

2002/2003. The money supply was positive with a growth of 11.6% in the 2001/2002 period (AEO, 2003, 2008).

Previously Egypt was financing its budget deficit by borrowing domestically from the National Investment Bank and now it has shifted to issuing government bonds and Treasury bills because it further increased borrowing which was not good for its Economy and financial outlay. According to World Bank (2017), Egypt has seen its toll of budget deficit on its cash flows and the problem could not be controlled because when a country experiences the issue of issuing government bills and bonds it simply states that it is going through serious cash which is afloat to cover small credit domestically not to mention loans abroad.

In addition, huge and determined budget deficit financing through net domestic credit by the Central Bank of Egypt tends to perpetuate high inflationary pressures, where on the other hand issuance of government bonds and treasury bills issued by domestic banks reduces money left for private banks because of their yields in risk-adjusted terms. This proves that indeed there's not enough credit left for private banks because of high budget deficit payments (World Bank, 2018). The price stability problems in Egypt emanates from its budget deficit and its various ways of financing it, and that is what is increasing the inflationary pressures it is currently facing. Increased inflation and inflation expectations happen because of large government debts and services that lead to the increment of budget expenditures, monetization expectations or promising markets that they will earn through the inflation tax.

2.2.2. Mauritius

Mauritius has been experiencing sustained economic growth since its independence in 1986. It has pushed its economy to be recorded by the world bank as an upper-middle-income country. Real GDP growth was at an average of 4.7% during the 2015-2017 period. It was influenced by changing from being an agriculturally based economy to being a more financial service, retail and wholesale trade and information and communications technology-oriented economy (IMF, 2017).

Mauritius like most other African countries experiences the problem of budget deficit which it finances through domestic debt issues and 500 million gran from India in 2016. During the 2015/2016 financed year, the budget deficit was 3.5% compared with 3.2% for the 2014 and 2015 financial years. However, it is expected to decrease in the 2016/2017 fiscal year to 3.3% of GDP. Headline inflation was 5.8% between 2001 to 2010, however it decreased to 3.2% between the years 2011 to 2016. Its average headline inflation peaked at 1.0% in 2016 from 1.3% in 2015 (Ministry of Finance, 2016c; Bank of Mauritius, 2016b). Its problem of high public debt concerning financing its budget deficit crowd out space for investing in infrastructure and human capital as well as become an impediment for economic growth.

2.2.3. Cameroon

Cameroon is an African country that is identified as a Highly Indebted Poor Country (HIPC) and not just a Central African Economic and Monetary Community (CEMAC) member but a country with the largest economy. Because is part of the HIPC initiative it must meet its macroeconomic convergence criteria of the CEMAC especially its inflation, budget balance, debt ratios, debt arrears and reach its HIPC completion point. Its economy since 1996 grew by 4% each year and had an inflation rate of less than 3%. While its fixed investment showed significant increases from 1994 with 14.55 of GDP until 2002 with a prediction of 21.65 of GDP except in 200 where it dropped to 16.4%. Inflation remains high despite declines (AEO, 2005).

Its debt arrears led to increased government finances which reduced tax revenue in 2004. The country got rated by two rating agencies, the Fitch and Standard and Poor's, because of the delays in repaying its debt and lower revenue collection. Since then, its investment has been progressively improving and the government is taking measures to boost investment and drive economic growth (AEO, 2005).

2.2.4. Namibia

Namibia is an upper-middle-income country, which is dependent on the agricultural sector. Before its independence in 1990, it has struggled to integrate into other economic activities which can help develop and grow its economic growth. Since then,

its economic growth maintained a stable rate of 3.3% each year between 2001 and 2008 (AEO, 2002).

Between the period 2000/2001 budget deficit was 3.6% from an average of 3.85 for the 1995 to 1999 period. This was a result of high civil expenditure and provision of jobs to 9000 ex-combatants. It reached a point where the government issued public domestic debt in concern to the budget deficit, and that set the rate at 15% in 1999, which became a concern that indeed the government cannot manage its consistent budget deficit. Since being added to the South African Monetary system, it was required to stimulate investment and economic growth, therefore, it opted for lowering the bank rate up to 11.5%. During 2000 inflation increased to 9.2% because of inflationary pressures from imports. Moreover, from there it became a country with the highest inflation rate in comparison to its trading partners which reduced its competitive advantage with international countries (AEO, 2000).

The domestic investment was largely contributed by the tertiary industry in the post-independence period from 1990 to 2008, which amounted to an average of 55.7% to GFCF, followed by primary industry by 22.5% and lastly the secondary industry by 18.8%. The financial crises in 2009/2010 heavily led to declined government revenue which broadened the budget deficit by 5% of GDP from a previous deficit of 1% in 2008/2009. Moreover, the decline was mainly caused by reduced SACU revenue receipts and reduced mining industry revenue (PSIA, 2010).

In 2015 real GDP was 6.1% followed by continuous contractions until 2017 when it was 0.5%, which resulted in decreased aggregate demand and fiscal consolidation by the government to correct imbalances in high public spending and decreased SACU revenue receipts. The fiscal deficit peaked at 9% of GDP in 2016, followed by 5.4% in 2017. Moreover, the country was financing its deficit through domestic debt of 39% of GDP in 2015, however not only did the country experience pressure on the domestic debt market but also entered into a technical recession in 2016 which led to a contraction of 1% in GDP in the 3rd quarter of 2016 as compared to 5% GDP growth in the corresponding quarter of 2015. Thus, the contraction was slightly less than 1.2% in the second quarter of 2016 (Namibia Statistics Agency, 2016).

2.2.5. South Africa

South Africa is one of Africa's largest economies and is ranked by the world bank as the middle-class income country. Since post-apartheid, after getting its independence South Africa has improved its economic status. That has been shown by achieving key macroeconomic objectives which were meeting primary objectives under the IMF, then structural programs were introduced such as the GEAR (growth employment and redistribution), the RDP program (which is the Reconstruction Development program) just to mention a few. Moreover, the country then maintained good economic growth rates between 1999 to 2017. To break it down, it has managed to record an average of 3.3% of economic growth rate over the 1994 to 2012 period, which indicated an improvement from the 1.4% average growth rate in 1980 to 1993. The South African marked improved, hence its low inflation which made the monetary authorities lessen its policies during the 1999 and 2000 period (IDC, 2013).

It is evident that South Africa's growth has been volatile and correlating to the world's economic growth. However, during 2008-2009 period its growth started to decline so quickly that it led to a technical recession in the first quarter of 2009. Its overall gross fixed capital formation to GDP peaked at 23.1% in 2008 from a rate of 15.2% in 1994. Because of the global financial crisis in 2008/2009, it struggled to grow its investment, which decreased GFCF to 19.2% in 2012. Looking at its headline inflation, statistics showed fluctuating patterns in the previous years of between 9% and 5.7%. therefore, the SARB decided to set an inflation range of between 3% and 6%. During the 2007/2008 period inflation peaked above the 6% limit, from then the reserve bank took measures of cutting the repo rate to try to stabilize the inflation hikes (SARB, 2009). From 1980 to 2010, the economy has been recording consistent budget deficits except in the years 2007 and 2008 when a budget surplus was recorded. According to Treasury the cause of consistent budget deficit was the result of high unemployment and low economic growth (National treasury, 2011).

2.2.6. Lesotho

Lesotho is a small landlocked country enclosed by South Africa. The country became independent in 1966 from the British Protectorate in 1868. However, it continues to be

divided between two major parties, the Basutoland National Party (BNP) and the Basotho Congress Party (BCP), making it a fragile country.

Lesotho's economic growth showed that it was inconsistent from 1990 to 2006 because it grew at about 6% for some years while others it showed growth of 3% until reaching a 7% increase in 2006. The setback came from various shocks like the rand real exchange rate appreciation, industrial countries removing textile quotas, declining terms of trade and continuous droughts. Unfortunately, it looks like the setback is far from being finished hence its high dependence on SACU for revenue which recently showed a decline or delay in receiving the revenue because the Southern African Customs Union (SACU) was busy reviewing its investment projects (IMF, 2018). During the 2008/2009 financial crisis, Lesotho just like any other country in the world was heavily affected especially by the fact that it's a very small country that relies too much on its imports from South Africa and the SACU for a revenue source.

Coming to its fiscal balances, since its low revenue receipts from the SACU, things changed in its revenue receipts reflecting 30% of GDP in 2014 and 2015. It led to a 0.6% in its overall fiscal balance in 2015 with fiscal deficits of 24% of GDP in the 2015-2016 period. With the severe droughts, its inflation increased to 8.5 in 2016 and 6% in 2015 as result of increases in food prices. Its public debt recorded 59.9% of GDP in 2015 with the current deficit at 9.4% of GDP because of its currency depreciation (Macro Poverty Outlook, 2016).

Not only does the reliance of Lesotho on the SACU revenue receipts account for half its revenue source but also contributes towards its government spending. Nonetheless, its vulnerability lead Lesotho in borrowing more than it should since its revenue source no longer contributes much more than it did before and labels it as a high-risk credit country as well as one of the countries that struggle to meet it credit agreement. From that Period onwards it had to come up with measures to generate revenue other than depending on the Southern African Customs Union hence delays and declines in revenge receipt will hinder it from meeting its macroeconomic objectives and cater for the water project and most importantly decreasing its expenditures (Masenyetse and Sephoko, 2012).

2.2.7. Seychelles

Seychelles is a small island economy ranked as a high middle-income country. After its independence in 1976, it succeeded in keeping its economic growth at par. It continued to show exceptional and successive economic prosperity for the past decades until the world's biggest enemy introduced its way in the entire world which is the global financial crisis in 2008. Prior to the global financial crises, it sustained a good economic growth rate between 2005 and 2007 before a slight decrease of 1.1% of growth in the 2008/2009 period. A year after, the economy expanded accounting for about 5.9% in growth rate because of contribution from the tourism and fisheries sector, foreign exchange account, and job creations (African Economic Outlook, 2018).

Even after the financial crisis and encountering some challenges Seychelle's economic performance still showed some progress and improvements. This is because during the 2011 to 2015 period its GDP growth averaged about 5.6%, while in 2016 was 4.4% and lastly accounted for an average of 4.9% in 2017. However, with the rising international fuel prices and fiscal changes in budget inflationary and BOP pressures were estimated to be 3% or less than that in 2017 and 2018. Additional economic growth rate projections of about 4.5% for 2018 and 3.9% in 2019 were made. Since most of its GDP contributions come from tourism, a forecast of 3.8% and 3.2% in 2018 and 2019 respectively was expected to improve the real GDP per capita growth rate. Due to external shocks from the external sector, Brexit, deprecation of the currency and other monetary shocks deem to steer more inflationary pressures this could not be achieved. As a SIDS country, it needs to reform, diversify and restructure its economic prospects to overcome these macroeconomic challenges, especially its fiscal balances. However, the way they decide to address them is very important in sustaining its private sector growth (African Economic Outlook, 2018).

2.2.8. Ghana

Ghana obtained its democratic independence from Britain in 1957 whereby it was characterised by poor economic performance and overtaken by military coup de tats in 1980. In that period its market was lacking policies that were in place to control income and their prices. It was characterised by low productivity, high and volatile

prices and low investment which shrinks its economy. During its second leg of independence, the country set objectives of achieving a GDP growth rate of 8% in 2009 and 10% in 2015 as well as transforming its economy into a middle-income country by 2015 (Overseas Development Institute, 2009).

The financial crisis that occurred in 2008/2009 led to food and fuel price shocks at that time Ghana was not stable and very vulnerable to fiscal shocks and experiencing slow economic growth. Its inflation rate peaked at 18% in 2008 and it was at its highest since 2009 leading to inflationary pressures towards poor households. Its budget deficit was also influenced because it sat around 12% of GDP for continuous years. It was largely driven by high government spending to set off the high food prices in the economy (ODI, 2009).

2.2.9. Botswana

Botswana is a very competitive country in Africa because it has developed itself into a middle-income country from being the least developed country in Africa since its independence in 1966. Its transformation was a result of meeting all criteria of its macroeconomic policies, good governance, effective institutions and its diamond export resource. The economy has been performing well after 2009 even when the financial crisis had influenced its economic growth, which was aided by its export diamond resource. During 2009 the country recorded a -4.9% of economic growth, which in 2010 recorded a positive economic growth of 7.2%. Since then, the country recorded positive rates of economic growth even though in 2012 it recorded lower rates yet still positive (African Economic Outlook, 2012).

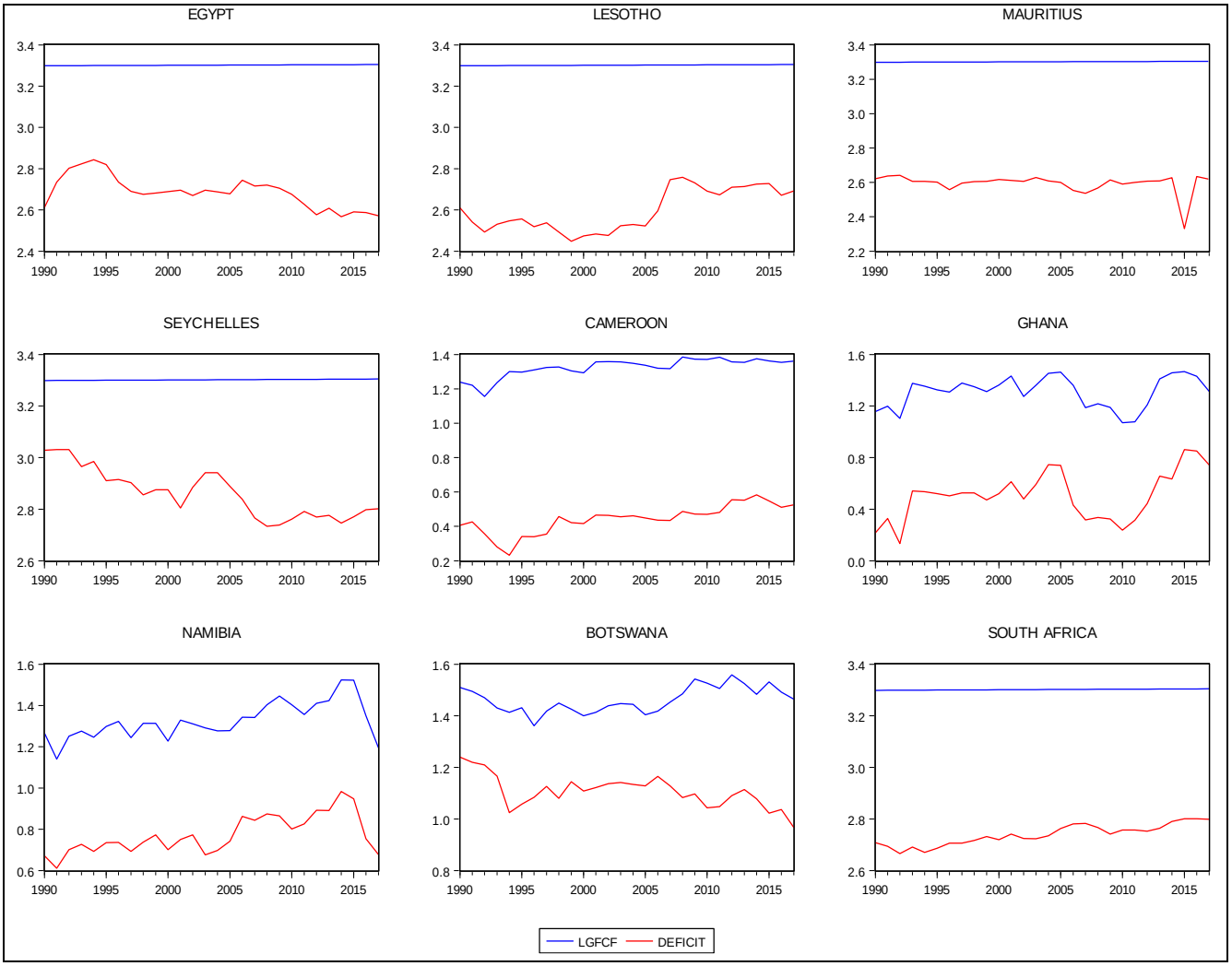
The inflation rate peaked at 9.2% in 2011 and it was very high that it was above its inflation range of between 3 and 6 percent, it was influenced by high international product prices. Botswana like most African countries experiences the problem of a high budget deficit, mostly because of the financial crisis and previous high government expenditure thus it is determined to decrease it in the future through reducing government expenditures and increased revenue receipt. Nonetheless, it is expected to decrease from 8.1% of GDP in 2011 to a further of 5.2% in 2012. Its fixed investment and money supply have been moderate although fixed investment showed

improvements which accounted for about 56% in real GDP in 2011 (African Economic Outlook, 2012).

2.3. TRENDS OF BUDGET DEFICIT AND FIXED INVESTMENT IN SELECTED COUNTRIES.

The overview trends are between budget deficit and fixed investment. This was examined to show the direction in which the variables are moving and if there are any irregular movements between the two for the period 1990 to 2015.

Figure 2.5: Trend between budget deficit and fixed investment



Source: Authorr computation using E-views.

Figure 2.5 presents the line graphs of fixed investment and the budget deficit for the selected countries and the patterns in which they move. For countries Egypt, Lesotho, Mauritius, Seychelles and South Africa, the figure indicated that there were no clear

movements between budget deficit and fixed investment for the period 1990 to 2015. Although, fixed investment shown to be growing above budget deficit in all countries at a relatively persistent and constant pattern throughout the period.

The behaviour for the budget deficit and fixed investment for economies of Cameroon, Ghana, Namibia, and Botswana showed a co-movement or a movement in the same direction even though the fixed investment was growing higher than the budget deficit. These movements are different from the ones observed in Egypt, Lesotho, Mauritius, Seychelles, and South Africa because there was no stable movement of fixed investment, and it was not growing as much as it did while the budget deficit was slightly decreasing towards 0.2 percent of GDP or negatives.

2.4. CHAPTER SUMMARY

The chapter explained the overview of variables in the selected countries. The chapter continued to discuss country specifications which highlighted the country's challenges and macroeconomic prospects which improved or reduced its economy in respect to the selected variables. And lastly, the chapter showed and discussed trends of the budget deficit and fixed investment for 1990 to 2015 in all selected countries. It has been outlined that a budget deficit is indeed a problematic macroeconomic policy.

CHAPTER 3

LITERATURE REVIEW

3.1. INTRODUCTION

Firstly, the chapter starts by discussing various theories, followed by previous studies regarding the effects of budget deficit on fixed investment and other control variables which can have a detrimental effect on fixed investment. This chapter is divided into two sections namely, theoretical literature and empirical literature review.

3.1.1. Theoretical Review

The relevant theories for the study are the accelerator, Neoclassical and Keynesian theories.

3.1.1.1. Accelerator theory

In the accelerator theory developed by Clark (1917) there is an assumption that there is a constant and stable relationship between the stock of capital and the output. Furthermore, during each investment period, the real stock of capital is immediately adjusted to the desired stock of capital. The accelerator theory is a special example of neoclassical investment theory in which price variables are reduced to constants. If the price of output is assumed to be constant and the price variables *s* and *r* in Jorgenson's (1963) user cost of capital, $\left(c = s\left[\delta + r - (\partial s / \partial t) / s\right]\right)$, are fixed, the equation is reduced to:

$$K^* = \alpha Y \tag{1}$$

This principle is the most used theory that assumes that desired capital stock is proportional to output. The theory postulates that every period of investment will therefore depend on output growth:

$$I = \alpha \dot{Y} \tag{2}$$

Each period of investment as mentioned before relies on input and output prices as well as on the cost of capital hence there is a given flexible cost and partial change towards the ideal capital stock. Smith (1961), for example, demonstrated the "logical inseparability" of "marginal efficiency" and the "accelerator" driver of investment

expenditures." Smith (1961) concentrated on the calculus variations to predict investment outcomes.

There is interrelatedness between the level of investment and changes in the level of output growth concerning the accelerator theory as assumed by Harrod (1936, 1948). Hicks (1949) stated that a decline in induced investment in inventories, and fixed plant and equipment occurs when output moves toward full employment level eventually leading to a decrease in output growth. According to Uneze (2012), the accelerator theory was favoured simply because of its realistic nature and simplicity. Another assumption of the model is that the demand for goods and services results in increased demand for machinery and factories. However, the higher the demand for goods produced by capital equipment, the more a need for new investment arises in plants and equipment to meet the expected increase in demand. Hence the existing one could not cater to it, therefore there is a direct relationship between changes in output level and the level of business investment.

3.1.1.2. Neoclassical theory

The accelerator theory developed by Hall back in 1971 was modified through the Neoclassical theory formulated by Jorgenson in 1967 to address its limitations. Static assumptions about future prices, output, and interest rate, perfect competition and exogenously decided output are the identified assumptions of the model. The assumptions of this model are perfect competition and exogenously decided output, static assumptions regarding future prices, output, and interest rate. The author further postulated that the user cost of capital and the level of output determines the ideal capital stock. The cost of capital goods, the real interest rate, and depreciation rate rely on the considerable cost of capital. The delays in decision making and delivery have an inherent effect on the appealed capital and current stock, which establishes the investment equation. The pace of user investment slows down as the cost of assets increase. Nevertheless, some of these assumptions, especially those of static expectations of economic agents, can be overly exorbitant (Sineviciene and Vasiliauskaite, 2012). Under these conditions, a perpetual expansion in government consumption driven by the increase in the budget deficits initiates interest rates and, in this manner, crowds out private investment (Diamond, 1965). Long-run

development is insignificantly caused by the expansions in budget deficit crowding private investment.

The neoclassical government has applied interest rate caps to reassure investors that they can afford to pay capital. As a result, interest rates have been fixed at low-interest rates, which can be below inflation. This boosted the need for savings, resulting in a shortage of assets in the formal financial system. This led MacKinnon and Shaw (1973) to call it financial or monetary repression. The authors challenged the neoclassical way of thinking and hypothesized that low-interest rates would lead to higher investments. It was further elaborated that; low-interest rates lead to a capital shortage in the economy as a cash flow to countries with high rates of return on capital. Mackinnon and Shaw (1973) identified that encouraging high borrowing costs to save money increased the amount of domestic credit available and attracted investment. The theory reveals that lack of accessible financial assets for investment is one of the detrimental factors that discourage investment instead of the cost of financial assets. The financial development recommended by MacKinnon and Shaw (1973) can promote investment and economic growth by relaxing credit restrictions on investment. In short, poor fiscal development makes credit essential and, on the contrary, can influence private investment. Bank loans are pre-requisites of credit for individuals in countries with poor financial systems and stock markets.

3.1.1.3. Keynesian theory

The Keynesian view was developed by British economist John Maynard Keynes in 1936 and borrowed by the study of Eze and Nwambeke (2015); Bakare, Adesanya, Boralinwa, 2014; Above all, Ali (2014). The Keynesianism assumption points out that, increasing government consumption through investment, employment and profitability can lead to a significant impact on economic growth (Eze and Nwambeke, 2015). It means that in periods of the budget deficit the government needs to expand programs that will enhance inadequate private investment in the economy. In order to boost government spending and money supply, the government should finance the budget deficit with intentions to improve private investment. Another assumption in the economist's view is that the state reverses the recession by raising money from non-public sources. Economic theory assumes that state participation in the money market to restore the budget deficit is a bailout to achieve attractive economic goals through

various regulatory, harmonised and stabilising measures as well as economic resource allocation. In general, the Keynesian hypothesis revealed that to maintain economic stability in the short run, government spending should be increased.

Keynes (1936) argued that savings were a function of income. Keynesian consumption can be divided into two components: the autonomous component, which is the minimum level of consumption that does not depend on income level, and the marginal propensity to consume, which depends on individual income level. According to Duesenberry (1949), the linkage between income and consumption is not as simple as Keynes's consumption approach described but shows that the level of consumption depends on how much an individual earns. The hypothesis is that consumption does not only consider how much an individual has earned (absolute income) but also what other measures have affected the income in the past, especially concerning the other members of society and current standards (relative income). The theory emphasizes that consumption does not change whenever income changes. Duesenberry (1949) also pointed out that the satisfaction that results from each level of consumption is not related to the absolute level of consumption, but the level of consumption of society. The same applies to savings. It does not increase with increasing income but increasing personal income levels increase the propensity to save.

Friedman decided to deviate from Keynes's and Dusenbury's approach to consumption by keeping in mind that savings are based on constant income rather than long-term income. The author went on to explain that personal consumption decisions are not based on short-term gains or capital gains, as human consumption adapts to needs over time. According to his approach, temporary windfalls influence the individual's saving behaviour (Friedman, 1957). The permanent income theory outlines that the decision behind individuals increasing their income regularly is to smooth out their consumption over different phases in their lives. According to Friedman (1957), an individual's current consumption is not influenced by temporary changes in income but by changes in permanent income. The theory is essentially based on consumer behaviour and varies from the traditional Keynesian marginal propensity to consume. Hence the assumption that people will magnify temporary income changes to derive long-term even consumption patterns.

3.1.2. Empirical review

3.1.2.1. Effects of budget deficit on fixed investment

Kiptui (2005) evaluated the impact of selected macroeconomic variables including the budget deficit, government consumption, tax burden and public debt on private investment in Kenya. The study used the autoregressive distributed lag (ARDL) method to assess the cointegration relationship between budget deficit and private investment. The findings revealed that budget shortfalls have a negative impact on private investment. This means that Kenya's budget discipline is not being enforced on time. Jahromi and Zayer (2008) found similar results in their study focusing on the impact of the budget deficit on private investment in Iran between 1342 and 1384.

A similar study by Kaakunga (2003), Kiptui (2005), Jahromi and Zayer (2008) and Traum and Yang (2010) investigated the association between budget shortfalls and private investment by means of econometric modelling. Berhheim (1987), Bartolini and Lahiri (2006) applied the cross-sectional analysis in their studies. Another study by Mauro (1995, 1997) and Pellegrini and Gerlagh (2004) paid attention to the relationship between economic growth, investment and corruption. Moreover, Ahmed and Alamder (2018) also added to the empirical literature in respect to investment, carried out in Pakistan, on the effects of corruption and budget deficit on private investment.

According to Apkokodje (1998), most developing countries in Africa from the end of the 1970s through the mid-1980s were experiencing an extreme economic crisis. The economic crisis emanated from persistent macroeconomic imbalances, the ongoing balance of payment problems, a huge budget deficit, a growing gap between investment and high rates of domestic inflation. The empirical results revealed a negative influence of high inflation and real exchange rate on private investment in Nigeria. The significance of the study was to emphasize and elaborate on the inherent consequences of a large budget deficit on private capital formation.

Bamidele and Englama (1998) researched the connection between the macroeconomic environment and private investment conduct in Nigeria. The outcomes uncovered that significant expense of doing business led to policy reversals,

political instability and poor infrastructure facilities. According to their study, for Nigeria to experience economic development and improved economic growth the country needs to revise and have sound macroeconomic stability, diversified export base, political stability, reliable and efficient infrastructure and transparency.

In Pakistan, Fatima, Ather and Wali (2011) used a time series model within a 2SLS-based framework based on simultaneous equations to investigate the impact of fiscal deficit on investment and economic growth during the period 1980-2009. The results showed a direct relationship between budget deficits and economic growth, and between the balance of payments deficits and fiscal deficits. From 1991 to 1992 and from 2013 to 2014, Bhoir and Dayre (2015) analysed the impact of budget deficits on India's economic growth, using the ordinary least squares approach. The results indicated no significant link between fiscal deficits and economic growth. In addition, the authors recommended that great attention should be shifted towards human development indicators related to health, education and infrastructure development for the development of the Indian economy, which will improve human and physical capital productivity.

Edame and Okoi (2015) investigated the effects of fiscal deficits, interest rates and total fixed capital formation on Nigeria's economic growth. The embarked study done during the military regime period revealed that fiscal deficit has a significant effect on economic growth and insignificant effect amongst fiscal deficit and economic growth during the democratic period. The results further proved that while interest rates had a significant but negative impact on the economic growth of both governments, both the military and democratic governments had significant total capital-building growth effects.

Ugochukwu and Chinyere (2013) examined the effects of private investment on economic growth in Nigeria. The study proved that capital formation can boost and contribute positively to Nigeria’s economy in the long run. Similar conclusions were drawn from a study by Ncanywa and Makhenyane (2016). Ghura and Hadji (1996); Gra, 1997; Beddy (1999); Kumo (2012) and Ugochukwu and Chinyere (2013), capital formation plays an important role in the development of economic growth in most developing countries. Furthermore, Ugochukwu and Chinyere (2013); Adegboyega

and Odusanya (2014) and Muneer et al. (2016) confirmed the direct linkage between increased economic growth and increased capital formation in Nigeria.

Blejer and Khan (1984) and Chhibber and Wijnbergen (1988) outlined the fact that private and public sectors in developing countries compete for scarce financial resources. That is why most private sectors are unable to provide a resource as a result of a higher fiscal deficit hence findings show its detrimental impact on private investment. Another variable that contributes negatively towards private investment is high government expenditure which the government needs to reduce to accelerate its economic growth. To encourage good private sector investment, the government needs to reasonable or constant public sector development expenditure as it crowds out private investment. Additionally, Shuaib and Dania (2015) revealed a direct link between economic growth and gross domestic capital formation.

Bukhari et al. (2007) examined the relationship between private investment and economic growth in East Asian countries from 1971 to 2000. The authors utilized the ARDL approach and found that economic growth was adversely affected by the crowding-out effect of private investment. An analysis of public investment dynamics also revealed that the reallocation of public spending has made a positive contribution to economic growth. According to the analysis, public investment, public consumption and private investment in all selected countries have a long-term positive relationship with economic growth. Haque (2013) came to the same conclusion that private and public investment have long-term positive effects on economic development by using the Cobb-Douglas function in Bangladesh. To further evaluate the variables, the authors used an error-correction model and found that capital formation plays an important role in stimulating economic growth in both the public and private sectors. The results show that economic growth is one of the most important factors driving investment in Bangladesh.

Hatano (2010) conducted a survey in Japan and found that there is a long-term equity relationship between private and public investment, rather than an investment cash flow relationship between the variables. According to Kollamparambil and Nicolaou (2011), public investment does not overwhelm private investment but indirectly accelerates private investment in South Africa. Similarly, Gjini and Kukeli (2012)

showed that there is no crowding-out effect of public investment on private investment, and the crowding-out effect of public investment on private investment is small.

Phetsavong and Ichihashi (2012) examined 15 Asian emerging nations from 1984 to 2009 using Le and Suruga's (2005) economic growth model and fixed-effects model. Private investment and economic growth were discovered to have a cointegrating relationship, which was determined to be very significant to the Asian economy, but public expenditure, financing, and economic growth were discovered to have an adverse association.

3.1.2.2. Causality between budget deficit and gross fixed capital formation

Kiptui (2005) examined the effects of budget deficit on private investment in Kenya and found that budget deficit has lagged effects on private investment which could not be noticed in the short run. In the study by Asogwa and Chetachukwu (2013) the assessment was on the effects of budget deficit on non-public investment in the Federal Republic of Nigeria and empirical analysis found that non-public investment was crowded out by budget deficit. The granger causality further demonstrated that there is a causal direction running from non-public investment to budget deficit with feedback.

Traum and Yang (2010) revealed the link between government debt, real interest rates, and private investment. It was observed that, depending on the cause for the debt as a percentage of GDP, government obligations might either crowd in or crowd out private investment in the short run. Private investment is crowded in when distortionary taxes are reduced; likewise, private investment is pushed out when government consumption spending and transfers are increased. In related research, Vamvoukas (2000) examined the relationship between fiscal deficits and interest rates in Greece from 1970 to 1994. The research adopted the ECM structure and integrated it with Barro's (1981, 1987) method of diving government consumption in long-term and short-term portions. The findings revealed that the study supports the Keynesian proposition and found the existence of a cointegrating relationship amongst interest rate and budget deficit in short and long run periods.

Malawi (2005) investigated patterns of total fixed capital formation and its impact on Algeria's money supply and economic production in 1971 and 2003. The Granger causality test was used to analyze the variability and the impulse response function. According to the Granger test, the outcome shows that all factors, particularly money supply and fixed capital formation, can aid economic growth. Oskooee (1999) conducted a study on crowding in or crowding out impact of budget deficits on Private Investment for the economy of the United States. The main aim of the study was to create empirical literature for any one school of thought over the long run. Yearly data for the was taken. To check the presence of a long-run relationship between real fixed investment and budget deficit yearly data was selected from 1947 through 1992, whereby the results revealed three cointegrating vectors among investment, income, interest rate, and the budget deficit.

Karim, Karim and Ahmad (2010) investigated the relationship between economic development, fixed investment, and household consumption in Malaysia. The basic vector error correction model was applied in the analysis, and the outcome demonstrated that economic growth was indeed affected by household consumption and fixed investment in the short run. Furthermore, the authors hypothesized that demand-side policies influencing household consumption and investment are incapable of boosting the economy in the long run. Karim et al. (2010) concluded that fixed investments in Malaysia are significant only in the short run. Another study used Granger causality analysis on infrastructure investment and economic growth in South Africa, and the empirical results demonstrated a granger causal relationship between economic infrastructure investment and GDP growth (Kumo, 2012).

Zafar (2011) examined the relationship between Saudi Arabia's domestic investment, exports, and economic growth in the period 1970 to 2007. In this study, a cointegration analysis approach was employed and found that there was a long-term relationship between the three variables. Additionally, the results of the survey showed that domestic investment alone had a significant impact on long-term and short-term economic growth.

Tien (2016) examined the association amongst foreign direct investment, domestic investment, and the exchange rate of Vietnam from the period 1985 to 2015. The VAR model was used to evaluate short-term interactions between variables. According to the survey, the inflow of foreign direct investment and economic growth is due to domestic investment, and growth is expected. In addition, the study found that the inflow of foreign direct investment did not affect Vietnam's economic growth. Nowbutsing (2012) applied Mauritius's boundary test method to see if foreign direct investment (FDI) impacts capital formation and economic growth. The study also showed that foreign direct investment had a positive and significant long-term impact on economic growth. According to Mauritius data, a 0.17% increase in FDI will contribute to economic growth.

Diep, Dang and Bui (2015) utilised the ARDL model to find cointegration amongst variables through the Pesaran et al. (2001) boundary approach. The outcomes proposed that both quality and efficiency of public investment are yet restricted, although there exists a long-term relationship between public investment and economic growth, however, there are no grounds to show the viability of public investment in short-term investment.

In India from 1970 to 2012, a study by Mohanty (2012) analysed the short-term and long-term relationships between fiscal deficits and economic growth. The survey found that there is a significant negative long-term relationship between fiscal deficits and economic growth. But in the short term, it was not possible to establish a relationship between fiscal deficits and economic growth. In addition, the study found that the negative impact of the reformed fiscal deficit on economic growth was greater than the impact of the pre-reform budget deficit. In recent years, public investment has been funded by external and internal credit, which has replaced overall private sector investment (Binte Ajaz and Ellahi, 2012).

Rana and Wahid (2016) examined the impact of budget deficit on economic growth on a time series analysis, the study used the ordinary least squares technique as well as the vector error correction model and the Granger causality test. The empirical results revealed a significant but negative impact of budget deficit on economic growth. Another study by Dritsaki (2015) focused on the savings and investment relationship

in Greece for the period 1980 to 2012. The study employed the augmented Dickey-Fuller test, the ARDL bounds test, the Granger causality test and the variance decomposition to further assess how the variables react to one another. The empirical analysis revealed a short and long-run relationship between the variables, and the granger causality showed a unidirectional relationship, which was running from saving to investment and lastly the variance decomposition found that domestic saving causes investment in the long run.

Regarding evidence from Uganda, Musa and Mawejje (2014) paid attention to the macroeconomic impact of the budget deficit by employing the vector error correction model. The model revealed that increases in the current account deficit and the interest rate were a cause of the macroeconomic impacts of the budget deficit in Uganda. The study recommended that for the Ugandan economy to avoid problems in collecting tax, revising and modifying policies needs to be prioritized to reduce tax and corruption. In Nigeria, Osuka and Achinihu (2014) examined the effects of budget deficit on macroeconomic variables such as gross domestic product, interest rate, nominal exchange rate and inflation rate from 1981 to 2012. The results showed that all variables were stationary at I (1) and a cointegration was found between the variables. This allowed the author to further investigate the direct relationships between variables using the Granger causality test. Causality testing has shown a one-way causal relationship between gross domestic product and the budget deficit, but there is a causal relationship between the budget deficit and inflation, between the budget deficit and the nominal exchange rate, or between the budget deficit and interest rates. Studies have also shown that budget deficits affect Nigeria's macroeconomic variables.

Wosowei (2013) used the OLS approach to investigate the relationship between budget deficits and macroeconomic aggregates for the period 1989-2010 and to assess the impact of budget deficits on macroeconomic variables. The Engle-Granger approach was also used to identify the existence of cointegrations between budget deficits, gross domestic product, government tax and unemployment. The OLS approach revealed that macroeconomic variables are not directly impacted by the budget deficit. On the other hand, the Engle-Granger approach considered bilateral causality between budget deficits and gross domestic product, government taxes and

unemployment and an independent relationship between government spending and inflation.

3.2. CHAPTER SUMMARY

The chapter discussed theoretical and empirical review for this study and the discussion, it showed that most studies were conducted using the ARDL method for time series data, the Ordinary least squares and the VECM approach. Different conclusions were drawn from their studies on the relationship between budget deficit and fixed investment. Most studies were carried on the effects of fixed investment on economic growth while others were on the relationship between fiscal deficit economic growth. This study will be investigating the effects of budget deficit on fixed investment in selected African countries using Panel ARDL methodology in annual frequency. With that being said, it gives leads to the following chapter which is the research methodology employed in the study.

CHAPTER 4

RESEARCH METHODOLOGY

4.1. INTRODUCTION

The study adopted an autoregressive distributed lag (ARDL) method to evaluate the effects of budget deficits on gross fixed capital formation in African countries. This section will discuss the data, model specification, unit root and diagnostic tests.

4.1.1. Data

The study embraced a quantitative research approach and a panel data method, which is a combination of time series and cross-sectional studies. The panel data consists of data from nine African countries namely Egypt, Lesotho, Mauritius, Seychelles, Namibia, Cameroon, Ghana, Botswana and South Africa. The model includes variables such as budget deficit, fixed investment, money supply and consumer price index. The data was sourced from the World Bank Development Indicators for the period 1990 to 2017. For the purpose of this study, data sourced from the World Bank is deemed accurate and reliable.

4.1.2. Specification of the model

The study adopted the model from the reviewed literature by Nyasha, Coulibaly and Kwaramba (2018) as well as (Knack and Keefer, 1995; Gichamo, 2012) in order to examine the impact of budget deficit on investment. In linear form, the model is specified as follows:

$$GFCF_{it} = \beta_0 + \beta_1 BD_{it}\ \beta_2 MS_{it} + \beta_3 CPI_{it} + \varepsilon_{it} \quad (1.1)$$

Therefore, since some variables are non-linear, logarithms were introduced to deal with non-linearity changing equation (1.1) to:

$$LGFCF_{it} = \beta_0 + BD_{it} + LMS_{it} + LCPI_{it} + \varepsilon_{it} \quad (1.2)$$

Where, i represents the countries chosen for the proposed study while t stands for the period of the study. β_0 is a constant, LGFCF is the dependent variable and a logarithm proxy for fixed investment as a percentage of GDP, BD is the independent

variable and a proxy for the budget deficit as percentage of GDP. Furthermore, LMS is denoting the log of the money supply as percentage of GDP, and lastly, the log of Consumer Price Index is denoted as LCPI which are used as control variables. ε represents the error term that may be included in the specified model to capture for omitted variables and measurement errors.

The panel data model was established to deal with the matters of the sample size where the number of time series observations T were small (approximately four or five observations) but the numbers of the groups or individuals N were large. Hence the asymptotic statistical theory was calculated by letting $N \to \infty$ for fixed T in comparison with the time series study which allowed $T \to \infty$ for fixed N.

The panel data has advantages that make the model deal with problems of time series studies and enables the works of the authors who use this type of model to get the best of both time series and cross-sectional data. Barberi (2016) stated that they include benefits of using data from countries in a panel for which the observations of time series data are limited and would prevent studies of many theories interested. Also, the advantage of the inclusion of better power properties of testing procedures in contrast to many standard time series methods and the issues of convergence as well as the power purchasing parity can be studied in a panel context. Provides an advantage when dealing with estimation and causal identification (Stritch, 2017). Other advantages include the likes of controlling individual heterogeneity, accurate prediction for individual outcomes by pooling the data rather than dealing with predictions of individual outcomes in question, controls the impact of omitted variables, problems of measurement errors since the availability of multiple observations at a given time allows the researcher to make the different transformation to induce different and deductible changes in the estimators (Hsiao, 2007).

The objective of the study is to investigate the effects of budget deficit on fixed investment in African countries and the impact budget deficit has on public and private investment. A study by Chipote and Tsegaye (2014) stated that developing countries are and have been experiencing low investment activities. In addition, Ncanywa and Letsoalo (2019) added that low industrial advancement, and income inequality are some of the factors which have an impact on fixed investment.

4.1.3. Definition of independent variables and a priori expectation

Budget deficit: The World Bank defines budget deficit as the difference between expenditure items including interest on government debt, transfers and subsidies, and revenue items including grants and sale of assets. It is defined by the IMF as the fiscal deficit amounts to expenditure on goods and services adding transfers subtracting from revenue (+ grants) plus lending (- payments) (Doh-Nani 2011). In simple terms, the budget deficit is defined as when government expenditures are more than government revenues. There is an expectation of a negative effect on fixed investment.

Money supply: that is the broad money in the country as a percentage of GDP which is made is the amount of money outside banks; demand deposits other than those of the central government; the time, reserve funds, and foreign currency deposits of other than the central government; bank and travellers' checks; and different protections, for example, certificate of deposit and commercial paper (World Bank, 2019). The a priori expectation of money supply variable to fixed investment is positive because if there is money in the country or the purchasing power parity has high value it is then expected that the private investment as well the public investments will be positively affected leading to the crowding-in effects. Therefore, the contributed percentage towards GDP will be available, leading to more money available for government spending (public and private investment and government spending activities which increasing money supply).

Consumer price index: The inflation on private investment may be negatively impacted since the increase in inflation rate generally increases the cost of doing business and makes macroeconomics to be unstable as well as ensuring uncertainty on the expected investment returns. This may essentially diminish the level of private investment in the economy. When the inflation rate is high, private investors find it hard to plan because they cannot predict future costs. Hence in this kind of situation investors may be required to participate in short term investments which normally do not have sufficient forward or backwards linkages. Therefore, the apriori expectation is that inflation will have a negative effect on fixed investment.

4.2. ESTIMATION TECHNIQUES

The study adopted the panel unit root to test for stationary series, panel cointegration, the panel Autoregressive Distributed Lag Model (ARDL) to test for the long run relationship between the gross fixed capital formation, budget deficit, and money supply and lastly consumer price index. Other techniques which were used include the diagnostic and stability tests and the impulse response function as well as the variance decomposition.

4.2.1. Panel Unit Root Test

The study employs the panel data unit root testing because it focuses on various countries, not on an individual country. In order to avoid getting misspecifications of the model, spurious regression and unreliable and unpractical inferences, determining the order of integration must be prioritised. The study by Krentz (2012) proposed that panel data unit root tests need to adjust to time series and cross-section analysis whenever dealing with non-stationary data. Additionally, Krentz (2012); Ngongang (2005) and Ramirez (2006) proposed that unit root tests have less power than the panel-based unit root tests because they are used in the examination of individual time series.

Each time a series contains a unit root the tests have the power to reject the null hypothesis. The study employed the LLC test (Levin, Lin and Chu, 2002) and the Fisher type tests using augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit roots tests. The reason for the application of the Fisher ADF and PP tests is that they rely on heterogeneity assumption among the observations (Maddala, 1999; Baltagi and Kao, 2000; Cheng, 2011; Nell and Zimmermann, 2011). Since African countries are naturally heterogeneous, they guarantee reliable results.

The inclusivity of the heterogeneity in the panel data model for cross-country found a solution for the asymmetric ways of dealing with the null hypothesis as well as the alternative hypothesis and that is not visible or easily detected from using the univariate time series or cross-sectional models. Simply because of the same null hypothesis that is carried throughout all i however the requirement of the alternative hypothesis stands to contrast i (Pesaran, 2011).

The panel unit root tests are based on the following univariate regression:

$$\Delta y_{it} = \alpha_i + \pi_i y_{i,t-1} + \varepsilon_{it} \quad (1.3)$$

where $\pi_i = \gamma_i - 1$,

The null hypothesis says all the series have the unit root $H_0 : \pi = 0$ (for all i) and the alternative hypothesis is that all series are stationary for the same mean-reversion parameter $H_1 : \pi_i = \pi < 0$ (for each country).

The first step in constructing panel data is to determine the non-stationary property of each variable. Testing of each of the series in the levels and in the first difference has been applied. All variables were tested at level and individual and intercept using the Fisher (ADF) Test and Fisher (PP) Tests and Levin, Lin and Chu test. A stationary series can be defined as one with a constant mean, constant variance and constant autocovariance for each given lag (Gujarati & Porter, 2009).

4.2.1.1. Fisher ADF and fisher PP test

Maddala and Wu (1999) suggested that to test for a unit root in panel data a non-parametric Fisher-type test must be used, which is based on a combination of p-values and test-statistics for a unit root in each cross-sectional unit the ADF and PP tests. It allows for as much heterogeneity across units as possible. If the test statistics are continuous, the significance levels P_i $(i = 1, 2, \dots, N)$ are the uniform (0, 1) variables and $-2log_e P_i$ has a x^2 distribution with two degrees of freedom. Using the x^2 Variables we get:

$$\lambda = -2 \sum_{i=1}^{N} log_e P_i \quad (1.4)$$

has a x^2 distribution with $2N$ degrees of freedom as $T_i \to \infty$ for all N

When N is large; it is necessary to modify the P test since in the limit it has a degenerate distribution. Having for the P test $E[-2In\, p_i] = 2$ and $Var[-2In\, p_i] = 4$, Choi (2001) proposed a Z test:

$$Z = \frac{1}{2\sqrt{N}} \sum_{i=1}^{N} (-2In\, \rho_i - 2) \quad (1.5)$$

where the Lindberg-Levy theorem is sufficient to show that Z converges to a standard normal distribution $(T_i, N \to \infty)$ for the null hypothesis.

4.2.1.2. Levin, Lin and Chu (LLC)

The test studies the model in which the coefficient of the lagged dependent variable is intended to be homogenous across units of the panel data (Levin, Lin and Chu, 2002). The test is expressed using the following equation for the model**:**

$$\Delta y_{it} = \alpha_i + \rho y_{i,t-1} + \sum_{z=1}^{pi} \beta_{i,z} \Delta y_{i,t-z} + \varepsilon_{i,t} \quad (1.6)$$

where $i = 1,\ldots, N$ and $t = 1, \ldots, T$. The error.s $\varepsilon_{i,t}$ $i.i.d.$ $(0, \sigma_{\varepsilon_i}^2)$ are assumed to be independent across the units of the sample.

The LLC tests the hypothesis as being**:**

$$H_o : \rho = 0$$

$$H_1 : \rho = \rho_i < 0$$

For all i = 1,…, *N*, with all auxiliary assumptions about the individual effects (α_i= 0 for all i = 1,…, N under H_o) Thus, under the homogenous alternative, the first order serial correlation coefficient ρ is required to be identical in all units. It is a precondition for the fact that the test is pooled. Under the null hypothesis, the model without deterministic trend its standard t-statistics t_p for a pooled estimator $\hat{p}$ has a standard normal distribution when N and T increases and $\sqrt{N/T} \to 0$. But the statistics changes to negative infinity for a model with individual effects. The LLC test tests the following adjusted t-statistics:

$$t *_p = \frac{t_p}{\sigma *_T} - NT\widehat{S_N} \left(\frac{\hat{\sigma}_{\hat{\rho}}}{\hat{\sigma}^2 \tilde{\varepsilon}}\right)\left(\frac{\mu *_T}{\sigma *_T}\right) \quad (1.7)$$

where $\mu *_T$ the mean adjustment as well as the function for the average individual ratios of long to short run variances (Levin, Lin and Chu, 2002).

$\sigma *_T$ is the standard deviation adjustment for various sample sizes T

$\widehat{S_N} = \left(\frac{1}{N}\right)\sum_{i=1}^{N} \hat{\sigma}_{yi} \ /\hat{\sigma}_{\varepsilon i}$ With $\hat{\sigma}_{yi}$ as the kernel estimator of the long run variance for the country i.

4.2.2. Optimal Lag Length Selection

Guterez, Souza and Guillèn (2007) stated that inferences from simultaneous equation modelling techniques based on Vector Auto Regression (VAR) and cointegration testing demonstrations are delicate to the right determination of the ideal lag length. To accurately choose the ideal lag length, information criteria are commonly utilized. The Schwarz data basis (SIC) is steady, which implies that asymptotically it will choose the right lag order while it additionally has the strictest penalty term for the consideration of more parameters which implies that it will, in general, distinguish under-parameterized models.

The Hannan-Quinn information criterion (HQIC), like SIC, is steady however ineffective and it has a less severe penalty term than SIC. AIC, interestingly, is effective however is conflicting (Brooks, 2008). It additionally has the most un-severe penalty term which implies that it will likely choose over-parametrized models (Brooks, 2008). Guterez, Souza and Guillèn (2007) outlined that the SIC and HQIC are not reasonable for selecting lag length in small samples, where consistency isn't pertinent because of the small sample size, and rather suggest the utilization of AIC as it is proficient and, in this way, liable to select the right lag length for the VAR model. This is because the AIC gauges the data lost when a model is utilized to represent the process to generate data and thus gives a proper tradeoff comparison between the integrity of fit and complexity of the model (Burnham, Anderson and Huyvaert, 2011).

According to Khim and Liew (2004), the application of lag length selection is important because it identifies the true lag length $\hat{\rho}$ for the model. The autoregressive process is divided into two stages, which the first stage is to identify the AR Lag length $\hat{\rho}$ which is structured under certain rules of the lag length selection criteria and the estimation of statistical values of intercepts and coefficients using regression analysis. The $AR(\rho)$ process of the series y_t is represented as:

$$y_t = a_1 y_{t-1} + \alpha_2 y_{t-2} + \cdots + \alpha_p y_{t-p} + \ \varepsilon_t \qquad (1.8)$$

where α_1, α_2,…., a_p are autoregressive parameters and ε_t are normally distributed random error terms with a zero mean and a finite variance σ^2. The criteria to be considered are:

a) Akaike information criterion, AIC= $-2T\ [In(\hat{\sigma}\, p^2)] + 2\rho$;
b) Schwarz information criterion, SIC= $In(\hat{\sigma}p^2) + \frac{[pIn\ (T)]}{T}$;
c) Hannan-Quinn criterion, HQC= $In(\hat{\sigma}p^2) + 2T^{-1}pIn\ \frac{[In\ (T)]}{T}$;
d) the final prediction error, FPE= $\hat{\sigma}p^2(T-p)^{-1}\ (T+P)$;

4.2.3. Panel Cointegration tests

The Panel data cointegration tests are utilized to analyse the long-run relationship between all variables. When testing for cointegration, issues such as (1) the heterogeneity in the parameters of the cointegrating relationships, (2) heterogeneity in the number of cointegrating relationships across countries and (3) the possibility of cointegration between the series from different countries need to be considered (Verbeek, 2004).

Brooks (2008) stated that variables are cointegrated if a linear combination of them is stationary. Most time series are non-stationary however they 'move together over time because of a few factors affecting the series. The series is bound to cointegrate in the long run. There is a possibility that most cointegrating variables may change from their initial relationship in the short run, but their association would return in the long run. The cointegration relationship may be seen as a long-term or equilibrium phenomenon.

If there is a possibility of no cointegrating relationship, which is almost always the case, most cointegration tests start with estimating the cointegrating regression. The panel regression is as follows:

$$y_{it} = \alpha_i + \beta_i x_{it} + u_{it} \qquad (1.9)$$

Where both y_{it} and x_{it} are integrated of order one. Cointegration implies that u_{it} is stationary for each. Additionally, homogeneous cointegration requires that $\beta_i = \beta$. For a cointegrating parameter that is heterogeneous, and homogeneity exists, one estimates

$$y_{it} = \beta x_{it} + [(\beta_i - \beta)\, x_{it} + u_{it}] \quad (1.10)$$

Generally, the composite error term is integrated of order one, for u_{it} is stationary. The pooled estimator averaging over i for the noise in the equation becomes less powerful in the expression above because the issue of spurious regression is becoming less influential. In most cases, when $N \to \infty$, the fixed effects estimator for β is constant for the long-run average relation parameter, just as asymptotically ordinary, despite the absence of cointegration (Phillips and Moon, 1999). The Panel cointegration tests utilized in this investigation are the Pedroni (Engle-granger), Kao (Engle-Granger) and the Fisher (combined- Johannsen) cointegration tests.

4.2.3.1. Pedroni (Engle-Granger based) panel cointegration test

Pedroni (1999, 2004) allows for the heterogeneous intercept and trend coefficients across cross-sections using different methods for developing statistics of no cointegration under the null hypothesis. There are two alternative hypotheses, which are the homogenous and heterogeneous alternatives where the latter is known as the panel statistics test and the former as the group statistics test. It considers the following model for heterogeneous panel data:

$$y_{it} = \alpha_{it} + x_{it}\beta_i + u_{it} \quad (1.11)$$

(i = 1,… N and t = 1,…T)

Under the processes:

$$x_{it} = x_{it-1} + \epsilon_{it} \quad (1.12)$$

$$y_{it} = y_{it-1} + v_{it} \quad (1.13)$$

where x_{it} individual constant term; β_i is the slope parameters for cross-section i of the panel, ϵ_{it} , v_{it} are stationary disturbance terms and y_{it} & x_{it} are integrated processes of order 1 for all i.

The null hypothesis for panel statistics and group statistics of no cointegration are as follows:

$$H_0 : y_i = 1, \text{ for all } i$$

$$H_0 : Y_i < 1, \text{ for all } i$$

The Pedroni cointegration test performs better than the other tests because no exogeneity requirements are imposed on the independent variables in the cointegrating equation and it combines only the required information in relation to the possible cointegrating relationships. Pedroni (1999) defined the seven residual-based panel cointegration statistics as follows:

a) Panel v-Statistic:

$$Z_{\hat{v}NT} = \frac{1}{\left(\sum_{i-1}^{N}\sum_{t-1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{it-1}^{2}\right)}$$

b) Panel p-Statistic:

$$Z_{\hat{p}NT-1} = \frac{\sum_{i-1}^{N}\sum_{t-1}^{T}\hat{L}_{11i}^{-2}\left(\hat{e}_{it-1}\,\Delta\hat{e}_{it}-\hat{\lambda}_i\right)}{\left(\sum_{i-1}^{N}\sum_{t-1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{it-1}^{2}\right)}$$

c) Panel t-Statistic (non-parametric):

$$Z_{tNT} = \frac{\sum_{i-1}^{N}\sum_{t-1}^{T}\hat{L}_{11i}^{-2}\left(\hat{e}_{it-1}\,\Delta\hat{e}_{it}-\hat{\lambda}_i\right)}{\sqrt{\hat{\sigma}_{NT}^{2}\left(\sum_{i-1}^{N}\sum_{t-1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{it-1}^{2}\right)}}$$

d) Panel t-Statistics (parametric):

$$Z_{tNT}^{*} = \frac{\sum_{i-1}^{N}\sum_{t-2}^{T}\hat{L}_{11i}^{-2}\,e_{it-1}^{*}\,\Delta\hat{e}_{it}^{*}}{\sqrt{\hat{S}_{NT}^{*2}\left(\sum_{i-1}^{N}\sum_{t-2}^{T}\hat{L}_{11i}^{-2}\hat{e}_{it-1}^{*2}\right)}}$$

e) Group p-Statistic:

$$\hat{Z}_{\hat{p}NT-1} = \sum_{i=1}^{N}\frac{\sum_{t=1}^{T}\left(\hat{e}_{it-1}\,\Delta\hat{e}_{it}-\hat{\lambda}_i\right)}{\left(\sum_{i-1}^{T}\hat{e}_{it-1}^{2}\right)}$$

f) Group t-Statistic (non-parametric):

$$\hat{Z}_{tNT} = \sum_{i=1}^{N} \frac{\sum_{t=1}^{T}(\hat{e}_{it-1}\,\Delta\hat{e}_{it} - \hat{\lambda}_i)}{\sqrt{\hat{\sigma}_i^2\left(\sum_{i-1}^{T}\hat{e}_{it-1}^2\right)}}$$

g) Group t-Statistic (parametric):

$$Z^*_{tNT} = \sum_{i=1}^{N} \frac{\sum_{t=1}^{T}\hat{e}_{it-1}^{*}\,\Delta\hat{e}_{it}^{*}}{\sqrt{\sum_{t=1}^{T}\hat{S}_i^{*2}\,\hat{e}_{it-1}^{*2}}}$$

4.2.3.2. Kao (Engle-Granger based) panel cointegration test

The Kao test specifies cross-section specific intercepts and cross-section homogeneous regression parameters which is given by the following equation:

$$Y_{it} = \alpha + X_{it}'\beta + \delta_i + \varepsilon_{it} \qquad (1.14)$$

For $t = 1, 2\ldots, T$, $i = 1, 2, \ldots, N$

where Y_{it} individual "cross-sectional" time series and X_{it} is the vector of the cross-sectional time series. The parameter α represents the overall constant in the model; parameter δ_i are individual effects that may be set to zero if desired and parameter vector β_i contains the cross-section specific regression parameters and lastly ε_{it} are the error terms.

The residuals from equation (1.14) are tested for unit root through auxiliary regression

$$\varepsilon_{it} = \rho\varepsilon_{it-1} + u_{it} \qquad (1.15)$$

OR

$$\varepsilon_{it} = \rho_i\varepsilon_{it} - 1 + \sum_{j=1}^{p}\psi_{ij}\,\Delta\varepsilon_{it-j} + v_{it}. \qquad (1.15.a)$$

where u_{it} and v_{it} independent and equally distributed and the underlying hypothesis of no cointegration is given as $p = 1$ against the alternative hypothesis of cointegration as $p < 1$.

4.2.3.3 Fisher (combined Johansen) panel cointegration test.

The proposed alternative approach for the testing of cointegration in the panel data model made by Maddala and Wu (1999) opted for a combination of the tests from individual cross-sections to create at test statistics for the full panel from the Fisher-type test reference. The Johansen Fisher Panel Cointegration test combines the individual Johansen's cointegration trace tests and maximum eigenvalue tests. The combined individual test sets π_i as the p-value for the individual cross-section$i$, for which the null hypothesis under the panel becomes:

$$-2\sum_{i=1}^{N}\log(\pi_i)\ , x^2 2N \qquad (1.16)$$

Trace Statistic tests for at most *r* cointegrating vectors among a system of $N < 1$ time series, and the Maximal Eigenvalue Statistic tests for exactly r cointegrating vectors against the alternative hypothesis of $r + 1$ cointegrating vectors.

4.2.4. Panel Autoregressive distributed lag

The test is employed to estimate the long run and short run relationship between the specified variables. The method includes the error correction term which shows how fast the determinants of the model will converge to equilibrium.it is an ARDL dynamic heterogeneous panel regression which can be shown as ARDL (p, q) approach where "p" is the dependent lag variable and "q" is the independent lag variable.

The generalized ARDL $(p, q, q, \dots, q)$ model specification can be given as follows:

$$y_{i,t} = \sum_{j=1}^{p}\delta_i y_{i,t-j} + \sum_{j=0}^{q}\beta_{ij}X_{i,t-j} + \varphi_i + e_{it} \qquad (1.17)$$

Here, $y_{i,t}$ denoted the dependent variable; $X_{i,t}$ are the $k \times 1$ vectors that are allowed to be purely I(0) or I(1) or cointegrated; δ_{ij} is the coefficient of lagged dependent variable called scalars; β_{ij} are the $k \times 1$ coefficient vectors; φ_i is the unit specified fixed effects $i = 1, \dots, N$; $t = 1,2, \dots, T; p, q$ are optimal lag orders; e_{it} is the error term.

The re-parameterized ARDL model specification becomes:

$$\Delta y_{it} = \theta_i\left[y_{i,t-1} - \acute{\lambda}_i X_{i,t}\right] + \sum_{j=1}^{p-1}\xi_{ij}\Delta y_{i,t-j} + \sum_{j=0}^{q-1}\acute{\beta}_{ij}\,\Delta X_{i,t-1} + \varphi_i + e_{it} \qquad (1.18)$$

where, $\theta_i = -(1-\delta_i)$ denotes group-specified sped of adjustment coefficient (expected that $\theta_i > 0$); X_i is the vector of long-run relationships; ECT= $\left[y_{i,t-1} - \acute{\lambda}_i X_{i,t}\right]$ shows the error correction term, and lastly ξ_{ij} and β_{ij} are the short-term dynamic coefficients or short-run parameters. When the ECT has a negative and significant coefficient it means that short-term variations amongst the dependent and independent variables will give a stable relationship between the variables in the long-run.

4.2.5. Panel Causality test

This study employed the Dumitrescu Hurlin Non-Causality Panel test formed by Dumitrescu and Hurlin (2012) to determine causality between the variables. The test is a similar bivariate testing method to Granger (1969). This kind of test differs from the panel Engle-Granger causality test because it allows all coefficients to be different across cross-sections. As well as considering the heterogeneity of the regression model used for testing Granger causality and the heterogeneity of the causality relationship across cross-sections under the null hypothesis of no causal relationship between any of the variables or panel units which means there is homogenous non-causality.

The general equation of the panel granger causality for the Dumitrescu Hurlin non-causality test is given as follows:

$$y_{it} = a_{0,i} + a_{1,i}y_{i,t-1} + \cdots + a_{l,i}y_{i,t-1} + \beta_{1,I}x_{i,t-1} + \cdots + \beta_{l,i}x_{i,t-1} + \varepsilon_{i,t}$$

$$x_{i,t} = a_{0,i} + a_{1,i}x_{i,t-1} + \cdots + a_{l,i}x_{i,t-1} + \beta_{1,i}y_{i,t-1} + \cdots + \beta_{1,i}y_{i,t-1} + \varepsilon_{i,t} \quad (1.19)$$

The Dumitrescu Hurlin causality null of the pair is as follows:

$$a_{0,i} \neq a_{o,j}, a_{1,j} \neq a_{1,j}, \ldots, a_{l,i} \neq a_{l,j}, \forall\, i,j$$

$$\beta_{1,j} \neq \beta_{1,j}, \ldots, \beta_{l,j} \neq \beta_{l,j}, \forall\, i,j$$

Under the DH test, there are two types of distributions namely asymptotic and semi-asymptotic. The asymptotic distribution is used when T>N and semi-asymptotic is applied when N>T. The null and the alternative hypothesis for the homogeneous non-causality pair are as follows:

$H_0: \beta_i = 0 \forall i$ with $\beta_i = \beta_{1,i} = \beta_{1,i}, \dots, \beta_{l,i} = \beta_{l,j}$

$H_1: \beta_i \neq 0 \forall i = 1, \dots, N_1 \ \beta_i \neq 0 \forall \ i = N_1 + 1, N_1 + 2, \dots, N$

where, the alternative hypothesis of HNC allows some of the individual vectors β_i to be equal to zero.

The average statistic for the test is:

$$W_{N,T}^{HNC} = \frac{1}{N} \sum_{i=1}^{N} W_{i,T} \quad (1.20)$$

where, $W_{i,T}$ stands for the individual Wald statistics values for cross-section units, the statistics have an asymptotic distribution when T>N. When integrated with the HNC null hypothesis the statistics become:

$$Z_{N,T}^{HNC} = \sqrt{\frac{N}{2K}} \left(W_{N,T}^{HNC} - K \right) T, N \to \infty \quad (1.20.a)$$

where $W_{i,T}$ =$(T - 2K - 1)$ for $i = 1,2, \dots, N$.

4.2.6. Diagnostic testing

In order to determine if the model is properly specified or not, the diagnostic and stability tests were employed. It can be stated that the diagnostic tests will illustrate the normality of the model which is employed in the proposed study using econometrics techniques. Heteroscedasticity is a situation where the error term does not have a constant variance. It can occur because of errors in the measurement or if there are subpopulation differences as well as interaction effects.

The Breusch Godfrey serial correlation LM test is another test under diagnostic that tests for autocorrelation in the model. The test is used to check if the model does not suffer from any misspecification of some kind. In terms of the Classical Linear Regression Model (CLRM) assumptions, it states that the model is normally distributed with a mean of zero and constant variances.

The AR root graph, which shows the inverse roots of the characteristic AR polynomial is used to enhance the stability test. When all the roots have a modulus that is smaller than one, this indicates that they lie within a unit circle and that the VAR is stable/stationary (QMS, 2009:462).

4.2.7. Impulse response function

The impulse response perform examines the reactions of the variables in the VAR system towards its innovations and to other included variables (Gujarati, 2004). The test also compliments the Granger causality test in evaluating the extent to which the relationship is depending on whether the relationship is positive or negative.

The test is employed to track the responses of a system's variables, so orthogonalising the VAR's shocks is required which enables the shocks tracked by IRFs to be uncorrelated which is referred to as the Cholesky decomposition (Sims, 1980). The author further stated that the process is traditionally called the triangularising of the VAR, though the method orthogonalises the shocks a recursive structure on the contemporary relationship of the variables is imposed. According to Ahmed and Romberg (2015), it is possible for some or every individual variable not to be correctly represented as the problem of correlation amongst the variables cease to occur.

4.2.8. Variance decomposition

The variance decomposition technique is accustomed to checking for the percentage of shocks the dependent variable cause to its own innovation as opposed to the percentage shock to other independent variables (Green, 2000). Similar to the impulse response function, the variance decomposition evaluates how variables react to each other and the variable in question in a given period.

4.3. CHAPTER SUMMARY

This chapter discussed the methodology that was used to study the relationship between budget deficit and macroeconomic fundamentals such as gross fixed capital formation, budget deficit, money supply and consumer price index in South Africa. The study used annual panel series data for the period 1990 to 2017. The Panel ARDL method was chosen to determine the short run and long run relationship as well as the cointegration between the variables under study. The model developed is tested against diagnostic and stability tests which are shown in chapter four.

CHAPTER 5

DISCUSSION AND INTERPRETATION OF FINDINGS

5.1 INTRODUCTION

The chapter is focusing on the presentation, evaluation and interpretation of the findings of data which was analysed by means of the E-views statistical package to achieve the objective of the study. The chapter presents the outcomes of the analyses of all the estimation techniques discussed in the previous chapter.

5.2 EMPIRICAL TESTS RESULTS

5.2.1 Panel unit root tests

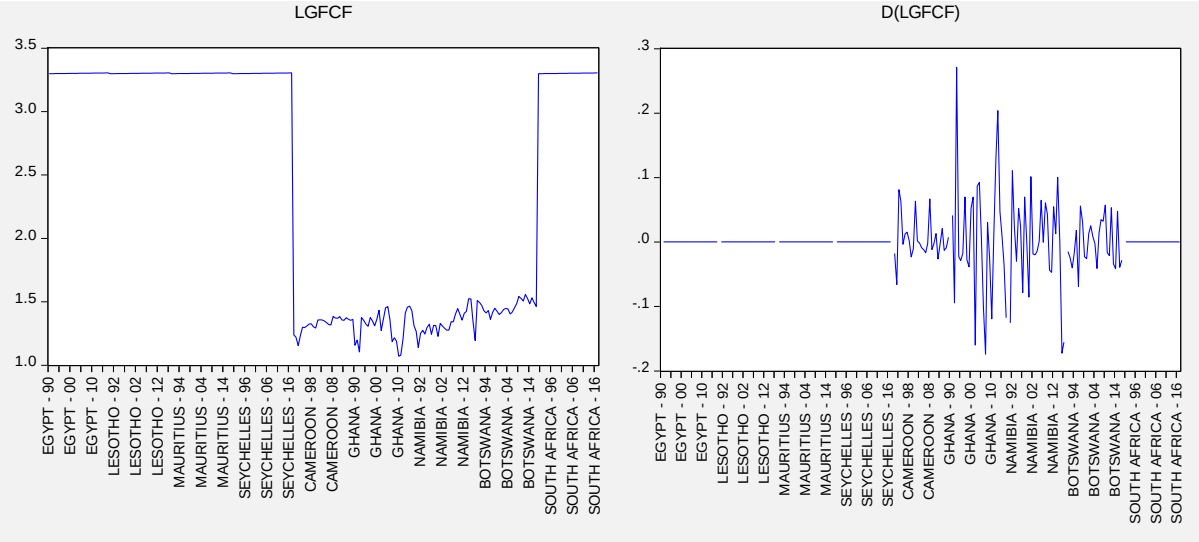
This is the first step of the data analysis process which was focused on unit root testing. The tests were employed to check for the existence of unit root in the variables and to identifying the order of integration of the variables in the model. The unit root analysis was carried by both informal and formal approaches. Since there are several types of panel unit root tests only Fisher ADF, Fisher PP and LLC tests were employed as formal way of unitroot testing

5.2.1.1 Informal unit root tests

The test shows the representation of the visual effects showing the stationarity or non-stationarity of the variables. Presented below from figure 5.1 to figure 5.4 are the graphical illustration at both level and first difference for all variables. From panel A of figure 5.1, it appears that gross fixed capital formation has a unit root. The data set does not seem to hover around zero mean over time. However, in panel B, after first differencing the data set seem to waver around zero mean which implies that gross fixed capital formation is integrated at order I (1).

Figure 5.1. Fixed Investment at level and first difference

Panel A **Panel B**

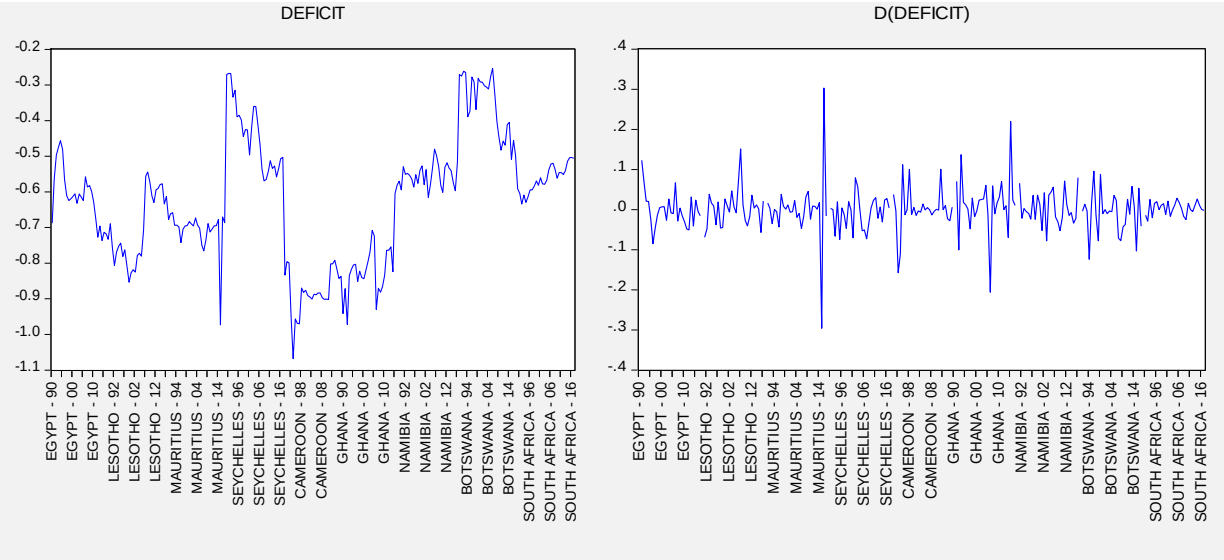


Source: E-views 9.0 output

Figure 5.2 presents the graphical unit root test for the budget deficit at level and first differencing in panel A and Panel B respectively. In panel A, the data set seems to exhibit a constant mean, thus it is suspected the data is non-stationary at level. In panel B the data appears to be hovering along the constant mean implying that the variable becomes stationary after first differencing.

Figure 5.2. The deficit at level and first differencing

Panel A **Panel B**

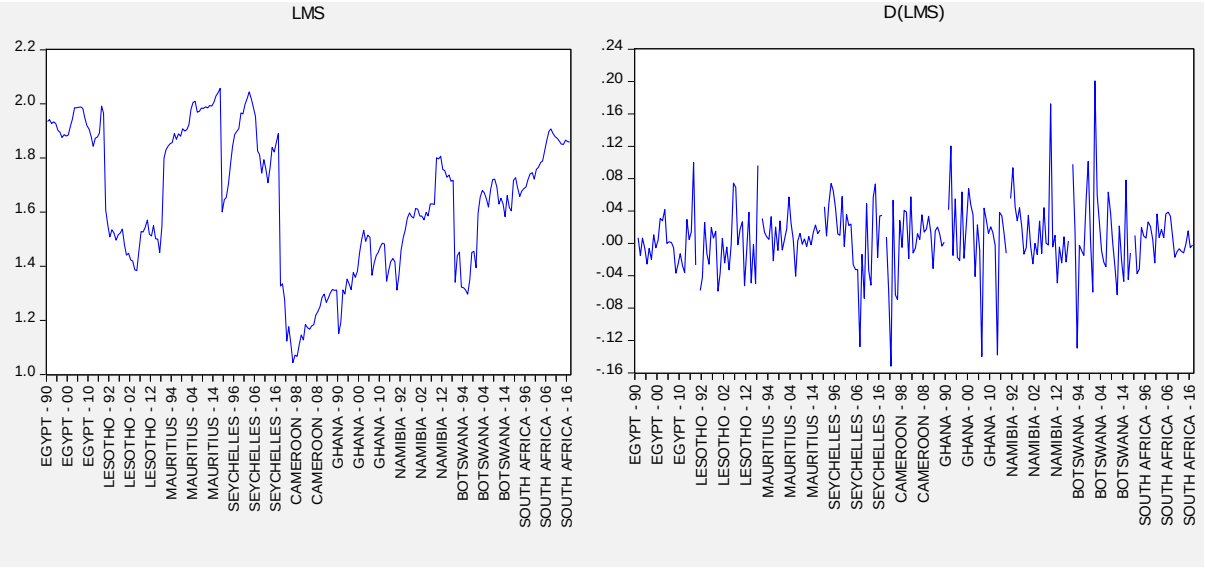


Source: E-views 9.0 output

Depicted in panel A and panel B of figure 5.3 are the informal unit root of money supply at level and 1st difference respectively. The visuals show that the variable is non-stationary at level and becomes stationary after first difference.

Figure 5.3**.** Money supply at level and first differencing

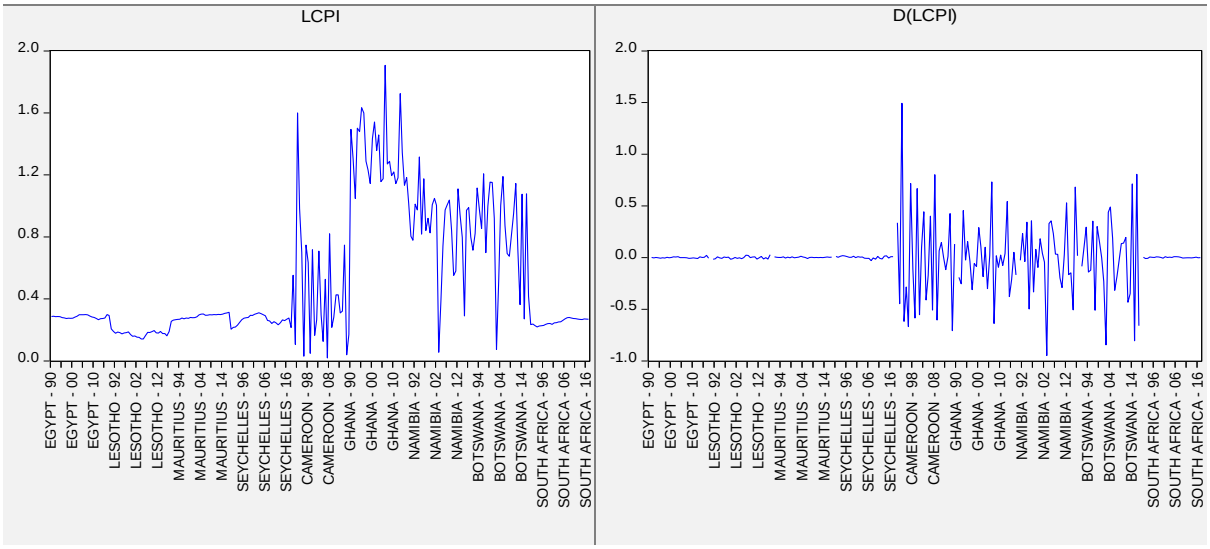
Panel A **Panel B**



Source: E-views 9.0 output

Figure 5.4. Consumer price index at level and first differencing

PANEL A **PANEL B**



Source: E-views 9.0 output

Lastly, consumer price index appears to be non-stationary at level and became stationary after being differenced at I(1) shown by figure 5.4 in panel A and panel B respectively.

5.2.1.2 Formal unit root tests

This is another form of the unit root test which three of the tests were applied to tests for the stationarity of the variables. Below in Table 5.1, is a detailed interpretation of Fisher ADF, Fisher PP and Levin, Lin and Chu tests. The tests employed showed that all variables are stationary at first difference even if at none LGFCF, BD and CPI are stationary therefore the decision taken is that all variables are stationary at I(1) since the majority outcome of the intercept at none are non-stationary which led to the decision of non-stationary at I(0) at none.

Table 5.1: Panel unit root test results

VARIABLE	Test equation	Fisher ADF	Fisher PP	Levin, Lin and Chu	DECISION
LGFCF	None	1.0000	1.0000	1.000	**Non-stationary**
	Intercept	0.0520	0.8723	0.0000	
	Intercept and trend	0.1222	0.0000	0.0000	
DLGFCF	None	0.0000	0.0000	0.0000	**stationary**
	Intercept	0.0000	0.0000	0.0000	
	Intercept and trend	0.0000	0.0000	1.0000	
BD	None	0.8482	0.8281	0.1754	**Non-stationary**
	Intercept	0.0259	0.0020	0.1980	
	Intercept and trend	0.0017	0.0000	0.1371	
DBD	None	0.0000	0.0000	0.0000	**stationary**
	Intercept	0.0000	0.0000	0.0000	
	Intercept and trend	0.0000	0.0000	0.0000	
MS	None	0.9997	0.9998	0.9819	**Non-stationary**
	Intercept	0.2179	0.1003	0.1039	
	Intercept and trend	0.2465	0.0626	0.1598	
DMS	None	0.0000	0.0000	0.0000	**stationary**
	Intercept	0.0000	0.0000	0.0000	
	Intercept and trend	0.0002	0.0000	0.0004	
CPI	None	0.8519	0.4680	0.9609	**Non-stationary**
	Intercept	0.0033	0.0000	0.1039	
	Intercept and trend	0.0007	0.0000	0.1531	
DCPI	None	0.0000	0.0000	0.0000	**stationary**
	Intercept	0.0000	0.0000	0.0027	
	Intercept and trend	0.0000	0.0000	0.0000	

Source**:** Author compilation using E-views.

5.2.2. Lag length criteria results

The lag order selection criteria test was applied to check for the necessary lag interval for the model.

Table 5.2.: Lag length criteria results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-159.8744	NA	5.36e-05	1.51736	1.5798	1.5426
1	1140.803	2541.138	3.66e-10	-10.3778	-10.0652*	-10.2516*
2	1161.740	40.12979	3.49e-10	-10.4235	-9.8609	-10.1963
3	1185.886	45.38443	3.24e-10	-10.4989	-9.6863	-10.1707
4	1210.142	44.69419*	3.00e-10*	-10.5754*	-9.5128	-10.1461

Source**:** Author compilation using E-views.

The results showed that the Schwarz information criterion (SC) and Hannan Quinn (HQ) indicated a 1 lag length, while the Akaike information criterion (AIC), LR and FPE suggests the 4 maximum lag lengths as per table 5.2. However, for this research, the AIC is the optimal lag length criteria for this model at lag 4 because the AIC criterion has the lowest value (-10.57539*) than other criteria. This is supported by Guterez, Souza & Guillen (2001) as the authors stated that the AIC is the most efficient and likely to select the correct lag length.

5.2.3. Panel cointegration test results

5.2.3.1. Pedroni panel cointegration test result

The panel Pedroni cointegration test is used to investigate cointegration in the model. It determines whether there is a long-run relationship in the study variables. Pedroni (2004) stated that there are seven types of statistics from the test, where four are

within dimension statistics and three are between dimension statistics. The general hypothesis is that the null hypothesis has no cointegration.

Table 5.3(a): Pedroni panel cointegration results

Within-dimension common AR coefficients		
	p-values	**p-values**
Panel v-s.tatistic	0.6996	0.9953
Panel rho-statistic	0.3627	0.2055
Panel PP-statistic	0.0527	0.0072
Panel ADF-statistic	0.0083	0.0104
Between-dimension individual AR coefficients		
	p-values	
Group rho-statistic	0.5614	
Group PP-statistic	0.0032	
Group ADF-statistic	0.0005	

Source**:** Author compilation using E-views.

The test revealed that five out of eleven statistics indicated a null hypothesis of no cointegration, implying the rejection of the null hypothesis and acceptance of the alternative hypothesis of cointegration in the model. This is shown by the results of Panel PP, Group PP and Group ADF which are significant at 1% significance level while the significance of Panel ADF was at 5% significance level.

5.2.3.2. Kao panel cointegration test result

To determine whether a long run relationship does exist amongst the variables studied, the Kao cointegration test was employed as another technique to test for cointegration. The test is based on the hypothesis that if the p-value is greater than 5% the null hypothesis is rejected implying that there is no cointegration and if the p-value is less than the 5% significance level then the alternative hypothesis is accepted as there is cointegration in the model. The general hypothesis of the Kao cointegration test is as follows:

H_0: no cointegration

H_1: there is cointegration

Table 5.3(b): Kao panel cointegration results

Tests	T-Statistics	Probability
ADF	-4.779470	0.0000
Residual variance	0.001945	
HAC variance	0.001477	

Source**:** Author compilation using E-views.

In table 5.3(b), the p-value is 0.0000 and is less than 5% significance level, so therefore there is the cointegrating relationship between the variables. The null hypothesis is rejected against the alternative hypothesis that there is cointegration in the model.

5.2.3.3 Johansen fisher panel cointegration test results

The test was adopted to examine the long-run relationship in the model like the Kao and Pedroni panel cointegration test. However, the test integrates both trace and max-eigen statistics to give the best inference results on the thumb rule that, if the p-value is less than 0.05 then there is an existence of cointegration and conversely if the p-value is greater than 0.05 there is no cointegration in the model.

Table 5.3(c): Johansen Fisher Panel cointegration test results

Hypothesized No of CE(s)	Fisher Stat. *(Trace Test)	Probability	Fisher Stat. *(Max-Eigen Test)	Probability
At none	139.6	0.0000***	120.2	0.0000***
At most 1	111.8	0.0000***	62.41	0.0000***
At most 2	70.05	0.0000***	46.81	0.0002***
At most 3	61.29	0.0000***	61.29	0.0000***

Source**:** Author compilation using E-views.

According to the results given by the Johansen Fisher panel cointegration test in table 5.3(c), the trace test shows that there is long run relationship in the model as given by the four cointegrating equations. All statistics have probability values of less than the

5% level of significance which indicates rejection of the null hypothesis of no cointegration and accepting the alternative hypothesis. Similar results were obtained from the maximum eigen test where all four statistics revealed a long run relationship in the model with probability values of below the 5% significance level. Therefore, that means the precondition of the thumb rule has been met of rejecting the null hypothesis when the probability value is less than 5 percent significance level.

Table 5.3(d): Individual cross-section results

Cross section	**Trace test statistics**	**Probability**	**Max-Eign test statistics**	**Probability**
Hypothesis of no cointegration				
Egypt	396.1974	0.0001	353.7108	0.0001
Lesotho	406.4335	0.0001	359.7760	0.0001
Mauritius	393.1187	0.0001	338.3617	0.0001
Seychelles	428.5338	0.0001	390.9656	0.0001
Cameroon	72.8458	0.0001	37.9916	0.0016
Ghana	48.2918	0.0455	24.5334	0.1172
Namibia	68.0784	0.0002	26.7111	0.0644
Botswana	44.9868	0.0907	26.7793	0.0631
South Africa	438.0216	0.0001	381.9348	0.0001
Hypothesis of most 1 cointegration relationship				
Egypt	42.4866	0.0011	21.4801	0.0447
Lesotho	46.6576	0.0003	24.2272	0.0177
Mauritius	54.7570	0.0000	25.1625	0.0128
Seychelles	37.5682	0.0052	22.9068	0.0278
Cameroon	34.8542	0.0120	19.8373	0.0751
Ghana	23.7584	0.2108	15.0337	0.2866
Namibia	41.3672	0.0015	23.2416	0.0249
Botswana	18.2103	0.5506	10.0196	0.7428
South Africa	56.0868	0.0000	35.6933	0.0003

Source**:** Author compilation using E-views.

Table 5.3(d) shows the results of the individual cross-section for the selected African countries. For this study, only the hypothesis of no and most 1 cointegration relationship will be interpreted for both trace and max Egen test. The results revealed that at the hypothesis of no cointegration, with respect to trace test statistics, there is the existence of long-run relationship amongst the variables for all selected countries except for Botswana. That is observed from their probability values which were below the 5% level of significance, whereas a sign of no cointegration was found for Botswana as its probability value, specified at 0.095 significance level, is above the 5% level of significance.

With the Maximum Eigen test, the results showed that there is evidence of long run relationship between the variables for all countries except for Ghana, Namibia and Botswana. That is seen from their probability values of 0.1172, 0.0644 and 0.0631 respectively, which indeed show a sign of no cointegrating relationship between the variables as their p-values are above the 5% level of significance. Therefore, that leads to the notion of not rejecting the null hypothesis of no cointegration meaning that Ghana, Namibia and Botswana are experiencing the problem of no cointegration.

In the hypothesis of most 1 cointegration relationship, with trace statistics test, the existence of long run relationship among the variables was found for all countries except for Ghana and Botswana with probability values of 0.2108 and 0.5506 respectively, which are above the 5% level of significance indicating that there is no cointegration. From the results, it appears that Botswana is still experiencing the challenges of no cointegration at the hypothesis of no and most 1 cointegrating relationship both with test statistics test and Maximum Eigen test. Furthermore, with the Maximum Eigen test, all countries showed a long run relationship amongst the variables, although Botswana still shows a sign of no cointegration. Even countries such as Cameroon and Ghana (which still shows the persistent problem of no cointegration) were revealed with probability values of 0.0751 and 0.2866 respectively above the 5% significance level, so that means we cannot reject the null hypothesis.

In summary, the panel cointegration test revealed that two of the panel cointegration test had cointegration in the model while one which is the Pedroni panel cointegration showed no existence of cointegration. Therefore, the conclusion is that there is indeed

cointegration in the model because two tests confirmed that, those tests are the Kao panel cointegration and the Johansen fisher panel cointegration.

5.2.4 Panel Autoregressive Distributed Lag (ARDL) test results

This test is used to explain how the regressors affect the regressand variable in both the long run and short run periods. It further entails the long run equation which entails the significant effect the regressors have on the regressand variable. The methodology is applied to investigate how budget deficit and other macroeconomic variables affect fixed investment in the selected African countries. Additionally, the panel ARDL was chosen to determine the long-term and short-term dynamics which integrates the error correction term.

5.2.4.1 Long run estimates results

Table 5.4(a): Long-run estimates result

Variable	**Coefficient**	**St. error**	**t-Statistics**	**P value***
BD	-0.4453	0.1192	-3.7360	0.0003
LMS	0.3913	0.0918	4.2634	0.0000
LCPI	0.0295	0.0683	0.432145	0.6664

Source**:** Author compilation using E-views.

The ECM equation has been derived from the long-run estimates and is given as follows:

$$LGFCF = -0.445345BD + 0.391305LMS + 0.029528LCPI \quad (5.1)$$

In table 5.4(a) the results of the long-run estimates revealed that gross fixed capital formation is negatively affected by the budget deficit in the long-run. This implies a negative and statistically significant relationship between budget deficit and gross fixed capital formation, where a 1% decrease in the budget deficit, holding other things constant, will lead to a 44% decrease in gross fixed capital formation. This is inconsistent with the Keynesian perspective, which outlined that budget deficit declines private investment in the long run as well as the findings of (Bui Van and

Sudhipongpracha, 2015). The long-run elasticities in equation 5.1 show that if the money supply increases by 1%, ceteris paribus, gross fixed capital formation will be expected to increase by 39% in the long-run. The outcome implies that there is a positive relationship between money supply and gross fixed capital formation, similarly to studies of Khan (2010) and Tobias and Chiluwe (2012).

From the results presented in equation 5.1, a positive relationship was found between inflation and gross fixed capital formation. This lies with the theory or approach by Hartman (1972) and Abel (1983) which explains that when there is high inflation in the country investments tends to increase because the real costs of capital increase. On the same token, Onwe and Olarenwaju (2014) using the error correction mechanism between inflation and corporate investment noted a positive relationship in the long run in the West-African Monetary zone. To further explain this the results showed that if inflation increases by 1%, holding other things constant, the gross fixed capital formation will be expected to increase by 29% in the long run. Similarly (Ajide, 2013; Naa-Idar, Ayentimi & Frimpong, 2012; Wiafe, Barnor & Quaidoo, 2015) found that inflation has a positive relationship with gross fixed capital formation.

5.2.4.2 Short run estimates results

Table 5.4(b): Short run estimates result and the ECM

Variable	Coefficient	St. error	t-Statistics	P value*
COINTEQ01	-0.1832	0.0856	-2.1406	0.0343
DBD	-0.0002	0.0414	-0.0057	0.9954
DLMS	0.0116	0.0547	0.2116	0.8328
DLCPI	0.0038	0.0169	0.2258	0.8218

Source**:** Author compilation using E-views.

The short-run estimates showed that money supply and inflation kept consistent signs, the same applies to the budget deficit as it maintained the negative relationship. All regressor variables showed a statistically insignificant relationship with the regressand variable. Moreover, table 5.4(b) shows the short-run coefficient estimates obtained from the ECM equation, which is coefficient that measures the speed of adjustment to

equilibrium. The coefficient of the error correction term is -0.18, that is 18%, and it is statistically significant, where the negative sign of the coefficient simply explains the previous disequilibrium. This means that the 18 percent is the speed that the model will take to adjust to equilibrium in the next year.

5.2.5. Panel Causality test results

The Dumitrescu Hurlin test was employed to determine the causality between the variables and the direction in which the independent variable can cause the dependent variable or both variables cause a causal relationship on each other. The results are presented in Table 5.5 as follows,

Table 5.5: Pairwise Dumitrescu Hurlin Causality results

Null hypothesis	p-value	Result	Conclusion
DEFICIT→ LGFCF	0.0000***	Yes	Bidirectional causality
LGFCF→ DEFICIT	2E-14***	Yes	
LMS → LGFCF	0.0000***	Yes	Bidirectional causality
LGFCF → LMS	0.0039***	Yes	
LCPI → LGFCF	0.0000***	Yes	Bidirectional causality
LGFCF → LCPI	0.0255**	Yes	
LMS → DEFICIT	0.2443	No	No causality
DEFICIT → LMS	0.3201	No	
LCPI → DEFICIT	0.4638	No	No causality
DEFICIT → LCPI	0.3562	No	
LCPI → LMS	0.2309	No	No causality
LMS → LCPI	0.2859	No	

Source**:** Author compilation using E-views.

Table 5.5 depicts the results of the Dumitrescu Hurlin panel causality test employed to investigate the causal relationship between the main variables and other control

variables for the specified countries under study. The results show a bidirectional causal relationship between budget deficit and fixed investment, as the statistical inference show significance. Therefore, the null hypothesis was not accepted because the probability values of 0.0000 and 2E-14 for the budget deficit to fixed investment and fixed investment to the budget deficit, respectively, are below the significance level of 5%. These results indicate that budget deficit can influence fixed investment in the long run and vice versa.

Furthermore, the test found a bidirectional causal relationship between money supply and fixed investment that is seen from their probability values less than the 5% significance level. Therefore, the null hypothesis was not accepted. The results imply that both money supply and fixed investment can influence each other in the long run. A bidirectional causal relationship between inflation and fixed investment was found. The implication is that inflation can forecast fixed investment while fixed investment can also forecast money supply in the long run. So, the rejection of null hypothesis at 5% level of significance is accepted as their probabilities of 0.0000 for inflation to fixed investment and, 0.0255 for fixed investment to inflation are below 5% significance level.

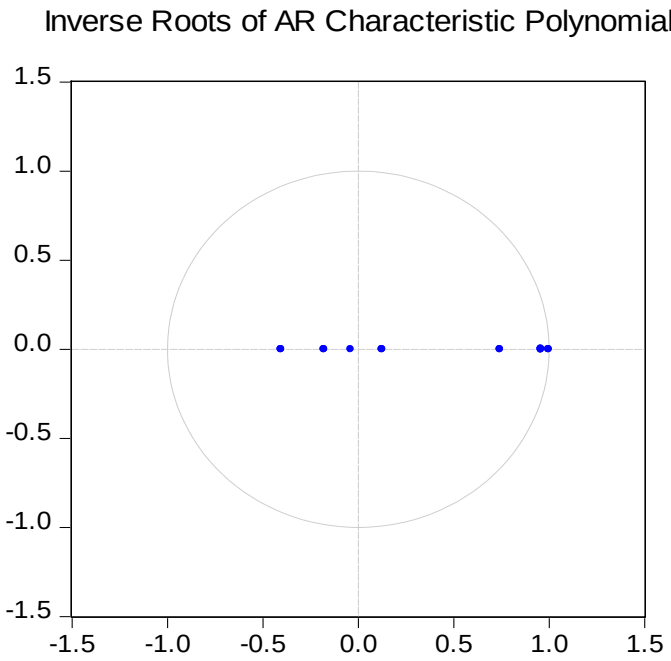
In addition, money supply does not cause a budget deficit, and a budget deficit does not also influence the money supply. The results explain the outcomes of no causal relationship between money supply and budget deficit. The same results of no causal relationship between inflation and budget deficit, and between inflation and money supply were found. These results were confirmed by the probability values above the significance level of 5%. The inference is that there is causality between budget deficit and fixed investment, and money supply and fixed investment, as well as between inflation and fixed investment, while the causal relationship between money supply and budget deficit, inflation and budget deficit and lastly between inflation and money supply is in the long run.

5.2.6. Diagnostic test results

The tests were performed to test whether the regression model is correctly specified about the regressors used in the model, for correlation and testing for non-zero mean of the error term (Pagan and Hall, 1983).

5.2.6.1. AR root test results

Figure 5.5: AR root graph.



Source: E-views 9.0 output

The AR root test showed that the roots have a modulus that is below one and they lie within the circle. This is a good indication that the estimated VAR model is stable and stationary. The results show that the model is stable and significant because the modulus is all on the zero-horizontal line, therefore the results are reliable.

5.2.6.2. Var Residual Serial Correlation LM test results

Table 5.6: Var residual serial correlation LM test results.

Lags	**LM-stat**	**p-value**
1	20.50089	0.1985

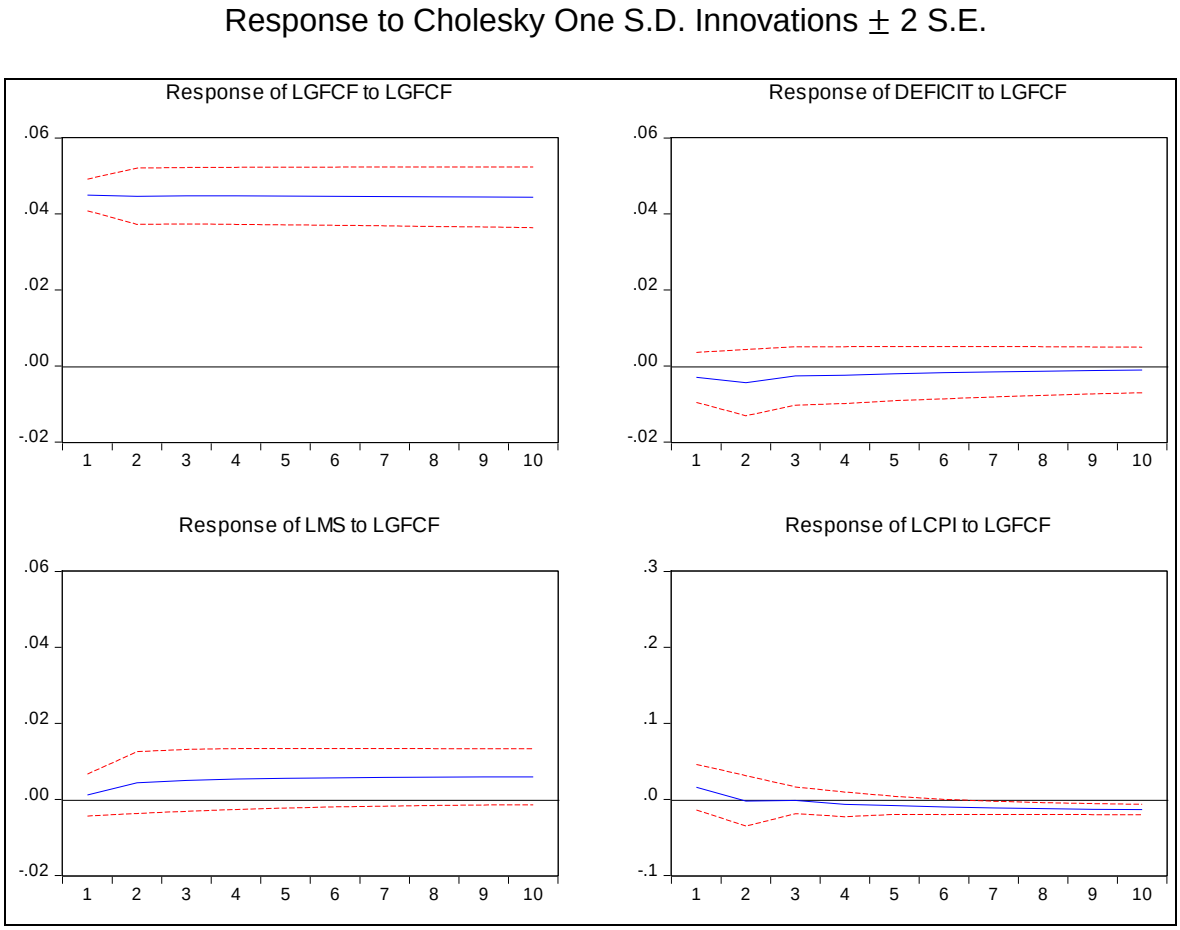
Source**:** Author compilation using E-views.

According to the serial correlation, LM test of no serial correlation was found in the model because the probability value for 1 lag is above the 5% significance level, therefore that means we cannot reject the null hypothesis rather accept the null hypothesis of no serial correlation.

5.2.7. Impulse response function (IRF, s) results

The IRF demonstrated the fluctuation in which the variables contribute to one another through time, in both the short and long run. A horizon of ten years was observed in order to obtain adequate results when examining the long-term persistence of gross fixed capital creation. The responses of gross fixed capital formation to explanatory variable shocks are reported or shown in generalized form. It also explains how the explanatory variable will react when the explained variables are given one S.D shock.

Figure 5.6: Impulse response function results



Source: E-views 9.0 output.

Figure 5.6 shows that the response of gross fixed capital formation to its own shocks and the response was positive. Shocks of budget deficit to gross fixed capital formation is negative, this simply means that when budget deficit increases it leads to a reduction in national saving, investment and net exports. Moreover, the budget deficit increases interest rates which in turn crowds out investments, this is in line with the studies of

(Mustafa & Ayhan, 2012; Hiroaki & Jun 2006). Shocks of the money supply to fixed investment is positive.

This is seen from the figure where from period one to period two the response was low but then continues to show gradually increases until period ten. Responses of inflation to fixed investment, the results showed that a one standard deviation shock in inflation is negative towards investment. Even if the shock was positive from periods one to two, the impact was very insignificant as it transited to a negative shock from period one to period ten. It implies that inflation negatively affects investment, when inflation rises investment decreases, and this is inconsistent with the results of the Dumitrescu Hurlin panel causality test.

5.2.8. Variance Decomposition (VD) results

Variance Decomposition was conducted to present evidence regarding variance relations between the selected macroeconomic variables. It examines the amount that the forecast error variance of each of the following can be explained by exogenous shocks to the other variables.

Table 5.7(a): Variance Decomposition results of LGFCF

Variance Decomposition of LGFCF: Period	S.E	LGFCF	DEFICIT	LMS	LCPI
1	0.0449	99.8603	0.0059	0.1023	0.0314
2	0.0634	99.8603	0.0059	0.1023	0.0314
3	0.0777	99.8513	0.0051	0.1215	0.0221
4	0.0896	99.8595	0.0039	0.1191	0.0175
5	0.1002	99.8743	0.0032	0.1084	0.0141
. 6	0.1097	99.8883	0.0034	0.0966	0.0117
7	0.1184	99.9001	0.0044	0.0854	0.0101
8	0.1265	99.9093	0.0063	0.0756	0.0088
9	0.1341	99.9157	0.0091	0.0674	0.0079
10	0.1412	99.9193	0.0127	0.0608	0.0071

Source**:** Author compilation using E-views

In the short run, that is period 3, the shock to a fixed investment account for 99.85 percentage variation to its own shock. Shock to deficit accounts for 0.01 percent in fixed investment. Shock to money supply accounts for 0,12 percentage variation to fixed investment and lastly, in the short run, inflation shocks can cause 0.02 percent variation in fixed investment. In the long run, that is period 10, the impulse to fixed investment can cause 99.92 percent variation to its own shock. The shocks have increased from period three to period ten but by a small variation. Shock to budget deficit causes 0.01 percent in fixed investment. Shock to money supply accounts for 0.06 percent in fixed investment while inflation accounts for 0.01 percent in fixed investment. In summary, investment accounts for the most to its own shocks than the budget deficit, money supply and inflation which accounts for the smallest changes in fixed investment.

Table 5.7(b): Variance Decomposition results of BD

Variance Decomposition of DEFICIT: Period	S.E	LGFCF	DEFICIT	LMS	LCPI
1	0.0504	0.3564	99.6438	0.0000	0.0000
2	0.0649	0.6793	95.9935	3.2640	0.0631
3	0.0762	0.6126	95.3773	3.6712	0.3389
4	0.0850	0.5732	94.9600	3.8295	0.6372
5	0.0922	0.5348	94.6749	3.8078	0.9825
6	0.0983	0.5028	94.4463	3.7366	1.3142
7	0.1036	0.4756	94.2497	3.6458	1.6289
8	0.1081	0.4525	94.0797	3.5533	1.9145
9	0.1119	0.4328	93.9319	3.4648	2.1704
10	0.1154	0.4159	93.8045	3.3832	2.3963

Source**:** Author compilation using E-views.

In the short run, period 3, the shock to fixed investment can cause 0,61 percent in the budget deficit. Shock to budget deficit accounts for 95.38 percent in its own innovations. Shock to money supply can cause 3.67 percent variation in the budget deficit and inflation shock to budget deficit accounts for 0.34 percent variation. In the

long run, which I period 10, the shock to fixed investment accounts for 0.42 percent in the budget deficit. Shock to budget deficit accounts for 93.80 percent in its own innovations, while the shock to money supply accounts for 3.38 percent in the budget deficit. Inflation shock can cause a 2.40 percent in the budget deficit. To conclude, for both short run and long run periods budget deficit account for the most in its own innovations, followed by the money supply, inflation and lastly, by fixed investment. However, inflation in the short and long run is the last to cause variations in the budget deficit whereas fixed investment in both short run and long run was second least and the least one variable to cause variations in budget deficit respectively.

Table 5.7(c): Variance Decomposition results of LM

Variance Decomposition of LMS: Period	S.E	LGFCF	DEFICIT	LMS	LCPI
1	0.0421	0.0716	0.5315	99.3969	0.0000
2	0.0608	0.5581	0.8619	98.0581	0.5218
3	0.0742	0.8264	1.1691	96.7941	1.2104
4	0.0847	1.0284	1.5066	95.3756	2.0893
5	0.0937	1.1917	1.8673	93.9518	2.9892
6	0.1014	1.3314	2.2511	92.5406	3.8768
7	0.1083	1.4536	2.6537	91.1815	4.7113
8	0.1145	1.5624	3.0714	89.8848	5.4813
9	0.1201	1.6606	3.5008	88.6576	6.1809
10	0.1253	1.7502	3.9381	87.4994	6.8116

Source**:** Author compilation using E-views.

In the short run, that is period 3, the shock to fixed investment accounts for 0.83 percent in the money supply. Shock to budget deficit account for 1.17 percent variation in money supply. Shocks to money supply can cause 96.79 percent in its own innovations while inflation shock accounts for 1.21 percent in the money supply. In the short run money supply causes more variations to its own shocks than inflation, budget deficit and fixed investment. In the long run, that is period 10, the shock to the

fixed investment accounts for 1.75 percent in money supply, while a shock to the budget deficit causes 3.94 percent in the money supply.

Shock to money supply accounts for 87.50 percent of its own innovations, whereas inflation shock can cause 6.81 percent in the money supply. In summary, shocks in the money supply from the independent variables showed the same results found in the short period where money supply causes more to its own shocks than other variables. However, inflation and budget deficit seem to be increasing from period 3 to period 10, as well as the fixed investment which showed a sign of increment but at a lower percentage than inflation and budget deficit.

Table 5.7(d): Variance Decomposition results of LCPI

Variance Decomposition of LMS: Period	S.E	LGFCF	DEFICIT	LMS	LCPI
1	0.2303	0.4793	0.0144	5.8032	93.7031
2	0.2445	0.4327	0.1233	5.5146	93.9294
3	0.2637	0.3742	0.1092	5.1485	94.3681
4	0.2705	0.4152	0.1098	4.9021	94.5728
5	0.2758	0.4835	0.1057	4.7201	94.6906
6	0.2788	0.6043	0.1046	4.6665	94.6245
7	0.2809	0.7542	0.1084	4.6913	94.4461
8	0.2826	0.9325	0.1173	4.7916	94.1586
9	0.2839	1.1297	0.1321	4.9414	93.7968
10	0.2851	1.3417	0.1528	5.1273	93.3782

Source**:** Author compilation using E-views.

Shocks to fixed investment account for 0.37 percent in inflation in the short run, period 3, shock to budget deficit can cause 0.11 percent in inflation, and shock to money supply account for 5.15 percent in inflation and lastly shock to inflation account for 94.37 percent in its own innovations. In the long run fixed investments account for 1.34 percent fluctuations in inflation. Shock to budget deficit accounts for 5.18 percent in inflation, while a shock to inflation accounts for 93.38 percentage fluctuations in its

own innovations. To conclude, inflation cause more fluctuations in its own innovations than the money supply, budget deficit and fixed investment hence their shocks cause smaller percentages in inflation.

5.3 CHAPTER SUMMARY

The chapter presented the results and its interpretation of different estimation techniques that were employed in the study. That ranges from panel unit root tests, lag length, panel cointegration, PARDL model, Panel causality, diagnostic tests, impulse response function and variance decomposition. The aims and objectives of the study were obtained, and necessary requirements were met. The following chapter will be discussing the conclusions drawn from the study on what findings were found, limitations of the study and policy recommendations.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1. SUMMARY

The study was carried out to investigate the effects of budget deficit on fixed investment in selected African countries using annual data for the period 1990 to 2017. The panel cointegration test was employed in determining the relationship between budget deficit and gross fixed capital formation, where tests such as the Kao panel cointegration, Pedroni panel cointegration and Johansen fisher panel cointegration were used. All the tests employed showed evidence of long run relationship using the Pedroni panel cointegration. Overall, the two types of panel cointegration tests indicated a long relationship between the variables which allowed for the examination of the panel ARDL test.

The PARDL test was used in the study and showed that there is a negative and statistically significant relationship between budget and fixed investment both in the short run and long run. This shows that holding other things constant, an increase in the budget deficit is associated with a lower fixed investment rate of about 44% in the long run. The finding is also in conformity with the Keynesian perspective, which holds that budget deficit reduces private investment in the long run. A positive and statistically significant relationship was found at the 1% significant level between money supply and fixed investment, while inflation is positively yet insignificantly related to fixed investment both in the short run and long run.

The Dumitrescu Hurlin Panel causality test was employed to examine if there is a causal relationship between budget deficit and fixed investment in the selected African countries. The results revealed that indeed there is a bidirectional causal relationship between budget deficit and fixed investment, money supply and fixed investment and lastly between inflation and fixed investment. The study also found no evidence of causality running from money supply to budget deficit and from budget deficit to the money supply. Finally, for inflation and budget deficit similar results prevailed of no causality in both directions.

6.2. CONCLUSION

The study confirmed a long run relationship between budget deficit and fixed investment in the nine selected African countries, where the Panel ARDL showed a negative and moderate speed of adjustment to adjust to equilibrium in the next year. It was also found that budget deficits affect fixed investment negatively in both the short run and long run, which implies that budget deficit reduces fixed investment in the economy of these countries. The contributions of a high budget deficit resulting in a decline in fixed investment are mainly because of a decline in revenue collection, large and persistent spending and consequently borrowing. It was found that all selected nine countries have been recording a budget deficit for the past 10 years.

6.3. RECOMMENDATIONS

The research found important policy implications that policymakers need to pay attention to in decision making hence the study was carried out as the problem of the budget deficit and falling investment consistently persists.

Firstly, the results showed that there was a negative and statistically significant relationship between budget deficit and fixed investment, implying that an increase in budget deficit lowers fixed investment in Namibia, Cameroon, Botswana, South Africa, Seychelles, Egypt, Ghana, Mauritius and Lesotho. This indicates that policymakers should focus on reducing budget deficits as this lower and crowds out investment in their respective countries.

Secondly, the Hurlin panel causality test further justified the negative relationship between budget deficits and fixed investment as it revealed a bidirectional causal relationship between budget deficit and fixed investment in the long run. This emphasizes that policymakers should control and contain high debt levels. The focus should be more on improving domestic investment, since most African countries are agriculturally endowed, and lack the technical know-how of how to produce their own products. The test also showed bidirectional causality running from money supply to fixed investment. This indicates that government should continue to increase the money supply in order to boost investment which will result in greater or increased budget balance but also be cautious of inflation.

Policymakers in these countries need to expand and diversify their infrastructure and telecommunication investment since the world is changing along with technology. This is because the more a country is developing the greater the chances of attracting tourists and investors who want to invest in their countries.

6.4. LIMITATIONS OF THE STUDY

Data availability was a major limitation and setback for the study. As a result, the study was delayed, and inconclusive results were obtained as a result of limited data. This led to a change of methodology and frequency to obtain the most accurate inferences.

6.5. AREAS FOR FUTURE RESEARCH

Future research could focus on the effects of budget deficit on other macroeconomic fundamentals like the gross domestic product, current account deficit and other variables to be considered in Sub-Saharan or SADC countries for analysis. The use of two simultaneous equations could be of interest to evaluate the effects of the budget deficit and other variables. Another area of interest is the application of two different methodologies such as the VECM and ARDL approaches on different sample sizes and different empirical approaches.

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APPENDICES

APPENDIX A: Data

COUNTRY	DATE	LGFCF	DEFICIT	LMS	LCPI
EGYPT	1990	3,298853	-0,68743	1,935129	0,28671
EGYPT	1991	3,299071	-0,56482	1,942125	0,288277
EGYPT	1992	3,299289	-0,49689	1,927057	0,284895
EGYPT	1993	3,299507	-0,47612	1,933527	0,28635
EGYPT	1994	3,299725	-0,45607	1,927543	0,285004
EGYPT	1995	3,299943	-0,48062	1,901934	0,279196
EGYPT	1996	3,300161	-0,56573	1,895652	0,277759
EGYPT	1997	3,300378	-0,61046	1,875956	0,273223
EGYPT	1998	3,300595	-0,62434	1,886635	0,275688
EGYPT	1999	3,300813	-0,61938	1,881061	0,274403
EGYPT	2000	3,30103	-0,61275	1,885033	0,275319
EGYPT	2001	3,301247	-0,6055	1,915813	0,282353
EGYPT	2002	3,301464	-0,63202	1,943675	0,288624
EGYPT	2003	3,301681	-0,60573	1,985331	0,297833
EGYPT	2004	3,301898	-0,61422	1,98533	0,297833
EGYPT	2005	3,302114	-0,62427	1,987388	0,298283
EGYPT	2006	3,302331	-0,55767	1,988502	0,298526
EGYPT	2007	3,302547	-0,5862	1,983204	0,297367
EGYPT	2008	3,302764	-0,58236	1,946473	0,289248
EGYPT	2009	3,30298	-0,59784	1,919893	0,283277
EGYPT	2010	3,303196	-0,628	1,907119	0,280378
EGYPT	2011	3,303412	-0,67648	1,879634	0,274073
EGYPT	2012	3,303628	-0,72714	1,843329	0,265603

EGYPT	2013	3,303844	-0,69594	1,872808	0,272493
EGYPT	2014	3,304059	-0,73681	1,877617	0,273607
EGYPT	2015	3,304275	-0,71336	1,892016	0,276925
EGYPT	2016	3,304491	-0,71765	1,991829	0,299252
EGYPT	2017	3,304706	-0,73297	1,965181	0,293403
LESOTHO	1990	3,298853	-0,6895	1,608961	0,206546
LESOTHO	1991	3,299071	-0,75856	1,550797	0,190555
LESOTHO	1992	3,299289	-0,80655	1,508614	0,178578
LESOTHO	1993	3,299507	-0,76876	1,534655	0,186011
LESOTHO	1994	3,299725	-0,75239	1,521837	0,182368
LESOTHO	1995	3,299943	-0,74356	1,496046	0,174945
LESOTHO	1996	3,300161	-0,78144	1,515817	0,180647
LESOTHO	1997	3,300378	-0,76244	1,522333	0,18251
LESOTHO	1998	3,300595	-0,80844	1,537333	0,186768
LESOTHO	1999	3,300813	-0,85347	1,478384	0,169787
LESOTHO	2000	3,30103	-0,82739	1,441264	0,158743
LESOTHO	2001	3,301247	-0,81852	1,447661	0,160667
LESOTHO	2002	3,301464	-0,82489	1,423487	0,153353
LESOTHO	2003	3,301681	-0,77852	1,418884	0,151947
LESOTHO	2004	3,301898	-0,77227	1,386226	0,141834
LESOTHO	2005	3,302114	-0,78022	1,384404	0,141263
LESOTHO	2006	3,302331	-0,70738	1,459065	0,164075
LESOTHO	2007	3,302547	-0,5563	1,528326	0,184216
LESOTHO	2008	3,302764	-0,54421	1,526542	0,183709
LESOTHO	2009	3,30298	-0,57162	1,544228	0,188711
LESOTHO	2010	3,303196	-0,61213	1,570933	0,196158
LESOTHO	2011	3,303412	-0,62967	1,518495	0,181413

LESOTHO	2012	3,303628	-0,5942	1,512004	0,179553
LESOTHO	2013	3,303844	-0,59063	1,550407	0,190446
LESOTHO	2014	3,304059	-0,579	1,50149	0,176522
LESOTHO	2015	3,304275	-0,57716	1,500264	0,176168
LESOTHO	2016	3,304491	-0,634	1,450537	0,161529
LESOTHO	2017	3,304706	-0,61293	1,546718	0,189411
MAURITIUS	1990	3,298853	-0,67748	1,799622	0,255181
MAURITIUS	1991	3,299071	-0,66146	1,830488	0,262567
MAURITIUS	1992	3,299289	-0,65833	1,844117	0,265789
MAURITIUS	1993	3,299507	-0,6937	1,852365	0,267727
MAURITIUS	1994	3,299725	-0,69345	1,85736	0,268896
MAURITIUS	1995	3,299943	-0,69877	1,890291	0,276529
MAURITIUS	1996	3,300161	-0,74218	1,868873	0,27158
MAURITIUS	1997	3,300378	-0,70415	1,889113	0,276258
MAURITIUS	1998	3,300595	-0,6957	1,880425	0,274256
MAURITIUS	1999	3,300813	-0,69483	1,908079	0,280596
MAURITIUS	2000	3,30103	-0,6832	1,89995	0,278742
MAURITIUS	2001	3,301247	-0,69019	1,905002	0,279895
MAURITIUS	2002	3,301464	-0,69547	1,9229	0,283957
MAURITIUS	2003	3,301681	-0,67295	1,980251	0,29672
MAURITIUS	2004	3,301898	-0,69269	2,00532	0,302184
MAURITIUS	2005	3,302114	-0,70218	2,009482	0,303084
MAURITIUS	2006	3,302331	-0,74929	1,969011	0,294248
MAURITIUS	2007	3,302547	-0,76564	1,972077	0,294924
MAURITIUS	2008	3,302764	-0,73442	1,984541	0,29766
MAURITIUS	2009	3,30298	-0,68897	1,983418	0,297414
MAURITIUS	2010	3,303196	-0,71271	1,988966	0,298627

MAURITIUS	2011	3,303412	-0,70377	1,985156	0,297795
MAURITIUS	2012	3,303628	-0,69563	1,993729	0,299666
MAURITIUS	2013	3,303844	-0,69479	1,99201	0,299292
MAURITIUS	2014	3,304059	-0,67722	2,006044	0,30234
MAURITIUS	2015	3,304275	-0,97308	2,028802	0,30724
MAURITIUS	2016	3,304491	-0,67013	2,040981	0,309839
MAURITIUS	2017	3,304706	-0,68644	2,057401	0,313319
SEYCHELLES	1990	3,298853	-0,27059	1,600323	0,204208
SEYCHELLES	1991	3,299071	-0,26779	1,645569	0,216316
SEYCHELLES	1992	3,299289	-0,26782	1,654713	0,218723
SEYCHELLES	1993	3,299507	-0,334	1,703614	0,231371
SEYCHELLES	1994	3,299725	-0,31489	1,777698	0,249858
SEYCHELLES	1995	3,299943	-0,38933	1,843099	0,265549
SEYCHELLES	1996	3,300161	-0,38537	1,887003	0,275773
SEYCHELLES	1997	3,300378	-0,39796	1,898558	0,278424
SEYCHELLES	1998	3,300595	-0,44484	1,908647	0,280726
SEYCHELLES	1999	3,300813	-0,42514	1,966566	0,293708
SEYCHELLES	2000	3,30103	-0,42588	1,962794	0,292875
SEYCHELLES	2001	3,301247	-0,49637	1,998387	0,30068
SEYCHELLES	2002	3,301464	-0,41711	2,020487	0,305456
SEYCHELLES	2003	3,301681	-0,36054	2,044417	0,310569
SEYCHELLES	2004	3,301898	-0,36054	2,018055	0,304933
SEYCHELLES	2005	3,302114	-0,41333	1,985731	0,29792
SEYCHELLES	2006	3,302331	-0,46427	1,953436	0,290799
SEYCHELLES	2007	3,302547	-0,53712	1,825857	0,261467
SEYCHELLES	2008	3,302764	-0,5692	1,812233	0,258214
SEYCHELLES	2009	3,30298	-0,56497	1,744301	0,241621

SEYCHELLES	2010	3,303196	-0,54237	1,793468	0,253694
SEYCHELLES	2011	3,303412	-0,51252	1,760125	0,245543
SEYCHELLES	2012	3,303628	-0,53396	1,708562	0,232631
SEYCHELLES	2013	3,303844	-0,52751	1,765844	0,246952
SEYCHELLES	2014	3,304059	-0,5583	1,839335	0,264661
SEYCHELLES	2015	3,304275	-0,53422	1,821986	0,260545
SEYCHELLES	2016	3,304491	-0,50682	1,855988	0,268575
SEYCHELLES	2017	3,304706	-0,5028	1,89049	0,276574
CAMEROON	1990	1,238918	-0,83317	1,327025	0,215664
CAMEROON	1991	1,221302	-0,79553	1,335035	0,552512
CAMEROON	1992	1,1555	-0,79931	1,274834	0,106419
CAMEROON	1993	1,236732	-0,95667	1,123168	1,599886
CAMEROON	1994	1,300141	-1,06794	1,176387	0,983118
CAMEROON	1995	1,296672	-0,95618	1,112827	0,698343
CAMEROON	1996	1,309348	-0,96915	1,043408	0,030504
CAMEROON	1997	1,324726	-0,96987	1,071647	0,747327
CAMEROON	1998	1,326927	-0,86948	1,066715	0,634305
CAMEROON	1999	1,303784	-0,88178	1,107573	0,049127
CAMEROON	2000	1,293074	-0,8764	1,146366	0,717239
CAMEROON	2001	1,356689	-0,8911	1,127431	0,164553
CAMEROON	2002	1,358443	-0,89449	1,184891	0,265208
CAMEROON	2003	1,356953	-0,90091	1,173022	0,70816
CAMEROON	2004	1,348215	-0,88714	1,167197	0,297981
CAMEROON	2005	1,336451	-0,88824	1,179154	0,12554
CAMEROON	2006	1,319899	-0,8835	1,183983	0,526167
CAMEROON	2007	1,317616	-0,88373	1,219272	0,01874
CAMEROON	2008	1,384465	-0,89707	1,233289	0,820384

CAMEROON	2009	1,372892	-0,90165	1,25111	0,216214
CAMEROON	2010	1,370476	-0,90088	1,284451	0,280994
CAMEROON	2011	1,383598	-0,90209	1,297341	0,426549
CAMEROON	2012	1,357237	-0,80168	1,266342	0,426658
CAMEROON	2013	1,354429	-0,80179	1,28177	0,309876
CAMEROON	2014	1,375473	-0,7919	1,301943	0,321407
CAMEROON	2015	1,362621	-0,81509	1,31393	0,74679
CAMEROON	2016	1,353966	-0,84285	1,310663	0,039271
CAMEROON	2017	1,361226	-0,83675	1,312099	0,170986
GHANA	1990	1,157946	-0,94149	1,150514	1,493689
GHANA	1991	1,1993	-0,8714	1,192087	1,301927
GHANA	1992	1,105033	-0,97187	1,312302	1,047278
GHANA	1993	1,376313	-0,83506	1,297442	1,501842
GHANA	1994	1,353617	-0,81729	1,352436	1,478984
GHANA	1995	1,324917	-0,80515	1,335317	1,633926
GHANA	1996	1,307467	-0,80334	1,313785	1,600295
GHANA	1997	1,377224	-0,85128	1,377342	1,289102
GHANA	1998	1,349541	-0,82253	1,359026	1,231685
GHANA	1999	1,311064	-0,84021	1,381888	1,145233
GHANA	2000	1,363577	-0,84351	1,449728	1,435049
GHANA	2001	1,433336	-0,81983	1,497556	1,541803
GHANA	2002	1,273579	-0,79471	1,532859	1,358289
GHANA	2003	1,360535	-0,76826	1,492005	1,457949
GHANA	2004	1,452974	-0,70804	1,514848	1,156856
GHANA	2005	1,46243	-0,72332	1,506641	1,17504
GHANA	2006	1,360861	-0,92938	1,366688	1,907167
GHANA	2007	1,187085	-0,87061	1,410217	1,270164

GHANA	2008	1,217272	-0,88147	1,438724	1,288032
GHANA	2009	1,189738	-0,86508	1,450973	1,194974
GHANA	2010	1,070558	-0,83358	1,471573	1,219994
GHANA	2011	1,078346	-0,76368	1,484997	1,143478
GHANA	2012	1,207093	-0,76379	1,482327	1,181994
GHANA	2013	1,410855	-0,75408	1,344386	1,724186
GHANA	2014	1,458013	-0,82379	1,382685	1,345648
GHANA	2015	1,466071	-0,60429	1,416893	1,133168
GHANA	2016	1,430979	-0,58023	1,428666	1,183252
GHANA	2017	1,313436	-0,5701	1,416598	1,015056
NAMIBIA	1990	1,266245	-0,59452	1,311712	0,804805
NAMIBIA	1991	1,140698	-0,52911	1,367267	0,777856
NAMIBIA	1992	1,251417	-0,55086	1,460706	1,011546
NAMIBIA	1993	1,27554	-0,54817	1,505625	0,973284
NAMIBIA	1994	1,245867	-0,55328	1,533532	1,315848
NAMIBIA	1995	1,298151	-0,56281	1,577682	0,81846
NAMIBIA	1996	1,322664	-0,5867	1,597215	1,174651
NAMIBIA	1997	1,244133	-0,55157	1,583902	0,841404
NAMIBIA	1998	1,313946	-0,57595	1,57864	0,920723
NAMIBIA	1999	1,31335	-0,53995	1,613437	0,82604
NAMIBIA	2000	1,228034	-0,52718	1,610239	1,008158
NAMIBIA	2001	1,329485	-0,57947	1,585134	1,048324
NAMIBIA	2002	1,310996	-0,53753	1,58513	1,003982
NAMIBIA	2003	1,291405	-0,61546	1,571186	0,05608
NAMIBIA	2004	1,27701	-0,57934	1,598679	0,386071
NAMIBIA	2005	1,27824	-0,53546	1,586182	0,741454
NAMIBIA	2006	1,342933	-0,47971	1,630302	0,973757

NAMIBIA	2007	1,342608	-0,49834	1,630539	1,006636
NAMIBIA	2008	1,403428	-0,52875	1,628456	1,037765
NAMIBIA	2009	1,446435	-0,58157	1,800957	0,84279
NAMIBIA	2010	1,402843	-0,60144	1,7966	0,551955
NAMIBIA	2011	1,355999	-0,53046	1,806513	0,580362
NAMIBIA	2012	1,410728	-0,51828	1,757698	1,109979
NAMIBIA	2013	1,423589	-0,53281	1,753233	0,944301
NAMIBIA	2014	1,523962	-0,54059	1,729099	0,796448
NAMIBIA	2015	1,522915	-0,5748	1,737133	0,29047
NAMIBIA	2016	1,350412	-0,59682	1,714121	0,972246
NAMIBIA	2017	1,19499	-0,51715	1,717056	0,988881
BOTSWANA	1990	1,509953	-0,27075	1,340845	0,799342
BOTSWANA	1991	1,495145	-0,27489	1,438643	0,714138
BOTSWANA	1992	1,470565	-0,2613	1,45228	0,822121
BOTSWANA	1993	1,430498	-0,26494	1,323001	1,116099
BOTSWANA	1994	1,412997	-0,38903	1,3206	0,976066
BOTSWANA	1995	1,431004	-0,37328	1,311293	0,854628
BOTSWANA	1996	1,361982	-0,27775	1,296545	1,207155
BOTSWANA	1997	1,417859	-0,29127	1,350048	0,698153
BOTSWANA	1998	1,4489	-0,36919	1,451219	0,998576
BOTSWANA	1999	1,426184	-0,28154	1,454859	1,153364
BOTSWANA	2000	1,400408	-0,29171	1,394735	1,151399
BOTSWANA	2001	1,41361	-0,29198	1,595488	0,919749
BOTSWANA	2002	1,438897	-0,30233	1,655605	0,074586
BOTSWANA	2003	1,447404	-0,30608	1,680139	0,513096
BOTSWANA	2004	1,444697	-0,31117	1,671026	1,003408
BOTSWANA	2005	1,403803	-0,276	1,647636	1,189538

BOTSWANA	2006	1,418319	-0,2537	1,618726	0,873503
BOTSWANA	2007	1,453093	-0,32521	1,682094	0,692636
BOTSWANA	2008	1,485475	-0,40295	1,720151	0,674805
BOTSWANA	2009	1,542946	-0,44552	1,721834	0,810402
BOTSWANA	2010	1,526548	-0,48305	1,693196	0,950365
BOTSWANA	2011	1,505758	-0,45753	1,629815	1,144827
BOTSWANA	2012	1,55904	-0,469	1,65141	0,71271
BOTSWANA	2013	1,525015	-0,41112	1,629999	0,363446
BOTSWANA	2014	1,483742	-0,4052	1,583001	1,075688
BOTSWANA	2015	1,531311	-0,50855	1,661143	0,270757
BOTSWANA	2016	1,492273	-0,45538	1,61661	1,077485
BOTSWANA	2017	1,464064	-0,4969	1,604619	0,41746
SOUTH AFRICA	1990	3,298853	-0,59087	1,717309	0,234848
SOUTH AFRICA	1991	3,299071	-0,60503	1,727199	0,237342
SOUTH AFRICA	1992	3,299289	-0,63407	1,68977	0,227828
SOUTH AFRICA	1993	3,299507	-0,60879	1,658012	0,219588
SOUTH AFRICA	1994	3,299725	-0,62933	1,677719	0,224719
SOUTH AFRICA	1995	3,299943	-0,61389	1,686801	0,227064
SOUTH AFRICA	1996	3,300161	-0,59413	1,693439	0,22877
SOUTH AFRICA	1997	3,300378	-0,59438	1,720113	0,235557
SOUTH AFRICA	1998	3,300595	-0,58368	1,740961	0,240789
SOUTH AFRICA	1999	3,300813	-0,56906	1,746123	0,242075
SOUTH AFRICA	2000	3,30103	-0,58113	1,721897	0,236007
SOUTH AFRICA	2001	3,301247	-0,56018	1,758213	0,245072
SOUTH AFRICA	2002	3,301464	-0,57722	1,765354	0,246832
SOUTH AFRICA	2003	3,301681	-0,57859	1,782696	0,251077
SOUTH AFRICA	2004	3,301898	-0,56726	1,789559	0,252746

SOUTH AFRICA	2005	3,302114	-0,53907	1,825881	0,261472
SOUTH AFRICA	2006	3,302331	-0,52191	1,864423	0,270544
SOUTH AFRICA	2007	3,302547	-0,51946	1,898099	0,278319
SOUTH AFRICA	2008	3,302764	-0,53622	1,907411	0,280444
SOUTH AFRICA	2009	3,30298	-0,56151	1,890298	0,27653
SOUTH AFRICA	2010	3,303196	-0,54573	1,879667	0,274081
SOUTH AFRICA	2011	3,303412	-0,54608	1,872946	0,272525
SOUTH AFRICA	2012	3,303628	-0,55093	1,86298	0,270208
SOUTH AFRICA	2013	3,303844	-0,54043	1,851342	0,267487
SOUTH AFRICA	2014	3,304059	-0,51413	1,850464	0,267281
SOUTH AFRICA	2015	3,304275	-0,50375	1,86592	0,270893
SOUTH AFRICA	2016	3,304491	-0,50338	1,860638	0,269662
SOUTH AFRICA	2017	3,304706	-0,50561	1,858585	0,269182

APPENDIX B: Panel Unit root tests

APPENDIX B: Gross fixed capital information at level for all tests

Null Hypothesis: Unit root (individual unit root process)
Series: LGFCF
Date: 11/01/20 Time: 23:11
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	2.89365	1.0000
ADF - Choi Z-stat	NA	

Test statistic value of 'NA' due to the present of a p-value of one or zero
** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results LGFCF

Cross

Section	Prob.	Lag	Max Lag	Obs
EGYPT	1.0000	1	1	26
LESOTHO	1.0000	1	1	26
MAURITIUS	1.0000	1	1	26
SEYCHELLES	1.0000	1	1	26
CAMEROON	0.8745	1	1	26
GHANA	0.6743	1	1	26
NAMIBIA	0.6736	1	1	26
BOTSWANA	0.5924	1	1	26
SOUTH AFRICA	1.0000	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: LGFCF
Date: 11/02/20 Time: 00:27
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 104
Cross-sections included: 4 (5 dropped)

Method	Statistic	Prob.**
ADF - Fisher Chi-square	15.3909	0.0520
ADF - Choi Z-stat	-2.00560	0.0224

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

Intermediate ADF test results LGFCF

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT		Dropped from Test		
LESOTHO		Dropped from Test		
MAURITIUS		Dropped from Test		
SEYCHELLES		Dropped from Test		
CAMEROON	0.2000	1	1	26
GHANA	0.0783	1	1	26
NAMIBIA	0.0795	1	1	26
BOTSWANA	0.3650	1	1	26
SOUTH AFRICA		Dropped from Test		

Null Hypothesis: Unit root (individual unit root process)
Series: LGFCF
Date: 11/01/20 Time: 23:09
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Total (balanced) observations: 104
Cross-sections included: 4 (5 dropped)

Method	Statistic	Prob.**
ADF - Fisher Chi-square	12.7109	0.1222
ADF - Choi Z-stat	-1.64792	0.0497

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

Intermediate ADF test results LGFCF

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT		Dropped from Test		
LESOTHO		Dropped from Test		
MAURITIUS		Dropped from Test		
SEYCHELLES		Dropped from Test		
CAMEROON	0.2001	1	1	26
GHANA	0.2556	1	1	26
NAMIBIA	0.1930	1	1	26
BOTSWANA	0.1760	1	1	26
SOUTH AFRICA		Dropped from Test		

Null Hypothesis: Unit root (individual unit root process)
Series: LGFCF
Date: 11/01/20 Time: 23:32
Sample: 1990 2017
Exogenous variables: None
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	3.13227	1.0000
PP - Choi Z-stat	7.05401	1.0000

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

Intermediate Phillips-Perron test results LGFCF

Cross Section	Prob.	Bandwidth	Obs
EGYPT	0.9999	3.0	27
LESOTHO	0.9999	3.0	27
MAURITIUS	0.9999	3.0	27
SEYCHELLES	0.9999	3.0	27
CAMEROON	0.9596	15.0	27
GHANA	0.7063	2.0	27
NAMIBIA	0.5610	4.0	27
BOTSWANA	0.5495	7.0	27
SOUTH AFRICA	0.9999	3.0	27

Null Hypothesis: Unit root (individual unit root process)
Series: LGFCF
Date: 11/02/20 Time: 00:29
Sample: 1990 2017
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	11.4919	0.8723
PP - Choi Z-stat		NA

Test statistic value of 'NA' due to the present of a p-value of one or zero

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

Intermediate Phillips-Perron test results LGFCF

Cross Section	Prob.	Bandwidth	Obs
EGYPT	1.0000	3.0	27
LESOTHO	1.0000	3.0	27
MAURITIUS	1.0000	3.0	27
SEYCHELLES	1.0000	3.0	27
CAMEROON	0.4339	12.0	27
GHANA	0.0974	1.0	27
NAMIBIA	0.2574	2.0	27
BOTSWANA	0.2937	2.0	27
SOUTH AFRICA	1.0000	3.0	27

Null Hypothesis: Unit root (individual unit root process)
Series: LGFCF
Date: 11/01/20 Time: 23:33
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear Trends
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	1325.32	0.0000
PP - Choi Z-stat	-27.1393	0.0000

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

Intermediate Phillips-Perron test results LGFCF

Cross Section	Prob.	Bandwidth	Obs
EGYPT	0.0000	3.0	27
LESOTHO	0.0000	3.0	27
MAURITIUS	0.0000	3.0	27
SEYCHELLES	0.0000	3.0	27
CAMEROON	0.4188	4.0	27
GHANA	0.3050	1.0	27
NAMIBIA	0.5073	3.0	27
BOTSWANA	0.2354	5.0	27
SOUTH AFRICA	0.0000	3.0	27

Null Hypothesis: Unit root (common unit root process)
Series: LGFCF
Date: 11/01/20 Time: 23:35
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234

Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	3079.02	1.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on LGFCF

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	2.9E-08	2.E-24	2.E-07	1	1	3.0	26
LESOTHO	2.9E-08	2.E-24	2.E-07	1	1	3.0	26
MAURITIUS	2.9E-08	2.E-24	2.E-07	1	1	3.0	26
SEYCHELLES	2.9E-08	2.E-24	2.E-07	1	1	3.0	26
CAMEROON	0.00381	0.0010	0.0005	1	1	9.0	26
GHANA	3.6E-05	0.0105	0.0093	1	1	2.0	26
NAMIBIA	3.3E-06	0.0049	0.0037	1	1	4.0	26
BOTSWANA	-0.00114	0.0012	0.0008	1	1	7.0	26
SOUTH AFRICA	2.9E-08	2.E-24	2.E-07	1	1	3.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	2.9E-08	3221.275	1.002	0.004	1.046	234

Null Hypothesis: Unit root (common unit root process)
Series: LGFCF
Date: 11/02/20 Time: 00:31
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-5419.03	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on LGFCF

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-5.0E-07	9.E-30	2.E-12	1	1	3.0	26
LESOTHO	-5.0E-07	9.E-30	2.E-12	1	1	3.0	26
MAURITIUS	-5.0E-07	9.E-30	2.E-12	1	1	3.0	26
SEYCHELLES	-5.0E-07	9.E-30	2.E-12	1	1	3.0	26
CAMEROON	-0.26001	0.0008	0.0002	1	1	16.0	26
GHANA	-0.47078	0.0079	0.0081	1	1	3.0	26
NAMIBIA	-0.43516	0.0037	0.0037	1	1	4.0	26
BOTSWANA	-0.26444	0.0011	0.0009	1	1	7.0	26
SOUTH AFRICA	-5.0E-07	9.E-30	2.E-12	1	1	3.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-5.0E-07	-4951.014	1.055	-0.552	0.913	234

Null Hypothesis: Unit root (common unit root process)
Series: LGFCF
Date: 11/01/20 Time: 23:37
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-6.11756	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on LGFCF

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-1.5E-06	6.E-30	3.E-17	1	1	3.0	26
LESOTHO	-1.5E-06	6.E-30	3.E-17	1	1	3.0	26
MAURITIUS	-1.5E-06	6.E-30	3.E-17	1	1	3.0	26
SEYCHELLES	-1.5E-06	6.E-30	3.E-17	1	1	3.0	26
CAMEROON	-0.55887	0.0007	6.E-05	1	1	26.0	26
GHANA	-0.46829	0.0079	0.0081	1	1	3.0	26
NAMIBIA	-1.00303	0.0032	0.0035	1	1	4.0	26
BOTSWANA	-0.49902	0.0009	0.0007	1	1	9.0	26
SOUTH AFRICA	-1.5E-06	6.E-30	3.E-17	1	1	3.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-1.5E-06	-18.867	1.077	-0.697	0.992	234

APPENDIX B: Gross fixed capital formation at first difference for all tests

Null Hypothesis: Unit root (individual unit root process)
Series: D(LGFCF)
Date: 11/01/20 Time: 23:38
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	1390.23	0.0000
ADF - Choi Z-stat	-31.5621	0.0000

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

Intermediate ADF test results D(LGFCF)

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.0000	1	1	25
LESOTHO	0.0000	1	1	25
MAURITIUS	0.0000	1	1	25
SEYCHELLES	0.0000	1	1	25
CAMEROON	0.0000	1	1	25
GHANA	0.0005	1	1	25
NAMIBIA	0.0011	1	1	25
BOTSWANA	0.0001	1	1	25
SOUTH AFRICA	0.0000	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(LGFCF)
Date: 11/02/20 Time: 00:58
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	195.195	0.0000
ADF - Choi Z-stat	-11.9139	0.0000

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

Intermediate ADF test results D(LGFCF)

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.0000	1	1	25
LESOTHO	0.0000	1	1	25
MAURITIUS	0.0000	1	1	25
SEYCHELLES	0.0000	1	1	25
CAMEROON	0.0000	1	1	25
GHANA	0.0084	1	1	25
NAMIBIA	0.0227	1	1	25
BOTSWANA	0.0016	1	1	25
SOUTH AFRICA	0.0000	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(LGFCF)
Date: 11/01/20 Time: 23:39
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	43.6998	0.0006
ADF - Choi Z-stat	6.59357	1.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi

-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results D(LGFCF)

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	1.0000	1	1	25
LESOTHO	1.0000	1	1	25
MAURITIUS	1.0000	1	1	25
SEYCHELLES	1.0000	1	1	25
CAMEROON	0.0000	1	1	25
GHANA	0.0376	1	1	25
NAMIBIA	0.0783	1	1	25
BOTSWANA	0.0091	1	1	25
SOUTH AFRICA	1.0000	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(LGFCF)
Date: 11/01/20 Time: 23:40
Sample: 1990 2017
Exogenous variables: None
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	1407.80	0.0000
PP - Choi Z-stat	-32.2996	0.0000

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

Intermediate Phillips-Perron test results D(LGFCF)

Cross Section	Prob.	Bandwidth	Obs
EGYPT	0.0000	3.0	26
LESOTHO	0.0000	3.0	26
MAURITIUS	0.0000	3.0	26
SEYCHELLES	0.0000	3.0	26
CAMEROON	0.0000	8.0	26
GHANA	0.0000	3.0	26
NAMIBIA	0.0000	3.0	26
BOTSWANA	0.0000	5.0	26
SOUTH AFRICA	0.0000	3.0	26

Null Hypothesis: Unit root (individual unit root process)
Series: D(LGFCF)
Date: 11/02/20 Time: 00:44
Sample: 1990 2017
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	68.4531	0.0000

PP - Choi Z-stat	NA

Test statistic value of 'NA' due to the present of a p-value of one or zero

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

Intermediate Phillips-Perron test results D(LGFCF)

Cross Section	Prob.	Bandwidth	Obs
EGYPT	1.0000	3.0	26
LESOTHO	1.0000	3.0	26
MAURITIUS	1.0000	3.0	26
SEYCHELLES	1.0000	3.0	26
CAMEROON	0.0000	13.0	26
GHANA	0.0009	3.0	26
NAMIBIA	0.0008	3.0	26
BOTSWANA	0.0001	5.0	26
SOUTH AFRICA	1.0000	3.0	26

Null Hypothesis: Unit root (individual unit root process)
Series: D(LGFCF)
Date: 11/01/20 Time: 23:41
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear Trends
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	1443.99	0.0000
PP - Choi Z-stat	-32.5483	0.0000

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

Intermediate Phillips-Perron test results D(LGFCF)

Cross Section	Prob.	Bandwidth	Obs
EGYPT	0.0000	3.0	26
LESOTHO	0.0000	3.0	26
MAURITIUS	0.0000	3.0	26
SEYCHELLES	0.0000	3.0	26
CAMEROON	0.0000	25.0	26
GHANA	0.0056	3.0	26
NAMIBIA	0.0025	3.0	26
BOTSWANA	0.0009	6.0	26
SOUTH AFRICA	0.0000	3.0	26

Null Hypothesis: Unit root (common unit root process)

Series: D(LGFCF)
Date: 11/02/20 Time: 01:03
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-2550.56	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(LGFCF)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-5.0E-07	2.E-30	4.E-14	1	1	3.0	25
LESOTHO	-5.0E-07	2.E-30	4.E-14	1	1	3.0	25
MAURITIUS	-5.0E-07	2.E-30	4.E-14	1	1	3.0	25
SEYCHELLES	-5.0E-07	2.E-30	4.E-14	1	1	3.0	25
CAMEROON	-1.40901	0.0008	0.0002	1	1	11.0	25
GHANA	-1.12989	0.0103	0.0014	1	1	25.0	25
NAMIBIA	-1.28514	0.0042	0.0022	1	1	17.0	25
BOTSWANA	-1.42718	0.0012	0.0003	1	1	9.0	25
SOUTH AFRICA	-5.0E-07	2.E-30	4.E-14	1	1	3.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*		Obs
Pooled	-5.0E-07	-2675.527	1.177	0.004	1.049		225

Null Hypothesis: Unit root (common unit root process)
Series: D(LGFCF)
Date: 11/02/20 Time: 00:39
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-23.2102	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(LGFCF)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-1.5E-06	4.E-31	2.E-18	1	1	3.0	25
LESOTHO	-1.5E-06	4.E-31	2.E-18	1	1	3.0	25
MAURITIUS	-1.5E-06	4.E-31	2.E-18	1	1	3.0	25
SEYCHELLES	-1.5E-06	4.E-31	2.E-18	1	1	3.0	25
CAMEROON	-1.51439	0.0007	0.0002	1	1	11.0	25
GHANA	-1.15136	0.0102	0.0012	1	1	23.0	25

NAMIBIA	-1.29062	0.0042	0.0022	1	1	17.0	25
BOTSWANA	-1.42714	0.0012	0.0003	1	1	9.0	25
SOUTH AFRICA	-1.5E-06	4.E-31	2.E-18	1	1	3.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*		Obs
Pooled	-1.5E-06	-27.534	1.194	-0.554	0.919		225

Null Hypothesis: Unit root (common unit root process)
Series: D(LGFCF)
Date: 11/02/20 Time: 01:02
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	17.711 1	1.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(LGFCF)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	1.1E-05	4.E-31	5.E-23	1	1	3.0	25
LESOTHO	1.1E-05	4.E-31	5.E-23	1	1	3.0	25
MAURITIUS	1.1E-05	4.E-31	5.E-23	1	1	3.0	25
SEYCHELLES	1.1E-05	4.E-31	5.E-23	1	1	3.0	25
CAMEROON	-1.62502	0.0005	0.0002	1	1	10.0	25
GHANA	-1.14863	0.0099	0.0011	1	1	23.0	25
NAMIBIA	-1.29984	0.0040	0.0011	1	1	13.0	25
BOTSWANA	-1.48752	0.0011	0.0002	1	1	9.0	25
SOUTH AFRICA	1.1E-05	4.E-31	5.E-23	1	1	3.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*		Obs
Pooled	1.1E-05	0.418	1.233	-0.703	1.003		225

APPENDIX B: Budget deficit at level for all tests

Null Hypothesis: Unit root (individual unit root process)
Series: DEFICIT
Date: 11/02/20 Time: 01:11
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	11.9804	0.8482

ADF - Choi Z-stat	0.74258	0.7711

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

Intermediate ADF test results DEFICIT

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.8725	1	1	26
LESOTHO	0.3711	1	1	26
MAURITIUS	0.6348	1	1	26
SEYCHELLES	0.8435	1	1	26
CAMEROON	0.6679	1	1	26
GHANA	0.2309	1	1	26
NAMIBIA	0.6059	1	1	26
BOTSWANA	0.8411	1	1	26
SOUTH AFRICA	0.1837	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: DEFICIT
Date: 11/02/20 Time: 01:12
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	31.3949	0.0259
ADF - Choi Z-stat	-1.46183	0.0719

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

Intermediate ADF test results DEFICIT

Cross section	Prob.	Lag	Max Lag	Obs
EGYPT	0.5854	1	1	26
LESOTHO	0.5962	1	1	26
MAURITIUS	0.0077	1	1	26
SEYCHELLES	0.2822	1	1	26
CAMEROON	0.0642	1	1	26
GHANA	0.7969	1	1	26
NAMIBIA	0.0074	1	1	26
BOTSWANA	0.6526	1	1	26
SOUTH AFRICA	0.8130	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: DEFICIT
Date: 11/02/20 Time: 01:13
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	40.6003	0.0017
ADF - Choi Z-stat	-3.09005	0.0010

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

Intermediate ADF test results DEFICIT

Cross section	Prob.	Lag	Max Lag	Obs
EGYPT	0.1821	1	1	26
LESOTHO	0.3831	1	1	26
MAURITIUS	0.0070	1	1	26
SEYCHELLES	0.3749	1	1	26
CAMEROON	0.0145	1	1	26
GHANA	0.7292	1	1	26
NAMIBIA	0.0262	1	1	26
BOTSWANA	0.3262	1	1	26
SOUTH AFRICA	0.0927	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: DEFICIT
Date: 11/02/20 Time: 01:14
Sample: 1990 2017
Exogenous variables: None
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	12.3602	0.8281
PP - Choi Z-stat	0.87213	0.8084

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

Intermediate Phillips-Perron test results DEFICIT

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.6692	2.0	27
LESOTHO	0.5127	1.0	27
MAURITIUS	0.6616	19.0	27
SEYCHELLES	0.8651	0.0	27
CAMEROON	0.6423	5.0	27
GHANA	0.1553	3.0	27
NAMIBIA	0.4341	3.0	27
BOTSWANA	0.9832	19.0	27
SOUTH AFRICA	0.2476	1.0	27

Null Hypothesis: Unit root (individual unit root process)
Series: DEFICIT
Date: 11/02/20 Time: 01:15
Sample: 1990 2017
Exogenous variables: Individual effects

Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	40.1521	0.0020
PP - Choi Z-stat	-1.95024	0.0256

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

Intermediate Phillips-Perron test results DEFICIT

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.4749	2.0	27
LESOTHO	0.7501	0.0	27
MAURITIUS	0.0001	2.0	27
SEYCHELLES	0.3803	0.0	27
CAMEROON	0.1640	2.0	27
GHANA	0.4287	0.0	27
NAMIBIA	0.0036	2.0	27
BOTSWANA	0.6717	5.0	27
SOUTH AFRICA	0.8322	0.0	27

Null Hypothesis: Unit root (individual unit root process)
Series: DEFICIT
Date: 11/02/20 Time: 01:16
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	65.0120	0.0000
PP - Choi Z-stat	-4.22485	0.0000

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

Intermediate Phillips-Perron test results DEFICIT

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0268	3.0	27
LESOTHO	0.3676	0.0	27
MAURITIUS	0.0000	7.0	27
SEYCHELLES	0.5213	1.0	27
CAMEROON	0.2924	6.0	27

GHANA	0.3393	1.0	27
NAMIBIA	0.0186	2.0	27
BOTSWANA	0.2754	2.0	27
SOUTH AFRICA	0.0733	1.0	27

Null Hypothesis: Unit root (common unit root process)
Series: DEFICIT
Date: 11/02/20 Time: 15:50
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-0.93298	0.1754

** Probabilities are computed assuming asympotic normality

Intermediate results on DEFICIT

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	0.00831	0.0011	0.0026	1	1	2.0	26
LESOTHO	-0.00915	0.0017	0.0025	1	1	1.0	26
MAURITIUS	-0.00240	0.0054	0.0003	1	1	26.0	26
SEYCHELLES	0.01157	0.0016	0.0018	1	1	1.0	26
CAMEROON	-0.00020	0.0028	0.0015	1	1	5.0	26
GHANA	-0.02009	0.0050	0.0039	1	1	2.0	26
NAMIBIA	-0.00276	0.0015	0.0005	1	1	4.0	26
BOTSWANA	0.01851	0.0028	0.0013	1	1	11.0	26
SOUTH AFRICA	-0.00741	0.0003	0.0003	1	1	0.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.00367	-0.973	1.009	0.004	1.046	234

Null Hypothesis: Unit root (common unit root process)
Series: DEFICIT
Date: 11/02/20 Time: 15:51
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-0.84871	0.1980

** Probabilities are computed assuming asympotic normality

Intermediate results on DEFICIT

Cross	2nd Stage	Variance	HAC of		Max	Band-

section	Coefficient	of Reg	Dep.	Lag	Lag	width	Obs
EGYPT	-0.12537	0.0010	0.0025	1	1	2.0	26
LESOTHO	-0.11491	0.0016	0.0025	1	1	1.0	26
MAURITIUS	-1.16341	0.0033	0.0003	1	1	26.0	26
SEYCHELLES	-0.17079	0.0013	0.0015	1	1	0.0	26
CAMEROON	-0.46816	0.0020	0.0015	1	1	5.0	26
GHANA	-0.17074	0.0049	0.0027	1	1	4.0	26
NAMIBIA	-0.94940	0.0009	0.0005	1	1	4.0	26
BOTSWANA	-0.17397	0.0026	0.0004	1	1	21.0	26
SOUTH AFRICA	-0.07300	0.0002	0.0002	1	1	1.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.18821	-4.766	1.060	-0.552	0.913	234

Null Hypothesis: Unit root (common unit root process)
Series: DEFICIT
Date: 11/02/20 Time: 15:51
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-1.09338	0.1371

** Probabilities are computed assuming asympotic normality

Intermediate results on DEFICIT

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.40204	0.0008	0.0023	1	1	2.0	26
LESOTHO	-0.30039	0.0014	0.0024	1	1	1.0	26
MAURITIUS	-1.57193	0.0028	0.0003	1	1	26.0	26
SEYCHELLES	-0.43607	0.0012	0.0015	1	1	1.0	26
CAMEROON	-0.66764	0.0015	0.0009	1	1	7.0	26
GHANA	-0.41440	0.0043	0.0025	1	1	4.0	26
NAMIBIA	-0.97701	0.0009	0.0005	1	1	4.0	26
BOTSWANA	-0.51171	0.0021	0.0002	1	1	26.0	26
SOUTH AFRICA	-0.67433	0.0002	0.0002	1	1	2.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.52436	-8.995	1.045	-0.697	0.992	234

APPENDIX B: Budget deficit at first difference for all tests

Null Hypothesis: Unit root (individual unit root process)
Series: D(DEFICIT)
Date: 11/02/20 Time: 15:53
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Total (balanced) observations: 225

Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	156.462	0.0000
ADF - Choi Z-stat	-10.6610	0.0000

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

Intermediate ADF test results D(DEFICIT)

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.0008	1	1	25
LESOTHO	0.0002	1	1	25
MAURITIUS	0.0000	1	1	25
SEYCHELLES	0.0030	1	1	25
CAMEROON	0.0001	1	1	25
GHANA	0.0005	1	1	25
NAMIBIA	0.0003	1	1	25
BOTSWANA	0.0000	1	1	25
SOUTH AFRICA	0.0004	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(DEFICIT)
Date: 11/02/20 Time: 15:54
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	110.243	0.0000
ADF - Choi Z-stat	-8.43074	0.0000

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

Intermediate ADF test results D(DEFICIT)

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.0072	1	1	25
LESOTHO	0.0027	1	1	25
MAURITIUS	0.0001	1	1	25
SEYCHELLES	0.0254	1	1	25
CAMEROON	0.0019	1	1	25
GHANA	0.0042	1	1	25
NAMIBIA	0.0064	1	1	25
BOTSWANA	0.0004	1	1	25
SOUTH AFRICA	0.0019	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(DEFICIT)
Date: 11/02/20 Time: 15:54
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends

User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	79.5581	0.0000
ADF - Choi Z-stat	-6.62534	0.0000

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

Intermediate ADF test results D(DEFICIT)

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.0524	1	1	25
LESOTHO	0.0161	1	1	25
MAURITIUS	0.0007	1	1	25
SEYCHELLES	0.0608	1	1	25
CAMEROON	0.0059	1	1	25
GHANA	0.0208	1	1	25
NAMIBIA	0.0355	1	1	25
BOTSWANA	0.0024	1	1	25
SOUTH AFRICA	0.0148	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(DEFICIT)
Date: 11/02/20 Time: 15:59
Sample: 1990 2017
Exogenous variables: None
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	450.122	0.0000
PP - Choi Z-stat	-16.7228	0.0000

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

Intermediate Phillips-Perron test results D(DEFICIT)

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0000	1.0	26
LESOTHO	0.0003	3.0	26
MAURITIUS	0.0000	25.0	26
SEYCHELLES	0.0001	0.0	26
CAMEROON	0.0000	4.0	26
GHANA	0.0000	1.0	26
NAMIBIA	0.0000	3.0	26
BOTSWANA	0.0000	7.0	26
SOUTH AFRICA	0.0000	0.0	26

Null Hypothesis: Unit root (individual unit root process)
Series: D(DEFICIT)
Date: 11/02/20 Time: 16:01
Sample: 1990 2017
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	157.878	0.0000
PP - Choi Z-stat	-10.6823	0.0000

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

Intermediate Phillips-Perron test results D(DEFICIT)

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0011	0.0	26
LESOTHO	0.0055	4.0	26
MAURITIUS	0.0001	25.0	26
SEYCHELLES	0.0010	0.0	26
CAMEROON	0.0008	4.0	26
GHANA	0.0000	2.0	26
NAMIBIA	0.0000	3.0	26
BOTSWANA	0.0000	11.0	26
SOUTH AFRICA	0.0002	1.0	26

Null Hypothesis: Unit root (individual unit root process)
Series: D(DEFICIT)
Date: 11/02/20 Time: 16:02
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	377.763	0.0000
PP - Choi Z-stat	-13.5233	0.0000

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

Intermediate Phillips-Perron test results D(DEFICIT)

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0086	0.0	26
LESOTHO	0.0307	4.0	26
MAURITIUS	0.0000	22.0	26
SEYCHELLES	0.0038	1.0	26
CAMEROON	0.0034	4.0	26

GHANA	0.0000	3.0	26
NAMIBIA	0.0003	3.0	26
BOTSWANA	0.0000	11.0	26
SOUTH AFRICA	0.0012	1.0	26

Null Hypothesis: Unit root (common unit root process)
Series: D(DEFICIT)
Date: 11/02/20 Time: 16:04
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-11.6316	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(DEFICIT)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.77562	0.0010	0.0011	1	1	2.0	25
LESOTHO	-0.99404	0.0016	0.0004	1	1	25.0	25
MAURITIUS	-2.74041	0.0042	0.0006	1	1	25.0	25
SEYCHELLES	-0.88807	0.0017	0.0002	1	1	18.0	25
CAMEROON	-1.24615	0.0026	0.0005	1	1	12.0	25
GHANA	-1.21748	0.0051	0.0005	1	1	25.0	25
NAMIBIA	-1.33587	0.0015	0.0014	1	1	3.0	25
BOTSWANA	-1.44747	0.0027	0.0005	1	1	9.0	25
SOUTH AFRICA	-1.06892	0.0002	5.E-05	1	1	13.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-1.13970	-12.160	1.042	0.004	1.049	225

Null Hypothesis: Unit root (common unit root process)
Series: D(DEFICIT)
Date: 11/02/20 Time: 16:05
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-7.71129	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(DEFICIT)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.81440	0.0010	0.0011	1	1	2.0	25
LESOTHO	-1.02262	0.0016	0.0002	1	1	25.0	25

MAURITIUS	-2.84206	0.0041	0.0006	1	1	25.0	25
SEYCHELLES	-0.98790	0.0016	0.0002	1	1	18.0	25
CAMEROON	-1.24662	0.0026	0.0005	1	1	12.0	25
GHANA	-1.33143	0.0048	0.0005	1	1	25.0	25
NAMIBIA	-1.33426	0.0015	0.0014	1	1	3.0	25
BOTSWANA	-1.53819	0.0025	0.0005	1	1	9.0	25
SOUTH AFRICA	-1.23194	0.0002	5.E-05	1	1	13.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-1.19940	-12.855	1.043	-0.554	0.919	225

Null Hypothesis: Unit root (common unit root process)
Series: D(DEFICIT)
Date: 11/02/20 Time: 16:07
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-5.74583	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(DEFICIT)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.79638	0.0010	0.0010	1	1	3.0	25
LESOTHO	-1.03313	0.0016	0.0002	1	1	25.0	25
MAURITIUS	-2.87503	0.0040	0.0006	1	1	25.0	25
SEYCHELLES	-1.06607	0.0015	0.0002	1	1	18.0	25
CAMEROON	-1.32484	0.0025	0.0006	1	1	12.0	25
GHANA	-1.36293	0.0047	0.0005	1	1	25.0	25
NAMIBIA	-1.32558	0.0015	0.0014	1	1	3.0	25
BOTSWANA	-1.55528	0.0025	0.0005	1	1	9.0	25
SOUTH AFRICA	-1.21593	0.0002	4.E-05	1	1	14.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-1.21834	-12.892	1.042	-0.703	1.003	225

APPENDIX B: Money Supply at level for all tests

Null Hypothesis: Unit root (individual unit root process)
Series: LMS
Date: 11/02/20 Time: 16:25
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	4.21264	0.9997
ADF - Choi Z-stat	2.96168	0.9985

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

Intermediate ADF test results LMS

Cross section	Prob.	Lag	Max Lag	Obs
EGYPT	0.6936	1	1	26
LESOTHO	0.6432	1	1	26
MAURITIUS	0.9893	1	1	26
SEYCHELLES	0.8332	1	1	26
CAMEROON	0.6054	1	1	26
GHANA	0.8557	1	1	26
NAMIBIA	0.9312	1	1	26
BOTSWANA	0.7873	1	1	26
SOUTH AFRICA	0.8712	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: LMS
Date: 11/02/20 Time: 16:26
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	22.3237	0.2179
ADF - Choi Z-stat	-0.97862	0.1639

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

Intermediate ADF test results LMS

Cross section	Prob.	Lag	Max Lag	Obs
EGYPT	0.2499	1	1	26
LESOTHO	0.2384	1	1	26
MAURITIUS	0.8066	1	1	26
SEYCHELLES	0.2971	1	1	26
CAMEROON	0.5079	1	1	26
GHANA	0.0356	1	1	26
NAMIBIA	0.1093	1	1	26
BOTSWANA	0.6582	1	1	26
SOUTH AFRICA	0.7659	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: LMS
Date: 11/02/20 Time: 16:27
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	21.6798	0.2465
ADF - Choi Z-stat	-0.89582	0.1852

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

Intermediate ADF test results LMS

Cross section	Prob.	Lag	Max Lag	Obs
EGYPT	0.5798	1	1	26
LESOTHO	0.5554	1	1	26
MAURITIUS	0.3556	1	1	26
SEYCHELLES	0.6134	1	1	26
CAMEROON	0.0113	1	1	26
GHANA	0.2869	1	1	26
NAMIBIA	0.2481	1	1	26
BOTSWANA	0.7456	1	1	26
SOUTH AFRICA	0.4673	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: LMS
Date: 11/02/20 Time: 16:29
Sample: 1990 2017
Exogenous variables: None
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	3.94582	0.9998
PP - Choi Z-stat	3.41158	0.9997

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

Intermediate Phillips-Perron test results LMS

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.7185	2.0	27
LESOTHO	0.5384	1.0	27
MAURITIUS	0.9968	0.0	27
SEYCHELLES	0.8603	3.0	27
CAMEROON	0.6182	1.0	27
GHANA	0.8854	2.0	27
NAMIBIA	0.9575	2.0	27

BOTSWANA	0.8687	4.0	27
SOUTH AFRICA	0.9207	2.0	27

Null Hypothesis: Unit root (individual unit root process)
Series: LMS
Date: 11/02/20 Time: 16:30
Sample: 1990 2017
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	25.9746	0.1003
PP - Choi Z-stat	-1.49433	0.0675

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

Intermediate Phillips-Perron test results LMS

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.3206	2.0	27
LESOTHO	0.1042	1.0	27
MAURITIUS	0.6531	0.0	27
SEYCHELLES	0.2438	2.0	27
CAMEROON	0.5509	1.0	27
GHANA	0.0338	2.0	27
NAMIBIA	0.0586	1.0	27
BOTSWANA	0.4992	2.0	27
SOUTH AFRICA	0.7912	2.0	27

Null Hypothesis: Unit root (individual unit root process)
Series: LMS
Date: 11/02/20 Time: 16:31
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	27.9642	0.0626
PP - Choi Z-stat	-1.11943	0.1315

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

Intermediate Phillips-Perron test results LMS

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.6496	2.0	27
LESOTHO	0.3925	0.0	27
MAURITIUS	0.2598	1.0	27
SEYCHELLES	0.6165	2.0	27
CAMEROON	0.0004	22.0	27
GHANA	0.3177	2.0	27
NAMIBIA	0.2861	1.0	27
BOTSWANA	0.7501	1.0	27
SOUTH AFRICA	0.7190	2.0	27

Null Hypothesis: Unit root (common unit root process)
Series: LMS
Date: 11/02/20 Time: 16:34
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	2.09488	0.9819

** Probabilities are computed assuming asympotic normality

Intermediate results on LMS

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	0.00019	0.0008	0.0010	1	1	2.0	26
LESOTHO	-0.00049	0.0015	0.0016	1	1	1.0	26
MAURITIUS	0.00448	0.0003	0.0006	1	1	2.0	26
SEYCHELLES	0.00293	0.0021	0.0046	1	1	3.0	26
CAMEROON	-0.00148	0.0020	0.0019	1	1	1.0	26
GHANA	0.00544	0.0030	0.0027	1	1	2.0	26
NAMIBIA	0.00656	0.0019	0.0028	1	1	2.0	26
BOTSWANA	0.00318	0.0039	0.0036	1	1	3.0	26
SOUTH AFRICA	0.00172	0.0004	0.0007	1	1	2.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	0.00258	2.193	1.006	0.004	1.046	234

Null Hypothesis: Unit root (common unit root process)
Series: LMS
Date: 11/02/20 Time: 16:34
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-1.25981	0.1039

** Probabilities are computed assuming asympotic normality

Intermediate results on LMS

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.28645	0.0007	0.0010	1	1	2.0	26
LESOTHO	-0.32483	0.0013	0.0016	1	1	1.0	26
MAURITIUS	-0.04657	0.0003	0.0003	1	1	0.0	26
SEYCHELLES	-0.15202	0.0018	0.0042	1	1	3.0	26
CAMEROON	-0.16443	0.0018	0.0019	1	1	1.0	26
GHANA	-0.37039	0.0021	0.0024	1	1	2.0	26
NAMIBIA	-0.19410	0.0014	0.0022	1	1	2.0	26
BOTSWANA	-0.10741	0.0036	0.0032	1	1	4.0	26
SOUTH AFRICA	-0.04636	0.0004	0.0006	1	1	2.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.12468	-4.815	1.030	-0.552	0.913	234

Null Hypothesis: Unit root (common unit root process)
Series: LMS
Date: 11/02/20 Time: 16:35
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-0.99540	0.1598

** Probabilities are computed assuming asympotic normality

Intermediate results on LMS

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.27995	0.0007	0.0010	1	1	2.0	26
LESOTHO	-0.31488	0.0013	0.0014	1	1	2.0	26
MAURITIUS	-0.42387	0.0003	0.0003	1	1	0.0	26
SEYCHELLES	-0.14966	0.0017	0.0030	1	1	2.0	26
CAMEROON	-0.40474	0.0009	0.0015	1	1	3.0	26
GHANA	-0.38185	0.0021	0.0010	1	1	5.0	26
NAMIBIA	-0.40831	0.0013	0.0016	1	1	1.0	26
BOTSWANA	-0.25341	0.0034	0.0026	1	1	5.0	26
SOUTH AFRICA	-0.24916	0.0003	0.0006	1	1	2.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.28891	-7.654	1.016	-0.697	0.992	234

APPENDIX B: Money Supply at first difference

Null Hypothesis: Unit root (individual unit root process)
Series: D(LMS)
Date: 11/02/20 Time: 16:38
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	109.009	0.0000
ADF - Choi Z-stat	-8.28337	0.0000

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

Intermediate ADF test results D(LMS)

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.0318	1	1	25
LESOTHO	0.0004	1	1	25
MAURITIUS	0.0096	1	1	25
SEYCHELLES	0.0385	1	1	25
CAMEROON	0.0020	1	1	25
GHANA	0.0001	1	1	25
NAMIBIA	0.0026	1	1	25
BOTSWANA	0.0001	1	1	25
SOUTH AFRICA	0.0056	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(LMS)
Date: 11/02/20 Time: 16:39
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	67.2038	0.0000
ADF - Choi Z-stat	-5.64265	0.0000

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

Intermediate ADF test results D(LMS)

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.2440	1	1	25
LESOTHO	0.0101	1	1	25
MAURITIUS	0.0242	1	1	25
SEYCHELLES	0.2416	1	1	25
CAMEROON	0.0300	1	1	25
GHANA	0.0022	1	1	25

NAMIBIA	0.0305	1	1	25
BOTSWANA	0.0028	1	1	25
SOUTH AFRICA	0.0304	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(LMS)
Date: 11/02/20 Time: 16:39
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	47.1324	0.0002
ADF - Choi Z-stat	-3.91872	0.0000

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

Intermediate ADF test results D(LMS)

Cross section	Prob.	Lag	Max Lag	Obs
EGYPT	0.5231	1	1	25
LESOTHO	0.0378	1	1	25
MAURITIUS	0.1030	1	1	25
SEYCHELLES	0.5146	1	1	25
CAMEROON	0.0407	1	1	25
GHANA	0.0081	1	1	25
NAMIBIA	0.1030	1	1	25
BOTSWANA	0.0147	1	1	25
SOUTH AFRICA	0.1111	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(LMS)
Date: 11/02/20 Time: 16:40
Sample: 1990 2017
Exogenous variables: None
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	170.246	0.0000
PP - Choi Z-stat	-11.2758	0.0000

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

Intermediate Phillips-Perron test results D(LMS)

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0001	1.0	26
LESOTHO	0.0001	1.0	26
MAURITIUS	0.0001	2.0	26
SEYCHELLES	0.0009	1.0	26

CAMEROON	0.0000	1.0	26
GHANA	0.0000	2.0	26
NAMIBIA	0.0001	1.0	26
BOTSWANA	0.0000	2.0	26
SOUTH AFRICA	0.0014	0.0	26

Null Hypothesis: Unit root (individual unit root process)
Series: D(LMS)
Date: 11/02/20 Time: 16:42
Sample: 1990 2017
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	118.574	0.0000
PP - Choi Z-stat	-8.88695	0.0000

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

Intermediate Phillips-Perron test results D(LMS)

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0032	1.0	26
LESOTHO	0.0017	1.0	26
MAURITIUS	0.0004	0.0	26
SEYCHELLES	0.0109	2.0	26
CAMEROON	0.0006	1.0	26
GHANA	0.0002	2.0	26
NAMIBIA	0.0012	1.0	26
BOTSWANA	0.0004	2.0	26
SOUTH AFRICA	0.0171	0.0	26

Null Hypothesis: Unit root (individual unit root process)
Series: D(LMS)
Date: 11/02/20 Time: 16:43
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	95.9612	0.0000
PP - Choi Z-stat	-7.58599	0.0000

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

Intermediate Phillips-Perron test results D(LMS)

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0152	1.0	26
LESOTHO	0.0070	2.0	26
MAURITIUS	0.0027	0.0	26
SEYCHELLES	0.0423	1.0	26
CAMEROON	0.0006	1.0	26
GHANA	0.0004	3.0	26
NAMIBIA	0.0030	1.0	26
BOTSWANA	0.0024	2.0	26
SOUTH AFRICA	0.0725	0.0	26

Null Hypothesis: Unit root (common unit root process)
Series: D(LMS)
Date: 11/02/20 Time: 16:45
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-9.26647	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(LMS)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.66126	0.0008	9.E-05	1	1	25.0	25
LESOTHO	-1.16928	0.0015	0.0006	1	1	13.0	25
MAURITIUS	-0.69806	0.0004	0.0007	1	1	0.0	25
SEYCHELLES	-0.49184	0.0020	0.0003	1	1	21.0	25
CAMEROON	-0.93748	0.0019	0.0003	1	1	10.0	25
GHANA	-1.18561	0.0025	0.0004	1	1	14.0	25
NAMIBIA	-0.76473	0.0017	0.0004	1	1	9.0	25
BOTSWANA	-1.19875	0.0039	0.0008	1	1	15.0	25
SOUTH AFRICA	-0.61514	0.0003	4.E-05	1	1	16.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.82229	-9.681	1.020	0.004	1.049	225

Null Hypothesis: Unit root (common unit root process)
Series: D(LMS)
Date: 11/02/20 Time: 16:48
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-5.07209	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(LMS)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.65723	0.0008	9.E-05	1	1	25.0	25
LESOTHO	-1.16446	0.0015	0.0005	1	1	14.0	25
MAURITIUS	-0.99908	0.0003	0.0007	1	1	0.0	25
SEYCHELLES	-0.52061	0.0020	0.0003	1	1	21.0	25
CAMEROON	-0.93636	0.0019	0.0004	1	1	10.0	25
GHANA	-1.22819	0.0025	0.0003	1	1	14.0	25
NAMIBIA	-0.86120	0.0016	0.0003	1	1	10.0	25
BOTSWANA	-1.24109	0.0038	0.0007	1	1	15.0	25
SOUTH AFRICA	-0.70989	0.0003	4.E-05	1	1	16.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.89319	-10.199	1.018	-0.554	0.919	225

Null Hypothesis: Unit root (common unit root process)
Series: D(LMS)
Date: 11/02/20 Time: 16:48
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-3.36972	0.0004

** Probabilities are computed assuming asympotic normality

Intermediate results on D(LMS)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.66560	0.0008	8.E-05	1	1	25.0	25
LESOTHO	-1.20285	0.0015	0.0005	1	1	13.0	25
MAURITIUS	-0.99836	0.0003	0.0007	1	1	0.0	25
SEYCHELLES	-0.58824	0.0020	0.0001	1	1	25.0	25
CAMEROON	-1.23168	0.0017	0.0004	1	1	10.0	25
GHANA	-1.36635	0.0023	0.0003	1	1	14.0	25
NAMIBIA	-0.94785	0.0016	0.0003	1	1	10.0	25
BOTSWANA	-1.25125	0.0038	0.0007	1	1	15.0	25
SOUTH AFRICA	-0.70358	0.0003	4.E-05	1	1	16.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.95762	-10.532	1.021	-0.703	1.003	225

APPENDIX B: Consumer price index at level for all tests

Null Hypothesis: Unit root (individual unit root process)
Series: LCPI
Date: 11/02/20 Time: 16:57
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	11.9089	0.8519
ADF - Choi Z-stat	1.11211	0.8670

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

Intermediate ADF test results LCPI

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.6860	1	1	26
LESOTHO	0.6110	1	1	26
MAURITIUS	0.9896	1	1	26
SEYCHELLES	0.8203	1	1	26
CAMEROON	0.1170	1	1	26
GHANA	0.4431	1	1	26
NAMIBIA	0.4568	1	1	26
BOTSWANA	0.3712	1	1	26
SOUTH AFRICA	0.8672	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: LCPI
Date: 11/02/20 Time: 17:09
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	43.3256	0.0007
ADF - Choi Z-stat	-3.07288	0.0011

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

Intermediate ADF test results LCPI

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.2478	1	1	26
LESOTHO	0.2431	1	1	26
MAURITIUS	0.7809	1	1	26
SEYCHELLES	0.2805	1	1	26
CAMEROON	0.0203	1	1	26
GHANA	0.0087	1	1	26
NAMIBIA	0.0141	1	1	26

BOTSWANA	0.0154	1	1	26
SOUTH AFRICA	0.7719	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: LCPI
Date: 11/02/20 Time: 17:00
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	38.4805	0.0033
ADF - Choi Z-stat	-2.70019	0.0035

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

Intermediate ADF test results LCPI

Cross Section	Prob.	Lag	Max Lag	Obs
EGYPT	0.5784	1	1	26
LESOTHO	0.5619	1	1	26
MAURITIUS	0.3775	1	1	26
SEYCHELLES	0.5956	1	1	26
CAMEROON	0.0140	1	1	26
GHANA	0.0157	1	1	26
NAMIBIA	0.0289	1	1	26
BOTSWANA	0.0205	1	1	26
SOUTH AFRICA	0.4623	1	1	26

Null Hypothesis: Unit root (individual unit root process)
Series: LCPI
Date: 11/02/20 Time: 17:12
Sample: 1990 2017
Exogenous variables: None
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	17.8141	0.4680
PP - Choi Z-stat	0.76661	0.7783

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

Intermediate Phillips-Perron test results LCPI

Cross Section	Prob.	Bandwidth	Obs

EGYPT	0.7113	2.0	27
LESOTHO	0.4968	1.0	27
MAURITIUS	0.9965	0.0	27
SEYCHELLES	0.8481	3.0	27
CAMEROON	0.0129	2.0	27
GHANA	0.3355	21.0	27
NAMIBIA	0.4917	3.0	27
BOTSWANA	0.2313	2.0	27
SOUTH AFRICA	0.9238	1.0	27

Null Hypothesis: Unit root (individual unit root process)
Series: LCPI
Date: 11/02/20 Time: 17:21
Sample: 1990 2017
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	68.2610	0.0000
PP - Choi Z-stat	-4.64220	0.0000

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

Intermediate Phillips-Perron test results LCPI

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.3204	2.0	27
LESOTHO	0.1171	1.0	27
MAURITIUS	0.5926	1.0	27
SEYCHELLES	0.2109	2.0	27
CAMEROON	0.0001	0.0	27
GHANA	0.0020	2.0	27
NAMIBIA	0.0050	1.0	27
BOTSWANA	0.0005	1.0	27
SOUTH AFRICA	0.7931	2.0	27

Null Hypothesis: Unit root (individual unit root process)
Series: LCPI
Date: 11/02/20 Time: 17:22
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 243
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	60.9052	0.0000
PP - Choi Z-stat	-3.85922	0.0001

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

Intermediate Phillips-Perron test results LCPI

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.6509	2.0	27
LESOTHO	0.4218	0.0	27
MAURITIUS	0.2451	1.0	27
SEYCHELLES	0.5785	2.0	27
CAMEROON	0.0000	5.0	27
GHANA	0.0042	4.0	27
NAMIBIA	0.0202	2.0	27
BOTSWANA	0.0009	3.0	27
SOUTH AFRICA	0.7111	2.0	27

Null Hypothesis: Unit root (common unit root process)
Series: LCPI
Date: 11/02/20 Time: 17:23
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	1.76163	0.9609

** Probabilities are computed assuming asympotic normality

Intermediate results on LCPI

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	0.00018	4.E-05	5.E-05	1	1	2.0	26
LESOTHO	-0.00246	0.0001	0.0001	1	1	1.0	26
MAURITIUS	0.00679	2.E-05	3.E-05	1	1	2.0	26
SEYCHELLES	0.00437	0.0001	0.0003	1	1	3.0	26
CAMEROON	-0.25601	0.1776	0.0153	1	1	24.0	26
GHANA	-0.02440	0.0706	0.0080	1	1	26.0	26
NAMIBIA	-0.04450	0.1074	0.0218	1	1	5.0	26
BOTSWANA	-0.06684	0.1345	0.0307	1	1	7.0	26
SOUTH AFRICA	0.00292	2.E-05	4.E-05	1	1	2.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	0.00376	1.845	1.013	0.004	1.046	234

Null Hypothesis: Unit root (common unit root process)
Series: LCPI
Date: 11/02/20 Time: 17:25
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-1.25978	0.1039

** Probabilities are computed assuming asympotic normality

Intermediate results on LCPI

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.28648	3.E-05	5.E-05	1	1	2.0	26
LESOTHO	-0.32018	0.0001	0.0001	1	1	1.0	26
MAURITIUS	-0.05123	2.E-05	2.E-05	1	1	0.0	26
SEYCHELLES	-0.15640	0.0001	0.0002	1	1	2.0	26
CAMEROON	-1.10712	0.1294	0.0151	1	1	24.0	26
GHANA	-1.11081	0.0442	0.0042	1	1	26.0	26
NAMIBIA	-0.91979	0.0701	0.0220	1	1	5.0	26
BOTSWANA	-1.07195	0.0895	0.0299	1	1	7.0	26
SOUTH AFRICA	-0.04623	2.E-05	3.E-05	1	1	1.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.13919	-4.182	1.106	-0.552	0.913	234

Null Hypothesis: Unit root (common unit root process)
Series: LCPI
Date: 11/02/20 Time: 17:26
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-1.02337	0.1531

** Probabilities are computed assuming asympotic normality

Intermediate results on LCPI

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.27983	3.E-05	5.E-05	1	1	2.0	26
LESOTHO	-0.31046	0.0001	0.0001	1	1	2.0	26
MAURITIUS	-0.41228	1.E-05	2.E-05	1	1	0.0	26
SEYCHELLES	-0.15350	0.0001	0.0002	1	1	2.0	26
CAMEROON	-1.38542	0.1071	0.0106	1	1	26.0	26
GHANA	-1.22237	0.0397	0.0035	1	1	26.0	26
NAMIBIA	-1.05714	0.0648	0.0219	1	1	5.0	26
BOTSWANA	-1.23552	0.0788	0.0242	1	1	8.0	26
SOUTH AFRICA	-0.25649	2.E-05	3.E-05	1	1	1.0	26

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.34098	-6.821	1.099	-0.697	0.992	234

APPENDIX B: Consumer price index for all tests

Null Hypothesis: Unit root (individual unit root process)
Series: D(LCPI)
Date: 11/02/20 Time: 17:47
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	139.608	0.0000
ADF - Choi Z-stat	-9.57636	0.0000

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

Intermediate ADF test results D(LCPI)

Cross section	Prob.	Lag	Max Lag	Obs
EGYPT	0.0311	1	1	25
LESOTHO	0.0005	1	1	25
MAURITIUS	0.0093	1	1	25
SEYCHELLES	0.0353	1	1	25
CAMEROON	0.0000	1	1	25
GHANA	0.0000	1	1	25
NAMIBIA	0.0002	1	1	25
BOTSWANA	0.0000	1	1	25
SOUTH AFRICA	0.0048	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(LCPI)
Date: 11/02/20 Time: 17:50
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	92.4123	0.0000
ADF - Choi Z-stat	-6.99709	0.0000

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

Intermediate ADF test results D(LCPI)

Cross section	Prob.	Lag	Max Lag	Obs
EGYPT	0.2399	1	1	25

LESOTHO	0.0113	1	1	25
MAURITIUS	0.0237	1	1	25
SEYCHELLES	0.2259	1	1	25
CAMEROON	0.0001	1	1	25
GHANA	0.0001	1	1	25
NAMIBIA	0.0036	1	1	25
BOTSWANA	0.0011	1	1	25
SOUTH AFRICA	0.0260	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(LCPI)
Date: 11/02/20 Time: 17:52
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
ADF - Fisher Chi-square	67.0353	0.0000
ADF - Choi Z-stat	-5.15316	0.0000

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

Intermediate ADF test results D(LCPI)

Cross section	Prob.	Lag	Max Lag	Obs
EGYPT	0.5165	1	1	25
LESOTHO	0.0416	1	1	25
MAURITIUS	0.1017	1	1	25
SEYCHELLES	0.4872	1	1	25
CAMEROON	0.0004	1	1	25
GHANA	0.0005	1	1	25
NAMIBIA	0.0211	1	1	25
BOTSWANA	0.0061	1	1	25
SOUTH AFRICA	0.0979	1	1	25

Null Hypothesis: Unit root (individual unit root process)
Series: D(LCPI)
Date: 11/02/20 Time: 17:35
Sample: 1990 2017
Exogenous variables: None
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	572.296	0.0000
PP - Choi Z-stat	-19.3403	0.0000

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

Intermediate Phillips-Perron test results D(LCPI)

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0001	1.0	26
LESOTHO	0.0001	1.0	26
MAURITIUS	0.0001	2.0	26
SEYCHELLES	0.0008	1.0	26
CAMEROON	0.0000	21.0	26
GHANA	0.0000	13.0	26
NAMIBIA	0.0000	6.0	26
BOTSWANA	0.0000	9.0	26
SOUTH AFRICA	0.0012	0.0	26

Null Hypothesis: Unit root (individual unit root process)
Series: D(LCPI)
Date: 11/02/20 Time: 17:36
Sample: 1990 2017
Exogenous variables: Individual effects
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	168.256	0.0000
PP - Choi Z-stat	-10.7958	0.0000

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

Intermediate Phillips-Perron test results D(LCPI)

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0033	1.0	26
LESOTHO	0.0019	1.0	26
MAURITIUS	0.0003	0.0	26
SEYCHELLES	0.0110	1.0	26
CAMEROON	0.0001	20.0	26
GHANA	0.0000	13.0	26
NAMIBIA	0.0000	6.0	26
BOTSWANA	0.0000	9.0	26
SOUTH AFRICA	0.0143	0.0	26

Null Hypothesis: Unit root (individual unit root process)
Series: D(LCPI)
Date: 11/02/20 Time: 17:38
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 234
Cross-sections included: 9

Method	Statistic	Prob.**
PP - Fisher Chi-square	868.426	0.0000
PP - Choi Z-stat	-21.4273	0.0000

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

Intermediate Phillips-Perron test results D(LCPI)

Cross section	Prob.	Bandwidth	Obs
EGYPT	0.0155	1.0	26
LESOTHO	0.0075	1.0	26
MAURITIUS	0.0021	0.0	26
SEYCHELLES	0.0374	1.0	26
CAMEROON	0.0000	20.0	26
GHANA	0.0000	16.0	26
NAMIBIA	0.0000	6.0	26
BOTSWANA	0.0000	9.0	26
SOUTH AFRICA	0.0625	0.0	26

Null Hypothesis: Unit root (common unit root process)
Series: D(LCPI)
Date: 11/02/20 Time: 17:29
Sample: 1990 2017
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-10.0464	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(LCPI)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.66154	4.E-05	5.E-06	1	1	25.0	25
LESOTHO	-1.15282	0.0001	5.E-05	1	1	13.0	25
MAURITIUS	-0.70019	2.E-05	3.E-05	1	1	0.0	25
SEYCHELLES	-0.50270	0.0001	1.E-05	1	1	25.0	25
CAMEROON	-2.11746	0.1757	0.0278	1	1	25.0	25
GHANA	-1.80330	0.0625	0.0172	1	1	13.0	25
NAMIBIA	-1.48335	0.1088	0.1110	1	1	2.0	25
BOTSWANA	-1.73381	0.1396	0.0649	1	1	7.0	25
SOUTH AFRICA	-0.63457	2.E-05	3.E-06	1	1	21.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-1.03221	-10.491	1.076	0.004	1.049	225

Null Hypothesis: Unit root (common unit root process)
Series: D(LCPI)
Date: 11/02/20 Time: 17:31
Sample: 1990 2017
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**

Levin, Lin & Chu t*	-4.65283	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on D(LCPI)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.65761	4.E-05	4.E-06	1	1	25.0	25
LESOTHO	-1.14788	0.0001	4.E-05	1	1	13.0	25
MAURITIUS	-1.00438	2.E-05	3.E-05	1	1	0.0	25
SEYCHELLES	-0.53415	0.0001	1.E-05	1	1	25.0	25
CAMEROON	-2.11740	0.1756	0.0270	1	1	25.0	25
GHANA	-1.80615	0.0624	0.0173	1	1	13.0	25
NAMIBIA	-1.48366	0.1088	0.1110	1	1	2.0	25
BOTSWANA	-1.73493	0.1395	0.0641	1	1	7.0	25
SOUTH AFRICA	-0.73169	2.E-05	2.E-06	1	1	20.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-1.10462	-11.089	1.066	-0.554	0.919	225

Null Hypothesis: Unit root (common unit root process)
Series: D(LCPI)
Date: 11/02/20 Time: 17:31
Sample: 1990 2017
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 225
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-2.78601	0.0027

** Probabilities are computed assuming asympotic normality

Intermediate results on D(LCPI)

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
EGYPT	-0.66654	4.E-05	4.E-06	1	1	25.0	25
LESOTHO	-1.18542	0.0001	4.E-05	1	1	13.0	25
MAURITIUS	-1.00670	2.E-05	3.E-05	1	1	0.0	25
SEYCHELLES	-0.60861	0.0001	8.E-06	1	1	25.0	25
CAMEROON	-2.12690	0.1720	0.0232	1	1	25.0	25
GHANA	-1.82604	0.0597	0.0158	1	1	13.0	25
NAMIBIA	-1.47527	0.1086	0.1111	1	1	2.0	25
BOTSWANA	-1.75026	0.1382	0.0633	1	1	7.0	25
SOUTH AFRICA	-0.72474	2.E-05	2.E-06	1	1	20.0	25

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-1.14009	-11.359	1.063	-0.703	1.003	225

APPENDIX C: Panel cointegration tests

Pedroni Residual Cointegration Test
Series: LGFCF DEFICIT LMS LCPI
Date: 10/27/19 Time: 20:53
Sample: 1990 2017
Included observations: 252
Cross-sections included: 9
Null Hypothesis: No cointegration
Trend assumption: No deterministic intercept or trend
Automatic lag length selection based on SIC with a max lag of 5
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.523251	0.6996	-2.595709	0.9953
Panel rho-Statistic	-0.351212	0.3627	-0.822231	0.2055
Panel PP-Statistic	-1.619108	0.0527	-2.447335	0.0072
Panel ADF-Statistic	-2.396653	0.0083	-2.310677	0.0104

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	0.154553	0.5614
Group PP-Statistic	-2.725370	0.0032
Group ADF-Statistic	-3.319797	0.0005

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
EGYPT	0.312	3.77E-06	3.77E-06	0.00	27
LESOTHO	0.301	1.05E-05	1.26E-05	1.00	27
MAURITIUS	0.741	9.28E-06	1.47E-05	2.00	27
SEYCHELLES	0.629	8.46E-05	0.000119	2.00	27
CAMEROON	0.577	0.002052	0.001453	1.00	27
GHANA	0.637	0.007114	0.008909	1.00	27
NAMIBIA	0.403	0.003350	0.003698	2.00	27
BOTSWANA	0.625	0.004494	0.003126	1.00	27
SOUTH AFRICA	0.686	1.56E-05	1.56E-05	0.00	27

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
EGYPT	0.312	3.77E-06	0	5	27
LESOTHO	0.301	1.05E-05	0	5	27
MAURITIUS	0.741	9.28E-06	0	5	27
SEYCHELLES	0.629	8.46E-05	0	5	27
CAMEROON	0.577	0.002052	0	5	27
GHANA	0.475	0.005948	1	5	26
NAMIBIA	0.120	0.002585	1	5	26
BOTSWANA	0.697	0.003816	1	5	26
SOUTH AFRICA	0.577	1.39E-05	1	5	26

Kao Residual Cointegration Test
Series: LGFCF DEFICIT LMS LCPI
Date: 10/27/19 Time: 20:57
Sample: 1990 2017
Included observations: 252
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 6
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-4.779470	0.0000
Residual variance	0.001945	
HAC variance	0.001477	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 10/27/19 Time: 20:57
Sample (adjusted): 1992 2017
Included observations: 234 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.452646	0.054052	-8.374276	0.0000
D(RESID(-1))	0.192282	0.064205	2.994827	0.0030

R-squared	0.232546	Mean dependent var	0.000390
Adjusted R-squared	0.229238	S.D. dependent var	0.044990
S.E. of regression	0.039498	Akaike info criterion	-3.616638
Sum squared resid	0.361936	Schwarz criterion	-3.587105
Log likelihood	425.1466	Hannan-Quinn criter.	-3.604730
Durbin-Watson stat	1.933928		

Johansen Fisher
Panel Cointegration
Test
Series: LGFCF DEFICIT LMS LCPI
Date: 03/10/20 Time: 00:19
Sample: 1990 2017
Included observations: 252
Trend assumption: Linear deterministic trend
Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	139.6	0.0000	120.2	0.0000
At most 1	111.8	0.0000	62.41	0.0000
At most 2	70.05	0.0000	46.81	0.0002
At most 3	61.29	0.0000	61.29	0.0000

* Probabilities are computed using asymptotic Chi-square distribution.

Individual cross section results

Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
Hypothesis of no cointegration				
EGYPT	396.1974	0.0001	353.7108	0.0001
LESOTHO	406.4335	0.0001	359.7760	0.0001
MAURITIUS	393.1187	0.0001	338.3617	0.0001
SEYCHELLES	428.5338	0.0001	390.9656	0.0001
CAMEROON	72.8458	0.0001	37.9916	0.0016
GHANA	48.2918	0.0455	24.5334	0.1172
NAMIBIA	68.0784	0.0002	26.7111	0.0644
BOTSWANA	44.9896	0.0907	26.7793	0.0631
SOUTH AFRICA	438.0216	0.0001	381.9348	0.0001
Hypothesis of at most 1 cointegration relationship				
EGYPT	42.4866	0.0011	21.4801	0.0447
LESOTHO	46.6576	0.0003	24.2272	0.0177
MAURITIUS	54.7570	0.0000	25.1625	0.0128
SEYCHELLES	37.5682	0.0052	22.9068	0.0278
CAMEROON	34.8542	0.0120	19.8373	0.0751
GHANA	23.7584	0.2108	15.0337	0.2866
NAMIBIA	41.3673	0.0015	23.2416	0.0249
BOTSWANA	18.2103	0.5506	10.0196	0.7428
SOUTH AFRICA	56.0868	0.0000	35.6933	0.0003
Hypothesis of at most 2 cointegration relationship				
EGYPT	21.0066	0.0067	12.9979	0.0785
LESOTHO	22.4304	0.0038	12.6153	0.0896
MAURITIUS	29.5946	0.0002	21.2508	0.0034
SEYCHELLES	14.6614	0.0665	14.3418	0.0486
CAMEROON	15.0169	0.0589	13.6060	0.0633
GHANA	8.7247	0.3915	8.2481	0.3540
NAMIBIA	18.1257	0.0196	11.8791	0.1153
BOTSWANA	8.1907	0.4452	4.7916	0.7679
SOUTH AFRICA	20.3935	0.0084	15.6528	0.0300

Hypothesis of at most 3 cointegration relationship

EGYPT	8.0087	0.0047	8.0087	0.0047
LESOTHO	9.8151	0.0017	9.8151	0.0017
MAURITIUS	8.3438	0.0039	8.3438	0.0039
SEYCHELLES	0.3196	0.5718	0.3196	0.5718
CAMEROON	1.4109	0.2349	1.4109	0.2349
GHANA	0.4766	0.4900	0.4766	0.4900
NAMIBIA	6.2466	0.0124	6.2466	0.0124
BOTSWANA	3.3992	0.0652	3.3992	0.0652
SOUTH AFRICA	4.7407	0.0294	4.7407	0.0294

**MacKinnon-Haug-Michelis (1999) p-values

APPENDIX D: Panel Autoregressive distributed lag test results

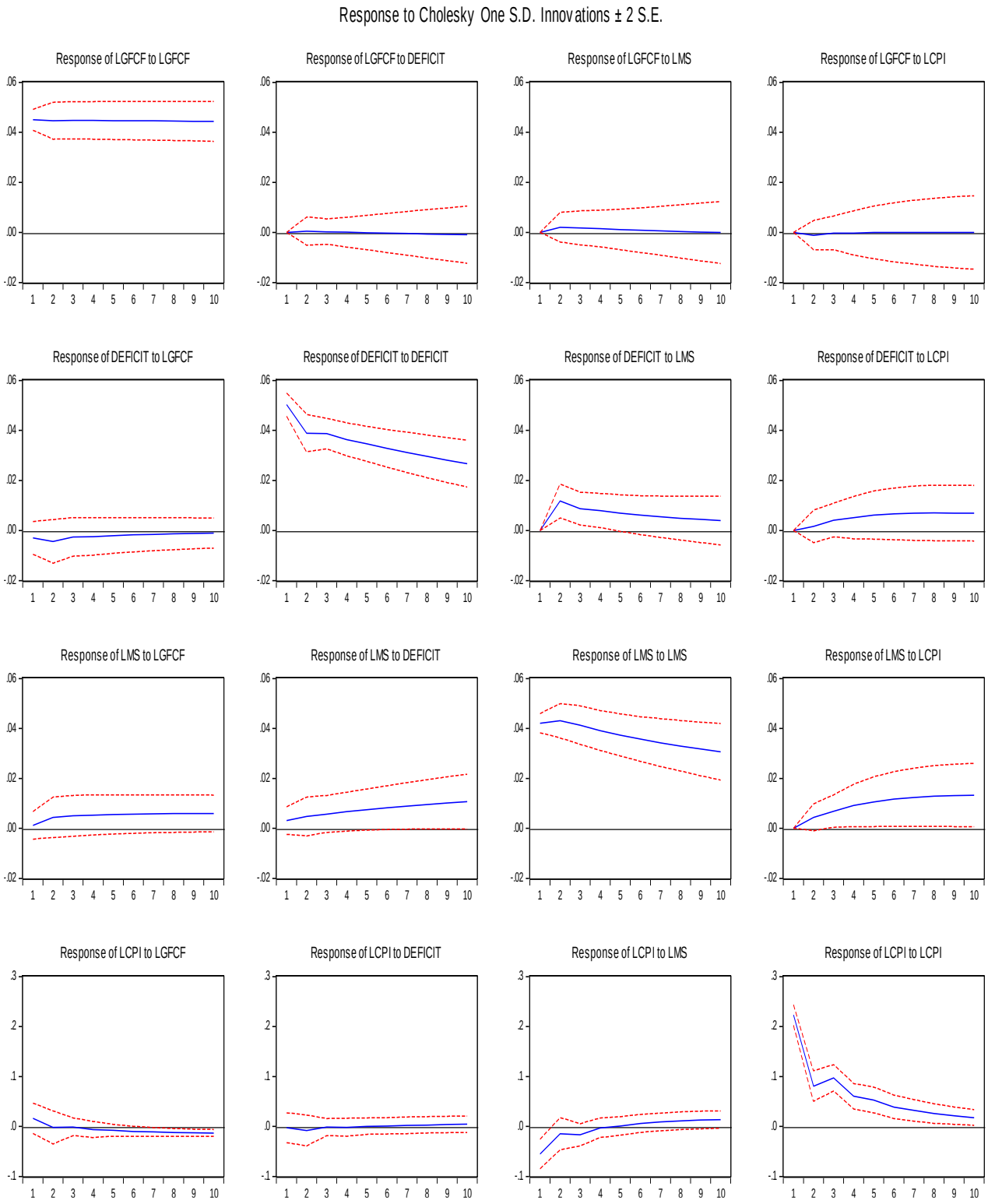
Dependent Variable: D(LGFCF)
Method: ARDL
Date: 12/03/19 Time: 09:19
Sample: 1994 2017
Included observations: 216
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): DEFICIT LMS LCPI
Fixed regressors: C
Number of models evalulated: 4
Selected Model: ARDL(1, 4, 4, 4)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
DEFICIT	-0.445345	0.119201	-3.736081	0.0003
LMS	0.391305	0.091782	4.263400	0.0000
LCPI	0.029528	0.068328	0.432145	0.6664
		Short Run Equation		
COINTEQ01	-0.183186	0.085577	-2.140596	0.0343
D(DEFICIT)	-0.000237	0.041453	-0.005721	0.9954
D(DEFICIT(-1))	0.161623	0.095747	1.688034	0.0939
D(DEFICIT(-2))	0.133502	0.098612	1.353811	0.1783
D(DEFICIT(-3))	0.073352	0.056866	1.289899	0.1995
D(LMS)	0.011577	0.054714	0.211598	0.8328
D(LMS(-1))	-0.002090	0.025356	-0.082441	0.9344
D(LMS(-2))	-0.160692	0.171208	-0.938575	0.3498
D(LMS(-3))	0.187087	0.146883	1.273709	0.2052
D(LCPI)	0.003805	0.016855	0.225773	0.8218
D(LCPI(-1))	0.001931	0.013700	0.140944	0.8881
D(LCPI(-2))	-0.023106	0.020043	-1.152801	0.2512
D(LCPI(-3))	0.021098	0.026119	0.807763	0.4208
C	0.083727	0.039929	2.096889	0.0381

Mean dependent var	0.000188	S.D. dependent var	0.040379
S.E. of regression	0.032324	Akaike info criterion	-13.83036
Sum squared resid	0.128512	Schwarz criterion	-12.02363
Log likelihood	1871.626	Hannan-Quinn criter.	-13.10337

*Note: p-values and any subsequent tests do not account for model selection.

APPENDIX E: Impulse response function results



APPENDIX F: Variance decomposition results

Variance Decomposition of LGFCF:

Period	S.E.	LGFCF	DEFICIT	LMS	LCPI
1	0.044985	100.0000	0.000000	0.000000	0.000000
2	0.063413	99.86030	0.005958	0.102302	0.031441
3	0.077655	99.85127	0.005089	0.121541	0.022098
4	0.089639	99.85950	0.003879	0.119105	0.017515
5	0.100179	99.87430	0.003214	0.108431	0.014053
6	0.109685	99.88827	0.003358	0.096643	0.011727
7	0.118406	99.90012	0.004367	0.085445	0.010064
8	0.126502	99.90927	0.006274	0.075641	0.008817
9	0.134087	99.91566	0.009061	0.067421	0.007855
10	0.141242	99.91938	0.012714	0.060793	0.007118

Variance Decomposition of DEFICIT:

Period	S.E.	LGFCF	DEFICIT	LMS	LCPI
1	0.050396	0.356432	99.64357	0.000000	0.000000
2	0.064920	0.679325	95.99351	3.264002	0.063162
3	0.076229	0.612633	95.37725	3.671147	0.338966
4	0.085025	0.573178	94.96004	3.829535	0.637243
5	0.092274	0.534781	94.67493	3.807824	0.982467
6	0.098362	0.502826	94.44639	3.736560	1.314223
7	0.103562	0.475588	94.24965	3.645846	1.628920
8	0.108047	0.452518	94.07968	3.553270	1.914535
9	0.111947	0.432831	93.93193	3.464807	2.170430
10	0.115355	0.415954	93.80449	3.383171	2.396383

Variance Decomposition of LMS:

Period	S.E.	LGFCF	DEFICIT	LMS	LCPI
1	0.042150	0.071556	0.531476	99.39697	0.000000
2	0.060757	0.558099	0.861965	98.05809	0.521847
3	0.074157	0.826376	1.169134	96.79413	1.210357
4	0.084786	1.028427	1.506622	95.37561	2.089337
5	0.093712	1.191687	1.867316	93.95178	2.989218
6	0.101463	1.331444	2.251173	92.54057	3.876818
7	0.108336	1.453611	2.653666	91.18146	4.711267
8	0.114520	1.562423	3.071450	89.88482	5.481304
9	0.120140	1.660591	3.500889	88.65759	6.180933
10	0.125289	1.750232	3.938781	87.49943	6.811555

Variance Decomposition of LCPI:

Period	S.E.	LGFCF	DEFICIT	LMS	LCPI
1	0.230308	0.479332	0.014356	5.803222	93.70309
2	0.244542	0.432738	0.123321	5.514565	93.92938
3	0.263705	0.374177	0.109238	5.148518	94.36807
4	0.270594	0.415284	0.109759	4.902063	94.57289
5	0.275778	0.483522	0.105724	4.720172	94.69058
6	0.278756	0.604363	0.104620	4.666523	94.62449
7	0.280947	0.754187	0.108440	4.691275	94.44610
8	0.282592	0.932505	0.117286	4.791645	94.15856
9	0.283972	1.129747	0.132120	4.941376	93.79676
10	0.285192	1.341739	0.152751	5.127333	93.37818

Cholesky Ordering: LGFCF DEFICIT LMS LCPI