T.C

ISTANBUL COMMERCE UNIVERSITY

GRADUATE SCHOOL OF SOCIAL SCIENCE

ECONOMICS PROGRAM

The Impact of the Macroeconomic Policies on the Economic Growth in Ghana

MA THESIS

COLLINS ADU TAKYI

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T.C. İSTANBUL TİCARET ÜNİVERSİTESİ

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Abstract

This study examines the impact of macroeconomic policies on real GDP growth of Ghana by focusing on the variables related to monetary and fiscal policies. With this aim, Johansen co-integration and VECM approaches are employed by using quarterly data between 2009Q1 and 2018Q4. In the model, consumer price index (CPI) and money supply variables are used as monetary policy tools while public expenditure and internal debt are used for fiscal policy tools. It is found that there is a long run correlation among the variables and CPI and money supply have a long run positive effect on real GDP, while the public expenditure and internal debt have long run negative effect on it. In the short run dynamic, it is found that, CPI and money supply have a positive effect on current real GDP growth while internal debt and public expenditure have a negative effect on current real GDP growth.

Keywords: VECM Model, GDP Growth, Macroeconomic policies

JEL Codes: F41, E62, E52

ÖZET

Bu çalışma, makroekonomik politikaların Gana'nın reel Gayri Safi Yurtiçi Hasıla (GSYH) büyümesi üzerindeki etkisini para ve maliye politikası araçlarına odaklanarak incelemektedir. Bu amaçla, Johansen eş-bütünleme ve VECM yöntemleri kullanılarak, 2009Q1-2018Q4 dönemi üç aylık veriler ile analiz edilmiştir. Modelde para politikası araçları olarak tüketici fiyat endeksi (TÜFE) ve para arzı değişkenleri kullanılırken, maliye politikası araçları için kamu harcamaları ve iç borç stoku değişkenleri kullanılmıştır. Modelde yer alan değişkenler arasında uzun dönemli bir korelasyon olduğu saptanırken, TÜFE ve para arzının reel GSYİH üzerinde uzun dönemli pozitif etkiye sahip olduğu, kamu harcamaları ve iç borç stokunun ise uzun dönemli olumsuz etkisinin olduğu bulunmuştur.Diğer yandan, TÜFE ve para arzının reel GSYİH büyümesi üzerinde kısa vadede pozitif etkiye sahip olduğunu, iç borç stoku ve kamu harcamalarının ise kısa dönemde reel GSYİH büyümesi üzerinde negatif bir etkiye sahip olduğu görülmüştür.

Anahtar Kelimeler: VECM Modeli, GSYİH Büyümesi, Makroekonomik politikalar

JEL Kodları: F41, E62, E52

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LIST OF ABBREVIATIONS

GDP: Gross Domestic Product

CPI: Consumer Price Index

VECM: Vector Error Correction Model

ARDL: Autoregressive Distributed Lag

US: United State

VAR: Vector Autoregressive

M2: Money Supply

ASEAN: Association of Southeast Asian Nations

OLS: Ordinary Least Square

SACU: Southern African Custom Union

IMF: International Monetary Fund

ERP: Economic Recovery Program

SAP: Structural Adjustment Policies

HIPC: Highly Indebted Poor Countries

PRPS: Poverty Reduction Strategy Program

BOG: Bank of Ghana

NLC: National Liberation Council

NRC: National Redemption Council

CRR: Cash Reserve Ratio

PNDC: Provisional National Defense Council

NPP: New Patriotic Party

NDC: National Democratic Congress

NDA: Net Domestic Assets

NPA: Net Foreign Assets

M1: Broad money

AIC: Akaike Information Criterion

AR: Autoregressive

ECT: Error Correction Term

RGDP: Real Gross Domestic Product

PUBEXP: Public Expenditure

MNYSUP: Money Supply

INTDBT: Internal Debt

LNRGDP: Log Real Gross Domestic Product

LNPUBEXP: Log Public Expenditure

LNMNYSUP: Log Money Supply

LNCPI: Log Consumer Price Index

SBC: Schwartz Bayesian Criterion

FPE: Final Prediction Error

HQIC : Hannan Quinn Information Criterion

GPRS II: Ghana Poverty Reduction Strategy Two

CHAPTER 1

INTRODUCTION

1.0. Introduction

This chapter explains the overview of the research and elaborates its objective. Firstly, the background of the study is explained to determine the context within which the research is conducted. Then the section explains the motivation and objective of the study. Finally, the research hypothesis, research question, the significance of the study, the scope of the study and limitations are elaborated under this section.

1.1. Background of the Study

After gaining its independence in 1957, Ghana adopted monetary and fiscal policies to create a lucrative environment for private and public sectors to establish industries and promote investment. These monetary and fiscal policies were aimed to reduce unemployment, create developmental projects, reduce the huge debt rate, embedded in the economy to promote rapid economic growth. From 1970-2013, the monetary and fiscal policy tools such as CPI, money supply and public spending have a negative effect on economic growth, which needs research to address the trend macroeconomic policies and economic growth (Agyapong et.al 2016, Havi et al. 2013, Enu 2009).

Fiscal policies are vital tools to ensure fast and resilient economic growth (Abdullah et. al 2018). The fiscal policy indicators such as public expenditure, total revenue, taxes and public debt influence government investment to induce long run economic growth. Ghana's public expenditure has been a macroeconomic tool which influences the level of individual consumption and hence leads to GDP growth. The taxes accrued from the investment, investors and individual have been a main source of the national income. Hence, fiscal discipline measures boost the investment level, which affects several sectors of the economy to induce GDP growth. The public debt has been used to invest in human capital, construction of roads, schools, creation of the hospital and hydroelectric power which has caused a massive impact on economic growth.

The monetary policy is the supply of the money and the value of it in an economy to boost GDP growth (Agbonlahor, 2014). The introduction of monetary policy in an economy aims to create price stability, control balance of payments, and reduce unemployment, expand investment and promote developmental projects in an economy which bring positive impact on GDP growth. However, studies have revealed that, for an economy to experience rapid growth there is a need to undertake further research to examine the relationship between of monetary policy and the economic growth. Monetary policy is used to control the policy interest rate which increases the aggregate demand and supply of goods and services hence promotes rapid economic growth.

Many research findings on monetary indicators of the Ghana have indicated that, since 1957 which is the year of independence, there has been an existence of a long run correlation between the monetary policy indicators such as money supply, consumer price index and GDP growth. This evidence has intrigued a lot of research to examine the relationship between macroeconomic policies and GDP growth of Ghana.

1.2. Problem Statement

Ghanaian economy has suffered poor economic growth since the colonial era. After the nineteenth century, through the British industrial influence, the economy of Ghana moved from the slave trade to legitimate trade. The Ghanaian economy shifted its attention to the production of gold, timber, palm oil and cocoa, which potentially would create an economic growth. After gaining independence in 1957, Ghana initiated some economic policies to eradicate high rate of poverty, poor medical facilities, high illiteracy level, high current account debt, corruption, poor market environment, and poor democratic system, high rate of crime and improper management of natural resources like gold, water, and timber. The country undertook several measures with the intention of attracting investment and producing an attractive market atmosphere for investors, improving the export production to create rapid and positive economic growth.

Many economists had conducted research to investigate the economy of Ghana and their recommendations had revealed that, it is vital for the Ghana to acquire long term plans and goals to ensure sustainable economic growth. In 1991, Ghana introduced economic reforms

with the aim of getting a vision for the country from 1991 to 2020.The plan was aimed to reach Ghana to a middle-income status with a resilient growth rate of 8% (The Global Social Change Research Project, 2007). The policy makers forecasted that GDP should grow positively by 7.1% to 8.3% for the period from 1996 to 2000. On the other hand, GDP growth fell at 4.2% in 2014 and 5.0% in 2015. GPRS II Annual Progress Report (2007) revealed that, for vision 2020 to become achievable, then GDP growth should be above 8.5% each year. However, Ghana's economic growth was about average 5% between 1990 and 2008. The vision 2020 report revealed that the policy-makers and government set a target to increase real GDP growth above 8.5%.

In Ghana, it is possible to achieve the target GDP growth of 9%, if the policy makers receive recommendations and understand how macroeconomics policies would impact the economic growth of Ghana. Several studies have examined determinants of growth on Ghana's economy, but unfortunately a few research studies have been examined the impacts of the macroeconomic policies and current GDP growth of Ghana. This study examines the impact of macroeconomics policies on the GDP growth of Ghana from 2009q1 to 2018q4 with a focus on fiscal and monetary policy tools. The empirical evidences of this study are expected to be a tool for policy makers for improving the economic growth and policies of Ghana.

1.3. Objectives of the Study

As it is indicated above, objective of this study is to examine the effects of monetary and fiscal policies on GDP growth of Ghana. The outcomes of this study are projected to guide the policy makers, stakeholders and economy; managers develop new ideas and understood the economy to accelerate economic growth. With this aim, following objectives are identified:

A. To examine the impact of macroeconomic policies, i.e. the monetary and fiscal policies on the GDP growth of Ghana.
B. To determine whether there is existence of a long run and short run impact of these policies on economic growth.
C. Assess the relationship between the explanatory variables and the outcome variable.

D. Identify some recommendations that need to be accepted to accelerate the impressive economic growth.

1.4. Research Questions

Based on the recognized problems and aims that needs to be investigated has raised research questions below;

A. Do monetary and fiscal macroeconomic policies have any impact on GDP growth of Ghana?

B. Do the impacts reflect long run and/or short run correlation between the macroeconomic policies and GDP growth?

1.5. Research Hypothesis

H_1: There is a short run association between internal debt, government expenditure, CPI, money supply and GDP growth of Ghana (Wisdom, 2018)

H_2: There is a long run relationship between internal debt, public expenditure, CPI, money supply and GDP growth of Ghana (Agyapong et at, 2016, Antwi et al, 2013 and Havi et al, 2013)

H_3: Internal debt has a positive effect on GDP growth of Ghana (Stella, 2015 and Havi et al, 2013)

H_4: CPI has a positive effect on GDP growth of Ghana (Enu, 2009; Haalisha and Jahufer, 2018 and Havi et al, 2013).

H_5: Public expenditure has a positive effect on GDP growth of Ghana (Wisdom, 2018 and Havi et al, 2013)

H_6: Money supply has a positive effect on GDP growth of Ghana. (Havi et al, 2013; Samuel et al, 2013 and Agyapong et at, 2016)

1.6. Significance of the Study

This study investigates the effect of fiscal and monetary macroeconomic policies on the economic development of Ghana. Research findings from this study will identify the lapses and challenges that hinder the economic growth of Ghana but rather induce the rapid GDP growth. It will also assist the policy makers, stakeholders as well as economic managers to unearth knowledge and improve upon their understanding to make good policies formulation and implementation to assist the country intention to increase growth above 8.5% as targeted to uplift the country to reach upper middle income suggested in vision 2020 reforms in 2005. Also, the research findings will assist experts in academia to get knowledge and understanding to take part of public analysis to induce economic growth in Ghana's economy.

1.7. Scope of the Study

This study used quarterly time series data from the period 2009q1 to 2018q4 to investigate the effect of macroeconomic policies on GDP growth of Ghana. The data are gained from bank of Ghana quarterly bulletin. The period of the study is chosen under the restriction of the data availability of the related variables. Due to the explanatory and outcome variables selected for the study made the researcher extract secondary data which will be used to carry out the research analysis. The econometric analyses are undertaken by using the STATA packet program.

1.8. Limitations of the Study

This study includes a limited number of explanatory variables due to the short length of the time series data available for the sake of the degrees of freedom. Degrees of freedom refer to the number of independent variables that a statistical analysis can estimate. The positive estimation between the sample size and degree of freedom indicate that increase in sample size may increase the degree of freedom (Pandy, S., Bright, C. 2008). Since the length of the period chosen for the study is short due to the data available, the study is limited to few independent variables to increase the degree of freedom. The higher degree of freedom implies the power to reject the null hypothesis and find significant results.

CHAPTER 2

LITERATURE REVIEW

There are several empirical studies by economists, policy makers and researchers to explore how fiscal and monetary policies have influenced the GDP growth of developed and developing countries.

2.1. Empirical Literature Review

For developed countries, a number of studies have identified the positive impacts of fiscal and monetary policies on GDP growth. Federico and Elliott (2010) investigated whether government purchases in Japan had an impact on GDP growth with quarterly data from 1955-2009. Their study used a co-integration and a VECM approach, indicating that public expenditure had positive effects on GDP growth in Japan. Hye and Chae (2014) adopted the VAR and VECM model to examine the impact of monetary and fiscal policies on economic development in nine EU Member States. By using quarterly data for the period 1980q1-2012q3, the results of the VECM revealed that the increase in government expenditure had a long-term positive effect on GDP growth in Denmark, Ireland and the Netherlands while the money supply has a long-term positive impact on GDP growth in Austria, Greece, Portugal, Spain and Sweden. Alejandro and Julián (2015) investigated the impact of fiscal policy on the Spanish economy over the period 1978-2009 using the VECM and the co-integration approach. The results showed that total government expenditure has a positive short-term and long-term impact on the growth of GDP in the Spanish economy. Dan et al. (2018) employed ARDL and VECM approach to explore the influence of public spending on GDP growth with quarterly data between 1995 and 2015 in 10 selected central and Eastern European countries. Results indicated that public expenditure has a positive effect on GDP growth.

On the other hand, there have been opposite findings that show negative impacts of fiscal and monetary policies on the economic growth for developing countries. Zestos et al. (2011) studied the influence of monetary and fiscal policies on US economic growth using

the VECM model, using annual data from 1955 to 2006. Findings indicated that government spending negatively affects the growth of GDP in the US economy.

There are also a number of studies that show negative effect monetary policies on GDP in developed countries. Batten et al. (2015) looked at the impact of macroeconomic factors on GDP growth in Norway. Quarterly data for the period 1986-2009 were analyzed using the VAR/VECM approach. The results revealed that the money supply had a negative effect on GDP growth in Norway. Simionescu et al. (2018) adopted the VECM and VAR approach to assess the impact of money supply on economic growth in the Czech Republic as a developed country and Romania as a developing country from 1995q1 to 2015q4. Results showed that money supply negatively affects GDP growth in the Czech Republic.

A significant number of the studies revealed the negative effect of the public and monetary policies on developing countries. Mehdi and Seyyed (2011) studied the impacts of money supply and inflation on GDP growth in Iran by adopting VECM approach. Quarterly data for the period 1988q1-2005q4 were used. The findings showed that the money supply had a negative impact on GDP growth in Iran. Attari and Javed (2013) investigated the effects of inflation and public expenditure on GDP development of Pakistan. VECM and the co-integration approach were adopted and annual data were used for the period between 1980 and 2010. The results showed that government expenditure and CPI as monetary policy tools had a negative impact on GDP growth. Hussain and Zafar (2017) looked at annual data from 1972 to 2015 and observed the relationship between money supply, inflation, government spending and economic growth in Pakistan between 1972 and 2015 using the VECM approach. Findings have shown that money supply and CPI have a negative impact on Pakistan's economic growth. Khaysy and Gang (2017) studied the influence of monetary policy on GDP growth from 1989 to 2016 Lao PDR by employing VECM model. Results revealed that money supply and CPI have a negative impact on GDP growth. Mohamed (2018) analyzed the effect of monetary policy tools on GDP growth in Jordan from 1990 to 2017. The results of the VECM approach have shown that money supply and CPI have a negative impact on GDP growth.

A number of studies revealed the positive impact of monetary policies on GDP growth in developing countries. Muhammad and Mohammad (2011) examined the effects of financial growth impact on GDP growth of Pakistan from 1990-2008 by using quarterly data. The VECM approach indicated that money supply has a positive effect on GDP growth of Pakistan. Chaitip et al. (2015) employed ARDL and VAR approach to assess the effect of money supply and economic growth in ASEAN countries from 1995-2013. The findings of the study indicated that money supply has a positive and statistically significant effect on GDP growth in ASEAN countries. Mohammed and Mahfuzul (2017) studied the influence of money supply on GDP growth for the period 1972-2014 in Bangladesh. The study employed VECM model which showed that the money supply has positive influence on the GDP growth of Bangladesh. Using annual data from 1984 to 2014, Nagoya and Priyanka (2017) assessed the impact of monetary policy on GDP growth in Pakistan. The VECM model showed that the money supply has positive effect on GDP growth in Pakistan. Javid et al. (2020) employed VECM model using data for the period 2005-2018 and revealed that money supply has significant and positive impact on GDP growth in Azerbaijan. Rami and Bassam (2017) explored the effect of monetary policy on GDP growth of Jordan by employing quarterly data for the period 2005-2015. The VECM results revealed that CPI and money supply have a long term positive impact on GDP growth.

There have been several studies that show the positive impact of fiscal policies on GDP growth in developing countries. Bose et al (2007) examined the influence of government spending on GDP growth for 30 developing countries in the 1970s. The VECM and co-integration results showed that the government capital spending has a positive effect on GDP growth in developing countries. Srinivasan (2013) studied the relationship between public expenditure and economic growth in India between 1973-2012 by employing co-integration approach and VECM model. The results indicated that government expenditure has long run positive effect on GDP growth. Mohapatra et al. (2016) studied the influence of foreign aid on GDP development in the Indian economy with annual data from 1970 - 2014. The VECM model revealed that government expenditure has long term and short term positive effect on GDP growth of Indian economy. Özer and Karagöl (2018) analyzed the effect of fiscal and monetary policies on GDP growth of Turkey. VECM and ARLD models

were employed to analyze data from 1998 to 2016. The findings of the study showed that the government spending has a positive effect on GDP growth of Turkey. Viktor and Roman (2018) employed VECM technique to examine fiscal policy effects on GDP growth of Ukraine from 2001-2016. The VECM results suggested that public expenditure has long run positive impact on GDP growth of Ukraine.

A number of studies found a negative impact of fiscal policies and GDP growth of developing countries. Jayaraman and Chee-Keong (2006) investigated the effect of public debt and GDP growth in Fiji. By using a VECM approach to explore 34 years data from 1970-2003, the results indicated the internal debt and government expenditure have a negative influence on GDP growth in Fiji. Tasnia (2018) investigated the effect of the fiscal policy on GDP growth in Bangladesh, India, Pakistan, and Sri Lanka for the period 1980 to 2016 by using vector error correction model and ARDL model. It was shown that government expenditure has a negative effect on GDP growth in these South Asian countries.

In the case of African countries, a significant number of the studies are conducted to explore the effects of the fiscal and monetary policies on GDP growth. Several empirical studies have shown positive consequence of monetary policies on GDP growth in African countries. Ogunmuyiwa and Ekone (2010) noted that the aggregate supply of money has a positive impact on GDP growth between 1980 and 2006 in Nigeria by employing a VECM model and OLS techniques. Dingela et al. (2017) studied the effect of broad money supply on GDP growth in South Africa by employing data from 1980-2016. The VECM approach findings revealed that increase in money supply has positive effect on GDP growth. Musa and Asare (2012) used vector error correction models and co-integration approach to examine the relationship between fiscal policies on GDP growth in Nigeria between 1970 and 2010.The results showed that government spending has a negative effect on GDP growth while the money supply has positive impact on GDP growth of Nigeria economy. Strike (2015) investigated the effect of macroeconomic variables on GDP growth in Botswana by employing the VECM model for the period 1975-2012. Findings from the VECM analysis showed that CPI has a positive effect on GDP growth in Botswana. Miftahu

(2019) conducted a study to observe monetary policies and their effect on GDP growth in Nigeria with data covering the period between1980-2017. The OLS and Johansen co-integration results revealed that money supply has positive impact on GDP growth in Nigeria. Krouso et al. (2019) analyzed the effect money supply and inflation on economic growth in Libya using the VAR model and co-integration technique for the period between 1960 and 2016. According to the results, money supply has positive impact on GDP growth in Libya.

There are also a few studies that showed the negative effects of monetary policies on GDP growth for African countries. Odo et al. (2015) explored the dynamics among financial development and GDP growth in Nigeria between 1980 and 2013. By using VECM approach, he showed that broad money supply has negative effect on GDP growth in Nigeria. Nwoko et al. (2016) investigated the impact of the monetary policies on GDP growth of Nigeria. Annual time series from 1990 to 2011 were used to conduct OLS and VAR approach. The empirical results from the study revealed that money supply has negative impact on GDP growth in Nigeria.

Another line of the literature revealed the positive effect of fiscal policies on GDP growth in Africa. Peter et al. (2013) analyzed the effect of domestic debt on GDP growth in Nigeria. The study employed data covering 1980 – 2011 by using VECM and co-integration approach. The research results reported that internal debt has a long term positive effect on GDP growth. Bokreta and Benanaya (2016) analyzed the effect of monetary and fiscal policy on GDP growth in Algeria by using data from 1970 to 2014. The VECM results showed that government spending has a positive effect on GDP growth while CPI has negative impact on GDP growth in Algeria. Lloyd (2018) examined the influence of public spending on GDP growth in 15 selected West African countries for the period between 1990 and 2016. VECM approach results showed that public spending has a positive effect on GDP growth in these West African countries. Using data from 1960-2014 Tshembhani et al. (2018) investigated the effect of fiscal policy on GDP growth of South Africa. The study employed Vector error correction approach and found that public spending has a positive impact on GDP growth. Ogar and Eyo (2019) used VAR approach to explore the influence

of government expenditure on GDP growth in Nigeria by employing data between 1980 and 2017. Results showed that government expenditure has a positive effect on GDP growth of the Nigerian economy. Mbanyele (2019) explored the effect of government expenditure on GDP growth in Zimbabwe by employing data between 1980 and 2018. Using ARDL and VECM model, they showed that public expenditure has a positive impact on GDP growth in Zimbabwe. Monamodi and Nkosinathi (2019) investigated the impact of fiscal and monetary policy on GDP growth of Southern African Custom Union (SACU) for the period between 1980 and 2017. The Johansen co-integration and VECM approach found that public expenditure as a fiscal policy tool has a positive effect on GDP growth.

On the other hand, a number of studies showed the negative effects of fiscal policies on GDP growth in African countries. Nwankwo et al. (2017) employed data from 1970 to 2014 to study the impact of fiscal policy on GDP growth of Nigeria. The VECM results revealed that government spending has a negative effect on GDP growth of Nigeria. Bongumusa et al. (2019) also investigated the impact of fiscal policy on GDP growth in South Africa by employing data covering from 1960 to 2017. The Johansen co-integration and VECM approach results revealed that government expenditure and internal debt have a negative impact on GDP growth in South Africa. Riadh et al. (2016) studied public debt and GDP growth in Tunisia. The study employed data from 1990 to 2013 by using VECM technique and found that internal debt has a negative effect on GDP growth of Tunisia. Employing data from 1963 to 2012, Christine (2015) examined the impact of the government expenditure on GDP growth in Kenya by using VECM approach and concluded that public expenditure has negative impact on the GDP growth in Kenya. Peter et al. (2013) analyzed the impact of domestic debt on GDP growth in Nigeria. The study used annual data covering 1980–2011 by employing VECM and co-integration approach and reported that public spending has negative impact on GDP growth of Nigeria. Idenyi et al. (2016) used data for the period 1980-2014 to determine whether public expenditure exhibit long run causality and relationship to GDP growth in South Africa by adopting VECM and Johansen Co-integration approach. Results showed that public expenditure has a negative effect on GDP growth in South Africa.

In the case of Ghana, there are several studies that aim to study the impact of macroeconomic variables on GDP growth. Agyapong et al. (2016) used quarterly data from 1980:Q1 to 2013:Q4 of Ghana and employing the Johansen approach and VECM technique and found that public expenditure has a positive impact on the GDP growth and monetary policy tools such as the CPI and money supply have a negative impact on GDP growth. Samuel et al. (2013) also examined major macroeconomic variables that influence GDP growth of Ghana. Using Johansen co-integration and error correction model by employing data from 1980-2010, they found that government expenditure and the consumer price index have a positive impact on GDP growth of Ghana. Havi et al. (2013) tested the influence of macroeconomic factors on GDP growth by using data for the period 1970-2007 in Ghana. The VECM findings indicated that, government spending and CPI have respectively positive and negative influence of the GDP growth of Ghana. Victor and Christopher (2016) studied public debt and GDP growth in Ghana. The study examined the relationships between the variables for the period 1970-2012. The VECM results found that the public debt has positive effect on GDP growth of Ghana. Wisdom (2018) employed VECM approach with time series data from 2008- 2017 in Ghana to study the influence of the macroeconomic variables on GDP growth. The results concluded that money supply has negative impact on GDP growth of Ghana while government spending as a fiscal policy tool has a positive impact on GDP growth of Ghana. Acheampong and Evans (2013) explored the effect of fiscal policy on GDP growth of Ghana's economy for the period 1980-2010 by employing VECM model. The findings revealed that government expenditure and CPI have positive effect on GDP growth. Enu (2009) examined the dynamics of macroeconomic indicators and GDP growth in Ghana for the long run. Co-integration and VECM method were employed by using 1970 to 2007 annual data and results showed that CPI as a monetary policy tool has a positive impact on GDP growth while public expenditure has negative impact on GDP growth of Ghana. Promise et al. (2016) analyzed the influence of fiscal policy on GDP growth in Ghana. The Johansen approach and VECM were used by using quarterly data for the period of 1983-2012. The VECM approach findings showed that government spending has a negative effect on GDP growth in Ghana. Darko (2015) employed VECM and co-integration method to study fiscal policy and GDP

growth in Ghana from 1975-2013 and found that public spending has a negative effect on GDP growth of Ghana.

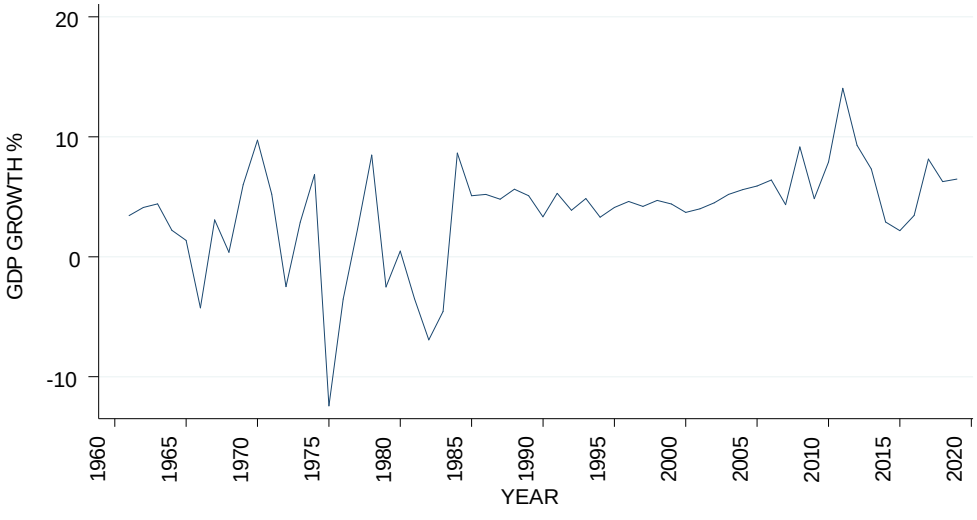
CHAPTER 3

AN OVERVIEW OF THE GHANIAN ECONOMY

3.1. Economic Growth in Ghana

Ghana's economy has been experiencing a fluctuation in GDP growth due to numerous political and economic incidents as it can be seen in Figure 1.Ghana ended its slave trade in the early nineteenth century and adopted a legal trade. Industrialization was the policy that aimed to enforce the economic growth. The adoption of industrial policies promoted the production of palm oil, timber and gold. During 1878, the Americans introduced cocoa trees in Ghana which became the country main export commodity. During the 1920s, Ghana was the leading cocoa producer in the world's cocoa market. In this period, increasing trade volume boosted productivity, which induced economic growth. The entry of European goods began with destroyed local industries which made the farmers shifted their attention on cash crops rather than vital food crops for local consumption.

Figure 1. Economic Growth in Ghana between 1960 And 2019



Source: https://databank.worldbank.org/source/world-development-indicators

Ghanaian economy was fluctuating before gaining independence in 1957, then, a stable and flourishing economic growth had started with the independence of the country. Enu (2009) revealed that, the real GDP grew at the rate of 4.6% in 1957 but decreased to 3.7% in 1958. From 1962 to 1963 the economy grew by 4.1% and 4.4%, respectively (World Bank, 2008). The rapid economic growth was as a result of being the world's main producer of cocoa and also having social amenities such as a developed infrastructure, modern educational facilities, hospitals and electricity. The country used the revenue accrued from the cocoa production as the financial resource to acquire financial credit to build industries to create, import substitutes and also manufacture goods that were mostly exported. Between 1960 and 1966, the fall in cocoa price, corruption and military coup led the economy into bankruptcy which induced a fall in GDP growth. From 1964 to 1983 the real GDP growth grew negatively due to the drought as an external shock. Fiscal and monetary policies adopted at that time to mitigate the economic crises resulted in huge fiscal deficits, huge borrowing and high rates of inflation. The economic crises during this period caused a disturbance cocoa producer which caused them to smuggle their cocoa production to neighboring countries. The collapsed of export and cocoa production made the country to secure loans to generate revenue to mitigate economic crisis.

In Ghana, real GDP grew negatively by 3.2% for the period 1970 to 1981. From 1976 to 1981, there was a drastic decrease in mineral production by 32%. The percentage decrease in gold, diamond, manganese, bauxite mining was 47%, 67%, 43% and 46% respectively. The economic crisis resulted in an inflation increase, which was more than 50 %. Inflation was 116.5% in 1981, which resulted in a significant decrease in trade volume of Ghana in world markets (Enu, 2009). During this period, productivity, standard of living, government infrastructure, agriculture, trade, industries and imports were distorted. In 1983, Ghana's economy started to experience a depression and recession due to the long drought that affected the agricultural production and industrial sectors of the economy which caused negative GDP growth. Ghana consulted World Bank and International Monetary Fund (IMF) to seek for financial credits or loans to serve as a stimulus package to induce rapid economic growth, which is a policy known as an Economic Recovery Program (ERP).The government aimed to implement economic reforms to mitigate the economic crisis and also

settle the current account debt of their foreign creditors by using the acquired funds. The country established structural adjustment policies (SAP) in 1980s with the intention of promoting export sector, reducing the budget deficit and also implementing good fiscal policies to ensure economic growth. Policies gained recognition from the international monetary agencies and the donor institution which brought support from these agencies to relieve the economy.

In 1992, there was a constitution amendment which eliminated the military system of government and adopted a civilian system. During the same year Ghana experienced poor accountability, high current account deficit, high inflation, unemployment, corruption which induced a slow GDP growth. From 1993 to 1999, macroeconomic stability measures were introduced which caused real GDP growth at 1.9%. From 1999-2000, the external shocks in exports and crude oil price led real GDP growth slow by 3.7%. In 2001, Ghana implemented market reforms and joined in Heavily Indebted Poor Countries (HIPC) initiative, which caused a real GDP growth by 4.2%. From 2003 to 2005, Ghana introduced monetary policies to remove the fuel subsidization as conditionality. The government passed on the real world market price of fuel to local consumers to pay. This policy led a real GDP growth at 4.5%. From 2005-2006, Ghana experienced international fuel price crisis, subsidization of utilities and fiscal stabilization that resulted in the adoption of macroeconomic policies to ensure rapid economic growth.

From 2008-2010, Ghana implemented a program designed by the IMF. The macroeconomic stability measures implemented brought rapid GDP growth at 6.4%. The higher export in cocoa production, higher oil revenue, strong service sectors, huge export of gold resulted in a real GDP growth at 7.1% in 2012. Economic policies and fiscal discipline measures implemented between 2016 and 2017 increased real GDP growth by 8.5%. The fact that the economy of Ghana experienced some serious problems such as political instability, coup d'état, high current account deficit, fiscal disciplines over the decades made many economic researchers to carry out numerous studies to examine the determinant of GDP growth of Ghana in terms of macroeconomics policies. In this study, the aim is going beyond these research concepts which have been studied by many researchers and investigate into extent the macroeconomic policies that potentially may

influence the GDP growth of Ghana between 2009q1-2018q4 by focusing monetary and fiscal policies.

3.2. MONETARY AND FISCAL POLICIES IN GHANA

Monetary and fiscal policies are the economic tools employed by the policy makers to maintain a healthy economic environment and to ensure economic growth in economies. Afful-Mensah and Quartey (2014) defined monetary policy as an adaptation of diverse measures to govern the money supply to induce economic growth. Fiscal policy, on the other hand is defined by Mark and Asmaa (2009) as the control of public spending and mobilization of taxes to impact GDP growth. The aim of adopting monetary and fiscal policies is to increase revenue, control government spending, money supply, balance of payment, export, price stability, create employment, improve development and ensure output to promote economic growth. The GDP growth in Ghana's economy is ensured by using monetary and fiscal policies. Alexander et al. (1995) indicated that, from 1980s, 1990s Ghana adopted monetary and fiscal policies to control the GDP growth. These policies were employed to control the monetary challenges which included massive budget deficits, high borrowing, huge interest rates which bring negative effect on economic growth. The stabilization monetary policies in Ghana was firmly restricted through macroeconomic policy contracts Signed with the International Monetary Fund (IMF), World Bank, Heavily Indebted Poor Countries (HIPC) in collaboration with IMF loans, and initiative of the Poverty Reduction Strategy Program (PRSP). The restrictions imposed on Ghana by these institutions compared Bank of Ghana (BOG) to manage inflation to become single digits and reduce government credit. International Monetary Fund (IMF) measures imposed on the Ghana reduce creation of employment, cause inflation which slows down the GDP growth. Alexander et al. (1995) and Roe and Sowa (1997) revealed that between 1996-2000, money supply rose to 31% as against inflation 22.7%. However, high borrowing, high interest rate and huge debt took the country to join HIPC in 2002. The country joined this organization to secure financial assistance from the IMF. Ghana joined in HIPC in 2002 and made tremendous increase in money supply to 50%.

According to Alexander et al. (1995) and Roe and Sowa (1997) monetary policies of Ghana evolved from employing direct instruments to targeting the money supply. The Bank of Ghana (BOG) also adopted financial sector restructuring for controlling the amount of money supply in Ghana's economy during 1992. These reforms were established to eliminate direct mechanism and adopt the market based method of allocating and controlling of resources in Ghana. The main purpose of using market based method was to reject the direct instrument and accept indirect instrument to control the money supply to induce GDP growth. Ghana eliminated the monetary aiming system and accepts inflation aiming approach to control the monetary policy.

3.3. MONETARY POLICIES AND THEIR IMPLEMENTATION

The Bank of Ghana (BOG) implemented measures to reduce huge liquidity in Ghana's economy to avert the problems in monetary policy. Ghana's huge liquidity rose up due to too much government loans obtained from the financial sector and only Bank of Ghana was mandated as an institution to give money to support government budget deficits. This monetary policy established within this era in Ghana restricted government spending, which adversely contributed to positive economic growth. Another implementation made in the establishment of monetary policy in Ghana was known as stabilization, which aimed to reduce the imbalance in the economy. This policy was implemented during National Liberation Council (NLC) era which began from 1966. Under this monetary policy, interest rates and credit controls were employed to induce economic growth in Ghana. These loans were allocated to selected sectors in the Ghana's economy, such as agriculture sector, export sector, trade sector, and industrial sector with the aim of boosting these sectors and strengthen its corridors to produce rapid economic growth of Ghana. These stricter measures imposed on the economy by the monetary policy highlighted above contributed massively to the GDP growth. This made inflation to reduce drastically to 2.5% in the middle of 1966 to 1967.

From1968 to 1970 the Bank of Ghana introduced careful measures to control credit facilities, the main purpose of implementing this monetary policy was to evade too much government credit on the Ghana's economy. From 970 to 1971 the monetary policies were

restricted due to continuation of the National Liberation Council (NLC) government stabilization monetary policy. Within this period, the monetary policies employed monetary tools such as interest rates, foreign reserve, credit controls to regulate the money supply in Ghana. All these measures employed to stabilize the Ghana's economy contributed massively to GDP growth by increasing the policy rate from 5.5% in 1970 to 8% during 1971. The monetary policy went further to reduce Credit ceilings from 33.3% to 20% in 1971 with the aim of supporting some selected sectors such as agriculture and manufacturing sectors which cause slow economic growth.

National Redemption Council (NRC) was ruled Ghana from 1972 to 1978 and this government introduced the self-reliance policy. Their policy aim was to make Ghana dependent on itself in terms of its monetary policies. Under this government, bank of Ghana was charged to increase money supply to promote fast economic growth, which compared them to implement expansionary monetary policy. The adoption of expansionary policy that started at the beginning of National Redemption Council, government period resulted in additional liquidity into the economy. Expansionary monetary policy included the actions of Bank of Ghana to adopt instruments and measures to stabilize the economy which reduce the interest rate, grow aggregate demand and also increase money supply which increase the economic growth. Acquaye (1995) showed that the policy caused interest rates to decline to 6% from 8% for the period 1973 to 1975. The government also gave more credit facility to some sectors which induce positive GDP growth. During 1975, expansionary monetary policy was transformed and later became restricted monetary policy which increased interest rate to rise up to 8% and credit facility given to the special sectors also grew from 25% to 50%. During 1977, central bank of Ghana set up Cash Reserve Ratio (CRR) monetary policy. The introduction of this monetary policy compared the commercial banks to hold customers reserve in cash or deposit. Also the (CRR) policy establishment in Ghana increases the cash reserve ratio to 42.8%. In 1978, the policy increased money supply to 72.4%, which created huge inflation rate to 46%.The excessive credit given to the government of Ghana under this monetary policy implementation created liquidity challenges which affected money supply. The too much credit allocated to the government of Ghana at that time made the monetary authorities to cancel the policy. For the period of

1979-1982, the Bank of Ghana in collaboration with PNDC government implemented contractionary monetary policy. This policy was used by the central bank of Ghana to tackle inflation rate and reduce the money supply to influence GDP growth. The implementation of contractionary monetary policy raised the interest rate to 13.5%. This caused a decrease in investors, expansion of industries, reduce employment, increase unemployment, reduce the export and increase inflation, which contributed massively to slow GDP growth of Ghana's economy. The Bank of Ghana puts restrictions on government credit and net domestic assets to improve total domestic demand to reduce high inflation. Alagidede et al. (2013) Ghana held first general election under the establishment of fourth republican constitutional rule in 1992. Ghana's economy experienced a huge fiscal deficit and recorded a fiscal surplus of 2.8% and 1.7% of GDP growth in 1992 and 1998. According to Bawumia and Halland (2017), the economy of Ghana during 2000 which is another election year experienced a new vicious cycle which led to high inflation, currency depreciation, which caused 50% of the Ghanaian Cedi's to lose its value to the US dollar. The country got a peaceful change of power from the incumbent government to incoming government in January 7, 2001. Although the incoming government led by John Agyekum Kuffour met fiscal challenges early in his administration. The government went ahead and accepted the economic reform program signed from 1999-2002 by the successive government. His main aimed to agree the policy with international monetary policy (IMF) was to alleviate the poverty of the populace. Also, his target was to reduce the high current account deficit, which was larger than the budget for public spending, reduces the higher price of fuel, water and electricity. From 2001-2006 the new government adopted the international monetary fund HIPC debt relief program. The Bank of Ghana Act (BOG 2002) implemented inflation-targeting framework, monetary policy which led to massive decreased inflation. The policy positively impacted Ghana's external payments position. From 2000 Inflation decreased from 40.5% to 12.7% during 2007.

In 2008, there was another election, which took place and the sitting new patriotic party (NPP) government led by Nana Akuffo Addo Dankwah lost power to national democratic congress (NDC) led by John Evans Atta Mills and appointed John Dramani Mahama as his vice president. Unfortunately the controller of the economy his excellence

John Evans Atta Mills passed on without ending his term of office as president, which paved way for his vice president John Dramani Mahama to become legitimate president to control the economic affairs on the economy of Ghana. The macroeconomic stability measures and policy signed with the IMF by the successive government brought economic stability of the economy which induced economic growth in Ghana. The country saw rapid growth in GDP which was 7.1% in 2012, this resilient economy was seen as a result of higher export in cocoa production, higher oil revenue, strong service sectors, strong export of gold. Notwithstanding these alone the country saw positive growth in its medium term plans due to larger investment from foreigners and local people industries as well as public infrastructure and good performance from commercial agriculture. The end of 2012 election continues to give the nod to the incumbent government president John Dramani Manama, who was sworn in into the presidency in 7th January, 2013 as the legitimate government to control the economy of Ghana. The monetary policy measures put in place from 2013- 2016 brought positive and resilient GDP growth. Ministry of Finance (2020) budget statement revealed that, the tight monetary policy established during 2017 to 2019 led the annual growth of broad money supply (M2+) to decline. The statistics showed that growth in M2+ decreased from 24.09% in 2018 to 16.51% in 2019. This declined in money supply accounted for slow GDP growth of Net Domestic Assets (NDA) which caused an increase in Net Foreign Assets (NFA). During the period of 2018-2019 there was an increase in credit to public and private institutions. Ghana nominal annual growth rate of outstanding credit rose from 13.01% to 14.88% in 2019. From 2019 total credit was GH¢47, 247.04 million, while 2018 credit stood at GH¢41, 126.62 million. The rise in total credit was as a result of huge public sector credit while private sector credit declined from 17.24% in 2018 to 12.62% during 2019. Ghana experienced growth in bank credit from 2.9% to 6.77% over the same period. The increased in the bank credit had led to massive economic growth on the economy of Ghana from 2017 to 2018.

3.4. FISCAL POLICIES AND THEIR IMPLEMENTATION

The fiscal policy is the fundamental force of economic growth and development in Ghana despite the views of the classical and the neoclassical economist. Ghana implemented fiscal policies to control the economy of Ghana. Aryeetey and Harrigan (2000) revealed Economic Recovery Program (ERP) as a fiscal policy to control the economy of Ghana. Ghana experienced slow GDP growth, which led the country to seek for assistance from IMF and World Bank. These institutions recommended ERP for the country to ensure sustainable economic growth. The initiation of the policy was to decrease budget deficits and inflation rate to cause rapid GDP growth of Ghana. The policy implementation aimed to establish cost retrieval, decrease of subsidies and divestiture of state-owned enterprises, decrease civil servants, workers, enlargements tax generation, broadening of the tax net and fiscal aggregate demand. From 1979 to 1983 the economy grew negatively -3.4%, which led to poor GDP growth. Karikari (1995) study reported that from 1975-1983 Ghana suffered from political instabilities and economic crisis such as drought, oil price increase, fast decreasing of trade crop which slow economic growth. The country under the ERP experienced huge debts and deficits because of government's dependency on the private sector for the credit facility. Kusi (1998) showed that between 1970 to 1982 government credits obtained from the local bank rose from 49% to 86%.

According to Aryeetey and Harrigan (2000), the outcome of constant local borrowing and loans decreased private investments. From 1984 to 1989 ERP made economic growth to increase from -3.4% to 5.7%. This significant growth in the economy was as a result of advancement in the revenue mobilization, proper government spending and government revenue stabilization. The huge revenue accumulated by government for developmental projects to influence GDP growth from 4.6% of 1983 increased massively to 12.3% in 1989. Moreover, government expenditure before implementation of the Economic Recovery Program (ERP) decreased from 18.8% to 16.2 % for the period 1981 to 1991. The decreased in GDP growth during this period is as a result of government measures to cut down consumption from 6.6% to reach 2% and government expenditure grew from 3.3% to 5.1%. The World Bank assessed ERP whether the economy has seen positive GDP growth. During 1986 the country implemented Structural Adjustment

Program (SAP).The policy was established to ensure the stability of fiscal policies to promote productivity. The recent and decades result received from (SAP) fiscal policies induce slow economic growth. Aryeetey and Harrigan (2000) statistical study indicated that after the policy implementation the economic growth from 1987 to 2000 was found within 3.3 % to 5.5% whereas the budget deficit was 1.6 % .The government expenditure raised from 14.3% during 1986 and increased to 28% in 2000. The government revenue rise was not able to show the positive impact on GDP growth due to high government consumption more than an investment. From 1986 to 2000, the public expenditure grew to 20 % and investment spending also rise to 2.5%. During political change of government between 2001 and 2008, GDP growth in Ghana increased from 4% to 7.3%, which brought relief of slow pace growing economy of Ghana. The government attempted to strengthen its fiscal policies due to the participation of the Highly Indebt Poor Country (HIPC).This policy aimed to seek for financial support to decrease the public debt of Ghana. The implementation of this fiscal policy induced positive impact on GDP growth during 2008. The rapid growth of the policy raised the government expenditure as a result of wage costs, and government consumption. Government revenue increased gradually from 18.2% during 2001 to 25.5% in 2007.

In 2008 Ghana's economy grew very slowly. The introduction of some expansionary fiscal policies resulted in a pressure on the economy. Ghana paid net arrears and outstanding commitments contracted over the year. This government spending caused public expenditure to increase by 55% and credit given to the private sector grew by 48%. Flooding and energy problems Ghana encountered in 2007 led to huge investment on roads and energy led to the huge public expenditure in that year. Higher public spending during the 2008 election is attributed to fiscal slippage. In 2009, Ghana adopted fiscal stabilization program which led GDP growth to reduce from 8.4% to 4.7%. The negative growth of government spending from 2008 to 2009 was 2.7% of GDP growth. The fiscal consolidation has a strong influence on GDP growth fluctuations in Ghana during 2009. In 2010, Ghana's total public expenditure arrears were 9.1% of GDP and 2.8% of private contractors. From 2008 to 2010, the public debt to GDP increased from 33.6% to 37.4%. The debt growth from 2008 to 2010 included external debt, financial assistance from donors and exchange rate devaluation. In 2011, the GDP growth of Ghana was 14%, due to increase in fuel price,

there was an increase in export goods such as cocoa, gold and oil production. The Ghanaian economy experienced massively increased in the total revenue and grants in 2011. The fiscal deficit was 3.3%. From 2012 to 2013 the fiscal deficit increased from 3.3% to 11.6%. The country debt interest payments increased from 9% to 11% of GDP during 2013. This made domestic financing became more expensive to secure credit facility to support the development. Between 2013 and last quarter of 2016, the interest rate on domestic financing increased from 22% to 25%. During 2013, the economy of Ghana encountered slow GDP growth due to challenges in tax collection and grant disbursements. Ghana saw drastic decreased GDP growth to 1.6%, due to the decrease export commodity prices on gold, cocoa, oil decreased. In 2014 Ghana introduced fiscal consolidation and structural reforms to bring sustainable fiscal targets in the medium term. The government reduced the fiscal deficit from 10.1% to 6.3% in 2015. In 2015 the grants for Ghana increased because of the assistance from the development organization to support the fiscal policy stabilization program. In 2016, Ghana recorded low grant disbursement which negatively affected the GDP growth. This slow economic growth experienced during 2016 was as a result of slow implementation of the fiscal reforms by the development partners of Ghana. The country's fiscal deficit increased to 8.7%. In 2017 the government fiscal deficit reduced by 3% of GDP in 2018. Ghana implemented fiscal measures to increase expenditures and increase revenues. The measures from the current government Nana Akuffo Addo Dankwah who is a president of Ghana made the economy to reach the path of positive GDP growth. From 2017 to 2018 GDP growth increased to 8.5%. The study looked at the extent of GDP growth in 2019 as compared to 2018 which was 8.5%.

CHAPTER 4

RESEARCH METHODOLOGY AND DATA

4.1. Introduction

This chapter explains the source of data and methodology used to undertake the study. The data section includes data source, description of the variables and the justification of the variables. The methodology framework section presents estimation techniques, i.e. unit root tests, Johansen co-integration approach, VAR-VECM approaches, empirical model specification and diagnostic tests.

4.2. Data

The data used in the study are obtained from secondary sources. The software Stata 15.0 is used to perform the required econometric techniques. The variables used in the study are real GDP, internal debt, public expenditure, money supply, Consumer price index (CPI), are taken from the website of the Central Bank of Ghana[1]. The quarterly time series data covers the period from 2009:Q1 to 2018:Q4. The abbreviations of the variables used in the model specifications can be seen in table 1.

[1] The Bank of Ghana, Retrieved from https://www.bog.gov.gh/publications/quarterly-bulletin (01.09.2019).

Table 1: Description of variables

Variables	Description
RGDP	Real gross domestic product
PUBEXP	Public expenditure
INTDBT	Internal debt
MNYSUP	Money supply
CPI	Consumer price index

Source: Bank of Ghana

The study investigates the effects of macroeconomic policies specifically fiscal and monetary policy choices on real GDP growth of Ghana. The purpose of the study is to unveil the dynamics of real GDP growth and a number of independent variables which are money supply and CPI for monetary policies, public expenditure and internal debt for fiscal policies. The study is conducted with a limited number of the variables in the model for the sake of the degrees of freedom due to the very limited number of the observation.

4.3. Justification of the Variables

4.3.1. Real GDP growth

In the study, real GDP growth is used to measure the well-being of an economy since it is a conventional indicator of the performance of an economy in the literature. Following Palamuleni (2014) and Bashar and Khan (2012) GDP growth is used as a dependent variable to study the impacts of fiscal and monetary policies on the economic well-being.

4.3.2. Public expenditure

Public expenditure is the government spending and purchasing of goods and service by the government in an economy and it is a component in the calculation of GDP. There are several studies in the literature such as Nyasha and Odhiambo (2019),Gosh and Gregarious (2008),Bose et al. (2007), that support the Keynesian view on how public investment in social amenities such as water, electricity, operations and maintenance have a positive influence on real GDP growth of an economy. Romer (1986) reports that, the expansionary policy leads to higher government expenditure which has positive influences on the real GDP growth. The public expenditure increases the real GDP, which in turn decreases unemployment, increases aggregate demand and increases price level. According to the Ram (1986), Ghali (1998) and Nyasha and Odhiambo (2019) if the government expenditure increases, it leads to the increase in private investment which causes positive influence on real GDP growth. However, Landau (1983), Aschauer (1989), Yasin (2000), Easterly and Rebelo (1993) and Barro (1999) revealed that, the government spending on capital, construction of airports, railways, seaports, communications, also have positive impact on real GDP growth. Friedman (1997), Barro (1999), Schaltegger and Torgler (2006), Taban (2010), Nurudeen and Usman (2010), Ndambiri et al. (2012) and Nyasha and Odhiambo (2019) showed that public expenditure on consumption have a strong negative impact on real GDP growth. The findings of this study also support this view.

4.3.3. Internal debt

Internal debt is the debt of the government to its domestic lenders. The lender agencies include central bank, commercial banks and financial institutions in the country. Mba et al. (2013) revealed that internal debt has positive impacts and direct relationship with real GDP growth. Abbas and Christensen (2007) showed that, internal debt without inflation and bank deposits have a positive impact on real GDP growth. According to Mba et al. (2013) and Emran and Fazari (2008, 2009) internal debt has a negative influence on

real GDP growth and the government internal borrowing decreases credit given to the private sector which leads to crowding out effect on developing countries. The crowding out effect on bank loans has impact on investment which may cause negative influence of real GDP growth. Ayyoub et al. (2012) examined the impact of internal debt on manufacturing and unemployment and their findings show that public spending on debt payment result in low productivity, high unemployment and low performance in the manufacturing sector which causes negative growth in real GDP. Putonoi et al. (2013), Checherita and Rother (2010), Kumar and Woo (2010) and Mba et al. (2013) showed that high internal debt has a negative effect on GDP growth. The increase in internal debt lowers labor productivity and discourages investment which may cause negative growth in real GDP. Examining the sectorial economic policies of Caribbean and Latin America countries Caner et al. (2010) found that, internal debt at 77% has negative effect GDP growth. Moreover, if the internal debt decreases, the economy has more strength to pay back its debt to lenders which increases real GDP growth. Also the decrease in internal debt reduces interest rates. If the interest rate decreases, people secure more loans from lenders, which increase consumption, investment and unemployment. Hence, many empirical studies have shown that internal debt has negative impact on the real GDP growth. Based on these findings, internal debt is expected to have a negative effect on the real GDP growth.

4.3.4. Money supply

The term money supply stands for all present currency and other liquid tool in an economy of a country within the period measured. It includes currency, printed notes, money in the deposit accounts, liquid assets and currency deposits by depositors. The government issues currency through the central bank of the country. Dingela et al. (2017), Hussain and Haque (2017), Chaitipa.et al. (2015) and Ogunmuyiwa and Ekone (2010) studied the impact of money supply on economic growth. Their study presented the positive and significant influence of money supply on real GDP growth. Babatunde and Shuaibu (2011), Chude and Chude (2016), and Dingela et al. (2017) investigated the influence of the money supply of real GDP growth of Nigeria economy and show that the broad money (M1) has a positive influence on real GDP growth. Mohammad, Wasti and Hussain (2009),

and Zapodeanu and Cociuba (2010) examined the effect of the money supply on real GDP growth and show that the money supply (M2) has positive influence of the real GDP growth. Ihsan and Anjum (2013), Ehigiamusoe (2013) and Gatawa et al. (2017) investigated the impact of money supply (M2) on real GDP growth and report that the broad money supply (M2) has a negative effect on real GDP growth. Based on the findings on similar African countries with Ghana, and explanations in the literature, this study expects to find a positive effect of money supply on GDP growth.

4.3.5. Consumer price index

The CPI shows the general price level in an economy and it is used to calculate the inflation rate. Several studies showed positive effect of the price level of economic growth. The theoretical prospect Keynesian theory postulates that, a rise in demand causes the inflation and production to grow, which lead to positive effect on economic growth (De Gregorio, 1992). Phillips Curve theory revealed that high inflation slows down the unemployment which positively affects growth (Grimes, 1991). An increase in CPI causes the consumers to purchase more goods and services which positively affect real GDP growth. Aboobucker and Jahufer (2018) and Mahmoud (2015) examined the impact of CPI on real GDP by using OLS approach and found that the CPI has a positive impact on GDP growth. Makuria (2014) revealed that inflation has strong positive influence on real GDP growth in Mauritania. Mallik and Chowdhury (2001) used vector error correction to examine CPI and economic growth in Bangladesh, India, Pakistan and Sri Lanka and indicated that CPI has a positive effect on GDP growth. Khayroollo (2011) examined CPI and economic growth in Finland by using VECM approach and revealed that inflation has a positive effect on economic growth. Empirical evidence by Tobin (1965) found that the CPI has a positive effect on economic growth in Singapore. Jing (2009) employed co-integration approach to analyze the effect of inflation on economic growth in China and the results indicated that inflation has a positive effect on economic growth. Isik et al. (2016) examined the relationship between economic growth and inflation in Turkey by employing VECM approach and found that inflation has a positive effect on GDP growth. Venkadasalam (2015) used Johansen approach to evaluate the effect of CPI and economic

growth in Malaysia from 1960 to 2012. The results revealed that CPI has a positive effect on GDP growth. Ngwen et al. (2015) examined the impact of CPI in economic growth of Cameroon by applying a VECM model. The results revealed that the CPI had a positive effect on economic growth. Lupu (2009) used a VECM model and found that inflation had a positive effect on GDP growth in Romania. Shapan and Majumder (2016) investigated the association between inflation and economic growth in Bangladesh through the use of VECM. The results of the VECM have shown that inflation has a positive effect on economic growth in the long run. Levine and Zervos (1993) revealed that the moderate inflation may increase GDP growth rate positively. The argument has shown that when the inflation rate is above 80%, it affects GDP growth negatively.

There are also a number of studies that show the negative impact of CPI on economic growth. The Philip curve approach or theory revealed that hyperinflation increases the instability and decreases production in an economy which affects the growth negatively (De Gregorio, 1992). Seth (2015) examined the correlation between inflation and real GDP growth in Tanzania and revealed that there is no long-term correlation between the CPI and real GDP and that inflation has a negative impact on real GDP growth in the short term by using the VAR approach. Ahmed and Mortaza (2005) analyzed the inflation and economic growth in Bangladesh by employing the co-integration and VECM approach. Results revealed that CPI has long-run negative impact on GDP growth. Gokal and Hanif (2004) employed VECM approach to examine inflation and economic growth of Fiji. The findings indicated that CPI has a negative effect on GDP growth. Valdo vinos et al (2003) studied the level of inflation effect on GDP growth in Latin American countries by using VECM analysis. The results indicated that inflation has a negative effect on economic growth. Barro (1995) investigated the influence of inflation on economic growth using panel data from 100 countries and found that inflation had a negative effect on economic growth. Saaed (2007) analyzed the effect of inflation and economic growth in Kuwait by using VECM. The results indicated negative effect between CPI and GDP growth. Faria and Carneiro (2001) adopted VECM approach to examine the association between inflation and GDP growth in Brazil and found that inflation has a negative effect on economic growth. Although it is very compelling to draw a conclusion based on these conflicting results and

explanations, this study expects to find a positive effect of CPI on the real GDP growth considering the results on similar countries.

4.4. Methodology

The Philips-Perron and DF-GLS tests are used to test the stationary properties of the variables. Secondly, the study conducts a co-integration analysis using the Johansen co-integration approach to determine whether there is a long-term relationship between the variables of interest. The estimation of VECM and VAR among the variables is undertaken to determine long run and short run dynamics in the model. Finally, diagnostic tests are used to check whether the model has an auto correlation, normality and stability.

4.5. Unit Root Tests

The Philips-Perron and DF-GLS tests are used to determine the stationarity of the variables. The study tests the null hypothesis H_0: $B_1 = 0$ and alternative hypothesis H_1: $B_1 > 0$ for unit root. According to Johansen (1988), the variables that are stationary at their first differences are integrated in order (1). In order to avoid losing degree of freedom; Akaike information criterion (AIC) is used to determine optimal lag length for the tests which selects (4) as optimum lag to carry out the analysis.

Herranz (2017) defines a random walk equation such as $X_t = X_t - _1 + \varepsilon_t$ as an example of non-stationary process. The ε_t is random –innovations, for example non-stationary is specified as; $E(\varepsilon_t) = 0$ and var $(\varepsilon_t) = 1$, then $E(X_t) = X_0$ and $var(X_t) = t$,which means the variable is a function of time. The unit root test is used to estimate null hypothesis test of AR (1) which specifies the equation such as $(X_t = \phi_1 X_t - 1 + \varepsilon_t)$ where $\phi 1 = 1$. The alternative hypothesis is normally used to estimate stationary process in unit root test with this equation $|\phi 1| < 1$, but can be expanded to include non-stationary with $\phi 1 \neq 1$. Brownian model is a model that can be used to estimate the null hypothesis that cannot be rejected by the null hypothesis. Brownian model, is mathematically specify as,

$$\lim_{n\to\infty} \frac{1}{\sqrt{n}} \sum_{i=1}^{[nr]} \varepsilon i \underset{D}{\Rightarrow} W(r) \quad (1)$$

Edward (2017) reveals that, stationary time series has two main categories that can be observed. First one is the weakly stationary time series with function y (s, t) which is an auto covariance function that depends on a variable that has a constant mean. A strictly stationary time series is used in practice which is defined as a joint probability distribution that does not change with time. The second, which is the weakly stationary process, is known as I (0). If unit root test specifies; $X_t = X_t - 1 + \varepsilon_t$; which indicates variables are integrated at I (1), then the variable can become stationary by taking their first differences, $\Delta (X_t) = \varepsilon_t$. However, if AR has polynomial roots with absolute value more than one, it can be concluded that variables are stationary.

The null hypothesis is set to observe that, the variables have unit root or non-stationary which means the series is integrated in order I (1). The alternative hypothesis is that the variables are weakly or trend stationary or have no unit root at their first difference. The step becomes explosive when $|\phi 1| > 1$. The study focuses AR (1) models, to observe the intercept and linear trend. The null hypothesis mathematically specifies AR (1) model as $X_t = \phi 1 X_t - 1 + \varepsilon_t$ where $\phi 1 = 1$ which is non-stationary I (1).The null hypothesis in the AR (1) model are specified below;

$$X_t = \phi_1 - 1 + \varepsilon_{t,} \quad (2)$$

$$Y_t = \beta_0 + \beta_{1t} + X_{t,}$$

$$\phi_1 = 1$$

The $\beta 0$, $\beta 1$ are coefficient of the AR model, hence the AR model is specified quadratic function;

$$X_t = \phi_1 X_{t-1} + \beta_{1t} + \varepsilon_t \quad (3)$$

$$\Phi_1 = 1$$

The alternative hypothesis for AR (1) model is specified as $\phi 1 \neq 1$. When $|\phi 1| < 1$, the explosive AR (1) process with $|\phi 1| > 1$ is a highly non-stationary process. The AR (1) with $\phi 1 \neq 1$ specifies the model as;

$$X_t = \phi_1 X_{t-1} + \varepsilon_t \quad (4)$$

$$Y_t = \beta_0 + \beta_{1t} + X_t$$

$$\Phi_1 \neq 1$$

Elliott, Rothenberg and Stock (1996) proposed Dickey-Fuller test known as the DF-GLS. The findings reveal that, DF-GLS have more significant strength than the Dickey-Fuller test. The DF-GLS is conducted to estimate the variables in their first difference or de-trended variables. The test model specification should include 1-k lags at their first difference. Dickey-Fuller regression model is identified as,

$$\Delta y_t = \alpha + \beta y_t - 1 + \delta t + \zeta_1 \Delta y_t - 1 + \zeta_2 \Delta y_t - 2 + \cdots + \zeta_k \Delta y_k - k + \varepsilon_t \quad (5)$$

The null hypothesis is specified as, *H*0: $\beta = 0$, which means yt is non-stationary. While the alternative hypothesis is H_1: $B_1 > 0$, which shows that *yt* is stationary at linear time trend or *yt* is stationary with no linear time trend. Dickey-Fuller test can be estimated on the transform variables unless OLS regression is included in the model. The study specifies the equation as,

$$\Delta y_t^* = \alpha + \beta y_t^* - 1 + \sum_{j=1}^{k} \zeta_j \Delta y_t^* - j + \varepsilon_t \quad (6)$$

The second alternative hypothesis in DF-GLS test is estimated with $y^* = y_t - \delta_0$. Cheung and Lai (1995) reveal that, DF-GLS test uses the test statistics values, 5% and 10% critical values to respond to the hypothesis. Perron (1986) defined regression model as,

$$\Delta y_t = \beta^0 D_t + \pi y_t - 1 + u_t \tag{7}$$

Where u_t I (0), The Philips-perron test corrects serial correlation in the error of the model with test statistics $t_{m=0}$ and $T_{\prod}$. This model specification is presented by Perron (1986) as

$$Z_t = \left(\frac{\sigma^2}{\lambda^2}\right)^{1/2} \cdot t_{\pi=0} - \frac{1}{2}\left(\frac{\lambda^2 - \sigma^2}{\lambda^2}\right) \cdot \left(\frac{T \cdot SE(\pi)}{\sigma^2}\right) \tag{8}$$

$$Z_\pi = T\pi - \frac{1}{2}\frac{T^2 \cdot SE(\pi)}{\sigma^2}(\lambda^2 - \sigma^2) \tag{9}$$

Where λ^2 and σ^2 are the estimators of the variance parameters

$$\sigma^2 = \lim_{T \to \infty} T^{-1} \sum_{t=1}^{T} E\left[u_t^2\right] \tag{10}$$

$$\lambda^2 = \lim_{T \to \infty} T \sum_{t=1}^{T} E\left[T^{-2} S_T^2\right] \tag{11}$$

Where, $S_T = \sum_{t=1}^{T} u_t$

Z_t and $Z\pi$ in Philips-perron test statistics have the same asymptotic distribution. In the philips-perron test estimation, if the Zt value in the test statistics is smaller than the 5% critical value, null hypothesis cannot be rejected, so the series is non-stationary at the level.

The alternative hypothesis is accepted, when the Zt value of the test statistics is greater than the 5% critical value.

4.6. Co-integration

After observing the series are integrated order one, the existence of co-integration needs to be checked in order to choose the appropriate estimation procedure. Hauser (2012) defines co-integration as given a set of I (1) variables $\{X_{1t} \ldots X_{kt}\}$. The co-integration is the long term equilibrium in which variables converge back to the time period The co-integration concept also means the common stochastic trend between processes X and Y which can be shown as.,

$$X_t = \gamma_0 + \gamma_1 Z_t + \in_t \quad (12)$$

$$Y_t = \delta_0 + \delta_1 Z_t + \eta_t$$

Where, ϵ_t and η_t are stationary I (0), which indicates serial correlation. The X_t and Y_t are integrated at I (1), which means there is a linear relationship between variables. The equation is;

$$\delta_1 X_t - \gamma_1 Y_t \sim \text{I}(0) \quad (13)$$

However, if there is an existence of linear relationship with a vector β, the equation is specified as;

$$\beta_1 X_{1t} + \cdots + \beta_k X_{kt} = \beta_0 X_t \ldots t\text{rend} - \text{stationary} \quad (14)$$

Equation (14) implies that ($\beta j \neq 0$, j = 1 . . . k.), where X's are co-integrated of order CI (1, 1). The X_t is a trend -stationary variable. The Co-integration test is conducted with the Johansen maximized likelihood approach developed by Johansen (1988). Hauser (2012)

defines Johansen approach specifies adjustment parameters with α and the Φ∗'s to be estimated. The Johansen estimation equation is specified as;

$$\Delta X_t = \varphi + \alpha\beta_0 X_t - 1 + \sum_{i-1}^{P-1} \Phi_i^* \Delta X_{t-i} + \in_t \quad (15)$$

The Johansen maximized likelihood function based on M co-integrating vectors are specified as;

$$L_{\text{Max}}^{-\frac{2}{T}} \propto \lfloor S_{00} \rfloor \prod_{i=1}^{m} (1 - \hat{\lambda}_i) \quad (16)$$

Where the Φ∗ j matrix S_{00} depends only on ΔX_t and $\Delta X_t - j$, j = 1. . . P

The co-integration approach estimation is based on two sequential test which are trace statistics test and maximum eigenvalue statistics test. The trace test is used to estimate the co-integration or relationship of the variables. The mathematical equation of the trace test for the rank of M = ∏ is specified as;

H_0: Rank (∏) = m, against the alternative Ha: Rank (∏) > m

The maximized likelihood function is;

$$LK_{tr}(m) = -(T-P) \sum_{i=m+1}^{K} ln\left(1 - \hat{\lambda}_i\right) \quad (17)$$

The null hypothesis with m = 0 or Rank (Π) = 0 is H_0: there is no co-integration among the variables, while the alternative hypothesis with m ≥ 1, is H_a: there is co-integration among the variables. But, if LK_{tr} (m) values are greater than 5% critical value

the null hypothesis (H_0) can be rejected. If eigenvalues $\lambda_m+1 \geq \lambda_m+2 \geq \ldots \geq \lambda_k$ is greater, it determines the rank of β. If the test reveals that, maximum eigenvalue statistics values are less than the 5% critical value, then the null hypothesis can be accepted that there is co-integration among the variable. The mathematical equation to specify this test is shown below;

Null hypothesis H_0: Rank (Π) = m, against the Alternative hypothesis H_a: Rank (Π) = m + 1

Where,

$$LK_{Max}\ (m) = -(T-P)\ln(1 - \hat{\lambda}_{m+1}) \quad (18)$$

The null hypothesis is specified as m = 0 with Rank(Π) = 0, indicates that there is no co-integration and the alternative hypothesis with m = 1, indicates there is 1 co-integration among the variables. Hence, if there is co-integration among the dependent variable and the independent variables in the model, VECM procedure should be used. But if no co-integration is detected between variables, VAR model should be estimated.

4.7. VECM model

The VAR-VECM estimations are used to determine the long run and short run relationship among the variables in the model. Medeiros et al. (2011) uses matrix notation to specify VAR model as;

$$y_t = A_0 + A_1 y_{t-1} + \cdots + A_p y_{t-p} + B_0 z_t + B_1 z_{t-1} + \cdots + B_p z_{t-r} + \in_t \quad (19)$$

Where, y is n x 1 vector which includes dependent variables, while z is m x 1 vector with independent variables. A_0 is an n x 1 vector of intercepts and $A_1 \ldots A_p$ is n x n coefficient

matrix which includes dependent variables' lag values to their current values. The $B_1 \ldots B_p$ is n x m coefficient matrix (Johansen and Juselius, 1990, p.7). If one or more co-integration exists in the model, vector error correction model VECM should be employed instead of VAR model. Engle and Granger (1987) proposed a VECM model to estimate the long run relationship among the variables if there is presence of co-integration into the model. The VECM model equation is represented as follows

$$\Delta y_t = \alpha_1 y_{t-k} + \beta_2 \Delta y_{t-1} + \cdots + \beta_k \Delta y_{t-1} + \varepsilon_t \quad (20)$$

The error correction term in the model is computed as,

$$Y_t = Y_{t-1} + \Delta Y_t \quad (21)$$

Therefore, VECM model form is shown as,

$$\Delta Y_t = \alpha + \beta_0 Y_{t-1} + \sum_{i=1}^{K-1} \beta_1 \Delta Y_{t-1} + \varepsilon_t \quad (22)$$

The presence of long run relationship in VECM model is specified as;

$$ECT_{t-1} = Y_{t-1} - \beta_0 - \beta_1 X_{t-1} \quad (23)$$

The presence of long run relationship in the VECM model requires detecting whether there is a deviation in the model. The deviation, i.e. the error is represented as;

$$\beta\text{^}1\ X_{t-1} = \xi_{t-1} \neq 0 \quad (24)$$

The k used in the VECM model represents value lag of dependent variables. $\beta_{1 \text{ and}} \beta_0$ are the long run equilibrium adjustment coefficients. $\mathbf{ECT_{t-1}}$ and $\boldsymbol{\varepsilon_t}$ represent the error correction terms which show the long run relationship in the model. In order to derive the result of adjustment variables, α is multiplied by the 'errors' $\beta^1 X_t - 1$ which lead to adjustment. The negative (ECT) with significance level indicates that, there is a short run deviation among the variables.

4.8. Empirical Model Specification

The model specifies that dependent variable which is the growth of the real gross domestic product (GDP) is a function of the public expenditure, money supply, internal debt and CPI which are the explanatory variables. The model specification is;

$$RGDP=f\ (PUBEXP, MNYSUP, INTDBT, CPI) \quad (25)$$

The log transformation is undertaken for all of the variables. Therefore the growth function for the study is;

$$LNRGDPt = \beta_1 LNPUBEXPt + \beta_2 LNINTDBTt + \beta_3 LNMNYSUPt + \beta_4 LNCPIt + \varepsilon_t \quad (26)$$

The LNRGDPt represents log of real GDP growth. The LNPUBEXPt is log of public expenditure. LNMNYSUPt represents the log of money supply. LNINTDBTt represents the log of internal debt. LNCPIt represents the log of consumer price index. The ε_t represents the error term and the $\boldsymbol{\beta i}, \boldsymbol{\phi_j}, \boldsymbol{\varphi_m}, \boldsymbol{\emptyset_n}, \boldsymbol{\delta_0}$ stand for the partial elasticity of GDP growth.

The VECM model specification for the variables is;

$$\Delta LNRGDP_t = \vartheta + \sum_{i=1}^{k-1} \beta_i \Delta LNCPI_{t-i} + \sum_{j=1}^{k-1} \phi_j \Delta LNMNYSUP_{t-j} + \sum_{m=1}^{k-1} \varphi_m \Delta LNPUBEXP_{t-m} + \sum_{n=1}^{k-1} \emptyset_n \Delta LNINTDEBT_{t-n} + \sum_{o=1}^{k-1} \delta_0 \Delta LNRGDP_{t-o} + \lambda_1 ECT_{t-1} + u_{1t} \quad (27)$$

The operators used in the VECM model are the short run dynamics of the model adjustment in the long run equilibrium which includes, ($\boldsymbol{\vartheta}$, $\boldsymbol{\beta_i}$, $\boldsymbol{\phi_j}$, $\boldsymbol{\varphi_m}$, $\boldsymbol{\emptyset_n}$, $\boldsymbol{\delta_0}$). They represent the long term impact of changes that the independent variables have on the change in the dependent variable. The $\boldsymbol{\lambda_1}$ indicates the speed of adjustment parameter with a negative sign and must be within this range ($\boldsymbol{-1 \leq \lambda \leq 0}$) and statistically significant.

CHAPTER 5

RESULTS AND THE DISCUSSION

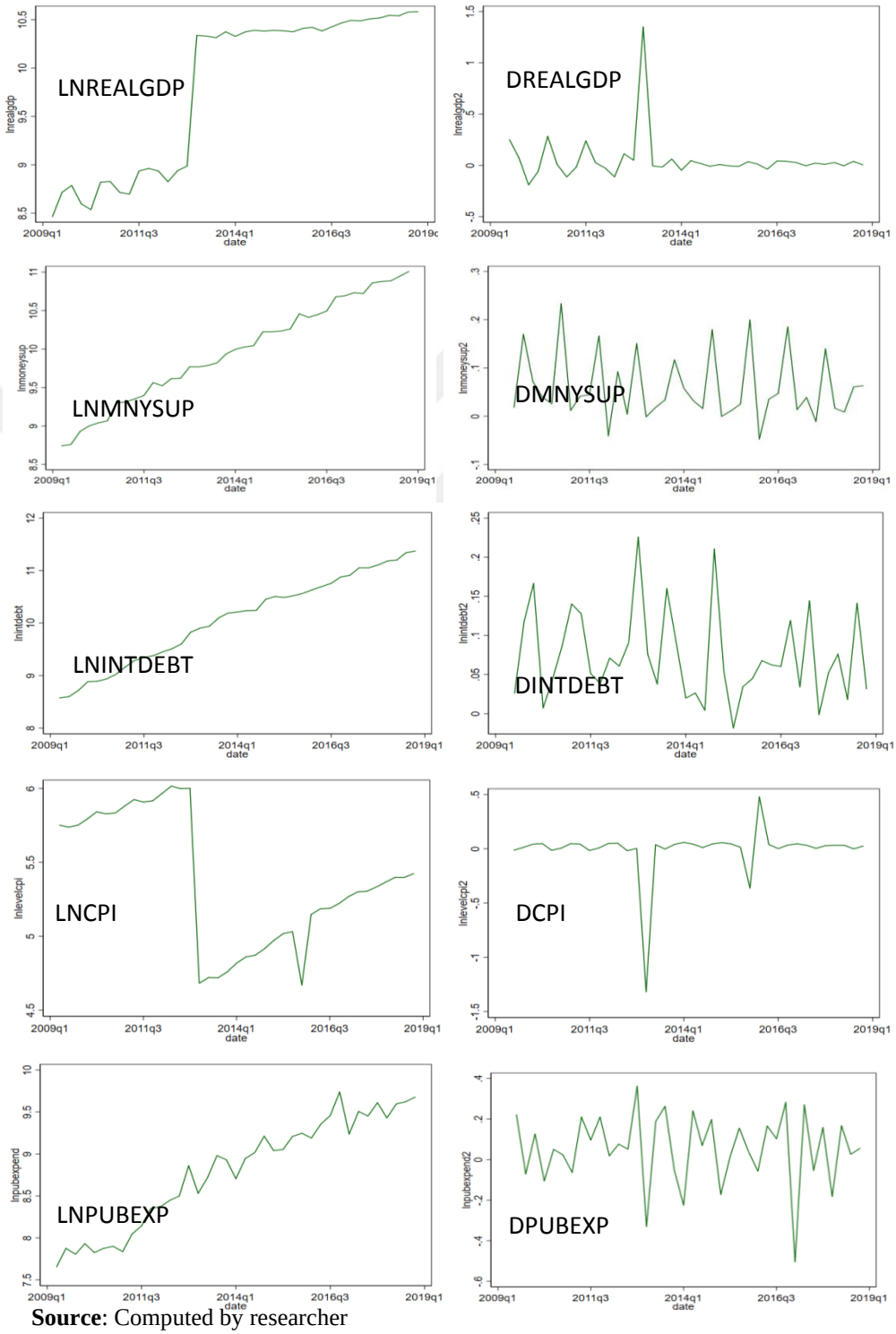
5. Introduction

This chapter elaborates the analysis and interprets the results of the model under study. Firstly, stationary properties of the variables are examined by using Philips Perron and DF-GLS unit root tests. Then Johansen co-integration method is employed to determine a long run relationship between variables.

5.1. Results of Unit Root Tests.

Before the stationary analysis, all variables are transformed to their logarithm with the aim stabilizing their variances. Then, in order to see the time series properties of each variable, their graphs for both level and first difference are drawn and compared as can be seen in Figure 2. They strongly imply that logarithms of the real GDP, internal debt, money supply, public expenditure and CPI are non-stationary at the level and stationary at their first difference.

Figure 2: Graphs of Levels and First Differences of the Variables



Source: Computed by researcher

The Philips Perron and DF-GLS unit root tests verify this graphical intuition. The Schwartz-Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) are used to determine the optimal lags length included in the test. For both unit root tests, the null hypothesis indicates that the series has a unit root while the alternative hypothesis indicates that series does not have unit root.

Table 2: Results of Philips Perron Unit Root Test

	Levels		First-difference		
Variables	**t-stats**	**Critical value 5%**	**t-stats**	**critical-value 5%**	**Conclusion**
LNRGDP	-1.367	-2.964	-6.172	-2.966	I (1)
LNPUBEXP	-1.155	-2.964	-12.577	-2.966	I (1)
LNMNYSUP	-1.603	-2.964	-11.070	-2.966	I (1)
LNCPI	-1.768	-2.964	-6.499	-2.966	I (1)
LNINTDBT	-1.656	-2.964	-6.915	-2.966	I (1)

Source: computed by the researcher.

The results of the Philips-Perron unit root test in table 2 above reveals that, the test statistics values are less than 5% critical value at their level while the test statistics value of the variables are greater than the 5% critical value at their first differences. Therefore null hypothesis is accepted while alternative hypothesis is rejected at level for all variables which means that all the variables of interest are non-stationary at their levels and stationary at their first differences.

Table 3: DF-GLS test for unit root

	Levels			First Difference	
	Lags	**t-stat**	**5% critical-value**	**t-stat**	**5%crital-value**
LNINTDBT	1	-1.324	-3.336	-4.658	-3.348
	2	-1.039	-3.262	-3.390	-3.270
	3	-1.023	-3.175	-3.138	-3.179
	4	-0.854	-3.081	-2.135	-3.081
	5	-1.165	-2.986	-2.246	-2.984
	6	-0.973	-2.896	-1.855	-2.893
	7	-1.021	-2.818	-1.450	-2.815
	8	-1.241	-2.757	-1.380	-2.758
	9	-1.266	-2.719	-1.209	-2.727
LNPUBEXP	1	-2.400	-3.336	-6.516	-3.348
	2	-1.905	-3.262	-7.834	-3.270
	3	-1.156	-3.175	-4.222	-3.179
	4	-1.402	-3.081	-3.296	-3.081
	5	-1.599	-2.986	-2.764	-2.984
	6	-1.668	-2.896	-3.393	-2.893
	7	-1.198	-2.818	-2.580	-2.815
	8	-1.366	-2.757	-2.414	-2.758
	9	-1.600	-2.719	-2.352	-2.727
LNMNYSUP	1	-2.235	-3.336	-6.402	-3.348
	2	-1.628	-3.262	-11.658	-3.270
	3	-0.967	-3.175	-3.605	-3.179
	4	-1.174	-3.081	-2.940	-3.081
	5	-1.407	-2.986	-2.805	-2.984
	6	-1.376	-2.896	-3.058	-2.893
	7	-1.102	-2.818	-3.008	-2.815
	8	-0.983	-2.757	-2.841	-2.758
	9	-1.119	-2.719	-2.727	-2.369
LNCPI	1	-1.632	-3.336	-3.869	-3.348
	2	-1.680	-3.262	-3.210	-3.270
	3	-1.661	-3.175	-2.855	-3.179
	4	-1.615	-3.081	-2.538	-3.081
	5	-1.615	-2.986	-2.264	-2.984
	6	-1.656	-2.896	-2.143	-2.893
	7	-1.629	-2.818	-2.064	-2.815
	8	-1.579	-2.757	-1.937	-2.758
	9	-1.576	-2.719	-1.812	-2.727
LNRGDP	1	-1.591	-3.336	-3.865	-3.348
	2	-1.663	-3.262	-3.529	-3.270
	3	-1.533	-3.175	-3.283	-3.179
	4	-1.422	-3.081	-2.819	-3.081
	5	-1.462	-2.986	-2.289	-2.984
	6	-1.701	-2.896	-2.347	-2.893
	7	-1.602	-2.818	-2.395	-2.815
	8	-1.468	-2.757	-2.262	-2.758
	9	-1.464	-2.719	-1.943	-2.727

Source: Computed by the researcher. The maximum lag of 9 is selected by the Schwartz criterion.

The results of DF-GLS test in table 3 above reports that, for the log of internal debt, the null hypothesis of unit root is failed to be rejected at the 5% in levels for lags 1–9 and null hypothesis of unit root are not rejected at the 5% for lags 3-9 but rejected at lags 1-2 in the first difference. For the log of public expenditure, the null hypothesis of unit root is not rejected at the 5% in level for lags 1-9 and at first difference, the null unit root rejected at the 5% for lags 1-4 and 6, while it is not rejected for lags 5, 7, 8, and 9. For the log of money supply level, the null hypothesis of unit root is not rejected at the 5% critical value for the lags between 1-9 but at its first difference, the alternative hypothesis of unit root are accepted at 5% for lags (1, 2, 3, 6, 7, and 8) and the null hypothesis of unit root is not rejected for the lags 4 and 5. From the log of consumer price index (CPI) in the level, the null hypothesis of a unit root at the 5% for lags 1-9 is not rejected, but at the first difference of the variable, null hypothesis of a unit root is rejected at 5% for lag 1 and is not rejected for lags 2-9 at 5%. Finally, for the log of the real GDP in level, the null hypothesis of a unit root at the 5% critical value for lags 1-9 is not rejected and at the first difference, the null hypothesis of a unit root at the 5% is rejected for lags 1-3 but it is not rejected for lags 4-9.

It can be concluded that, the results of the DF-GLS test result supports unit root test results of the Philips Perron, which indicates that the log of the variables are non- stationary in level and stationary at their first difference. Therefore, both of the stationary tests proof that the model is integrated in order (1) and the existence of the co-integration should be checked for choosing between VAR and VECM models.

5.2. Lag length selection

The lag selection is vital in VAR estimation. It is conducted to maintain a degree of freedom and ensures no serial correlation between the model. There are four lag length selection tests which are Final prediction error (FPE), Akaike information criterion (AIC), Hannan-Quinn information criterion (HQIC) and Schwarz Information criterion (SBIC). Four of them (FPE, AIC and HQIC) indicate the optimal lag as four, so the analysis is conducted with 4 lags. The results are presented in table 4 below.

Table 4: Lag Order Selection Criteria

|LAG	LL	LR	DF	P	FPE	AIC	HQIC	SBIC
0	58.4028				3.3e-08	-3.05159	-2.97489	-2.8294
1	187.467	258.13	25	0.000	8.7e-11	-8.99812	-8.53791	-7.66496*
2	209.855	44.776	25	0.009	1.1e-10	-8.84886	-8.00515	-6.40474
3	234.837	49.964	25	0.002	1.4e-10	-8.84785	-7.62063	-5.29277
4	304.353	139.03*	25	0.000	2.0e-11*	-11.3916*	-9.78091*	-6.72558

Source: Computed by researcher

* indicates lag order selected by the criterion (each test at 5% level).LR: sequential modified LR test statistic, FPE: Final prediction error AIC: Akaike information criterion, SC: Schwarz Information criterion, HQ: Hannan-Quinn information criterion

5.3. Test for Co-integration.

With the aim of determining if there is a long run relationship existence between the variables, Johansen method of Co-integration is employed. The test is carried with the null hypothesis of; Ho: There is no co-integration among the variables and the alternative hypothesis of Ha: There is co-integration among the variables.

Table 5: Johansen Co-integration test (Trace statistics) Results.

Maximum Rank	Parms	LL	Eigenvalue	Trace Statistics	5% Critical Value
0	80	220.25626	.	168.1944	68.52
1	89	263.38172	0.91493	81.9435	47.21
2	96	286.89934	0.73916	34.9083	29.68
3	101	297.47777	0.45364	13.7514*	15.41
4	104	301.85026	0.22109	5.0064	3.76
5	105	304.35348	013328		

Source: Computed by researcher

Table 6: Johansen Co-integration test (Maximum Eigen Value) Results.

Maximum Rank	Parms	LL	Eigenvalue	Max Statistics	5% Critical Value
0	80	220.25626	.	86.2509	33.46
1	89	263.38172	0.91493	47.0352	27.07
2	96	286.89934	0.73916	21.1568	20.97
3	101	297.47777	0.45364	8.7450*	14.07
4	104	301.85026	0.22109	5.0064	3.76
5	105	304.35348	013328		

Source: Computed by researcher. Both tests indicate 3 co-integrating equation(s) at 5% level of significance
Note: * denotes rejection of the hypothesis at the 5% significance level

As it can be seen from table 5 and 6, both the trace statistics and the maximum Eigen value statistics show that there are three co-integrations existence among the variables of interest. The null hypothesis of no co-integration vector (r = 0) is rejected since the test statistics values of rank 0, 1 and 2 of the trace test is greater than 5% critical value statistics of 34.9083 and 29.68 while the maximum Eigen value has statistic value 21.1568 and critical value of 20.97 (5%) respectively. With the existence of 3 co-integrations among the variables, it is concluded that there is a long run correlation existence among the variables in the model. Therefore, to estimate the model, vector error correction (VECM) is used in order to determine whether the long run and short run dynamics are permanent or temporary.

5.4. The Results of Error Correction Model for Long Run Dynamics

Normalized co-integrating coefficients of the model can be seen in Table 7 below. The results show that, as a monetary variable, consumer price index has a statistically significant positive impact on real GDP in the long run at the significance level of 1%. It can be interpreted that a 1% percent raises in the CPI causes a 0.56 % increase in real GDP.

Findings also show that the money supply has a positive impact on real GDP at significance level of 1%. According to coefficients, a 1 % increase in the money supply of Ghana leads to a 1.45% increase in the real GDP. Therefore, according to the model, money supply as a monetary macroeconomic tool has a positive and long run effect on real GDP in the Ghana's economy.

In the long run, the public expenditure has a negative impact on real GDP. A 1% increase in the public expenditure causes a 0.11 % decreases in real GDP. Therefore the model reveals the negative long run effect of the public expenditure as a fiscal macroeconomic policy tool on the real GDP of Ghana's economy.

Finally, as it can be seen in the table 7 below, internal debt has a negative impact on the real GDP at 1% significance level. The inference of the result is that when the internal debt rise at 1%, it causes a 1.82 % fall in the real GDP. Consequently, the internal debt is a fiscal macroeconomic policy tool that has a long run negative impact on the real GDP of Ghana's economy.

In conclusion, the table 7 reports that the explanatory or independent variables of money supply, public expenditure, consumer price index (CPI) and internal debt have a long run impact on the outcome variable of real GDP of Ghana.

Table 7: The Results of Error Correction Model for Long Run Dynamics

Variables	Coefficient	Standard Error	T statistics	Prob
LNCPI	.5576502	.0248902	22.40	0.000
LNMNYSUP	1.453415	.1454592	9.99	0.000
LNPUBEXP	-.1118241	.0400874	-2.79	0.005
LNINTDBT	-1.817028	.1280888	-14.19	0.000
_CONS	-7.856138			

Source: Computed by the researcher

5.5: The Result of Error Correction Model for Short Run Dynamics

The table 8 below, shows the estimated coefficient of VECM term is - 3.468067 implying that the speed of adjustment is approximately 34% per quarter. Which shows the long run relationship among the variables in the model. The VECM-term coefficient shows that approximately 34% of the instability of real GDP growth caused by previous year's shocks have returned to the long-term stability in the next quarter. VECM term is statistically significant but smaller than -1 which is out of the range between -1 and 1. However, for VECM term, being smaller than 1 ensures that fluctuating is the equilibrating factor in the system (Bildirici et al, 2012). The variables in the model show evidence of moderate response to shocks in the short run. Therefore, the findings from the short-term dynamics show that the coefficient rate in this study reveals the slow speed at which long-term deviations are corrected.

The most recent value of real GDP is affected by the past quarter values of real GDP growth that is real GDP growth at lag 1 and 2 are significant with coefficients of 2.242246, 2.242246 respectively at 1% significance level. In the short run past two quarters of the consumer price index have a positive effect on the current real GDP growth with a coefficient of 1.455497 and .7864006. Past three quarters of money supply has a positive and significant effect on real GDP with coefficients of 4.568497, .0316612 and 2.846099 respectively at 1% significance level. Past two quarters of the internal debt has a negative effect on the real GDP growth with coefficients of 2.749357 and 2.02771 respectively at significance level 5%. First and second lag of public expenditure are statistically insignificant. Only the 3th lag is statistically significant at 10% significance level.

In conclusion, the study is conducted to examine the impact of the macroeconomic policies on real GDP growth of Ghana's economy with the VECM approach. The study finds that the monetary and fiscal variables such as money supply, CPI, public expenditure and internal debt have a long run effect on real GDP growth of economy of Ghana. The results also reveal that, monetary variables which are consumer price index (CPI) and money supply have a positive effect on current real GDP growth in a short run dynamic while internal debt as a fiscal policy tool has a negative effect on current real GDP in a short

run. As a fiscal policy tool, public expenditure loses its effect on real GDP growth in the short run dynamic.

Table 8: Results of Vector Error-Correction Model (VECM) of Economic Growth

Variables	Coefficient	Standard Error	T statistics	Prob
ECT (-1)	-3.468067	.7949149	-4.36	0.000
LNRGDP				
D	2.242246	.745446	3.01	0.003
2D	1.42765	.511956	2.79	0.005
3D	.4641495	.4709624	0.99	0.324
LNCPI				
D	1.455497	.5644831	2.53	0.010
2D	.7864006	.3972564	1.98	0.048
3D	.3983492	.3691298	1.08	0.281
LNMNYSUP				
D	4.568497	1.295335	3.53	0.000
2D	3.546909	1.076872	3.29	0.001
3D	2.846099	.847659	3.36	0.001
LNPUBEXP				
D	.0316612	.3114324	0.10	0.919
2D	.2578388	.3218403	0.80	0.423
3D	-.4363594	243099	-1.79	0.073
LNINTDBT				
D	-2.749357	1.361825	-2.02	0.044
2D	-2.027712	.9379495	-2.16	0.031
3D	.0276005	.80778	0.03	0.973
CONS	.033165	.1459528	0.23	0.820

Source: Computed by the researcher

The study employs diagnostic tests that can be seen on the table 9 to evaluate the model. The Lagrange multiplier test shows a significance level for the lags of 1-4 which fails to reject the null hypothesis of no autocorrelation in the model. The model for real GDP growth is normally distributed at 10% significance level. The stability test shows that the

model imposes 4 units moduli stability, which fail to reject the null hypothesis that there is no stability in the model.

Table 9: Results of Diagnostic Tests

Lagrange-Multiplier Test	**Statistics (P-value)**	**Conclusion**
Lag 1	0.32418	No autocorrelation
Lag 2	0.84629	in the model
Lag 3	0.32393	
Lag 4	0.08575	
Jarque-Bera test	**Statistics (P-value)**	**Conclusion**
D_lnrealgdp	0.06915	some of the equations are
D_lncpi	0.00000	normally distributed
D_lnmnysup	0.75641	
D_pubexp	0.80511	
D_intdbt	0.00184	
ALL	0.00000	
Stability test	**Eigen-value**	**Conclusion**
1	1	The VECM model imposes
1	1	4 unit moduli stability
1	1	
1	1	

Source: Computed by researcher

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

Experiencing volatile and unstable economic growth for decades, Ghana introduced economic reforms with the aim of getting a vision for the country from 1991 to 2020. This plan was aimed to move Ghana to a middle income country status with a resilient growth rate of 8% (The Global Social Change Research Project, 2007).

Between 1991 and 1996, Ghana started to introduce the economic reforms to achieve vision 2020 plan which resulted in a fluctuation in GDP between 3.3% and 5.3%. New government, which was elected in 1996 introduced policy reforms such as tax increases and infrastructure expansion, but these measures could not stop the fluctuation in GDP growth between 3% and 6% until 2007. From 2008, the GDP growth exceeded the target rate to 9.1% and declined to 4.8% in 2009. Between 2010 and 2013, Ghana achieved its aim with real GDP growth at 7.9% in 2010, 14.04% in 2011, 9.29% in 2012 and 7.3% in 2013. Between 2014 and 2016, the real GDP growth was 2.89%, 2.17% and 3.4%, respectively which indicated that plans to strengthen the economy was not achieved. The statistics revealed that, real GDP growth grew by 8.14% in 2017 which exceeded the target rate, but declined by 6.26% in 2018 and 6.47% in 2019. Based on these fluctuations in GDP growth, this study intends to examine the extent of macroeconomic indicator's impact on GDP growth of Ghana's economy for the period of 2009q1-2018q4 by employing a Johansen approach for co-integration and VECM model.

Results from Johansen approach showed that there is a long run relationship between public expenditure, internal debt CPI, money supply and real GDP level of Ghana's economy. In the long run VECM model, while monetary policy variables which are CPI and money supply have a positive effect on real GDP, fiscal policy variables which are internal debt and public expenditure have a negative effect on real GDP. The short run VECM model results revealed that monetary variables have a positive effect on current real GDP growth, while fiscal policy variables have a negative effect on real GDP growth. The sign of an error correction term is negative and significant.

Based on the these findings, the following recommendations can be proposed;

The Positive effect of money supply on real GDP growth indicates a relationship between expansionary monetary policies and economic performance of Ghana. However , this policy tool should be used cautiously in order to achieve a stable and healthy growth path with price stability, considering the possible future negative effects of high money supply on the different mechanisms in the overall economy that are indicated in the economics literature.

Having a lagged negative effect on real GDP growth, public expenditure shows us employing expansionary fiscal policies by using this tool may create slowdown in the economic growth in Ghana. Considering the fundamental theory of growth, the necessity of an independent institution for monitoring the government and public spending and directing these spending more heavily to the investment activities such as establishment of new industries, education, healthcare system and other infrastructures should be evaluated to achieve a sustainable economic growth and a higher human development level. The negative effect of internal debt on GDP growth is another indicator that shows the necessity of avoiding the expansionary fiscal policies.

In order to understand the mechanism between monetary and fiscal variables and economic growth in Ghana, further studies that include more explanatory variables and employ simulation based methodologies to overcome the degrees of freedom issues should be undertaken.

APPENDIX 1: Unit root test results

```
. //graphs to check variables at their first difference//
. line lnrealgdp2  lnintdebt2 lnpubexpend2 lnmoneysup2 lnlevelcpi2 date,legend(size(medsmall))

.
end of do-file

. do "C:\Users\raz\AppData\Local\Temp\STD1274_000000.tmp"

. ***Stationarity Test***
. pperron lnintdebt, lags(4)

Phillips-Perron test for unit root                 Number of obs   =        38
                                                   Newey-West lags =         4

                                 ---------- Interpolated Dickey-Fuller ----------
                    Test         1% Critical       5% Critical      10% Critical
                  Statistic         Value             Value            Value
------------------------------------------------------------------------------
 Z(rho)            -0.453          -18.084           -12.916          -10.460
 Z(t)              -1.656           -3.662            -2.964           -2.614
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.4540

. pperron lnintdebt2, lags(4)

Phillips-Perron test for unit root                 Number of obs   =        37
                                                   Newey-West lags =         4

                                 ---------- Interpolated Dickey-Fuller ----------
                    Test         1% Critical       5% Critical      10% Critical
                  Statistic         Value             Value            Value
------------------------------------------------------------------------------
 Z(rho)           -34.760          -18.016           -12.884          -10.440
 Z(t)              -6.915           -3.668            -2.966           -2.616
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000
```

```
. pperron lnpubexpend, lags(4)

Phillips-Perron test for unit root                 Number of obs   =        38
                                                   Newey-West lags =         4

                                                 ---------- Interpolated Dickey-Fuller ----------
                 Test                 1% Critical          5% Critical          10% Critical
               Statistic                 Value                Value                Value
------------------------------------------------------------------------------------------------
 Z(rho)          -1.222                  -18.084              -12.916              -10.460
 Z(t)            -1.155                   -3.662               -2.964               -2.614
------------------------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.6926

. pperron lnpubexpend2, lags(4)

Phillips-Perron test for unit root                 Number of obs   =        37
                                                   Newey-West lags =         4

                                                 ---------- Interpolated Dickey-Fuller ----------
                 Test                 1% Critical          5% Critical          10% Critical
               Statistic                 Value                Value                Value
------------------------------------------------------------------------------------------------
 Z(rho)          -49.291                 -18.016              -12.884              -10.440
 Z(t)            -12.577                  -3.668               -2.966               -2.616
------------------------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000
```

```
. pperron lnmoneysup, lags(4)

Phillips-Perron test for unit root                 Number of obs   =        38
                                                   Newey-West lags =         4

                                 ---------- Interpolated Dickey-Fuller ----------
                 Test            1% Critical       5% Critical      10% Critical
               Statistic            Value             Value            Value
------------------------------------------------------------------------------
 Z(rho)         -0.549             -18.084           -12.916          -10.460
 Z(t)           -1.603              -3.662            -2.964           -2.614
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.4819

. pperron lnmoneysup2, lags(4)

Phillips-Perron test for unit root                 Number of obs   =        37
                                                   Newey-West lags =         4

                                 ---------- Interpolated Dickey-Fuller ----------
                 Test            1% Critical       5% Critical      10% Critical
               Statistic            Value             Value            Value
------------------------------------------------------------------------------
 Z(rho)         -45.655            -18.016           -12.884          -10.440
 Z(t)           -11.070             -3.668            -2.966           -2.616
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

. pperron lnlevelcpi, lags(4)

Phillips-Perron test for unit root                 Number of obs   =        38
                                                   Newey-West lags =         4

                                 ---------- Interpolated Dickey-Fuller ----------
                 Test            1% Critical       5% Critical      10% Critical
               Statistic            Value             Value            Value
------------------------------------------------------------------------------
 Z(rho)         -5.715             -18.084           -12.916          -10.460
 Z(t)           -1.768              -3.662            -2.964           -2.614
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.3966
```

```
. pperron lnlevelcpi2, lags(4)

Phillips-Perron test for unit root                 Number of obs   =        37
                                                   Newey-West lags =         4

                                 ---------- Interpolated Dickey-Fuller ----------
                 Test            1% Critical       5% Critical      10% Critical
               Statistic             Value             Value            Value
------------------------------------------------------------------------------
 Z(rho)          -39.150            -18.016           -12.884          -10.440
 Z(t)             -6.499             -3.668            -2.966           -2.616
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

. pperron lnrealgdp, lags (4)

Phillips-Perron test for unit root                 Number of obs   =        38
                                                   Newey-West lags =         4

                                 ---------- Interpolated Dickey-Fuller ----------
                 Test            1% Critical       5% Critical      10% Critical
               Statistic             Value             Value            Value
------------------------------------------------------------------------------
 Z(rho)          -2.192            -18.084           -12.916          -10.460
 Z(t)            -1.367             -3.662            -2.964           -2.614
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.5980

. pperron lnrealgdp2, lags(4)

Phillips-Perron test for unit root                 Number of obs   =        37
                                                   Newey-West lags =         4

                                 ---------- Interpolated Dickey-Fuller ----------
                 Test            1% Critical       5% Critical      10% Critical
               Statistic             Value             Value            Value
------------------------------------------------------------------------------
 Z(rho)          -34.999            -18.016           -12.884          -10.440
 Z(t)             -6.172             -3.668            -2.966           -2.616
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000
```

```
. // dfgls stationary test //
.
. dfgls lnintdebt,

DF-GLS for lnintdebt                                    Number of obs =    29
Maxlag = 9 chosen by Schwert criterion

                DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]     Test Statistic        Value             Value             Value
------------------------------------------------------------------------------
    9            -1.266          -3.770            -2.719            -2.372
    8            -1.241          -3.770            -2.757            -2.428
    7            -1.021          -3.770            -2.818            -2.502
    6            -0.973          -3.770            -2.896            -2.586
    5            -1.165          -3.770            -2.986            -2.678
    4            -0.854          -3.770            -3.081            -2.771
    3            -1.023          -3.770            -3.175            -2.861
    2            -1.039          -3.770            -3.262            -2.943
    1            -1.324          -3.770            -3.336            -3.011

Opt Lag (Ng-Perron seq t) = 0 [use maxlag(0)]
Min SC   = -5.534778 at lag  1 with RMSE   .0559385
Min MAIC = -5.553507 at lag  1 with RMSE   .0559385
```

```
. dfgls lnintdebt2,

DF-GLS for lnintdebt2                                   Number of obs =    28
Maxlag = 9 chosen by Schwert criterion

                DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]     Test Statistic        Value             Value             Value
------------------------------------------------------------------------------
    9            -1.209          -3.770            -2.727            -2.369
    8            -1.380          -3.770            -2.758            -2.422
    7            -1.450          -3.770            -2.815            -2.493
    6            -1.855          -3.770            -2.893            -2.579
    5            -2.246          -3.770            -2.984            -2.673
    4            -2.135          -3.770            -3.081            -2.769
    3            -3.138          -3.770            -3.179            -2.863
    2            -3.390          -3.770            -3.270            -2.949
    1            -4.658          -3.770            -3.348            -3.020

Opt Lag (Ng-Perron seq t) = 0 [use maxlag(0)]
Min SC   = -5.482758 at lag  1 with RMSE   .0572466
Min MAIC = -2.769737 at lag  9 with RMSE   .0532139
```

```
. dfgls lnpubexpend,

DF-GLS for lnpubexpend                                  Number of obs =    29
Maxlag = 9 chosen by Schwert criterion

                     DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]          Test Statistic        Value             Value            Value
------------------------------------------------------------------------------
     9               -1.600           -3.770            -2.719           -2.372
     8               -1.366           -3.770            -2.757           -2.428
     7               -1.198           -3.770            -2.818           -2.502
     6               -1.668           -3.770            -2.896           -2.586
     5               -1.599           -3.770            -2.986           -2.678
     4               -1.402           -3.770            -3.081           -2.771
     3               -1.156           -3.770            -3.175           -2.861
     2               -1.905           -3.770            -3.262           -2.943
     1               -2.400           -3.770            -3.336           -3.011

Opt Lag (Ng-Perron seq t) =  3 with RMSE  .1383458
Min SC   = -3.560973 at lag  1 with RMSE   .150078
Min MAIC = -3.509674 at lag  3 with RMSE  .1383458
```

```
. dfgls lnpubexpend2,

DF-GLS for lnpubexpend2                                 Number of obs =    28
Maxlag = 9 chosen by Schwert criterion

                     DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]          Test Statistic        Value             Value            Value
------------------------------------------------------------------------------
     9               -2.352           -3.770            -2.727           -2.369
     8               -2.414           -3.770            -2.758           -2.422
     7               -2.580           -3.770            -2.815           -2.493
     6               -3.393           -3.770            -2.893           -2.579
     5               -2.764           -3.770            -2.984           -2.673
     4               -3.296           -3.770            -3.081           -2.769
     3               -4.222           -3.770            -3.179           -2.863
     2               -7.834           -3.770            -3.270           -2.949
     1               -6.516           -3.770            -3.348           -3.020

Opt Lag (Ng-Perron seq t) =  6 with RMSE  .1136618
Min SC   =   -3.8361 at lag  2 with RMSE  .1228783
Min MAIC =  10.09803 at lag  1 with RMSE  .1529726
```

```
. dfgls lnmoneysup,

DF-GLS for lnmoneysup                                    Number of obs =    29
Maxlag = 9 chosen by Schwert criterion

                  DF-GLS tau      1% Critical       5% Critical      10% Critical
   [lags]     Test Statistic        Value             Value             Value
------------------------------------------------------------------------------
        9           -1.119          -3.770            -2.719           -2.372
        8           -0.983          -3.770            -2.757           -2.428
        7           -1.102          -3.770            -2.818           -2.502
        6           -1.376          -3.770            -2.896           -2.586
        5           -1.407          -3.770            -2.986           -2.678
        4           -1.174          -3.770            -3.081           -2.771
        3           -0.967          -3.770            -3.175           -2.861
        2           -1.628          -3.770            -3.262           -2.943
        1           -2.235          -3.770            -3.336           -3.011

Opt Lag (Ng-Perron seq t) =  4 with RMSE   .0335005
Min SC   = -6.211819 at lag  4 with RMSE   .0335005
Min MAIC = -6.289551 at lag  4 with RMSE   .0335005
```

```
. dfgls lnmoneysup2,

DF-GLS for lnmoneysup2                                   Number of obs =    28
Maxlag = 9 chosen by Schwert criterion

                  DF-GLS tau      1% Critical       5% Critical      10% Critical
   [lags]     Test Statistic        Value             Value             Value
------------------------------------------------------------------------------
        9           -2.788          -3.770            -2.727           -2.369
        8           -2.841          -3.770            -2.758           -2.422
        7           -3.008          -3.770            -2.815           -2.493
        6           -3.058          -3.770            -2.893           -2.579
        5           -2.805          -3.770            -2.984           -2.673
        4           -2.940          -3.770            -3.081           -2.769
        3           -3.605          -3.770            -3.179           -2.863
        2          -11.658          -3.770            -3.270           -2.949
        1           -6.402          -3.770            -3.348           -3.020

Opt Lag (Ng-Perron seq t) =  2 with RMSE   .0329569
Min SC   =  -6.46809 at lag  2 with RMSE   .0329569
Min MAIC =   6.00609 at lag  1 with RMSE   .0543853
```

```
. dfgls lnlevelcpi,

DF-GLS for lnlevelcpi                                    Number of obs =    29
Maxlag = 9 chosen by Schwert criterion

                     DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]          Test Statistic        Value             Value            Value
------------------------------------------------------------------------------
     9               -1.576           -3.770            -2.719           -2.372
     8               -1.579           -3.770            -2.757           -2.428
     7               -1.629           -3.770            -2.818           -2.502
     6               -1.656           -3.770            -2.896           -2.586
     5               -1.615           -3.770            -2.986           -2.678
     4               -1.615           -3.770            -3.081           -2.771
     3               -1.661           -3.770            -3.175           -2.861
     2               -1.680           -3.770            -3.262           -2.943
     1               -1.632           -3.770            -3.336           -3.011

Opt Lag (Ng-Perron seq t) = 0 [use maxlag(0)]
Min SC   = -2.485593 at lag  1 with RMSE   .2569407
Min MAIC = -2.425413 at lag  1 with RMSE   .2569407
```

```
. dfgls lnlevelcpi2,

DF-GLS for lnlevelcpi2                                   Number of obs =    28
Maxlag = 9 chosen by Schwert criterion

                     DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]          Test Statistic        Value             Value            Value
------------------------------------------------------------------------------
     9               -1.812           -3.770            -2.727           -2.369
     8               -1.937           -3.770            -2.758           -2.422
     7               -2.064           -3.770            -2.815           -2.493
     6               -2.143           -3.770            -2.893           -2.579
     5               -2.264           -3.770            -2.984           -2.673
     4               -2.538           -3.770            -3.081           -2.769
     3               -2.855           -3.770            -3.179           -2.863
     2               -3.210           -3.770            -3.270           -2.949
     1               -3.869           -3.770            -3.348           -3.020

Opt Lag (Ng-Perron seq t) = 0 [use maxlag(0)]
Min SC   = -2.364728 at lag  1 with RMSE   .2721583
Min MAIC =  .0493606 at lag  1 with RMSE   .2721583
```

```
. dfgls lnrealgdp,

DF-GLS for lnrealgdp                                    Number of obs =    29
Maxlag = 9 chosen by Schwert criterion

                     DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]          Test Statistic        Value             Value             Value
------------------------------------------------------------------------------
     9               -1.464           -3.770            -2.719           -2.372
     8               -1.468           -3.770            -2.757           -2.428
     7               -1.602           -3.770            -2.818           -2.502
     6               -1.701           -3.770            -2.896           -2.586
     5               -1.462           -3.770            -2.986           -2.678
     4               -1.422           -3.770            -3.081           -2.771
     3               -1.533           -3.770            -3.175           -2.861
     2               -1.663           -3.770            -3.262           -2.943
     1               -1.591           -3.770            -3.336           -3.011

Opt Lag (Ng-Perron seq t) = 0 [use maxlag(0)]
Min SC   = -2.651747 at lag  1 with RMSE  .2364574
Min MAIC = -2.602413 at lag  1 with RMSE  .2364574
```

```
. dfgls lnrealgdp2,

DF-GLS for lnrealgdp2                                   Number of obs =    28
Maxlag = 9 chosen by Schwert criterion

                     DF-GLS tau      1% Critical       5% Critical      10% Critical
  [lags]          Test Statistic        Value             Value             Value
------------------------------------------------------------------------------
     9               -1.943           -3.770            -2.727           -2.369
     8               -2.262           -3.770            -2.758           -2.422
     7               -2.395           -3.770            -2.815           -2.493
     6               -2.347           -3.770            -2.893           -2.579
     5               -2.289           -3.770            -2.984           -2.673
     4               -2.819           -3.770            -3.081           -2.769
     3               -3.283           -3.770            -3.179           -2.863
     2               -3.529           -3.770            -3.270           -2.949
     1               -3.865           -3.770            -3.348           -3.020

Opt Lag (Ng-Perron seq t) = 0 [use maxlag(0)]
Min SC   = -2.563388 at lag  1 with RMSE  .2464241
Min MAIC = -.2507805 at lag  1 with RMSE  .2464241
```

APPENDIX 2: Lag Selection-order criteria results

```
. **dertermine optimal lag length (p) for the model**
.  varsoc lnrealgdp lnintdebt lnpubexpend lnmoneysup lnlevelcpi,

   Selection-order criteria
   Sample:  2010q2 - 2018q4                    Number of obs      =        35
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	58.4028				3.3e-08	-3.05159	-2.97489	-2.8294
1	187.467	258.13	25	0.000	8.7e-11	-8.99812	-8.53791	-7.66496*
2	209.855	44.776	25	0.009	1.1e-10	-8.84886	-8.00515	-6.40474
3	234.837	49.964	25	0.002	1.4e-10	-8.84785	-7.62063	-5.29277
4	304.353	139.03*	25	0.000	2.0e-11*	-11.3916*	-9.78091*	-6.72558

```
   Endogenous:  lnrealgdp lnintdebt lnpubexpend lnmoneysup lnlevelcpi
    Exogenous:  _cons

.
```

APPENDIX 3: Johansen test for co-integration results

```
. vecrank lnrealgdp lnlevelcpi lnmoneysup lnpubexpend lnintdebt, trend(constant) lags(4) max

                    Johansen tests for cointegration
Trend: constant                                      Number of obs =      35
Sample:  2010q2 - 2018q4                                   Lags =       4
------------------------------------------------------------------------------
                                                              5%
maximum                                            trace      critical
  rank     parms       LL       eigenvalue      statistic      value
    0        80     220.25626          .          168.1944      68.52
    1        89     263.38172       0.91493        81.9435      47.21
    2        96     286.89934       0.73916        34.9083      29.68
    3       101     297.47777       0.45364        13.7514*     15.41
    4       104     301.85026       0.22109         5.0064       3.76
    5       105     304.35348       0.13328
------------------------------------------------------------------------------
                                                              5%
maximum                                            max        critical
  rank     parms       LL       eigenvalue      statistic      value
    0        80     220.25626          .          86.2509      33.46
    1        89     263.38172       0.91493        47.0352      27.07
    2        96     286.89934       0.73916        21.1568      20.97
    3       101     297.47777       0.45364         8.7450      14.07
    4       104     301.85026       0.22109         5.0064       3.76
    5       105     304.35348       0.13328
------------------------------------------------------------------------------
```

APPENDIX 4: VECM results

```
. vec lnrealgdp lnlevelcpi lnmoneysup lnpubexpend lnintdebt, trend(constant) lags(4)

Vector error-correction model

Sample:  2010q2 - 2018q4                        Number of obs     =         35
                                                AIC               =   -9.96467
Log likelihood =  263.3817                      HQIC              =  -8.599395
Det(Sigma_ml)  =  2.00e-13                      SBIC              =  -6.009642

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_lnrealgdp           17     .165657   0.7557   55.6711   0.0000
D_lnlevelcpi          17     .203552   0.6511   33.5965   0.0095
D_lnmoneysup          17     .039332   0.9016   164.8561  0.0000
D_lnpubexpend         17     .134496   0.7331   49.42863  0.0001
D_lnintdebt           17     .064591   0.7398   51.16879  0.0000
------------------------------------------------------------------
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnrealgdp						
_ce1						
L1.	-3.468067	.7949149	-4.36	0.000	-5.026072	-1.910063
lnrealgdp						
LD.	2.242246	.745446	3.01	0.003	.7811985	3.703293
L2D.	1.427654	.511956	2.79	0.005	.4242386	2.431069
L3D.	.4641495	.4709624	0.99	0.324	-.4589198	1.387219
lnlevelcpi						
LD.	1.455497	.5644831	2.58	0.010	.3491308	2.561864
L2D.	.7864006	.3972564	1.98	0.048	.0077923	1.565009
L3D.	.3983492	.3691298	1.08	0.281	-.3251319	1.12183
lnmoneysup						
LD.	4.568497	1.295335	3.53	0.000	2.029687	7.107307
L2D.	3.546909	1.076872	3.29	0.001	1.436279	5.657539
L3D.	2.846099	.8476599	3.36	0.001	1.184716	4.507482
lnpubexpend						
LD.	.0316612	.3114324	0.10	0.919	-.578735	.6420574
L2D.	.2578388	.3218403	0.80	0.423	-.3729566	.8886341
L3D.	-.4363594	.2430996	-1.79	0.073	-.9128259	.0401071
lnintdebt						
LD.	-2.749357	1.361825	-2.02	0.044	-5.418484	-.0802292
L2D.	-2.027712	.9379495	-2.16	0.031	-3.866059	-.1893647
L3D.	.0276005	.80778	0.03	0.973	-1.555619	1.61082
_cons	.0331655	.1459528	0.23	0.820	-.2528968	.3192278

D_lnlevelcpi						
_ce1						
L1.	3.477604	.9767583	3.56	0.000	1.563192	5.392015
lnrealgdp						
LD.	-2.765918	.915973	-3.02	0.003	-4.561192	-.9706441
L2D.	-2.073756	.6290701	-3.30	0.001	-3.306711	-.8408016
L3D.	-.6888229	.578699	-1.19	0.234	-1.823052	.4454063
lnlevelcpi						
LD.	-1.989142	.6936133	-2.87	0.004	-3.3486	-.6296854
L2D.	-1.351582	.4881321	-2.77	0.006	-2.308304	-.394861
L3D.	-.6642957	.4535713	-1.46	0.143	-1.553279	.2246877
lnmoneysup						
LD.	-3.9593	1.591654	-2.49	0.013	-7.078884	-.8397156
L2D.	-3.396779	1.323215	-2.57	0.010	-5.990233	-.8033244
L3D.	-2.376774	1.041569	-2.28	0.022	-4.418213	-.3353363
lnpubexpend						
LD.	-.0071802	.3826751	-0.02	0.985	-.7572096	.7428492
L2D.	-.1477717	.3954639	-0.37	0.709	-.9228667	.6273234
L3D.	.454899	.2987107	1.52	0.128	-.1305632	1.040361
lnintdebt						
LD.	2.501527	1.673354	1.49	0.135	-.7781859	5.78124
L2D.	2.289648	1.152513	1.99	0.047	.0307631	4.548532
L3D.	.0909859	.9925664	0.09	0.927	-1.854409	2.03638
_cons	-.0183704	.1793408	-0.10	0.918	-.3698718	.3331311

D_lnmoneysup						
_ce1						
L1.	.7623657	.1887383	4.04	0.000	.3924453	1.132286
lnrealgdp						
LD.	-.586241	.1769928	-3.31	0.001	-.9331406	-.2393414
L2D.	-.3699538	.1215548	-3.04	0.002	-.6081969	-.1317108
L3D.	-.3100233	.1118216	-2.77	0.006	-.5291896	-.090857
lnlevelcpi						
LD.	-.3571544	.1340264	-2.66	0.008	-.6198414	-.0944674
L2D.	-.1913544	.0943214	-2.03	0.042	-.376221	-.0064877
L3D.	-.1494737	.0876433	-1.71	0.088	-.3212514	.0223039
lnmoneysup						
LD.	-1.737474	.3075542	-5.65	0.000	-2.340269	-1.134679
L2D.	-1.09549	.255684	-4.28	0.000	-1.596621	-.5943584
L3D.	-.9531386	.2012617	-4.74	0.000	-1.347604	-.5586729
lnpubexpend						
LD.	.1572102	.073944	2.13	0.033	.0122826	.3021379
L2D.	.0997366	.0764152	1.31	0.192	-.0500345	.2495077
L3D.	-.0574149	.0577197	-0.99	0.320	-.1705434	.0557135
lnintdebt						
LD.	1.16264	.323341	3.60	0.000	.5289034	1.796377
L2D.	.5198667	.2226994	2.33	0.020	.083384	.9563494
L3D.	.5894681	.1917929	3.07	0.002	.2135608	.9653753
_cons	.0626128	.0346539	1.81	0.071	-.0053076	.1305332

D_lnpubexpend						
_ce1						
L1.	.8222271	.6453869	1.27	0.203	-.4427081	2.087162
lnrealgdp						
LD.	-.7829882	.6052235	-1.29	0.196	-1.969204	.403228
L2D.	-.1321022	.4156542	-0.32	0.751	-.9467694	.682565
L3D.	-.197112	.3823717	-0.52	0.606	-.9465468	.5523229
lnlevelcpi						
LD.	-.5526348	.4583007	-1.21	0.228	-1.450888	.345618
L2D.	-.0968743	.3225303	-0.30	0.764	-.729022	.5352734
L3D.	.0296551	.2996944	0.10	0.921	-.5577351	.6170453
lnmoneysup						
LD.	-2.700058	1.051675	-2.57	0.010	-4.761304	-.6388126
L2D.	-1.026681	.8743062	-1.17	0.240	-2.74029	.6869273
L3D.	-.6447407	.6882103	-0.94	0.349	-1.993608	.7041268
lnpubexpend						
LD.	-.343753	.2528502	-1.36	0.174	-.8393302	.1518243
L2D.	-.0153406	.2613003	-0.06	0.953	-.5274798	.4967986
L3D.	-.1638257	.1973712	-0.83	0.407	-.5506662	.2230147
lnintdebt						
LD.	1.083263	1.105658	0.98	0.327	-1.083787	3.250313
L2D.	.205802	.761516	0.27	0.787	-1.286742	1.698346
L3D.	.8109613	.6558321	1.24	0.216	-.4744459	2.096369
_cons	.1214136	.1184983	1.02	0.306	-.1108388	.3536659

D_lnintdebt						
_ce1						
L1.	.4540315	.3099455	1.46	0.143	-.1534506	1.061514
lnrealgdp						
LD.	-.3809257	.2906571	-1.31	0.190	-.9506032	.1887518
L2D.	-.1403072	.1996169	-0.70	0.482	-.5315492	.2509348
L3D.	-.1533481	.1836331	-0.84	0.404	-.5132624	.2065662
lnlevelcpi						
LD.	-.262043	.2200978	-1.19	0.234	-.6934268	.1693407
L2D.	-.1534701	.1548944	-0.99	0.322	-.4570576	.1501173
L3D.	-.0782791	.1439275	-0.54	0.587	-.3603718	.2038137
lnmoneysup						
LD.	-.7860854	.5050645	-1.56	0.120	-1.775994	.2038229
L2D.	-.4959125	.4198835	-1.18	0.238	-1.318869	.327044
L3D.	-.1787875	.3305114	-0.54	0.589	-.8265779	.4690029
lnpubexpend						
LD.	.0402279	.1214307	0.33	0.740	-.1977719	.2782277
L2D.	.1443207	.1254889	1.15	0.250	-.1016329	.3902744
L3D.	.0130821	.0947871	0.14	0.890	-.1726971	.1988613
lnintdebt						
LD.	.617726	.5309896	1.16	0.245	-.4229945	1.658446
L2D.	-.034991	.3657162	-0.10	0.924	-.7517817	.6817996
L3D.	.0812855	.3149618	0.26	0.796	-.5360283	.6985993
_cons	.0690299	.0569085	1.21	0.225	-.0425088	.1805685

APPENDIX 5: VECM results for long run dynamics

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	4	60467.33	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
lnrealgdp	1	.	.	.	.	.
lnlevelcpi	.5576502	.0248902	22.40	0.000	.5088663	.6064342
lnmoneysup	1.453415	.1454592	9.99	0.000	1.168321	1.73851
lnpubexpend	-.1118241	.0400874	-2.79	0.005	-.1903939	-.0332542
lnintdebt	-1.817028	.1280888	-14.19	0.000	-2.068077	-1.565978
_cons	-7.856138	.	.	.	.	.

APPENDIX 6: Diagnostics test results

```
. ** autocorrelation**
. veclmar, mlag(4)

   Lagrange-multiplier test
```

lag	chi2	df	Prob > chi2
1	27.6508	25	0.32418
2	17.9075	25	0.84629
3	27.6561	25	0.32393
4	35.1371	25	0.08575

```
   H0: no autocorrelation at lag order

.
.   ** normality**
.
. . vecnorm, jbera

   Jarque-Bera test
```

Equation	chi2	df	Prob > chi2
D_lnrealgdp	5.343	2	0.06915
D_lnlevelcpi	61.172	2	0.00000
D_lnmoneysup	0.558	2	0.75641
D_lnpubexpend	0.434	2	0.80511
D_lnintdebt	12.599	2	0.00184
ALL	80.106	10	0.00000

```
.
```

```
.
. **stability**
.  vecstable
```

Eigenvalue stability condition

Eigenvalue	Modulus
1	1
1	1
1	1
1	1
-.9582161	.958216
.00641855 + .9400787i	.940101
.00641855 - .9400787i	.940101
.2504634 + .8615025i	.897172
.2504634 - .8615025i	.897172
.8249181	.824918
-.07777378 + .8100462i	.813771
-.07777378 - .8100462i	.813771
-.469638 + .5430939i	.717991
-.469638 - .5430939i	.717991
-.7148246	.714825
.4168573 + .3983339i	.576576
.4168573 - .3983339i	.576576
-.5557827 + .1484051i	.575255
-.5557827 - .1484051i	.575255
.1589558	.158956

The VECM specification imposes 4 unit moduli.

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