THE DYNAMIC EFFECTS OF MONETARY POLICY SHOCKS ON MANUFACTURING SECTOR GROWTH IN NIGERIA

by

RASHEEDAT GBEMINIYI OMOTOLA AMUSA

[redacted]

A thesis submitted in fulfilment of the requirements for the degree of

DOCTOR OF COMMERCE IN ECONOMICS

FACULTY OF MANAGEMENT AND LAW

(School of Economics and Management)

At

UNIVERSITY OF LIMPOPO

SUPERVISOR

PROF I. P. MONGALE

2022

DECLARATION

I declare that “THE DYNAMIC EFFECTS OF MONETARY POLICY SHOCKS ON MANUFACTURING SECTOR GROWTH IN NIGERIA” hereby submitted to the university of Limpopo for the degree of Doctor of Commerce in Economics has not previously been submitted by me for a degree at this or any other University, that it is my work in design and execution and that all material contained herein has been duly acknowledged.

Rasheedat Gbeminiyi Omotola Amusa 2022

ACKNOWLEDGMENTS

First, I would like to thank Allah (SWT) who has made it possible for me to complete this program successfully and I graciously thank Him for His abundant mercies and blessings in my walk of life.

I also wish to extend my sincere thanks to my supervisors, Prof Richard Ilorah and Prof Itumeleng P. Mongale for their constructive comments, valuable inputs, and positive guidance and equally thank them for their kindness and for providing the much-needed encouragement that spurred me on to the successful completion of this thesis. I am extremely indebted to them as it has been through their relentless efforts, extreme patience, motivation, and immense disciplinary knowledge that I have reached my goal. I learned so much from both of them and I cannot imagine better advisors and mentors for my Ph.D. study than the two.

A special mention is made of my friend Sylvester Tatenda Nyerere who was there for me when days were dark, as he made sure that I did not give up. As a result, I owe him a lot for his encouragement, which saw me through to the finishing line. I appreciate his walk with me during the trying times of my Ph.D. work.

Finally, I wish to extend my gratefulness and appreciation to my family: my mother, Mrs. Margaret Olubunmi Amusa, for her encouragement and prayers; my sister - Dr. Lateefat Amusa-Archer; my brother - Dr. Hammed Adedeji Amusa; and my sister - Dr. Kayafat Olusola Amusa for their support and cooperation during the whole Ph.D. process.

DEDICATION

This study is wholeheartedly dedicated to my father, the late Professor Lateef Oluwole Amusa who even in death has been a source of inspiration and strength even when I thought of giving up. I cherish who he was, and who he will always be in my entire life.

ABSTRACT

Over the years there have been a series of monetary interventions taken by the monetary authorities in Nigeria to influence the growth of the manufacturing sector. These monetary interventions are usually called monetary policy shocks. The manufacturing sector remains an important sector of the Nigerian economy where the country is hoping to diversify reducing its dependence of the country on oil. This study investigated the effects of monetary policy shocks on manufacturing sector growth in the Nigerian economy from 1980Q1 to 2019Q4. The study was carried out under two broad modular theses namely examining the effects of monetary policy shocks on the manufacturing output growth of the Nigerian manufacturing sector and investigating the transmission mechanism through which global shocks transmit to the manufacturing output. The achievement of the first objective was done using the cointegration and Vector Error Correction Model where the long and short-run effects of monetary policy variables and other macroeconomic variables on the output of the manufacturing sector were examined. The second aspect of objective one which investigates the impact of monetary policy shocks on manufacturing output as well as the transmission mechanism through which the global shocks transmit to the manufacturing output growth was done using the VECM/VAR method with the application of both impulse response function and variance decomposition. Data on the variables were sought from both the World Bank tables and the International Financial Statistics 2020 edition. The result obtained from the first aspect of the analysis showed that there exists a long-run relationship between manufacturing output growth and monetary policy variables such as interest rate and money supply and other macroeconomic variables. Furthermore, the result further confirms the significant impact of the monetary policy rate on the manufacturing output growth both in the long and short run. Money supply failed to show the same significant impact. Notwithstanding, external variables such as World Oil Price and Federal Fund Rate also showed a significant effect on manufacturing output. Other variables with a long-run significant impact on manufacturing output growth are the Inflation rate and exchange rate. capita and labour. The second objective of the study which investigated the transmission mechanism through which global shocks affect the manufacturing output is done using the impulse response function and variance decomposition tools of the VECM. The confirmation of cointegration showed the adoption of VECM as against VAR and the impulse response function vividly showed the responses of manufacturing output to both the monetary policy shocks and global shocks as well as the medium through which these shocks are transmitted. The results further indicated that the effect of global shocks on manufacturing output makes use of the exchange rate channel and interest rate channel directly. Further analysis shows that exchange rate shocks also affect manufacturing output directly or indirectly through inflation rate. Again, Monetary policy shocks affect manufacturing output directly or indirectly through inflation and private sector credit respectively. The study recommends a more purposeful effort on the part of the monetary authorities in Nigeria to minimize the effect of external shocks on the manufacturing sector which has been aggravating the negative effects of monetary policy shocks on manufacturing output and frustrating internal monetary policy efforts of the Central Bank of Nigeria.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ADF	African Development Fund
AD	Aggregate Demand
ADF	Augmented Dickey-Fuller
ADR	Average Deposit Rate
AIC	Akaike Information Criterion
ALR	Average Lending Rate
ARCH	Autoregressive Conditional Heteroskedasticity
ARDL	Autoregressive Distributed Lag
AS	Aggregate Supply
ASI	All Share Index
BOFIA	Bank and Other Financial Institutions Act
BRICKS	Brazil, Russia, India, China, Korea (South), South Africa
CB	Central Bank
CBN	Central Bank of Nigeria
CiC	Currency in Circulation
CoB	Currency Outside Banks
CPI	Consumer Price Index
CRR	Cash Reserve Ratio
DMB	Deposit Money Bank
DR	Deposit Rate

ECB	European Central Bank
FD	Fiscal Deficit
FGN	Federal Government of Nigeria
FOS	Federal Office of Statistics
GARCH	Generalised Autoregressive Conditional Heteroskedasticity
GDP	Gross Domestic Product
HAC	Heteroskedastic and Autocorrelation Consistent
IBR	Interbank Rate
IFEM	Interbank Foreign Exchange Market
IRR	Internal Rate of Return
IT	Inflation Targeting
KPSS	Kwaitkowski-Phillips-Schmidt-Shin
LR	Lending Rate
LR-PC	Long run Phillips Curve
M.A.L	Mean Adjustment Lag
M2	Broad Money Stock
MLR	Maximum Lending Rate
MPC	Monetary Policy Committee
MPR	Monetary Policy Rate
MR	Monetary Rule
MRR	Minimum Rediscount Rate

NARDL	Nonlinear Autoregressive Distributed Lag
NBS	National Bureau of Statistics
NCM	New Consensus Macroeconomics
NIBOR	Nigeria Interbank Offer Rate
NISER	Nigeria Institute of Social and Economic Research
NTB	Nigerian Treasury Bills
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
OMO	Open Market Operations
PCA	Principal Component Analysis
PLR	Prime Lending Rate
PSS	Pesaran-Shin-Smith
QTM	Quantity Theory of Money
REER	Real Effective Exchange Rate
RESET	Regression Specification Error Test
RSS	Residual Sum of Squares
SDR	Savings Deposit Rate
SR-PC	Short-run Phillips Curve
T-ARDL	Threshold Autoregressive Distributed Lag
TBR	Treasury Bills Rate
TDR	Term Deposit Rate

VIF	Variance Inflation Factor
WAMZ	West African Monetary Zone
WDAS	Wholesale Dutch Auction System

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 Introduction and Background

One of the macroeconomic policies used by countries across the globe to achieve various macroeconomic objectives is monetary policy. Important macroeconomic objectives that global economies always try to achieve stability in gross domestic product or output and consistent economic growth (Honohan, 2019). Monetary policy is usually designed to support other economic policies to achieve this objective. Notwithstanding, many countries in the world are bedevilled with a series of challenges owing to economic instability and slow growth rates with developing countries like Nigeria is the most affected.

According to Shokr, Karim, and Zaidi (2019), one of the main differences between developed and developing countries is the levels of domestic output and the methods through which these outputs are produced. The manufacturing sector of any economy plays important role in this aspect and hence the level of economic output achieved by a particular economy and the methods through which the output is produced have a strong link with the manufacturing sector (Hammed, 2020). Being a major player in the gross output production process countries across the globe usually accord the sector an important position in the formulation of macroeconomic policy and monetary policy is not an exemption in this regard. The United States of America have to influence the federal fund rate about two times within the last two years to cope with the effect of COVID 19 that has affected the global economy. This was done to maintain and achieve a certain level of economic output and performance during this period (Hammed, 2020). Many other developed and developing countries across the globe also did the same thing during this period.

The case of Nigeria as a developing economy is different because apart from the fact that monetary policy is very important to the achievement of macroeconomic output stability, the structure of the Nigerian economy being a mono-economy that majorly depends on oil naturally imposes some responsibilities that bother on economic diversification on macroeconomic policies like monetary policy. However, without this policy playing these roles appropriately important sectors like manufacturing might not contribute their expected quota to the national output. This singular reason beholds policymakers to get it right by developing monetary policy which will have an effect that is significant positively on the manufacturing sector of the Nigerian economy.

However, in the assessment of the relationship between monetary policy and the output of the manufacturing sector, the debates among monetary authorities and policymakers have generally been centered on issues relating to the effects of monetary policy on the growth of real output and that of the price level in general. Does monetary policy explain variations in manufacturing output growth and prices? What are the possible processes through which these occur? Chuku (2009) opined from his study that the response to this question primarily depends on the economic structure of a country as well as the research methodology used by the researcher carrying out the investigation. Rafiq and Mallick (2008) and Mihov (2001) concluded from their study that monetary policy usually plays a stabilization role in an economy and ensures sustainable output growth. Mihov (2001) especially concluded that there exist long and short-run effects of monetary policy on both inflation and output. In contrast, Kandil (2014) argued that capacity constraints hamper output adjustment to monetary policy as well as increase price inflation. With the arrays of diverse conclusions on the relationship between the two, it is obvious that this issue is still a developing one that has not reached a consensus hence this study is to also contribute to the existing literature on this debate.

From another perspective on the effect of monetary policy on the manufacturing output. Some groups of authors are more concerned about the dynamic effect which studies the transmission mechanism through which monetary policy influences output generally (Obioma and Anyanwu, 2015). The idea of these schools of thought is that monetary policy might not affect output directly but the effect might be dynamic by influencing some variables which will now transmit the fact of the monetary policy via some channels which are called monetary transmission channels to output. This aspect of the relationship between the two is also an evolving one that has enjoyed the patronage of different researchers and this has led to different debates in the literature. For instance, there has been a counter-argument against the prominent Keynesian approach to monetary policy transmission which suggests that the main medium through which monetary policy influences output is via the interest rate (Angeloni et al., 2003; Smets and Wouters, 2002; Boivin et al., 2010; Loayza and Schmidt-Hebbel, 2002). From another perspective, some authors have identified exchange rates from their studies as the most vibrant channels through which the monetary policy influences the output (Kabundi and Ngwenya 2011). Furthermore, the credit channel was supported as the most effective channel in monetary transmission by Hall (2001) and Bayangos (2010). Again, the asset channel and the lending rate appeared to be the most effective channel from the studies of Mishkin (2001), Elbourne (2008), and Disyatat and Vongsinsirikul (2003), Alfaro et al. (2003), and Borio and Zhu (2012). These divergent views have naturally necessitated more contributions from researchers which this study also hopes to make.

1.2 Statement of the problem

Over the years the Nigerian economy has been striving to achieve economic diversification which has been adjudged to be the panacea for the chronic economic instability problem affecting the Nigeran economy (Kayode, 2019). The manufacturing sector has been identified as an important sector to play important role in this agenda and concerted efforts especially via monetary policy have been directed to improve the manufacturing output so that it can contribute more to the national output, reduce dependency on oil and at the same time achieve sustainable economic output growth. These efforts have necessitated numerous policy rate changes over the years (monetary policy shocks) especially after the sector was neglected immediately after oil was discovered in the 60s in Nigeria (Anyanwu, 2020). Till today, the manufacturing sector in Nigeria remains grossly underdeveloped, heavily dependent on imported human and material resources, and low contribution to the national output despite all these monetary policy rate changes.

This problem has been manifesting from year to year and it seems it will not abate anytime soon. The Nigerian economy has undergone different phases over the years and the monetary policy has reacted differently to these phases with the main aim of improving the contribution of the non-oil sector to the gross earnings of the country. In one of the most recent efforts of about 61 years of existence of Nigeria as a sovereign state, precisely in 2016 January, the policy rate was increased from 12% as of December 2015 to 14% in the first quarter of 2016 to curb the rising trend of inflation occasioned by the fall in the global oil price which reduced the revenue to Nigeria drastically. At the end of the second quarter, Nigeria's economy plunged into a negative growth rate. The CBN then went ahead to retain the tight monetary policy and also devalued the naira to attract foreign investment. In the third quarter of 2016, the country recorded worse economic performance which forced the economy to the second consecutive negative growth rate and the economy went into recession. During these periods, the contribution of the manufacturing sector has fallen by -15%, the highest fall within the last decade as at then. Some economists then castigated the CBN that the monetary intervention which adjusted the policy rate upward coupled with currency devaluation was double jeopardy for the manufacturing sector hence the effect of the monetary policy on the manufacturing sector during this period was counter-productive (Omolade and Ngalawa 2018, Omolade, Ngalawa and Kutu, 2019). However, since then the monetary policy rate has eased to almost a decade low of 11.5% when the CBN kept the rate at that level in November 2019 for the 11th consecutive time owing to a noticeable fall in the inflation rate. Notwithstanding, the output fell by 2% during the same period. This is another signal that the fall in the monetary policy rate still does not have the desired effect on the output.

Again, several efforts have been made both in the past and recently to always aid monetary policy interventions so that desired effect on the economy can be achieved. For instance, there have been establishments of specialized and development banks such as the Bank of Industry and Bank of Agriculture. These banks are meant to offer loans to the manufacturers under less stringent conditions apart from this, programs such as anchor borrowers' scheme, selective credit control, and rationing in favour of the manufacturing sector among other schemes have been put in place to aid policy rate adjustment all these with little or no effect on the manufacturing output. Does the question continue to resonate as could the monetary policy shocks occasioned by different policy rates adjustment could be responsible for the continued underperformance of the Nigerian manufacturing sector? This further informed the conduct of this research exercise.

Some authors have explained in the background of the study believed that all the efforts of the monetary policy authorities in Nigeria to improve the performance of the manufacturing sector via monetary policy interventions might not work until the channels of transmission of monetary policy affect output in Nigeria is identified (Ogundipe, Uzoma and Bowale, 2017). Nigeria as a country runs an open economy like other developing countries but the country is highly dependent on foreign goods and services and this has exposed the economy to global shocks which makes the country highly vulnerable to external shocks (Hammed, 2020). It is believed that regardless of the internal policy framework if the global effect on the Nigerian domestic economy is not considered all internal efforts might not have their desired effect (Omolade, Ngalawa, and Kutu, 2019). These are the arguments for studying the effect of channels of transmission of monetary policy shocks and external shocks on the domestic economy. Studies in this area are also numerous with diverse conclusions. However, most of these studies focused on monetary policy shocks' effect on output and not the manufacturing output (Hammed, 2020). While some that focused on the manufacturing sector did not look at the roles of the channels of transmission (Obamuyi, Edun, and Kayode, 2010). Some that studied the channels of transmission focused on monetary policy shocks alone without incorporating global shocks to capture the global effect on the domestic manufacturing output.

Consequently, the study apart from examining the effect of monetary policy on manufacturing output, this study will further investigate the dynamic effect of monetary policy on manufacturing output by assessing the channels of transmission of both global and monetary policy shocks to the manufacturing output in Nigeria. In other to achieve these objectives, the following research questions are identified.

1.3 Research Aim and Objectives

1.3.1 Aim of the study

This study aims to investigate the effects of monetary policy shocks on manufacturing sector growth in Nigeria.

1.3.2 Objectives of the study

To realize the above-mentioned aim, the objectives of the study are organized as follows:

- To determine the long and short relationships between manufacturing output and monetary policy shocks.
- To determine the transmission mechanism through which global shocks are transmitted to the manufacturing output.

1.4 Research questions

The study addressed the following research questions:

- Which are the transmission mechanisms through which global shocks are transmitted to the manufacturing output?
- What is the relationship between the manufacturing sector and monetary policy shocks?

1.5 Definition of concepts

For this study, the following concepts were used as per the definitions given below.

- Manufacturing Output

The manufacturing output is the share of the manufacturing sector out of the gross output or the GDP of the country. The manufacturing sector remains a major component through which the GDP is calculated. In this study, it is the dependent variable, and the effect of monetary policy shock is examined on the output growth of the sector. Diverse areas of the economy are identified as areas where manufacturing output contributes to the output growth of the country. This includes employment generation, output or production generation, and the development of other sectors that are contributors to the GDP as well. However, the output approach to calculating the national income considers the output of the manufacturing sector (Elbourne and De Haan 2006).

- The World Oil Prices

According to the World Bank (2019), it is the average annual oil price in the international market. The annual average oil price is used since it reflects the international dimension and exogenous character of oil price. As an exogenous variable, the world oil price represents the variables that explain the external effects in the model.

- The Federal Fund Rate

This is the prevailing short-term cost of capital in the United States of America. It represents the cost at which the Federal Reserve Bank lends money to other commercial banks across the globe. Since many economies, Nigeria inclusive in the world are affected by the monetary policy in the US hence this variable is very important, and it is captured as a control variable or exogenous shocks in the model.

- Inflation Rate

The general and persistent rise in the price level is called the inflation rate; this variable remains an important variable used in measuring the position of a particular economy at a point in time. It is measured using the consumer price index, which can also be called the CPI. The policy target of most Central Banks in the world is to keep the inflation rate at a certain level threshold because of its effect on general economic activities. The manufacturing sector is also strongly affected by this variable both on the cost side and output side hence the inclusion in the model.

- Interest Rate

This is known as the REP rate and in some countries like Nigeria; it is referred to as the monetary policy rate. The Central bank lends money to the commercial banks in Nigeria at this rate. The addition of the variable to the model in this study is premised on its role in the monetary transmission channel (See Banake, 2009. Aung, 1998)

- Exchange Rate

The price of a currency in the foreign exchange market is referred to as the exchange rate. The currency is transacted to the US dollars most especially in the foreign exchange market at this rate. For instance, the Nigeria exchange rate depicts the rate at which Naira is valued against the US dollar. From the literature it is believed that when the exchange rate of the Naira to a Dollar falls, that is appreciation of the currency, it should affect the manufacturing sector negatively. The reverse is the case when Naira depreciates. This justifies the inclusion in the model expressing the relationship between monetary policy shocks and manufacturing sector growth in Nigeria (Etuk 2012).

- Money Supply

Money supply refers to the total stock of money in circulation. It comprises both the currency in circulation and the monetary base, which is called the high-powered money. Money supply includes coins, notes, deposits as well as cheques (Kimberly, 2012). The rise in the volume of the money supply is expected to trigger output, boost demand, and in essence, increase the manufacturing output growth. However, in a situation where the money supply rate of growth outweighs the rate of growth of the real output then, there is an inflation problem. It is believed from the Keynesian perspective that a rise in money supply leads to a fall in the interest rate and stimulates investment and aggregate demand. Furthermore, the broad definition of the money supply is usually used and it comprises time, savings, and money deposits (Jones, Dutkowsky, and Elger, 2005).

1.6 Ethical considerations

As basic principles of ethics are observed in this study, the researcher acknowledges all the sources and embraces all the rules of the University of Limpopo in conducting research. The aspect of plagiarism is eliminated in appreciation of intellectual rights.

1.7 Significance of the study

The study investigates the relationship between monetary policy shocks and manufacturing output in Nigeria. This study could not have come at a better time than now when the country is going through a kind of output growth trajectory characterized by a lot of instabilities that have made reliant on the oil sector alone less realistic if the country intends to maintain a consistent and healthy growth rate (Ayanwu, 2020). Based on the foregoing the quest for economic diversification has not been more pronounced than now in Nigeria and the manufacturing sector is an important sector primed to play important role in the economic diversification crusade of Nigeria (CBN, 2019). Having realized this fact, all policy interventions within the last two decades have been geared toward improving the non-oil sector of the economy, especially the manufacturing sector (CBN, 2020). The monetary policy intervention of the CBN in most cases over the years have been directed to the improvement of the performance of the real sector of the Nigerian economy so that sector like manufacturing can increase their contributions to the national output. Consequently, this study serves as one of the studies meant to appraise this effort s so far, identify the loopholes, and suggest areas of improvement on the part of the policymakers that can place monetary policy on a more appropriate pedestal that will have a more significant impact on the manufacturing output in Nigeria.

From another perspective, it has been established from the background of the study and the statement of the problem that the efficacy of internal policy like monetary policy is usually affected by external or global shocks (Shokr, Karim, and Zaidi, 2019). The case of Nigeria is a special one in this scenario as the country is heavily dependent on importation. The manufacturing sector of Nigeria remains one of the sectors that have the highest import bills in Nigeria because the sector is grossly dependent on foreign raw materials and human services for its operations (Omolade and Ngalawa, 2018). This situation put Nigeria at the forefront of countries that are highly vulnerable to global shocks therefore the effect on the monetary policy is very crucial. Consequently, this study among others serves as an avenue through which the effect of the global shocks on the monetary policy and the implication on the manufacturing sector output is ascertained empirically.

In addition, debates on the transmission mechanism of the monetary policy as discussed under the statement of the problem remains a crucial aspect where this study is very important. Identification of the channels of monetary policy transmission has been adjudged to be another way by which monetary policy shocks' effect on output can be assessed (Alam and Waheed, 2006). Literature has shown that monetary transmission channels are capable of influencing the effect of monetary policy shocks on output, Consequently, this study will enable policymakers to identify these channels or the channel that is most potent in transmitting both the global shocks and the monetary policy shocks to the manufacturing sector output in Nigeria.

Finally, from the discussions above it is obvious that various agencies of the government such as the Central Bank of Nigeria CBN, the Ministry of Finance, and The Nigeria Investment Promotion Commission among others will find the results and the findings of this thesis very useful in their policy formulation as they will have access to findings that are based on empirical analysis on all the aforementioned areas.

1.8 Structure of the study

Chapter 1 presented the introduction and the definitions of the important concepts, which are also the main variables of the study. Moreover, Chapter 2 covers an overview of the manufacturing sector of the Nigerian economy. It focuses on the manufacturing sector's growth and its composition. The chapter also discusses the monetary policy targets in the Nigerian manufacturing sectors and concludes with different kinds of economic shocks. Chapter 3 introduces the theoretical and empirical literature. Economic theories such as the monetary theory, new quantity theory, and growth theories are used to justify and explain the Nigerian manufacturing sector. The empirical literature section of the chapter covers both the International and Nigerian literature review. Chapter 4 presents the embraced research method for the achievement of all the objectives stated in Chapter 1. Chapter 4 also covers the estimation techniques needed for the analysis. Subsequently, the results of all the estimation techniques undertaken in Chapter 4, and their discussions are presented in Chapter 5. The discussion of findings and inferences from the empirical results are discussed in Chapter 6 as well as the conclusion and policy implications of the study.

CHAPTER TWO

OVERVIEW OF MANUFACTURING SECTOR AND MONETARY POLICY IN NIGERIA

2.1 Introduction

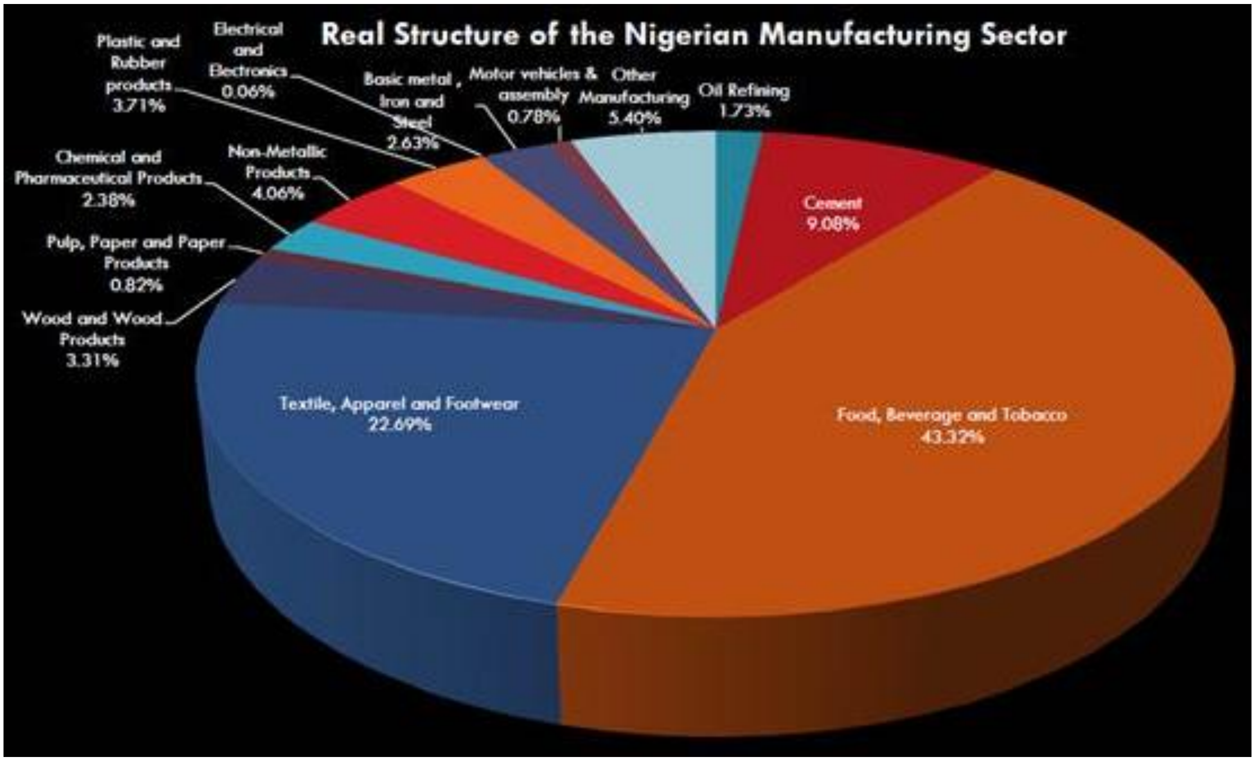
This section discusses various views on the manufacturing sector in Nigeria. Performance indicators of the sector are brought to the fore under this section. In addition, the structure of the sector, as well as the trends of the output growth of the sector in Nigeria, are reviewed among others under this section.

2.2 The Nigerian Manufacturing Sector Growth

Since the first global oil price shock in the early 80s, Nigeria has been intensifying efforts to enlarge its economic base. The drive was premised on the inability of the economy to withstand the decline in the price of oil, which threw the economy into its first recession between 1980 and 1982 (Olomola, 2007). Following this period, the Nigerian government has increased its efforts to diversify the economy and the manufacturing sector was identified as the key player. This period initiated the beginning of various policies that would influence the growth of the Nigerian manufacturing sector (Adofu, Taiga, and Tijani, 2015).

The Nigerian manufacturing sector is relatively broad, and its categorization is based on the country's activities. Before rebasing, manufacturing activities comprised three major undertakings namely, refining of oil, cement, and other manufacturing ventures. Presently, the other manufacturing ventures have been disaggregated into 11 different ventures, which bring the total to 13 in the sector as illustrated in Figure 2.1.

Figure 2. 1 Composition of the Nigerian Manufacturing Sector



Source: Nigeria Bureau of Statistics, 2016

As illustrated in Figure 2.1, some sub-sectors such as food, apparel, and beverages contributed 43.32 percent and 22.69 percent of the total output respectively with which the former is the greatest contributor to the manufacturing sector. Also, in 2015 the contribution of oil refining and cement to the manufacturing sector stood at N612.30 billion or 9.08 percent and N250.75 billion or 1.73 percent respectively. In the same vein, in 2013 the total manufacturing product contribution in the formal sector in Nigeria stood at N6, 845,678.59 million. However, the contribution of the organized sector is on the increase in the two subsequent years that is in 2014, it contributed N1, 326,277.80 million or 19.37 percent to reach N8, 171,906.39 million and N1, 652,610.80 million or 20.22 percent to reach a total of N9, 824,517.19 million in 2015 (NBS, 2018).

According to the Manufacturing Association of Nigeria MAN (2018), In years past the food industry aspect of the manufacturing sector has been dominating the growth rate of the manufacturing sector, the percentage of the overall output of the manufacturing sector in 2013 was 72 percent. However, these Figures have been falling, in recent years it was 66 percent in 2014, and it fell to 62 percent in the year 2015 (NBS, 2018).

Following the food and beverages sector are the footwear as well as the textile industry with the contribution to manufacturing output, which stood at N792, 693.12million or, 11.58 percent of total output in 2013. With the increase from N1, 190,712.77million or 14.57 percent to N398, 019.65million or 50.21 percentin2014 of the total output. Similarly, in 2012 this share further increase with an output of N1, 652,840.71million representing 16.82 percent of the total, as a result of an increase in output of N462, 127.94million or38.81 percent. Next to textile, apparel and footwear are other manufacturing and no-metallic products, which are the third, and fourth in rank respectively that contribute to the sector's output (Manufacturing Association of Nigeria MAN 2018). Other manufacturing contributed to the sector to the tune of N392,317.00million or 11.58 percent of the total and N187, 709.52million or 5.73 percent of the total in 2013. Whereas the contribution of the non-metallic product to the sector remains relatively constant over the same period. The year 2014 experienced an increase of N183, 354.36million or 46.74 percent, which represents an increase in its share to about 7.04 percent of the sector's total share. Following the total value of N575, 671.36million, it further rises to N210,716.46million or 36.60 percent, reaching N786, 387.82million or 8.00 percent of the total (NBS, 2018).

Over this period, basic metals, Iron, and Steel displayed the fastest rate of increase, rising to N177, 490.11million in 2014 from N100, 262.47million recorded in 2013. Notwithstanding in 2014, food, beverages, and tobacco activity recorded the lowest rate of growth of 9.91 percent, total output still rose by a magnificent N488, 855.06million. The summary of the composition of the manufacturing sector by output is shown in appendix E, for the years 2013, 2014, and 2015.

2.3 Manufacturing sector and the Nigerian economy

According to Bennett, Anyanwu, and Kalu (2015), the contribution of the sector (manufacturing) as a share of economic output in Nigeria has fallen since the peak of

7.83 percent in 1983. Over time, many factors have contributed to the difference in the sector, many of which display both susceptibility of the sector to external/worldwide economic pressure, as well as the effect that policy changes can have in restructuring the sector (Teshome, 2014). Before the oil boom of the 1970s, the sector contributed nearly 10 percent to the output of the Nigerian economy. Afterward, the rise in revenue from oil caused the sector's relative GDP share to fall, growth continued though at a slower rate (Olayinka and Abdullahi, 2015). As a result of a decline in oil price, there was a recession in the early 1980 and this prompted policy attention to return to the manufacturing sector, with steel production as a primary focus.

Before this, the Nigerian Enterprises Promotion Decrees of 1972 and 1977 had shifted the majority of the ownership of firms to Nigeria from foreign, limiting foreign capital influx. The absence of foreign capital and technology coupled with the inadequate moderation of foreign goods stimulated local production of basic goods and services such as soap and salt, etc.

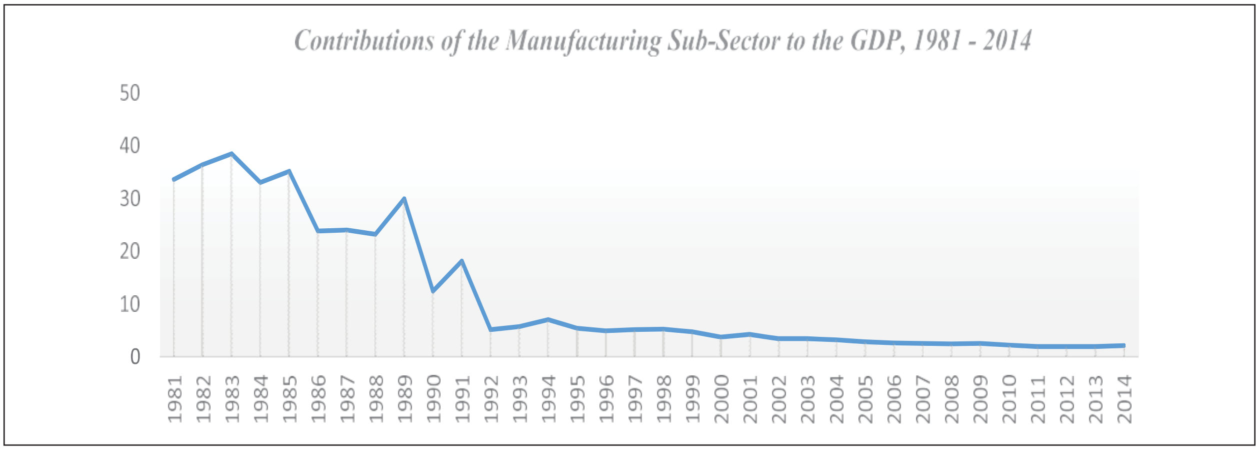
However, the expansion of sectors such as assembly-based industries and importation of intermediary inputs had been motivated by price adjustment via export and export subsidies. In the early 1980s, a short projection in manufacturing output was noted (Figure 2.2) contributing to 7.83 percent of total economic output. The price adjustment was discouraged via local manufacture of inputs while spending on the infrastructure and share of human capital requirements for the future soon began to fall (NBS, 2018).

According to the Manufacturing Association of Nigeria MAN (2018), to motivate import substitution, import bans on raw materials were forced under World Bank Structural Adjustment Programmes (SAPs) in 1987. As a result of this shutdown, some plants/factory intermediary inputs producers were able to produce competitively. This, joined with the Privatization and Commercialization Act of 1988, motivated a higher extent of efficiency to be accomplished in the manufacturing sector. From 1986-1988 it was noted that there was a short rise in the share of manufacturing in economic output of 0.62 percent points as shown in Figure 2.2.

Nigeria continued to depend immensely on the export of oil consequently; manufacturing remained in decline through the 1990s and 2000s due to a lack of efficiency and export-oriented firms, therefore, causing competitive firms to change their plants to other countries.

According to Adegbite (2012), major industries like beverages, textiles, cement, and tobacco maintained the sector in operation, although they are not operating at their full capacity. Consequently, the creation of goods and services are majorly located in Lagos and its environment/suburb, and to a fewer degree some other commercial cities such as Kaduna and Kano (Adegbite, 2012).

Figure 2. 2: Contribution of the manufacturing sector to real GDP over time



Source: Nigeria Bureau of Statistics, 2016

Nevertheless, after the rebasing of the country's GDP in 2003, the sector gives a futuristic view, as modern manufacturing has been considered (CBN, 2018). For price to be represented in the structure of the economy at that period, it needs (price) to be accurately deflated. For instance, considering inflation standing in 2010 at a value of N3, 578,641.72million, in the same year the sector had a share of 6.55 percent of the total real GDP. In 2011, it rose to N948, 803.34million or 26.51 percent to reach N4, 527,445.06million or 7.79 percent of real GDP in the same year, and in 2012, it increased by N1, 061,376.64million or 23.44 percent to reach a value of N5, 588,821.69million or 7.79 percent of real GDP in the same year.

However, in 2013, the highest growth was recorded at N1,644,500.79 million or 29.42 percent, because the manufacturing sector's contribution reached N7,233,322.48 million or 9.03 percent of real GDP, the highest value recorded so far in decades (NBS, 2016).
In recent times the manufacturing sector in Nigeria has been moving from one end of the cycle to the other before 2016 before the economic recession the purchasing managers' index PMI of the manufacturing sector was 56 points as of the first quarter of the year. In the third quarter when the Nigerian economy recorded two consecutive negative growth rates and was declared to be in recession the PMI in the Nigerian manufacturing sector fell to 41 points. Since this period the recovery process has been going back and forth. In 2019, the PMI has risen to 57% the position it was before the economic recession of 2016 (CBN, 2019).
The recovery process of the manufacturing sector after the 2016 economic recession was slowed down with the COVID 19 pandemic of 2020 and the PMI of the sector fell again by the second quarter of the year to 45 points as the pandemic bites harder it continued to take its toll on the real sector of the Nigerian economy resulting into the further dip in the PMI and the contribution of the manufacturing to the GDP by the third quarter of 2020 was negative (NBS, 2020). The situation has continued to improve slowly since the dip in late 2020. The slow pace in the recovery process of the PMI might not be unconnected to incessant security and institutional challenges faced by the country in recent times (Ayanwu, 2020).

2.4 Structure of inputs in the manufacturing sector

The inputs in the Nigerian manufacturing sector can be divided into different categories. The structures and composition of these categories are discussed below.

2.4.1 Raw materials

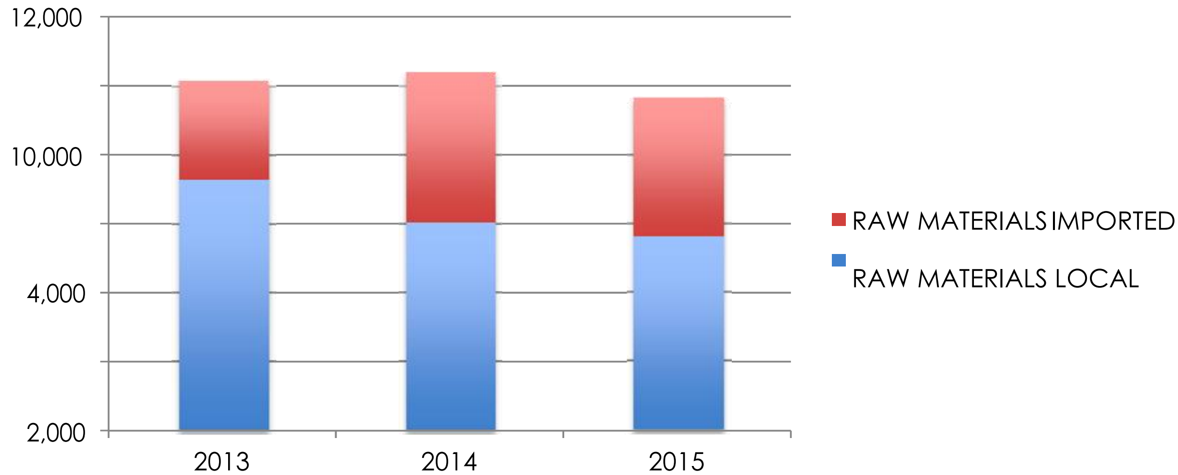
The food and beverages and pharmaceutical raw materials dominated the opening stock of raw materials in the Nigerian manufacturing sector and they were valued at N2, 349,374.68million in 2013. In 2014, it opened at N2, 784,271.02 million but rose by N434, 896.34 million or 18.51 percent; still fell by the same N492, 291.15 million or 17.68 percent in 2012, opening at N2, 291,979.86 million. The domestically sourced raw materials were more than the foreign-sourced raw materials in all the 3years, although this portion fell over the period (Manufacturing Association of Nigeria MAN, 2018).

In 2013, domestically foreign raw materials comprising food/beverages and pharmaceuticals were valued at N7, 304,864.27million or 71.70 percent of the total. In 2014, their value fell byN1,261,182.74 million or 17.26 percent, whereas, the value of foreign raw materials rose by N1,476,946.94 million or 51.22 percent from N2,883,805.34 million to N4,360,752.28 million (NBS, 2018). The share of locally sourced raw materials subsequently fell to 58.09 percent. However, both local and imported sourced raw materials used fell by N422, 813.79 or 7.00 percent and N333, 410.69million or 7.65 percent respectively in 2015 (Figure 2.3).

There was a constant decline in an opening stock of finished goods. In 2013, it was valued at N2, 333,732.34million and fell by N488, 327.64million or 20.92 percent in 2014. They continue to fall by N123, 147.95million or 6.67 percent in 2015, reaching a value of N2, 291,979.86million.

Contrarily, in 2013, capital allowance (depreciation) rose constantly from the N699, 135.17million over time, and in 2014, it rose by N192, 5ee95.28million or 27.55 percent to N891, 730.45million and then continue in 2015 by N22, 583.20million or 2.53percent to N914, 313.65million (NBS, 2016).

Figure 2. 3: Manufacturing raw materials by source

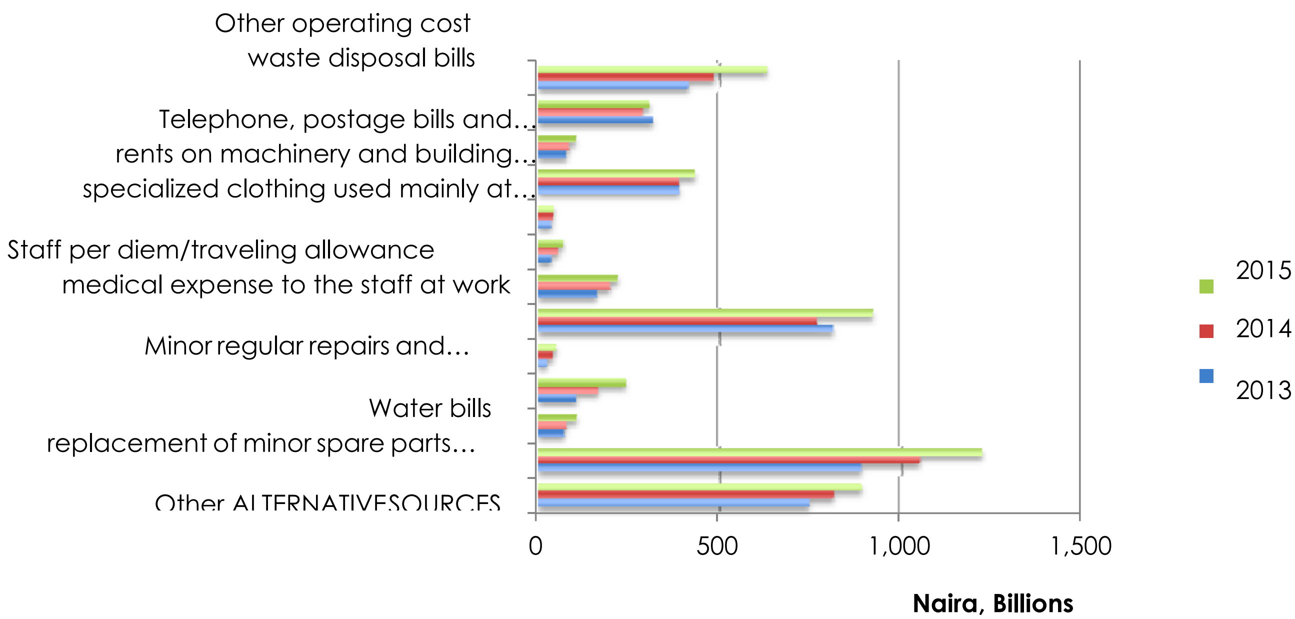


Source: Nigeria Bureau of Statistics, 2016

2.4.2 Composite intermediate input

Intermediate inputs are the commodities that are consumed or used in the production process, Figure 2.4 indicated the examples. In 2013, the total amount spent on intermediate inputs by the manufacturing sector totalled N4, 043,539.22million. In 2014, it rose from N376,940.34 million 9.32 percent to N4,420,479.56 million and even more than N780,765.14 million or 17.66 percent in 2015 to reach N5,201,244.69 spent on intermediate inputs. From 2013-2015, the total expenditure on generator fuel was the highest of all intermediate inputs in the sector. In 2013, the value stood at N886, 255.56million or 21.92 percent of all input costs in the same year. It further increased in 2014 from N161, 265.99million or 18.20 percent to N1, 047,521.56 million or 23.70 percent of all intermediate input costs. By 2015, it rose again from N171, 057.89 million or 16.33 percent to N1, 218,579.44 million, although a 0.27 percent smaller compared to 2012 at 23.43 percent. Depreciation, which comes as the second greatest cost for little repairs and maintenance both, stood at N809, 332.65 million or 20.02 percent of the total in 2013.

Figure 2. 4: Intermediate input distribution

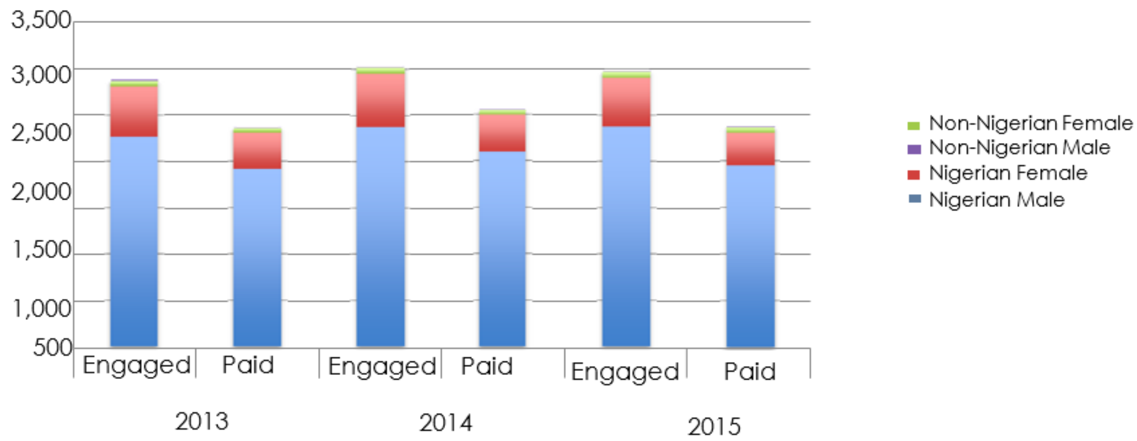


Source: Nigeria Bureau of Statistics, 2016

However, this cost fell in the subsequent year by N46, 092.89million or 5.70 percent to N763, 239.76million or 17.27 percent. Again, in 2015, it rose from N156, 374.54million or 20.49 percent to N919, 614.30million or 17.68 percent.

Over time, the Power Holding Company of Nigeria's bills increased constantly which indicates the third greatest intermediate input cost. From N743,325.43 million, it increased in 2014 by N66,377.96 million or 8.93 percent and in 2015 by N76,299.04 million or 9.42 percent to reach a value of N886,002.43 million in that year. Water bills, which is the greatest percentage increase in an intermediate cost increased in 2013 by N16, 242.56million or 75.85 percent from N21, 414.85million to N37, 657.12 million in 2014 (Manufacturing Association of Nigeria MAN 2018). In 2015, there was no record of a decline in expenditure on intermediate inputs in any subcategories. However, there were decreases in waste disposal bills, minor regular repairs, and maintenance as well as rents on machinery and buildings (office accommodation) in 2014. Waste disposal bills experienced the greatest decrease from N312, 253.04million to N284, 059.59 million constituting (which implies) a decrease of N28, 193.45million or 9.03 percent.

Figure 2.5 Employment in the Nigerian Manufacturing Sector



Source: Nigeria Bureau of Statistics, 2016

2.5 Nigerian manufacturing sector employment

The Nigerian manufacturing sector was one of the largest employers of labour before 1970 after the agricultural sector. Between 1970 and 1978, the sector accounted for about 23 percent of the total employed workforce. However, due to the myriad of problems especially after the neglect it suffered immediately after the oil discovery, the sector was left struggling. In 2013, the manufacturing sector employed a total number of 2,880,973, and in 2014, it increased by 148,912 persons, or 5.17 percent to 3,029,884 (NBS, 2018).

However, there was a slight decrease in employment by 48,803 persons or 1.61 percent to reach 2,368,514 employed in 2015. About 82.23 percent or 2,368,970 employed by the manufacturing sector were paid employees. An increase in newly paid workers result in to rise in the fraction in the subsequent year by 7.86 percent. In 2014, from 2,555,184 paid workers recorded in the sector, there was a decline of 7.31 percent, or 186,870 workers to 2,368,514 (NBS, 2018).

From MAN, (2016), In 2013, the majority of those engaged in the sector were Nigerian males, making up 78.62 percent (2,264,916 workers) of those employed, and a marginally greater portion of 81.14percent (1,922,223 workers) was paid. Also in 2013, out of those employed, Nigerian females make up 546,805 or 18.98 percent, still 391,362 or 16.52

percent of those engaged in the same period. The rest of 2.41 percent is dominated by non-Nigerian males, which comprised 57,570 or 2.00 percent of those employed in 2013, whereas 11,681 or 0.41 percent of those employed were non-Nigerian females. The non-Nigerian females had a lesser fraction paid at 8,043 or 0.34 percent out of the total, while non-Nigerian males had the same fraction of 2.00 percent that were paid workers comprising 47,342 workers in 2013.

Overall, the genders and nationalities there were rises in the employed workers in the sector in 2014. Holistically, Nigerian males had the highest, which rose by 4.98 percent, or 112,785 persons employed and 9.01 percent or 172,097 persons engaged to reach 2,377,701 and 2,095,320 employees respectively. In 2014, out of 12,820 non-Nigerian had the highest percentage rise with females employed rising by 9.75 percent or 1,139 persons. In 2014, the highest rise in paid workers is a result of non-Nigerian paid employment with 11.04 percent or 5,227 workers reaching 52,568 employed (NBS, 2018).

In 2015, the rise in employment for Nigerian males continued in the manufacturing sector, although by a slight 0.16 percent or 3,733 persons, reaching 2,381,435 employed. However, despite the number paid for employment, it fails to maintain growth; it fell in 2015 by 6.56 percent or 137,455 engaged. For Nigerian females, decline growth was highest. There was 62,217 person or 10.79 percent fell to 512,642 from 576,868 persons. However, the decrease was by 14.59 percent or 58,123 workers in 2015 to 340, 335 from 398,458 in 2014 for the manufacturing sector employees. The only rise in engagement was non-Nigerian males, which rose to 61,765 paid workers from 9,197 workers or 17.49 percent in 2015, for those in paid in manufacturing engagement.

The employment of males in the Nigerian manufacturing sector has also been falling in 2015. It fell by about 7 percent. This is for the Nigerian nationality. However, the contrary is the case when we consider the non-Nigerians whose employment has been rising over the years in the Nigerian manufacturing sector. The expatriates appear to dominate the sector to date.

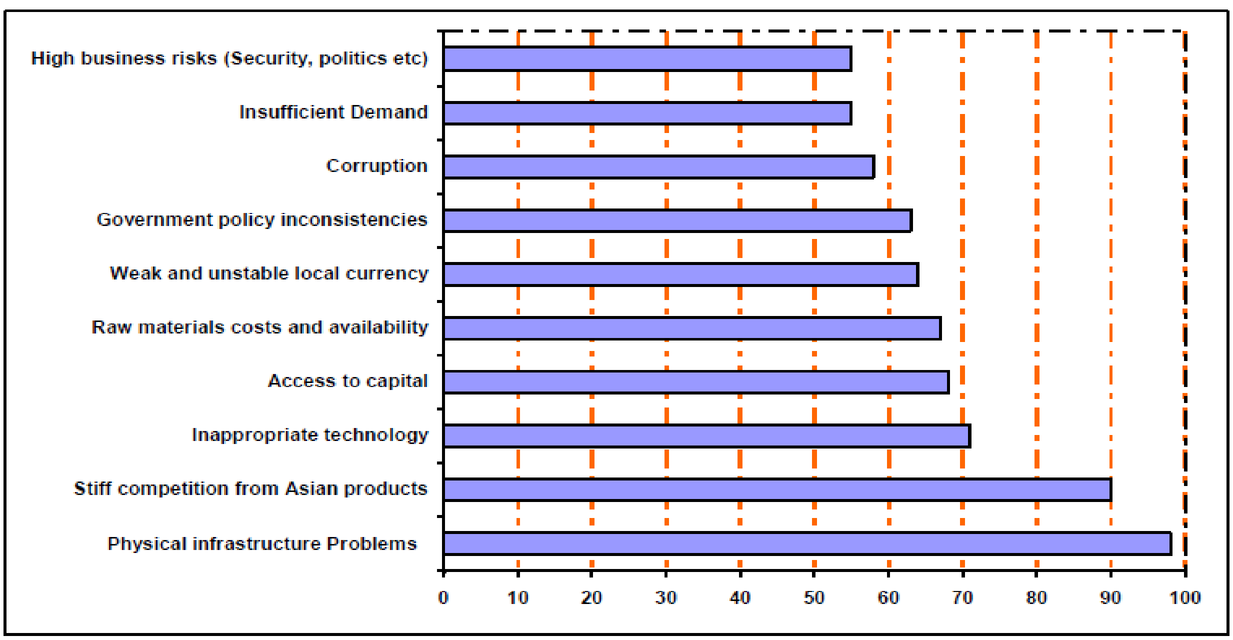
2.6 General limitations and challenges of the manufacturing sector

Over 40 years ago, the manufacturing sector's performance in Nigeria has shown signs of various challenges that acted as barriers to its growth. This was confirmed by several studies such as Teshome, (2014) Bennett, Anyanwu, and Kalu (2015), and Okon and Osesie (2017) who argued that some basic limitations are impeding the growth and development of the sector despite the proposed solutions. In an attempt to identify some of the core challenges, Bigsten and Soderbom (2006) and Adofu, Taiga, and Tijani (2015) conducted studies on the past and present conditions of the manufacturing sector.

Some of the reasons for the poor performance of the sector included poor sales due to the low consumers' purchasing power and boggled delays in clearing goods because of the presence of multiple inspection agencies at the ports (Matthew, Mark, and Han, 2011).

Bigsten and Soderbom (2006) used ten selected variables as shown in Figure 2.6. The result showed the recognized factors delaying manufacturing firms as physical infrastructure challenges (98 percent), rigid rivalry from Asian products (90 percent) and then unsuitable technology (71 percent), and many more as shown in Figure 2.6.

Figure 2. 6: Recognized Challenges Facing the Manufacturing Sector in Nigeria.



Source: Soderbom (2006)

In another study, Ayeni (2003), after analyzing the pattern of growth of the manufacturing sector in Nigeria, also identified the main challenges and analyzed their pattern of growth around the creation of the manufacturing sector in Nigeria. One of the factors that were identified that often impedes the growth of manufacturing was the severe infrastructural deficiency, which is a result of the inability of organizations and agencies charged to provide various infrastructures (Ayeni, 2003).

According to Chete, Adeoti, Adeyinka, and Ogundele (2014), manufacturers and investors complained about the inadequate motivation and encouragement for investors to have opportunities to invest in various manufacturing firms. Eventually, manufacturing firms can have opportunities to access funds needed not just to keep the operation of manufacturing running but also to operate productively.

Furthermore, other challenges that the manufacturing sector in Nigeria is facing are the ongoing improvement in technology because this international manufacturing market is heading towards a high level of competition (Akinmulegun and Oluwole, 2014). Similarly, Adenikinju (2003) criticized the government for the recent negligent performance of the manufacturing sector in Nigeria. He explained that the continued involvement of government in various issues in the sector reduces the role of the private sector.

Also (2000) examined the Nigerian business surroundings and discovered that the manufacturing sector's performance has been unknown to the point of being almost chaotic for many years. Adu, and Taiga, have echoed the same notion, and Tijani (2015), pointed out that it has not only been nearly chaotic, but it has also been very uncertain for many years. Away from the conclusion put forward by Olayinka and Abdullahi (2015), the low rate of capital utilization is another germane impediment that exists in the manufacturing sector in Nigeria. The study pinpointed important impediments in the manufacturing sector in Nigeria including the rate of capital utilization confirmed later by Ojowu (2003). Furthermore, there is total underutilization of resources as only 30 percent to 40 percent of the needed capital because of “frequent power outages, lack of funds to procure inputs, fall in demand for manufactured goods, and frequent strikes and lockouts by workers and their employers'' (Alos, 2000). Akinmulegun and Oluwole (2014), also pointed out another gross under-application of resources. They maintained that only 30 to 40 percent of funds are being used because of incessant power failure, inadequate capital to purchase raw materials, a decrease in demand for manufactured products, and incessant industrial actions by employees and their employers. Hence, some of the identified challenges include:

2.6.1 Funding

Inadequate access to funds has been an utmost impediment. Access to funding has accounted for about 47 percent of other problems (Nasir, 2011). According to Okon and Osesie (2017), a consequence of poor access to funding namely, a low investment makes it impossible for producers/manufacturers to purchase modern machinery, information technology, and human resource, which are important in minimizing the cost of production, increasing productivity, and enhancing competition. As per the credit issue, banks are scared to borrow short and long-term funds needed by industries, therefore, jettisoned the real sector and are not ready to make funds accessible to manufacturers (Ududechinyere, Eze, and Nweke, 2016).

2.6.2 Product flexibility and technology

Globally, the manufacturing sector changes because of development in technology in all countries (Chete, Adeoti, Adeyinka, and Ogundele 2014); some researchers have stated that the low level of technology is the highest impediment to the productivity in the manufacturing sector in Nigeria. Economies of the world are changing speedily hence, technological advancement and innovations are the main forces moving industrialization globally today (Sola, et al, 2013). According to Okon and Osesie (2017), rising in the mover of economic growth and societal progress hinges on innovation and new ideas. Okejiri (2003) disclosed that one of the highest impediments to an increase in productivity in the manufacturing sector in Nigeria is the lack of technology, as technological developments are changing the manufacturing sector in various parts of the world.

In the opinion of Chukwuedo and Ifere (2017), the emerging nations are keeping ahead with difficulties in the technological environment to maintain higher productivity and transform their manufacturing firm. Regrettably, consequent upon the fact that the manufacturing firms in Nigeria are not focussing much more on purchasing up-to-date equipment, they are still using the obsolete system and equipment dating back to the 1960s and 1970s (Adekoya, 1987), therefore affecting the growth of the sector adversely.

2.6.3 The high cost of raw materials

The rationale behind the lesser growth and performance of the manufacturing sector in Nigeria include inflated production costs ascribed to energy, rise in rates of interest and exchange, inferior goods from other countries, double taxes, and levies (Bigsten and Soderbom, 2006). According to Adofu, Taiga, and Tijani (2015), inflated costs of inputs both local and foreign also contribute to poor capacity utilization. According to CBN (2018) capacity utilization of industry in Nigeria was 55.5 percent in 2010.

2.6.4 Security issues

For anyone to invest his/her fund in product development and manufacturing, the entrepreneur's trust must be considered, which is a necessity for any product development, (Bennett, Anyanwu, and Kalu, 2015). An entrepreneur is an individual who establishes an activity that becomes a newcomer to the market (Oyati, 2010).

2.6.5 Inadequate academic research

One of the main challenges of the manufacturing sector is innovation. It is obvious that innovation comes via research and the Nigerian government has a custom that is very bad when it comes to research generally in Africa (Okon and Osesie, 2017).

Consequently, the dying manufacturing sector can be resuscitated by involving these institutions in a meaningful investigation that will be helpful. Research institutions could have assisted in the discovery of oil in the Northern part of Nigeria if well-funded since there has been a pre-exploration activity that confirms the presence of oil there (Emilia, 2016).

According to Sarah (2015), the research and development departments of the manufacturing sector should be established or improved for new technologies and new domestic raw materials to be found, tested, and used as concluded by the researcher.

2.6.6 Infrastructure

According to Teshome (2014), the huge infrastructural gaps in many of the SSA are a big problem for the manufacturing sector. Nigeria as a case study. For easy access to manufacturing sites and commodities markets, both raw materials and finished goods need a good working road. The present condition of roads in Nigeria and railways harms the manufacturing sector (Adofu, Taiga, and Tijani, 2015). Despite enormous allocation to capital projects most especially roads and bridges annually, it seems far away from the solution to decaying infrastructure (Chete, et al, 2016). Most companies who depend on road transport for their raw materials must shut down because of the delay in receiving their raw materials into their plants, which is a discouragement to the manufacturing sector.

2.6.7 Market challenges and tax regimes

According to Okon and Osesie (2017), the manufacturing sector is besieged by both ethical and non-ethical rivalry between old and newcomers to the marketplace for their goods. Close rivalry in the market places requests on innovative business models to survive. Reduction in costs relentlessly and profit margin close to zero is the only solution for manufacturing firms to flourish in these developing markets today (Emilia, 2016). In the opinion of Emilia (2016) Nigeria's tax era as they affect the manufacturing sector is uneven, unethical, and harmful for significant growth in the economy. Both double taxation and the imposition of levies on manufacturers discourage investment and give the feeling of systematic inequality (Teriba, 2015).

2.6.8 Trade policies

Economic development has been hindered and industries choked due to Nigeria’s trade policy. Without recourse to total effect on the local economy, import bans are most times forced and lifted (Chukwuedo and Ifere, 2017). The import ban list currently includes 25 groups of products whose restricted status hinders domestic development (Modebe and Ezeaku, 2016). As a result of varieties of challenges, the manufacturing sector in Nigeria needs to be reformed for many years because the sector has been impotent to support the economy as observed by (Nishimizu and Robinson, 2014). For instance, there is a need for a manufacturing sector to have policies that are friendly to the private sector so that the complete manufacturing process can be improved to a private sector level and therefore, the sector can have better capacity utilization (Teriba, 2015). There is a great need for various reforms in the sectors as it relates to manufacturing such as the power sector as pointed out by researchers. With the assistance of a reliable power supply, the manufacturing sector can perform therefore, the power sector begins to move forward effectively as mentioned earlier (Modebe and Ezeaku, 2016).

In the same vein, the improvement in the transportation and communication sector is very germane to the growth of the manufacturing sector including the railway and the telecommunication infrastructures.

2.7 Low growth and poor performance in the manufacturing industry

Over 40 years ago, the Nigerian manufacturing sector reveals that some crucial challenges have acted and still acting, as impediments to the growth of manufacturing (Bennett, Anyanwu, and Kalu, 2015). Despite past studies and planned solutions, other scholars have also argued that the main limitations hindering the growth and development of the sector Teshome (2014).

According to Matthew, Mark, and Han (2011), delays in clearing goods as a result of the evidence of double inspection agencies at the port and inadequate sales as a result of lesser purchasing power of the customers are the reasons for inadequate performance in the sector.

Furthermore, other difficulties faced by the manufacturing sector in Nigeria are the continuing technological development, as these are taking the foreign manufacturing market towards a greater height of competitiveness (Akinmulegun and Oluwole, 2014).

Havrylyshyn (1990) conducted a study and showed the main difficulties that act as an impediment to growth and good performance in the manufacturing sector in Nigeria. Similarly, the recent inefficient performance of the sector can be traced to the government (Havrylyshyn, 1990). The rise in involvement of government in issues concerning the manufacturing industry lessens the role of the private sector as added by the researcher.

Also (2000) examined Nigeria's business environment and noticed that the performance of the sector has been much undetermined, to the point of being virtually disorganized for several years. The rate of capital utilization is one of the important impediments to the manufacturing sector in Nigeria as pinpointed by the study and later confirmed by (Ojowu, 2003). In the manufacturing sector, there is total underutilization of resources at only thirty to forty percent of the required fund as a result of due to "incessant power failure, lack of capital to purchase inputs, fall in demand for manufactured goods, and incessant industrial actions by workers and their employers" (Alos, 2000; Akinmulegun and Oluwole 2014). Nigerian manufacturing sector's performance has been much undetermined, and almost disorganized for several years (Adofu, Taiga, and Tijani, 2015). Contrary to the conclusion given by Olayinka and Abdullahi (2015), another significant impediment that exists in the sector is the low rate of capital utilization.

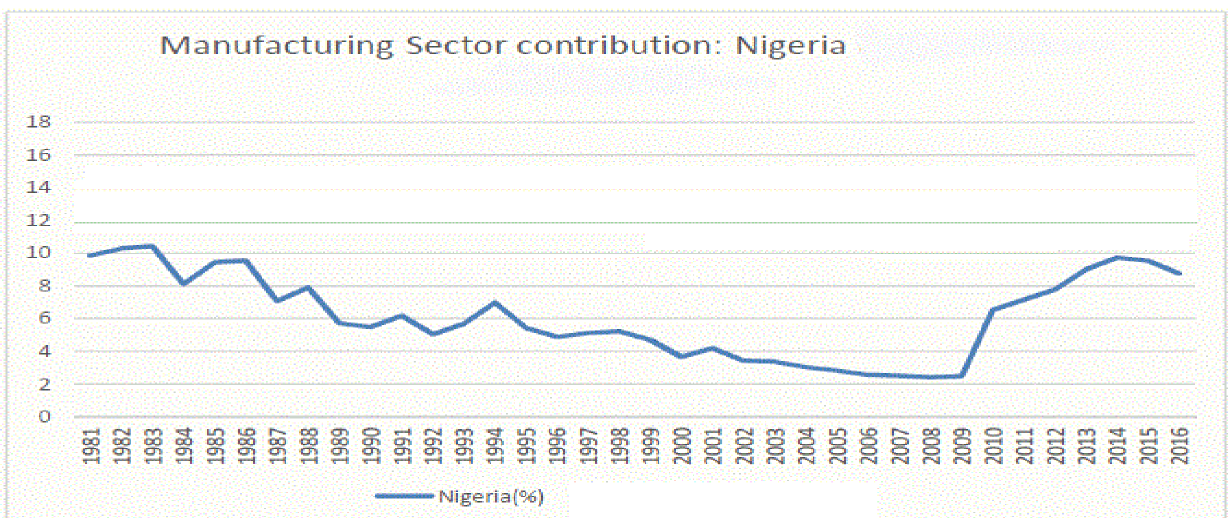
2.8 The success of Nigerian businesses

According to Chukwuedo and Ifere (2017), some firms in Nigeria are operating flourishingly and getting a great turnover on their investments via determined performance despite this risk in the business environment. The introduction of transparent management policies and acceptance of aggressive methods among others are the major factors that give achievement to these firms (Okon and Osesie, 2017). Although the manufacturing sector is expanding quickly yet it has failed immensely in its percentage share in the total GDP because of problems of the sector in Nigeria today (Herman, 2016). Over years since independence, the contribution of the manufacturing sector in Nigeria to GDP increased and decreased (Sarah, 2015). According to Teriba (2015), the contribution of the sector increased to 9.4 percent of the GDP in 1970. During the oil boom in 1973, it decreased to 7 percent but increased to 13 percent in 1980 at the height of the second oil boom (Modebe and Ezeaku, 2016).

2.9 Manufacturing output and economic growth

Over the years, the contribution of the manufacturing sector in Nigeria to GDP has not been stable. At independence in 1960 and 15 years later in 1970, it increased from an insignificant 4.8 percent to 7.4 percent respectively. The sector's contribution rose to its highest of 10.4 percent at the end of 1980 however, fell to 4.7 percent in 1990, ten years later. Ever since the fraction of manufacturing to GDP has fallen to 4.5 percent and 6.3 percent in 1992 and 1997 respectively. The lowest ever was recorded in 2009 at 2.4 percent while some fraction of 4.21 percent was gained in 2010 (CBN, 2012). These contributions continue to increase by 8.67 percent and 10.83 percent in 2012 and 2013 respectively (National Bureau of Statistics, 2014).

Figure 2. 7: The contribution of the manufacturing sector in Nigeria to GDP.



Source: Central Bank of Nigeria Statistical Bulletin Various Issues

The economic recession (2016-2017) also affected the manufacturing sector. There was an 8.7 percent decrease in industrial production in the Q4 of 2016. The average production growth from 2007 to 2016 was 1.35 percent reaching the height of 20.10 percent in Q1 of 2010 whereas in Q1 of 2016 a minimum of 10.10 percent was recorded.

In the same vein, there are unstable movements for the growth rate of the macroeconomic variables. There is evidence of problems in managing the components-macroeconomic variables such as inflation rate, interest rate, unemployment rate, exchange rate, and the endpoint of GDP. For instance, the interest rate increased from 12 percent to 15 percent in Q3 and Q4 respectively though connected with an unstable foreign exchange policy.

This was because of the fiscal authority policy of Nigeria of 'spend our way out of economic recession via expansionary government expenditure. This continued to lead to trending inflation all through 2016 as it was noted that there was an increasing consumer price from 12.8 percent in March, to 13.7 percent in April and 17.6 percent in September 2016 respectively. The main rate of inflation in Nigeria rose by 17.85 percent in 2017 January. In 2016 August, about 4.58 million were not employed (NBS, 2019). That is, the Figure increased to 13.3 percent in Q2 and then to 14 percent in Q3 from 12.1 percent in Q1. In 2016 November, the ratio put at 17.8 percent as Foreign Direct Investment (FDI) whereas portfolio investment fell by -23.75 percent and -9.49 percent respectively. The output from industry which was put at -10.1 in Q1 of 2016, increased to 0.1 percent in Q2 and fell to - 3.6 percent and -8.7 percent in Q3 and Q4 of 2016 respectively (Nigeria Industrial Production, 2017).

2.10 Appraisal of the manufacturing sector and monetary policy relationship

The manufacturing sector in Nigeria is very key to the economic growth of the country especially considering the improved clamour for economic diversification in recent years, Therefore, the relationship of the output of the sector with various macroeconomic policies like the monetary policy is very important. The Nigeran manufacturing sector has benefited from various monetary policy interventions of the CBN over the years and these efforts are continuing because the desired effect appears not to have been achieved.

For instance, the monetary policy authority in Nigeria devalued the naira in the second quarter of 2016 to improve foreign investment, especially in the Nigerian manufacturing sector (Olomola, 2018). During this period the effect on the sector was not vivid as the country was experiencing oil price shocks then which plunged oil prices to a decade low of about 30 USD per barrel. This affected the foreign exchange earnings of the country hence the implementation of monetary policy became very difficult and the manufacturing sector was among the sector bearing the brunt of this situation. During this period, the interest rate remains at 14% as the CBN continued the tight monetary policy approach to stem the rising tide of inflation rate then. This approach again reduced the loanable fund available to the manufacturing sector and on another side, this action reduces the performance of the manufacturing sector.

The manufacturing sector remains the engine room of any economy, from the literature the sector has been identified as a very important sector with the strongest influence on the level of economic development of a region (Anyanwu 2004). In many economies, the manufacturing sector's performance is the measurement for appraising macroeconomic policies' effectiveness. For government policies to be adjudged flourishing, they must positively affect the production and distribution of commodities. A dynamic and high-yielding manufacturing sector in an economy creates more economic linkages that promote both inside and outside balances.

According to Chukwuedo and Ifere (2017), stated that monetary policy is a key policy that is used to control levels of economic activities and it is very germane to the growth of the manufacturing sector. It is believed that variables such as interest rate, exchange rate, money supply, and inflation rate are within the control of monetary policy, and they are strongly attached to the manufacturing sector of any economy. This is because the changes in these variables affect the level of investment in the sector at any point in time (See Mishkin 2018, Falaye, 2019).

The investigation of the monetary policy impact on the manufacturing sector has revealed that the sector is very responsive to external shocks, especially in a country like Nigeria where their domestic economy is dictated by most of the external variables such as oil price and federal fund rate. These variables are uncontrollable factors to the economy and manufacturing sector due to its largely undeveloped nature Nigeria relies on international countries for both human capital and raw materials hence highly susceptible to external shocks.

For example, contractionary monetary policy might be weighed as an instrument to solve the increase in the rate of inflation from a common perspective. Still, this can be examined as exorbitant for particular sectors of the economy such as the manufacturing sector which relies on investment to develop well (Falaye et al, 2019). If this is the case, it is believed that monetary policy should show a kind of very influential effect that has widespread effects on general economic activities. The effect of contractionary tight monetary policy on the manufacturing sector is often greeted with sporadic effects on other sectors of the economy (Godslove and Chibuike, 2018).

2.10.1 Exchange rate policy and the manufacturing output

According to Adewuyi and Akpokodje (2013), a powerful and clear basis for investigating the impact of the exchange rate on economic growth has not been provided by the conventional growth theory framework. This is because the theories of growth such as Solow (1956) and Mankiw et al (1992) considered a closed economy. Additionally, as a result of the fixed exchange rate during this time, their theoretical model did not take care of the rate of exchange. In fact, with the emergence of globalization, the expanding linkage among countries, and the fall apart of the Bretton-Woods exchange rate system in the 1970s, various nations Nigeria inclusive, started embracing floating exchange rate (Ehikioya and Mohammed, 2014). Consequent to the unstable nature of exchange rates after embracing floating exchange rates, Aghion et al., (2009) emerged with a monetary theory of growth, which pinpoints that manufacturing productivity falls as the exchange rate becomes more volatile.

The rate of exchange remains an important variable that affects the growth of the Nigerian manufacturing sector. It should be noted that the naira as a currency can either depreciate or appreciate at any given time, either of these two there is an implication for the Nigerian manufacturing sector. For instance, if the currency appreciates it makes importation very expensive while exportation is very cheap this is very okay to prevent an influx of foreign competitive items into the country. However, the adverse effect is that most of the manufacturers in Nigeria rely on imported raw materials so as result they will be adversely affected too (King-George, 2013).

To appraise this hypothesis, annual times series data on manufacturing GDP, which is used to measure economic growth, exchange rate, private foreign investment, and rate of employment in manufacturing were gathered between 1986 and 2010 (Kimberly, 2018). Ordinary Least Square (OLS) techniques were employed using multiple-linear regression. Some interesting answers were obtained from this analysis. From the results, it was noted that the exchange rate had no significant effect on economic growth in Nigeria (Lawal, 2016).

The dependent variables in this study are the manufacturing sector growth and it is obvious that in the literature some of the drivers of these variables are employment rate in the sector, exchange rate, and foreign capital inflow. All these variables are strongly tied to exchange rate variations. From Olufayo and Fagile (2014) where the effect of exchange rate volatility was studied using the GARCH approach, it was found that the volatility in the exchange rate is very germane to the manufacturing output thus underscoring the importance of exchange rate in the manufacturing process in Nigeria. This finding was corroborated by the study (Nwokoro, 2017).

As long as manufacturing productivity growth changes to the overall growth of output, it can be concluded that because of exchange rate volatility, leads to a reduction in manufacturing productivity growth, which changes into output growth reduction (Olayinka and Abdullahi, 2015).

Aghion et al., (2009), further pinpoint that via the accessibility of capital in the credit market, the effect of the exchange rate on output falls. On the other hand, the monetary growth theory propounded by Bakare-Aremu and Osobase (2015), reveals the functions of financial development in minimizing the impact of exchange rate volatility on output growth via the provision of capital. Unreliability in the real exchange rate can harm both local and foreign investment decisions. Lowering of production is a result of establishing an unreliable environment for manufacturing investment and this could change the redistribution of resources between sectors and nations, export and imports (Azid, et al, 2005).

In as much as manufacturing companies in Nigeria rely on foreign raw materials and technology for the creation of goods and services, the control of the exchange rate volatility through the exchange rate target has been given precedence by CBN. Hence the importance of exchange rate volatility on manufacturing production cannot be overemphasized (Falaye et al, 2019). Exchange rate fluctuation could make the production cost high and more uncertain. It is, therefore, clear that manufacturing sector growth will be impeded by exchange rate fluctuation (Chinyere, Michael, and Emeka, 2018). This is presumed on the impact of output growth on the long-run living standard of a nation's citizenry and the adverse effect of exchange rate fluctuation on the growth of manufacturing output. To reduce the dependency ratio of the manufacturing sector on foreign raw materials, CBN must control the fluctuating nature of the exchange rate (Nwokoro, 2017). In addition, this has forced the CBN to intervene in the foreign exchange market for two years so that the stabilization of the currency can be facilitated.

2.10.2 Inflation rate policy and the manufacturing output

The priority of the Central Bank is to achieve a single-digit inflation rate. This is called the inflation-targeting approach of the monetary policy. It is expected that a sable price will guarantee sustainable growth in the real sector of the economy including the manufacturing sector. Inflation according to Ahlgrim and D'Arcy (2012), represents changes in the general price level in an upward manner that is consistent. Normally when there is a rise in inflation the purchasing power of money falls and hence, we have more money chasing few goods. This portends great danger for the growth of the manufacturing sector who depends heavily on raw materials that are mainly imported. Again, there is the tendency of the CBN to create price stability via monetary policy to stabilize the economic growth of the country, however, this tendency can only be effective on growth if the real sector economy feels the effect first (Kasidi and Mwakanemela, 2013).

Consequently, over the years, the activity of the CBN has been focused on reducing the Nigerian headline inflation rate to promote the growth of key sectors of the economy like the manufacturing sector. According to CBN (2014), one of the major challenges of the manufacturing sector in Nigeria has been and remains the rising cost of production. The inflation rate remains the major cause of the rising cost of manufacturing production and the ability of the CBN to follow the inflation targeting policy very well is a good antidote for the high cost of production as this translates into improved manufacturing output in Nigeria (Falaye, 2017).

Hence maintaining price stability is key to the Nigerian monetary policy. Stability in the Nigerian context is a condition where changes in prices over a long period are low but does not mean a condition where the price remains unchanged (Anyanwaokoro, 1999). There are three main methods of measuring inflation namely, the consumer price index (CPI), wholesale price index, and the gross national product implicit deflator. Inflation in Nigeria is measured by CBN using CPI as a method (Adofu, Taiga, and Tijani, 2015). This method is also adopted in the USA and other advanced economies. The CPI is an important variable used in measuring the rate of inflation and the rise and fall dictate the pace of the economy. Mostly the relationship between output growth and inflation is non-linear which shows that the rise in Inflation might not be significant to output growth initially but at the time the period persists, the rise becomes more significant, and it is evident in the growth of the economy (Georganas, Healy and Li, 2014). Notwithstanding inflation rate can be growing and output to be growing simultaneously. Some countries have witnessed an inflation rate in the region of 20 to 30 percent and yet the economy is growing, while the study of Alade (2015) emphasised the need for a trade-off between some monetary policy targets at a particular period. In some other related studies like that of Bawa and Abdullahi (2012). The level of inflation that will not be inimical to the growth of the Nigerian economy was estimated to be 13 percent. This is in the quest of the study to examine the inflation threshold for the Nigerian economy during the period the study was conducted.

Some studies propose a unidirectional causality, while some show bidirectional or even no causality between inflation and manufacturing activities. Understanding these clear arguments has offered diverse policy options for the CBN, which in summary culminates in the fact that a tight monetary policy can reduce the inflation rate and hence leads to price stability, which will, in the long run, promote the growth of the Nigeria manufacturing sector. The CBN monetary policy intervention over the years, especially for the past three years, has been more contractionary than expansionary. This is in a bid to reduce the trend of the rising inflation rate, which has affected the manufacturing sector's growth adversely.

2.10.3 Interest rate

In 2016, the interest rose within the first quarter of the year, and it was revealed that fiscal authority in Nigeria increased government expenditure during this period to move the economy out of recession (Chinyere, Michael, and Emeka, 2018). This further ran inflation all through 2016. This led to a rise in consumer prices to 13.7 percent in April and 17.6 percent in September from 12.8 percent in March 2016 period the main rate of inflation rose by 17.85 percent in January 2017 as the same period in 2016 (Falaye et al, 2019). However, 4.58 million were unemployed as of August 2016. In terms of ratio, the Figure increased from 12.1 percent in Q1 and 13.3 percent in Q2, and 14 percent in Q3. According to Kathleen (2018), this ratio was dip further due to the fall in foreign private investment and industrial output (Nigeria Industrial Production, 2007 to 2017).

2.10.4 Private sector credit and the manufacturing output

According to Chinyere, Michael, and Emeka (2018), the transformation of primary products into the finished ones is called the manufacturing process; it starts from the small scale to the large-scale segments. The dominant small manufacturers are in the eastern part of Nigeria. These companies are locally based, and they produced some of the goods that are imported from abroad. The skills of these groups of firms are largely untapped and undeveloped due to a lack of government assistance in form of credit facility provision and policy aids. The discovery of oil in Nigeria further compounded the woes of this sector as it was neglected. Attentions were shifted from the real sector where the agriculture and manufacturing sector were moving the economy before the independence to the oil sector. This move aggravates the problem of the sector and makes it less competitive in the World. According to Bakare-Aremu and Osobase (2015), in most developing nations, Nigeria's inclusive, inadequate access to production capital has been condemned for lack of growth in the sector. In Nigeria, opinion has it that poor funding and exorbitant rate of interest are the main hindrances of doing business as complained about by administrators of companies. Corroborating the same school of thought, a study by the Federal Republic of Nigeria (2011), discovered that the movement and quality of capital from a financial institution to the private sector fell drastically as the risk aversion of the financial institution rose due to the repercussions of the financial meltdown. According to Kathleen (2018), the important elements in cutting costs, increasing productivity, and enhancing strong competition, however, the cost of capital that is needed for manufacturing production is too expensive and this is one of the most serious negative drivers of the sector. The paucity of funds for the sector squeezed the sector out of the competition to contribute to the economic growth of Nigeria. The private sector credit in 2018 and 2019 can be obtained at around a 30 percent lending rate. This rate is termed too high by some investors, and one can wonder how the manufacturing sector can survive under such a high cost of capital. The tradable sector of the Nigerian economy as a whole was squeezed out of the market by the hugely needed funds that are missing.

The adverse effect of the paucity of the fund is manifested in the drop in capacity utilization and the investment generally in the manufacturing sector of the economy. All CBN policies to introduce credit rationing to promote funds availability to the sector remained a mirage as corruption, on the part of most of the financial intermediaries did not allow the efforts of the Central Bank to be fruitful. The banks prefer to loan money to the customer with a huge interest rate to be paid and this does not bode well with manufacturers. In the early 2000s, the growth of the manufacturing sector started falling after a short recovery from the economic recession of 2016. However, the recovery was short-lived due to a lack of adequate funds for the sector during this period and hence the performance of the sector and the contribution to the economic growth of Nigeria took a big hit.

Even though monetary authority classifies the sector as predominant, the sector has other challenges aside from amenities such as strangulating high-interest rates and the non-willingness of a bank to lend to the sector. Following the adverse state of the economic indicators, the contribution of the manufacturing sector to GDP in 2013 was put at 4.23 percent.

The Nigerian manufacturing sector has a wide potential for economic development because enough workers joined with the agrarian nature Nigerian economy (Adebiyi, 2011). Unfortunately, the absorptive volume of workers anticipated from the sector and spill over impact has not given the required result. Efforts to promote the manufacturing sector include the import substitution approach. However, the effort failed to yield the required and needed result due to a lack of funding in the sector. The objective of the monetary authority to follow a credit line that is production driving are constantly sabotaged by some financial intermediary who tries to maximize their profit by diverting these funds to other sectors that can meet their high-interest payment. The manufacturing sector remains largely unattractive to the bankers to enjoy loans from them. All these issues compounded the problem of credit availability to the sector.

Additionally, despite the different motivations from the government, the sector had not recorded an encouraging performance in sourcing domestic raw materials with a rise in foreign exchange revenue over time (Akinmulegun and Oluwole, 2014). Recently, most companies in the manufacturing sector in Nigeria have been known for a fall in the rate of output growth due to the perennial problem of lack of finance and competition from the importation of finished products from abroad. The slow performance of the manufacturing sector is very evident in the drastic fall in capacity utilization since they are unable to compete with the goods that are imported hence many of these firms folded up (Tomola et al., 2012). The fall in investment in the manufacturing sector has been attributed to the lack of dedication on the part of the commercial banks to the policy of credit rationing by the CBN. While this might not be generalized as some commercial banks are giving support to the manufacturing sector, the number is not significant
(Anyanwu, 2004).

Table 2. 1: Sectorial Distribution of Commercial Banks Loans

Sector	Av. Ann Total	Agric	Man.	Mining	RE and C	Product	Miscel	Svs others	Total
Period	N'Million	percent share	percent share	percent share	percent share	percent share	percent share	percent share	percent share
Pre-SAP 1970-79	3,952.9	2.3	12.5	0.9	8.9	24.7	1.8	73.5	100.00
Pre-SAP 1980-85	11,978.3	7.2	23.7	1.0	17.1	49.0	4.7	46.3	100.00
Post – SAP1986 -93	32,053.4	14.7	31.0	1.6	11.0	58.3	5.0	36.6	100.00
RefmsLeth1994– 1998	202,177.9	13.0	34.7	8.7	0.0	54.7	34.6	10.6	100.00
Pre-Soludo1999-2004	3,248,367.7	6.1	25.0	8.3	0.0	39.4	57.2	3.4	100.00
Soludo 2004	5,686,669.2	4.6	23.0	9.1	0.0	36.7	39.4	2.2	100.00
Post Soludo 2005	7,392,670.0	3.8	19.9	9.1	0.0	32.8	36.7	1.7	100.00
Post Soludo 2006	9,684,397.7	3.2	16.9	8.0	0.0	28.1	28.1	1.3	100.00

Source: Computed from CBN Statistical Bulletin

The credit survey in the Nigerian economy during the initial period after SAP showed a positive horizon. During this period, there was an increase in credit allocation to both the agricultural and manufacturing sectors. However, within the period of transformation lassitude, diverse lending crowded out production credit, up until the post-Soludo era and it recorded almost 70.6 percent of the whole credit. Whereas it is contended that reforms after Soludo's regime have helped to enhance and encourage a competitive and vigorous financial system, it is arguably important to note whether the standing of their investment portfolio has the strength to accommodate the needed economic development as opined by the pioneers.

It can be seen from Table 2.1, that indicates notwithstanding the fast-rising lending in the economy, the portion of real sectors in the economy particularly manufacturing and extractive sectors continued to be low and in fact, declined regularly with time meaning that the new loans might have been channelled to miscellaneous events.

2.10.5 Significance of the manufacturing sector to the economy

The manufacturing sector is not a major propeller of the developed nations' economy of developed nations Falaye, (2017). The Verdoorn's (1949) and Kaldor's (1975) laws, however, confirm the crucial significance of the manufacturing sector to the underdeveloped nations' economies. The major conclusion is that increase in the productivity of labour in the sector leads to the growth of manufacturing productivity as a result of the impact of the improved output of higher production technological development (Kathleen, 2018). This position has also been reinforced by (Thirlwall, 2013) who postulated that the productivity-enhancing innovations and technologies deployed in the manufacturing sector engender economies of scale in greater proportion than the spill-over effects of both the service and agricultural sectors. Over the years, the contribution of the manufacturing sector in Nigeria towards GDP growth has been fluctuating generally as noted by (Kimberly, 2018). From a paltry 4.8 percent at independence in 1960, in 1975 it increased to 7.4 percent, fifteen years later. However, its contribution decline to 5.4 percent by the end of 1980 and increase sharply to 10.7 percent, after 5 years precisely in 1985. After which, the share of GDP from the manufacturing sector continues to drop: 1992 (7.9 percent), 1997 (6.3 percent). In 2001, 3.4 percent was the lowest recorded, however, the fraction of 4.21 percent was accomplished in 2009 (CBN, 2012).

According to Lawal (2016), the important connection between exchange rate, external reserve, and inflation rate shows the power of the indicators as vital instruments in transferring monetary policy drive to connect the manufacturing sector in the case of Nigeria. The significant nexus between exchange rate, external reserve, and inflation rate reflects the power of the indicators as crucial behaviour in transferring monetary policy drives to the manufacturing sector in Nigeria's scenario (Lawal, 2016). Contrarily, the non-importance association between interest rate and money supply in Nigeria discloses the importance of monetary policy impotent in affecting the aforementioned microeconomic indicators to enhance manufacturing sector performance (Kimberly, 2018). It could be a consequence of the superiority of fiscal policy, particularly public expenditure in invigorating such macroeconomic indicators (Kathleen, 2018). Furthermore, the poor nature of banks in transferring the monetary policy to the best variables in the economy led to an unimportant relationship between these indicators, which normally boost the development of the productive sector like the manufacturing sector (Okon and Osesie 2017).

Falaye et al (2019) confirmed the adverse nexus between the fluctuation of export performance of oil and non-oil sectors and exchange rate through time-series data between 1980 and 2011, although it is empirically insignificant, and it as well revealed the important impact of the flexible exchange era in Nigeria. Hence, the adoption of a non-fixed exchange rate influenced the non-stability of the exchange rate in the country. This is in accord with the transfer from the fixed exchange rate to the flexible exchange rate, which brought about variability in the exchange rate (Chinyere, Michael, and Emeka, 2018, Aremu and Osobase, 2014). Furthermore, Ehikioya and Mohammed (2014), the adverse link between the exports and exchange rate fluctuation in Nigeria brought about an impulse towards localization of resources of the country, via domesticated policy to improve the domestic utilization of the country's numerous assets and modification of the export strength of the country.

2.11 Special monetary interventions in the manufacturing sector

The Central Bank of Nigeria (CBN) via its development finance plans has intervened in the manufacturing sector in Nigeria. Small and Medium Enterprises (SMEs) that are manufacturing companies have been the focus of development finances over the years. These interventions come in form of selective credit control, and specialized financial development targets for the sector among others.

2.11.1 CBN Development finance in SME (Manufacturing firms)

SMEs are important to the economic progress of a nation as they exhibit high capacities for job creation, improving home-based technology, productivity variation, improved homegrown skills, and outsourcing with all-encompassing businesses. In Nigeria, the SME manufacturing sub-sector has not been performing to expectation, which has reduced its influence on economic growth and development. The main concerns/challenges hampering manufacturing companies that are SMEs in the countries are categorized into four namely, hostile business environment, no access to modern technical expertise, poor funding, and poor managerial acumen (FSS 2020 SME Sector Report, 2007).

Of all these, lack of funding is a major concern. Universally, due to the anticipated risks and uncertainties in the manufacturing sector of Nigeria, commercial banks that maintain the largest source of capital for SMEs have been protected.

In Nigeria, the weak economic atmosphere and lack of required social amenities made manufacturing practices exorbitant and ineffective, thus disrupting their credit competitiveness.

However, CBN has disbursed the sum of N500 billion investment in debenture stock to be distributed by the Bank of Industry (BOI) starting from May 2010 to enhance opportunities to fund manufacturing firms SMEs. Firstly, N300 billion will be used for energy generation and N200 billion for the refinancing/restructuring of the banks' outstanding loans to the SME/manufacturing sector in Nigeria.

Hitherto, re-financing and restructuring of bank loans to the manufacturing sector has been provided by the Bank in a total balance of N200 billion, whereas the ones for the energy sector will be provided at future date.

The aims of the 200 billion refinancings and reform of banks loans to the manufacturing sector are to:

- Accelerate the development of the SMEs and manufacturing sector of the Nigerian economy.
- Enhance the financial position of the deposit money banks.

In line with the aims, an N200 billion Small and Medium Enterprises Credit Guarantee Scheme (SMECGS) has been created by the bank, for assisting opportunities to fund SMEs in Nigeria. The Scheme is funded by the CBN as specified in the procedures

The aims of the SMECGS are to:

- Establish a formidable link between banks, SMEs, and manufacturers on credit transfer.
- Expand the opportunity for supporters of SMEs and manufacturers to credit.

- Provide enabling environment for industrialization in the Nigerian economic space.

The general objective of the three ideas above is to enhance productivity, create jobs, expand the revenue size, rise foreign exchange incomes, and affordable raw materials for the manufacturing sector towards sustainability.

2.12 Economic shocks

Economic shocks can be in different ways. A supply shock is also a result of limited supply. The supply of staple goods and services like oil may experience shock, which can lead to an uncontrollable rise in prices, making it exorbitant to apply for productive purposes. These can be manufactured, frequently, through misfortunes and adversities (Agbede, 2013). The last economic meltdown worldwide happened which equally led to the collapse of oil prices and other goods and services. The price of oil collapsed to as low as $40/barrel from over $140/barrel in a matter of days in 2008-2009. Since a country has challenges in importing foreign goods, the quick currency devaluation tends to encourage shock for the industries at the country's borders. Going by the instability of the naira in 1986, a policy-induced by SAP, due to an unstable exchange rate has become a recent issue in the Nigerian case. However, the economy's objective is to have a stable exchange rate with its trade partners. According to Umar, Aliyu, and Ahmed (2017), this objective could not be achieved in Nigeria after the authorities applied currency devaluation to stabilize the exchange rate and encourage export. The inability to achieve this objective brought about continuous fluctuation in exchange that affects the productive sector performance in Nigeria. The low and slight productive size of the sector with the growing cost of importation necessitated the devaluation of the Naira and equally made it stronger. The monetary authority arranges several rates of exchange policies to curtail this trend and secure exchange rate stability (Okeke, 2015).

However, a very small accomplishment was done in sustaining the exchange rate. Because of this, the challenges of unstable exchange rates continued in macro-economic management. The exchange rate policy is a crucial instrument obtained that indicates how the exchange rate has important effects, on income distribution, the balance of payment size, and the growth of a country. This is expected that its conduct predicts the conduct of many other macro-economic indicators (Oyejide, 1985). Productivity size is disrupted by technology progress, which is due to a technology shock. The sharp rise in prices of commodities increase (i.e., due to poor distribution of subsidies or supply shock) is called inflationary shock, especially when the rise in prices of goods and services does not move along with the country's minimum wage. It can reduce consumers' purchasing power, which may occur on bigger scales, as well as the production cost falling below statutory revenues, basically for the same factor (Oriakhi, and Osaze, 2013).

The transferring process via which the price of oil has posed actual economic transaction comprises both demand and supply channels (Olomola, 2007). The supply-part impact is connected to the truth that the basic input to production is crude oil, as a result, a rise in oil price results in to increase in the cost of production that induces firms to lessen output. Changes in the price of oil also involve demand-part impacts on consuming and investing. Hence, the effect to which oil prices fluctuate might influence the economic processes either positively or negatively lies on which side of the channel that the economy operates as well as the extent of price change (either rise or fall in price). Nevertheless, because the main Nigerian exports are crude oil, with imports premium motor spirit qualifies her as both an oil-exporting and oil-importing nation (Chuku, 2009).

Monetary policy shocks happen once the Apex Bank deviates, without real warning from a suitable pattern of either increasing or decreasing interest rate, or control of currency in circulation. To keep long-run information, the study applied the Unit Root Stationarity test to avoid spurious regression results, correlogram, and Granger causality tests. The result revealed that in Nigeria, the major monetary policy instruments are interest rate and liquidity, which were used in checkmating inflation, whereas the inactive monetary tools are cash reserve ratio, broad money supply, and exchange rate. Chuku, (2009) studied how monetary policy shocks influence Nigeria’s output and prices through Structural Vector Autoregression (SVAR) model. The postulation that the Apex Bank cannot spot unforeseen disruption in output and prices at the same time was validated, hence putting a recursive limit on the disturbances of the SVAR (Danjuma et al 2012).

2.13 Structural adjustment programs and Nigeria's manufacturing sector

The intention of the IMF in 1980 by introducing the Structural Adjustment Programme in the African continent was to fast-track the rate of economic growth after the economic downturn of many African countries during these periods.

The adoption of SAP from the IMF during this period was premised on a fall in output and inconsistent growth rate witnessed immediately after the oil price glut then. The fall in aggregate output necessitated the adoption of SAP to improve the real sector, galvanized the economy, and restore it to a sustainable growth trajectory. The manufacturing sector remains one of the important sectors primed to benefit from SAP, especially from the window of economic deregulation (Kayode, 2010). The monetary policy intervention at the inception of SAP included the deregulation of key monetary variables like interest rates. The manufacturing sector was to benefit from the interest rate deregulation as the loanable fund's accessibility will now be determined by the market forces and hence create optimal utilization of funds and increase access to funds by the manufacturers.

After about a decade of SAP has been adopted, the effect on a key sector like the manufacturing sector remains invisible. According to Anyanwu (2018), this was because other factors that can aid the growth of the sector were not put in place. The infrastructural deficit in the economy continued to rise and enabling an environment that would have aided output growth despite the monetary policy rate deregulation was not there (World Bank, 2018). According to Adebayo (2019), the effect of SAP on the manufacturing sector in Nigeria has been short-lived because the program was haphazardly implemented and other factors that could aid the output of the sector which could stem the rising cost of production were not present.

The main aim of the IMF was to adjust the imbalances that were prevalent in the continent and the main cause of the imbalance then was the ownership of main production factors by the public. Public expenditure during these periods was the main driver of the economy and it is the main component of the GNDP (Krugman and Obstfeld, 1991). During this period the African countries were practicing both fixed/flexible exchange rate systems where they fixed their currency against the US dollar thereby overvaluing their currencies.

However, they still allow the forces of the demand and supply in the foreign exchange market to play their role but with a benchmark set by the countries. This situation led to the existence of a black market for buying foreign currency and it led to two parallel exchange rates for most of the currency. The inadequacy of the local currency to meet up with the pace in the foreign exchange market led to the printing of fiat money by many African countries. This further compounded the inflation rate at this time and further led to a devaluation of the domestic currencies. These scenarios led to many other macroeconomic problems as well as political issues for most of the countries in the continent during this period (Krugman and Obstfeld, 1991).

Another issue with the African governments was the manipulation of the lending rate by the government without recourse to the forces of demand and supply in the loan market. The essence then was to make funds available for investment purposes for the private sector and get money to fund many government projects that do not have an impact on the people. At this moment, the banks bear the brunt by offering loans at a non-competitive interest rate thus leading to the compilation of taxes from the government without adequate returns from their loans (Krugman and Obstfeld, 1991).

To ameliorate these sets of problems, the IMF introduces SAPs with some conditionality to reign in the African economies. These policies included the liberalization of the African economy, promoting the rate of investment, and correct the overvaluation of currency through devaluation, reducing the inflation rate via some control measures, cutting state expenses, and promoting domestic exports by encouraging local outputs (Chabal and Daloz, 1999).

The main tool of SAP is embedded in the reduction of the control, of the government in the market. This is to be achieved through price and demand controls as well as currency devaluation. This is believed will ensure the transfer of foreign resources to most of the poor African countries and thus underscores the importance of the whole exercise of SAP.

From the analysis of Sandbrook (1991), from the 45 countries in the SSA 35 adopted SAP, and after twenty years it was discovered that the program has failed because the economic conditions of these countries have not changed in fact, they became poorer than before the SAP. The main problem was the implementation of the policy and the role of the government in the implementation of the program, which did not give room for all conditions to work appropriately. The public debt in these countries has multiplied during the period of adoption of SAP, if not for the intervention of the G8 countries recently that granted debt relief to some African countries the situation would have worsened.

All those backup theories on which the introduction of SAP lies have remained the bedrock of the problem of the program. They form the main reasons why the program failed woefully in the African continent. However, it is not yet clear if the African countries have learned anything at all from the evil bestowed on them by SAP as the economic woes of the continent continue.

2.14 Monetary policy transmission mechanism MTM and manufacturing sector output in Nigeria

The monetary policy transmission explains the indirect transmission mechanism of monetary policy and by extension, policy shocks. In its simplest form, a change in the money supply results in a change in interest rates and subsequently a change in income and real variables including real output (Brunner and Meltzer, 1997). In Nigeria, it implies that the monetary authority that is the Central Bank of Nigeria (CBN) can administer a shock to the monetary sector by changing the money supply, which in turn results in a change in interest rates, and subsequently influences the real sector, commonly known as the goods sector. Through this impact on interest rates, the MTM links two sectors, namely the financial or monetary sector and the goods or real sector. In the Keynesian tradition, other real forces of output and expenditure or injections and withdrawals, apart from interest rates, also have roles to play in the determination of income. Interest rates on their part do not operate in isolation but are themselves determined by the same real forces. Another notable feature of MTM is that it is comparatively static, equipped for the calculation of equilibrium values of interest rates and income rather than focusing on the process of adjustment to a new equilibrium. The model can be employed for an illuminating accurate investigation of the effectiveness of the monetary policy in Nigeria which is one of the main focuses of this study.

It would, therefore, imply that the impact of any change in the money supply by CBN on income would depend on:

i) How large a change in interest rates is generated by a given change in money supply and,

ii) How large a change in the level of aggregate expenditure (demand) is generated by this change in interest rates, i.e., the size of the interest elasticity of expenditure (see a succeeding section for deficit finance theory). These channels of transmission, i.e., from money supply to interest rates and subsequently to aggregate demand (income), could determine the effectiveness of the monetary policy. For example, if the impact of a change in money supply on interest rates or the impact of a change in interest rates on income or both combined are insignificant, monetary policy will be relatively ineffective.

According to Ireland (2005), there are systems through which policies meant to induce some changes in both money supply and the short-term interest rate affects the real variable in the economy. This system is known as the monetary transmission mechanism. The effect on the real variables produces a reaction from the general price level. The chains of reaction and the system through which this would occur are called the channels of transmission. Mishkin (1995) identified the following channels.

(a) Credit Channel
(b) Interest rate channel
(c) Asset Channel
(d) Exchange rate channel
(e) Expectation Channel

All the above channels play important roles in transmitting changes in monetary policy to the real variables in the economy. The discussion starts with the Credit Channel

2.14.1 Credit channel

The credit channels as described by Bernanke and Gertler (1995 are the balance sheet and the bank lending channels. The bank lending channels are mainly controlled by the financial institutions that provide financial services majorly credit facilities to households, SMEs, and other smaller units of the economy. The main features of this unit are the fact that asymmetric information exists in the process of obtaining loans from banks. The process is that for instance an increase in the interest rate will lead to a reduction in both bank reserves and deposits hence limiting the money available for credit facilities provided to the populace. However, other forms of external finance during this period gained momentum as people consider other forms of a source of finance. The balance sheet channels on the other hand use the net worth of the collateral used for the loan and the net worth of the business. A tight monetary policy reduces the net worth of the loan collateral. This creates risk in the adverse selection, as the losses might be very high. Apart from this, since the net worth of the firms has fallen it reduces the stakes of the owners and hence spurs engagement in very risky investments leading to moral hazard issues. The moral hazard issue implies that it reduces loan supply as well as outputs. The only exception is the fact that this situation can be shifted to debt burden. The increase in debt burden will lead to lower investment as well as outputs.

2.14.2 Interest rate channel

The channel is one of the most prominent channels of transmission in the monetary mechanism. It borders on the decision of the monetary authorities to manipulate the short-term interest rate in the face of rational expectation as well as a sticky-price regime. The long-term interest rate is also affected at least temporarily.

During tight monetary policy, the short-term interest rate rises, and since the sticky price assumption holds the real interest rate rises thus causing a reduction in the general level of investment and output. This is very evident in the fact that this process will lead to a higher cost of funds. The investment that is affected by this includes the firm's investment, household consumption, and inventory investments among others. All these falls with the resultant effect on the output level also have a reducing effect on the general price level because the inflation rate will fall as well.

Although for these channels to be efficient, some factors are very important. The interbank interest rate, as well as the client interest rate, are necessary to ensure the efficiency of the interest rate channel. According to Mukherjee and Bhattacharya (2011).

The banking sector must be liberalized before the credit channel can be effective in the transmission of monetary policy to the real economy. Another vital condition for the effectiveness of this channel is that the real sector must rely on funds from the banks for their operations. However, these assumptions might be weak because the structure of the economy in question matters. The sensitivity of interest rate to consumption as well investment or the marginal propensity to consume all has a role to play in this situation.

2.14.3 Asset price channel

The concept of the asset price in the monetary transmission mechanism is mainly described in the Tobin q theory of 1969. The q means the ratio of the market value of a firm to the replacement cost. Therefore, an increase in the interest rate leads to a fall in the price of bonds. This increases the demand for bonds and equity is abandoned. During this period, the prices of equities fall as well which leads to a reduction in the value of q, which in turn leads to lower investment expenditure and ultimately output fall in this scenario. Modigliani (1971) in his life cycle hypothesis also explains how the asset price affects the real variable. According to this theory, the future consumption of an individual existing for a lifetime period depends on the resources gotten in the lifetime of the individual. The lifetime resources described in this theory include financial wealth comprising mainly of stocks. Tight monetary policy will cause the resources that are the financial wealth to fall. This implies that financial resources available for the lifetime period of the individual also fall. From another perspective, Meltzer (1995) posited that the tight monetary policy causes the prices of the land and properties of the households to fall thus leading to a fall in the financial wealth of the households. The effect of this is that investment falls and output falls as a result.

2.14.4 Exchange rate channel

Globalization has led to an increase in the effects and the role of the exchange rate in the monetary transmission mechanism. The practice of a flexible exchange rate is an important factor that drives the exchange rate channel. According to Batini et al (2001) whenever there is an increase in the domestic interest rate during the tight monetary policy compared to the foreign interest rate, there is going to be a shift in the foreign exchange market equilibrium, which will necessitate the domestic currency to fall in reaction to this action of the monetary authority. Notwithstanding, the process requires that the domestic currency rises first before the depreciation occurs (Ireland, 2005). The appreciation of the domestic currency causes the export to be expensive in comparison to imported goods, the effect of this is a fall in the net export, which will also lead to a fall in domestic production and consequently, output reduction. By extension, Nell (2004) emphasized that this situation can cause an imported inflation scenario in a way that foreign inflation affects domestic inflation.

2.14.5 The channel of expectations

This channel has to do with the devaluation of the expected macroeconomic variables in the future. The current and past values of macroeconomic variables are put into consideration by economic agents. This decision is guided by past monetary policy. Under the assumption of optimistic economic agents where they are optimizing their both current and future investments then, expectation play important role in their decisions to invest. This is embedded in the role expectation plays in the actual investment as well as consumption and by extension output. However, this channel relies much on the moral and psychological states of mind of the economic agents toward the monetary policy of the Central bank therefore it is important that the monetary authority need to gain the trust of the economic agents in expectation to play the required role in the monetary transmission.

2.15 Summary

This chapter has discussed and reviewed monetary policy and manufacturing sector output in Nigeria. The emphasis of the discussion in this chapter revolves around the trend of output growth in the manufacturing sector, the structure of the sector, inputs in the sector, employment in the sector, and other indicators of the performance of the manufacturing sector are also overviewed under this chapter.

The discussions in this chapter have also shown that the association between monetary policy and Nigerian manufacturing sector growth appeared not to be the best one expected. It is evident from the various interventions of CBN via monetary policy with a less than expected impact on the manufacturing sector's growth.

In addition, this chapter also explained the monetary policy intervention of the Central Bank of Nigeria and its effect on the manufacturing output in Nigeria. The monetary policy transmission and the relationship with the manufacturing sector in Nigeria are reviewed in this section. Different channels of the MTM and their effects on the transmission mechanism coupled with the implications on the output of the manufacturing sector are discussed as well. Structural Adjustment Programme SAP remains an important truing point in the economic history of Nigeria. The implication of the adoption of monetary policy intervention especially via economic deregulation was discussed. Furthermore, the effect on the manufacturing output and how it relates to the dynamism of the effect on the sector are also reviewed in the chapter

CHAPTER THREE

THEORETICAL AND EMPIRICAL LITERATURE REVIEW

3.1 Introduction

This chapter comprises both theoretical and empirical literature. The theoretical literature includes models and theories discussion that is related to the study. Precisely, discussions on monetary theory as well as output growth theory are given priority in this chapter. The discussion of each theory is done under the following headings: the basic tenet, the assumptions, the criticism, and the relevance of the theory to the study. The empirical literature is the second aspect of this chapter and it reviewed and assessed past empirical studies that are relevant to the thesis. Gaps are extracted and identified as well.

3.2 Theoretical Literature

The theories related to monetary and output growth are given preference under the discussion of the empirical literature. This is because the two main variables in the thesis title which are monetary policy and manufacturing output are related to those two theories.

3.2.1 Theories of money demand and supply (ISLM)

These theories are combined to form the famous ISLM model which is popularised by the Keynesian school of economics in 1936.

3.2.1.1 Basic tenet of ISLM theory

The ISLM was invented by Keynes in 1936 and popularised by Hicks in 1937. IS means investment-Savings while the LM is liquidity preference-money supply. The basic idea behind the ISLM model is the determination of the distribution of loanable funds in the market. According to the theory, these are determined by the equilibrium of IS and LM which represents both the goods market and the money market. According to Miskin (2016), the IS shows the locus of a combination of interest rate and income that clears the goods market. The LM is the locus of the combination of interest rate and income that clears the money market. Keynesian economics identified IS as the equilibrium in the goods market where aggregate investment equates to aggregate savings. The equilibrium in the money market described the equilibrium between aggregate money demand and money supply (Lipsey, 2010).

The basic tenet of the ISLM framework indicates the equilibrium in both the money and the goods market. While the LM which is the money market shows the rate of interest and income that clears the money market, the IS indicates the combinations of the rate of interest and income that clears the goods market at a particular period (Onokoya, 2018). The IS curve produces a negative slope curve while the LM produces a positive slope curve that all explains the relationship between interest rate and output in both markets.

The relationship between money demand and general economic activities is well described within the framework of the ISLM and this further underscores the importance of this framework. The money market brings both money supply and money demand to equilibrium while the goods market brings the aggregate expenditure and income into equilibrium.

3.2.1.2 Assumption of ISLM theory

The ISLM theory works under the following assumptions

(i) Fixed price level: it is assumed that the general price level in the economy is fixed and hence the value of money remains the same and that prices and wages do not adapt quickly to changes.
(ii) The beliefs of the people about money and how it should be spent (rationality) are the same
(iii) The analysis and the relationship between the goods and the money markets are only in the short run.

3.2.1.3 Criticisms of ISLM theory

Firstly, the Critics of this model pointed out that important factors which include the marginal propensity to consume (MPC) might not be easy to be postulated. Critics have also argued on the correctness of the fact that saving today as well as consumption today is all functions of the interest rate (Mishkin, 2001).

Secondly, the assumption of fixed price has been criticized. The implication of this is that inflation is not taken into consideration in the ISLM formation and this is believed by authors such as Raghavan, Athanasopoulos, & Silvapulle (2016) as an oversimplification of the model. This is because in the real world one of the most important macroeconomic variables that affect and determine the growth and development of major economies in the world today is the inflation rate hence, its role cannot be trivialized like that in the ISLM framework.

Thirdly, the assumption that ISLM only considers short-run behaviour and neglects long-run effects is seen as not realistic. According to Rafiq & Mallick (2008) many variables might not have a significant relationship in the short run but in the long run their relationship might be significant. This calls to question the super-neutrality of money that is being advocated by the ISLM which states that money only has a transitory effect and not permanent effect on asset. This assertion has been generating a lot of debates and contributions in macroeconomics and it will continue to generate such in years to come because there is still a lack of consensus in this area (Omolade and Ngalawa, 2018).

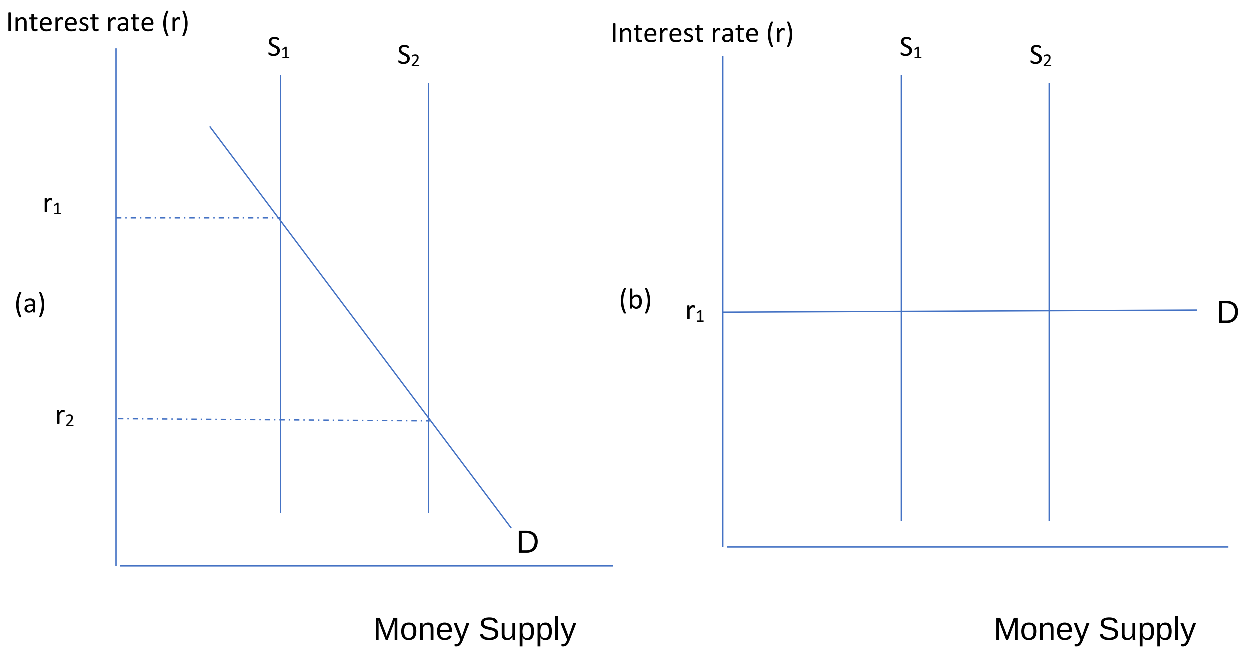
3.2.1.4 Relevance of ISLM theory to the study

The monetary policy shock (as a result of the money supply) on the economic variables including the interest rates depends on the workings of the monetary sector where the money supply is assumed to be exogenously determined by the monetary authorities whose actions are considered on the act of policy. The demand for money, on the other hand, depends upon the interest rate, considering the price of holding money, and this price (interest rate) adjusts to equalize the quantities of the money supply with demand. Assume an inelastic supply curve and an inelastic demand curve, and then the price change will be relatively large as in Figure 3.1 (a) below. Whereas with an elastic demand curve, the effect on price is small as in Figure 3.1 (b) below.

Assuming demand for money in the form of a loan in a loanable funds market by manufacturers (manufacturing firms), the interest elasticity of demand for such a loan can be expressed as the percentage change in the quantity of loan demanded divided by the percentage change in the loan interest rate.

Figure 3. 1 Quantity of Money and Price Level

(a) Inelastic demand curve Fig 3.1. (b) Elastic demand curve



Source: McCallum, (1981)

This is an indication that when demand for money becomes more elastic there will be a change in interest rate become lesser for a particular money supply change. This process is referred to as the liquidity trap phenomenon. Even though this analysis is only partial, since it ignores certain possible feedback effects such as the change in income, it nevertheless does capture the core of the model. The basic continuing conclusions hold that: -

- Monetary policy is least effective when the demand for money is high-interest elastic and the demand for goods is highly interest-inelastic.

- Monetary policy is most effective when the demand for money is interest-inelastic and the demand for goods is highly interest elastic.

As for the result of a common link between the real sector and the monetary sector, through the interest rate, any shock to either sector causes a change in the interest rate and so affects the other sector, and subsequently initiates an interactive process until a re-attainment of equilibrium values of nominal income and interest rate. The interest rate is relevant, both as the representative price in the monetary section and as a link between the sectors, given its influence on expenditure and money demand. This model is easily transformed into a model of output determination especially if prices are exogenous. For example, to determine income (PQ) is to determine output, Q, if the price, P, is fixed. This model is most useful when used to establish a new equilibrium level of income (or output) and interest rates in response to a change in an exogenous variable. It might have been produced by a shock to either the system or an act of government policy, such as an increase in government spending on goods and services financed to leave the money supply unchanged (more in the upcoming section).

Economists have likened the model discussed above to the IS-LM model invented by Hicks (1937), which has remained relevant with an algebraic derivation as follows: -

Firstly, is the locus of all possible equilibria for the goods market in which planned injections J* is assumed equal to planned withdrawals, W*, i.e.

$$\mathrm{J} *= \mathrm{W} * \tag{3.1}$$

For ease of analysis, we assume a closed economy with two injections, namely government spending, G and Investment I, thus,

$$J = G + I \tag{3.2}$$

The study assumed negatively related to the interest rate, hence,

$$\mathrm{G} = \bar{\mathrm{G}} \tag{3.3}$$

$$I *= \mathrm{a} - \mathrm{br} \tag{3.4}$$

Where b denotes a parameter measuring the responsiveness of investment to changes in interest rate. Equations (3.2), (3.3), and (3.4) combined give

$$J^* = \bar{G} + a\text{-}br \tag{3.5}$$

Withdrawals in the economy are savings, S, and taxation, T,

Hence:

$$W = S + T \qquad (3.6)$$

It is assumed that planned savings S*, as a constant proportion, s of income, Y, that is, equal to both the average and the marginal propensity to save, hence:

$$S *= sY \qquad (3.7)$$

Taxation depends upon both the level of income and the tax structure. We assume a proportional income tax for simplicity, with a rate t. This tax structure can also stand for general sales tax on all financial output at the rate, *t.* Hence the tax revenue:

$$T = tY \qquad (3.8)$$

Equations 3.7 and 3.8 in 3.6 becomes

$$W *= sY + t \ = Y(s + t) \qquad (3.9)$$

Hence the equilibrium: -

$$W = J^*$$

or

$$Y\ (s + t) = a + br$$

In addition, incorporating government spending, assumed to be fixed exogenously by the government as $\bar{G}$, we get: -

$$Y(s + t) = \ \bar{G} + a - br$$

$$Y = \frac{\bar{G} + a - br}{s + t} \qquad (3.10)$$

Equation (3.10) gives the equilibrium value of income for any given value of interest rate, r. The slope of the demand curve is$-(\frac{s+t}{b})$ and depends on b which measures the responsiveness of investment to changes in the interest rate. As the interest elasticity falls, b falls, and the slope of the demand curve becomes steeper. In the extreme case when the investment is not responsive to changes in interest rate, b equals zero and so the slope is infinitive, and the demand curve is vertical.

Hence, the analysis of fiscal policy is based on an increase in government spending. $\bar{G}$ (fixed exogenously by the government as Ḡ) shifting the demand curve (I*=a-br) and the elasticity analysis (J*= $\bar{G}$ +a-br) are illustrated.

In the monetary sector, the equality of money supply (SM) and money demand (DM) is assumed, thus

$$\mathrm{SM} = \mathrm{DM} \qquad (3.11)$$

Where money supply is assumed fixed exogenously by the authorities as $\dot{N}$ *and hence:* -

$$\mathrm{SM} = \dot{\mathrm{N}} \qquad (3.12)$$

Money demand, on the other hand, is positively related to income and negatively to the interest rate. If the responsiveness of money demand to income is measured by w, and to interest rates by v, the money demand can be expressed as: -

$$DM = z + vr + wY \qquad (3.13)$$

Equations (3.11), (3.12), and (3.13) combined give: -

$$\bar{\mathrm{M}} = z + vr + wY$$

$$\Longrightarrow wY = \bar{M} - z - VR$$

Therefore:

$$Y = \frac{\bar{\mathrm{M}} - \mathrm{z} - \mathrm{vr}}{w} \qquad (3.14)$$

Which reduces to $Y = \frac{\bar{\mathrm{M}} - \mathrm{z}}{w} \ \ if\ v = 0$

According to equation (3.14) as the responsiveness of money demand to interest rate increases, that is, as v increases, the slope of the money demand becomes less steep. Ultimately, when the money demand becomes infinitely elastic, the curve becomes horizontal. Increasing money supply assumed fixed exogenously by the authorities, as $\bar{M}$ will shift the money demand curve to the right. It is possible to solve equations (3.1) and (3.14) by a simultaneous equation method to solve Y and r in which case:

$$Y = \frac{vG + av + b\bar{M} - bz}{(s+t)(v+bw)} \tag{3.15}$$

Equation (3.15) shows that income Y will normally increase when either G or $\bar{M}$ increases. It also shows that an interest-inelastic money demand, that is, $v = 0$, would mean that fiscal policy is ineffective. Similarly, when the investment demand is interest-inelastic, and b=0, then changes in the money supply have no effect on income. Note that this model tolerates flexibility, having the advantage to facilitate the addition of extra variables to the analysis.

3.2.2 Other monetary theories

As earlier stated, it is not only the transmission mechanism theory of money that will be the focus here, various theories of money are also discussed and reviewed under this subsection. Consequently, this aspect of the theoretical literature is devoted to the review of various theories of money

3.2.2.1 Theories of money demand

The theory of money demand is the main theory that provides a link between the general price level and output. The theory of money demand is the bedrock of the influence of monetary policy on the economic aggregates in any economy. According to Busari (2004), the control of monetary aggregate by monetary policy depends on the elasticity of interest rate to expenditure and the influence of this on the aggregate money supply. With the application of this theory to developing economy Nigeria inclusive, it is evident that the macroeconomic objective of price and economic stability rests on the ability of the monetary policy to influence the general output of the country. The process through which interest rates affect the GDP is crucial to the achievement of this macroeconomic objective (Ajayi and Ojo, 2006; Gbadebo and Oladapo, 2009).

According to Uwubanmwen and Olagun (2002), money demand can be defined as the aggregate money that an individual is willing to hold to make transactions either in the future or now. Achievement of economic stability by applying monetary policy rests on the characteristics of demand for money function as well as the cash balance with the individual. In addition, the monetarist view on money demand is the fact that there is a short-term effect of money on output. Their argument negates the belief of the Keynesian school of thought on the money they believe failed to accord more importance to the role of money in the output process. The monetarist believes that contraction in the level of money in circulation leads to economic depression and rescission while expansion of money leads to inflation and a boom period in the business cycle.

According to the monetarist, money supply influence consumer prices and output domestically in the short run but in the long run, it affects the general price level in the economy. It is believed by the monetarist that changes in money supply have a significant effect on domestic output positively especially when the velocity of money is assumed to be stable. Again, for the positions of the monetarist to be effective it is believed that the economy is close to full employment in the long run so that whenever income rises it carries along with it the general price level.

Furthermore, the monetarist argued that the money supply is not influenced by the interest rate. This is contained in the Irvin Fisher quantity theory of money. According to Fisher, money is primarily used for transaction purposes and as a medium of exchange and he came up with the first equation of money under the quality theory (Aigbokhan, 1995).

This identity is expressed as (3.16):

$$MV = PT \qquad 3.16$$

From equation 3.16 the V is the velocity of money in circulation while M is the stock of money, and P is the general price level in the economy. T represents the volume of transactions. An important assumption here is that V and T are constant while M is exogenously determined. It is believed that an appropriate relationship exists between the volume of money and the general price level) (Iyoha, 2002).

It should be noted that M represents the money supply stock, V shows the velocity with which money circulates in the economy, T is the level of the economic transaction while

P shows the general price level in the economy. Under the normal situation, the V and T should be constant in the model while the M is believed to be exogenous. A proportional relationship is deemed to exist between the general level of price in the economy and the broad supply of money (Iyoha, 2002). It is believed that the only variable that is responsible for the change in P is M the equation thus becomes

$$\% \Delta M = \% \Delta p \qquad 3.17$$

Thus equation (3.17), is an indication that any change in money supply will produce an equal proportionate change in the price level as well as the inflation rate in the economy. In the opposite direction, an increase in money supply will also generate an increase in investment thereby increasing the domestic output in the long run (Enoma, 2004). This condition shows that a rise in money supply will lead to a fall in the rate of interest and this will invariably expand investment as well as output of goods and services in the economy.

3.2.2.1.1 Classical quantity theory of money

The classical theory emphasizes the quantity theory of money and supported the fact that money constitutes a great influence on the general price level. The classical perspective divided the money demand functions into the equation of exchange and the real cash balance equation (Grubb, 2019. The classical theory divides the quantity theory of money into two namely the income version and the transaction version. However, a direct and positive relationship is postulated between the money supply and the general price level. It follows that an increase in the money supply will also lead to a rise in the money supply. It should be noted that the assumption of the classical theory is based on two dimensions of Laws namely the Says Law, which states that supply creates its demand. This means that the monetary value of the goods produced is directly the same as the values of all the goods and services purchased as well. The implication of this is that there is no idle capacity, and the economy is in full employment. This is the second assumption, which by implication means that resources are not underutilized in any form (Mihályi and Szelényi, 2019).

3.2.2.1.2 Quantity theory of money: Cambridge version

Pigou, Marshall, Robertson, and Keynes in the early 1900s, came up with the second version of the quantity theory of money, which is called the Cambridge version. These economists are from Cambridge University, and they popularise this second aspect of the quantity theory of money. This version is also known as the cash balance version as they postulated that the motive for holding cash which can either be for transitionary motive or precautionary motive needs (Eatwell, 2019). They further stated that the cash balance held by an individual s directly proportional to his income level (Grubb, 2019).

3.2.2.1.3 The New quantity theory: The Monetarists

The history of the old quaintly theory of money took its root from the days of Irvin Fisher to the period days of David Ricardo, John Start Mills, and a host of other classical and Neo-Classical economists. This is also followed by the Keynesian school, which emerged in 1930, and the modification of the quantity theory of money to include the speculative demand of holding money, which was introduced, by the Keynesian school. However, after the Keynesian school, there has been the emergence of some group of economists from Chicago University. This group was led by Milton Friedman in 1960 and it gave birth to the new quantity theory of money. They retained the name quantity theory of money because their belief in the efficacy of monetary policy remains like that of the old quantity theory of money (Evans and Thorpe, 2013).

3.2.3 Output growth theories

The study bothers on manufacturing output growth hence growth theories are relevant to the study. This section will briefly discuss some growth theories that are relevant to the study.

3.2.3.1 Harrod-Domar Growth Theory

This is one of the prominent growths there is in macroeconomics and the theory is discussed under the following headings:

3.2.3 .1.1 Basic Tenet of Theory

Harrod-Domar's growth theory was proposed by Harrod (1943) and Domar (1943) cited in Easterly; et al, (2003). The theory views the capital factor as the crucial factor of economic growth. It concentrates on the possibility of steady growth through adjustment of the supply of demand for capital. It assumes that substitution between capital, labour, and neutral technical progress in the sense that technical progress is neither saving nor absorbing labour or capital. Both factors are used in the same proportion even when neutral technical progress takes place.

Harrod-Domar's model points out that output depends on the investment rate and the productivity of that investment. According to this model, to maintain full employment, real income and output should be expanded at the same rate at which the productive capacity of the capital stock is increasing. Any divergence between these two will lead to excess or idle capacity, forcing the entrepreneurs to cut back their investments. It will adversely affect the economy by lowering incomes and employment in the subsequent periods and will move the economy away from the equilibrium path of a steady growth state (Irene et al, 2020).

3.2.3 .1.2 Assumptions of the theory

The theory assumes that a full-employment level of income already exists, with no government interference in the functioning of the economy. The constant ratio of propensity to save and capital-output ratio

3.2.3 .1.3 Criticisms of the theory

One of the major criticisms of the theory is that the theory is based on rigid, abstract, and unrealistic assumptions. For example, the propensity to save and capital-output ratio are assumed constant. In the short period, the propensity to save and the capital-output ratio may remain constant, but in the long run, these factors are likely to change. Likewise, it is also assumed that the production function is fixed, and factors of production cannot be substituted for each other, this is contrary to real-life situations.

3.2.3 .1.4 Relevance of the theory

The theory explains the inclusion of factors that influence production in the manufacturing sector which include capital and labour. The theory is relevant to the study as it explains the key factors of production which include capital and labour force. The output of the manufacturing sector is very relevant to this theory and the inclusion of variables like capital will emanate from this theory.

3.2.3.2 Endogenous Growth Theory

Endogenous growth theory was an advancement over new classical growth theory as propounded by Paul Romer (1989) and Robert Lucas (1990). The theory emerged in the early 1980s as an alternative to the neoclassical growth theory. Its main tenets questioned why there should be persistent gaps in wealth between developed and underdeveloped nations if investment in physical capital such as infrastructure could be subjected to the laws of diminishing returns. The growth theory was further developed as a reaction to deficiencies and omissions in the neoclassical growth model. It is a new theory that explains the long-run growth rate of an economy based on endogenous factors as against exogenous factors of the neoclassical growth theory.

3.2.3.2.1 The basic tenet of Endogenous growth theory

Endogenous growth theory incorporated a mathematical explanation of the concept of human capital. Human capital according to this theory is the knowledge and skills that enhances workers' productivity sequel to technological advancement (Field, 2004 and 2007). Unlike physical capital, human capital has increasing rates of return. Therefore, in the aggregate, there are constant returns to capital, and economies never reach a steady state. With the concept of human capital, economic growth does not slow as capital accumulates; rather, the growth rate in the economy strongly depends on the types of capital such a country invests in. Evidence from research has shown that what increases human capital includes education and technological change (e.g., innovation) (Elhanah, 2004).

3.2.3.2.2 Assumptions of Endogenous growth theory

1. The existence of many firms in a given market.

2. Technological advances and Knowledge are seen as non-rival goods.

3. There is a constant return to a single factor, at least for one whereas are increasing returns to scale to all factors taken together as a group.

4. Technological advancement emerges from the task performed by people. This indicates that the creation of new ideas is the engine room of technological advancement.

5. Individuals and firms can directly earn profits from the market power resulting from their discoveries. This assumption is based on imperfect competition resulting from increasing returns to scale in production.

Endogenous growth theory argued that growth in the economy is primarily the outcome of internal forces, rather than external ones. Consequently, productivity improvements can be directly linked to more investments and faster innovation in human capital from the private sector and government institutions.

3.2.3.2.3 Criticisms of Endogenous growth theory

The endogenous growth theory has been greatly criticized on the ground that it is impossible to validate the theory with empirical evidence. Consequently, the economist argued that the theory was largely based on assumptions that cannot be measured accurately.

3.2.3.2.4 Relevance to the study

The endogenous growth model remains one of the most recent developments in growth theories and it has been gaining relevance in its application to output growth research. This study is one of the studies that delve into examining output growth with a focus on the manufacturing output. The inclusion of the shift factors in the model that described the relationship between monetary policy and manufacturing output apart from the natural capital and labour identified by the Harold-Domar growth model will be justified by the review of the endogenous growth model.

3.2.3.3. Dual Sector Growth Theory

Lewis (1954) came up with the "Dual Sector Model" which is a theory of development that harps on surplus labour from the traditional agricultural sector to be transferred to the modern industrial sector whose growth over time depends on the surplus of labour and capital supplied from the Agricultural sector in order to achieve sustainable growth.

3.2.3.3.1 Basic tenet of the theory

In the theory, there is a conception that the manufacturing sector is a capital-intensive sector that relies little on labour supplied from the Agricultural sector; in contrast, the Agricultural sector is seen as a sector with a labour-intensive method of production. These were the initial thinking but as the production process goes on it was realized that little labour will be needed as well in the manufacturing process. However, it is still a dominant belief from the model that manufacturing is capital-intensive. Therefore there is an investment in favor of the accumulation of capital stock and reinvestment in the manufacturing sector.

The theory opines that there is a surplus of labour in the agricultural sector hence the marginal productivity of the input is low and almost zero. This guides the transfer of labour to other sectors like the manufacturing sector where their services can be put to more usefulness. It should be noted from the theory that surplus labour is used in terms of Marxist approach which only refers to the movement of unproductive labour to the manufacturing sector.

3.2.3.3.2 Assumption of the theory

The theory main assumption is that there exist two main sectors of production in the economy namely the manufacturing and the Agricultural sectors and they both contribute to the overall growth of the economy.

3.2.3.3.3 Criticisms of the theory

The theory was mainly criticised based on the assumption that apart from the manufacturing and agricultural sector, there some other sectors that contribute to overall economic growth and their roles are very germane as well.

3.2.3.3.4 Relevance to the study

The Dual sector theory generally emphasizes the synergy between the manufacturing sector and the agricultural sector as very important for overall growth.

The main manufacturing shift factors are capital and labour and they form the nucleus of the independent variables on which manufacturing production depends. This is a guide for this study on those shift factors to be included and priorotized under the methodology when specifying the model for manufacturing output.

3.3 Empirical Literature

Investigation of the relationship between monetary policy and output growth generally has enjoyed the patronage of many scholars around the globe. Some of these studies are based on regions and sub-regions while some are on countries as well as cross-countries analyses. The literature that is related to this study can be divided into three aspects which form the basis for the review of the empirical literature; the first are the studies that focused on monetary policy and output generally, second are the studies that examined the relationship between monetary policy and manufacturing output in particular and the last are the studies on the monetary transmission mechanism of monetary policy.

3.3.1 Relationship between manufacturing output and monetary policy

There are few pieces of literature on the relationship between monetary policy and manufacturing sector output growth. Even at that, there appears to be a lack of consensus among the authors on the role of monetary policy in manufacturing sector output growth. Related studies in this area both in Nigeria and outside are discussed under this sub-section.

For instance, Omolade and Ngalawa (2016) examined the monetary policy transmission and the growth of the manufacturing sector in Algeria using the time series data from 1980Q1 to 2010Q4. The two instruments of monetary policy used are the interest rate and the money supply. Structural vector Auto-Regression analysis was used to analyse the data. The result of the study showed that the money supply failed to respond significantly to shocks from the growth of manufacturing sectors and vice versa. The only policy instrument that commanded a significant response for the manufacturing output is the interest rate. In addition, the interest rate was shown to demonstrate a significant effect on the exchange rate with implications for the manufacturing sector's growth.

From another perspective, Usman and Adejare (2014) analyzed the impact of monetary policy on industrial growth using manufacturing output as a proxy for industrial sector growth. The study employed multiple regressions using variables such as lending rate, rediscount rate, treasury bills, and manufacturing output. Data on these variables were harvested for the period 1970 to 2010. The results from the tests suggested that all the variables influence industrial sector growth positively and significantly as well. Capital expenditure was recommended as a means to improve the industrial sector growth in Nigeria. These results compared to that of Omolade and Ngalawa (2016) did not study shocks but just the effect of monetary policy variables like the interest rate.

Again, Nneka (2012), examined the performance of the Nigerian manufacturing sector as it is affected by the monetary policy. The study used the VECM and discovered that money supply remains the only variable in the monetary policy model with an outstanding and significant impact on the performance of the Nigerian manufacturing sector. All other variables such as interest rate and inflation rate harm the growth of the sector during the year under review. This conclusion is in contrast to the findings of Omolade and Ngalawa (2016 who identified interest rate has the most influence on the manufacturing output in Nigeria. The difference in the result might be a result of different periods and estimating techniques used by the two studies.

In the same vein in 2015, Okonkwo and Godslove established a relationship between monetary policy and the manufacturing sector in Nigeria. Credit to the private sector, money supply, and interest rate are used as explanatory variables while the manufacturing sector output growth was used as the dependent variable. Cointegration and error correction models were applied and the result showed that credit to the private sector and money supply have the most significant impact on manufacturing sector output growth. This shows that the money supply remains dominant as it was established in the earlier study

Still, on the Nigerian economy, Ayuko (2020) assessed the impact of monetary policy on the performance of the Nigerian manufacturing sector. The data used to span from 1981 to 2018. Variables such as money supply, interest rate, and the manufacturing contribution to the GDP are used among others. Both the causality test and the Johansen cointegration approach were applied in the data analysis and the findings support Okonkwo and Godslove (2015) and Nneka's (2012) results that the money supply is most crucial to the performance of the Nigerian manufacturing sector.

From a different approach, Shobande (2019) studies monetary policy slipovers and the effect on the Nigerian industrial sector proxied by manufacturing output. The data used are from 1980 to 2015 and Auto Regressive Distributed Lag ARDL approach was used to estimate and analyse the data. The result of the long-run estimates shows that domestic credit, interest rate, and trade balance have a positive impact on industrial output while money supply, inflation, and exchange rate hurt industrial growth. The result went contrary to the three immediate last studies reviewed where money supply was confirmed to have a positive significant impact.

Ibrahim and Amin (2005), focused on Malaysia and assessed the relationships between monetary policy, exchange rate, and the output of the manufacturing sector. VAR was applied and the result indicated that the manufacturing sector responded more to exchange rate shock than the overall economic growth of the country. Real variables also showed negative and significant responses to monetary tightening and the entire manufacturing sector respond very well to both monetary policy shocks ad exchange rate shocks.

Again, Sahinöz and Coşar (2010), used the Turkish economy to investigate the effect of monetary policy on spectral growth cycles. The application of Vector Auto-regression analysis showed that tight monetary policy produced a pronounced adverse effect on the manufacturing sector in the country because their outputs fall drastically. Again, the sub-sectors in the manufacturing sector have varying degrees of responses.

Finally, it is obvious that all the studies reviewed under this sub-section offer diverse conclusions, and as such, no consensus can be agreed upon on exactly the relationship between manufacturing sector output growth and monetary policy. This is an indication that more empirical work is required on this and this further justifies the conduct of this research exercise.

3.3.2 Relationship between output growth, macroeconomic variables, and monetary policy

This is the area where there are immense contributions from the literature. Most of the studies that are available in the literature centered on output growth and monetary policy. Some of these studies are reviewed in this section.

The relationship between monetary policy and inflation as a macroeconomic variable was given prominence in the study of Abradu-Otoo et al (2003) who investigated the relationship between monetary policy and the inflation rate in Ghana. The study applied Vector Error Correction Model. The result of the study indicated that interest rate during contractionary monetary policy can make inflation rise initially but later leads to a fall in the inflation rate. However, their findings further showed that appreciation in the GDP led to a fall in the inflation rate and the exchange rate depreciation. In a similar study by Epstein and Heintz (2006) the findings showed that the result of the previous author was validated in that it was found that with a threshold of 5 percent monetary expansion, the GDP will grow by about 25 percent while the inflation rate only increased by just 1.2 percent. The study finally submitted that with high output growth, inflation can be subdued especially during monetary expansion.

In another view, the study of Balogun (2007) centered on monetary policy and economic performance of some African countries that were interested in forming the Africa Monetary Zone in West Africa. These countries include Gambia, Nigeria, Ghana, Guinea, and Sierra Leone. Using data from 1991 to 2004 on variables such as minimum rediscount rate, money supply, bank credit to the private sector, credit to the government, and individual country exchange rate. The study applied the Generalized Least Square Estimating technique and the result found that monetary policy is a form of policy that can disrupt the economies if not administered very well and it can cause serious stagnation in their quest to form a monetary zone.

Still, on the African economy, Ngalawa and Viegi using the Malawian economy found that the monetary aggregate has a significant impact on output but not on the exchange rate and the domestic prices in the country. The result obtained by Lourens (2000) was contrary to this no evidence of the significant influence of monetary policy was found on the economic growth of the country.

However, still, in the Malawian economy, the result of Mangani (2011) supported the findings of Ngalawa and Viegi (2011) by concluding that there is a significant influence of the exchange rate on domestic prices but the money supply failed to influence domestic prices. One of the bizarre results of this study was the negative relationship that was obtained between monetary aggregate and money supply. In addition, it was also found that the credit channels of monetary policy remain the most potent channel to influence domestic output in the economy. Furthermore, as part of the studies finding ambiguous results, Manjate (2011) used the Mozambique economy and discovered that expansionary monetary policy caused the domestic price to fall and influenced the exchange rate positively that is causing the exchange rate to appreciate.

Again, Chipote and Makhetha-Kosi (2014) used the South African economy and found that the money supply as an instrument of monetary policy failed to affect output significantly in the economy. On the contrary, it was found that inflation has a more important influence on the growth of the economy. The study recommended that government expenditure should be directed to the product or the real sector of the economy before it can have a significant positive impact on the growth of the South African economy. Khabo and Harmse (2005) also supported the finding by establishing from their study that a reduction in interest rate might be ineffective in promoting growth as it may lead to an increase in capital flight that will further reduce the money supply in the economy, on the contrary, the tight monetary policy will reverse the trend by promoting capital inflow.

Rafiq and Mallick (2008), used a couple of some European countries namely Germany, France, and Italy to investigate the effectiveness of the monetary policy, and the result which was obtained from the VAR method of estimating technique was found that contractionary monetary policy only promotes output in Germany while the result for other countries remains unclear.

The Turkish economy was the focus of the study of Berument and Dincer (2008) where the effect of monetary policy was investigated on the output growth of the country. The structural vector autoregression analysis was applied to the data that was collected on monetary policy variables from 1986 to 2000. Findings from the study established a significant effect of contractionary monetary policy on the output of the country although it was temporary. Results from the study corroborated initial empirical findings of authors like Eichenbaum and Evans (1995)) this same result was obtained by Borys et al (2009), who discovered that tight monetary policy has a significant effect on the output growth of the country. In the same Czech Republic economy, Bayesian VAR was used by Botys *et al* (2009) and discovered that the shock of monetary policy has negative implications on the general economic activities and price level of the economy. Although the kind of monetary policy in question is a tight one. This confirms Us (2004), findings that a zero correlation was detected between money and inflation in Turkey. According to the study, for more than thirty years, Turkey was faced with ever-increasing inflation rates, which were because of the country's currency depreciation coupled with increasing prices in the public sector.

Arratibel and Michaelis (2014), showed that time is of the essence in the effect of exchange rate shock on the general levels of economic activities after the usage of VAR with a specialized feature of the time-varying effect. The country of focus for the study was Poland. It was discovered that inflation was more reactive to the exchange rate than the other macroeconomic variables used in the VAR model. De Grauwe and Polan

(2005), confirmed that inflation could only be harmful to an economy if and only if it is beyond a certain percentage level. In their study of one hundred and sixty countries using thirty years' data range, they claimed that the inflation and supply of money relationship are much stronger in countries with high inflation rates than in those with lower rates. This was supported by Thornton (2008), in his study of the applicability of the Quantity Theory of Money to 36 African countries. The study found a strong influence of inflation on countries that have more than 10 percent inflation and growth of money rates.

The focus of Starr (2005) was on the investigation of the direction of causality between output, some monetary policy variables, and the general price level. The country of focus includes Belarus, Ukraine, Russia, and Kazakhstan. Findings from the study notably showed that interest rate as a monetary policy variable played a significant role in output determination in all the countries but that of Russia stood out.

Tyrkalo and Adamyk (1999), and Doroshenko and Njinkweu (2001), assessed empirically the relationship between monetary policy, GDP, and inflation rate. The study applied the cointegration test and found that there exists a long-run relationship between money supply and economic growth. It was discovered that a period of high inflation and expansionary monetary policy application led to a reduction in the economic output. With the application of the same techniques Cambazoglu and Karaalp, 2012; Gul et al., 2012; Loría and Ramirez, 2011) and Nouri and Samimi (2011), using the Iranian economy from 1974 to 2014, the result showed that there existed a positive and significant relationship between money supply and economic growth after the application of the Ordinary Least Square technique.

In a similar study, Van der Ploeg and Alogoskoufis (1994) and Chari et al (1995), utilized the growth rate of the broad money supply as a proxy for monetary policy and examined the effect of the levels of economic activities. The co-movement between growth and inflation rate was also established just as many other studies have done in the past. In contrast, Kone (2000) used the error correction model to examine the relative effect of both monetary and fiscal policies on economic activities in the West Africa Economic Monetary Union (WAEMU). Ndiaye (2009) evaluated the relative effectiveness of fiscal and monetary policies in Senegal and stated that these policies remain subject to sources of uncertainty that have to do with any unpredictable outside shocks arising from weak automatic stabilizers.

From another perspective, Mishra et al. (2012) investigated the potency of lending rate channels in monetary policy transmission. They used monthly data from 2000 to 2010 in the Iranian economy, and it was found that the reserved money shock had failed to attract a significant response from the output of the economy and the positive shocks were found to increase both the exchange rate and lending rate.

Most of these ambiguous results were not found in the USA. In the study (Starr, 2005), a reduction in the policy rate was found to improve output in the US economy. In addition, the result produced different outcomes in some sets for middle-income countries where the reverse is the case. For instance, in the study of Hayo (1999) where 17 industrialized countries were used, it was discovered that while some showed a positive response to falling policy rate by outputs some showed contrary results. In the same vein (Agenor et al., 2000). Hafer and Kutan (2002) found that the policy rate plays a more important role in output manipulation in all the OECD countries. However, in the sample of Ganev et al. (2002) which includes some Central European countries, it was found that the policy rate failed to produce a significant response from the output of the economies used. This is an indication that there are diverse results on the relationship between monetary policy and output in some advanced countries as well.

From another perspective, it was shown from the study of De Grauwe and Polan (2005), that inflation is purely influenced by monetary policy and that it is a monetary phenomenon. The study utilized data from about 160 countries for a period that span through 30years. One of the important findings is that the relationship between inflation and money supply is very strong in countries with a high rate of inflation. Thornton (2008) also supported this by concluding from his study that money is a strong determinant of inflation after surveying about 36 African countries trying to model the quantity theory of money empirically.

Ridhwan et al (2011) used the Indonesian economy to evaluate the regional impacts of monetary policy shocks on outputs. The VECM approach was used and the evidence from the result established that there are variations in the responses of outputs to monetary policy shocks across the regions. It is further established from the study that regional responses to monetary policy shocks depend on the sectors that are present in the regions. In addition, the composition of the sectors across the regions also accounts for the differences in the results.

Peersman and Smet (2002), in their study, examined how dynamics in monetary policy affect the output of some European countries. The study made use of 11 industries across the countries and focused on data from 1980 to 1998. The panel cointegration analysis was applied and the results indicated that there is a more negative effect of contractionary monetary policy on the general economic activities during the recession period than during the boom period. Cross-sectional dependency of the industry was discovered in the results and the asymmetric effect of monetary policy was confirmed.

Gul, Mughal, and Rahim (2012) used the OLS to investigate the impacts of monetary policy instruments on growth in Pakistan. The ordinary least square method was applied, and the result indicated that contractionary monetary policy would only influence output positively if exchange rate and inflation rate policies are in the right direction. It was also discovered that expansionary monetary policy would have a positive impact on output only in the short run.

One of the prominent studies on the Nigerian economy that relates to the impacts of monetary policy is that of Onyewu (2012). The study investigated the effects of monetary policy on the growth of the Nigerian economy. The data set used spans from 1981 to 2008. Ordinary Least Square method of estimating techniques was applied, and the result showed that money supply as a monetary policy variable has significant positive impacts on growth and balance of payment. However, a contrary result was obtained when it comes to inflation as the result showed an inverse relationship. The study recommended a favourable investment climate with an optimal interest rate to improve Nigerian economic growth via monetary policy.

In a related study, Baghebo and Stephen (2014) and Fasanya et al (2013). Fasanya et al. (2013), used data from 1975 to 2010 to investigate the effects of monetary policy on the economic growth of Nigeria. The Error Correction Model approach was applied along with cointegration analysis. The result of the estimating techniques indicated that the inflation rate and external reserve all have significant impacts on the output of Nigeria. An increase in the stock market activity in terms of stock trading was recommended for the improvement of the effect of the effects of monetary policy on growth in Nigeria.

However, Ogunmuyiwa and Ekone (2010) only used one of the monetary policy instruments, which is money supply, and investigated its impact on both investment and growth in Nigeria. The study also applied VECM and OLS. The results showed that there exists a significant long-run relationship between the monetary policy variable (money supply) and investment as well as the growth of the Nigerian economy. A similar study by Baghebo and Stephen (2014), the study further investigated the effect of the environment on growth apart from monetary policy and the study concluded that an investment-friendly environment is very important for Nigerian economic growth.

Ogege and Shiro (2012), Udoh (2009), Ajisafe and Folorunso (2002), Akujuobi (2010), Altar (2003), Havi and Emu (2014), and Rakic and Radenovic (2013), in their studies, embarked on a comparative analysis of the effectiveness of monetary policy and fiscal policy on the output. Their results after the application of the cointegration, and error correction model suggested that monetary policy is less effective during the depression period. They concluded from their studies that monetary policy only promotes growth during the boom period and that fiscal policy is the best alternative policy for the recession period in Nigeria.

The approach of Balogun (2007) to the effect of monetary policy was a bit different. The study employed a simultaneous equation technique and showed that monetary policy is less effective in controlling the output of Nigeria. However, evidence from some studies outside Nigeria also supported these findings. These studies are that of Fasanya et al

(2013), and Baghebo and Stephen (2014), who used serial Leone and Gambia economies respectively, obtained a similar result that monetary policy is becoming less effective in influencing levels of economic activities in these countries.

In a slightly different but similar view, the study of Ogege and Shiro (2012), recommended the hybrid of monetary policy and fiscal policy as both contributing to economic growth in Nigeria. They assessed the level of dynamism in the monetary policy of Nigeria and the attendant impact on both the fiscal variables and the general level of economic activities in Nigeria. The Johansen cointegration methodology was applied and the results confirmed the existence of a co-movement between the dependent and the independent variables that are used to proxy both economic growth, monetary policy, and fiscal policy. This was in contrast with the findings of Ajisafe and Folorunso (2002), in which monetary policy was found to exert more influence on economic activities than fiscal policy in Nigeria.

The study of Ajisafe and Folorunso (2002) is another contribution to the studies that investigated the comparative effectiveness of fiscal and monetary policy in Nigeria. The data set used spans from 1970 to 1998 and the cointegration and error correction model was applied. The result showed that monetary policy is more potent in controlling output in Nigeria. They also concluded that fiscal policy has led to financial recklessness and plunged the economy into a serious macroeconomic problem. Adebiyi (2006), from a different perspective, assessed the impacts of interest rates, and financial sector reforms on the manufacturing sector growth. The study applied a cointegration and error correction model using quarterly data from 1986 to 2002. The result suggested that the deposit rate and inflation rate are the most important factors that affect manufacturing production in Nigeria and that the shock that affects manufacturing production the most in Nigeria is its shock.

Apere and Karimo (2014), in their study, focused on the effect of monetary policy on both growth and inflation in Nigeria. The data used were from 1970 to 2011. Variables of interest are interest rate t, the broad money supply, consumer price index, and the

Nigerian economic growth proxy by the GDP. The VAR analysis was applied, and the result showed that monetary policy shocks, as well as inflation shocks, drive the growth of Nigeria at least in the short run. In the long run, the result shows that monetary policy might not have a significant effect on growth however, it was recommended by the study that a policy that will make monetary policy have a sustained effect on output is very important in Nigeria.

Anthony and Mustafa (2011) shifted attention to non-oil export and investigated the effect of both monetary policy and the financial sector generally on the growth of the non-oil sector in Nigeria. Cointegration and error correction model was applied, and the result showed that there exists a positive and significant relationship between non-oil export and the variables. Monetary policy is advocated as an important policy that will be used to promote the growth of the non-oil sector in Nigeria.

Nenbee and Madume (2011) showed that there exists a co-movement between the monetary policy and the general economic performance in Nigeria. The study used the cointegration approach and the test of cointegration was positive after the estimation.

As earlier stated, many studies investigated the relationship between monetary policy and economic growth when compared to manufacturing sector growth. The findings from this reviewed literature have shown that there are diverse conclusions and that the effect of monetary policy on the output of the manufacturing sector might be different from that of the effect of monetary policy on the output growth generally for the whole economy.

3.3.3 Analysis of the monetary transmission mechanism

The studies that are reviewed under this subsection focused on examining the effect of monetary policy transmission channels on output or manufacturing output as the case may be. Studies on this aspect of monetary policy assessment are very diverse in the sense that they have produced different results over the years about the efficacy of one channel of transmission or the other. While some found credit channels as the most vital in the transmission process some see bank deposit channels and interest rates as the main channel of transmission of monetary policy shocks (Bernanke and Blinder (1992), Bernanke, and Gertler (1995). More studies have now been contributing to this discourse. One of them is that Aleem (2010) investigated monetary policy transmission mechanisms in India. The study used VAR and found out that the most important agent in the monetary transmission process is the Banks. Inflation targeting is seen as the main medium via which monetary policy influences output in the study of Montes (2013) who focused on the Brazilian economy. Furthermore, expectations were found to be key in the monetary policy transmission channels and it influences the entrepreneur's decisions and employment as well.

From another point of view, Mishra, Montiel, Pedroni, and Spilimbergo (2014), evaluated the influence of monetary policy transmission on lending rates using some emerging low-income countries. The heterogeneous form of the Panel structural vector Auto Regression was applied, and the result showed that there are variances in the responses of lending rates to monetary policy shows in the countries. The authors posited and concluded that it is expected that monetary transmission in advanced countries will be more significant than that in low-income countries. In a similar study but this, time the advanced countries such as the Euro Area and the US were used, and the credit channels of the monetary transmission mechanism were examined. The result showed that credit channels are significant in transmitting the shocks from monetary policy to both GDP and prices. In addition, the medium through which this is done is the balance sheets of the households and the firms.

In addition, time-varying parameters have been sued in conjunction with VAR to examine the monetary transmission mechanism in an economy. Franta, Horvath, and Rusnak (2014). The major task was to investigate the responses of the GDP and prices to interest and exchange rate shocks that vary over time. The result showed that prices have been showing diverse responses to monetary policy shocks while exchange rate shocks have been stable over time. In a clear departure from the investigation of the time-varying effect of the monetary policy transmission mechanism, Simo-Kenge, Miller, Gupta, and Balcilar (2016), examined if the monetary policy transmission mechanism takes into consideration the responses of the interest rate to the asset price shocks. The stochastic volatility technique was added to the VAR method and the data from 1980 to 2012 on the US economy showed that the interest rate was more responsive to asset return shocks during the period of high volatility.

At the same Time-Varying, TVP-VAR was applied to Malawi's economy by Mwabutwa, Viegi, and Bittencourt (2016). The core objective of the study was to investigate the responses of output and general price level to the following shocks, interest rate, bank rate, exchange rate, and credit. The responses of these variables were found to have varied over time for instance the real output and inflation rate responses to monetary policy shocks were found to have varied throughout tie in Malawi. It was also discovered that macroeconomic instability has affected the monetary policy transmission mechanism over time.

The studies on monetary policy transmission mechanisms have shown that empirical literature on this subject has witnessed different stages of development over time. In the early days, the ISLM framework was the major tool of analysis the main result then was that monetary policy affects economic aggregates such as output and inflation but the ISLM framework does not show the medium of transmission. (Bernanke and Gertler, 1995). The second stage of the development was the studies that focused on using the disaggregated data in a bid to show what happened in the interim, which the ISLM could not show. However, the division of the effect of the monetary policy transmission technique made use of VAR but the results were examined in different sectors. Studies like that of Nwosa and Saibu (2012), are in this category. They investigated the monetary policy transmission mechanism and sectorial outputs. The result confirmed that policy shocks are the most potent channels through which monetary policy shocks affect Agricultural and manufacturing outputs while the exchange rate channels are the most vibrant in transmitting shocks to the construction, services, and real estate sectors' outputs.

In a related study, investigating the impact of monetary policy Kamaan (2014) showed that monetary policy will influence output via the interest rate channels and that it is the most potent channel through which monetary policy influences output. This was established through the usage of Vector Autoregression techniques VAR. Similarly using the Tanzania economy, Ayubu (2013 discovered that inflation in the country was more of a real and structural phenomenon than a monetary phenomenon. This was obtained in his study of the effect of monetary policy on inflation in Tanzania.

With the usage of a similar estimating technique, Bhuiyan (2008) studied the Canadian economy by assessing the effect of the shocks to the monetary policy on the general economic output and activities. The finding from the study further affirmed that the main medium of transmission of the shocks to monetary policy is the interest rate as well as the exchange rate. It should be noted that the overnight discounting rate was used as a proxy for monetary policy in the study.

3.3.4 Gaps in the literature

Firstly, the empirical literature review has shown some areas where there is lack of consensus as well as areas where enough work is still being expected. For instance, in the areas of the relationship between monetary policy shocks and output growth of the manufacturing sector, it is obvious from the reviewed studies as most of them centered on the relationship between monetary policy and output growth or other macroeconomic variables such as inflation and exchange rates (Onyewu, 2012; Arratibel and Michaelis 2014) among others. The studies on the relationship between manufacturing output which is the main focus of this study and monetary policy shocks are very few. In addition, many of the studies on manufacturing sector output and monetary policy only considered monetary policy variables like interest rate and money supply without attention to how their shocks affect the manufacturing sector. It should be noted that this study is not only looking at the effect of these monetary policy variables on manufacturing output but also investigating how sudden interventions by the monetary policy authorities in Nigeria which has always been leading to an adjustment of the monetary policy rate (monetary policy shocks) affects the growth of the manufacturing output in Nigeria. Studies like (Shobande, 2019; Omolade, and Ngalawa 2016) among others only examined monetary policy variables' effect on manufacturing sector growth in Nigeria and not the monetary policy shocks. Consequently, this study apart from studying the effect of the monetary policy variables on the output of the manufacturing sector will also investigate empirically how their shocks influence the growth of the output in the manufacturing sector since the monetary policy authorities usually claim in Nigeria that all those interventions which are called shocks are to improve the output of the real sector of the Nigerian economy, especially the manufacturing sector.

Again, the issue of the monetary policy transmission mechanism and its effect on the manufacturing sector has continued to resonate in recent times. Studies that investigated the relationship between the monetary policy transmission mechanism and the manufacturing sector were also reviewed in this study (Ayubu, 2013; Mishra, Montiel, Pedroni, and Spilimbergo 2014). It was discovered that many of these studies investigated monetary policy shocks as they affect the output of the manufacturing sector via the monetary policy transmission mechanism. However, global shocks have been identified as one of the variables that can affect the effectiveness of the monetary policy transmission mechanism to the manufacturing sector. Most of the studies only considered monetary policy shocks within the context of the monetary transmission mechanism without adequate attention to the global shocks like oil price and federal fund rate. These two global shocks have been described as very germane to the internal policy formulation of any country especially the developing countries because they are heavily dependent on a foreign country for goods and services (Mishkin, 2018). Therefore, apart from the inclusion of the monetary policy shocks in the monetary policy transmission mechanism, the global shocks such as oil prices are also captured in the system so that the response of the channels of the transmission can be examined and the implication of the manufacturing output investigated as well.

Finally, all the studies have identified diverse channels as the most potent channels in transmuting monetary policy shocks to the manufacturing output. While Mishra, Montiel, Pedroni, and Spilimbergo (2014) concluded that the lending rate channel is the most potent, Aleem (2010) found the credit channels as the most important transmission mechanism. In addition, Omolade and Ngakawa (2018) found exchange rate channels as the most potent transmission shocks to the manufacturing sector output. From these conclusions, it is obvious that consensus is yet to be reached on the channels of transmission of shocks to the manufacturing sector hence this study will also be contributing to the existing literature in this area.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

This aspect of the research focuses on the research method adopted to achieve all the objectives set in the introductory aspect of this thesis. The chapter comprises the theory adopted, the model specification, sources of data, and estimating techniques among others. It should be noted that the theory adopted has been discussed in chapter three but the link to the model specification is explained in this chapter.

4.2 Theory and model specification

The theories adopted for mode specification are the Dual sector growth model of Lewis (1954) and the endogenous growth model of Romer (2014). As discussed under the theoretical literature, Lewis Dual sector growth theory emphasised on the shift factors that affects the growth of manufacturing (Industrial) and that of Agricultural sectors. This model was relied upon to in this study as it was used in the study of Hirota (2002). The theory emphasised the development in the Agricultural sector which supplies labour and capital that serve as the primary inputs to the manufacturing sector. Lewis theory primary emphasised on the labour and capital supply to the manufacturing sector as key variables that can influence the manufacturing output.

As a modification of this model, the objective of this study added monetary policy variables to the explanatory variable to explain the effect of monetary policy shocks on the growth of the manufacturing sector in Nigeria. In addition, the effect of the transmission mechanism is the transmission of global shock to the manufacturing output requires the inclusion of variables such as Federal fund rate FFR and World oil price WOP in the model to capture global shocks (see Omolade and Ngalawa 2018; Omolade, Ngalawa and Kutu 2019). Furthermore, modifications of their model require the inclusion of private sector credit to take care of the credit channel in the monetary policy transmission mechanism (Shobande, 2019; Nwosa and Saibu 2014). Therefore, the model for the objective of this study is stated as follows;

$$MUP_t = \beta_0 + \beta_1 K_t + \beta_2 L + \beta_3 MPR_t + \beta_4 MSGR_t + \beta_5 INF_t + \beta_6 EXR_t + \beta_7 PCRE_t + \beta_8 WOP_t + \beta_9 FFR_t + \varepsilon_{i,t} \ldots \quad (4.1)$$

Where MUP is the growth rate of output of the manufacturing sector, MPR is the monetary policy rate that is the interest rate, MSGR is the money supply growth rate, EXR is the exchange rate, INF is inflation, PCRE is the private sector credit, WOP is World Oil price and FFR is Federal fund rate, while $K \ and \ L$ is the gross capital formation and Labour participation rate respectively all of them are expressed at a particular period t and $\varepsilon_{i,}$ represents a stochastic variable.

4.3 Apriori expectations

β_1 that shows the relationship between MUP and K is expected to be positive that is $\beta_1 > 0$. This is because from the macroeconomic theory capital formation is a positive shift factor of output growth (Lipsey, 2010).

β_2 that shows the relationship between MUP and L is expected to be positive that is $\beta_2 > 0$. This is because from the macroeconomic theory labour is a positive shift factor of output growth (Lipsey, 2010).

β_3 is the coefficient of monetary policy rate or interest rate. A negative relationship is expected that is $\beta_3 < 0$. This is because the inverse relationship is expected between investment and interest rate so also output and interest rate (Romer, 2016).

β_4 is the parameter estimate for money supply that explains the relationship between manufacturing output and money supply. A positive relationship that is $\beta_4 > 0$ is expected between the two according to monetary theory. Expansion in the money supply is expected to boost output (Romer, 2016).

β_5 this is the parameter estimate that shows the relationship between manufacturing output and inflation rate. This variable is expected to be negative that is $\beta_5 < 0$. The inverse relationship is postulated between inflation and output, especially under the structural theory of inflation (Romer, 2016).

β_6 is the coefficient of exchange rate and it is expected that there can either be a positive or negative relationship between the exchange rate and the output of the manufacturing sector that is $\beta_6 \gtreqless 0$ the purchasing power parity theory explains this (Mankiw, 2020).

β_7 is the coefficient of private sector credit and it is expected to be positive that is $\beta_7 > 0$. An increase in credit or funds to the manufacturing sector in macroeconomic theory is expected to lead to manufacturing output expansion (Ball and Mankiw,2002).

β_8 is the coefficient of World oil price and it is expected that there can either be a positive or negative relationship between oil price and the output of the manufacturing sector that is $\beta_8 \gtreqless 0$ (Ball and Mankiw,2002).

β_9 is the coefficient of the Federal fund rate and it is the parameter estimate that shows the relationship between manufacturing output and the Federal fund rate. This variable is expected to be negative that is $\beta_9 < 0$. The inverse relationship is postulated between FFR which is the policy rate in the US and output (Ball and Mankiw,2002).

For the second objective of the study where the monetary policy transmission mechanism that explains the channels of transmission of global shocks to the manufacturing sector output is examined, the Romer endogenous growth model is adopted. The reason behind this is that VAR/VECM model is adopted as the estimating technique. Since all the variables in the VAR/VECM model are endogenous hence it is more suitable to adopt the VAR model to achieve this objective. Both VAR and VECM use the same mechanism the difference is that when cointegration is confirmed in the model, then VECM is used to examine the dynamic relationship among the variables, otherwise, VAR is used. The model in 4.1 is respecified inform of VAR to achieve the second objective of the study.

The VAR/VECM Model is described as

$$[MUP, K, L, PCRE, INT, INF, EXR, MSGR, WOP, FFR]. \quad (4.2)$$

All variables are as defined above.

4.4 Data

All the data used in this study are in rates or percentages and they are high-frequency data. This is important to be able to show the dynamism in the relationship estimated. Consequently, the quarterly version of the data from 1980Q1 to 2019Q4 was used for the estimation. Again, the Central bank of Nigeria statistical Bulletin for the 2020 edition was used as the main source where the data were collected. Other sources are the World Bank and the International Financial Statistics. Precisely, the quarterly data on the monetary policy variables are extracted from the CBN, while the World oil price and Federal Fund rate are extracted from both IFS and World Bank tales 2020 editions. The data on the manufacturing output was collected from the Nigeria Bureau of Statistics NBS during the period under review.

4.5 Estimating techniques

Two estimating techniques were adopted. The first is for the model specification described under equation 4.1 where the effect of monetary policy on manufacturing output is investigated. The techniques of analysis adopted there are cointegration and error correction models.

The second estimating technique described the VAR/VECM model stated in equation 4.2. This will enable the study to determine the transmission channels through which the global shocks and the monetary policy shocks affect the manufacturing output in Nigeria.

Notwithstanding, for the two techniques, some pre-estimation analyses are necessary and they are explained first.

4.5.1 Descriptive statistics

The time series properties of the data collected on the variables must be explored first. This is done via descriptive analysis. Both the summary of statistics, which involve the median, mean and standard deviation of the variables are obtained and the correlation or the covariance matrix of the variables is done. The unit root test is also inclusive. All these are to give an initial description of the time series properties of the data to ascertain the suitability of the proposed estimating technique.

4.5.2 Correlation matrix

The correlation matrix is a descriptive analysis technique that shows the relationship in terms of correlation among the variables. The product movement correlation coefficient of the variables is done and computed. This shows the correlations between each of the variables in the model and it is an avenue to investigate the presence of multicollinearity (Duhachek and Lacobucci, 2004).

4.5.3 Unit root Testing

The unit root test is necessary for exploring the stationary status of the variable. This is an important pre-condition for the cointegration analysis. The order of integration of the series is determined with the application of the unit root test. Since there are different methods of cointegration their selection depends on the result of the unit root test. For instance, all variables must be integrated of order one that is I (1) before the Johansen cointegration test is applied and if there is an I(0) variable that variable is stationary at a level in the mix then, ARDL cointegration test might be preferred. All these underscores the importance of the unit root test. Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test. The condition that guides the conduct the unit root test is usage of both trend and intercept which is generally acceptable to produce more reliable result. (Omolade and Ngalawa, 2019)

For the ADF test;

Assume the unit root equation for the Nigerian economy is given as:

$$Y_t = \beta + Y_{t-1} + \sum_{j=1}^{\emptyset} \gamma ij \, \Delta Y_{t-j} + \alpha_0 + \alpha_1 x_t + \mu_t \text{ .... (4.3)}$$

In equation 4.3 Y_t is the dependent variable and the error correction or random term is β. This random term must be less than one before we can have a stationary series otherwise the series is not stationary because it has a unit root x_t are the independent variables, t

is the time series period while ∅ is used to represent the lag length. α_o is the intercept and μ_t is the stochastic variable.

The tested hypothesis regarding the unit root test using both the ADF are:

- $H_0: \alpha = 1$, the series is non-stationary.
- $H_1: \alpha < 1$, the series is stationary.

Acceptance of H_0:shows that the model has a unit root hence it is nonstationary otherwise H_1 is accepted.

For the PP test

The test equation is described as follows;

$Y_t = C + \delta t + aY_{t-1} + e_t$……………………………………………………………………(4.4)

Where Y_t is the dependent variable, C is the constant or intercept, δ is the explanatory variable t and t-1 are lag operators and et is the random variable.

The tested hypothesis regarding the unit root test using both the PP are:

- $H_0: \alpha = 1$, the series is non-stationary.
- $H_1: \alpha < 1$, the series is stationary.

Acceptance of H_0: shows that the model has a unit root hence it is nonstationary otherwise H_1 is accepted.

4.5.4 Determination of Lag Lengths

The selection of lag length is crucial to the multivariate model to be used in autoregressive estimation. This will enable the generating of robust results. In econometrics literature, many criteria exist which include the Schwarz Bayesian Information Criterion SBIC, Final Prediction Error criterion FPEC, the Akaike Information Criterion AIC, and the Hannan-Quinn Information Criterion HIC. In most cases, the AIC is used but this study will use all the criteria and select the one with a minimum number of lags. This is necessary for either VECM or VAR model, as they are very important to the impulse response and variance decomposition analysis. The AIC information is used most widely used and the lag length with the least value is selected (Kutu and Ngalawa, 2017).

4.5.5 Cointegration analysis (Johansen Cointegration Test)

Cointegration tests analyse the existence of long-run association among a combination of non-stationary variables. The idea is that even if a variable is not stationary a combination with another variable may be stationary in the long run (Rao, 2007).

Cointegration analysis is very necessary to avoid the incident of spurious regression. The application of Ordinary Least Square is based on the fact the series is stationary and exhibits constant variance as well as the mean. However, in reality, this assumption is too optimistic because normally many variables are not stationary. The implication of the result of the OLS analysis on these kinds of variables is that the result will be biased in inefficient. This is the main reason for cointegration analysis (Chaovalitwongse et al, 2010).

However, once the cointegration test is conducted and it shows that there is no cointegration. It does not mean absolutely that there is no long-run relationship among the variables. It only suggests that there might not be a long-run relationship (Rao 2007),

Three approaches to cointegration analysis are prominent they are Engel- Granger and Phillips-Ouliaris , ARDL, and Johansen cointegration analysis. Due to the nature and the result of the unit root test the Johansen cointegration is adopted and it is discussed in this study.

The Johansen approach to cointegration is another form of multivariate model-inclined test for cointegration. The test is very common and prominent among econometricians and they are used in establishing the existence of co-movement among variables. In many studies. However, a major condition that must be fulfilled before the test can be conducted is the fact that all the variables to be used in the model be stationary after the first difference that is they must be ordered in one I (1) series.

The numbers of cointegration vectors are determined by two main methods namely, the Maxima Engel value and the Trace Statistics. These two approaches are used to determine the number of cointegrating vectors as well as the existence of cointegration among the variables (Granger and Newbold, 1974).

The hypothesis to be tested is stated as follows;

- $\boldsymbol{H_0}: \boldsymbol{\alpha} = \mathbf{1}$, no cointegrating vectors exist.
- $\boldsymbol{H_1}: \boldsymbol{\alpha} < \mathbf{1}$, Cointegrating vectors exist.

4.5.6 The VECM

The second objective of this study investigates how global shocks as well as monetary policy shocks transmit to the manufacturing output. The model described in equation 4.2 is estimated with the use of VAR or VECM depending on the cointegration result. The result from the study confirmed cointegration hence the VECM is discussed. The VECM has some important advantages that distinguish it from levels of VAR. First, it incorporates stochastic trends and cointegration in the systems. In addition, estimators of impulse responses from the VECM are more precise. For instance, usage of level VAR can give birth to what is called exploding analysis of responses of impulse even though the true impulse response position is not exploding originally. The SVECM will advertise this situation (Jang and Ogaki, 2004). Thirdly, it is possible to impose long-run restrictions as well as standard recursive order restrictions to identify shocks.

It is assumed that the following VECM model can present the true economic structure of the Nigerian economy:

$$\Delta \boldsymbol{y_t} = \boldsymbol{\beta_{y0}} + \boldsymbol{\beta_{y1}} \Delta \boldsymbol{y_{t-1}} + \cdots . + \boldsymbol{\beta_{yp}} \Delta \boldsymbol{y_{t-p}} + \boldsymbol{\gamma_{y1}} \Delta \boldsymbol{x_{t-1}} + \cdots + \boldsymbol{\gamma_{yp}} \Delta \boldsymbol{x_{t-p}} - \boldsymbol{\pi_y} \left(\boldsymbol{y_{t-1}^{-\alpha_0 - \alpha_1 x_{t-1}}} \right) + \boldsymbol{v_t^y} \ldots \quad (4.5)$$

$$\Delta \boldsymbol{x_t} = \boldsymbol{\beta_{x0}} + \boldsymbol{\beta_{x1}} \Delta \boldsymbol{y_{t-1}} + \cdots . + \boldsymbol{\beta_{xp}} \Delta \boldsymbol{y_{t-p}} + \boldsymbol{\gamma_{x1}} \Delta \boldsymbol{x_{t-1}} + \cdots + \boldsymbol{\gamma_{xp}} \Delta \boldsymbol{x_{t-p}} - \boldsymbol{\pi_x} \left(\boldsymbol{y_{t-1}^{-\alpha_0 - \alpha_1 x_{t-1}}} \right) + \boldsymbol{v_t^x} \ldots \quad (4.6)$$

Equations 4.5 and 4.6 capture variables (y and x) for the VAR model where $\boldsymbol{y_t = \alpha_0 + \alpha_1 x_t}$ is the long-run cointegrating relationship between the variables and $\boldsymbol{\pi_y}$ and $\boldsymbol{\pi_x}$ are the error-correction parameters that measure how *y* and *x* react to deviations from long-run equilibrium.

The VECM approach was followed and the Nigerian economy will be described according to the following structural VECM equation:

$$\boldsymbol{FY_t = C_o + B_1 Y_{t-1} + B_2 Y_{t-2} + \cdots \ldots .. + B_p Y_{t-p} + \pi_i X_t + Z\varepsilon_t} \ldots\ldots\ldots\ldots \quad (4.7)$$

Where $\boldsymbol{F}$ represents a $(\boldsymbol{k} \times \boldsymbol{k})$ matrix that is somehow invertible but the function is to explain contemporaneous reactions of variables in the model. In addition, $\boldsymbol{Y_t}$ represents $(\boldsymbol{k} \times \boldsymbol{1})$ vector which describes the endogenous variables that are on the model in a way that$(\boldsymbol{Y_t = Y_{1t,} Y_{2t,} \ldots \ldots Y_{nt}})$. Furthermore, $\boldsymbol{C_o}$ implies a $(\boldsymbol{k} \times \boldsymbol{1})$ for an array of vector that stands for the intercepts or constants; $\boldsymbol{B_i}$ represent $(\boldsymbol{k} \times \boldsymbol{k})$ matrix for the coefficients of a host of lagged variables that are purely endogenous $(\boldsymbol{for\ every\ i = 1 \ldots \ldots \ldots \ldots .. p})$; $\boldsymbol{\pi_i}$ as well as $\boldsymbol{X_t}$ represents the coefficients and vectors of many exogenous variables that normally capture the effects of shocks that are external. $\boldsymbol{Z}$ represents $(\boldsymbol{k} \times \boldsymbol{k})$ that depicts the non-zero order of the matrix that and they all explain direct responses to shocks in the model in the system and $\boldsymbol{\varepsilon_t}$ represents the normal distribution error term.

The VECM presented in equation 4.2 might be difficult to estimate due to the presence of contemporaneous responses that are common to the VECM method. (Enders, 2004). The variables that are endogenous in the model are ordinarily allowed to affect themselves since there is a feedback mechanism in the structure of the VECM. Consequently, parameters are known as unidentified, and hence impossible to determine their core values because the coefficients are not known (McCoy, 1997). However, estimation of the reduced form model especially in the VECM implicit function can assist in the recovery of the information inherent in the system (Ngalawa and Viegi, 2011). Therefore, the multiplication of equation 1 by an inverse of $\boldsymbol{F}$ which is revealed in equation 2 below:

$$\boldsymbol{Y_t = F^{-1}{}_{C_o} + F^{-1}B_1 Y_{t-1} + F^{-1}B_2 Y_{t-2} + \cdots F^{-1}B_p Y_{t-p} + F^{-1}\pi_i X_t + F^{-1}Z\varepsilon_t} \quad (4.8)$$

One can denote

$\boldsymbol{F^{-1}}_{\boldsymbol{C_o}} = \boldsymbol{C},\ \boldsymbol{F^{-1}B_i = A_i\, for\ i = 1 \ldots\ldots\ldots p},\ \boldsymbol{F^{-1}\pi_i = \alpha i\ and\ F^{-1}Z\varepsilon_t = \mu_t}.$

Hence, equation (4.8) becomes:

$$\boldsymbol{Y_t = C + A_1Y_{t-1} + A_2Y_{t-2} + \cdots \ldots\ldots.. + A_pY_{t-p} + \alpha_iX_t} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots \quad (4.9)$$

The difference between equations (4.8) and (4.9) is that the first equation denotes the structural equation or the one called the primitive equation where all variables have immediate and direct responses to one another in the VECM system. The second one is called the reduced form equation where it is believed that the variables do not have contemporaneous or what is known as instant and immediate effects on one another in the VECM system (Enders, 2004).

Again, in this study, the VAR approach was used to determine the impact of global shocks and monetary policy shocks on manufacturing output growth using the impulse response functions and variance decomposition of the model. The choice of VECM is rooted in its several advantages. Firstly, VECM account for endogenous relationships and can summarize empirical relationships. They are well-established approaches in the literature on monetary policy (Stock and Watson 2001; Cheng, 2006; Van Hai and Trang, 2015 among others). In addition, they can isolate the response of each variable to shocks that affect the economy. Furthermore, VECM is simple and flexible to analyse without necessarily having to run out of the degree of freedom (Cochrane, 1998).

4.5.7 Diagnostic testing

These four notable diagnostic tests are performed after the estimation of the VAR/VECM model. These are the Serial Correlation Test, heteroscedasticity test, Normality test, and Stability test. Discussion on each of them is as follows:

4.5.8 Serial Correlation Test

This test is also known as the auto-correlation test as it investigates the existence of a correlation between two successive periods of the error term. Using the First Order Auto-Regression, it is believed that both the AR1 and Art-1 should not be correlated and if they are the serial correlation assumption is violated. The null and alternative hypotheses are no autocorrelation and there is auto-correlating respectively.

4.5.9 Heteroskedasticity Test

This assumption is that the variance of the parameter estimates must be constant from all the observations in the estimated model once this assumption is violated then, there is the problem of Heteroscedasticity. The hypothesis that is tested is both null and alternative hypothesis. These hypotheses are not heteroscedasticity and there is heteroscedasticity for both null and alternative hypotheses.

4.5.10 Stability testing (AR roots test)

For VECM the appropriate stability test from the model use the AR roots approach. Both the graphical and tabular illustrations are presented. The hypothesis tested under this diagnostic are:

$H_0: \alpha$: No roots lie outside the unit circle

$H_1: \alpha$: At least one root lies outside the unit circle

Acceptance of H_0indicates that the stability condition is met and the VEC model is stable and hence the parameter estimates are fit for inferences. Otherwise, the model is nonstable and parameter estimates are not reliable.

4.5.11 Normality testing

The normality test is carried out using the JARQUE BERRA statistics approach. Precisely the statistics of the JARQUE BERRA is computed as well as the probability which determines the level of significance. The hypothesis tested is:

$H_0: \alpha$: the error term of the estimated model is normally distributed

$H_1: \alpha$: the error term of the estimated model is not normally distributed

If the probability of the JACQUE BERRA is greater than 5% level then H_0 is accepted and it is concluded that the error term of the estimated model is normally distributed otherwise H_1 is accepted.

4.5.12 Generalized Impulse Response Function

These two tools of information are used in conveying the result of the VAR model when it comes to the results of responses and reactions to shocks in the VAR system. These tools are called the impulse response function and the Variance decomposition.

The main function of the impulse response function is to explain the reaction of some variables in the VAR model to some external shocks. For instance, in this study, the impulse response function explains the responses and reactions of manufacturing output and other macroeconomic variables to monetary policy shocks and other external shocks as the case may be. The dynamic behaviour of financial variables is appropriately explained via the impulse response functions and they have been proven to be very helpful in forecasting the behaviour of most financial variables.

The main function of the impulse response is to trace the reaction of each endogenous variable to the shock coming from the system. According to Stock and Watson (2001), the generalized impulse response function explains the reaction of some variables to a one percent standard deviation in a particular variable which is called the shock variable.

Furthermore, analyzing the responses of the manufacturing sector to the monetary policy shocks is carried out via the impulse response functions as well as the variance decomposition. These approaches have been used in various studies highlighted in previous discussions and they have been adjudged to be proficient in casting behaviours among variables, especially in financial time series data. From the study of Wouter (2011), there are three types of shocks, which are monetary policy shocks, productivity shocks, and preference shocks, all these shocks are investigated as well in this study under the Impulse Response Function Analysis.

Although there are different types of impulse response function applications, this study makes use of the factorization version of the Cholchesky orthogonalization approach, which has been applied by many related studies (Cheng, 2006)

4.5.13 Variance Decomposition

The variance decomposition is a table that shows the contributions of each shock in the system to the behaviour of a particular variable. According to Sims (1980), this is also known as the FEVD, which means the Forecast Error Variance Decomposition. The usefulness of this tool of analysis under the VAR is that it helps analyse the behaviour of the manufacturing sector to the shocks from the monetary policy and other macroeconomic variables in the VAR framework. According to Stock and Watson (2001), the variance decompositions explain the fraction of the observed variable in that it can either be ascribed to the variables being affected by shock or that of another endogenous variable. The application of this analysis assisted in analyzing the behaviour of the Nigerian economy or that of the reserve bank when used together with the impulse response function (Stock and Watson 2001).

4.6 Summary

This chapter has discussed generally the research methodology embraced to achieve the objectives of the study. The chapter began with a description of the research design and the theoretical framework followed. The theoretical framework explains the theoretical underpinning for the model estimated to achieve the objectives of the study. The theories that serve as the precursor for the model specification and the linkage to the estimated model were all discussed under the theoretical framework. The model was specified and the variables in the model were subsequently defined. Furthermore, the chapter also discussed the sources and nature of the data that are used for the analysis before the discussion on the estimating techniques. The method of data analysis was explained and all the post and other estimation test and their relevance to the empirical results were explained in the chapter.

CHAPTER FIVE

RESULTS AND DISCUSSIONS

5.1 Introduction

The chapter presents the analysis of the empirical results on the dynamic effects of monetary policy shocks and manufacturing sector growth in Nigeria. It interprets all the analysis on each of the objectives and discusses them as well. The chapter dedicated a section for the discussion of the findings from the results of the analysis and compares all the findings with previous empirical findings and inferences are drawn appropriately.

5.2 Descriptive statistics

Table 5.1 shows a summary of the statistics of the variables in the model. Their means and variances are computed and the limits are determined.

Table 5. 1: Summary of statistics

	MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR
Mean	6.150827	2.17E+10	39623975	17.42054	17.42500	18.94111	71.94815	2.10E+12	84.75931	7.365229
Median	5.704737	5.17E+09	39256651	17.64216	17.89063	12.77680	56.38086	4.90E+11	59.59824	7.621146
Max	10.76479	9.37E+10	57046253	32.48151	32.90625	76.42606	160.3424	1.18E+13	203.1129	19.13323
Min	1.631273	-5.02E+09	20210415	7.511120	7.843750	1.863981	0.541920	8.99E+09	22.92778	2.962891
Std. De	2.641805	2.89E+10	9937659.	5.188493	5.205059	16.98900	64.50956	3.21E+12	54.96753	3.672288
Obs	160	160	160	160	160	160	160	160	160	160

Source: Author's Computation

Table 5.1 shows both the variances and the means of the variables included in the model. The results show that data on manufacturing output is averagely low because the mean value of 6.15082is closer to the minimum limit of 1.63127 than the maximum limit of 10.764. The implication is that during the period 1980Q1 to 2019Q4, the values of the quarterly contribution of the manufacturing sector to the GDP of Nigeria appeared to be very low. However, in terms of the variance, the variance value of 2.64180 is closer to the minimum than the maximum. Hence the values of the manufacturing contribution demonstrated little dispersion or deviation during the period. The implication of this, is that there is not much difference in the successive year's contributions to the manufacturing sector to the GDP of Nigeria.

Other variables, namely, interest rate, inflation rate, and money supply growth rate in the Nigerian manufacturing sector, exhibited relatively low mean values during the period. This means that these variables are not averagely on the high side in terms of the data distribution. The implication is that they are very low. In terms of variance, they also show few variations. That is, their data is not widely dispersed. Thus, showing a relatively consistent form of figure in successive years.

Notwithstanding, the remaining variables are just on average except for the exchange rate which shows a high variance as an indication of widely dispersed data. The economic implication of this is that the exchange rate values lack consistency during the periods under consideration. This could be an indication of the unstable nature of the exchange rate during the periods under review.

5.3 Correlation matrix

The variables were also examined to confirm the expected relationship expected among them using the historical data collected. The results are presented in Table 5.2 as follows.

Table 5. 2: Correlation/covariance matrix of the variables

Covariance										
Corr	**MUP**	**K**	**L**	**INTR**	**MSGR**	**INF**	**EXR**	**PCRE**	**WOP**	**FFR**
MUP	6.93551									
	1.00000									
K	3.76	8.29E+20								
	0.49616	1.000000								
L	-29216	2.20E+17	9.81							
	0.1119	0.770810	1.00000							
INTR	-8.0155	-1.66E+10	155550	26.75221						
	-0.5884	-0.111305	0.3035	1.000000						
MSGR	7.893	-1.45E+10	162065	26.79075	26.92331					
	0.5776	-0.09687	0.31528	0.99825	1.000000					
INF	-3.0430	-1.41E+11	-44620	32.16009	31.88470	286.8223				
	-0.0682	-0.28928	-0.2659	0.367139	0.362837	1.000000				
EXR	-30.236	1.30E+12	5.95E	86.63897	90.42591	-390.72	4135.474			
	-0.178	0.700915	0.9335	0.260478	0.270998	-0.3587	1.000000			
PCRE	1.66	7.22E+22	2.33	2.07	2.64	-1.56	1.38	1.02		
	0.1971	0.78468	0.7344	0.012553	0.015935	-0.2889	0.670352	1.000000		
WOP	0.945	0.0131	0.049	37.28260	41.30876	-232.71	3015.243	1.17	3002.	
	0.065	0.829860	0.9079	0.131547	0.145289	-0.2507	0.855687	0.665521	1.0000	
FFR	2.271	-0.0058	-0.312	-9.415	-9.66	0.1004	-0.179	-0.068	-0.14	0.013
	0.23	-0.5527	-0.861	-0.497	-0.50	0.162	-0.0764	-0.058	-0.07	1.0000

Source: Author's Computation

The results as presented in table 5.2 indicate that a host of variables used showed a direct and positive relationship between themselves and manufacturing output, however rate of interest, as well as the exchange rate, displayed an inverse correlation or negative correlation with manufacturing output. More importantly, the result implies that evidence of multicollinearity was not revealed in the result of the correlation matrix because all the correlation coefficients are low and economically, it suggested a weak relationship among the variables.

5.4 Unit root test

An important precondition for the VECM estimation is the test for stationarity. This is an important step, which helps to determine the suitability of the data for VECM analysis. The two-unit root tests were used in the study to carry out this and they are the ADF and the PP tests. Their results are presented in the following tables in Tables 5.3 and 5.4 respectively.

Table 5. 3: Summary of unit root test at level (with trend and intercept)

	Augmented Dickey-Fuller test			Philip Perron test			
Variable	**ADF statistics**	**1% critical value**	**5% critical value**	**PP Statistics**	**1% critical value**	**5% critical value**	**Order of integration**
MUP	-2.420080	-3.474265	-2.880722	-2.066110	-3.471719	-2.879610	
K	-1.953772	-3.475500	-2.881260	-1.631892	-3.471719	-2.879610	
L	-1.928389	-3.473096	-2.880211	-1.572063	-3.471719	-2.879610	
MPR	-2.408771	-3.474265	-2.880722	-2.176765	-3.471719	-2.879610	
MSGR	-2.438068	-3.474265	-2.880722	-2.275158	-3.471719	-2.879610	
INF	-2.747528	-3.474265	-2.880722	-2.936650	-3.471719	-2.879610	
EXR	-0.784431	-3.474265	-2.880722	-0.689977	-3.471719	-2.879610	
PCRE	-2.160849	-3.474265	-2.880722	-3.471719	-3.471719	-2.879610	
WOP	-0.914475	-3.475500	-2.881260	-1.510165	-3.471719	-2.879610	
FFR	-2.542295	-3.474265	-2.880722	-1.940841	-3.471719	-2.879610	

Note: (*) connotes significance at 1 percent significant levels respectively

Source: Author's Computation

Table 5. 4: Summary of unit root test at first difference (with trend and intercept)

	Augmented Dickey Fuller test			Philip Perron test			
Variable	ADF statistics	1% critical value	5% critical value	PP Statistics	1% critical value	5% critical value	Order of integration
MUP	-3.111234**	-3.474265	-2.880722	-6.200970*	-3.471987	-2.879727	I(1)
K	-2.925364**	-3.475500	-2.881260	-5.569747*	-3.471987	-2.879727	I(1)
L	-5.234510*	-3.473096	-2.880211	-5.552278*	-3.471987	-2.879727	I(1)
MPR	-3.175997**	-3.474265	-2.880722	-6.221748*	-3.471987	-2.879727	I(1)
MSGR	-3.276485**	-3.474265	-2.880722	-6.182572*	-3.471987	-2.879727	I(1)
INF	-4.316884*	-3.474265	-2.880722	-5.791303*	-3.471987	-2.879727	I(1)
EXR	-3.244453**	-3.474265	-2.880722	-6.238418*	-3.471987	-2.879727	I(1)
PCRE	-3.366053**	-3.474265	-2.880722	-6.086290*	-3.471987	-2.879727	I(1)
WOP	-3.142773	-3.475500	-2.881260	-5.083725	-3.471987	-2.879727	I(1)
FFR	-4.038133	-3.474265	-2.880722	-5.842789	-3.471987	-2.879727	I(1)

Note: (*) and (**) connote significance at 1 and 5 percent significant levels respectively

Source: Author's Computation

The unit root test results shown in Table 5.3 and Table 5.4 revealed that all the variables included in the model of the study are integrated at order one I (1). As reflected by both the ADF and the PP tests, the results are at level, there is a presence of a unit root in each of the variables, while after first differencing there is no unit root. Notably, an evaluation of the presence of unit root was done comparing ADF statistics and PP statistics with the critical values at both 1 percent and 5 percent levels of significance respectively. By implication unit, root test results show that all the series that are involved in the study showed integration of order one. Therefore, with all the series stationary at the first difference, this study proceeded by conducting the test for cointegration using the approach of the Johansen, this is to either validate or otherwise the existence of co-movement among the variables.

5.5 Cointegration test

The idea behind cointegration is that some variables individually might not be stationary but a linear combination of these variables with some other variables might be stationary leading to what is called the existence of a long-run relationship or co-movement (Rao, 2007). However, the lag length selection has to be conducted first to arrive at the optimal lag length for the analysis.

5.5.1 Length selection

The five notable criteria used for lag length selection are used in this study and they include FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, and HQ: Hannan-Quinn information criterion. Their results are presented in table 5.5

Table 5.5: Lag length selection

Lag	LR	FPE	AIC	SC	HQ
0	-813.5237	NA	1.15e+10	43.03080	43.34505
1	-624.6106	309.009	52987076	37.09474	39.60874*
2	-610.3411	57.30119*	41921077*	36.96124*	41.67500

*Note: * indicates lag order selected by the criterion, LR: sequential modified LR test statistics, FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, and HQ: Hannan-Quinn information criterion*

Source: Author’s computation

Table 5.5 indicated that the optimal lag length that is automatically selected by the system to run the analysis was lag 2, which gives the lowest values in terms of statistics reported for FPE, SC, and AIC). The estimation conducted in the study was done using two periods of lag. The result of the cointegration test is presented next in Table 5.6.

Table 5. 6: Johansen Cointegration Test Result

Series: MUP, LOGK, LOGL, INTR, MSGR, INF, LOGEXR, LOGPCRE, LOGWOP, LOGFFR

H_0	Trace	C.v	Max. Eig.	C.v
r = 0	509.45*	259.03	110.89*	100.91
r = 1	210.56	215.12	91.89	94.81
r = 2	184.67	195.17	83.54	85.73
r = 3	101.13	139.28	69.19	79.59
r = 4	91.94	107.35	44.50	53.42
r = 5	77.45	79.34	38.97	47.16
r = 6	48.48	55.25	22.95	30.82
r = 7	25.53	35.01	16.06	24.25
r = 8	9.47	18.40	8.07	17.15
r = 9	1.41	3.84	1.41	3.84

Source: Author's computation

****** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$***

The result of the Johansen tests is presented in the Table above. In the Johansen approach, the two major statistics for decision-making are the Trace and the Maximum-Eigen statistics. The rules of thumb are that a test's result with a full rank implies that a VAR model is appropriate while a VEC model is in a reduced rank case. A zero-rank test result implies that a VAR model with a differenced variable should be estimated. However, the results of the Trace and the Maximum-Eigen statistics do not always agree but the literature (Lütkepohl & Kratzig, 2004; Lütkepohl, 2005) suggested that the Trace statistics are more robust than the Maximum-Eigen statistics. Notwithstanding, the results for the two tests show that there is at most one cointegrating vector in the 9-variable VEC model.

After the establishment of the long-run relationship, there is a need to examine the long-run relationship to explore the nexus between and among the variables. The result is presented in Table 5.7.

Table 5. 7: Long run Relationships for MUP

Cointegrating Eq:	CointEq1
LOG(K(-1))	0.105877**
	(0.018979)
LOG(L(-1))	-0.092750**
	(0.020816)
MPR(-1)	-0.097251*
	(0.003148)
MSGR(-1)	-0.066761
	(0.506950)
INF(-1)	-0.078319**
	(0.00727)
LOG(EXR(-1))	-0.482207**
	(0.022085)
LOG(PCRE(-1))	8.852140
	(7.31240)
LOG(WOP(-1))	-0.484287**
	(0.049748)
LOG(FFR(-1))	0.879372*
	(0.042942)
C	11.75454

Note: (*) and (**) connote significance at 1 and 5 percent significant levels respectively

Source: Author's Computation

The result justifies the cointegration test, which indicates the existence of a co-movement among variables. It further showed that the level of relationship of these variables is strong in the long run period. The result indicates a significant long-run relationship between capital, labour, and manufacturing output in Nigeria. This result conforms to the apriori expectation.

Firstly, there is the existence of a significant association in the long run between the exchange rate and manufacturing output, especially in the long run period. The exchange rate in the model has -0.482207 as a parameter estimate and the value is significant. This implies that the relationship between exchange rate and manufacturing output is inverse, especially in the long run period and a unit rise in the exchange rate will bring about 0.482207 unit fall in the manufacturing output growth. This is an indication that currency devaluation will not promote value-added to the economic growth of Nigeria by the manufacturing sector. The result shows that the nature of Nigeria being an oil-producing economy that is solely dependent on the export of crude oil might be the reason for this kind of result (Omolade and Ngalawa, 2014).

Another macroeconomic variable used in the model is the inflation rate and the cointegration regression shows that the coefficient is -0.078319. This value is significant at 5 percent, which is an indication that inflation has a significant adverse effect on manufacturing output in Nigeria. It further follows that a unit rise in inflation in Nigeria will result in an about 0.006389 decrease in manufacturing output growth. This follows a priori expectation for the relationship earlier speculated in the methodology.

For the monetary policy indicators, the supply of money and the policy rate were used in this study. The interest rate coefficient is -0.097251 and is significant at 5 percent. Hence. The interest rate as a monetary policy indicator has a significant negative relationship with manufacturing output. It shows that a unit upward movement of the interest rate will lead to about 0.097251 decreases in the output growth of the manufacturing industry in Nigeria. However, the broad money supply that is used as the other variable to capture monetary policy did not have a significant effect like the policy rate on the output of the manufacturers. Although, the coefficient is 0.586866 which is an indication that it is positive, but not significant.

Another variable without a significant impact on the manufacturing output is the private sector credit. The coefficient is rightly positive which is 8.852140. but the effect is not significant. The result implies that the current private sector credit in the Nigerian manufacturing sector is not enough to influence their growth rate significantly.

The results also confirm the significant influence of external variables such as oil price and federal fund rate on the manufacturing sector growth. The implication of this is that oil price is a very important determinant of the growth of the Nigerian manufacturing sector. The shocks of these two variables will be examined under the VECM. How the shocks affect the growth of the manufacturing sector will be explained under the VECM

The next is the error correction model estimated equation and the result is presented in table 5.8. This explains the short-run relationship among the variables.

Table 5. 8: Error correction model Result

Error Correction:	D(MUP)
CointEq1	-0.026323**
	(0.01725)
D(MUP(-1))	-0.244755**
	(0.04662)
D(LOG(K(-1)))	0.404483**
	(0.02454)
D(LOG(L(-1)))	-10.26421
	(7.32625)
D(MPR(-1))	-0.966817**
	(0.01656)
D(MSGR(-1))	-0.964134
	(0.97036)
D(INF(-1))	-4.82E-05**
	(0.01669)
D(LOG(EXR(-1)))	-1.286621
	(0.97684)
D(LOG(PCRE(-1)))	-0.435501
	(0.37799)

D(LOG(WOP(-1)))	1.844746
	(1.60415)
D(LOG(FFR(-1)))	-3.505150
	(1.37331)
C	0.394128
	(0.75593)
R-squared	0.679559
Adj. R-squared	0.429748
Sum sq. resids	53.19814
S.E. equation	1.458741
F-statistic	1.919685

Note: (*) and (**) connote significance at 1 and 5 percent significant levels respectively

Source: Author's Computation

Results in Table 5.8 show that there are more significant variables in the long run than in the short run. Notwithstanding, the monetary policy rate has a sustained significant impact on manufacturing output in Nigeria. This is because the lag one coefficient of MPR which is -0.966817 remains statistically significant.

Variables like capital and labour with significant results, in the long run, failed to replicate such in the short run. The same goes for the exchange rate. However, inflation maintained a dominant and significant effect on the manufacturing sector output in Nigeria during the period under review.

The error correction term is -0.026323 and it is statistically significant. The implication is that the adjustment process is in the right direction and this shows that whenever there is disequilibrium, adjustment sets in to restore the original equilibrium position. The feedback from the previous period is about 2% as shown by the error correction term.

5.5.2 Discussion of findings on the relationship between manufacturing output growth, monetary policy, and other relevant variables

Findings from the empirical analysis in this study produce some inferences that have policy implications on the current monetary policy and manufacturing production relationship in Nigeria. Again, these findings are also compared to the findings on the same subject matter from previous empirical studies. This has paved the way for critical analysis and discussions of the empirical results in a way that makes this study's contributions to existing literature much clearer.

the initial assessment of the distribution of historical Nigerian data on the variables included in the models shows that manufacturing production in Nigeria during the period under review from 1980Q1 to 2019Q4 is very low. The results imply that the performance of the manufacturing sector in Nigeria has been below average for the past three decades or more. In addition, it is clear from the findings that the underperformance of the manufacturing sector in Nigeria has been consistent annually for most of the years covered in the study. As such, these results support the conclusions of previous authors like Adejare (2014) and Nneka (2012) that the neglect of the manufacturing sector in Nigeria after the discovery of oil has continued to affect negatively, the performance of the sector and the output has been consistently on the decline since oil discovery. The quantity theory of money states that there is a direct relationship between the quantity of money in an economy and the level of prices of goods and services sold (Mihályi & Szelényi, 2019).

Firstly, on the effect of monetary policy on manufacturing sector growth in Nigeria, some other variables are used as shift factors in the model apart from the two monetary policy variables namely monetary policy rate and money supply. The variables such as capital and labour which are important shift factors variables in any output growth model by default are included. Others are macroeconomic and policy variables such as exchange rate, inflation rate, private sector credit, and exogenous variables such as oil price and federal fund rate.

The objective of this thesis included investigating the relationship between monetary policy and manufacturing output growth in Nigeria. Consequently, the discussion of the results starts from the discussion of the impacts of both interest rates that is monetary policy rate and money supply on the manufacturing output growth in Nigeria during the year under investigation. The monetary policy variables fail to show a significant long-run impact on manufacturing production except for the interest rate with a long and short-run impact. The implication is that the monetary policy appears to support the fact that has a transitory or short-run impact on manufacturing output. These findings support the school of thought on the super-neutrality of money (Sidrauski (2009), Papademos (2010), among others. Notwithstanding, the results have questioned the effectiveness of the monetary policy on manufacturing output in Nigeria because the money supply failed to influence manufacturing sector growth significantly. According to MAN (2016), monetary policy in Nigeria, especially in recent times, appears to be causing more problems for manufacturing. The conclusion from these authors is that the mobilization of funds to the manufacturing sector through domestic credit is not yielding any significant positive impact on the manufacturing output. Instead, it has a negative significant impact because the release of money into circulation diffuses into other sectors, and hence the expansionary monetary policy of the CBN most times that improve other sectors at the expense of the manufacturing sector (See MAN, 2016). This result showed that despite the significant effect of interest rate, the money supply is not contributing much to the growth of the manufacturing sector in Nigeria. The implication of this is that the effect of interest rate might not influence the money supply in the right direction to make it have a significant impact on the manufacturing sector.

Secondly, on the relationships between manufacturing output growth and other variables, evidence of consistencies in this present study results are confirmed when considering the relationship between gross capital formation as a macroeconomic variable and manufacturing production. The relationship between the result is positive and significant. It should be recalled that physical capital as a determinant of manufacturing production also showed a significant positive impact on manufacturing production. A similar result is also exhibited by labour. The results support various economic theories like growth and production theories that postulate a direct relationship between capital, labour, and output. The results also follow the findings of a host of studies like Nenbee and Madume (2012); Ditimi, Nwosa, and Olaiya (2012) among others. In addition to this, the present study highlighted that the money supply or interest rate is another variable that influences the behaviour of monetary policy instruments in Nigeria is the exchange rate. Findings are consistent with those of Bigsten and Soderbom (2006) where low productivity prevalent in the manufacturing industry in Nigeria was attributed to the high cost of production, especially energy costs. Adofu, Taiga, and Tijani (2015), further show that the low-capacity utilization in the industry was due to the high cost of raw materials and other overheads.

Another variable used is the exchange rate which appears to be a strong macroeconomic variable affecting the Nigerian manufacturing sector. The current study results showed a significantly negative long-run relationship between manufacturing production and exchange rate. The implication is that the depreciation of the local currency might not necessarily promote the growth of the manufacturing sector in Nigeria. These results are in contradiction to Lawal (2016), who posits that the exchange rate is an important conduit in transmitting monetary policy impulses to the manufacturing sector in the Nigerian economy.

The findings from the study indicate that the exchange rate is an important determinant of manufacturing production and that it influences manufacturing output, which is sustained in the short run through the long run. In other words, it has both significant long-run and short-run impacts on manufacturing output. However, the study shows a negative relationship with the manufacturing output an indication that currency devaluation might not promote the growth of the manufacturing sector in Nigeria. According to Ehinomen (2012) and Olorunfemi et al (2013), the manufacturing sector in Nigeria is highly dependent on imported raw materials and hence the sector is mostly affected more on the cost side than on the output side. Devaluation of Naira makes raw materials much dearer and increases the cost of production for the manufacturing firms and this brings about the decline in production.

Results from the present study highlight the fact that the exchange rate has a significant relationship with manufacturing production in Nigeria. This is consistent with results from Falaye (2017), study who noted that there is a significant relationship between real money, real exchange rate, real exchange rate volatility, exports, imports, and manufacturing production indexes. Again, the exchange rate as a macroeconomic variable maintains the same type of relationship when it is used as a determinant. The exchange rate shows a significant negative relationship with the manufacturing output especially in the long run though in the short run the relationship is positive. The implication is that currency devaluation in Nigeria might not have a sustainable positive impact on manufacturing production in Nigeria. The relationship between exchange rate and output in Nigeria has given birth to diverse conclusions from different past empirical studies. For instance, Ismaila, (2016); Dada and Oyeranti, (2012); Eze and Okpala, (2014); Obi, Oniore, Nnadi (2016); Amassoma and Odeniyi, (2016) among others have supported the view that as a developing country, the relationship between exchange rate and output growth is positive and that devaluation promotes output growth in Nigeria. The conclusions of these authors can be summarized as follows: devaluation of currency may render imports dearer and hence discourage importation of goods that may compete with locally made manufacturing goods, thus improving the profit margin of the local manufacturers and attracting more investors into the manufacturing sector. Olomola (2007), also posited that overvaluation of currency will squeeze out the tradable sector of the Nigerian economy.

On the other hand, a host of empirical studies have also disagreed with the conclusions of the authors whose findings are discussed in the previous paragraph. They concluded from their studies that there exists a negative relationship between exchange rate and output in Nigeria and that the devaluation does not promote the growth of the Nigerian manufacturing sector. Olorunfemi, Obamuyi, Adekunjo and Ogunleye (2013), Adahlla (2016), Ehinomen and Oladipo (2012) among others concluded that the Nigerian manufacturing sector and the exchange rate have a negative relationship. They argued that currency appreciation makes imported goods cheaper and hence makes the raw materials and other imported capital goods that are used for manufacturing production by domestic manufacturing firms more affordable. Hence, the reduced cost of production, in the long run, promotes their output growth. They further argued that the Nigerian manufacturing sector is more affected by the cost side of production than the output side and they cited the exits of many manufacturing firms from the Nigerian economy in recent times due to an increase in the cost of production as examples.

However, findings from this study support the second group of authors that there exists a significant negative relationship between the exchange rate and manufacturing production in Nigeria. Empirical results from our analysis of the relationship between manufacturing output and macroeconomic variables show that the exchange rates are significantly negative, especially in the long run. The implication is that these findings also support the view that devaluation does not promote the growth of the manufacturing sector in Nigeria. The reason for this might not be connected to the fact that most of the studies that concluded that there exists a positive relationship between exchange rate and output did not focus primarily on manufacturing output alone but the entire growth of the Nigerian economy using the GDP as a proxy. As such, this might not reflect the situation that is typical of the Nigerian manufacturing sector.

Again, the results on manufacturing production and exchange rate relationship of this study are also tarry with recent data in the Nigerian economy. In April 2016, the CBN bowed to external pressure and devalued the Naira with the major aim of encouraging investment and improving local production. However, since then, the output growth of key sectors like the manufacturing sector has been tumbling down every quarter. The quarterly data from the Nigerian Bureau of Statistics (NBS) in the third quarter of 2016, showed that the contribution of the manufacturing sector to the GDP dropped by 5 percent, and by the end of the fourth quarter of 2016, it went down further by 7.5 percent despite the devaluation of the currency (NBS, 2016). All these chains of reactions further pushed the entire economy into a recession in 2016. According to the NBS, the reason for the slow performance of the real sector of the economy during the period was the rising cost of production because of a fall in the value of the Naira against the US dollar. In support of the position of the NBS, the Manufacturing Association of Nigeria (MAN) also lamented the rising cost of raw materials and other capital goods that are used for production in the manufacturing sector (MAN, 2016). All these submissions were supporting the position that the manufacturing sector of Nigeria is much more affected by the cost side than the output side.

It should also be noted that with the implementation of the new forex policy in February 2017, CBN had to pump about 2 billion US dollars into the economy. This has seen the Naira reacting strongly against the US dollar and other hard currencies during the time in question. The appreciation of the Naira made the consumer price index fell for the first time since the first quarter of 2016 and the favourable economic outlook made the economists declare Nigeria as an economic recession-free in March 2017 due to a positive growth rate recorded for the first time since the devaluation of the currency.

Inflation is another macroeconomic variable used in the study and the result also indicated that it hurts manufacturing sector output growth, especially in the long run. The result tallies with the findings of many studies in the past that concluded that most of the challenges faced by the manufacturing sector in Nigeria are that of the high cost of production (Omolade and Ngalawa, 2018). With the findings of this study, it is obvious that the challenges are very serious. The inflation rate was also found to have a rather convincing relationship with Nigerian manufacturing production. This is indicated by the significant negative relationship between manufacturing production and the inflation rate in the present study. The implication is that a rise in the inflation rate might not promote the growth of manufacturing production in Nigeria. In Lawal's (2016) findings some variables such as external reserve, inflation rate and exchange rate inclusive are pivotal variables that transmit monetary policy effects to the real sector of the Nigerian economy including the manufacturing sector.

Other variables used in the model will be discussed very well under the impacts of monetary policy transmission, monetary policy shocks, and global shocks on manufacturing sector output growth in Nigeria.

5.5.3 Diagnostics

As indicated in the methodology, some post-estimation tests such as normality, serial correlation, and heteroskedasticity tests among others are done to confirm the validity of the estimated results their results are presented as follows

Table 5.9 Serial correlation test

VEC Residual Serial Correlation LM Tests		
Lags	LM-Stat	Prob
1	41.44842	1.0000
2	131.7356	0.0684
Probs from chi-square with 100 df.		

Source: Author's Computation

Results in Table 5.9 show that the null hypothesis of no serial correlation s accepted since all the probabilities at both lag lengths is greater than 5%. Consequently, it can be concluded from the result that the estimated models are not affected by the problem of autocorrelation.

Table 5.10 Heteroskedasticity test

VEC Residual Heteroskedasticity test		
Joint test:		
Chi-sq	Df	Prob.
2538.789	2750	0.9982

Source: Author's Computation

The Heteroskedasticity test for the joint lags is shown in table 5.10 and the result confirmed that the estimated models do not have the problem of Heteroskedasticity. Again, this is because the probability of the chi-square statistics is greater than 5% hence the model is suitable for empirical analysis.

Table 5.11 Normality test

Component	Jarque-Bera	Df	Prob.
1	19.18783	2	0.0510
2	18.71446	2	0.0599
3	152.7307	2	0.0000
4	86.39386	2	0.0000
5	112.4606	2	0.0000
6	12.45835	2	0.0917
7	103.0632	2	0.0000
8	132.0222	2	0.0000
9	225.5268	2	0.0000
10	14.22381	2	0.0641
Joint	1502.499	20	0.0000

Source: Author's Computation

Table 5.11 shows the normality test using the JARQUE BERRA statistics. The result shows that the residual is not normally distributed because the joint statistics give a probability that is less than 5%. Notwithstanding, four out of the ten variables included in the estimated VEC model showed normally distributed residuals, and with good results under both serial correlation and heteroskedasticity, this result might not have serious implications for the estimated result (Omolade and Ngalawa. 2018).

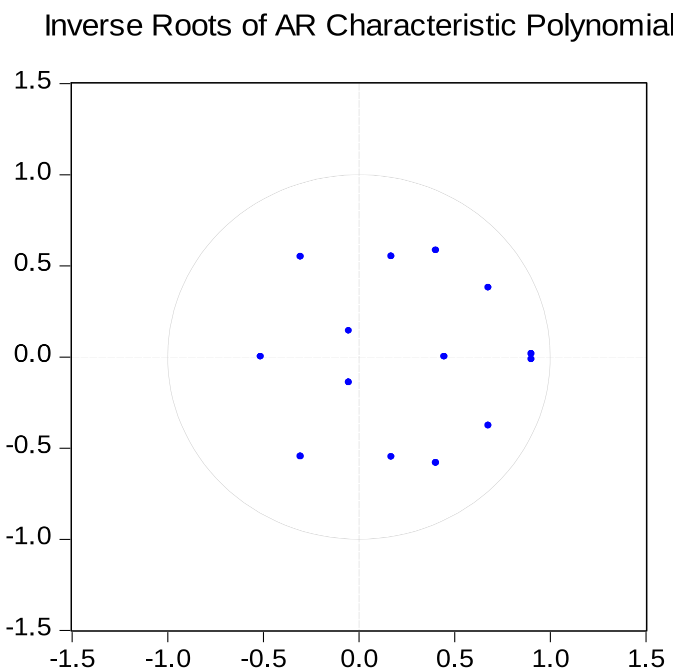
Table 5.12 Stability Test (AR root test)

Roots of Characteristic Polynomial	
Endogenous variables: MUP INTR INF MSGR LOG(EXR) LOG(K) LOG(L) LOG(WOP) LOG(FFR)	
Root	Modulus
0.904444 - 0.015032i	0.904568
0.904444 + 0.015032i	0.904568
0.679765 - 0.377884i	0.777738
0.679765 + 0.377884i	0.777738
0.403626 - 0.582701i	0.708840
0.403626 + 0.582701i	0.708840

-0.303907 - 0.547414i	0.626117
-0.303907 + 0.547414i	0.626117
0.171218 - 0.550625i	0.576631
0.171218 + 0.550625i	0.576631
-0.510342	0.510342
0.447880	0.447880
-0.051064 - 0.141436i	0.150372
-0.051064 + 0.141436i	0.150372
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

Source: Author's Computation

Figure 5.1: VEC Stability test AR roots



Source: Author's Computation

Both Table 5.12 and Figure 5.1 have shown that the stability condition for the estimated VEC model are met. The null hypothesis as stated under the methodology which says that "No roots lie outside the circle" is accepted and it is concluded that the estimated

VEC model is stable. Hence the parameter estimates are fit for making empirical inferences as the case may be.

5.6 Investigation of the transmission mechanism through which global shocks are transmitted to the manufacturing output

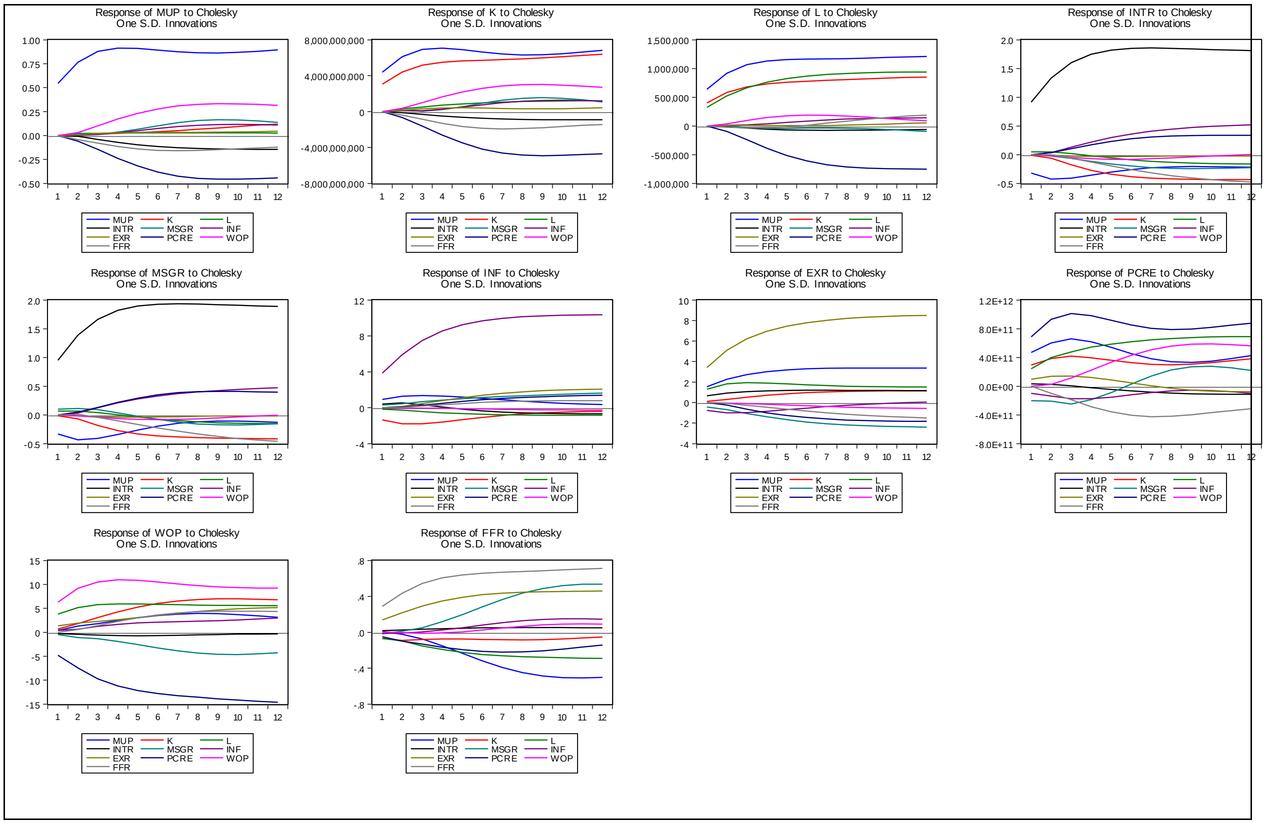
A VECM model provides an opportunity to investigate the short-run dynamics among variables by using the impulse response functions and the variance decomposition approaches. Since cointegration was established, the VECM is used to explore the equilibrium of the system in the short run and the results are presented in Table 5.8. above. However, under this section attention is given to impulse response functions IRFS and the variance decomposition tables to enable us to examine the transmission of global shocks as well as monetary policy shocks to the manufacturing output in Nigeria.

Their interpretation focuses largely on the response of manufacturing output to global shocks measured in terms of one stand0ard deviation shock to world oil price (WOP) and Federal fund rate FFR as well as monetary policy shocks such as MPR and MSGR.

5.6.1 Generalised impulse response function

The GIRF test was used to analyse the response of manufacturing output (MUP) of one Standard Deviation in other variables in the VECM model. The impulse response function result is presented in Figure 5.2.

Figure 5.2 Impulse response function



Source: Author's Computation

The response of manufacturing output to 1 percent standard deviation shock of the world oil price as shown in the first row, the first column of Figure 5.1, maintained a consistent and progressive upward movement from period 1 up to period 10, in the positive region. This reflects among other things that manufacturing output stands the chance of experiencing a progressive increase in the presence of innovative shock to world oil price (global shock).

As shown in the first row, the first column of Figure 5.1, manufacturing output responded positively to 1 percent innovation variation shock in the exchange rate; the response portrayed a mild upward trend from period 1 to period 10 in the positive region. In response to the 1 percent innovation variation shock in the federal fund rate, manufacturing output declined progressively from period 1 to a period in the negative region. In response to a 1 percent innovation variation shock in the inflation rate, manufacturing output oscillated between periods 1 and 3.

It was rising and falling with a moderately high momentum after which it maintained a mild upward trend between period 4 and period 10. In response to the 1 percent innovation variation shock in interest rate, the manufacturing output declined mildly in the first two periods, followed by a wave-like trend between periods 3 and 10, with a relatively sharp downswing between periods 4 and 5. The same response ensued for a 1 percent innovation variation shock in the money supply.

5.6.2 Variance decomposition

For the variance, decomposition attention is only given to the variable of interest in the monetary policy transmission mechanism. Variance decomposition explains the contributions of shocks to the behaviour of variables in the VAR system. Consequently, the contributions of global shocks such as FFR and WOP as well as monetary policy shocks to the behaviours of MUP, MRP, MSGR, PCRE, EXR, and INF are the main focus here.

Table 5.13 Variance decomposition of MUP

Periods	MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR
3	97.18326	0.012854	0.063932	0.470922	0.031858	0.105675	1.460150	0.006920	0.638473	0.025957
6	86.70489	0.068116	0.070817	1.364615	0.346901	0.619863	6.957450	0.186481	3.609621	0.071243
8	80.40234	0.143584	0.069455	1.638851	0.843524	0.920836	10.15413	0.414520	5.332413	0.080347
10	76.49260	0.270653	0.068470	1.676310	1.217003	1.130279	12.08444	0.599092	6.372689	0.088464

Source: Author’s Computation

The variance decomposition of manufacturing output is shown in table 5.13. The results show that the largest shock affecting the manufacturing output sector domestically comes from the exchange rate and monetary policy rates. In terms of the global shock, the oil price has a larger contribution than the federal fund rate. The result is an indication that shock from world oil price affects manufacturing output while internally, the exchange rate shock has the highest contribution of shocks to the behaviours of the manufacturing output in Nigeria followed by the monetary policy rate or interest rate shock and inflation rate shock. To examine the monetary channels that are most affected by the global shocks, the behaviour of private sector credit which represents credit channels, interest rate which is the interest rate channel, and exchange rate channel to the shocks from the global variables such as oil price and federal fund rate is analysed

Table 5.14 Variance decomposition of key monetary transmission channels in the system

Interest rate channels

Periods	MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR
3	0.045616	0.087274	0.094880	90.60399	0.621019	0.322999	0.012927	0.212072	7.928896	0.070327
6	0.124955	0.500499	0.104636	89.13546	2.208988	1.689342	0.024537	1.030414	4.415408	0.765761
8	0.117592	0.766953	0.196282	87.17365	2.863070	2.579342	0.022202	1.487333	3.347057	1.446521
10	0.095043	0.926173	0.283961	85.40936	3.262477	3.319604	0.019650	1.778758	2.765367	2.139609

Exchange rate channel

Periods	MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR
3	0.012590	0.346098	2.315752	1.669282	8.135118	2.251527	70.87566	0.433703	13.89228	0.067989
6	0.056449	0.755857	1.190152	3.011183	5.581638	1.965827	72.00547	1.543382	13.47673	0.413309
8	0.103357	0.934131	0.814343	3.693916	4.630675	1.828255	72.13260	2.054345	13.09731	0.711066
10	0.148562	1.039014	0.596634	4.169230	4.036128	1.724344	72.15669	2.391244	12.73633	1.001831

Credit channel

Periods	MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR
3	0.037459	8.930769	3.210076	22.42388	9.808230	1.289105	1.060797	51.96190	0.297581	0.980206
6	0.086536	7.813290	1.855109	18.57555	14.31861	1.239053	0.703748	47.80913	3.503915	4.095064
8	0.181955	7.081277	1.878337	15.63778	16.78742	1.006516	0.527377	44.58819	6.699651	5.611496
10	0.273759	6.684327	2.316904	13.54808	18.40113	0.828548	0.457608	42.29255	9.134351	6.062752

Source: Author's Computation

The result is an indication that oil price again is dominant among the shocks affecting the interest rate in Nigeria. It can be seen from the table that oil price contributed the largest shocks to the behaviour of the interest rate in Nigeria as a global shock of course internally money supply shock which is the other monetary policy instrument has the largest shock to the behaviour of interest rate. From the table it is obvious apart from the own shock, the two shocks affecting the interest rate channel mostly are the oil price and money supply shocks.

The contributions of shocks to the behaviour of the exchange rate are analysed in the table also. The Figures under the oil price are the highest, this implies that the oil price in Nigeria affected the exchange rate the most apart from the own shock. This is followed by monetary policy instruments that are money supply and interest rate shocks in that order and inflation rate shock is the next. This result has underscored the importance of oil price shocks in the determination of the exchange rate in Nigeria.

The credit channel is captured with the private sector credit. The result from the table shows that monetary policy instrument especially the interest rate contributes the largest shock to the behaviour of private sector credit. This is followed by a money supply shock. The credit channel in Nigeria is strongly affected by monetary policy shocks. In addition, the result also shocks that apart from the own shocks and the monetary policy shocks, investment shock is very key in affecting the behaviour of private sector credit in Nigeria. It is again obvious that the two global shocks namely oil price and federal fund rate have not shown a direct significant effect on the behaviour of credit in Nigeria.

Finally, the conclusion that can be drawn from the variance decomposition result is that global shocks affect monetary policy instruments and exchange rates directly while they affect manufacturing output both directly and indirectly. Both interest rate and exchange rate are mostly affected by oil price shocks and they are the most dominant variables that contribute the largest shocks to the behaviour of manufacturing output followed by the inflation rate

5.6.3 Discussion of findings on Global shocks, monetary transmission channels, and manufacturing output growth in Nigeria.

The two global shocks used in the model are oil price and federal fund rate. Considering the monetary policy transmission mechanism and the manufacturing production in Nigeria, empirical results from the study have shown that the domestic economy is highly susceptible to external shocks. Precisely, the findings show that manufacturing production in Nigeria is very vulnerable to external shocks of oil price and federal fund rate (FFR) though the world oil price shock has more effect than the FFR shock. The shock of the world oil price has a significant influence on the behaviour of manufacturing production. This is confirmed by both the impulse response and variance decomposition results.

The result obtained here depicts a situation that the manufacturing industry in Nigeria, that appears to be vulnerable to external shocks since world oil price is an exogenous variable and its price is highly influenced by the value of the currency. Notwithstanding, federal fund rate shock does not have a significant contribution to the behaviour of manufacturing sector output. This finding implies that for instance increase in oil price, which should translate to an increase in income for Nigeria being an oil-producing country, is not felt positively on the domestic manufacturing outputs. The revenue from oil appears to pose more challenges for the manufacturers than benefits. This is an indication of the resource curse phenomenon, which is a clear symptom of Dutch Disease. Previous empirical studies like Omolade and Ngalawa (2014), among others, have concluded that there is evidence of Dutch Disease in Nigeria just like in other resource-endowed countries in the world.

As part of the monetary transmission, the result from the study has also shown exchange rate channels to be very important in transmission the of external shocks like oil price shocks to the domestic economy. Findings from the results have shown that the nature of domestic currency in Nigeria is dictated by the world oil price. The exchange rate reacts sharply and significantly to the two exogenous shocks. The findings are similar to the results of Demachi (2010), who stated that oil price fluctuations are seen as the largest determinant of the exchange rate in Nigeria. The reason for this result is connected to the fact that the Nigerian economy is solely dependent on crude oil production and oil revenue from the major economic base of the country. This is evident in the recent crash in the world oil price that severely affected the value of the Naira and further led to the spiral effects on other sectors in the Nigerian economy with the inclusion of the manufacturing industry.

Since the exchange rate is very responsive to external shocks, the study also found that the inflation rate is again very responsive to exchange rate shock. The present study results highlighted the fact the foreign exchange market plays a significant role in the determination of the value of a currency. This relationship has implications for manufacturing production. The link is that domestic prices are influenced by exchange rate shock, depending on the level of dependency of the country on importation. The situation in Nigeria is such that the volume of imports rises year after year and hence makes the domestic prices highly vulnerable to exchange rate shock. All these further underscores the importance of the inflation rate in the transmission of exchange rate shocks to the domestic economy.

The current study results indicated that the behaviour of the inflation rate in Nigeria is affected by two major variables namely, world oil price and exchange rate. In addition, this study's findings indicate that the shocks that contribute the highest percentage of shocks to the behaviour of the money supply are interest rate and exchange rate and they are followed by inflation rate in that order. In line with these findings, Bigsten & Soderbom (2006) posited that the reasons behind the low growth and performance of the Nigerian manufacturing sector include high production costs caused by energy and exchange rates. This is explained by the quantity theory of money, which states that there is a direct relationship between the quantity of money in an economy and the level of prices of goods and services sold. Therefore, an increase in the money supply causes prices to rise (inflation) as they compensate for the decrease in money's marginal value (Innerlind, 2005).

According to Omolade and Ngalawa (2015), more than 50 percent of the raw materials used in the Nigerian manufacturing sector are sourced externally. Again, capital goods, which are also used in the production process and the provision of infrastructures, are all imported. This has been supported by the import bill, which rose from 305 billion US dollars in 2012 to 495 billion US dollars in 2016, making Nigeria one of the largest importers of foreign commodities in Africa (NBS, 2016). The resultant effect of currency devaluation in this situation is raising the cost of production since it increases the domestic consumer price index. The link between the exchange rate and inflation rate appears to be very strong in Nigeria and the effect of this relationship on the manufacturing output is very significant. According to Omolade and Ngalawa (2014), inflation in Nigeria is more of a structural issue than monetary motivated inflation. This underscores the importance of the exchange rate in the determination of domestic prices and by extension, the inflation rate in Nigeria since the country largely depends on importation.

Apart from inflation that reacts significantly to exchange rate shocks, the study has also revealed that the monetary policy instruments are also very responsive to the exchange rate shock. it is also shown that the policy rate and broad money supply also react very sharply to exchange rate shock as well. It is clear from the variance decomposition that the character of the monetary policy instrument is highly dictated by the exchange rate.

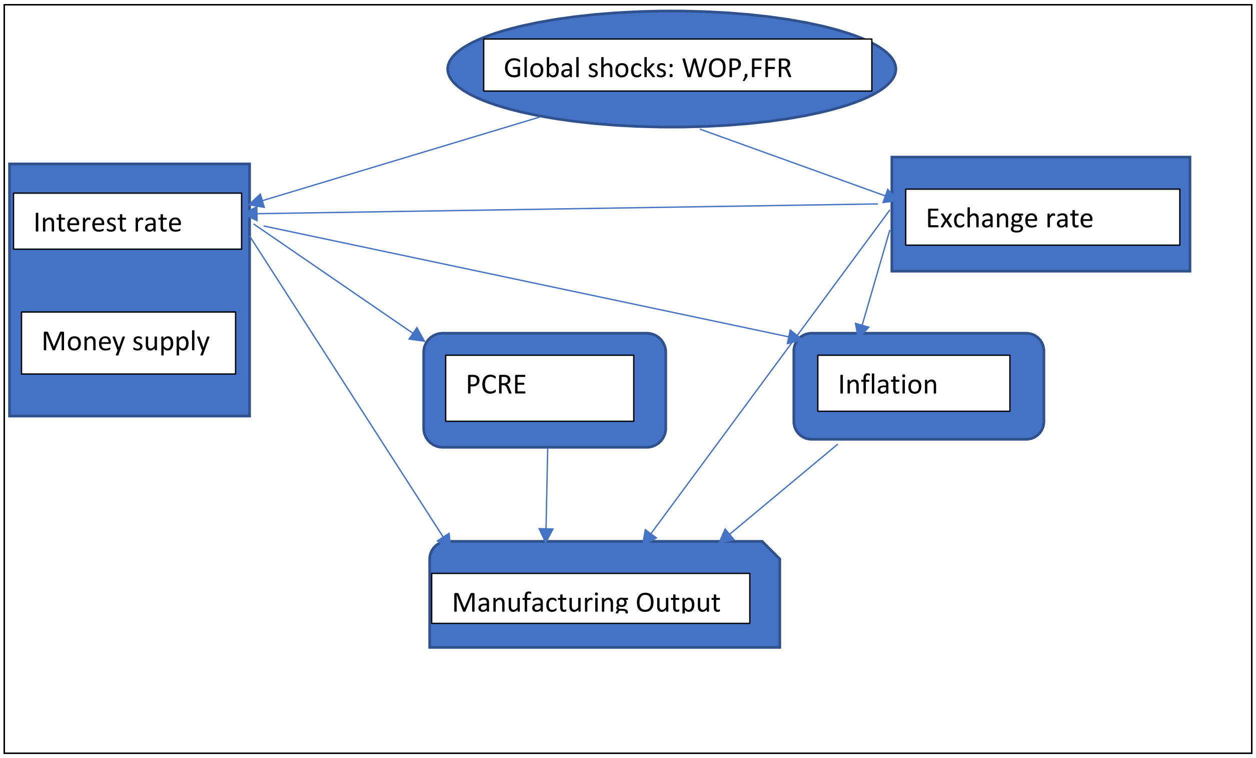
These findings are in line with the Mundell-Fleming model, which postulates that the monetary policy has a strong link to the exchange rate, especially for a country that is practicing the floating exchange rate system like Nigeria (See Romer, 2009). It implies that monetary policy is the medium through which the exchange rate passes its shock to domestic activities.

Monetary policy shocks are also analysed in the monetary transmission result. This study has confirmed the significant influence of monetary policy shocks on inflation and there exist a strong linkage between the stability in the monetary policy and general price stability, however, some studies in the past have also confirmed similar result from there various studies across the globe (Lawal, 2016). It should be noted that inflation is very key to the behaviour of the manufacturing output. The present study results show that the rate of inflation shows an inverse relationship that is significant with the manufacturing output. The empirical findings indicate that a rise in the consumer price index inflation rate (CPI inflation rate) significantly reduced the value-added coming to the manufacturing industry in Nigeria. This finding further supports our discussion earlier that the manufacturing industry is significantly affected by the rising cost of production.

In addition, monetary policy shocks have also shown a significant impact on private sector credit. Analysis from the monetary transmission channels depicts a situation where private sector credit responds mostly to interest rate shocks. The implication of this is that credit channels in the monetary transmission are highly sensitive to monetary policy shocks.

From the discussion above a diagram that represents the channels of transmission can be represented in Figure 5.3.

Figure 5.3: Channels of Transmission



Source: Author's Computation

Figure 5.3 shows the summary of the results obtained on the monetary transmission channels. it indicates a direct influence of the global shocks on the exchange rate and monetary policy instruments. Also, the shocks can pass through the exchange rate to influence monetary policy. It was shown further that monetary policy shocks affect both private sector credit and inflation significantly. Inflation behaviour is mostly influenced by exchange rate shocks and monetary policy shocks. For the manufacturing output, exchange rate shocks, inflation shocks, and monetary policy shocks have the greatest effect on it. In some cases, the effect of exchange rate shocks passes through the inflation rate to the manufacturing output while in some cases the effect of the monetary policy shocks passes through the private sector credit.

No significant relationship was recorded from the result between private sector credit and inflation. Money supply also shows no significant effect on the behaviour of manufacturing output except interest rate.

In conclusion, the effect of global shocks on manufacturing output makes use of the exchange rate channel and interest rate channel directly. Further analysis shows that exchange rate shocks also affect manufacturing output directly or indirectly through the inflation rate. Again, Monetary policy shocks affect manufacturing output directly or indirectly through inflation and private sector credit

5.7 Conclusion

This chapter has presented, analysed, and interpreted the empirical results based on the data collected on all the variables. Each objective of the study was analysed using the estimation techniques discussed in the previous chapters. The diagnostic test was also included in the chapter. More importantly, a discussion of the findings based on the empirical results of each of the objectives of the study was also done in a very elaborate manner.

CHAPTER SIX

GENERAL SUMMARY, POLICY IMPLICATIONS, AND RECOMMENDATIONS

6.1 Introduction

This chapter summarises the thesis, especially the findings, it gives some conclusions and policy implications as well as recommendations that are directly emanating from the findings in the thesis.

6.2 Summary

Some of the major justification thrusts for the study included the poor state of the manufacturing sector of Nigeria and the need to contribute to the literature by assessing the level and the causes of the decadence, and the ways through which the country can solve this problem. In solving the problem of the manufacturing sector in Nigeria, the role of the monetary policy has been questioned. This was critically explained in chapter one of this research report. Therefore, assessing the relationship between monetary policy dynamics and the manufacturing sector of Nigeria also became imperative. In addition, the utilization of monetary policy to promote growth and maintain economic stability in many countries of the world also necessitated the verification of its efficacy in rejuvenating and maintaining sustainable development of the manufacturing sector in Nigeria.

The efficacy of the monetary policy in promoting the growth of the manufacturing sector hinges on the effectiveness of the monetary policy transmission mechanism. The composition, structure, and vulnerability of the monetary policy mechanism to various internal and external shocks also play many roles in determining its efficiency in influencing the growth of the manufacturing sector. This is because a consensus has been reached that oil-rich economies are most likely to be highly susceptible to both external and internal shocks, particularly oil price shocks. This is the reason one of the study's objectives was the assessment of the transmission mechanism through which global shocks transmit to manufacturing output.

Generally, apart from investigating the trends of manufacturing outputs in Nigeria, the study was carried out based on two modular themes, which also form the specific objectives; assessing the relationship between manufacturing production and monetary policy shocks in Nigeria and investigating the transmission mechanism through which global shocks and monetary policy transmit to the manufacturing output.

The first specific objective of the research work was the assessment of the relationship between macroeconomic indicators and manufacturing production in Nigeria. The model expressed the manufacturing sector output growth rate as a function of macroeconomic variables such as inflation rate, exchange rate, and some monetary policy variables such as interest rate and money supply. The model also included some variables, which were considered exogenous to the economy in the form of oil prices and the federal fund rate. The time series analysis was used to explore the relationship between manufacturing output and the identified determinants.

Due to the results of the unit root tests, which showed that all the variables in the model have an integration of order one, that is I (1), the Johansen type of cointegration technique was applied to estimate the model. The results from the Johansen cointegration showed that there exists a long-run relationship between manufacturing output and the macroeconomic variables. In other words, the Johansen cointegration result indicated that there exist at least seven cointegrating vectors which were a confirmation of the existence of co-movement between manufacturing output in Nigeria and these variables

Furthermore, the cointegration regression analysis showed that the variables in the model were more significant in the long run than in the short run. For instance, the exchange rate was shown to have a negative and significant relationship with the Nigerian manufacturing output while the inflation rate shows a negative and significant relationship with manufacturing output. For the monetary policy variables included in the model, the result shows that interest rate is the only variable with a significant impact on the manufacturing output while the money supply failed to exert any significant impact on manufacturing output. As for the exogenous variables, they both have a significant impact on the manufacturing output in Nigeria. This shows that the manufacturing sector in Nigeria is most likely to be exposed to external shocks.

Some diagnostic tests were carried out to examine the validity of the parameter estimates in the long and short-run estimated models. The normality test was carried out through the histogram and Jarque-Berra statistics and the result showed that the estimated model was normally distributed. In addition, the test for autocorrelation was carried out and the result confirmed that there was no serial correlation in the estimated results. Finally, the test for heteroskedasticity was carried out and the hypothesis of no heteroskedasticity was accepted which indicated that the estimated models do not have heteroskedasticity problems.

Furthermore, the results from the second objective of the study which was to determine the transmission mechanism through which global shocks, as well as monetary policy transition to the manufacturing output, was carried out within the framework of the VECM via generalized impulse response and variance decomposition analysis. The choice of the VECM model was based on its ability to study the effects of macroeconomic shocks on a particular variable of interest and the efficacy in tracing the mechanism through which variables influence and transmit effects within themselves in a single model specification in the long run.

Just like the cointegration regression, the following variables were included in the VECM model; INTR is the interest rate, MSGR is the money supply growth rate, EXR is the exchange rate, INF is inflation is included as endogenous variables in the model while world oil price WOP and Federal Fund rates FFR are used as exogenous variables. These variables also represented global shocks.

The generalized impulse response function of the world oil price showed that manufacturing output and the exchange rate is most responsive to the oil price shocks while other variables were relatively docile. However, the responses to the other exogenous shock, which was the Federal Fund rate (FFR), were not significant like the oil price. Not all the variables included in the model showed a significant response to the shocks from the FFR.

Responses to monetary policy shocks were also examined and the money supply shock was the first to be examined. The result of the generalized impulse response function of the money supply indicated that only the interest rate which is the other monetary policy instrument in the model responds significantly to the shock from the money supply. However, the case is a bit different when the impulse response function of the interest rate is investigated. The result showed that manufacturing output, money supply, and exchange rate all respond significantly to the shock from the interest rate. This is an indication that the interest rate appears to be a more potent instrument of monetary policy than the money supply in Nigeria.

The inflation rate generalized impulse response function showed that both manufacturing output and exchange rate were most responsive to inflation rate shock. This confirms the vulnerability of the Nigerian manufacturing sector to inflation rate shocks. In addition, it affirms the fact that the exchange rate and inflation rate are strongly related.

The reaction to the exchange rate shock is a clear departure from all other shocks as it commands significant responses from virtually all the macroeconomic variables included in the model. Manufacturing output, interest rate, and inflation rate all exhibited a significant response to the exchange rate shock. Both interest rate and inflation rate react positively while manufacturing output growth reacted negatively. The impulse response function of interest rate revealed that manufacturing output and macroeconomic variables in Nigeria are highly susceptible to exchange rate shocks

Considering the variance decomposition model, the results showed that the exchange rate and interest rate were the most important variables that dictated the behaviour of the money supply as an instrument of monetary policy and inflation in Nigeria. In addition, according to the variance decomposition result, the behaviour of the inflation rate was mostly affected by the exchange rate through world oil prices. Again, the linkage between the exchange rate and the inflation rate was further confirmed through the variance decomposition result. The results further showed that, apart from the money supply, which is a monetary policy instrument, the behaviour of interest rate is affected by exchange rate shocks. In other words, the exchange rate contributed the largest shock to the interest rate after money supply shocks.

Considering the behaviour of the exchange rate within the variance decomposition framework, the result indicates that the Nigerian exchange rate is strongly affected by the two exogenous variables used in the VECM model, world oil price and federal fund rate. This is an indication that the Nigerian economy generally is highly vulnerable to global shocks. World oil price accounts for the largest shocks to the exchange rate followed by the federal fund rate. The fluctuations in the Nigerian exchange rate according to the variance decomposition result can be traced to the world oil price shocks.

The manufacturing output variance decomposition is an indication that the behaviour of manufacturing output responsibilities is shared among three variables namely, world oil price, interest rate, and exchange rate. The three variables account for the significant changes in the manufacturing output. Notwithstanding they are also closely followed by inflation rate shock. Therefore, world oil price shock, exchange rate shocks, interest rate shocks, and inflation rate shock all account for the behaviour of manufacturing output in Nigeria.

6.3 Findings

The study has confirmed an inverse relationship between the oil price of oil revenue and the manufacturing output growth in Nigeria. The results are consistent with the evidence of Dutch Disease, which has previously been confirmed by some studies like Olomola (2007) and Omolade and Ngalawa (2014). This result implies that the Nigerian economy is long overdue for economic diversification. For instance, studies have shown that countries that are naturally endowed do have development challenges. The only exception is Botswana because out of 65 countries that are naturally endowed, it has an investment share of the GDP that exceeds 25 percent while others such as Nigeria have below 10 percent. The success of Botswana was unconnected to the fact that the country might diversify the economy via both manufacturing and the Agricultural sectors (Olomola, 2007). It is expedient that the Nigerian government should take an aggressive approach toward the issues of economic diversification through the manufacturing sector. A policy that will enhance the utilization of the oil revenue to revamp the ailing manufacturing sector should be put in place and executed more purposefully. The implication for a more diversified economy is the limitation in the vulnerability of such economies to external shocks enhancing long-term economic planning.

The findings from the study also have some implications for the current exchange rate policy in Nigeria. Currently, the CBN is following a controlled floating exchange rate system. In other words, while they allow the currency to move freely in the foreign exchange market, the CBN still exerts some degree of control on the range within which the currency should hover around by providing support for the Naira using the country's external reserves among others. However, this effort was maintained until the first quarter of the year 2016 when the CBN finally bowed down to external pressure and devalued the Naira officially. The intention then was to encourage foreign investment and encourage exportation and thereby boosting domestic output. This action further plunges the economy into a deeper economic recession as the GDP fell by another -1.5 percent in the third quarter of the same year. The implication of this is that currency devaluation might not be the solution to the economic woes of a country like Nigeria which is heavily dependent on the importation of virtually all kinds of goods. The effect of this is that it makes imports dearer and hence it triggers the domestic inflation rate. This is evident in the Figures of the inflation rate, which rose from 11 percent in the first quarter of 2016 to as high as 17 percent at the end of the third quarter of 2016. Inference from this study has shown that currency devaluation without an increase in domestic output without improvement in manufacturing and agricultural outputs creates further problems for the economy.

Again, the findings from this study also have some implications for the inflation rate policy of the CBN especially as it affects the manufacturing sector of the economy. It appears that the CBN is tackling the inflation problem of Nigeria from the wrong perspective. The chains of action of the CBN from 2016 to date are evidence of this fact. The CBN decided to follow a tight monetary policy in the first quarter of 2016 by raising the monetary policy rate from 12 percent to 14 percent to reduce the inflationary pressure on the economy. During the first quarter of 2016, the inflation rate in Nigeria was around 11 percent from about 9 percent in December 2105 thus making it enter double-digit for the first time within the last decade then. The action of the CBN further aggravated the inflation rate to as high as 17 percent in the third quarter of 2016 as it discouraged more domestic investment opportunities.

In the release of MAN (2016), a strong case for the reduction in the monetary policy rate to boost and aid their production was made but instead, the CBN kept on maintaining a tight monetary policy to curtail the rising inflation trend. However, by the end of 2016, the inflation rate had reached 18 percent, which was an unprecedented Figure within the last two decades in the Nigerian economy. These chains of action imply that the inflation rate in Nigeria might not be a monetary phenomenon as the CBN opined but more of a structural phenomenon. The rising cost of production against excessive money in circulation appears to be the major factor responsible for domestic inflation in Nigeria. This has been confirmed by the findings in this study that structural imbalances in terms of prices and outputs are major causes of the inflation rate in Nigeria and this has serious adverse effects on the manufacturing sector of the economy.

Generally, the inefficiency of the monetary policy to assist the manufacturing sector of Nigeria lies in the lack of understanding of the true relationship that exists between the exchange rate and the inflation rate in Nigeria. Findings from this research work have shown a strong association between the two. A poor exchange rate policy will promote imported inflation and a misunderstanding of this relationship leads to the application of the wrong monetary policy, which in turn aggravates the problem of the productive sectors like the manufacturing sector. Apart from capital goods import, which forms the basic import of the manufacturing sector through which it gets the machinery needed for production, the Nigerian manufacturing sector is also heavily dependent on raw materials importation. This makes devaluation more harmful than helpful for the sector. The sector is more adversely affected by the cost side than the output side. Once the cost of production is high, the output is reduced and hence the gains from devaluation through export will elude the sector.

6.4 Policy Recommendations

Considering the findings from this study, it is recommended that the Nigerian government should direct the CBN to further boost loan availability to the manufacturing sector in

Nigeria. These loans should also come at affordable prices. It is evident from the findings and discussions that despite the increase in money supply in Nigeria the effect on the manufacturing output has been insignificant. The implication of this is that these monies are not getting to the productive sector of the economy like the manufacturing sector. It is recommended that CBN should reduce the monetary policy rates drastically to promote the growth of the real sector and rejuvenate the manufacturing sector of the country. The current activity of the CBN in boosting the domestic money supply is inefficient in promoting the growth of the manufacturing sector.

6.4.1 Exchange rate policy

The exchange rate policy is one of the challenges for the monetary authorities in Nigeria. Instead of bringing about sanity into the economy by reducing economic uncertainty, the kind of exchange rate policy implemented in Nigeria is such that it escalates the already depressed state of the economy. For instance, the currency devaluation policy carried out during the economic recession is well conceived and hence inimical to improvement in the manufacturing production capacity.

Based on the previous point, monetary authorities are advised to be cautious when implementing exchange rate policy especially, currency devaluation.

6.4.2 Inflation rate policy

Based on the findings of the current study and the discussions of the empirical results, it has been shown that the CBN is tackling the inflation problem in Nigeria wrongly. The conceptualization of the inflation rate in Nigeria as a purely monetary phenomenon by the CBN is misleading and inimical to the progress of the manufacturing sector. The inflation rate dynamics in Nigeria are more structurally motivated than monetary motivated. As such, imbalances in output and prices appear to be causes of inflation rather than excessive money in circulation. Consequently, embarking on a tight monetary policy to curb inflation might not be a good idea, but a policy position that will aid domestic production and assist in the stabilization of prices might be a better way to reduce the rising inflation trend in Nigeria.

The Central Bank should implement policies to ensure accessibility of the foreign exchange to the Nigerian manufacturers to enable the manufacturing sector to obtain inputs such as plant and machinery cheaper from the global market as their scarcity makes it more expensive to source for and discourages production.

6.4.3 Monetary policy

As a corollary to the immediate previous point, it is advised that the monetary policy rate should always be inclined towards efforts geared towards improving investment in the manufacturing sector and not one that will discourage further domestic investment. Consequently, the continued implementation of tight monetary policy since the first quarter of 2016 is worsening the situation of the manufacturing sector as it is reducing investment further in the sectors.

The monetary authority should ensure the implementation of various to guarantee that the lending interest rate to the manufacturing sector is affordable and sustainable to ensure greater productivity. It is crucial because the manufacturing sectors account for the considerable variance in the manufacturing contribution to GDP relative to other monetary variables.

6.4.4 Monetary transmission mechanisms

Based on the result of this thesis, it is evident that the monetary policy transmission mechanism needs some attention for it to have the expected impact on the real economy.

Firstly, the result has shown that the interest rate is the most proficient channel in monetary transmission in Nigeria. This finding implies that the CBN should prioritize this channel and influence economic activity, especially the growth of the manufacturing sector, which was the focus of this study via this channel. Over the years, the Nigerian economy has grappled with the effects of the high cost of capital, and it has limited the growth of the real sectors. The findings of the monetary transmission mechanism suggest that a moderately low-interest rate can percolate easily into the economy via investment and capital inflow and, in turn, aid the growth of the manufacturing sector.

Secondly, effective exchange rate management is crucial. The results have shown that the exchange rate channels are a vital transmitter of shocks to the real economy. Moreover, the devaluation or depreciation of the Naira should be handled carefully to prevent a backlash from such policies. The results have also shown that without putting other enabling factors in place that can boost the manufacturing output currency devaluation might be counterproductive. That might increase the woes of the manufacturing sector because the exchange rate channel is a quick transmitter of shocks in the monetary transmission mechanism.

Thirdly, a favourable balance should be reached between inflation targeting policy and output growth. A tight monetary policy to curtail rising inflation might be counterproductive if inflation in Nigeria is not a monetary phenomenon. Therefore, CBN needs to do a careful assessment of the nature of the inflation rate in Nigeria. This assessment will enable it to know the right policy to mix in achieving the inflation target for the economy without jeopardizing the growth of the sectors like the manufacturing sector in Nigeria.

Finally, this study also recommends credit channel priority. It should be noted that this channel worked symbiotically with the interest rate channel. A tight monetary policy limits credit availability in the economy and vice versa.

6.5 Suggestions for further research

The study has analysed, interpreted, and discussed extensively the empirical results on the dynamic effects of monetary policy shocks on manufacturing sector growth in Nigeria. After all, efforts put in place for further research can continue from where this thesis stopped firstly by introducing more channels into the transmission mechanism to see if other channels apart from the exchange rate, interest rate, credit, and price channels were included in this studies can also influence the relationships between monetary policy shocks and manufacturing sector growth of Nigeria, For instance, the balance sheet channels were not captured in this study, this can be added by further empirical research.

In addition, since there is the likelihood of each sub-sectors in the manufacturing sector responding to monetary policy shocks as well as global shocks differently, it might be more interesting to see if further research can unbundle the manufacturing sector into subsectors such s as consumer goods, ICT, pharmaceuticals among other and see if the results will be different from the entire manufacturing sector growth which has been done in this study. This can offer further policy options for sectoral implementation of monetary policy in Nigeria.

REFERENCES

Abdulrahman, B.M.A. (2010). The Role of Monetary Policy on Economic Activity in Sudan: An Empirical Investigation, 1990-2004. *Journal of Human Science, Issue 44, Jan.*

Abradu-Otoo, P, Amoah, & Bawumia, M. (2003). An Investigation of the Transmission Mechanisms of Monetary Policy in Ghana: A Structural Vector Error Correction Analysis. *Bank of Ghana Working Paper, No WP/BOG-3002/02.*

Acosta-Ormaechea, S., & Coble, D. (2011). Monetary transmission in dollarized and non-dollarized Economies: The Cases of Chile, New Zealand, Peru, and Uruguay. *IMF document de trabajo WP/11/87.*

Ade-Agoye, I. (2011), MAN Ikeja holds AGM and expresses worry over the poor contribution of the manufacturing sector to GDP. *Manufacturing Association of Nigeria News. p8*.

Adebiyi, M. A. (2006). Inflation Targeting: Can we establish a stable and predictable policy instrument between inflation and monetary policy instrument in Nigeria and Ghana? *Retrieved from http://www.google.com.ng.*

Adegbite, S. (2012). An Evaluation of Technology Innovation on the Performance of Indigenous Textile Weaving Firms in South-western Nigeria. *Journal of Business & Management,* 1 (1), 1-14.

Adekoya, A. (1987). The role of government in promoting increase productivity on Nigerian firms. Proceeding of the National Conference on productivity, National productivity Centre, 1991, p. 56.

Adenikinju, A. (2003). Nigeria's Imperative in the New World Trade Order. Workshop Report, African Economic Research Consortium (AERC). Department of Economics, University of Ibadan, Ibadan, Nairobi, Kenya and Trade Policy Research and Training (TPRTP).

Adewuyi, A. O & Akpokodje, G. (2013). Exchange Rate Volatility and Economic Activities of Africa's Sub-Groups. *The International Trade Journal,* 27 (4), 349-384.

Adigwe, P. K.1., Echekoba, F.N., & Onyeagba, J. B.C (2015). Monetary Policy and Economic Growth in Nigeria: A Critical Evaluation. *Journal of Business and Management,* 17 (2) 110-119*.*

Adofu, I., Taiga, U. U. & Tijani, Y. (2015). Manufacturing Sector and Economic Growth in Nigeria (1990-2013). *Donnish Journal of Economics and International Finance,* 1 (1), 001-006.

Adolfson, M. (2001). Monetary Policy with Incomplete Exchange Rate Pass-Through. *Sveriges Riksbank Working Paper Series No. 127.*

Afam, A.M. (2012). Banking Sector Reforms and the Manufacturing Sector: The Manufacturing Association of Nigeria Perspective. *Central Bank of Nigeria Publication*.

Agbede, M.O. (2013). The Growth Implications of Oil Price Shock in Nigeria. *Journal of Emerging Trends in Economics and Management Sciences,* 4 (3), 343-349.

Agenor, P. R. & McDermott, C. J & Prasad, E. S, (2000). Macroeconomic Fluctuations in Developing Countries: Some Stylized Facts. *World Bank Economic Review, World Bank Group,* 14 (2), 251-285.

Aghion, P., Bacchetta, P., Ranciere, R & Rogoff, K. (2009), Exchange Rate Volatility and Productivity Growth: The Role of Financial Development, *Journal of Monetary Economics*, 56 (4), 494-513.

Agung, J. (1998). Financial Deregulation and the Bank Lending Channel in Developing Countries: The Case of Indonesia. *Asian Economic Journal, 12(3): 273-294.*

Ahlgrim, K. C & D'Arcy S. P. (2012). The Effect of Deflation or High Inflation on the Insurance Industry. *Casualty Actuarial Society, Canadian Institute of Actuaries, and Society of Actuaries.*

Aigbedion, I. M. (2017). Inflation Targeting as a Monetary Policy in Nigeria: An Application of Vector Autoregressive (VAR) Model. *Journal of Economics and Sustainable Development*, 8 (7), 2222-2700.

Aigbokhan, K. B. (1995). Financial Development and Economic Growth: A Test of Hypothesis on Supply Leading and Demand Following with Evidence on Nigeria. *The Nigerian Economic and Financial Review NEFR,* 1 (2), 1-10.

Ajayi, S. I. & Ojo, O. O. (2006). Money and Banking: Analysis and Policy in the Nigerian Context. *Ibadan, Daily Graphics.*

Ajisafe, R. A & Folorunso, B. A. (2002). The Relative Effectiveness of Fiscal and Monetary Policy in Macroeconomic Management in Nigeria. *The African Economic and Business Review,* 3(1), 23-40.

Akinjare, V., Babajide, A. A., Isibor, A. A. and Okafor, T. (2016) Monetary Policy and its Effectiveness on Economic Development in Nigeria. *International Business Management*, 10 (22), 5336–5340*.*

Akinlo, O. O & Lawal, Q. A. (2015). Impact of Exchange Rate on Industrial Production in Nigeria 1986-2010. *International Business and Management,* 10(1), 104-110.

Akinmulegun S. O and Oluwole F. O. (2014) An Assessment of the Nigerian Manufacturing Sector in the Era of Globalization. A*merican Journal of social and Management Sciences,* 5 (1), 27-31.

Akujuobi, L. (2010). Monetary Policy and Nigeria's Economic Development. *African Research Review,* 4 (4), 153-161.

Alade, S. O. (2015). Determination of an Optimal Threshold for the Central Bank of Nigeria's Monetary Policy Rate. *CBN Working Paper Series. CBN/WPS/01/2015/01.*

Alam, T. & Muhammad, H. (2006). The Monetary Transmission Mechanism in Pakistan: A Sectoral Analysis. *The Pakistan Development Review Vol. 45(4), 1103-1115. Papers and Proceedings PARTS I and II Twenty-second Annual General Meeting and Conference of the Pakistan Society of Development Economists Lahore, December 19-22, 2006 (Winter 2006)*.

Aleem, A, 2010. Transmission Mechanism of Monetary Policy in India. *Journal of Asian Economics, Elsevier*, 21(2), 186-197.

Alfaro, R., Franken, H., García, C., & Jara, A. (2003). Bank Lending Channel and the Monetary Transmission Mechanism: The case of Chile. *Banco Central de Chile, Working Papers,* 22(1), 128-145*.*

Alley, I.A., Asekomeh, H., Mobolaji, H and Adeniran, Y.A. (2014). Oil Price Shocks and Nigerian Economic Growth*. European Scientific Journal. Edition,* 10 (19), 1-17.

Alos, A. J. (2000) Creating Value under Uncertainty, *Journal of African Business.* 1(1), 9-24.

Altar, M. (2003) Fiscal and Monetary Policies and Economic Growth. *Bucharest Academy of Economic Studies.*

Andrea Brischetto and Graham Voss, (1999), A Structural Vector Autoregression Model of Monetary Policy in Australia, RBA Research Discussion Papers, Reserve Bank of Australia Issue, 12 (3), 45-67.

Angeloni, I., Kashyap, A. K., Mojon, B., & Terlizzese, D. (2003). Monetary Transmission in the Euro Area: Does the Interest Rate Channel Explain It All? National Bureau of Economic Research. Working Paper No. 9984.

Anthony E. & Mustafa, I. (2011). The Impact of Financial Sector Reforms on Non-Oil Export in Nigeria. *Journal of Economics,* 2(2), 115-120.

Anyanwaokoro, M. (1999). Theory and Policy of Money and Banking. Enugu, Nigeria, *Hossana Publication.*

Anyanwu, C. M. (2004). Productivity in the Nigerian Manufacturing Industry. *Central Bank of Nigeria Research Department Publication 124-129.*

Apere, T.O. & Karimo, T.M. (2014). Monetary Policy Effectiveness, Output Growth and Inflation in Nigeria. *International Journal of Economics, Finance, and Management,* 3 (6), 301-307.

Armstrong, J. S. (1985). Long-range Forecasting: From crystal ball to computer. 2nd Edition. New York: John Wiley & Sons.

Arratibel, O., & Michaelis, H. (2014). The Impact of Monetary Policy and Exchange Rate Shocks in Poland: Evidence from a Time-Varying VAR. *Discussion Papers in Economics from the University of Munich, Department of Economics.*

Asongu, S. (2014). African Development: Beyond Income Convergence. *South African Journal of Economics,* 82 (3), 334-353.

Ayeni, O. B. (2003). SON Representative, Speech at Nigeria's Imperative in the New World Trade Order, Workshop Report. African Economic Research Consortium (AERC), (Nairobi, Kenya, and Trade Policy Research and Training Programme (TPRTP), Department of Economics, University of Ibadan, Ibadan).

Ayubu, V.S (2013). Monetary Policy and Inflation Dynamics: An Empirical Case Study of the Tanzanian Economy. (Unpublished Master's Degree Thesis).

Azid, T., M. Jamil, A. K. & M. A. Kemal (2005). Impact of Exchange Rate Volatility on Growth and Economic Performance: A Case Study of Pakistan, 1973- 2003.*The Pakistan Development Review*, 44 (4), 749-775.

Babalola, S. J., & Aminu, U. (2011). Fiscal Policy and Economic Growth Relationship in Nigeria. *International Journal of Business and Social Sciences,* 2(17), 244-249.

Baghebo, M. & Stephen, E.T 2014. Monetary Policy and Economic Growth in Nigeria (1980-2011). *Asian Economic and Financial Review, Asian Economic and Social Society,* 4(1), 20-32.

Bakare-Aremu, T. A. & Osobase, A. O., (2014). An Empirical Analysis of Response of Nigerian Industrial Output to Macroeconomic Adjustment Policies. *International Journal of Management Sciences and Humanities,* 2 (9), 178-196.

Bakare-Aremu, T. A., Osobase, A. O. (2015). Effect of Fiscal and Monetary Policies on Industrial Sector Performance- Evidence from Nigeria. Journal of Economics and Sustainable Development, 6 (17), 67-82.

Balassa, B. (1982). Structural Adjustment Policies in Developing Economies. Elsevier. *World Development, 10* (1), 23-38.

Balogun, E. (2007) Monetary Policy and Economic Performance of West African Monetary Zone Countries. *MPRA Paper No. 3408.*

Bawa, S. & Abdullahi, I. (2012). Threshold Effect of Inflation on Economic Growth in Nigeria. *CBN Journal of Applied Statistics,* 3(1) 43-63.

Bayangos, V. B. (2010). Tracing the Bank Credit Channel of Monetary Policy in the Philippines. *Bangko Sentral Review, 1-24*.

Baye, M. R. & Jansen, D. W. (2006) Money, Banking, and Financial Markets: An Economics Approach. *AITBS Publishers, India, pp* 570-573.

Bennett, K. O., Anyanwu, U. N. & Kalu, A. O. U. (2015). The Effect of Industrial Development on Economic Growth: An Empirical Evidence in Nigeria. *European Journal of Business and Social Sciences,* 4(2), 127 – 140*.*

Benos, N. (2009). Fiscal Policy and Economic Growth: Empirical Evidence from EU countries. *MPRA Paper 19174, University Library of Munich, Germany.*

Berkelmans, L. (2005). Credit and Monetary Policy: An Australian SVAR. *Reserve Bank of Australia Research Discussion Paper No. 2005-06.*

Bernanke, B. S & Blinder, A. S, (1992). The Federal Funds Rate and the Channels of Monetary Transmission. *American Economic Review, American Economic Association,* 82(4), 901-921*.*

Bernanke, B. S. & Reinhart, V. R. and Sack, B. P. (2004). Monetary Policy Alternatives at the Zero Bound: An Empirical Assessment (September 2004). *FEDS Working Paper No. 2004-48.*

Bernanke, B. S., & Gertler, M. (1995). Inside the black box: The Credit Channel of Monetary Policy Transmission. *Journal of Economic Perspective,* 9(4), 27-48*.*

Bernanke, B., Boivin, J., & Eliasz, P. (2005). Measuring the Effects of Monetary Policy: A Factor-Augmented Vector Autoregressive (FAVAR) Approach. *The Quarterly Journal of Economics,* 120 (1), 387-422*.*

Bernanke, B., Gertler, M. & Gilchrist, S. (1998). The Financial Accelerator in a Quantitative Business Cycle Framework. *NBER Working Papers 6455, National Bureau of Economic Research, Inc.*

Berument, H. & Dincer, N.H. (2004). The Effects of Exchange Rate Risk on Economic Performance: The Turkish Experience. *Journal of Applied Economics,* 3 (21), 2429-2441.

Bhagwati J. N. (1985) Structural Adjustment and International Factor Mobility: Some Issues. In: Jungenfelt K., Hague D. (Eds) Structural Adjustment in Developed Open Economies. International Economic Association Series. Palgrave Macmillan, London.

Bhuiyan, R. (2008), Monetary Transmission Mechanism in a Small Open Economy: A Bayesian Structural VAR Approach. *Canadian Journal of Economics,* 40(2), 679-702.

Bigsten, A. & Soderbom, M., (2006). What Have We Learned from a Decade of Manufacturing Enterprise Surveys in Africa? *World Bank Research Observer*, 21(2) 241-265.

Boivin, J., Kiley, M. T., & Mishkin, F. (2010). How has the monetary transmission mechanism evolved over time? *NBER Working Papers, (15879), National Bureau of Economic Research, Inc*.

Borio, C., & Zhu, H. (2012). Capital Regulation, Risk-Taking and Monetary Policy: A missing link in the transmission mechanism*? Journal of Financial Stability,* 8(4), 236-251.

Borys, M., Horvath, R. & Franta, M. (2009). The Effects of Monetary Policy in the Czech Republic: An Empirical Study, *Empirica,* 36 (4), 419-443*.*

Brunner, K & Meltzer, A.H. (1997). Money and the Economy: Issues in Monetary Analysis. *Cambridge University Press*.

Bruno, M. and Easterly, W. (1998) Inflation Crises and Long run Growth. *Journal of Monetary Economics,* 41 (1), 3-26.

Busari, D., Omoke, P. and Adesoye, B. (2002) Monetary Policy and Macroeconomic Stabilization under Alternative Exchange Rate Regime: Evidence from Nigeria. *CBN Bullion,* 6, 15-24.

Busari, D.T. (2004): Foreign Capital, globalization and the challenges of industrialization in Nigeria. Being a paper presented at the 45th Annual Conference of the Nigerian Economic Society (NES), Abuja.

Cambazoglu, B, & Karaalp, H.S. (2012). The Effect of Monetary Policy Shock on Employment and Output: The Case of Turkey. *International Journal of Emerging Sciences*, 2(1) 23-29.

Cambazoglu, B. & Karaalp, H. S. (2014), "Does Foreign Direct Investment Affect Economic Growth? The Case of Turkey. *International Journal of Social Economics*, 41(6) 434-449.

CBN (2008). Central Bank of Nigeria (CBN), Monetary Policy Department Series 1, 2008.CBN/MPD/Series/01/2008.

Central Bank of Nigeria. (2010). Central Bank of Nigeria Statistical Bulletin Vol. 21.

Chabal, P & Daloz, J. P. (1999). Africa Works: Disorder as Political Instrument. International African Institute.

Chaovalitwongse, W. & Prokopyev, O. & Pardalos, P. (2006). Electroencephalogram (EEG) time series classification: Applications in epilepsy. *Annals OR,* 148(1):227-250.

Chari, V. V. & Kehoe, P. J., (1999). Optimal Fiscal and Monetary Policy. *Handbook of Macroeconomics, in J. B. Taylor & M. Woodford (ed.), Handbook of Macroeconomics, edition 1,* 1 (26) 1671-1745*, Elsevier.*

Chari, V., Christiano, O and Kehoe, P. (1991), Optimal Fiscal and Monetary Policy: Some Recent Results. *Journal of Money, Credit and Banking*, 23 (3), 519-539.

Charles-Anyaogu N. B. (2012). Investigating the Performance of Monetary Policy on the Manufacturing Sector in Nigeria. *Arabian Journal of Business and Management Review (OMAN Section),* 2(1), 12-25.

Cheng, C. C. C (2006). A VAR Analysis of Kenya's Monetary Policy Transmission Mechanism; How Does the Central Bank's REPO Rate Affect the Economy? *IMF Working Papers 06/300, International Monetary Fund.*

Chete L. N., Adeoti, J. O., Adeyinka, F. M. and Ogundele, O. (2014). Industrial Development and Growth in Nigeria Lessons and Challenges. Learning to Complete, *Working Paper No. 8*.

Chinyere, C.U., Michael, E.O., & Emeka, A. (2018). An Investigation of the Impact of Exchange Rate Policy on Manufacturing Sector Output: Evidence from Nigeria. *Journal of Humanities and Social Science,* 23(8), 81-90.

Chipote, P; Makhetha-Kosi, P. (2014) Impact of Monetary Policy on Economic Growth: A Case Study of South Africa. *Mediterranean Journal of Social Sciences,* 5 (15), 76.

Christiano, L. J., Eichenbaum, M., and Evans, C. L. (1999). Monetary Policy Shocks: What Have We Learned and to What End? *Handbook of macroeconomics,* 1:65-148.

Chuku, C. A. (2009). Measuring the Effects of Monetary Policy Innovations in Nigeria. *African Journal of Accounting, Economics, Finance, and Banking Research,* 5 (5) 141-153.

Chukwuedo, S. O. & Ifere, E. O. (2017). Manufacturing Subsector and Economic Growth in Nigeria. *Journal of Economics, Management and Trade*, 17 (3), 1-9.

Ciccarelli, M., Maddaloni, A. and Peydro, Jose-Luis, (2015). Trusting the Bankers: A New Look at the Credit Channel of Monetary Policy, *Review of Economic Dynamics*, 18, (4), 979-1002.

Clarida, R., Gali, J. & Gertler, M. (2002) A Simple Framework for International Monetary Policy Analysis, *Journal of Monetary Economics,* 49 (2), 879–904.

Cochrane, John H., (1998). What do the VARs mean? Measuring the Output Effects of Monetary Policy. *Journal of Monetary Economics, Elsevier,* 41(2) 277-300.

Cooray, A. (2009). Government Expenditure, Governance, and Economic Growth. *Comparative Economic Studies.* 51 (1), 401-418.

Danjuma, I., Jbrin, S. M. and Success, E. B. (2012). An Assessment of the Effectiveness of Monetary Policy in Combating Inflation Pressure on the Nigerian Economy. *Erudite Journal of Business Administration and Management,* 1(1), 7-16.

De Grauwe P. & Polan, M. (2005). Is Inflation Always and Everywhere a Monetary Phenomenon? *The Scandinavian Journal of Economics*, 107 (2), 239-259.

Dinca, M. & Dincă, G. (2013). The Impact of Government Expenditures upon Economic Growth in Post-Communist Countries. *Annals of the Alexandru Ioan Cuza University – Economics,* 60 (1), 126-134.

Duhachek, A. and Lacobucci, D. (2004). Alpha's standard error (ASE): An accurate and precise confidence interval estimate. *Journal of Applied Psychology*, 89(5), 792-808.

Disyatat, P. & Vongsinsirikul, P. (2003). Monetary Policy and the Transmission Mechanism in Thailand. *Journal of Asian Economics, Elsevier,* 14 (3) 389-418.

Ditimi, A., Nwosa P.I & Olaiya, S.A (2011). An Appraisal of Monetary Policy and Its Effect on Macro-Economic Stabilization in Nigeria. *Journal of Emerging Trends in Economics and Management Sciences (JETEMS),* 2 (3), 232-237.

Doroshenko, C. K. & Njinkweu, D. (2001). Foreign Exchange Rate Region and Macroeconomic Performance in Sub-Saharan Africa. *Journal of African Economics, Supplementary* 6 (1), 121-149.

Dungey, M., & Pagan, A. (2000). A Structural VAR Model of the Australian economy. *Economic Record,* 76 (235), 321-342.

Eatwell, J. (2019). Cost of Production and the Theory of the Rate of Profit, *Contributions to Political Economy*, 38 (1) 1–11.

Edoumiekumo, S.G., Karimo, T.M. & Amaegberi, A. (2013). Real Sector Responsiveness to Monetary Policy shocks in Nigeria. *Journal of Research in National Development,* 11(2) 269-277.

Ehikioya, I. L., & Mohammed, I (2014). Empirical Investigation of the Impact of Monetary Policy on Manufacturing Sector performance in Nigeria (1986 – 2012). *International Journal of Education and Research,* 2 (1), 1-20.

Ehinomen, C., & Charles, A. C. (2012). The Impact of Monetary Policy on Agricultural Development in Nigeria. *Journal of Humanities and Social Science,* 5 (5). 13-255.

Eichenbaum, M. & Evans, C. L., (1995) Some Empirical Evidence on the Effects of Shocks to Monetary Policy on Exchange Rates. *The Quarterly Journal of Economics*, 110 (4), *975–1009.*

Elbourne, A. (2008). The UK Housing Market and the Monetary Policy Transmission Mechanism: An SVAR Approach. *Journal of Housing Economics,* 17(1), 65-87.

Elbourne, A., & De Haan, J. (2006). Financial Structure and Monetary Policy Transmission in Transition Countries. *Journal of Comparative Economics,* 34(1), 1-23.

Emilia, H. (2016). The Importance of the Manufacturing Sector in the Romanian Economy. 9th International Conference Interdisciplinary in Engineering, INTER-ENG2015, 8-9 October 2015: *Procedia Technology,* 22 (1), 976-983.

Emu, P. & Havi, E.D. (2014). Influence of Electricity Consumption on Economic Growth in Ghana: An Econometric Approach, *International Journal of Economics, Commerce and Management,* 2(9), 1-16.

Enders, W. (2008). Applied Econometric Time Series, 4th Edition. John Wiley & Sons. New York.

Enoma, A. (2010). Agricultural Credit and Economic Growth in Nigeria: An empirical analysis. *Business and Economics Journal,* 14 (1): 1-7.

Enoma, A. I. (2004). The Relative Potency of Monetary and Fiscal Policies for Counter-Cyclical Output Stabilization in Nigeria: Some Simulation Results. PhD Thesis, Unpublished. Department of Economics and Statistics, University of Benin, Nigeria.

Epstein, G. & Heintz, J. (2006). Monetary Policy and Financial Sector Reform for Employment Creation and Poverty Reduction in Ghana. *Political Economy Research Institute University of Massachusetts, Amherst, MA USA. PERI Working Paper No. 113.*

Epstein, G. (2007). Central Banks as Agents of Economic Development, in Ha-Joon Chang, ed. Institutional Change and Economic Development, 2007. *United Nations University and Anthem Press.*

Etuk, E. H. (2012). A Seasonal ARIMA model for Daily Nigerian Naira-US Dollar exchange rates. *Asian Journal of Empirical Research*, 2(6), 219-227.

Evans, A.J and Thorpe, R. (2013). The (quantity) theory of money and credit. *Review of Austrian Economics,* 26 (4), 463-481.

Falaye, A., Eseyin, O., Otekunrin, A., Asamu, F., Ogunlade, P., Egbide, B. C., Bamidele, R., Eluyela, D., & Moyinoluwa, Niyi-Oyebanji. (2019). Impact of Exchange Rate on the Manufacturing Sector in Nigeria. *International Journal of Mechanical Engineering and Technology,* 10 (1), 1568–1583.

Falaye, J. A. (2017). Government Financial Policies and Emerging Countries' Small-scale enterprises. Lap Lambert Academic Publishing, EU. ISBN/978-3-659-88901-1.

Fasanya, I. O., Onakoya, A. B., & Agboluaje, M. A. (2013). Does Monetary Policy Influence Economic Growth in Nigeria? *Asian Economic and Financial Review,* 3(5), 635-646.

Ferreira de Mendonça, H. & Simão Filho, J. (2007). Economic transparency and effectiveness of monetary policy. *Journal of Economic Studies*, 34 (6), 497-514.

Finger, J.M. and Kreinin, M.E. (1979) Measure of Export Similarity and Its Possible Uses. *Economic Journal,* 89 (1), 905-912.

Forbes, K. J. and Rigobon, R. (1999). No Contagion, Only Interdependence: Measuring Stock Market Co-movements. *Journal of Finance,* 57(5), 2223-2261.

Franta, M., Horvath, R. & Rusnak, M. (2014). Evaluating Changes in the Monetary Transmission Mechanism in the Czech Republic. *Empirical Economics,* 46 (3), 827–842.

Frederick (Rick) van der Ploeg & George Alogoskoufis, (1994), Money and Endogenous Growth, *Journal of Money, Credit and Banking*, 26 (4), 771-91.

Friedman, M. & Schwartz, J. A. (1963). A Monetary History of the United States, 1867–1960. Princeton: Princeton University Press for NBER.

Ganev, G., Molner, K., Rybinski, K., & Wozniak, P. (2002). Transmission Mechanism of Monetary Policy in Central and Eastern Europe. *CASE Network Reports, No. 52, Center for Social and Economic Research.*

Gbadebo O. O & Oladapo A. O. (2009). Modelling the Impact of Financial Innovation on the Demand for Money in Nigeria. *African Journal of Business Management,* 3 (2) 039-051.

Georganas, S., Healy, P & Li, N (2014). Frequency Bias in Consumers′ Perceptions of Inflation: An Experimental Study, *European Economic Review*, 67 (1), 144-158*.*

Ghali, K. H. & Al - Shamsi, F. (1997). Fiscal Policy and Economic Growth: A Study Relating to the United Arab Emirates. *Economia Internazionale/International Economics, Camera di Commercio Industria Artigianato Agricoltura di Genova,* 50 (4), 519-533.

Godslove, E. K. & Chibuike, U. C. (2018). Impact of Monetary Policy on the Growth of the Nigerian Manufacturing Sector (1980-2016). *International Journal of Scientific & Engineering Research, 9* (9), 1-13.

Granger, C.W.J. & Newbold, P (1974). Spurious Regression in Econometrics. *Journal of Econometrics,* 2 (2), 111-120.

Green R. H. (1995). The IMF in Sub-Saharan African Structural Adjustment: No Lenders of First Resort. In: Helleiner G., Abrahamian S., Bacha E., Lawrence R., Malan P. (Eds) Poverty, Prosperity and the World Economy. Palgrave Macmillan, London.

Greiner, A. (2015). Public Debt, Productive Public Spending, and Endogenous Growth. *The Japanese Economic Review,* 66 (4) 520-535.

Gjermeni, O. (2016). Descriptive Analysis of Characteristics: A Case Study of a Phone Call Network Graph.

Grubb, F. (2019). Colonial American Paper Money and the Quantity Theory of Money: An Extension. *Social Science History,* 43(1), 185-207.

Gul, H., Mughal, K., & Rahim, S. (2012). The linkage between Monetary Instruments and Economic Growth. *Universal Journal of Management and Social Sciences,* 2 (5), 69-76.

Hafer, R. & Kutan, A. (2002). Detrending and the Money-Output Link: International Evidence. *Southern Economic Journal.* 69 (1), 159-174.

Hall, S. (2001). Credit Channel Effects in the Monetary Transmission Mechanism. *Bank of England Quarterly Bulletin, winter 2001.*

Hameed, I. (2010). Impact of Monetary Policy on Gross Domestic Product (GDP). *Interdisciplinary Journal of Contemporary Research in Business*, 3(1), 1348 - 1361.

Hassan, O. M. (2012). Monetary Policy Management Implications on the Movement of Agricultural Prices in Nigeria. *African Journal of Business Management,* 6(46), 11401-11410.

Havi, E. K. & Enu, P. (2014). Macroeconomic Determinants of Inflation in Ghana: A Cointegration Approach. *International Journal of Academic Research and Social Sciences*, 4 (7), 95-110.

Havrylyshyn, O. (1990). Trade Policy and Productivity Gains in Developing Countries: A Survey of the Literature. *The World Bank Research Observer*, 5 (1), 1-24.

Heino B. N, (2005), Non-Stationary Time Series and Unit Root Tests. *Economic Studies Advance Access Econometrics 2*, 4(1), 15-21.

Hicks, J. (1937). IS-LM: An Explanation. *Journal of Post Keynesian Economics,* 3(2) 139-154.

Ibrahim, M. H. & Amin, R.M. (2005). Exchange Rate, Monetary Policy and Manufacturing Output in Malaysia, *Journal of Economic Cooperation,* 26(3), 103-130.

Ifeakachukwu, P, Olufemi, M. & Saibu, O. (2012). The Monetary Transmission Mechanism in Nigeria: A Sectoral Output Analysis. *The International Journal of Economics and Finance (IJEF), 4* (1). 204-212.

Ilorah, R. (2019). Are there Important Lessons from the failed 1980's SAP in Africa? Unpublished paper.

Innerlind, C. (2005). David Hume's monetary theory revisited. *Journal of Political Economy*, 113 (1), 233–237.

Ishioro, B. O. (2013). Monetary Transmission Mechanism in Nigeria: A Causality Test. *Mediterranean Journal of Social Sciences,* 4(13), 377-388*.*

Iyoha, M. A. (2002). An Econometric Model of the Nigerian economy: In Iyoha, M. A. & Itsede, C. O. (Eds.). The Nigerian Economy: Structure, Growth, and Development, Ibadan: Mindex Publishers.

Jang, K. & Ogaki, M. (2004), The Effects of Monetary Policy Shocks on Exchange Rates: A Structural Vector Error Correction Model Approach, *Journal of the Japanese and International Economies*, 18(1) 99-114.

Jones, B., Dutkowsky, D. & Elger, T. (2005). Sweep Programs and Optimal Monetary Aggregation. *Journal of Banking and Finance,* 29 (2), 483-508*.*

Kabundi, A., & Ngwenya, N. (2011). Assessing Monetary Policy in South Africa in a Data-Rich Environment. *South African Journal of Economics,* 79 (1), 91-107.

Kalu E. U., Benson M. O. & Paul O. (2014). Monetary Policy Transmission Mechanism in Nigeria: An Overview. Proceedings of International Academic Conferences 0702180, *International Institute of Social and Economic Sciences*.

Kamaan, C. K. (2014). The Effect of Monetary Policy on Economic Growth in Kenya. *International Journal of Business and Commerce,* 3 (8), 11-24.

Kandil, M. (2014). On the Effects of Monetary Policy Shocks in Developing Countries. *Borsa Istanbul Review, Research, and Business Development Department, Borsa Istanbul,* 14 (2), 104-118.

Kar, M., Nazlioglu, S. & Ağır, H. (2011). Financial Development and Economic Growth Nexus in the MENA Countries: Bootstrap panel granger causality analysis, *Economic Modelling*, 28, (1), 685-693.

Kashyap, A. K & Jeremy Stein, J. C (1995). The Impact of Monetary Policy on Bank Balance Sheets. *Carnegie-Rochester Conference Series on Public Policy*, 42 (1), 151-195.

Kashyap, A. K, Stein, J. C & Wilcox, D. W. (1993). Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance. *Amercian Economic Review,* 83 (3), 78-98.

Kasidi, F., & Mwakanemela, K. (2013), Impact of Inflation on Economic Growth: A Case Study of Tanzania. *Asian Journal of Empirical Research,* 3 (4), 363-380.

Kates, S. (2018). Making Sense of Classical Theory. *Journal of the History of Economic Thought,* 40 (2), 279-283.

Kathleen, C. (2018), *What is an Exchange Rate and What Does It Mean?* Edited by Joe Cortez.

Kayode, M. O. & Odusola, A. (2001), Economic Development Management in Nigeria: Dynamics, Dialectics and Outcomes. *Development Policy and Analysis (2001).*

Khabo, V., & Harmse, C. (2005). The Impact of Monetary Policy on the Economic Growth of a Small and Open Economy: The Case of South Africa. *South African Journal of Economic and Management Sciences,* 8 (3), 348–362.

Khan, G. A., & Jacobson, A. (1989). Lessons from West German Monetary Policy. *Economic Review,* 74 (4), 18-35.

Killian, L., & Lütkepohl, H. (2017). Structural Vector Autoregressive Analysis (Themes in Modern Econometrics). *Cambridge: Cambridge University Press*.

Kim, S. & Roubini, N. (2000), Exchange Rate Anomalies in the Industrial Countries: A Solution with a Structural VAR Approach. *Journal of Monetary Economics, 45 (3), 561-586.*

Kimball, M. S. & Michael Woodford, 1994. "The Quantitative Analysis of the Basic Neomonetarist Model. *Journal of Money, Credit, and Banking,* 27 (4), 1241-1289*.*

Kimberly, A. (2012). What is the Money Supply, and How Does It Affect the Economy?

Kimberly, A. (2018). Exchange Rates Explained Downloaded on 18 July 2018.

King-George, O. J (2013). The Effect of Exchange Rate Fluctuation on the Nigeria Manufacturing sector (1986-2010), pp. 20, 28-29.

Kone (2000). L'impact des politiques monétaires et budgetaires sur la croissance économique dans les Pays de l'UEMOA. BCEAO Working Paper.

Krugman, P. R & Obstfeld, M. (1991). International Economics: Theory and Policy. Harper Collins College Publishers.

Kydland, F. E & Prescott, E. C. (1982). Time to Build and Aggregate Fluctuations. *Econometrica, Econometric Society, 50* (6), 1345-1370*.*

Lai, D. (1979). Market Access for Semi Manufacturers from Developing Countries. Graduate Institute of International Studies, and Trade Policy Research Centre, Geneva, and London (mimeo).

Lawal, E. O. (2016). Effect of Exchange Rate Fluctuations on Manufacturing Sector Output in Nigeria. *Journal of Research in Business and Management, 4*(10), 32-39*.*

Loayza, N. & Schmidt-Hebbel, K. (2002). Monetary Policy Functions and Transmission Mechanisms: An Overview. Central Banking, Analysis, and Economic Policies Book Series, in: Norman Loayza & Klaus Schmidt-Hebbel & Norman Loayza (Series Editor) & Klaus Schmidt-Hebbel (Series (ed.), *Monetary Policy: Rules and Transmission Mechanisms, Edition* 1, (1), 001-020, *Central Bank of Chile.*

Loría, E. & Ramírez, J. (2011). Inflation, Monetary Policy and Economic Growth in Mexico. An Inverse Causation, 1970-2009. *Modern Economy,* 29(1). 834-845.

Lourens, B. (2000). Monetary Policy Implementation at Different Stages of Market Development. International Monetary Fund.

Machlup, F. (1966). “Währung und Auslandsverschuldung: Bemerkungen zur Diskussion zwischen Schacht und seinen Kritikern” Mitteilungen des Verbands österreichischer Banken und Bankiers, Vol. 10, 194-208. Revised English version entitled “Foreign Debts, Reparations and the Transfer Problem” published in Machlup, 1966.

Mamo, F.T. (2012). Economic Growth and Inflation: A panel data analysis. Södertörn University, School of Social Sciences. Independent thesis Advanced level.

MAN (1983). Manufacturer’s Association of Nigeria Directory.

Mangani, R. (2011). The Effects of Monetary Policy on Prices in Malawi. University of Malawi, Chancellor College, Department of Economics, Zomba. *Open Journal of Modelling and Simulation,* 4 (4), 1-66.

Mankiw N. G, Romer D, & Weil, D. (1992) A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics,* 107(1), 407-437.

Matthew, I. E., Mark W. J., & Han N. (2011). New Business Models in Emerging Markets. *Harvard Business Review*.

Maturu, B. O. (2007). Channels of Monetary Policy Transmission in Kenya. *Paper Presented at the 12th Annual International Conference of the African Econometric Society, Cape Town, South Africa, 4 -6th July.*

McCallum, B. (1981). Price Level Determinacy with an Interest Rate Policy Rule and Rational Expectations. *Journal of Monetary Economics*, 8 (3), 319-329.

McCoy, D., (1997). How useful is Structural VAR Analysis for Irish economics? *Research Technical Papers 2/RT/97, Central Bank of Ireland.*

Meagher, K. (2006). Social Capital, Social Liabilities, and Political Capital: Social Networks and Informal Manufacturing in Nigeria. *African Affairs*, 105 (421), 553–582.

Mihályi P., & Szelényi I. (2019) Rent in Classical Economic, Social, and Political Theory. In: Rent-Seekers, Profits, Wages, and Inequality. Palgrave Pivot, Cham.

Mihályi, Peter & Szelényi, Ivan. (2017). The Role of Rents in the Transition from Socialist Redistributive Economies to Market Capitalism. Comparative Sociology, 16 (1), 13-38.

Mihov, I., (2001), Monetary Policy Implementation and Transmission in the European Monetary Union, *Economic Policy*, 16 (33), 369-406.

Mishkin, F. S. (2001). The Transmission Mechanism and the Role of Asset Prices in Monetary Policy. NBER Working Papers 8617, National Bureau of Economic Research, Inc. Published: Aspects of the Transmission Mechanism of Monetary Policy, Focus on Austria 3-4/2001. Österreichischer National Bank: Vienna 2001.

Mishra, P., Montiel, P. Pedroni, P., & Spilimbergo, A. Monetary Policy and Bank Lending Rates in Low-Income Countries: Heterogeneous Panel Estimates. *Journal of Development Economics,* 111 (1), 117-131.

Modebe N. J, & Ezeaku H. C. (2016). Relationship between Financial Development and Economic Growth in Nigeria: A Triangulation Approach. *International Journal of Economics and Financial,* 6 (4), 1842-1850.

Mohamed, B. & Ahmed A. B. (2010). The Role of Monetary policy on Economic activity in Sudan: An Empirical Investigation, 1990-2004. *Journal of Human Science,* 44 (7), 1-21.

Mollentze S. (2000). Monetary Policy in South Africa on the Threshold of a new era. *South African Journal of Economic and Management Sciences,* SS (2), 1-50.

Montes, G.C. (2013). Credibility and Monetary Transmission Channels under Inflation Targeting: An Econometric Analysis from a Developing Country. *Economic Modelling Elsevier,* 3(C) 670-684.

Montiel, P., Adam, C. & Wilfred, M & O'Connell, (2012). Financial Architecture and the Monetary Transmission Mechanism in Tanzania. CSAE Working Paper Series 2012-03, Centre for the Study of African Economies, University of Oxford.

Mordi, C.N., Adebiyi, M.A., Adenuga, A.O., & Fowowe, B. (2010). The Asymmetric Effects of Oil Price Shocks on Output and Prices in Nigeria using a Structural VAR Model. *Central Bank of Nigeria Economic and Financial Review,* 48(1), 1-32.

Muhammad, A., Chaudhry, Imran, C & Farooq, F. (2011). Does Inflation Affect Economic Growth? The case of Pakistan.

Mwabutwa, C., Bittencourt, M. & Viegi, N., (2013). Evolution of Monetary Policy Transmission Mechanism in Malawi. A TVP VAR approach. *Journal of Economic Development,* 41(1), 33-35.

Nasir, A. E. (2011). Commentary on Silent Factories, Empty warehouse. This Day: September 23.

Ncube, M. & Ndou, E. (2011). Monetary Policy Transmission, House Prices and Consumer Spending in South Africa: An SVAR Approach. *African Development Bank. Working Paper* 133, 1-48.

Ndekwu, E. C. (1983). Government Borrowing, Money Supply and Monetary Policy, Ibadan: Nigerian Institute of Social & Economic Research (NISER).

Ndekwu, E. C. (1990). Monetary Development and Management in Nigeria, Ibadan: Nigerian Institute of Social & Economic Research (NISER).

Ndekwu, E. C. (2013). An Analysis of the Monetary Policy Transmission Mechanism and the Real Economy in Nigeria. *Central Bank of Nigeria occasional papers No. 43.*

Ndiaye, C. (2009). Analyse de l'efficacité relative des politiques monétaire et budgétaire au Sénégal. http://www.univ-orleans.fr/leo/semmar9/sem_doctorants/ndiaye.pdf.

Nenbee, S. G. & Madume, J. V. (2011). The Impact of Monetary Policy on Nigeria's Macroeconomic Stability (1970 - 2009). *International Journal of Economic Development Research and Investment,* 2(2), 174-183.

Ngalawa, H., & Viegi, N. (2011). Dynamic Effects of Monetary Policy Shocks in Malawi. *South African Journal of Economics*, 79(3), 224-250.

Nguena, Christian L., (2012). Pro-Growth Monetary Policy in Africa: Monetarist versus Keynesian Approach. *MPRA Paper 49410, University Library of Munich, Germany, revised 31 Aug 2013.*

Nigeria Industrial Production, (2017), Nigeria's Industrial Production Index Growth Rate Data. Q4.

Nishimizu, M., & Robinson, S. (2014). Trade policies and productivity change in semi-industrialized.

Nkoro, E. (2005). The study of monetary policy and macroeconomic stability in Nigeria: 1980-2000. The University of Benin. Benin City.

Nneka, C. A. B., (2012). Investigating the Performance of Monetary Policy on the Manufacturing Sector in Nigeria. *Arabian Journal of Business and Management Review (OMAN Chapter)* 2 (1), 12-25.

Nouri, M., & Samimi, A.J. (2011). The Impact of Monetary Policy on Economic Growth in Iran. *Middle East Journal of Scientific Research, 9* (6), 740-743.

Nwasilike, O.T. (2006). Local Manufacturing Capacity Supporting the Energy and Power Sector in Nigeria, NCD Series.

Nwokoro, A. N. (2017). Foreign exchange and interest rates and manufacturing output in Nigeria. *International Journal of Business & Law Research,* 5(1), 30-38.

Nwosa, P. I., & Saibu, M. O. (2012). The Monetary Transmission Mechanism in Nigeria: A Sectoral Output Analysis. *International Journal of Economics and Finance,* 4(11), 204-212.

Obidigbo, C. (2012). Report on Indigenous Manufacturing Activates Manufacturers Association of Nigeria Anambra Enugu/Ebonyi. *24th Annual General Meeting Report.* PP 56-57.

Obstfelf, M. & Rogoff, K. (1995). The Mirage of Fixed Exchange Rates. *Journal of Economic Perspectives,* 9(4), 73-96*.*

Ogege, S. & Shiro, A. A. (2012). The Dynamics of Monetary and Fiscal Policy as a Tool for Economic Growth: Evidence from Nigeria. *Journal of Management and Sustainability, 2*(2), 247-258.

Ogunmuyiwa M. S. & Ekone, A. F. (2010). Money Supply - Economic Growth Nexus in Nigeria, *Journal of Social Sciences,* 22(3), 199-204*.*

Ojowu, N. Speech at Nigeria's imperative in the new World trade Order, workshop report. African economic research consortium (AERC). Nairobi, Kenya and trade policy research and training (TPRTP). Department of economics, University of Ibadan: 2003*.*

Okejiri, E. (2003). National Office for technology acquisition and promotion (NOTAP), speech at Nigeria's imperative in the new World Trade order, workshop report. African economic research consortium (AERC), Nairobi, Kenya, and trade policy research and training program (TPRTP). Department of economics, University of Ibadan: Ibadan.

Okon, E. O., & Osesie, S.W. (2017). Hazards of Manufacturing Sector and Economic Growth in Nigeria. *International Journal of Social Sciences, Humanities, and Education*, 1(1), 50-65.

Olomola, P. (2007). Oil Wealth and Economic Growth in Oil Exporting African Countries. *AERC Research Paper 170. African Economic Research Consortium, Nairobi, September 2007.*

Olorunfemi, M.S, Tomola, M.O, Adekunjo, F.O. & Ogunleye, E.O. (2013). Manufacturing Performance in Nigeria: Implication for Sustainable Development. *Asian Economic and Financial Review,* 3(9), 1195-1213.

Olorunfemi. S. (2013). Money Supply and Inflation in Nigeria: Implications for National Development. *Modern Economy, 4*(3), 161-170*.*

Olufayo M. B. & Fagite, B. A. (2014). Exchange Rate Volatility and Sectoral Export of Nigeria: Case of Oil and Non-Oil Sectors. *Journal of Economics and Sustainable Development,* 5 (10), 66-69.

Omankhanlen, O., & Owonibi, A. (2012), Manufacturers and Burden of High Interest Rates. Ghanamma.com. *Available from: http://www.ebcache.googleuserconten.com/search?q=cach: http://news.ghanamma.com/1/manufacturers-and-burden-of-high-interest-rates/&strip=0.*

Omolade, A., & Ngalawa, H. (2014). Oil Revenue and Manufacturing Sector Growth in Africa's oil-exporting countries. *Journal of Economic and Financial Sciences*, 7(3), 925-944.

Onakoya, A. (2018). Macroeconomic Dynamics and the Manufacturing Output in Nigeria. *Mediterranean Journal of Social Sciences, 9* (1), 43-54.

Onoh J. K. (2002). Dynamics of Money, Banking and Finance in Nigeria: An Emerging Market Abia: *Astra Meridian Publishers.*

Onyeiwe, A. (2012). Domestic Debt and the Growth of the Nigerian Economy. *Research Journal of Finance and Accounting,* 3(5), 45-56.

Opaluwa, D., Umeh, J & Abu, A. (2010). The Effect of Exchange Rate Fluctuations on the Nigerian Manufacturing Sector. *African Journal of Business Management, 4*(14), 32-39.

Oriakhi D.E & Osaze, I. D. (2013). Oil Price Volatility and its Consequences on the Growth of the Nigerian Economy: An Examination (1970-2010), *Asian Economic and Financial Review*, 3 (5), 683-702*.*

Osagie, C. (2011). Federal Government Blames Sluggish GDP Growth on Poor Management. *This Day, 25 October 2011.*

Owalabi, A. U. & Adegbite, T. A. (2014). Impact of Monetary Policy on Industrial Growth in Nigeria. *International Journal of Academic Research in Business and Social Sciences*, 4 (1), 18-31.

Oyati, E. (2010). The Relevance, Prospects and the Challenges of the Manufacturing Sector in Nigeria. Department of Civil Technology, Auchi Polytechnic.

Oyejide, T. (1985). Exchange Rate Policy for Nigeria: Some Options and Their Consequences. Proceedings of a One-Day Workshop. *The Nigerian Economic Society, Management of Nigeria's Foreign Exchange Resources,* 4 (9), 17-32.

Pandey I.M. (2010). *Financial Management*. 10th edition, Vikas Publishing House PVT LTD, Jangpura, New Delhi.

Papademos L. (2003). The Contribution of Monetary Policy to Economic growth. European Central Bank, 31st Economics Conference, Vienna. Paper No 223, 67-89.

Peersman, G. & Smets, F. (2002). The Industry Effects of Monetary Policy in the Euro Area (August 2002). ECB Working Paper No. 165. 34-56.

Peiris, S. & Clement, J. (2008). Post-Stabilization in Sub-Saharan Africa: Lessons from Mozambique. *Washington, DC: International Monetary Fund.*

Phillips, P. & Ouliaris S. (1990). Asymptotic Properties of Residual Based Tests for Cointegration. *Econometrica,* 58(1), 165-193.

Pindyck, Robert S. and Daniel L. Rubinfeld. (1995). Microeconomics. 3d Ed Prentice-Hall: Englewood Cliffs, NJ, 1995, pp.285-288.

Pritsker M. (2001). The Channels for Financial Contagion. In: Claessens S., Forbes K.J. (Eds) International Financial Contagion. Springer, Boston, MA.

Quartey, P. & Afful-Mensah, G. (2014). Financial and Monetary Policies in Ghana: A review of recent trends. *Review of Development Finance,* Vol. 4(2), 1-11.

Radnia, K. (2014). The Impacts of Oil Price and Selected Macroeconomic Variables on the Consumer Price Index in IRAN (1971-2010). *European Journal of Business and Management,* 6(2), 154-166.

Rafiq M. & Mallick, S. (2008). The effect of monetary policy on output in EMU3: A sign restriction approach, *Journal of Macroeconomics*, 30(4), 1756-1791.

Raghavan, M. & Athanasopoulos, G. & Silvapulle, P. (2016). Canadian Monetary Policy Analysis using a Structural VARMA Model. *Canadian Journal of Economics, Canadian Economics Association,* 49 (1), 347-373.

Rakic B. & Radenovic, T. (2013). The Effectiveness of Monetary and Fiscal Policy in Serbia. *Industrija,* 41 (2). 103-122.

Ridhwan, M. M., De Groot, H.L., Njikamp, P. & Rietveld, P. (2010). The Impact of Monetary Policy on Economic Activity-Evidence from a meta-analysis. *Tinbergen Institute Discussion Paper 10-043/3. Amsterdam: Tinbergen Institute.*

Romer, P. M. (1994). The Origins of Endogenous Growth. *Journal of Economic Perspectives*, *8* (1), 3-22.

Romer, P. M. (2014). Mathiness in the Theory of Economic Growth. T*he American Economic Review Vol. 105(5). Papers and Proceedings of the One Hundred Twenty-Seventh Annual Meeting of the American Economic Association (May 2015),* 105 (5), 89-93.

Rose-Ackerman, S. (1999). Political Corruption and Democracy. Faculty Scholarship Series. Paper 592.h□p://digitalcommons.law.yale.edu/fss papers/592.

Rungo E, & Manjate J. (2011). Mecanismo de Transmiss˜ao da Política Monetária: Uma Investigac˜ao do Canal de Juros em Moçambique. Maputo: Banco de Moçambique.

Sahinöz, S. & Coşar, E.E. (2010) Understanding Sectoral Growth Cycles and the Impact of Monetary Policy in the Turkish manufacturing industry. Central Bank of the Republic of Turkey, Working Paper No. 3, 34-56.

Sakyi, D. (2011). Trade Openness, Foreign Aid and Economic Growth in Post-Liberalisation Ghana: An application of ARDL bounds test. *Journal of Economics and International Finance,* 3 (3), 146-156.

Sandbrook, R. (1999). The Politics of Africa's Economic Recovery. *A Journal of African Studies,* 21(3), 83-84.

Sarah L. O. (2015). The Rural Manufacturing Survival and Its role in the Rural Economy. *Rural Manufacturing at a Glance,* 48 (3), 297-312.

Sidrauski, M. (1967). Inflation and Economic Growth. *Journal of Political Economy*, 75 (1), 796-810.

Simo-Kenge, B.D, Miller, S.M. Gupta, R., & Balcilar, M. (2016). Evolution of Monetary Policy in the US: The role of Asset Prices. *Journal of Real Estate Finance and Economics,* 52(3), 226-243.

Sims, C.A. (1980). Macroeconomics and Reality. *Econometrica,* 48(1), 1-48.

Smets, F. & Wouters, R. (2002). An Estimated Stochastic Dynamic General Equilibrium Model of the Euro Area: *International Seminar on Macroeconomics*. Europe. Central Bank.

Sola, O., Obamuyi, T. M., Adekunjo, F. O., & Ogunleye, E. O. (2013). Manufacturing Performance in Nigeria: Implication for Sustainable Development. *Asian Economic and Financial Review*, 3(9), 1195-1213.

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics,* 70 (1) 65-94.

Sousa, J. M., & Zaghini, A. (2007). Global Monetary Policy Shocks in the G5: an SVAR approach. *Journal of International Financial Markets, Institutions, and Money*, 17(5), 403-419.

Starr, M. A. (2005). Does money matter in the CIS? Effects of Monetary Policy on Output and Prices. *Journal of Comparative Economics*, 33(3), 441-461.

Stiglitz, J. & Weiss, A. (1981). Credit Rationing in Markets with Imperfect Information. *American Economic Review,* 71 (3), 393-410.

Stock, J.H. & Watson, M.W. (2001). Vector Autoregressions. *Journal of Economic Perspectives,* 15(4), 101-115.

Stockman, A. (1981). Anticipated Inflation and the Capital Stock in a cash-in-advance Economy, *Journal of Monetary Economics*, 8 (3), 387-393.

Teriba, A. (2015). Harmonization of Fiscal and Monetary Policies in Nigeria. Available at SSRN: https://ssrn.com/abstract=3163481 or http://dx.doi.org/10.2139/ssrn.3163481.

Teshome, A. (2014). Impacts of Manufacturing Sector on Economic Growth in Ethiopia: A Kaldorian Approach. *Journal of Business Economics and Management Sciences,* 1(1), 1-8.

The National Bureau of Statistics (*NBS*) Nigerian Gross Domestic Product Report (2016)

Thirlwall, A. P. (2013). Economic Growth in an Open Developing Economy: The Role of Structure and Demand. Cheltenham: Edward Elgar.

Thornton, J. (2008). Money, Output and Inflation in African Economies. *South African Journal of Economics,* 76 (3), 356-366.

Theil, H., (1965), the analysis of disturbances in regression analysis, Journal of the American Statistical Association, 60 (1), 1067-1079.

Tobin, J. (1965). Money and Economic Growth, *Econometrica,* 33 (4), 671-684.

Tomola, M. O., Adebisi, T. E., & Olawale, F. K. (2012): Bank Lending, Economic Growth and the Performance of the Manufacturing Sector in Nigeria. *European Scientific Journal,* 8(3), 19-36.

Tyrkalo R. & Adamyk, B. (1999). Monetary Policy Transmission and its Meaning to the Effectiveness of NBU activity; Herald of NBU, 7(6), 11.

Udoh, E. (2011). A Dynamic Macroeconomic Model of the Nigerian Economy with an emphasis on the Monetary Sector. *South African Journal of Economic and Management Sciences,* 12 (1), 28-47.

Ududechinyere, C., Eze, O.M., & Nweke, A.M. (2016). An Analysis of the Effect of the Manufacturing Sector on the Growth of the Nigerian economy. *Journal of Business and Management*, 20 (4), 34-46.

Umar M., Aliyu, G., & Muhammad, A. (2017). Oil Price Fluctuations and Economic Growth in Nigeria (Evidence from Granger Causality Test). *Australasian Journal of Social Science,* 3(1), 1-16*.*

Us, V. (2004). Inflation Dynamics and Monetary Policy Strategy: Some Prospects for the Turkish Economy. *Journal of Policy Modelling,* 26 (1), 1003-1013*.*

Usman, A. O & Adegbite T. A, 2014. Impact of Monetary Policy on Industrial Growth in Nigeria. International Journal of Academic Research in Business and Social Sciences, Human Resource Management Academic Research Society. *International Journal of Academic Research in Business and Social Sciences,* 4(1), 18-31.

Van Hai, B., & Trang, T. T. M. (2015). The Transmission Mechanism of Monetary Policy in Vietnam: A VAR Approach. *Graduate Institute of International and Development Studies Working Paper No. 15/2015.*

Wen F, *Min* F, Zhang Y- J & Yang C., (2018) Oil Price Shocks, Economic Policy Uncertainty and Industrial Economic Growth in China. PLoS ONE 14(5): e0215397

World Bank. (2019). Annual report 2019: Ending poverty, investing in opportunity. *World Bank Group*, 319.

Woodford, M. (2003). Inflation Targeting and Optimal Monetary Policy. *Annual Economic Conference Federal Reserve bank of St. Louis. October 16-17, 2003.*

Wuyts, M. (1991), Mozambique: Economic Management and Adjustment Policies: In Ghai, D. The IMF and the South (The Social Impact of Crisis and Adjustment). Zed books Ltd, London and New Jersey, on behalf of UNRISD, Geneva.

Zhensheng, Z. Y. J. (2002). Monetary Channel, Credit Channel and the Effectiveness of Monetary Policy. *Journal of Finance, 9, 003.*

APPENDICES

Appendix A: Data

Year	Inf	Intr	Exr	Msgr	Wop	FFR
1980	11.7097	7.7875	0.60401	8	24.56	15.2658
1981	9.97226	8.43167	0.54678	8	27.89	18.87
1982	20.8128	8.91667	0.61771	9	29.467	14.8608
1983	7.69775	9.5375	0.67346	10	30.78	10.7942
1984	23.2123	9.97667	0.72441	10	31.67	12.0425
1985	17.8205	10.2417	0.76653	10	33.897	9.93333
1986	7.43534	9.43333	0.89377	9	34.76	8.3325
1987	5.71715	9.95917	1.75452	10	34.98	8.20333
1988	11.2903	13.9617	4.01604	14	35.54	9.315
1989	54.5112	16.6167	4.53697	17	42.17	10.8733
1990	50.4667	20.4417	7.36474	20	47.704	10.0092
1991	7.3644	25.3	8.03829	25	50.132	8.46333
1992	13.007	20.0417	9.90949	20	54.7458	6.25167
1993	44.5888	24.7583	17.2984	25	52.4108	6
1994	57.1653	31.65	22.0654	32	54.6325	7.13833
1995	57.0317	20.4833	21.996	20	59.06	8.82917
1996	72.8355	20.2333	21.8953	20	62.0183	8.27083
1997	29.2683	19.8367	21.8844	20	59.4225	8.44167
1998	8.52987	17.795	21.8861	18	47.63	8.35417
1999	9.99638	18.1842	21.886	18	49.8433	7.99417
2000	6.61837	20.29	92.3381	20	63.055	9.23333
2001	6.93329	21.2742	101.697	21	58.3558	6.92167
2002	18.8736	23.4383	111.231	23	58.1692	4.675
2003	12.8766	24.7708	120.578	25	64.9758	4.1225
2004	14.0318	20.7142	129.222	21	80.3167	4.34
2005	14.998	19.1808	132.888	19	100	6.18917
2006	17.8635	17.9483	131.274	18	120.762	7.9575
2007	8.23953	16.9	128.652	17	134.935	8.05
2008	5.38222	16.9392	125.808	17	172.373	5.0875
2009	11.578	15.4798	118.546	15	120.723	3.25
2010	11.5377	18.3617	148.902	18	152.308	3.25
2011	13.7202	17.585	150.298	18	192.406	3.25
2012	10.8408	16.0167	153.862	16	186.262	3.25
2013	12.217	16.7925	157.499	17	183.338	3.25
2014	8.47583	16.7225	157.311	17	171.837	3.25
2015	8.05738	16.5483	158.553	17	111.185	3.26

Source: Authors Computation

Appendix B: Descriptive statistics

Dependent Variable: MUP
Method: Least Squares
Date: 01/16/22 Time: 07:02
Sample: 1980Q1 2019Q4
Included observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
K	1.27E-10	7.68E-12	16.52350	0.0000
L	1.56E-07	2.13E-08	7.318035	0.0000
INTR	-0.678472	0.316006	-2.147020	0.0334
MSGR	0.641575	0.315440	2.033904	0.0437
INF	-0.000165	0.006912	-0.023807	0.9810
EXR	-0.032192	0.003614	-8.907817	0.0000
PCRE	-1.74E-13	5.23E-14	-3.336625	0.0011
WOP	-0.022434	0.004696	-4.777391	0.0000
FFR	0.330357	0.030991	10.65991	0.0000

R-squared	0.822811	Mean dependent var	6.150827
Adjusted R-squared	0.813423	S.D. dependent var	2.641805
S.E. of regression	1.141115	Akaike info criterion	3.156494
Sum squared resid	196.6235	Schwarz criterion	3.329473
Log likelihood	-243.5195	Hannan-Quinn criter.	3.226735
Durbin-Watson stat	0.175383		

Date: 10/28/22 Time: 04:31
Sample (adjusted): 1982 2019
Included observations: 38 after adjustments
Trend assumption: Quadratic deterministic trend
Series: MUP LOG(K) LOG(L) INTR MSGR INF LOG(EXR) LOG(PCRE) LOG(WOP) LOG(FFR)
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.966352	509.4471	259.0294	0.0000
At most 1	0.919820	210.5586	215.1232	0.1381
At most 2	0.889012	184.6665	195.1715	0.7769
At most 3	0.838083	101.1300	139.2753	0.2315
At most 4	0.689927	91.94450	107.3466	0.4753
At most 5	0.641350	77.44850	79.34145	0.1069
At most 6	0.453396	48.48300	55.24578	0.1722
At most 7	0.344625	25.52980	35.01090	0.3532
At most 8	0.191252	9.473000	18.39771	0.5322
At most 9	0.036344	1.406800	3.841465	0.2356

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.966352	110.8885	100.9103	0.0000
At most 1	0.919820	91.89209	94.80550	0.2602
At most 2	0.889012	83.53658	85.72819	0.1583
At most 3	0.838083	69.18546	79.58633	0.1735
At most 4	0.689927	44.49599	53.41977	0.3803
At most 5	0.641350	38.96557	47.16359	0.3072
At most 6	0.453396	22.95313	30.81507	0.3331
At most 7	0.344625	16.05684	24.25202	0.4088
At most 8	0.191252	8.066177	17.14769	0.5956
At most 9	0.036344	1.406813	3.841465	0.2356

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
0.072893	0.771767	-6.580442	3.624617	-3.402347	-0.005709	-1.809347	0.645256	-3.530109	0.640998
-0.432045	0.651452	15.73871	2.058520	-1.777140	0.022159	-2.904462	-1.359701	-2.823229	1.208056
0.314134	0.133203	-3.824306	-0.821210	1.087150	-0.068363	-0.058814	-0.745024	2.336520	4.474377
-0.015873	-1.442211	-10.54229	-0.486768	0.562794	-0.063757	-1.266866	0.343497	3.060467	-4.123173
0.598464	-2.915342	-28.51756	-1.323479	0.696655	0.033003	2.763347	-0.605058	2.338451	-4.266938
0.679194	-2.772324	-3.341326	3.871588	-4.077207	-0.047772	1.278429	0.148134	6.459666	0.640856
-0.330736	1.669513	3.883679	1.313335	-1.262318	0.017758	1.247504	-1.628059	0.987811	-3.093380
-0.065099	-0.049494	10.38398	0.863140	-0.993485	-0.028788	1.472806	-0.767068	-4.138776	-0.617874
0.454433	-1.102145	-4.957930	0.227786	-0.070871	-0.016256	0.652224	0.009255	0.200585	1.110988
0.624399	0.826860	21.28926	-0.492148	0.542287	0.002592	1.872983	-0.373015	-3.201572	1.712078

Unrestricted Adjustment Coefficients (alpha):

D(MUP)	-0.361123	-0.648118	0.001148	-0.079235	-0.564421	0.172351	0.119831	-0.162743	-0.151818	-0.084000
D(LOG(K))	-0.242499	-0.246649	-0.104880	-0.036405	-0.149046	0.087065	-0.034966	0.063442	0.011302	-0.005678
D(LOG(L))	0.001322	-0.035471	0.003662	-0.011521	-0.009282	0.004363	0.005333	0.005293	0.001450	-0.003040
D(INTR)	-0.073648	0.400126	0.498744	-0.239761	1.010142	-0.000563	0.035742	0.411842	-0.657343	-0.055154
D(MSGR)	0.135129	0.374799	0.425961	-0.272897	1.061402	0.106629	0.151605	0.439445	-0.691313	-0.055644
D(INF)	1.431476	-5.319987	5.779798	7.945983	-1.437880	-0.787637	1.144783	-0.167813	-1.385126	0.597512
D(LOG(EXR))	0.052529	0.068996	0.017667	0.080162	-0.015443	0.024888	-0.050044	0.047155	-0.021179	-0.033900
D(LOG(PCRE))	-0.315184	0.009547	0.363863	-0.096335	0.043471	0.163722	0.142010	0.014145	0.117994	-0.033025
D(LOG(WOP))	0.009611	-0.045076	-0.036219	-0.002121	-0.090886	-0.034638	0.028088	0.073642	-0.011996	-0.002396
D(LOG(FFR))	-0.004148	0.018657	-0.069629	0.101029	0.060698	-0.039666	0.017756	-0.004046	0.006292	-0.006796

1 Cointegrating Equation(s): Log likelihood -162.2892

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	10.58772	-90.27580	49.72541	-46.67613	-0.078319	-24.82207	8.852140	-48.42887	8.793726
	(1.89719)	(20.8126)	(3.14578)	(3.06950)	(0.05727)	(2.20825)	(1.31240)	(4.97485)	(4.29472)

Adjustment coefficients (standard error in parentheses)

D(MUP)	-0.026323
	(0.01725)

D(LOG(K))	-0.017676
	(0.00550)
D(LOG(L))	9.64E-05
	(0.00067)
D(INTR)	-0.005368
	(0.03207)
D(MSGR)	0.009850
	(0.03354)
D(INF)	0.104344
	(0.19039)
D(LOG(EXR))	0.003829
	(0.00359)
D(LOG(PCRE))	-0.022975
	(0.00870)
D(LOG(WOP))	0.000701
	(0.00276)
D(LOG(FFR))	-0.000302
	(0.00244)

2 Cointegrating Equation(s): Log likelihood -114.3432

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	-43.14105	2.028138	-2.218103	-0.054659	2.790230	3.858317	-0.317182	-1.351341
		(4.21025)	(0.83314)	(0.81082)	(0.01503)	(0.58428)	(0.34347)	(1.05901)	(0.94887)
0.000000	1.000000	-4.451832	4.504962	-4.199018	-0.002235	-2.607956	0.471662	-4.544103	0.958192
		(1.36032)	(0.26918)	(0.26197)	(0.00486)	(0.18878)	(0.11097)	(0.34216)	(0.30658)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.253693	-0.700920
	(0.08674)	(0.19995)
D(LOG(K))	0.088887	-0.347833
	(0.02498)	(0.05758)
D(LOG(L))	0.015422	-0.022088
	(0.00255)	(0.00588)
D(INTR)	-0.178241	0.203824
	(0.18956)	(0.43695)
D(MSGR)	-0.152080	0.348452
	(0.19889)	(0.45846)
D(INF)	2.402817	-2.360951
	(1.04513)	(2.40907)
D(LOG(EXR))	-0.025981	0.085488
	(0.02070)	(0.04771)

D(LOG(PCRE))	-0.027099	-0.237029
	(0.05228)	(0.12050)
D(LOG(WOP))	0.020176	-0.021948
	(0.01613)	(0.03719)
D(LOG(FFR))	-0.008363	0.008953
	(0.01458)	(0.03360)

3 Cointegrating Equation(s): Log likelihood -72.57490

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	-6.575989	7.576753	-0.267401	0.332657	-4.584831	12.39614	18.59258
			(1.78786)	(1.74438)	(0.03296)	(1.29283)	(0.74332)	(2.29112)	(1.99746)
0.000000	1.000000	0.000000	3.617080	-3.188262	-0.024188	-2.861559	-0.399608	-3.232184	3.016255
			(0.30525)	(0.29783)	(0.00563)	(0.22073)	(0.12691)	(0.39117)	(0.34104)
0.000000	0.000000	1.000000	-0.199442	0.227043	-0.004931	-0.056966	-0.195710	0.294692	0.462296
			(0.04812)	(0.04695)	(0.00089)	(0.03480)	(0.02001)	(0.06167)	(0.05377)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.254053	-0.700768	-7.828582
	(0.10674)	(0.20168)	(3.46115)
D(LOG(K))	0.055941	-0.361803	-1.885089
	(0.02858)	(0.05400)	(0.92676)
D(LOG(L))	0.016572	-0.021600	-0.580979
	(0.00311)	(0.00588)	(0.10095)
D(INTR)	-0.021568	0.270258	4.874752
	(0.22697)	(0.42886)	(7.35989)
D(MSGR)	-0.018271	0.405191	3.380645
	(0.24038)	(0.45421)	(7.79497)
D(INF)	4.218448	-1.591064	-115.2532
	(1.12489)	(2.12553)	(36.4770)
D(LOG(EXR))	-0.020431	0.087841	0.672688
	(0.02540)	(0.04799)	(0.82350)
D(LOG(PCRE))	0.087202	-0.188562	0.832785
	(0.05097)	(0.09631)	(1.65288)
D(LOG(WOP))	0.008798	-0.026772	-0.634172
	(0.01946)	(0.03677)	(0.63111)
D(LOG(FFR))	-0.030236	-0.000322	0.587220
	(0.01629)	(0.03078)	(0.52829)

4 Cointegrating Equation(s): Log likelihood -37.98217

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	3.610787	-0.671086	-15.27825	-10.75930	16.83370	32.65668
				(0.41192)	(0.07513)	(2.79153)	(1.71028)	(5.27379)	(4.58879)
0.000000	1.000000	0.000000	0.000000	-1.006808	0.197856	5.725119	2.996621	-5.673035	-4.719611
				(0.12366)	(0.02255)	(0.83804)	(0.51344)	(1.58324)	(1.37760)
0.000000	0.000000	1.000000	0.000000	0.106760	-0.017175	-0.530426	-0.382975	0.429278	0.888843
				(0.01205)	(0.00220)	(0.08166)	(0.05003)	(0.15427)	(0.13424)
0.000000	0.000000	0.000000	1.000000	-0.603098	-0.061388	-2.373925	-0.938942	0.674812	2.138704
				(0.03984)	(0.00727)	(0.27001)	(0.16543)	(0.51011)	(0.44385)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.255311	-0.586494	-6.993261	-2.605469
	(0.10644)	(0.34845)	(4.02878)	(0.84390)
D(LOG(K))	0.056519	-0.309300	-1.501301	-1.282850
	(0.02832)	(0.09271)	(1.07196)	(0.22454)
D(LOG(L))	0.016755	-0.004985	-0.459524	-0.065626
	(0.00286)	(0.00935)	(0.10809)	(0.02264)
D(INTR)	-0.017763	0.616044	7.402380	0.263857
	(0.22559)	(0.73851)	(8.53856)	(1.78855)
D(MSGR)	-0.013940	0.798767	6.257608	1.044357
	(0.23868)	(0.78137)	(9.03411)	(1.89235)
D(INF)	4.092323	-13.05085	-199.0220	-14.37703
	(0.72922)	(2.38726)	(27.6014)	(5.78160)
D(LOG(EXR))	-0.021703	-0.027770	-0.172405	0.278898
	(0.02389)	(0.07821)	(0.90423)	(0.18941)
D(LOG(PCRE))	0.088732	-0.049626	1.848381	-1.374684
	(0.04992)	(0.16344)	(1.88964)	(0.39582)
D(LOG(WOP))	0.008831	-0.023713	-0.611813	-0.027179
	(0.01947)	(0.06374)	(0.73692)	(0.15436)
D(LOG(FFR))	-0.031840	-0.146027	-0.477855	0.031373
	(0.01212)	(0.03967)	(0.45872)	(0.09609)

5 Cointegrating Equation(s): Log likelihood -15.73417

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.067498	2.043852	-6.724432	-1.847570	16.90644
					(0.03160)	(0.90683)	(0.92021)	(2.84034)	(2.10188)
0.000000	1.000000	0.000000	0.000000	0.000000	-0.008086	0.895140	1.871565	-0.464075	-0.327919
					(0.00713)	(0.20453)	(0.20755)	(0.64063)	(0.47407)
0.000000	0.000000	1.000000	0.000000	0.000000	0.004663	-0.018266	-0.263676	-0.123069	0.423158
					(0.00097)	(0.02792)	(0.02833)	(0.08745)	(0.06471)

0.000000	0.000000	0.000000	1.000000	0.000000	-0.184751	-5.267180	-1.612873	3.795085	4.769416
					(0.01428)	(0.40973)	(0.41577)	(1.28333)	(0.94968)
0.000000	0.000000	0.000000	0.000000	1.000000	-0.204549	-4.797320	-1.117449	5.173738	4.361996
					(0.01512)	(0.43384)	(0.44024)	(1.35885)	(1.00556)

Adjustment coefficients (standard error in parentheses)

D(MUP)	-0.082475	1.058986	9.102642	-1.858470	1.943909
	(0.13041)	(0.55171)	(5.67704)	(0.72460)	(0.66185)
D(LOG(K))	-0.032680	0.125221	2.749132	-1.085591	1.025055
	(0.03483)	(0.14733)	(1.51603)	(0.19350)	(0.17674)
D(LOG(L))	0.011200	0.022076	-0.194816	-0.053342	0.049571
	(0.00399)	(0.01690)	(0.17391)	(0.02220)	(0.02027)
D(INTR)	0.586771	-2.328865	-21.40440	-1.073044	0.650490
	(0.29504)	(1.24821)	(12.8439)	(1.63935)	(1.49739)
D(MSGR)	0.621272	-2.295582	-24.01098	-0.360386	-0.076896
	(0.31282)	(1.32341)	(13.6177)	(1.73811)	(1.58760)
D(INF)	3.231803	-8.858937	-158.0172	-12.47403	14.33773
	(1.06432)	(4.50270)	(46.3324)	(5.91368)	(5.40159)
D(LOG(EXR))	-0.030946	0.017253	0.268003	0.299337	-0.247774
	(0.03560)	(0.15060)	(1.54962)	(0.19779)	(0.18066)
D(LOG(PCRE))	0.114747	-0.176359	0.608692	-1.432217	1.427040
	(0.07424)	(0.31409)	(3.23193)	(0.41251)	(0.37679)
D(LOG(WOP))	-0.045561	0.241250	1.980031	0.093107	-0.056478
	(0.02513)	(0.10629)	(1.09376)	(0.13960)	(0.12751)
D(LOG(FFR))	0.004486	-0.322981	-2.208804	-0.048960	0.004404
	(0.01523)	(0.06445)	(0.66313)	(0.08464)	(0.07731)

6 Cointegrating Equation(s): Log likelihood 3.748611

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	3.012010	-3.425553	1.977022	13.51321
						(0.50335)	(0.56746)	(1.67837)	(1.29385)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.779164	1.476390	-0.922225	0.078558
						(0.14563)	(0.16418)	(0.48559)	(0.37434)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.048618	-0.035777	0.141149	0.188740
						(0.00987)	(0.01113)	(0.03292)	(0.02538)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	-7.917147	-10.64231	-6.673295	14.05711
						(1.09054)	(1.22945)	(3.63630)	(2.80322)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	-7.731263	-11.11450	-6.416455	14.64497
						(1.13720)	(1.28206)	(3.79190)	(2.92317)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	-14.34345	-48.87355	-56.66209	50.27138
						(5.60512)	(6.31909)	(18.6898)	(14.4079)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.034585	0.581174	8.526762	-1.191199	1.241199	-0.034188
	(0.16666)	(0.69486)	(5.57195)	(0.93604)	(0.91323)	(0.01778)
D(LOG(K))	0.026454	-0.116151	2.458220	-0.748512	0.670073	-0.003668
	(0.04169)	(0.17383)	(1.39387)	(0.23416)	(0.22845)	(0.00445)
D(LOG(L))	0.014163	0.009982	-0.209393	-0.036451	0.031783	-0.000824
	(0.00514)	(0.02145)	(0.17197)	(0.02889)	(0.02819)	(0.00055)
D(INTR)	0.586389	-2.327306	-21.40252	-1.075222	0.652783	0.023843
	(0.38590)	(1.60898)	(12.9021)	(2.16743)	(2.11463)	(0.04116)
D(MSGR)	0.693693	-2.591191	-24.36726	0.052436	-0.511643	0.025749
	(0.40853)	(1.70334)	(13.6587)	(2.29454)	(2.23865)	(0.04358)
D(INF)	2.696844	-6.675351	-155.3855	-15.52343	17.54909	-1.037626
	(1.38214)	(5.76271)	(46.2101)	(7.76287)	(7.57377)	(0.14743)
D(LOG(EXR))	-0.014042	-0.051744	0.184845	0.395692	-0.349247	-0.006788
	(0.04626)	(0.19289)	(1.54673)	(0.25984)	(0.25351)	(0.00493)
D(LOG(PCRE))	0.225947	-0.630250	0.061643	-0.798351	0.759511	-0.023108
	(0.09077)	(0.37845)	(3.03469)	(0.50980)	(0.49738)	(0.00968)
D(LOG(WOP))	-0.069086	0.337278	2.095768	-0.040997	0.084748	0.000213
	(0.03204)	(0.13359)	(1.07126)	(0.17996)	(0.17558)	(0.00342)
D(LOG(FFR))	-0.022455	-0.213013	-2.076266	-0.202531	0.166132	0.002654
	(0.01809)	(0.07541)	(0.60467)	(0.10158)	(0.09910)	(0.00193)

7 Cointegrating Equation(s): Log likelihood 15.22518

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	4.385765	-5.892722	14.16423
							(0.90187)	(2.96983)	(2.31432)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	3.497066	-2.958015	0.246967
							(0.33663)	(1.10852)	(0.86384)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.090310	0.014119	0.199249
							(0.01851)	(0.06094)	(0.04749)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	-31.17457	14.01253	12.34589
							(3.14375)	(10.3523)	(8.06727)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	-31.16469	13.78370	12.97393
							(3.11802)	(10.2675)	(8.00124)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	-86.07171	-19.18570	47.17117
							(8.45552)	(27.8437)	(21.6980)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	-2.593391	2.612788	-0.216141
							(0.31903)	(1.05057)	(0.81868)

Adjustment coefficients (standard error in parentheses)

D(MUP)	-0.005048	0.781233	8.992148	-1.033820	1.089934	-0.032060	1.446281
	(0.17266)	(0.73475)	(5.54096)	(0.94773)	(0.92401)	(0.01779)	(0.76817)
D(LOG(K))	0.038018	-0.174528	2.322421	-0.794434	0.714212	-0.004289	0.863255
	(0.04301)	(0.18302)	(1.38024)	(0.23608)	(0.23017)	(0.00443)	(0.19135)
D(LOG(L))	0.012399	0.018885	-0.188682	-0.029447	0.025052	-0.000729	0.101593
	(0.00526)	(0.02239)	(0.16883)	(0.02888)	(0.02815)	(0.00054)	(0.02341)
D(INTR)	0.574568	-2.267635	-21.26371	-1.028282	0.607666	0.024477	2.080757
	(0.40438)	(1.72090)	(12.9778)	(2.21973)	(2.16416)	(0.04167)	(1.79916)
D(MSGR)	0.643552	-2.338085	-23.77848	0.251543	-0.703016	0.028441	2.246052
	(0.42687)	(1.81659)	(13.6994)	(2.34316)	(2.28450)	(0.04398)	(1.89920)
D(INF)	2.318224	-4.764121	-150.9395	-14.01995	16.10401	-1.017297	-1.096939
	(1.42638)	(6.07011)	(45.7763)	(7.82962)	(7.63361)	(0.14696)	(6.34614)
D(LOG(EXR))	0.002509	-0.135293	-0.009510	0.329968	-0.286075	-0.007677	-0.471322
	(0.04721)	(0.20091)	(1.51512)	(0.25915)	(0.25266)	(0.00486)	(0.21005)
D(LOG(PCRE))	0.178979	-0.393162	0.613165	-0.611844	0.580248	-0.020586	1.149783
	(0.08981)	(0.38221)	(2.88234)	(0.49300)	(0.48066)	(0.00925)	(0.39959)
D(LOG(WOP))	-0.078376	0.384170	2.204851	-0.004108	0.049292	0.000712	-0.142042
	(0.03300)	(0.14045)	(1.05920)	(0.18117)	(0.17663)	(0.00340)	(0.14684)
D(LOG(FFR))	-0.028328	-0.183370	-2.007309	-0.179212	0.143719	0.002969	-0.031410
	(0.01855)	(0.07892)	(0.59517)	(0.10180)	(0.09925)	(0.00191)	(0.08251)

8 Cointegrating Equation(s): Log likelihood 23.25360

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-14.33232	16.55416
								(3.74414)	(2.91433)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-9.687478	2.152617
								(1.91957)	(1.49414)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-0.159666	0.248461
								(0.06469)	(0.05036)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	74.00228	-4.642017
								(17.0671)	(13.2845)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	73.75443	-4.008587
								(16.9697)	(13.2087)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	146.4435	0.268267
								(43.8891)	(34.1619)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	7.603293	-1.629353
								(1.60737)	(1.25113)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.924317	-0.544928
								(0.58239)	(0.45332)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.005547	0.789288	7.302225	-1.174291	1.251617	-0.027375	1.206592	0.916939
	(0.16916)	(0.71869)	(5.64733)	(0.93631)	(0.91643)	(0.01795)	(0.78436)	(0.39178)
D(LOG(K))	0.033888	-0.177668	2.981203	-0.739675	0.651183	-0.006116	0.956693	0.355869
	(0.04073)	(0.17305)	(1.35976)	(0.22544)	(0.22066)	(0.00432)	(0.18886)	(0.09433)
D(LOG(L))	0.012055	0.018623	-0.133717	-0.024879	0.019793	-0.000882	0.109389	0.035918
	(0.00514)	(0.02183)	(0.17152)	(0.02844)	(0.02783)	(0.00055)	(0.02382)	(0.01190)
D(INTR)	0.547758	-2.288018	-16.98716	-0.672805	0.198508	0.012621	2.687320	-2.030884
	(0.39470)	(1.67688)	(13.1766)	(2.18465)	(2.13827)	(0.04188)	(1.83010)	(0.91412)
D(MSGR)	0.614944	-2.359835	-19.21529	0.630846	-1.139598	0.015790	2.893270	-2.043833
	(0.41641)	(1.76910)	(13.9012)	(2.30479)	(2.25586)	(0.04418)	(1.93074)	(0.96439)
D(INF)	2.329148	-4.755815	-152.6821	-14.16480	16.27073	-1.012466	-1.344095	5.598866
	(1.42837)	(6.06839)	(47.6842)	(7.90591)	(7.73808)	(0.15154)	(6.62284)	(3.30808)
D(LOG(EXR))	-0.000560	-0.137627	0.480148	0.370669	-0.332923	-0.009034	-0.401872	0.012788
	(0.04613)	(0.19597)	(1.53990)	(0.25531)	(0.24989)	(0.00489)	(0.21388)	(0.10683)
D(LOG(PCRE))	0.178058	-0.393862	0.760044	-0.599635	0.566196	-0.020994	1.170616	-0.764634
	(0.08991)	(0.38200)	(3.00167)	(0.49767)	(0.48710)	(0.00954)	(0.41690)	(0.20824)
D(LOG(WOP))	-0.083170	0.380525	2.969546	0.059455	-0.023870	-0.001408	-0.033582	0.041391
	(0.02877)	(0.12222)	(0.96036)	(0.15923)	(0.15584)	(0.00305)	(0.13338)	(0.06662)
D(LOG(FFR))	-0.028064	-0.183170	-2.049327	-0.182705	0.147739	0.003086	-0.037370	-0.009872
	(0.01856)	(0.07883)	(0.61946)	(0.10271)	(0.10052)	(0.00197)	(0.08604)	(0.04297)

9 Cointegrating Equation(s): Log likelihood 27.28668

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	17.28057
									(2.48042)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	2.643613
									(1.14275)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.256553
									(0.03956)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-8.392712
									(8.77191)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	-7.746721
									(8.72452)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	-7.154007
									(20.2303)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	-2.014715
									(0.95277)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	-0.642459
									(0.33606)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.050684
									(0.19869)

Adjustment coefficients (standard error in parentheses)

D(MUP)	-0.063444	0.956614	8.054928	-1.208873	1.262376	-0.024907	1.107573	0.915533	3.419708
	(0.17924)	(0.72348)	(5.58451)	(0.91830)	(0.89825)	(0.01776)	(0.77492)	(0.38398)	(1.50308)
D(LOG(K))	0.039024	-0.190125	2.925170	-0.737101	0.650382	-0.006300	0.964064	0.355974	1.114954
	(0.04395)	(0.17740)	(1.36937)	(0.22517)	(0.22026)	(0.00435)	(0.19002)	(0.09416)	(0.36857)
D(LOG(L))	0.012713	0.017025	-0.140905	-0.024548	0.019690	-0.000905	0.110335	0.035931	0.058901
	(0.00554)	(0.02238)	(0.17273)	(0.02840)	(0.02778)	(0.00055)	(0.02397)	(0.01188)	(0.04649)
D(INTR)	0.249039	-1.563530	-13.72810	-0.822538	0.245094	0.023307	2.258584	-2.036968	0.119348
	(0.39667)	(1.60116)	(12.3592)	(2.03231)	(1.98793)	(0.03930)	(1.71500)	(0.84980)	(3.32649)
D(MSGR)	0.300789	-1.597907	-15.78780	0.473374	-1.090604	0.027028	2.442379	-2.050232	-0.011946
	(0.41869)	(1.69004)	(13.0453)	(2.14513)	(2.09829)	(0.04148)	(1.81021)	(0.89697)	(3.51115)
D(INF)	1.699701	-3.229205	-145.8147	-14.48031	16.36890	-0.989949	-2.247508	5.586046	40.88655
	(1.50821)	(6.08782)	(46.9914)	(7.72711)	(7.55838)	(0.14943)	(6.52067)	(3.23105)	(12.6478)
D(LOG(EXR))	-0.010185	-0.114285	0.585151	0.365845	-0.331422	-0.008690	-0.415685	0.012592	-0.217806
	(0.04961)	(0.20025)	(1.54568)	(0.25417)	(0.24862)	(0.00492)	(0.21448)	(0.10628)	(0.41602)
D(LOG(PCRE))	0.231678	-0.523908	0.175039	-0.572758	0.557833	-0.022912	1.247574	-0.763542	2.905674
	(0.09302)	(0.37545)	(2.89811)	(0.47656)	(0.46615)	(0.00922)	(0.40215)	(0.19927)	(0.78003)
D(LOG(WOP))	-0.088622	0.393747	3.029024	0.056722	-0.023020	-0.001213	-0.041406	0.041280	-0.713514
	(0.03097)	(0.12500)	(0.96484)	(0.15866)	(0.15519)	(0.00307)	(0.13388)	(0.06634)	(0.25969)
D(LOG(FFR))	-0.025205	-0.190104	-2.080523	-0.181272	0.147293	0.002983	-0.033266	-0.009813	0.029733
	(0.02000)	(0.08074)	(0.62326)	(0.10249)	(0.10025)	(0.00198)	(0.08649)	(0.04285)	(0.16775)

Vector Error Correction Estimates
Date: 10/28/22   Time: 04:14
Sample (adjusted): 1982 2019
Included observations: 38 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
MUP(-1)	1.000000
LOG(K(-1))	0.105877
	(0.018979)
	[5.58073]
LOG(L(-1))	-0.092750
	(0.020816)
	[-4.33756]
INTR(-1)	-0.097251
	(0.003148)
	[-15.8070]
MSGR(-1)	-0.066761
	(0.506950)
	[-15.2064]
INF(-1)	-0.078319
	(0.00727)
	[-1.36765]
LOG(EXR(-1))	-0.482207
	(0.022085)
	[-11.2406]
LOG(PCRE(-1))	8.852140
	(7.31240)
	[6.74498]
LOG(WOP(-1))	-0.484287
	(0.049748)
	[-9.73474]
LOG(FFR(-1))	0.879372
	(0.042942)

	[2.04757]
@TREND(80)	6.463129
C	11.75454

Error Correction:	D(MUP)	D(LOG(K))	D(LOG(L))	D(INTR)	D(MSGR)	D(INF)	D(LOG(EXR))	D(LOG(PCRE))	D(LOG(WOP))	D(LOG(FFR))
CointEq1	-0.026323	-0.017676	9.64E-05	-0.005368	0.009850	0.104344	0.003829	-0.022975	0.000701	-0.000302
	(0.01725)	(0.00550)	(0.00067)	(0.03207)	(0.03354)	(0.19039)	(0.00359)	(0.00870)	(0.00276)	(0.00244)
	[-1.52605]	[-3.21662]	[0.14406]	[-0.16739]	[0.29370]	[0.54807]	[1.06741]	[-2.64141]	[0.25354]	[-0.12390]
D(MUP(-1))	-0.244755	-0.099233	0.005030	0.730018	0.731943	-3.896595	-0.034103	0.095189	-0.035855	-0.017264
	(0.04662)	(0.07857)	(0.00956)	(0.45854)	(0.47949)	(2.72201)	(0.05129)	(0.12436)	(0.03951)	(0.03489)
	[-0.99244]	[-1.26302]	[0.52591]	[1.59206]	[1.52650]	[-1.43152]	[-0.66495]	[0.76545]	[-0.90759]	[-0.49477]
D(LOG(K(-1)))	0.404483	0.093340	-0.020065	-1.253918	-1.129934	5.415833	0.218550	-0.305927	0.168284	0.042331
	(0.02454)	(0.23083)	(0.02810)	(1.34714)	(1.40870)	(7.99699)	(0.15067)	(0.36535)	(0.11606)	(0.10251)
	[0.55826]	[0.40437]	[-0.71413]	[-0.93080]	[-0.80211]	[0.67723]	[1.45048]	[-0.83736]	[1.44994]	[0.41293]
D(LOG(L(-1)))	-10.26421	-2.833377	-0.148938	-14.32660	-14.00344	-54.19953	-2.114663	-4.522254	0.653647	-0.190142
	(7.32625)	(2.33403)	(0.28410)	(13.6217)	(14.2442)	(80.8622)	(1.52356)	(3.69423)	(1.17358)	(1.03657)
	[-1.40102]	[-1.21394]	[-0.52424]	[-1.05175]	[-0.98310]	[-0.67027]	[-1.38797]	[-1.22414]	[0.55697]	[-0.18343]
D(INTR(-1))	-0.966817	0.613099	0.015841	0.541187	0.180208	-13.41211	-0.241501	0.630431	-0.006033	-0.085547
	(0.01656)	(0.32386)	(0.03942)	(1.89010)	(1.97647)	(11.2201)	(0.21140)	(0.51260)	(0.16284)	(0.14383)
	[0.95106]	[1.89309]	[0.40183]	[0.28633]	[0.09118]	[-1.19536]	[-1.14237]	[1.22987]	[-0.03705]	[-0.59477]
D(MSGR(-1))	-0.964134	-0.607330	-0.014625	-0.833012	-0.514615	11.34700	0.218058	-0.587075	0.007411	0.080093
	(0.97036)	(0.30914)	(0.03763)	(1.80418)	(1.88663)	(10.7101)	(0.20179)	(0.48930)	(0.15544)	(0.13729)
	[-0.99359]	[-1.96458]	[-0.38867]	[-0.46171]	[-0.27277]	[1.05946]	[1.08060]	[-1.19983]	[0.04768]	[0.58337]
D(INF(-1))	-4.82E-05	0.001197	-9.83E-05	0.071022	0.069052	0.125924	0.002824	-0.006371	0.001764	0.002234
	(0.01669)	(0.00532)	(0.00065)	(0.03104)	(0.03245)	(0.18424)	(0.00347)	(0.00842)	(0.00267)	(0.00236)
	[-0.00289]	[0.22500]	[-0.15182]	[2.28835]	[2.12765]	[0.68348]	[0.81346]	[-0.75688]	[0.65958]	[0.94573]
D(LOG(EXR(-1)))	-1.286621	0.113842	-0.047000	3.496252	3.919875	18.10548	0.169488	-0.495552	-0.003498	0.017192
	(0.97684)	(0.31121)	(0.03788)	(1.81624)	(1.89923)	(10.7817)	(0.20314)	(0.49257)	(0.15648)	(0.13821)
	[-1.31713]	[0.36581]	[-1.24076]	[1.92500]	[2.06392]	[1.67928]	[0.83433]	[-1.00606]	[-0.02236]	[0.12439]
D(LOG(PCRE(-1)))	-0.435501	-0.193298	-0.021050	0.472721	0.546085	6.114117	0.013999	-0.319911	-0.099280	-0.008259
	(0.37799)	(0.12042)	(0.01466)	(0.70280)	(0.73492)	(4.17202)	(0.07861)	(0.19060)	(0.06055)	(0.05348)
	[-1.15214]	[-1.60517]	[-1.43611]	[0.67262]	[0.74306]	[1.46551]	[0.17809]	[-1.67843]	[-1.63963]	[-0.15443]

D(LOG(WOP(-1)))	1.844746	-0.646722	0.068950	-1.786067	-1.096175	3.360743	0.114317	0.567276	-0.427310	-0.257573
	(1.60415)	(0.51106)	(0.06221)	(2.98259)	(3.11889)	(17.7055)	(0.33360)	(0.80889)	(0.25697)	(0.22697)
	[1.14998]	[-1.26546]	[1.10840]	[-0.59883]	[-0.35146]	[0.18981]	[0.34268]	[0.70131]	[-1.66291]	[-1.13485]
D(LOG(FFR(-1)))	-3.505150	-0.858969	-0.005655	-4.273047	-4.270285	-5.764876	-0.306370	-0.903004	0.144735	0.342186
	(1.37331)	(0.43752)	(0.05326)	(2.55340)	(2.67008)	(15.1577)	(0.28559)	(0.69249)	(0.21999)	(0.19431)
	[-2.55233]	[-1.96329]	[-0.10619]	[-1.67347]	[-1.59931]	[-0.38033]	[-1.07275]	[-1.30400]	[0.65792]	[1.76106]
C	0.394128	0.084677	0.083295	0.681562	0.554395	-2.167638	0.411655	0.700588	0.142139	-0.054496
	(0.75593)	(0.24083)	(0.02931)	(1.40550)	(1.46973)	(8.34345)	(0.15720)	(0.38117)	(0.12109)	(0.10695)
	[0.52138]	[0.35161]	[2.84149]	[0.48492]	[0.37721]	[-0.25980]	[2.61863]	[1.83797]	[1.17382]	[-0.50952]
@TREND(80)	-0.017981	-0.002669	-0.002626	-0.028045	-0.025340	-0.008212	-0.012581	-0.021534	-0.004459	0.002270
	(0.02762)	(0.00880)	(0.00107)	(0.05135)	(0.05370)	(0.30483)	(0.00574)	(0.01393)	(0.00442)	(0.00391)
	[-0.65107]	[-0.30331]	[-2.45215]	[-0.54616]	[-0.47191]	[-0.02694]	[-2.19050]	[-1.54630]	[-1.00778]	[0.58090]
R-squared	0.679559	0.527259	0.379553	0.479845	0.473313	0.247967	0.297818	0.477348	0.252082	0.310232
Adj. R-squared	0.429748	0.300343	0.081738	0.230171	0.220503	-0.113008	-0.039229	0.226476	-0.106919	-0.020856
Sum sq. resids	53.19814	5.399386	0.079998	183.9057	201.0975	6480.726	2.300658	13.52637	1.365082	1.064952
S.E. equation	1.458741	0.464732	0.056568	2.712237	2.836177	16.10059	0.303358	0.735564	0.233673	0.206393
F-statistic	1.919685	2.323586	1.274459	1.921887	1.872209	0.686937	0.883611	1.902751	0.702176	0.937006
Log likelihood	-60.31197	-16.84495	63.18378	-83.87957	-85.57753	-151.5607	-0.636236	-34.29371	9.281400	13.99881
Akaike AIC	3.858525	1.570787	-2.641252	5.098925	5.188291	8.661089	0.717697	2.489143	0.195716	-0.052569
Schwarz SC	4.418752	2.131014	-2.081025	5.659152	5.748518	9.221316	1.277923	3.049370	0.755943	0.507658
Mean dependent	-0.202871	-0.008212	0.019744	0.282873	0.289474	0.132257	0.144558	0.115417	0.033603	-0.029336
S.D. dependent	1.662118	0.555596	0.059032	3.091225	3.212374	15.26134	0.297578	0.836342	0.222101	0.204274

Determinant resid covariance (dof adj.)	1.60E-07
Determinant resid covariance	2.43E-09
Log likelihood	-162.2892
Akaike information criterion	15.90996
Schwarz criterion	21.94317
Number of coefficients	140

Covariance										
Correlation	MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR
MUP	6.935512									

	1.000000									
K	3.76E+10	8.29E+20								
	0.496166	1.000000								
L	-2921676.	2.20E+17	9.81E+13							
	-0.111988	0.770810	1.000000							
INTR	-8.015546	-1.66E+10	15555089	26.75221						
	-0.588456	-0.111305	0.303578	1.000000						
MSGR	-7.893313	-1.45E+10	16206540	26.79075	26.92331					
	-0.577638	-0.096871	0.315285	0.998254	1.000000					
INF	-3.043032	-1.41E+11	-44620963	32.16009	31.88470	286.8223				
	-0.068228	-0.289288	-0.265956	0.367139	0.362837	1.000000				
EXR	-30.23609	1.30E+12	5.95E+08	86.63897	90.42591	-390.7244	4135.474			
	-0.178535	0.700915	0.933502	0.260478	0.270998	-0.358758	1.000000			
PCRE	1.66E+12	7.22E+22	2.33E+19	2.07E+11	2.64E+11	-1.56E+13	1.38E+14	1.02E+25		
	0.197189	0.784689	0.734478	0.012553	0.015935	-0.288982	0.670352	1.000000		
WOP	9.457780	1.31E+12	4.93E+08	37.28260	41.30876	-232.7148	3015.243	1.17E+14	3002.545	
	0.065540	0.829860	0.907972	0.131547	0.145289	-0.250768	0.855687	0.665521	1.000000	
FFR	2.271909	-5.83E+10	-31253713	-9.415700	-9.665709	10.04945	-179.8733	-6.80E+12	-141.9979	13.40142
	0.235655	-0.552771	-0.861794	-0.497276	-0.508855	0.162092	-0.764062	-0.581121	-0.707884	1.000000

Appendix C: Unit root tests

Null Hypothesis: CU has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.582669	0.0988
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CU)
Method: Least Squares
Date: 01/08/22 Time: 07:01
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CU(-1)	-0.027665	0.010712	-2.582669	0.0108
D(CU(-1))	0.703201	0.078186	8.993911	0.0000
D(CU(-2))	0.207023	0.088232	2.346349	0.0204
D(CU(-3))	0.074681	0.089959	0.830166	0.4079
D(CU(-4))	-0.871411	0.089844	-9.699150	0.0000
D(CU(-5))	0.620472	0.104026	5.964586	0.0000
D(CU(-6))	0.115025	0.089354	1.287300	0.2001
D(CU(-7))	0.037805	0.089800	0.420987	0.6744
D(CU(-8))	-0.487711	0.088500	-5.510879	0.0000
D(CU(-9))	0.345939	0.077573	4.459536	0.0000
C	1.272282	0.510210	2.493641	0.0138

R-squared	0.645792	Mean dependent var	-0.071742
Adjusted R-squared	0.620309	S.D. dependent var	2.012571
S.E. of regression	1.240128	Akaike info criterion	3.338811
Sum squared resid	213.7704	Schwarz criterion	3.559591
Log likelihood	-239.4108	Hannan-Quinn criter.	3.428507
F-statistic	25.34243	Durbin-Watson stat	2.035096
Prob(F-statistic)	0.000000		

Null Hypothesis: CU has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.343404	0.1598
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3.847962
HAC corrected variance (Bartlett kernel)	10.15173

Phillips-Perron Test Equation
Dependent Variable: D(CU)
Method: Least Squares
Date: 01/08/22 Time: 07:09
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CU(-1)	-0.027792	0.013478	-2.062041	0.0409
C	1.216444	0.663580	1.833154	0.0687

R-squared	0.026369	Mean dependent var	-0.113259
Adjusted R-squared	0.020167	S.D. dependent var	1.994289
S.E. of regression	1.974077	Akaike info criterion	4.210578
Sum squared resid	611.8260	Schwarz criterion	4.249181
Log likelihood	-332.7410	Hannan-Quinn criter.	4.226254
F-statistic	4.252013	Durbin-Watson stat	0.806909
Prob(F-statistic)	0.040852		

Null Hypothesis: MUP has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.420080	0.1380
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MUP)
Method: Least Squares
Date: 01/08/22 Time: 07:12
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MUP(-1)	-0.030776	0.012717	-2.420080	0.0168
D(MUP(-1))	0.740816	0.073810	10.03676	0.0000
D(MUP(-2))	0.159229	0.081210	1.960706	0.0519
D(MUP(-3))	0.040155	0.083089	0.483270	0.6297
D(MUP(-4))	-1.213783	0.099871	-12.15348	0.0000
D(MUP(-5))	0.967048	0.117396	8.237458	0.0000
D(MUP(-6))	0.085535	0.082000	1.043110	0.2987
D(MUP(-7))	-0.001428	0.084204	-0.016958	0.9865
D(MUP(-8))	-0.846818	0.118935	-7.119978	0.0000
D(MUP(-9))	0.732526	0.108809	6.732209	0.0000
C	0.167176	0.082935	2.015743	0.0458

R-squared	0.691174	Mean dependent var	-0.044721
Adjusted R-squared	0.668956	S.D. dependent var	0.618322
S.E. of regression	0.355761	Akaike info criterion	0.841387
Sum squared resid	17.59261	Schwarz criterion	1.062167
Log likelihood	-52.10406	Hannan-Quinn criter.	0.931083
F-statistic	31.10911	Durbin-Watson stat	2.104608
Prob(F-statistic)	0.000000		

Null Hypothesis: MUP has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.066110	0.2588
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.354426
HAC corrected variance (Bartlett kernel)	0.641849

Phillips-Perron Test Equation
Dependent Variable: D(MUP)
Method: Least Squares
Date: 01/08/22 Time: 07:13
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MUP(-1)	-0.029302	0.018025	-1.625642	0.1060
C	0.144700	0.120851	1.197343	0.2330

R-squared	0.016554	Mean dependent var	-0.035940
Adjusted R-squared	0.010290	S.D. dependent var	0.602223
S.E. of regression	0.599117	Akaike info criterion	1.825778
Sum squared resid	56.35372	Schwarz criterion	1.864381
Log likelihood	-143.1494	Hannan-Quinn criter.	1.841454
F-statistic	2.642713	Durbin-Watson stat	1.012868
Prob(F-statistic)	0.106031		

Null Hypothesis: K has a unit root
Exogenous: Constant
Lag Length: 13 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.953772	0.3071
Test critical values:	1% level	-3.475500	
	5% level	-2.881260	
	10% level	-2.577365	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(K)
Method: Least Squares
Date: 01/08/22 Time: 07:15
Sample (adjusted): 1983Q3 2019Q4
Included observations: 146 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
K(-1)	-0.024091	0.012330	-1.953772	0.0529
D(K(-1))	0.751232	0.080400	9.343679	0.0000
D(K(-2))	0.163396	0.094463	1.729729	0.0860
D(K(-3))	-0.013541	0.099983	-0.135435	0.8925
D(K(-4))	-1.373675	0.161299	-8.516332	0.0000
D(K(-5))	1.191581	0.194604	6.123120	0.0000
D(K(-6))	0.183625	0.198005	0.927371	0.3554
D(K(-7))	-0.053774	0.204797	-0.262573	0.7933
D(K(-8))	-1.716330	0.286582	-5.988962	0.0000
D(K(-9))	1.638414	0.288996	5.669321	0.0000
D(K(-10))	0.171761	0.228047	0.753181	0.4527
D(K(-11))	0.036194	0.228684	0.158272	0.8745
D(K(-12))	-1.210174	0.226531	-5.342205	0.0000
D(K(-13))	1.058075	0.195870	5.401918	0.0000
C	5.15E+08	3.92E+08	1.313732	0.1912

R-squared	0.683164	Mean dependent var	1.97E+08
Adjusted R-squared	0.649304	S.D. dependent var	6.22E+09
S.E. of regression	3.69E+09	Akaike info criterion	46.99064
Sum squared resid	1.78E+21	Schwarz criterion	47.29717
Log likelihood	-3415.316	Hannan-Quinn criter.	47.11519
F-statistic	20.17594	Durbin-Watson stat	2.085549
Prob(F-statistic)	0.000000		

Null Hypothesis: K has a unit root
Exogenous: Constant
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.631892	0.4639
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3.52E+19
HAC corrected variance (Bartlett kernel)	5.71E+19

Phillips-Perron Test Equation
Dependent Variable: D(K)
Method: Least Squares
Date: 01/08/22 Time: 07:17
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
K(-1)	-0.020860	0.016403	-1.271743	0.2053
C	5.15E+08	5.91E+08	0.870413	0.3854

R-squared	0.010196	Mean dependent var	64214492
Adjusted R-squared	0.003892	S.D. dependent var	5.98E+09
S.E. of regression	5.97E+09	Akaike info criterion	47.87062
Sum squared resid	5.60E+21	Schwarz criterion	47.90923
Log likelihood	-3803.715	Hannan-Quinn criter.	47.88630
F-statistic	1.617330	Durbin-Watson stat	0.985244
Prob(F-statistic)	0.205345		

Null Hypothesis: L has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.928389	0.3186
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(L)
Method: Least Squares
Date: 01/08/22 Time: 07:18
Sample (adjusted): 1981Q3 2019Q4
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
L(-1)	-0.010564	0.005478	-1.928389	0.0557
D(L(-1))	0.579806	0.078846	7.353630	0.0000
D(L(-2))	0.140787	0.074801	1.882147	0.0618
D(L(-3))	0.036936	0.075579	0.488711	0.6258
D(L(-4))	-0.661107	0.074693	-8.850937	0.0000
D(L(-5))	0.311009	0.079641	3.905133	0.0001
C	530069.4	228421.1	2.320580	0.0217

R-squared	0.541422	Mean dependent var	177828.3
Adjusted R-squared	0.522705	S.D. dependent var	923560.4
S.E. of regression	638056.2	Akaike info criterion	29.61463
Sum squared resid	5.98E+13	Schwarz criterion	29.75267
Log likelihood	-2273.326	Hannan-Quinn criter.	29.67070
F-statistic	28.92603	Durbin-Watson stat	1.942080
Prob(F-statistic)	0.000000		

Null Hypothesis: L has a unit root

Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.572063	0.4945
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	8.19E+11
HAC corrected variance (Bartlett kernel)	1.49E+12

Phillips-Perron Test Equation
Dependent Variable: D(L)
Method: Least Squares
Date: 01/08/22 Time: 07:19
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
L(-1)	-0.012012	0.007285	-1.648897	0.1012
C	638312.8	297188.7	2.147837	0.0333

R-squared	0.017023	Mean dependent var	162974.9
Adjusted R-squared	0.010762	S.D. dependent var	915789.3
S.E. of regression	910848.2	Akaike info criterion	30.29464
Sum squared resid	1.30E+14	Schwarz criterion	30.33324
Log likelihood	-2406.424	Hannan-Quinn criter.	30.31032
F-statistic	2.718861	Durbin-Watson stat	0.944474
Prob(F-statistic)	0.101168		

Null Hypothesis: INTR has a unit root

Exogenous: Constant

Lag Length: 9 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.408771	0.1410
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTR)
Method: Least Squares
Date: 01/08/22 Time: 07:21
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTR(-1)	-0.025058	0.010403	-2.408771	0.0173
D(INTR(-1))	0.775119	0.066648	11.63003	0.0000
D(INTR(-2))	0.123136	0.068130	1.807358	0.0729
D(INTR(-3))	0.044383	0.068928	0.643906	0.5207
D(INTR(-4))	-0.988512	0.069580	-14.20674	0.0000
D(INTR(-5))	0.788992	0.086754	9.094593	0.0000
D(INTR(-6))	0.061397	0.068504	0.896254	0.3717
D(INTR(-7))	0.016507	0.068736	0.240148	0.8106
D(INTR(-8))	-0.764940	0.070271	-10.88564	0.0000
D(INTR(-9))	0.625234	0.068821	9.084899	0.0000
C	0.462976	0.190907	2.425144	0.0166

R-squared	0.746502	Mean dependent var	0.057128
Adjusted R-squared	0.728265	S.D. dependent var	1.106635
S.E. of regression	0.576869	Akaike info criterion	1.808103
Sum squared resid	46.25617	Schwarz criterion	2.028883
Log likelihood	-124.6077	Hannan-Quinn criter.	1.897799
F-statistic	40.93276	Durbin-Watson stat	2.141420
Prob(F-statistic)	0.000000		

Null Hypothesis: INTR has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.176765	0.2157
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.119040
HAC corrected variance (Bartlett kernel)	1.688028

Phillips-Perron Test Equation
Dependent Variable: D(INTR)
Method: Least Squares
Date: 01/08/22 Time: 07:23
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTR(-1)	-0.032867	0.016272	-2.019897	0.0451
C	0.634837	0.295767	2.146407	0.0334

R-squared	0.025329	Mean dependent var	0.062273
Adjusted R-squared	0.019121	S.D. dependent var	1.074890
S.E. of regression	1.064564	Akaike info criterion	2.975506
Sum squared resid	177.9274	Schwarz criterion	3.014108
Log likelihood	-234.5527	Hannan-Quinn criter.	2.991182
F-statistic	4.079983	Durbin-Watson stat	0.971489
Prob(F-statistic)	0.045095		

Null Hypothesis: MSGR has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.438068	0.1331
Test critical values: 1% level	-3.474265	
5% level	-2.880722	
10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MSGR)
Method: Least Squares
Date: 01/08/22 Time: 07:24
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MSGR(-1)	-0.027015	0.011081	-2.438068	0.0160
D(MSGR(-1))	0.764373	0.067969	11.24583	0.0000
D(MSGR(-2))	0.126671	0.069265	1.828783	0.0696
D(MSGR(-3))	0.045175	0.070105	0.644394	0.5204
D(MSGR(-4))	-0.992003	0.070840	-14.00340	0.0000
D(MSGR(-5))	0.781176	0.088814	8.795613	0.0000
D(MSGR(-6))	0.063084	0.069650	0.905732	0.3666
D(MSGR(-7))	0.015537	0.069899	0.222282	0.8244
D(MSGR(-8))	-0.752656	0.071604	-10.51141	0.0000
D(MSGR(-9))	0.608069	0.070340	8.644661	0.0000
C	0.499218	0.203321	2.455316	0.0153

R-squared	0.738299	Mean dependent var	0.053750
Adjusted R-squared	0.719472	S.D. dependent var	1.157738
S.E. of regression	0.613195	Akaike info criterion	1.930238
Sum squared resid	52.26513	Schwarz criterion	2.151018
Log likelihood	-133.7678	Hannan-Quinn criter.	2.019934
F-statistic	39.21404	Durbin-Watson stat	2.132846
Prob(F-statistic)	0.000000		

Null Hypothesis: MSGR has a unit root
Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.275158	0.1813
Test critical values: 1% level	-3.471719	
5% level	-2.879610	
10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.228235
HAC corrected variance (Bartlett kernel)	2.287576

Phillips-Perron Test Equation
Dependent Variable: D(MSGR)
Method: Least Squares
Date: 01/08/22 Time: 07:26
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MSGR(-1)	-0.033088	0.016993	-1.947134	0.0533
C	0.631498	0.309086	2.043118	0.0427

R-squared	0.023579	Mean dependent var	0.054835
Adjusted R-squared	0.017360	S.D. dependent var	1.125103
S.E. of regression	1.115294	Akaike info criterion	3.068612
Sum squared resid	195.2893	Schwarz criterion	3.107215
Log likelihood	-241.9547	Hannan-Quinn criter.	3.084288
F-statistic	3.791333	Durbin-Watson stat	0.977657
Prob(F-statistic)	0.053303		

Null Hypothesis: INF has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.747528	0.0685
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 01/08/22 Time: 07:27
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.053635	0.019521	-2.747528	0.0068
D(INF(-1))	0.689692	0.077145	8.940252	0.0000
D(INF(-2))	0.186102	0.080252	2.318963	0.0219
D(INF(-3))	0.081537	0.081714	0.997838	0.3201
D(INF(-4))	-0.673191	0.081969	-8.212718	0.0000
D(INF(-5))	0.487285	0.092901	5.245225	0.0000
D(INF(-6))	0.081726	0.080836	1.011016	0.3138
D(INF(-7))	0.035875	0.081087	0.442424	0.6589
D(INF(-8))	-0.550515	0.080348	-6.851629	0.0000
D(INF(-9))	0.383556	0.076726	4.999037	0.0000
C	1.026196	0.454213	2.259285	0.0254

R-squared	0.646223	Mean dependent var	-0.043526
Adjusted R-squared	0.620771	S.D. dependent var	5.030699
S.E. of regression	3.097982	Akaike info criterion	5.169884
Sum squared resid	1334.051	Schwarz criterion	5.390664
Log likelihood	-376.7413	Hannan-Quinn criter.	5.259580
F-statistic	25.39029	Durbin-Watson stat	2.058241
Prob(F-statistic)	0.000000		

Null Hypothesis: INF has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.936650	0.0434
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	23.77881
HAC corrected variance (Bartlett kernel)	61.87487

Phillips-Perron Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 01/08/22 Time: 07:29
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.042097	0.022911	-1.837418	0.0680
C	0.798754	0.583310	1.369348	0.1728

R-squared	0.021051	Mean dependent var	0.000390
Adjusted R-squared	0.014816	S.D. dependent var	4.944076
S.E. of regression	4.907314	Akaike info criterion	6.031829
Sum squared resid	3780.831	Schwarz criterion	6.070432
Log likelihood	-477.5304	Hannan-Quinn criter.	6.047505
F-statistic	3.376104	Durbin-Watson stat	0.807309
Prob(F-statistic)	0.068039		

Null Hypothesis: EXR has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-0.784431	0.8203
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR)
Method: Least Squares
Date: 01/08/22 Time: 07:30
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR(-1)	-0.003004	0.003829	-0.784431	0.4341
D(EXR(-1))	0.723435	0.080100	9.031683	0.0000
D(EXR(-2))	0.193480	0.091730	2.109243	0.0367
D(EXR(-3))	0.041779	0.093340	0.447600	0.6551
D(EXR(-4))	-1.018390	0.097214	-10.47576	0.0000
D(EXR(-5))	0.730001	0.114210	6.391749	0.0000
D(EXR(-6))	0.115762	0.092837	1.246941	0.2145
D(EXR(-7))	0.010963	0.093721	0.116970	0.9071
D(EXR(-8))	-0.532141	0.101990	-5.217574	0.0000
D(EXR(-9))	0.385600	0.089379	4.314214	0.0000
C	0.580443	0.378951	1.531708	0.1279

R-squared	0.638616	Mean dependent var	0.937599
Adjusted R-squared	0.612617	S.D. dependent var	4.724327
S.E. of regression	2.940424	Akaike info criterion	5.065490
Sum squared resid	1201.807	Schwarz criterion	5.286270
Log likelihood	-368.9118	Hannan-Quinn criter.	5.155186
F-statistic	24.56326	Durbin-Watson stat	2.014138
Prob(F-statistic)	0.000000		

Null Hypothesis: EXR has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.689977	0.8451
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	20.93171
HAC corrected variance (Bartlett kernel)	46.09442

Phillips-Perron Test Equation
Dependent Variable: D(EXR)
Method: Least Squares
Date: 01/08/22 Time: 07:32
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR(-1)	-0.002752	0.005681	-0.484397	0.6288
C	1.081045	0.546231	1.979101	0.0496

R-squared	0.001492	Mean dependent var	0.884256
Adjusted R-squared	-0.004868	S.D. dependent var	4.593002
S.E. of regression	4.604167	Akaike info criterion	5.904299
Sum squared resid	3328.142	Schwarz criterion	5.942902
Log likelihood	-467.3918	Hannan-Quinn criter.	5.919976
F-statistic	0.234640	Durbin-Watson stat	0.914809
Prob(F-statistic)	0.628779		

Null Hypothesis: D(MUP) has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=13)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-3.111234	0.0278
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MUP,2)
Method: Least Squares
Date: 01/08/22 Time: 07:38
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MUP(-1))	-0.460835	0.148120	-3.111234	0.0023
D(MUP(-1),2)	0.199522	0.133638	1.492997	0.1377
D(MUP(-2),2)	0.341792	0.136900	2.496662	0.0137
D(MUP(-3),2)	0.359328	0.145310	2.472843	0.0146
D(MUP(-4),2)	-0.882930	0.141247	-6.250951	0.0000
D(MUP(-5),2)	0.078128	0.090732	0.861091	0.3907
D(MUP(-6),2)	0.156919	0.097005	1.617641	0.1080
D(MUP(-7),2)	0.145207	0.110844	1.310019	0.1923
D(MUP(-8),2)	-0.719492	0.110545	-6.508605	0.0000
C	-0.020342	0.030080	-0.676254	0.5000

R-squared	0.685770	Mean dependent var	0.008683
Adjusted R-squared	0.665570	S.D. dependent var	0.625764
S.E. of regression	0.361879	Akaike info criterion	0.869326
Sum squared resid	18.33388	Schwarz criterion	1.070035
Log likelihood	-55.19943	Hannan-Quinn criter.	0.950867
F-statistic	33.94821	Durbin-Watson stat	2.072947
Prob(F-statistic)	0.000000		

Null Hypothesis: D(MUP) has a unit root
Exogenous: Constant
Bandwidth: 31 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*

Phillips-Perron test statistic		-6.200970	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.278645
HAC corrected variance (Bartlett kernel)	0.130509

Phillips-Perron Test Equation
Dependent Variable: D(MUP,2)
Method: Least Squares
Date: 01/08/22 Time: 07:39
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MUP(-1))	-0.512884	0.071118	-7.211707	0.0000
C	-0.015868	0.042377	-0.374434	0.7086

R-squared	0.250031	Mean dependent var	0.006534
Adjusted R-squared	0.245224	S.D. dependent var	0.611481
S.E. of regression	0.531242	Akaike info criterion	1.585378
Sum squared resid	44.02596	Schwarz criterion	1.624145
Log likelihood	-123.2449	Hannan-Quinn criter.	1.601122
F-statistic	52.00872	Durbin-Watson stat	2.015098
Prob(F-statistic)	0.000000		

Null Hypothesis: D(K) has a unit root
Exogenous: Constant
Lag Length: 12 (Automatic - based on SIC, maxlag=13)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-2.925364	0.0458
Test critical values:	1% level	-3.475500	
	5% level	-2.881260	
	10% level	-2.577365	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(K,2)
Method: Least Squares
Date: 01/08/22 Time: 07:41
Sample (adjusted): 1983Q3 2019Q4
Included observations: 146 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(K(-1))	-0.452799	0.223564	-2.025364	0.0448
D(K(-1),2)	0.197485	0.217267	0.908954	0.3650
D(K(-2),2)	0.358136	0.225859	1.585663	0.1152
D(K(-3),2)	0.345400	0.246474	1.401363	0.1635
D(K(-4),2)	-1.067863	0.242171	-4.409534	0.0000
D(K(-5),2)	0.107320	0.227309	0.472131	0.6376
D(K(-6),2)	0.297896	0.236652	1.258793	0.2103
D(K(-7),2)	0.257288	0.264676	0.972086	0.3328
D(K(-8),2)	-1.519535	0.269766	-5.632789	0.0000
D(K(-9),2)	0.054457	0.199560	0.272883	0.7854
D(K(-10),2)	0.223110	0.199614	1.117705	0.2657
D(K(-11),2)	0.251052	0.200499	1.252136	0.2127
D(K(-12),2)	-0.992031	0.194979	-5.087879	0.0000
C	60784590	3.19E+08	0.190551	0.8492

R-squared	0.673832	Mean dependent var	1.25E+08
Adjusted R-squared	0.641710	S.D. dependent var	6.22E+09
S.E. of regression	3.73E+09	Akaike info criterion	47.00566
Sum squared resid	1.83E+21	Schwarz criterion	47.29176
Log likelihood	-3417.413	Hannan-Quinn criter.	47.12191
F-statistic	20.97692	Durbin-Watson stat	2.046989
Prob(F-statistic)	0.000000		

Null Hypothesis: D(K) has a unit root
Exogenous: Constant
Bandwidth: 30 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.569747	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	2.72E+19
HAC corrected variance (Bartlett kernel)	1.05E+19

Phillips-Perron Test Equation
Dependent Variable: D(K,2)
Method: Least Squares
Date: 01/08/22 Time: 07:43
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(K(-1))	-0.496896	0.071791	-6.921417	0.0000
C	92130386	4.18E+08	0.220564	0.8257

R-squared	0.234942	Mean dependent var	1.15E+08
Adjusted R-squared	0.230037	S.D. dependent var	5.98E+09
S.E. of regression	5.25E+09	Akaike info criterion	47.61355
Sum squared resid	4.30E+21	Schwarz criterion	47.65232
Log likelihood	-3759.471	Hannan-Quinn criter.	47.62930
F-statistic	47.90601	Durbin-Watson stat	1.996150
Prob(F-statistic)	0.000000		

Null Hypothesis: D(L) has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-5.234510	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(L,2)
Method: Least Squares
Date: 01/08/22 Time: 07:45
Sample (adjusted): 1981Q3 2019Q4
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(L(-1))	-0.568438	0.108594	-5.234510	0.0000
D(L(-1),2)	0.165899	0.085785	1.933884	0.0550
D(L(-2),2)	0.306339	0.084044	3.645003	0.0004
D(L(-3),2)	0.339835	0.083807	4.054960	0.0001
D(L(-4),2)	-0.325364	0.080017	-4.066166	0.0001
C	101954.5	54243.90	1.879557	0.0621

R-squared	0.505140	Mean dependent var	16657.42
Adjusted R-squared	0.488422	S.D. dependent var	900234.9
S.E. of regression	643889.9	Akaike info criterion	29.62663
Sum squared resid	6.14E+13	Schwarz criterion	29.74495
Log likelihood	-2275.250	Hannan-Quinn criter.	29.67469
F-statistic	30.21496	Durbin-Watson stat	1.946646
Prob(F-statistic)	0.000000		

Null Hypothesis: D(L) has a unit root
Exogenous: Constant
Bandwidth: 24 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.552278	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6.11E+11
HAC corrected variance (Bartlett kernel)	2.96E+11

Phillips-Perron Test Equation
Dependent Variable: D(L,2)
Method: Least Squares
Date: 01/08/22 Time: 07:46
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(L(-1))	-0.471823	0.070313	-6.710345	0.0000
C	92723.12	63395.81	1.462606	0.1456

R-squared	0.223992	Mean dependent var	23939.38
Adjusted R-squared	0.219017	S.D. dependent var	889848.1
S.E. of regression	786387.6	Akaike info criterion	30.00086
Sum squared resid	9.65E+13	Schwarz criterion	30.03963
Log likelihood	-2368.068	Hannan-Quinn criter.	30.01661
F-statistic	45.02874	Durbin-Watson stat	2.007302
Prob(F-statistic)	0.000000		

Null Hypothesis: D(INTR) has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.175997	0.0234
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTR,2)
Method: Least Squares
Date: 01/08/22 Time: 07:47
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTR(-1))	-0.385293	0.121314	-3.175997	0.0018
D(INTR(-1),2)	0.162760	0.101591	1.602104	0.1114
D(INTR(-2),2)	0.273573	0.100563	2.720423	0.0073
D(INTR(-3),2)	0.300848	0.100962	2.979811	0.0034
D(INTR(-4),2)	-0.707447	0.100859	-7.014253	0.0000
D(INTR(-5),2)	0.085418	0.070365	1.213930	0.2268
D(INTR(-6),2)	0.141159	0.070474	2.002983	0.0471
D(INTR(-7),2)	0.149103	0.071161	2.095291	0.0379
D(INTR(-8),2)	-0.627635	0.069984	-8.968232	0.0000
C	0.017831	0.048707	0.366094	0.7148

R-squared	0.729951	Mean dependent var	-0.010239
Adjusted R-squared	0.712591	S.D. dependent var	1.094336
S.E. of regression	0.586680	Akaike info criterion	1.835665
Sum squared resid	48.18701	Schwarz criterion	2.036374
Log likelihood	-127.6748	Hannan-Quinn criter.	1.917206
F-statistic	42.04717	Durbin-Watson stat	2.109265
Prob(F-statistic)	0.000000		

Null Hypothesis: D(INTR) has a unit root
Exogenous: Constant
Bandwidth: 19 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.221748	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.856778
HAC corrected variance (Bartlett kernel)	0.483877

Phillips-Perron Test Equation
Dependent Variable: D(INTR,2)
Method: Least Squares
Date: 01/08/22 Time: 07:49
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTR(-1))	-0.488662	0.069359	-7.045376	0.0000
C	0.024864	0.074275	0.334759	0.7383

R-squared	0.241383	Mean dependent var	-0.010108
Adjusted R-squared	0.236520	S.D. dependent var	1.066109
S.E. of regression	0.931538	Akaike info criterion	2.708617
Sum squared resid	135.3709	Schwarz criterion	2.747384
Log likelihood	-211.9808	Hannan-Quinn criter.	2.724361
F-statistic	49.63732	Durbin-Watson stat	2.045290
Prob(F-statistic)	0.000000		

Null Hypothesis: D(MSGR) has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.276485	0.0177
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MSGR,2)
Method: Least Squares
Date: 01/09/22 Time: 04:52
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MSGR(-1))	-0.414994	0.126658	-3.276485	0.0013
D(MSGR(-1),2)	0.179835	0.105668	1.701881	0.0910
D(MSGR(-2),2)	0.293796	0.104413	2.813784	0.0056
D(MSGR(-3),2)	0.321072	0.104671	3.067440	0.0026
D(MSGR(-4),2)	-0.691869	0.104471	-6.622599	0.0000
D(MSGR(-5),2)	0.091613	0.072251	1.267983	0.2069
D(MSGR(-6),2)	0.149244	0.072268	2.065154	0.0408
D(MSGR(-7),2)	0.156185	0.072872	2.143258	0.0338
D(MSGR(-8),2)	-0.608742	0.071571	-8.505409	0.0000
C	0.019286	0.051782	0.372450	0.7101

R-squared	0.723388	Mean dependent var	-0.012500
Adjusted R-squared	0.705605	S.D. dependent var	1.149927
S.E. of regression	0.623929	Akaike info criterion	1.958779
Sum squared resid	54.50019	Schwarz criterion	2.159488
Log likelihood	-136.9084	Hannan-Quinn criter.	2.040321
F-statistic	40.68039	Durbin-Watson stat	2.098629
Prob(F-statistic)	0.000000		

Null Hypothesis: D(MSGR) has a unit root
Exogenous: Constant
Bandwidth: 20 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.182572	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.944547
HAC corrected variance (Bartlett kernel)	0.496909

Phillips-Perron Test Equation
Dependent Variable: D(MSGR,2)
Method: Least Squares
Date: 01/09/22 Time: 04:54
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MSGR(-1))	-0.492867	0.069657	-7.075665	0.0000
C	0.023168	0.077946	0.297235	0.7667

R-squared	0.242957	Mean dependent var	-0.009098
Adjusted R-squared	0.238105	S.D. dependent var	1.120548
S.E. of regression	0.978088	Akaike info criterion	2.806143
Sum squared resid	149.2384	Schwarz criterion	2.844910
Log likelihood	-219.6853	Hannan-Quinn criter.	2.821887
F-statistic	50.06504	Durbin-Watson stat	2.040680
Prob(F-statistic)	0.000000		

Null Hypothesis: D(INF) has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.316884	0.0006
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 01/09/22 Time: 04:56

Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-0.518659	0.120147	-4.316884	0.0000
D(INF(-1),2)	0.187508	0.102816	1.823728	0.0703
D(INF(-2),2)	0.349191	0.100814	3.463733	0.0007
D(INF(-3),2)	0.397115	0.101751	3.902819	0.0001
D(INF(-4),2)	-0.315862	0.102344	-3.086273	0.0024
D(INF(-5),2)	0.144614	0.079361	1.822227	0.0706
D(INF(-6),2)	0.212857	0.079523	2.676689	0.0083
D(INF(-7),2)	0.229215	0.080223	2.857231	0.0049
D(INF(-8),2)	-0.350418	0.077524	-4.520120	0.0000
C	-0.010265	0.258839	-0.039657	0.9684

R-squared	0.543613	Mean dependent var	-0.007536
Adjusted R-squared	0.514274	S.D. dependent var	4.547896
S.E. of regression	3.169612	Akaike info criterion	5.209436
Sum squared resid	1406.502	Schwarz criterion	5.410145
Log likelihood	-380.7077	Hannan-Quinn criter.	5.290978
F-statistic	18.52860	Durbin-Watson stat	2.014258
Prob(F-statistic)	0.000000		

Null Hypothesis: D(INF) has a unit root
Exogenous: Constant
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.791303	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	15.96161
HAC corrected variance (Bartlett kernel)	11.08238

Phillips-Perron Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 01/09/22 Time: 04:57
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-0.412652	0.064698	-6.378118	0.0000
C	0.018144	0.319872	0.056723	0.9548

R-squared	0.206835	Mean dependent var	0.018198
Adjusted R-squared	0.201751	S.D. dependent var	4.500236
S.E. of regression	4.020727	Akaike info criterion	5.633380
Sum squared resid	2521.935	Schwarz criterion	5.672147
Log likelihood	-443.0370	Hannan-Quinn criter.	5.649124
F-statistic	40.68039	Durbin-Watson stat	2.096859
Prob(F-statistic)	0.000000		

Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.244453	0.0194
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR,2)
Method: Least Squares
Date: 01/09/22 Time: 04:58
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.362612	0.111764	-3.244453	0.0015
D(EXR(-1),2)	0.086113	0.109755	0.784593	0.4340
D(EXR(-2),2)	0.279683	0.109895	2.544995	0.0120
D(EXR(-3),2)	0.321048	0.112941	2.842619	0.0051
D(EXR(-4),2)	-0.701163	0.112053	-6.257403	0.0000
D(EXR(-5),2)	0.026371	0.084297	0.312839	0.7549
D(EXR(-6),2)	0.143300	0.085957	1.667107	0.0977
D(EXR(-7),2)	0.155421	0.090344	1.720315	0.0876
D(EXR(-8),2)	-0.380549	0.089024	-4.274669	0.0000
C	0.365432	0.261317	1.398426	0.1642

R-squared	0.604550	Mean dependent var	0.045926
Adjusted R-squared	0.579128	S.D. dependent var	4.526239
S.E. of regression	2.936382	Akaike info criterion	5.056574
Sum squared resid	1207.128	Schwarz criterion	5.257283
Log likelihood	-369.2430	Hannan-Quinn criter.	5.138116
F-statistic	23.78075	Durbin-Watson stat	2.010743
Prob(F-statistic)	0.000000		

Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant
Bandwidth: 21 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.238418	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	14.95136
HAC corrected variance (Bartlett kernel)	11.04970

Phillips-Perron Test Equation
Dependent Variable: D(EXR,2)
Method: Least Squares
Date: 01/09/22 Time: 04:59
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.457577	0.067775	-6.751377	0.0000
C	0.431126	0.314850	1.369303	0.1729

R-squared	0.226118	Mean dependent var	0.043949
Adjusted R-squared	0.221157	S.D. dependent var	4.409422
S.E. of regression	3.891407	Akaike info criterion	5.567996
Sum squared resid	2362.315	Schwarz criterion	5.606763
Log likelihood	-437.8717	Hannan-Quinn criter.	5.583740
F-statistic	45.58109	Durbin-Watson stat	2.069586
Prob(F-statistic)	0.000000		

Null Hypothesis: D(CU) has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.366053	0.0137
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CU,2)
Method: Least Squares
Date: 01/09/22 Time: 05:00
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CU(-1))	-0.332327	0.098729	-3.366053	0.0010

D(CU(-1),2)	0.043456	0.099037	0.438781	0.6615
D(CU(-2),2)	0.245351	0.098117	2.500604	0.0136
D(CU(-3),2)	0.304295	0.099095	3.070741	0.0026
D(CU(-4),2)	-0.589499	0.099444	-5.927963	0.0000
D(CU(-5),2)	0.028593	0.080309	0.356034	0.7224
D(CU(-6),2)	0.143771	0.080168	1.793364	0.0751
D(CU(-7),2)	0.174312	0.080752	2.158612	0.0326
D(CU(-8),2)	-0.328722	0.078835	-4.169723	0.0001
C	-0.018915	0.103863	-0.182119	0.8558

R-squared	0.555124	Mean dependent var	0.016317
Adjusted R-squared	0.526525	S.D. dependent var	1.838395
S.E. of regression	1.264992	Akaike info criterion	3.372349
Sum squared resid	224.0285	Schwarz criterion	3.573058
Log likelihood	-242.9261	Hannan-Quinn criter.	3.453890
F-statistic	19.41047	Durbin-Watson stat	2.010462
Prob(F-statistic)	0.000000		

Null Hypothesis: D(CU) has a unit root
Exogenous: Constant
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.086290	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	2.556483
HAC corrected variance (Bartlett kernel)	2.241495

Phillips-Perron Test Equation
Dependent Variable: D(CU,2)
Method: Least Squares
Date: 01/09/22 Time: 05:02
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CU(-1))	-0.405681	0.064191	-6.319872	0.0000
C	-0.056436	0.128218	-0.440160	0.6604

R-squared	0.203841	Mean dependent var	-0.010815
Adjusted R-squared	0.198737	S.D. dependent var	1.797630
S.E. of regression	1.609117	Akaike info criterion	3.801826
Sum squared resid	403.9243	Schwarz criterion	3.840593
Log likelihood	-298.3443	Hannan-Quinn criter.	3.817570
F-statistic	39.94078	Durbin-Watson stat	2.114277
Prob(F-statistic)	0.000000		

Null Hypothesis: PCRE has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.160849	0.2216
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(PCRE)
Method: Least Squares
Date: 01/16/22 Time: 06:42
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PCRE(-1)	-0.038543	0.017837	-2.160849	0.0324
D(PCRE(-1))	0.703253	0.077523	9.071536	0.0000
D(PCRE(-2))	0.184607	0.081429	2.267088	0.0249

D(PCRE(-3))	0.072819	0.083057	0.876730	0.3821
D(PCRE(-4))	-1.202243	0.088175	-13.63468	0.0000
D(PCRE(-5))	0.847404	0.115272	7.351337	0.0000
D(PCRE(-6))	0.123374	0.081621	1.511554	0.1329
D(PCRE(-7))	0.040072	0.082593	0.485169	0.6283
D(PCRE(-8))	-0.664491	0.091069	-7.296588	0.0000
D(PCRE(-9))	0.462028	0.086336	5.351493	0.0000
C	9.75E+10	6.18E+10	1.578314	0.1168

R-squared	0.716559	Mean dependent var	1.55E+10
Adjusted R-squared	0.696168	S.D. dependent var	1.07E+12
S.E. of regression	5.90E+11	Akaike info criterion	57.11623
Sum squared resid	4.84E+25	Schwarz criterion	57.33701
Log likelihood	-4272.718	Hannan-Quinn criter.	57.20593
F-statistic	35.14023	Durbin-Watson stat	2.022988
Prob(F-statistic)	0.000000		

Null Hypothesis: PCRE has a unit root
Exogenous: Constant
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.303821	0.1721
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.05E+24
HAC corrected variance (Bartlett kernel)	1.27E+24

Phillips-Perron Test Equation
Dependent Variable: D(PCRE)
Method: Least Squares
Date: 01/16/22 Time: 06:45
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PCRE(-1)	-0.053633	0.025454	-2.107031	0.0367
C	1.27E+11	9.76E+10	1.305908	0.1935

R-squared	0.027500	Mean dependent var	1.47E+10
Adjusted R-squared	0.021306	S.D. dependent var	1.04E+12
S.E. of regression	1.03E+12	Akaike info criterion	58.16933
Sum squared resid	1.66E+26	Schwarz criterion	58.20794
Log likelihood	-4622.462	Hannan-Quinn criter.	58.18501
F-statistic	4.439579	Durbin-Watson stat	1.096380
Prob(F-statistic)	0.036704		

Null Hypothesis: WOP has a unit root
Exogenous: Constant
Lag Length: 13 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.914475	0.7814
Test critical values:	1% level	-3.475500	
	5% level	-2.881260	
	10% level	-2.577365	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(WOP)
Method: Least Squares
Date: 01/16/22 Time: 06:48
Sample (adjusted): 1983Q3 2019Q4
Included observations: 146 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WOP(-1)	-0.008455	0.009246	-0.914475	0.3621
D(WOP(-1))	0.720205	0.080082	8.993333	0.0000
D(WOP(-2))	0.172781	0.088385	1.954864	0.0527
D(WOP(-3))	0.044616	0.090844	0.491134	0.6242
D(WOP(-4))	-1.357768	0.117344	-11.57086	0.0000

D(WOP(-5))	1.018720	0.139849	7.284438	0.0000
D(WOP(-6))	0.124864	0.100269	1.245294	0.2152
D(WOP(-7))	0.020490	0.104047	0.196927	0.8442
D(WOP(-8))	-1.604441	0.158449	-10.12595	0.0000
D(WOP(-9))	1.218172	0.173511	7.020723	0.0000
D(WOP(-10))	0.124569	0.106905	1.165230	0.2460
D(WOP(-11))	0.024526	0.109310	0.224373	0.8228
D(WOP(-12))	-0.881914	0.141831	-6.218054	0.0000
D(WOP(-13))	0.690927	0.126563	5.459161	0.0000
C	1.274962	0.926711	1.375793	0.1712

R-squared	0.742053	Mean dependent var	0.709365
Adjusted R-squared	0.714487	S.D. dependent var	10.56902
S.E. of regression	5.647393	Akaike info criterion	6.397335
Sum squared resid	4177.989	Schwarz criterion	6.703870
Log likelihood	-452.0055	Hannan-Quinn criter.	6.521887
F-statistic	26.91836	Durbin-Watson stat	2.050081
Prob(F-statistic)	0.000000		

Null Hypothesis: WOP has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.510165	0.5261
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	100.8602
HAC corrected variance (Bartlett kernel)	153.8695

Phillips-Perron Test Equation
Dependent Variable: D(WOP)
Method: Least Squares
Date: 01/16/22 Time: 06:49
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WOP(-1)	-0.018395	0.014619	-1.258292	0.2102
C	2.253398	1.471919	1.530926	0.1278

R-squared	0.009984	Mean dependent var	0.699969
Adjusted R-squared	0.003678	S.D. dependent var	10.12532
S.E. of regression	10.10668	Akaike info criterion	7.476770
Sum squared resid	16036.77	Schwarz criterion	7.515372
Log likelihood	-592.4032	Hannan-Quinn criter.	7.492446
F-statistic	1.583299	Durbin-Watson stat	0.901225
Prob(F-statistic)	0.210154		

Null Hypothesis: FFR has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.542295	0.1076
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FFR)
Method: Least Squares
Date: 01/16/22 Time: 06:51
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FFR(-1)	-0.021581	0.008489	-2.542295	0.0121
D(FFR(-1))	0.625195	0.080257	7.789913	0.0000
D(FFR(-2))	0.162109	0.083178	1.948927	0.0533

D(FFR(-3))	0.054169	0.083389	0.649596	0.5170
D(FFR(-4))	-0.322658	0.083328	-3.872135	0.0002
D(FFR(-5))	0.202123	0.086011	2.349985	0.0202
D(FFR(-6))	0.036659	0.083106	0.441111	0.6598
D(FFR(-7))	0.010723	0.083093	0.129052	0.8975
D(FFR(-8))	-0.324850	0.081815	-3.970516	0.0001
D(FFR(-9))	0.183989	0.069712	2.639272	0.0093
C	0.130887	0.062920	2.080207	0.0393

R-squared	0.612589	Mean dependent var	-0.055458
Adjusted R-squared	0.584718	S.D. dependent var	0.445392
S.E. of regression	0.287021	Akaike info criterion	0.411985
Sum squared resid	11.45099	Schwarz criterion	0.632764
Log likelihood	-19.89884	Hannan-Quinn criter.	0.501680
F-statistic	21.97925	Durbin-Watson stat	2.024444
Prob(F-statistic)	0.000000		

Null Hypothesis: FFR has a unit root
Exogenous: Constant
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.940841	0.3130
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.295923
HAC corrected variance (Bartlett kernel)	0.951416

Phillips-Perron Test Equation
Dependent Variable: D(FFR)
Method: Least Squares
Date: 01/16/22 Time: 06:53
Sample (adjusted): 1980Q2 2019Q4
Included observations: 159 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FFR(-1)	-0.016685	0.011823	-1.411243	0.1602
C	0.090213	0.097320	0.926974	0.3554

R-squared	0.012526	Mean dependent var	-0.032706
Adjusted R-squared	0.006237	S.D. dependent var	0.549157
S.E. of regression	0.547442	Akaike info criterion	1.645379
Sum squared resid	47.05179	Schwarz criterion	1.683982
Log likelihood	-128.8076	Hannan-Quinn criter.	1.661055
F-statistic	1.991607	Durbin-Watson stat	0.482207
Prob(F-statistic)	0.160152		

Null Hypothesis: D(WOP) has a unit root
Exogenous: Constant
Lag Length: 12 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.142773	0.0256
Test critical values:	1% level	-3.475500	
	5% level	-2.881260	
	10% level	-2.577365	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(WOP,2)
Method: Least Squares
Date: 01/16/22 Time: 06:55
Sample (adjusted): 1983Q3 2019Q4
Included observations: 146 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(WOP(-1))	-0.751914	0.239252	-3.142773	0.0021
D(WOP(-1),2)	0.467656	0.218350	2.141774	0.0340
D(WOP(-2),2)	0.637249	0.220004	2.896539	0.0044
D(WOP(-3),2)	0.679215	0.228435	2.973340	0.0035
D(WOP(-4),2)	-0.690606	0.225787	-3.058656	0.0027

D(WOP(-5),2)	0.319241	0.164431	1.941495	0.0543
D(WOP(-6),2)	0.443935	0.169997	2.611436	0.0101
D(WOP(-7),2)	0.466226	0.185965	2.507064	0.0134
D(WOP(-8),2)	-1.151151	0.188512	-6.106512	0.0000
D(WOP(-9),2)	0.057052	0.107909	0.528702	0.5979
D(WOP(-10),2)	0.183225	0.111002	1.650651	0.1012
D(WOP(-11),2)	0.210496	0.121133	1.737728	0.0846
D(WOP(-12),2)	-0.680719	0.125991	-5.402898	0.0000
C	0.568094	0.510859	1.112038	0.2681

R-squared	0.713933	Mean dependent var	0.189220
Adjusted R-squared	0.685760	S.D. dependent var	10.06810
S.E. of regression	5.643889	Akaike info criterion	6.390000
Sum squared resid	4204.660	Schwarz criterion	6.676099
Log likelihood	-452.4700	Hannan-Quinn criter.	6.506249
F-statistic	25.34082	Durbin-Watson stat	2.043017
Prob(F-statistic)	0.000000		

Null Hypothesis: D(WOP) has a unit root
Exogenous: Constant
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.083725	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	73.09633
HAC corrected variance (Bartlett kernel)	26.60848

Phillips-Perron Test Equation
Dependent Variable: D(WOP,2)
Method: Least Squares
Date: 01/16/22 Time: 06:57
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(WOP(-1))	-0.451491	0.069217	-6.522790	0.0000
C	0.407634	0.685493	0.594658	0.5529

R-squared	0.214291	Mean dependent var	0.169409
Adjusted R-squared	0.209254	S.D. dependent var	9.675995
S.E. of regression	8.604270	Akaike info criterion	7.154972
Sum squared resid	11549.22	Schwarz criterion	7.193739
Log likelihood	-563.2428	Hannan-Quinn criter.	7.170716
F-statistic	42.54679	Durbin-Watson stat	2.022000
Prob(F-statistic)	0.000000		

Null Hypothesis: D(FFR) has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.038133	0.0016
Test critical values:	1% level	-3.474265	
	5% level	-2.880722	
	10% level	-2.577077	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FFR,2)
Method: Least Squares
Date: 01/16/22 Time: 06:58
Sample (adjusted): 1982Q3 2019Q4
Included observations: 150 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FFR(-1))	-0.384023	0.095099	-4.038133	0.0001
D(FFR(-1),2)	0.020709	0.096283	0.215089	0.8300
D(FFR(-2),2)	0.191748	0.086875	2.207158	0.0289
D(FFR(-3),2)	0.243478	0.083537	2.914611	0.0041

D(FFR(-4),2)	-0.086686	0.082618	-1.049239	0.2959
D(FFR(-5),2)	0.114320	0.076439	1.495571	0.1370
D(FFR(-6),2)	0.152769	0.074729	2.044302	0.0428
D(FFR(-7),2)	0.161681	0.073987	2.185264	0.0305
D(FFR(-8),2)	-0.170866	0.070864	-2.411179	0.0172
C	-0.016514	0.024912	-0.662878	0.5085

R-squared	0.320710	Mean dependent var	0.010737
Adjusted R-squared	0.277041	S.D. dependent var	0.344088
S.E. of regression	0.292568	Akaike info criterion	0.444101
Sum squared resid	11.98344	Schwarz criterion	0.644810
Log likelihood	-23.30756	Hannan-Quinn criter.	0.525643
F-statistic	7.344165	Durbin-Watson stat	1.998692
Prob(F-statistic)	0.000000		

Null Hypothesis: D(FFR) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.842789	0.0000
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.119494
HAC corrected variance (Bartlett kernel)	0.109692

Phillips-Perron Test Equation
Dependent Variable: D(FFR,2)
Method: Least Squares
Date: 01/16/22 Time: 06:59
Sample (adjusted): 1980Q3 2019Q4
Included observations: 158 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FFR(-1))	-0.299844	0.050616	-5.923945	0.0000
C	-0.021927	0.027739	-0.790475	0.4305

R-squared	0.183644	Mean dependent var	-0.010911
Adjusted R-squared	0.178411	S.D. dependent var	0.383806
S.E. of regression	0.347888	Akaike info criterion	0.738704
Sum squared resid	18.88004	Schwarz criterion	0.777471
Log likelihood	-56.35760	Hannan-Quinn criter.	0.754448
F-statistic	35.09312	Durbin-Watson stat	2.157936
Prob(F-statistic)	0.000000		

Appendix D: Variance Decomposition analysis

Variance Decomposition of MUP:											
Period	**S.E.**	**MUP**	**K**	**L**	**INTR**	**MSGR**	**INF**	**EXR**	**PCRE**	**WOP**	**FFR**
1	0.544062	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.943204	99.18266	0.000498	0.059856	0.008879	0.040885	0.000937	0.400971	0.205126	0.095267	0.004921
3	1.304348	97.18326	0.012854	0.063932	0.105675	0.031858	0.006920	1.460150	0.470922	0.638473	0.025957
4	1.625557	94.06782	0.025623	0.070896	0.261921	0.066474	0.034970	3.095412	0.802872	1.527675	0.046338
5	1.914288	90.43162	0.044191	0.071286	0.441523	0.163727	0.094271	5.012944	1.112361	2.566304	0.061775
6	2.177022	86.70489	0.068116	0.070817	0.619863	0.346901	0.186481	6.957450	1.364615	3.609621	0.071243
7	2.418840	83.28566	0.100316	0.069991	0.781603	0.588870	0.298927	8.708343	1.539029	4.550532	0.076728
8	2.643168	80.40234	0.143584	0.069455	0.920836	0.843524	0.414520	10.15413	1.638851	5.332413	0.080347
9	2.852574	78.14668	0.200308	0.069016	1.036547	1.062323	0.517655	11.26845	1.678358	5.936805	0.083858
10	3.049291	76.49260	0.270653	0.068470	1.130279	1.217003	0.599092	12.08444	1.676310	6.372689	0.088464

Appendix E: Summary of manufacturing sector composition by output

Output	Product	2013	2014	2015
Food	Fish	2,137,057	2,721,440	3,293,813
Food	Palm Kernel	20,984	26,610	31,968
Food	Ground nut oil	9,229,609	12,420,541	14,174,865
Food	Palm Oil	6,512,150	9,420,450	12,875,180
Food	Yogurt	4,632,662	5,982,002	7,734,299
Food	Ice-cream	135,587	124,561	191,140
Food	Gari	31,715,553	67,362,621	58,314,262
Food	Cornflakes	2,445,209	3,206,036	3,571,317
Food	Rice	508,720,126	681,562,841	760,719,922
Food	Starch	348,951	420,262	809,129
Food	Animal Feed	5,972,839	10,131,484	9,095,484
Food	Biscuit	353,836,076	453,807,448	503,679,491
Food	Pastry and cakes	68,489	98,657	124,652
Food	Bread	1,398,459,117	1,099,934,593	1,319,418,189
Food	Sugar	1,940,413,379	2,438,316,122	2,710,304,147
Food	Chocolate	316,314	417,721	473,453
Food	Other food product	2,681,088	11,145,151	12,615,500
Beverages	Juice	2,723,281	4,674,892	6,168,750
Beverages	Alcoholic Drink	303,015,410	120,157,128	158,212,090
Beverages	Wine	266,868,070	352,536,890	390,908,935
Beverages	Beer	17,986,310	23,463,036	24,929,678
Beverages	Malt drink	6,755,285	8,763,024	9,310,789
Beverages	Water	63,253,781	98,651,028	109,912,570
Beverages	Soft drink	2,247,196	14,005,042	15,239,309
FOOD, BEVERAGE AND TOBACCO		4,930,494,522	5,419,349,578	6,132,108,930
Textiles	Sack	97,483	140,413	197,431
Textiles	Sewing thread	10,100,975	46,547,866	72,415,824
Textiles	Cotton	38,889,157	46,325,931	64,065,074
Textiles	Other woven fabric	682,446,649	965,358,728	1,368,667,681
Textiles	Blanket/Rug	1,866,219	16,058,518	21,037,717
Textiles	Window cloth	9,601	13,756	19,781
Textiles	Tarpaulin	8,880	131,582	211,980
Wearing app.	Other woven fabric	118,909	222,908	372,549
Wearing app.	Window cloth	20,678	129,372	180,560
Wearing app.	Embroidery Design	859	1,329	2,123
Wearing app.	Men’s Wear	10,226,995	15,793,773	21,390,894

Wearing app.	Woman wear	2,872,472	4,333,118	6,814,479
Leather	Suitcase/luggage	9,188,439	14,418,438	23,417,273
Leather	Shoe	36,845,806	81,237,039	74,047,343
Textile, Apparel and Footwear		792,693,123	1,190,712,770	1,652,840,709
Wood	Plank	121,034,150	40,850,043	157,660,511
Wood	Plywood	53,032,622	151,898,454	60,904,770
WOOD AND WOOD PRODUCTS		174,066,772	192,748,497	218,565,281
Paper	Corrugated Paper	14,555,197	6,820,790	11,021,246
Paper	Toilet Roll	6,020,365	24,480,244	15,937,693
Paper	Paper Label	112	52	80
Paper	Notebook/Account	1,051,604	499,751	658,290
Printing	Printing	22,844,937	11,432,525	15,463,461
Printing	Notebook/Account	10,907,027	28,230,100	37,722,760
PULP, PAPER AND PAPER PRODUCTS		55,379,241	71,463,461	80,803,530
Chemicals	Engine Oil	4,185,628	5,844,367	7,876,205
Chemicals	Printing Ink	60,707	73,581	98,491
Chemicals	Zinc Oxide	31,905	38,671	51,763
Chemicals	Fertilizer	650,821	1,483,068	2,538,605
Chemicals	Insecticides	753,531	910,935	1,608,589
Chemicals	Paint	35,838,327	43,164,774	75,926,748
Chemicals	Soap and detergent	19,789,695	25,972,888	35,722,141
Chemicals	Cosmetics	2,497,083	6,192,040	8,427,000
Chemicals	Chemical	21,412	25,953	37,897
Pharm.	Pharmaceutical	63,829,108	83,706,278	132,287,439
CHEMICAL AND PHARMACEUTICAL PRODUCTS		63,829,108	83,706,278	132,287,439
Rubber	Shoe(Plastic)	31,588,352	33,660,451	51,010,787
Rubber	Peeking Case	11,687,637	9,555,126	14,156,690
Rubber	Nylon	877,253	1,003,134	1,476,481
Rubber	Rubber tubes	1,374,178	1,571,365	2,312,845
Rubber	Arabic Gum	4,422	5,057	7,444
Rubber	Plastic bag	29,462,491	50,415,363	74,333,241
Rubber	Table Wire/Kitchen	4,269,308	26,080,597	38,565,244
Rubber	Plastic Product	34,979,271	57,309,485	87,517,786
Rubber	Bucket	229,207	274,773	433,061
PLASTIC AND RUBBER PRODUCTS		114,472,120	179,875,350	269,813,580
Non-metallic	Glass Bottle	279,405	564,212	710,881
NON-METALIC	Ceramic Mug/Vase Flower	17,222	30,906	36,512
Non-metallic	Block Ring	2,924,311	6,679,902	8,547,475
Non-metallic	Block	33,724,066	63,055,863	77,280,025

Non-metallic	Tiles	117,104,243	118,536,403	143,259,744
Non-metallic	Cement	33,340,312	42,245,397	49,933,055
Non-metallic	Ceiling	319,959	7,199,034	8,507,436
NON-METALLIC PRODUCTS		187,709,518	238,311,717	288,275,130
Basic metals	General Purpose Machinery.	1,507,774	7,513,263	10,827,111
Fabricated	Necklace	72,195	108,716	122,561
Fabricated	Aluminum Roofing	51,061,214	86,541,958	98,776,470
Fabricated	Metal door	19,564,751	34,158,739	39,231,536
Fabricated	Tank	632,553	1,394,870	1,577,816
Fabricated	Razor	615	1,076	1,226
Fabricated	Hoes/Cutlass	416,731	2,069,339	2,396,193
Fabricated	Metal box	413,163	717,358	854,255
Fabricated	Domestic Metal product	4,287	7,440	8,823
Fabricated	Domestic Metal product	26,589,190	44,977,355	53,532,877
BASIC METAL, IRON AND STEEL		100,262,473	177,490,114	207,328,869
Electrical	Wire Nail	2,546,258	405,907	391,322
Electrical	Electrical wire	6,169,652	9,387,703	10,711,188
ELECTRICAL AND ELECTRONICS		8,715,910	9,793,610	11,102,510
Machinery	Presser	23,828	42,764	64,550
Machinery	Milling Machine	20,535	233,158	375,988
Machinery	Bicycle	311,274	404,654	638,192
Motor vehicle	Motor vehicle	16,426,440	14,802,115	720,133
Motor vehicle	Spare parts	15,390	16,975	44,576
Motor vehicle	Vehicle body	1,820,480	5,232,720	13,067,719
Motor vehicle	Motorcycle	7,120,853	12,051,265	30,092,231
O/TRANS.	Spare parts	25,738,800	32,783,650	45,003,390
Motor Vehicles & Assembly		25,738,800	32,783,650	45,003,390
Other man.	Office Furniture	2,651,204	4,763,450	6,465,493
Other man.	Cupboard/wardrobe	366,192	421,041	601,020
Other man.	Furniture door/Window	103,699,492	121,372,634	170,839,595
Other man.	Mattress	89,441,613	161,278,556	215,287,801
Other man.	Biro/pen/pencil	196,158,501	287,835,680	393,193,909
	Office Stationery plus Furniture	198,809,705	292,599,130	399,659,402
Other Manufacturing		392,317,002	575,671,360	786,387,818
TOTAL		**6,845,678,589**	**8,171,906,385**	**9,824,517,186**

Source: Nigeria Bureau of Statistics, 2015

Appendix F: Cointergration Test Results

Date: 01/16/22 Time: 07:47				
Sample (adjusted): 1981Q2 2019Q4				
Included observations: 155 after adjustments				
Trend assumption: Linear deterministic trend				
Series: MUP K L INTR MSGR INF EXR PCRE WOP FFR				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.632199	509.4208	239.2354	0.0000
At most 1 *	0.486483	354.3878	197.3709	0.0000
At most 2 *	0.393351	251.0847	159.5297	0.0000
At most 3 *	0.343047	173.6151	125.6154	0.0000
At most 4 *	0.247352	108.4929	95.75366	0.0050
At most 5	0.194572	64.44851	69.81889	0.1245
At most 6	0.099333	30.90936	47.85613	0.6714
At most 7	0.046393	14.69331	29.79707	0.7996
At most 8	0.032524	7.330224	15.49471	0.5395
At most 9	0.014126	2.205151	3.841466	0.1375
Trace test indicates 5 cointegrating eqn(s) at the 0.05 level				
*** denotes rejection of the hypothesis at the 0.05 level**				
****MacKinnon-Haug-Michelis (1999) p-values**				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		**Max-Eigen**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.632199	155.0330	64.50472	0.0000

At most 1 *	0.486483	103.3031	58.43354	0.0000						
At most 2 *	0.393351	77.46964	52.36261	0.0000						
At most 3 *	0.343047	65.12221	46.23142	0.0002						
At most 4 *	0.247352	44.04439	40.07757	0.0170						
At most 5	0.194572	33.53915	33.87687	0.0548						
At most 6	0.099333	16.21606	27.58434	0.6474						
At most 7	0.046393	7.363085	21.13162	0.9382						
At most 8	0.032524	5.125073	14.26460	0.7260						
At most 9	0.014126	2.205151	3.841466	0.1375						
Max-eigenvalue test indicates 5 cointegrating eqn(s) at the 0.05 level										
*** denotes rejection of the hypothesis at the 0.05 level**										
****MacKinnon-Haug-Michelis (1999) p-values**										
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):										
MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR	
0.439262	-5.98E-11	-1.40E-07	-2.860981	3.131046	-0.065258	0.005678	-1.06E-13	0.044984	0.308206	
0.530099	-6.25E-11	-3.43E-07	1.053479	-0.912958	-0.025543	0.016713	4.69E-13	0.031694	-0.477056	
-0.292123	8.03E-11	7.40E-08	2.460961	-2.254594	-0.067694	-0.024875	2.22E-13	-0.021971	0.476469	
-0.850232	8.13E-11	3.23E-08	-1.655086	1.496835	-0.048326	-0.044780	-1.14E-13	-0.010705	-0.570506	
1.108469	-2.02E-10	5.23E-07	2.719810	-2.464558	-0.050799	-0.006067	3.30E-13	0.016669	0.525556	
-0.226381	-4.25E-11	-1.86E-07	-4.014749	3.897298	0.026353	0.007849	6.37E-13	0.005659	-0.090430	
-0.310418	1.08E-13	-5.49E-08	0.246693	-0.302437	0.009604	-0.023646	6.48E-14	0.058096	0.190503	
-0.491635	2.88E-11	-3.96E-07	1.481620	-1.655944	-0.001299	0.025169	-1.07E-13	0.022469	-0.351178	
0.863958	-1.52E-10	1.50E-07	1.943103	-2.000737	-0.015912	-0.014781	1.56E-13	0.035795	-0.190284	
-0.531674	5.84E-11	-2.42E-07	0.471413	-0.391036	0.012350	-0.013119	-3.11E-14	0.016249	-0.217488	
Unrestricted Adjustment Coefficients (alpha):										
D(MUP)	0.023495	0.058545	0.062850	0.007682	0.055066	0.083283	0.028106	0.011238	-0.001779	0.025235
D(K)	-1.78E+08	61077842	1.85E+08	-36275137	8.18E+08	1.10E+09	-15553852	1.46E+08	1.81E+08	1.66E+08
D(L)	-6940.458	-30587.95	97260.95	-79105.74	92314.93	132060.4	-46857.77	43455.31	14447.83	33922.51
D(INTR)	0.073587	-0.184487	0.096090	0.212029	-0.201373	-0.028287	0.012293	0.036567	0.020295	-0.010844
D(MSGR)	0.043152	-0.172405	0.111728	0.217967	-0.212579	-0.049396	0.011887	0.047496	0.023313	-0.009066
D(INF)	1.397834	1.332001	0.657524	0.339342	-0.161640	0.019152	-0.175045	0.076551	0.200679	-0.055015
D(EXR)	0.009528	-0.630459	0.503861	0.767018	0.689599	-0.202866	-0.385271	-0.022848	-0.070237	0.193284
D(PCRE)	2.27E+11	-1.94E+11	-6.74E+10	-1.04E+11	1.33E+11	6.07E+09	3.65E+10	2.69E+10	3.90E+10	2.65E+10
D(WOP)	-1.182313	0.198147	0.600130	0.583839	0.652825	1.167043	-1.118622	0.803063	-0.547960	-0.062739
D(FFR)	0.003539	0.026484	-0.116538	0.088129	-0.037301	0.005972	-0.021896	-0.015228	-0.000423	0.012478

1 Cointegrating Equation(s):		**Log likelihood**	-11297.50							
Normalized cointegrating coefficients (standard error in parentheses)										
MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR	
1.000000	-1.36E-10	-3.20E-07	-6.513151	7.127965	-0.148562	0.012926	-2.42E-13	0.102408	0.701644	
	(2.0E-11)	(1.2E-07)	(1.06643)	(1.06169)	(0.01966)	(0.01066)	(1.4E-13)	(0.01494)	(0.17881)	
Adjustment coefficients (standard error in parentheses)										
D(MUP)	0.010320									
	(0.01439)									
D(K)	-78210819									
	(1.5E+08)									
D(L)	-3048.681									
	(23339.4)									
D(INTR)	0.032324									
	(0.02763)									
D(MSGR)	0.018955									
	(0.02923)									
D(INF)	0.614016									
	(0.11843)									
D(EXR)	0.004185									
	(0.12812)									
D(PCRE)	9.97E+10									
	(2.4E+10)									
D(WOP)	-0.519346									
	(0.28490)									
D(FFR)	0.001555									
	(0.01207)									
2 Cointegrating Equation(s):		Log likelihood	-11245.85							
Normalized cointegrating coefficients (standard error in parentheses)										
MUP	**K**	**L**	**INTR**	**MSGR**	**INF**	**EXR**	**PCRE**	**WOP**	**FFR**	
1.000000	0.000000	-2.77E-06	57.14184	-59.14594	0.603104	0.152228	8.20E-12	-0.216740	-11.29165	
		(1.3E-06)	(10.9691)	(10.9860)	(0.20776)	(0.11153)	(1.3E-12)	(0.13346)	(1.84380)	
0.000000	1.000000	-17982.30	4.68E+11	-4.87E+11	5.52E+09	1.02E+09	0.062045	-2.35E+09	-8.81E+10	
		(9804.15)	(8.5E+10)	(8.6E+10)	(1.6E+09)	(8.7E+08)	(0.01039)	(1.0E+09)	(1.4E+10)	

Adjustment coefficients (standard error in parentheses)										
D(MUP)	0.041355	-5.06E-12								
	(0.02224)	(2.8E-12)								
D(K)	-45833543	0.006826								
	(2.3E+08)	(0.02876)								
D(L)	-19263.31	2.33E-06								
	(36525.6)	(4.6E-06)								
D(INTR)	-0.065472	7.13E-12								
	(0.04162)	(5.2E-12)								
D(MSGR)	-0.072437	8.20E-12								
	(0.04442)	(5.6E-12)								
D(INF)	1.320108	-1.67E-10								
	(0.16434)	(2.1E-11)								
D(EXR)	-0.330020	3.88E-11								
	(0.19661)	(2.5E-11)								
D(PCRE)	-3.20E+09	-1.435431								
	(3.6E+10)	(4.53300)								
D(WOP)	-0.414308	5.83E-11								
	(0.44633)	(5.6E-11)								
D(FFR)	0.015594	-1.87E-12								
	(0.01883)	(2.4E-12)								
3 Cointegrating Equation(s):		Log likelihood	-11207.12							
Normalized cointegrating coefficients (standard error in parentheses)										
MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR	
1.000000	0.000000	0.000000	-14.62413	17.16832	-0.703545	-0.091919	-1.02E-12	0.184998	5.299256	
			(4.62869)	(4.63621)	(0.08879)	(0.03706)	(5.6E-13)	(0.04596)	(0.68527)	
0.000000	1.000000	0.000000	1.34E+09	8.97E+09	-2.97E+09	-5.63E+08	0.002143	2.66E+08	1.97E+10	
			(2.1E+10)	(2.1E+10)	(3.9E+08)	(1.6E+08)	(0.00248)	(2.0E+08)	(3.0E+09)	
0.000000	0.000000	1.000000	-25937148	27580958	-472239.7	-88237.73	-3.33E-06	145193.2	5996168.	
			(5167844)	(5176244)	(99137.6)	(41381.7)	(6.2E-07)	(51315.5)	(765093.)	
Adjustment coefficients (standard error in parentheses)										
D(MUP)	0.022995	-1.90E-14	-1.87E-08							
	(0.02375)	(3.7E-12)	(1.2E-08)							
D(K)	-1.00E+08	0.021715	17.79956							
	(2.5E+08)	(0.03918)	(125.419)							

D(L)	-47675.50	1.01E-05	0.018655							
	(39083.3)	(6.2E-06)	(0.01974)							
D(INTR)	-0.093542	1.48E-11	6.00E-08							
	(0.04470)	(7.1E-12)	(2.3E-08)							
D(MSGR)	-0.105075	1.72E-11	6.13E-08							
	(0.04761)	(7.5E-12)	(2.4E-08)							
D(INF)	1.128030	-1.14E-10	-6.04E-07							
	(0.17243)	(2.7E-11)	(8.7E-08)							
D(EXR)	-0.477210	7.93E-11	2.52E-07							
	(0.21061)	(3.3E-11)	(1.1E-07)							
D(PCRE)	1.65E+10	-6.842999	29681.22							
	(3.9E+10)	(6.13900)	(19651.7)							
D(WOP)	-0.589620	1.06E-10	1.43E-07							
	(0.48301)	(7.6E-11)	(2.4E-07)							
D(FFR)	0.049637	-1.12E-11	-1.82E-08							
	(0.01875)	(3.0E-12)	(9.5E-09)							
4 Cointegrating Equation(s):		Log likelihood	-11174.56							
Normalized cointegrating coefficients (standard error in parentheses)										
MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR	
1.000000	0.000000	0.000000	0.000000	1.326227	-0.276902	-0.010616	1.27E-13	0.053338	2.957712	
				(0.15710)	(0.04580)	(0.01908)	(2.9E-13)	(0.02335)	(0.35436)	
0.000000	1.000000	0.000000	0.000000	1.04E+10	-3.01E+09	-5.71E+08	0.002038	2.78E+08	1.99E+10	
				(1.4E+09)	(4.0E+08)	(1.6E+08)	(0.00250)	(2.0E+08)	(3.1E+09)	
0.000000	0.000000	1.000000	0.000000	-516353.8	284447.5	55959.61	-1.30E-06	-88316.16	1843239.	
				(163297.)	(47607.5)	(19835.2)	(3.0E-07)	(24267.8)	(368335.)	
0.000000	0.000000	0.000000	1.000000	-1.083285	0.029174	0.005559	7.81E-14	-0.009003	-0.160115	
				(0.01237)	(0.00361)	(0.00150)	(2.3E-14)	(0.00184)	(0.02790)	
Adjustment coefficients (standard error in parentheses)										
D(MUP)	0.016464	6.06E-13	-1.85E-08	0.136416						
	(0.03595)	(4.6E-12)	(1.2E-08)	(0.13504)						
D(K)	-69179208	0.018764	16.62665	1.09E+09						
	(3.8E+08)	(0.04759)	(125.871)	(1.4E+09)						
D(L)	19582.77	3.70E-06	0.016097	357915.0						
	(58573.3)	(7.4E-06)	(0.01961)	(220015.)						
D(INTR)	-0.273817	3.21E-11	6.69E-08	-0.519336						

	(0.06381)	(8.1E-12)	(2.1E-08)	(0.23967)						
D(MSGR)	-0.290398	3.49E-11	6.83E-08	-0.390879						
	(0.06825)	(8.6E-12)	(2.3E-08)	(0.25636)						
D(INF)	0.839510	-8.64E-11	-5.93E-07	-1.539441						
	(0.25856)	(3.3E-11)	(8.7E-08)	(0.97120)						
D(EXR)	-1.129353	1.42E-10	2.77E-07	-0.720933						
	(0.30825)	(3.9E-11)	(1.0E-07)	(1.15784)						
D(PCRE)	1.05E+11	-15.31907	26312.16	-8.48E+11						
	(5.8E+10)	(7.32293)	(19370.4)	(2.2E+11)						
D(WOP)	-1.086019	1.54E-10	1.61E-07	4.101912						
	(0.72867)	(9.2E-11)	(2.4E-07)	(2.73707)						
D(FFR)	-0.025293	-4.05E-12	-1.53E-08	-0.414882						
	(0.02679)	(3.4E-12)	(9.0E-09)	(0.10061)						
5 Cointegrating Equation(s):		Log likelihood	-11152.53							
Normalized cointegrating coefficients (standard error in parentheses)										
MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR	
1.000000	0.000000	0.000000	0.000000	0.000000	0.276287	0.136220	-8.93E-13	-0.027117	2.244889	
					(0.04591)	(0.02339)	(3.7E-13)	(0.02869)	(0.37737)	
0.000000	1.000000	0.000000	0.000000	0.000000	1.34E+09	5.84E+08	-0.005983	-3.55E+08	1.43E+10	
					(2.7E+08)	(1.4E+08)	(0.00214)	(1.7E+08)	(2.2E+09)	
0.000000	0.000000	1.000000	0.000000	0.000000	69068.61	-1209.653	-9.07E-07	-56991.53	2120770.	
					(25575.7)	(13026.4)	(2.0E-07)	(15981.2)	(210203.)	
0.000000	0.000000	0.000000	1.000000	0.000000	-0.422680	-0.114379	9.12E-13	0.056715	0.422130	
					(0.03734)	(0.01902)	(3.0E-13)	(0.02333)	(0.30685)	
0.000000	0.000000	0.000000	0.000000	1.000000	-0.417115	-0.110717	7.69E-13	0.060665	0.537481	
					(0.03592)	(0.01830)	(2.9E-13)	(0.02245)	(0.29523)	
Adjustment coefficients (standard error in parentheses)										
D(MUP)	0.077503	-1.05E-11	1.04E-08	0.286186	-0.245804					
	(0.04963)	(7.8E-12)	(2.0E-08)	(0.15814)	(0.15356)					
D(K)	8.37E+08	-0.146747	444.5201	3.31E+09	-3.10E+09					
	(5.1E+08)	(0.08012)	(208.743)	(1.6E+09)	(1.6E+09)					
D(L)	121911.0	-1.50E-05	0.064415	608994.0	-559013.1					
	(80803.4)	(1.3E-05)	(0.03296)	(257445.)	(249997.)					
D(INTR)	-0.497033	7.29E-11	-3.85E-08	-1.067034	0.995858					
	(0.08409)	(1.3E-11)	(3.4E-08)	(0.26792)	(0.26017)					

D(MSGR)	-0.526035	7.79E-11	-4.29E-08	-0.969053	0.890782					
	(0.09010)	(1.4E-11)	(3.7E-08)	(0.28705)	(0.27875)					
D(INF)	0.660337	-5.37E-11	-6.78E-07	-1.979072	2.584483					
	(0.36102)	(5.7E-11)	(1.5E-07)	(1.15022)	(1.11695)					
D(EXR)	-0.364954	2.06E-12	6.38E-07	1.154646	-1.082046					
	(0.41893)	(6.6E-11)	(1.7E-07)	(1.33473)	(1.29612)					
D(PCRE)	2.53E+11	-42.26483	95974.37	-4.86E+11	5.56E+11					
	(7.8E+10)	(12.2877)	(32014.7)	(2.5E+11)	(2.4E+11)					
D(WOP)	-0.362383	2.18E-11	5.03E-07	5.877473	-5.970841					
	(1.01504)	(1.6E-10)	(4.1E-07)	(3.23400)	(3.14044)					
D(FFR)	-0.066640	3.50E-12	-3.49E-08	-0.516334	0.473494					
	(0.03707)	(5.8E-12)	(1.5E-08)	(0.11810)	(0.11468)					
6 Cointegrating Equation(s):		**Log likelihood**	**-11135.76**							
Normalized cointegrating coefficients (standard error in parentheses)										
MUP	**K**	**L**	**INTR**	**MSGR**	**INF**	**EXR**	**PCRE**	**WOP**	**FFR**	
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.023765	-3.02E-12	0.083103	-0.977668	
						(0.02798)	(4.9E-13)	(0.03873)	(0.47143)	
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	37850685	-0.016321	1.80E+08	-1.34E+09	
						(1.3E+08)	(0.00235)	(1.8E+08)	(2.2E+09)	
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	-29322.13	-1.44E-06	-29437.79	1315167.	
						(10864.2)	(1.9E-07)	(15035.7)	(183036.)	
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.057662	4.17E-12	-0.111907	5.352189	
						(0.05160)	(9.1E-13)	(0.07141)	(0.86936)	
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.059058	3.98E-12	-0.105736	5.402627	
						(0.05096)	(9.0E-13)	(0.07052)	(0.85850)	
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.407023	7.71E-12	-0.398933	11.66380	
						(0.12634)	(2.2E-12)	(0.17485)	(2.12851)	
Adjustment coefficients (standard error in parentheses)										
D(MUP)	0.058649	-1.41E-11	-5.10E-09	-0.048175	0.078775	-0.008257				
	(0.04854)	(7.6E-12)	(2.0E-08)	(0.19562)	(0.18994)	(0.00373)				
D(K)	5.87E+08	-0.193645	239.7796	-1.11E+09	1.20E+09	-13205322				
	(4.9E+08)	(0.07698)	(205.668)	(2.0E+09)	(1.9E+09)	(3.8E+07)				
D(L)	92015.03	-2.06E-05	0.039903	78804.67	-44334.33	-2736.212				
	(79164.6)	(1.2E-05)	(0.03326)	(319013.)	(309744.)	(6078.18)				
D(INTR)	-0.490629	7.41E-11	-3.33E-08	-0.953467	0.885613	-0.007357				
	(0.08484)	(1.3E-11)	(3.6E-08)	(0.34188)	(0.33195)	(0.00651)				

D(MSGR)	-0.514852	8.00E-11	-3.38E-08	-0.770739	0.698270	-0.007012				
	(0.09071)	(1.4E-11)	(3.8E-08)	(0.36553)	(0.35491)	(0.00696)				
D(INF)	0.656001	-5.45E-11	-6.81E-07	-2.055964	2.659125	-0.177436				
	(0.36467)	(5.7E-11)	(1.5E-07)	(1.46954)	(1.42684)	(0.02800)				
D(EXR)	-0.319029	1.07E-11	6.75E-07	1.969103	-1.872675	-0.096070				
	(0.42208)	(6.6E-11)	(1.8E-07)	(1.70087)	(1.65145)	(0.03241)				
D(PCRE)	2.51E+11	-42.52296	94847.42	-5.10E+11	5.80E+11	-6.86E+09				
	(7.9E+10)	(12.4661)	(33306.7)	(3.2E+11)	(3.1E+11)	(6.1E+09)				
D(WOP)	-0.626579	-2.78E-11	2.87E-07	1.192088	-1.422526	0.000846				
	(1.01018)	(1.6E-10)	(4.2E-07)	(4.07077)	(3.95250)	(0.07756)				
D(FFR)	-0.067992	3.25E-12	-3.60E-08	-0.540308	0.496767	0.004775				
	(0.03743)	(5.9E-12)	(1.6E-08)	(0.15085)	(0.14646)	(0.00287)				
7 Cointegrating Equation(s):		**Log likelihood**	**-11127.66**							
Normalized cointegrating coefficients (standard error in parentheses)										
MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR	
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-4.13E-12	0.190066	-0.766992	
							(7.2E-13)	(0.04743)	(0.64356)	
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-0.018090	3.51E+08	-1.01E+09	
							(0.00264)	(1.7E+08)	(2.4E+09)	
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	-6.93E-08	-161413.4	1055227.	
							(3.7E-07)	(24435.1)	(331536.)	
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	1.47E-12	0.147622	5.863358	
							(8.7E-13)	(0.05736)	(0.77830)	
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	1.22E-12	0.160077	5.926174	
							(8.7E-13)	(0.05763)	(0.78191)	
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	-1.13E-11	1.433030	15.27204	
							(4.9E-12)	(0.32679)	(4.43389)	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	4.67E-11	-4.500887	-8.864969	
							(1.3E-11)	(0.88474)	(12.0042)	
Adjustment coefficients (standard error in parentheses)										
D(MUP)	0.049924	-1.41E-11	-6.65E-09	-0.041241	0.070275	-0.007987	-0.001141			
	(0.04926)	(7.6E-12)	(2.0E-08)	(0.19502)	(0.18944)	(0.00372)	(0.00181)			
D(K)	5.92E+08	-0.193646	240.6335	-1.12E+09	1.20E+09	-13354704	1085658.			
	(5.0E+08)	(0.07698)	(206.350)	(2.0E+09)	(1.9E+09)	(3.8E+07)	(1.8E+07)			
D(L)	106560.5	-2.06E-05	0.042476	67245.16	-30162.82	-3186.242	2156.782			
	(80318.5)	(1.2E-05)	(0.03323)	(317976.)	(308871.)	(6072.45)	(2952.79)			

D(INTR)	-0.494445	7.41E-11	-3.40E-08	-0.950434	0.881895	-0.007239	-0.013841			
	(0.08640)	(1.3E-11)	(3.6E-08)	(0.34205)	(0.33226)	(0.00653)	(0.00318)			
D(MSGR)	-0.518542	8.00E-11	-3.44E-08	-0.767806	0.694675	-0.006898	-0.014555			
	(0.09238)	(1.4E-11)	(3.8E-08)	(0.36572)	(0.35525)	(0.00698)	(0.00340)			
D(INF)	0.710338	-5.45E-11	-6.72E-07	-2.099146	2.712065	-0.179117	0.003918			
	(0.37049)	(5.7E-11)	(1.5E-07)	(1.46676)	(1.42476)	(0.02801)	(0.01362)			
D(EXR)	-0.199434	1.06E-11	6.97E-07	1.874059	-1.756155	-0.099771	-0.054029			
	(0.42586)	(6.6E-11)	(1.8E-07)	(1.68596)	(1.63768)	(0.03220)	(0.01566)			
D(PCRE)	2.40E+11	-42.51902	92844.51	-5.01E+11	5.69E+11	-6.51E+09	2.76E+09			
	(8.1E+10)	(12.4361)	(33337.2)	(3.2E+11)	(3.1E+11)	(6.1E+09)	(3.0E+09)			
D(WOP)	-0.279339	-2.80E-11	3.48E-07	0.916131	-1.084214	-0.009897	-0.012823			
	(1.01460)	(1.6E-10)	(4.2E-07)	(4.01672)	(3.90170)	(0.07671)	(0.03730)			
D(FFR)	-0.061195	3.24E-12	-3.48E-08	-0.545710	0.503389	0.004564	0.000206			
	(0.03798)	(5.9E-12)	(1.6E-08)	(0.15037)	(0.14607)	(0.00287)	(0.00140)			
8 Cointegrating Equation(s):		**Log likelihood**	**-11123.98**							
Normalized cointegrating coefficients (standard error in parentheses)										
MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR	
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-0.090814	-2.268491	
								(0.02779)	(0.51139)	
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-8.79E+08	-7.58E+09	
								(1.4E+08)	(2.6E+09)	
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-166125.2	1030039.	
								(18513.3)	(340662.)	
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.247849	6.399140	
								(0.04930)	(0.90713)	
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.243290	6.371003	
								(0.04835)	(0.88970)	
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.664294	11.16262	
								(0.16552)	(3.04575)	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	-1.325420	8.110110	
								(0.34035)	(6.26277)	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	-6.80E+10	-3.63E+11	
								(1.1E+10)	(1.9E+11)	
Adjustment coefficients (standard error in parentheses)										
D(MUP)	0.044399	-1.38E-11	-1.11E-08	-0.024590	0.051665	-0.008002	-0.000858	1.10E-13		
	(0.05142)	(7.6E-12)	(2.4E-08)	(0.19997)	(0.19581)	(0.00372)	(0.00196)	(2.7E-14)		

D(K)	5.21E+08	-0.189449	183.0162	-9.03E+08	9.62E+08	-13543854	4750108.	0.001049		
	(5.2E+08)	(0.07740)	(238.992)	(2.0E+09)	(2.0E+09)	(3.8E+07)	(2.0E+07)	(0.00028)		
D(L)	85196.37	-1.94E-05	0.025279	131629.4	-102122.4	-3242.698	3250.506	1.24E-07		
	(83601.0)	(1.2E-05)	(0.03840)	(325119.)	(318359.)	(6051.84)	(3191.48)	(4.5E-08)		
D(INTR)	-0.512423	7.51E-11	-4.84E-08	-0.896255	0.821342	-0.007286	-0.012921	-1.85E-13		
	(0.09005)	(1.3E-11)	(4.1E-08)	(0.35020)	(0.34292)	(0.00652)	(0.00344)	(4.8E-14)		
D(MSGR)	-0.541893	8.14E-11	-5.32E-08	-0.697435	0.616024	-0.006959	-0.013360	-1.91E-13		
	(0.09619)	(1.4E-11)	(4.4E-08)	(0.37406)	(0.36629)	(0.00696)	(0.00367)	(5.1E-14)		
D(INF)	0.672703	-5.23E-11	-7.02E-07	-1.985728	2.585301	-0.179216	0.005844	5.23E-13		
	(0.38678)	(5.8E-11)	(1.8E-07)	(1.50415)	(1.47287)	(0.02800)	(0.01477)	(2.1E-13)		
D(EXR)	-0.188201	9.99E-12	7.06E-07	1.840207	-1.718320	-0.099741	-0.054604	-1.97E-13		
	(0.44478)	(6.6E-11)	(2.0E-07)	(1.72974)	(1.69377)	(0.03220)	(0.01698)	(2.4E-13)		
D(PCRE)	2.27E+11	-41.74249	82185.56	-4.61E+11	5.24E+11	-6.55E+09	3.44E+09	-0.071226		
	(8.4E+10)	(12.5010)	(38598.7)	(3.3E+11)	(3.2E+11)	(6.1E+09)	(3.2E+09)	(0.04481)		
D(WOP)	-0.674153	-4.80E-12	3.01E-08	2.105965	-2.414041	-0.010941	0.007389	1.09E-12		
	(1.05188)	(1.6E-10)	(4.8E-07)	(4.09068)	(4.00563)	(0.07614)	(0.04016)	(5.6E-13)		
D(FFR)	-0.053708	2.80E-12	-2.88E-08	-0.568272	0.528606	0.004584	-0.000177	-3.21E-14		
	(0.03960)	(5.9E-12)	(1.8E-08)	(0.15399)	(0.15079)	(0.00287)	(0.00151)	(2.1E-14)		
9 Cointegrating Equation(s):		Log likelihood	-11121.41							
Normalized cointegrating coefficients (standard error in parentheses)										
MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR	
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	5.873641	
									(1.66367)	
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	7.12E+10	
									(1.7E+10)	
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	15924383	
									(3229854)	
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-15.82233	
									(4.66119)	
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	-15.44171	
									(4.57570)	
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	-48.39620	
									(12.8778)	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	126.9437	
									(26.9204)	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	5.73E+12	

									(1.3E+12)	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	89.65733	
									(19.2932)	
Adjustment coefficients (standard error in parentheses)										
D(MUP)	0.042863	-1.35E-11	-1.14E-08	-0.028046	0.055223	-0.007973	-0.000831	1.10E-13	0.004660	
	(0.05766)	(8.9E-12)	(2.4E-08)	(0.20840)	(0.20492)	(0.00375)	(0.00201)	(2.8E-14)	(0.00288)	
D(K)	6.77E+08	-0.216964	210.1986	-5.50E+08	5.99E+08	-16431590	2067609.	0.001077	18972661	
	(5.8E+08)	(0.09007)	(242.955)	(2.1E+09)	(2.1E+09)	(3.8E+07)	(2.0E+07)	(0.00028)	(2.9E+07)	
D(L)	97678.68	-2.15E-05	0.027443	159703.0	-131028.7	-3472.596	3036.948	1.26E-07	-1514.300	
	(93707.9)	(1.4E-05)	(0.03908)	(338694.)	(333038.)	(6099.70)	(3271.67)	(4.5E-08)	(4680.27)	
D(INTR)	-0.494889	7.20E-11	-4.54E-08	-0.856820	0.780737	-0.007609	-0.013221	-1.82E-13	-0.008172	
	(0.10091)	(1.6E-11)	(4.2E-08)	(0.36473)	(0.35864)	(0.00657)	(0.00352)	(4.9E-14)	(0.00504)	
D(MSGR)	-0.521752	7.79E-11	-4.97E-08	-0.652136	0.569381	-0.007330	-0.013704	-1.88E-13	-0.009542	
	(0.10778)	(1.7E-11)	(4.5E-08)	(0.38954)	(0.38303)	(0.00702)	(0.00376)	(5.2E-14)	(0.00538)	
D(INF)	0.846082	-8.28E-11	-6.72E-07	-1.595787	2.183795	-0.182410	0.002878	5.55E-13	0.083166	
	(0.43220)	(6.7E-11)	(1.8E-07)	(1.56213)	(1.53604)	(0.02813)	(0.01509)	(2.1E-13)	(0.02159)	
D(EXR)	-0.248883	2.06E-11	6.95E-07	1.703728	-1.577794	-0.098623	-0.053566	-2.08E-13	-0.053897	
	(0.49859)	(7.7E-11)	(2.1E-07)	(1.80207)	(1.77198)	(0.03245)	(0.01741)	(2.4E-13)	(0.02490)	
D(PCRE)	2.60E+11	-47.65658	88028.10	-3.85E+11	4.46E+11	-7.17E+09	2.86E+09	-0.065156	1.30E+10	
	(9.4E+10)	(14.5288)	(39191.3)	(3.4E+11)	(3.3E+11)	(6.1E+09)	(3.3E+09)	(0.04534)	(4.7E+09)	
D(WOP)	-1.147567	7.83E-11	-5.20E-08	1.041222	-1.317718	-0.002221	0.015488	1.00E-12	-0.115412	
	(1.17538)	(1.8E-10)	(4.9E-07)	(4.24824)	(4.17730)	(0.07651)	(0.04104)	(5.7E-13)	(0.05870)	
D(FFR)	-0.054074	2.87E-12	-2.88E-08	-0.569094	0.529453	0.004591	-0.000171	-3.22E-14	0.000398	
	(0.04440)	(6.9E-12)	(1.9E-08)	(0.16048)	(0.15780)	(0.00289)	(0.00155)	(2.1E-14)	(0.00222)	

Appendix G: Covariance Analysis

$$MUP_t = \beta_0 + \beta_1 K_t + \beta_2 L + \beta_3 MPR_t + \beta_4 MSGR_t + \beta_5 INF_t + \beta_6 EXR_t + \beta_7 PCRE_t + \beta_8 WOP_t + \beta_9 FFR_t + \varepsilon_{i,t} \ldots \quad (4.1$$

	MUP	**K**	**L**	**INTR**	**MSGR**	**INF**	**EXR**	**PCRE**	**WOP**	**FFR**
Mean	6.150827	2.17E+10	39623975	17.42054	17.42500	18.94111	71.94815	2.10E+12	84.75931	7.365229
Median	5.704737	5.17E+09	39256651	17.64216	17.89063	12.77680	56.38086	4.90E+11	59.59824	7.621146
Maximum	10.76479	9.37E+10	57046253	32.48151	32.90625	76.42606	160.3424	1.18E+13	203.1129	19.13323
Minimum	1.631273	-5.02E+09	20210415	7.511120	7.843750	1.863981	0.541920	8.99E+09	22.92778	2.962891
Std. Dev.	2.641805	2.89E+10	9937659.	5.188493	5.205059	16.98900	64.50956	3.21E+12	54.96753	3.672288
Observations	160	160	160	160	160	160	160	160	160	160

Covariance Analysis: Ordinary										
Date: 01/12/22 Time: 05:53										
Sample: 1980Q1 2019Q4										
Included observations: 160										
Covariance										
Correlation	MUP	K	L	INTR	MSGR	INF	EXR	PCRE	WOP	FFR
MUP	6.935512									
	1.000000									
K	3.76E+10	8.29E+20								
	0.496166	1.000000								
L	-2921676.	2.20E+17	9.81E+13							
	-0.111988	0.770810	1.000000							
INTR	-8.015546	-1.66E+10	15555089	26.75221						
	-0.588456	-0.111305	0.303578	1.000000						
MSGR	-7.893313	-1.45E+10	16206540	26.79075	26.92331					
	-0.577638	-0.096871	0.315285	0.998254	1.000000					
INF	-3.043032	-1.41E+11	-44620963	32.16009	31.88470	286.8223				
	-0.068228	-0.289288	-0.265956	0.367139	0.362837	1.000000				
EXR	-30.23609	1.30E+12	5.95E+08	86.63897	90.42591	-390.7244	4135.474			
	-0.178535	0.700915	0.933502	0.260478	0.270998	-0.358758	1.000000			

PCRE	1.66E+12	7.22E+22	2.33E+19	2.07E+11	2.64E+11	-1.56E+13	1.38E+14	1.02E+25		
	0.197189	0.784689	0.734478	0.012553	0.015935	-0.288982	0.670352	1.000000		
WOP	9.457780	1.31E+12	4.93E+08	37.28260	41.30876	-232.7148	3015.243	1.17E+14	3002.545	
	0.065540	0.829860	0.907972	0.131547	0.145289	-0.250768	0.855687	0.665521	1.000000	
FFR	2.271909	-5.83E+10	-31253713	-9.415700	-9.665709	10.04945	-179.8733	-6.80E+12	-141.9979	13.40142
	0.235655	-0.552771	-0.861794	-0.497276	-0.508855	0.162092	-0.764062	-0.581121	-0.707884	1.000000

Appendix H: VECM results

Long run result

Dependent Variable: MUP
Method: Least Squares
Date: 01/16/22 Time: 07:02
Sample: 1980Q1 2019Q4
Included observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
K	1.27E-10	7.68E-12	16.52350	0.0000
L	1.56E-07	2.13E-08	7.318035	0.0000
INTR	-0.678472	0.316006	-2.147020	0.0334
MSGR	0.641575	0.315440	2.033904	0.0437
INF	-0.000165	0.006912	-0.023807	0.9810
EXR	-0.032192	0.003614	-8.907817	0.0000
PCRE	-1.74E-13	5.23E-14	-3.336625	0.0011
WOP	-0.022434	0.004696	-4.777391	0.0000
FFR	0.330357	0.030991	10.65991	0.0000

R-squared	0.822811	Mean dependent var	6.150827
Adjusted R-squared	0.813423	S.D. dependent var	2.641805
S.E. of regression	1.141115	Akaike info criterion	3.156494
Sum squared resid	196.6235	Schwarz criterion	3.329473
Log likelihood	-243.5195	Hannan-Quinn criter.	3.226735
Durbin-Watson stat	0.175383		

Date: 10/28/22 Time: 04:31
Sample (adjusted): 1982 2019
Included observations: 38 after adjustments
Trend assumption: Quadratic deterministic trend
Series: MUP LOG(K) LOG(L) INTR MSGR INF LOG(EXR) LOG(PCRE) LOG(WOP) LOG(FFR)
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.966352	509.4471	259.0294	0.0000
At most 1	0.919820	210.5586	215.1232	0.1381

At most 2	0.889012	184.6665	195.1715	0.7769
At most 3	0.838083	101.1300	139.2753	0.2315
At most 4	0.689927	91.94450	107.3466	0.4753
At most 5	0.641350	77.44850	79.34145	0.1069
At most 6	0.453396	48.48300	55.24578	0.1722
At most 7	0.344625	25.52980	35.01090	0.3532
At most 8	0.191252	9.473000	18.39771	0.5322
At most 9	0.036344	1.406800	3.841465	0.2356

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.966352	110.8885	100.9103	0.0000
At most 1	0.919820	91.89209	94.80550	0.2602
At most 2	0.889012	83.53658	85.72819	0.1583
At most 3	0.838083	69.18546	79.58633	0.1735
At most 4	0.689927	44.49599	53.41977	0.3803
At most 5	0.641350	38.96557	47.16359	0.3072
At most 6	0.453396	22.95313	30.81507	0.3331
At most 7	0.344625	16.05684	24.25202	0.4088
At most 8	0.191252	8.066177	17.14769	0.5956
At most 9	0.036344	1.406813	3.841465	0.2356

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
0.072893	0.771767	-6.580442	3.624617	-3.402347	-0.005709	-1.809347	0.645256	-3.530109	0.640998
-0.432045	0.651452	15.73871	2.058520	-1.777140	0.022159	-2.904462	-1.359701	-2.823229	1.208056
0.314134	0.133203	-3.824306	-0.821210	1.087150	-0.068363	-0.058814	-0.745024	2.336520	4.474377
-0.015873	-1.442211	-10.54229	-0.486768	0.562794	-0.063757	-1.266866	0.343497	3.060467	-4.123173
0.598464	-2.915342	-28.51756	-1.323479	0.696655	0.033003	2.763347	-0.605058	2.338451	-4.266938
0.679194	-2.772324	-3.341326	3.871588	-4.077207	-0.047772	1.278429	0.148134	6.459666	0.640856
-0.330736	1.669513	3.883679	1.313335	-1.262318	0.017758	1.247504	-1.628059	0.987811	-3.093380
-0.065099	-0.049494	10.38398	0.863140	-0.993485	-0.028788	1.472806	-0.767068	-4.138776	-0.617874
0.454433	-1.102145	-4.957930	0.227786	-0.070871	-0.016256	0.652224	0.009255	0.200585	1.110988
0.624399	0.826860	21.28926	-0.492148	0.542287	0.002592	1.872983	-0.373015	-3.201572	1.712078

Unrestricted Adjustment Coefficients (alpha):

D(MUP)	-0.361123	-0.648118	0.001148	-0.079235	-0.564421	0.172351	0.119831	-0.162743	-0.151818	-0.084000
D(LOG(K))	-0.242499	-0.246649	-0.104880	-0.036405	-0.149046	0.087065	-0.034966	0.063442	0.011302	-0.005678
D(LOG(L))	0.001322	-0.035471	0.003662	-0.011521	-0.009282	0.004363	0.005333	0.005293	0.001450	-0.003040
D(INTR)	-0.073648	0.400126	0.498744	-0.239761	1.010142	-0.000563	0.035742	0.411842	-0.657343	-0.055154
D(MSGR)	0.135129	0.374799	0.425961	-0.272897	1.061402	0.106629	0.151605	0.439445	-0.691313	-0.055644
D(INF)	1.431476	-5.319987	5.779798	7.945983	-1.437880	-0.787637	1.144783	-0.167813	-1.385126	0.597512
D(LOG(EXR))	0.052529	0.068996	0.017667	0.080162	-0.015443	0.024888	-0.050044	0.047155	-0.021179	-0.033900
D(LOG(PCRE))	-0.315184	0.009547	0.363863	-0.096335	0.043471	0.163722	0.142010	0.014145	0.117994	-0.033025
D(LOG(WOP))	0.009611	-0.045076	-0.036219	-0.002121	-0.090886	-0.034638	0.028088	0.073642	-0.011996	-0.002396
D(LOG(FFR))	-0.004148	0.018657	-0.069629	0.101029	0.060698	-0.039666	0.017756	-0.004046	0.006292	-0.006796

1 Cointegrating Equation(s): Log likelihood -162.2892

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	10.58772	-90.27580	49.72541	-46.67613	-0.078319	-24.82207	8.852140	-48.42887	8.793726
	(1.89719)	(20.8126)	(3.14578)	(3.06950)	(0.05727)	(2.20825)	(1.31240)	(4.97485)	(4.29472)

Adjustment coefficients (standard error in parentheses)

D(MUP)	-0.026323
	(0.01725)
D(LOG(K))	-0.017676
	(0.00550)
D(LOG(L))	9.64E-05
	(0.00067)
D(INTR)	-0.005368
	(0.03207)
D(MSGR)	0.009850
	(0.03354)
D(INF)	0.104344
	(0.19039)
D(LOG(EXR))	0.003829
	(0.00359)
D(LOG(PCRE))	-0.022975
	(0.00870)
D(LOG(WOP))	0.000701
	(0.00276)
D(LOG(FFR))	-0.000302
	(0.00244)

2 Cointegrating Equation(s): Log likelihood -114.3432

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	-43.14105	2.028138	-2.218103	-0.054659	2.790230	3.858317	-0.317182	-1.351341
		(4.21025)	(0.83314)	(0.81082)	(0.01503)	(0.58428)	(0.34347)	(1.05901)	(0.94887)
0.000000	1.000000	-4.451832	4.504962	-4.199018	-0.002235	-2.607956	0.471662	-4.544103	0.958192
		(1.36032)	(0.26918)	(0.26197)	(0.00486)	(0.18878)	(0.11097)	(0.34216)	(0.30658)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.253693	-0.700920
	(0.08674)	(0.19995)
D(LOG(K))	0.088887	-0.347833
	(0.02498)	(0.05758)
D(LOG(L))	0.015422	-0.022088
	(0.00255)	(0.00588)
D(INTR)	-0.178241	0.203824
	(0.18956)	(0.43695)
D(MSGR)	-0.152080	0.348452
	(0.19889)	(0.45846)
D(INF)	2.402817	-2.360951
	(1.04513)	(2.40907)
D(LOG(EXR))	-0.025981	0.085488
	(0.02070)	(0.04771)
D(LOG(PCRE))	-0.027099	-0.237029
	(0.05228)	(0.12050)
D(LOG(WOP))	0.020176	-0.021948
	(0.01613)	(0.03719)

D(LOG(FFR))	-0.008363	0.008953
	(0.01458)	(0.03360)

3 Cointegrating Equation(s): Log likelihood -72.57490

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	-6.575989	7.576753	-0.267401	0.332657	-4.584831	12.39614	18.59258
			(1.78786)	(1.74438)	(0.03296)	(1.29283)	(0.74332)	(2.29112)	(1.99746)
0.000000	1.000000	0.000000	3.617080	-3.188262	-0.024188	-2.861559	-0.399608	-3.232184	3.016255
			(0.30525)	(0.29783)	(0.00563)	(0.22073)	(0.12691)	(0.39117)	(0.34104)
0.000000	0.000000	1.000000	-0.199442	0.227043	-0.004931	-0.056966	-0.195710	0.294692	0.462296
			(0.04812)	(0.04695)	(0.00089)	(0.03480)	(0.02001)	(0.06167)	(0.05377)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.254053	-0.700768	-7.828582
	(0.10674)	(0.20168)	(3.46115)
D(LOG(K))	0.055941	-0.361803	-1.885089
	(0.02858)	(0.05400)	(0.92676)
D(LOG(L))	0.016572	-0.021600	-0.580979
	(0.00311)	(0.00588)	(0.10095)
D(INTR)	-0.021568	0.270258	4.874752
	(0.22697)	(0.42886)	(7.35989)
D(MSGR)	-0.018271	0.405191	3.380645
	(0.24038)	(0.45421)	(7.79497)
D(INF)	4.218448	-1.591064	-115.2532
	(1.12489)	(2.12553)	(36.4770)
D(LOG(EXR))	-0.020431	0.087841	0.672688
	(0.02540)	(0.04799)	(0.82350)
D(LOG(PCRE))	0.087202	-0.188562	0.832785
	(0.05097)	(0.09631)	(1.65288)
D(LOG(WOP))	0.008798	-0.026772	-0.634172
	(0.01946)	(0.03677)	(0.63111)
D(LOG(FFR))	-0.030236	-0.000322	0.587220
	(0.01629)	(0.03078)	(0.52829)

4 Cointegrating Equation(s): Log likelihood -37.98217

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	3.610787	-0.671086	-15.27825	-10.75930	16.83370	32.65668
				(0.41192)	(0.07513)	(2.79153)	(1.71028)	(5.27379)	(4.58879)
0.000000	1.000000	0.000000	0.000000	-1.006808	0.197856	5.725119	2.996621	-5.673035	-4.719611
				(0.12366)	(0.02255)	(0.83804)	(0.51344)	(1.58324)	(1.37760)
0.000000	0.000000	1.000000	0.000000	0.106760	-0.017175	-0.530426	-0.382975	0.429278	0.888843
				(0.01205)	(0.00220)	(0.08166)	(0.05003)	(0.15427)	(0.13424)
0.000000	0.000000	0.000000	1.000000	-0.603098	-0.061388	-2.373925	-0.938942	0.674812	2.138704
				(0.03984)	(0.00727)	(0.27001)	(0.16543)	(0.51011)	(0.44385)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.255311	-0.586494	-6.993261	-2.605469
	(0.10644)	(0.34845)	(4.02878)	(0.84390)
D(LOG(K))	0.056519	-0.309300	-1.501301	-1.282850
	(0.02832)	(0.09271)	(1.07196)	(0.22454)
D(LOG(L))	0.016755	-0.004985	-0.459524	-0.065626
	(0.00286)	(0.00935)	(0.10809)	(0.02264)
D(INTR)	-0.017763	0.616044	7.402380	0.263857
	(0.22559)	(0.73851)	(8.53856)	(1.78855)

D(MSGR)	-0.013940	0.798767	6.257608	1.044357
	(0.23868)	(0.78137)	(9.03411)	(1.89235)
D(INF)	4.092323	-13.05085	-199.0220	-14.37703
	(0.72922)	(2.38726)	(27.6014)	(5.78160)
D(LOG(EXR))	-0.021703	-0.027770	-0.172405	0.278898
	(0.02389)	(0.07821)	(0.90423)	(0.18941)
D(LOG(PCRE))	0.088732	-0.049626	1.848381	-1.374684
	(0.04992)	(0.16344)	(1.88964)	(0.39582)
D(LOG(WOP))	0.008831	-0.023713	-0.611813	-0.027179
	(0.01947)	(0.06374)	(0.73692)	(0.15436)
D(LOG(FFR))	-0.031840	-0.146027	-0.477855	0.031373
	(0.01212)	(0.03967)	(0.45872)	(0.09609)

5 Cointegrating Equation(s): Log likelihood -15.73417

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.067498	2.043852	-6.724432	-1.847570	16.90644
					(0.03160)	(0.90683)	(0.92021)	(2.84034)	(2.10188)
0.000000	1.000000	0.000000	0.000000	0.000000	-0.008086	0.895140	1.871565	-0.464075	-0.327919
					(0.00713)	(0.20453)	(0.20755)	(0.64063)	(0.47407)
0.000000	0.000000	1.000000	0.000000	0.000000	0.004663	-0.018266	-0.263676	-0.123069	0.423158
					(0.00097)	(0.02792)	(0.02833)	(0.08745)	(0.06471)
0.000000	0.000000	0.000000	1.000000	0.000000	-0.184751	-5.267180	-1.612873	3.795085	4.769416
					(0.01428)	(0.40973)	(0.41577)	(1.28333)	(0.94968)
0.000000	0.000000	0.000000	0.000000	1.000000	-0.204549	-4.797320	-1.117449	5.173738	4.361996
					(0.01512)	(0.43384)	(0.44024)	(1.35885)	(1.00556)

Adjustment coefficients (standard error in parentheses)

D(MUP)	-0.082475	1.058986	9.102642	-1.858470	1.943909
	(0.13041)	(0.55171)	(5.67704)	(0.72460)	(0.66185)
D(LOG(K))	-0.032680	0.125221	2.749132	-1.085591	1.025055
	(0.03483)	(0.14733)	(1.51603)	(0.19350)	(0.17674)
D(LOG(L))	0.011200	0.022076	-0.194816	-0.053342	0.049571
	(0.00399)	(0.01690)	(0.17391)	(0.02220)	(0.02027)
D(INTR)	0.586771	-2.328865	-21.40440	-1.073044	0.650490
	(0.29504)	(1.24821)	(12.8439)	(1.63935)	(1.49739)
D(MSGR)	0.621272	-2.295582	-24.01098	-0.360386	-0.076896
	(0.31282)	(1.32341)	(13.6177)	(1.73811)	(1.58760)
D(INF)	3.231803	-8.858937	-158.0172	-12.47403	14.33773
	(1.06432)	(4.50270)	(46.3324)	(5.91368)	(5.40159)
D(LOG(EXR))	-0.030946	0.017253	0.268003	0.299337	-0.247774
	(0.03560)	(0.15060)	(1.54962)	(0.19779)	(0.18066)
D(LOG(PCRE))	0.114747	-0.176359	0.608692	-1.432217	1.427040
	(0.07424)	(0.31409)	(3.23193)	(0.41251)	(0.37679)
D(LOG(WOP))	-0.045561	0.241250	1.980031	0.093107	-0.056478
	(0.02513)	(0.10629)	(1.09376)	(0.13960)	(0.12751)
D(LOG(FFR))	0.004486	-0.322981	-2.208804	-0.048960	0.004404
	(0.01523)	(0.06445)	(0.66313)	(0.08464)	(0.07731)

6 Cointegrating Equation(s): Log likelihood 3.748611

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	3.012010	-3.425553	1.977022	13.51321
						(0.50335)	(0.56746)	(1.67837)	(1.29385)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.779164	1.476390	-0.922225	0.078558
						(0.14563)	(0.16418)	(0.48559)	(0.37434)

0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.048618	-0.035777	0.141149	0.188740
						(0.00987)	(0.01113)	(0.03292)	(0.02538)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	-7.917147	-10.64231	-6.673295	14.05711
						(1.09054)	(1.22945)	(3.63630)	(2.80322)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	-7.731263	-11.11450	-6.416455	14.64497
						(1.13720)	(1.28206)	(3.79190)	(2.92317)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	-14.34345	-48.87355	-56.66209	50.27138
						(5.60512)	(6.31909)	(18.6898)	(14.4079)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.034585	0.581174	8.526762	-1.191199	1.241199	-0.034188
	(0.16666)	(0.69486)	(5.57195)	(0.93604)	(0.91323)	(0.01778)
D(LOG(K))	0.026454	-0.116151	2.458220	-0.748512	0.670073	-0.003668
	(0.04169)	(0.17383)	(1.39387)	(0.23416)	(0.22845)	(0.00445)
D(LOG(L))	0.014163	0.009982	-0.209393	-0.036451	0.031783	-0.000824
	(0.00514)	(0.02145)	(0.17197)	(0.02889)	(0.02819)	(0.00055)
D(INTR)	0.586389	-2.327306	-21.40252	-1.075222	0.652783	0.023843
	(0.38590)	(1.60898)	(12.9021)	(2.16743)	(2.11463)	(0.04116)
D(MSGR)	0.693693	-2.591191	-24.36726	0.052436	-0.511643	0.025749
	(0.40853)	(1.70334)	(13.6587)	(2.29454)	(2.23865)	(0.04358)
D(INF)	2.696844	-6.675351	-155.3855	-15.52343	17.54909	-1.037626
	(1.38214)	(5.76271)	(46.2101)	(7.76287)	(7.57377)	(0.14743)
D(LOG(EXR))	-0.014042	-0.051744	0.184845	0.395692	-0.349247	-0.006788
	(0.04626)	(0.19289)	(1.54673)	(0.25984)	(0.25351)	(0.00493)
D(LOG(PCRE))	0.225947	-0.630250	0.061643	-0.798351	0.759511	-0.023108
	(0.09077)	(0.37845)	(3.03469)	(0.50980)	(0.49738)	(0.00968)
D(LOG(WOP))	-0.069086	0.337278	2.095768	-0.040997	0.084748	0.000213
	(0.03204)	(0.13359)	(1.07126)	(0.17996)	(0.17558)	(0.00342)
D(LOG(FFR))	-0.022455	-0.213013	-2.076266	-0.202531	0.166132	0.002654
	(0.01809)	(0.07541)	(0.60467)	(0.10158)	(0.09910)	(0.00193)

7 Cointegrating Equation(s): Log likelihood 15.22518

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	4.385765	-5.892722	14.16423
							(0.90187)	(2.96983)	(2.31432)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	3.497066	-2.958015	0.246967
							(0.33663)	(1.10852)	(0.86384)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.090310	0.014119	0.199249
							(0.01851)	(0.06094)	(0.04749)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	-31.17457	14.01253	12.34589
							(3.14375)	(10.3523)	(8.06727)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	-31.16469	13.78370	12.97393
							(3.11802)	(10.2675)	(8.00124)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	-86.07171	-19.18570	47.17117
							(8.45552)	(27.8437)	(21.6980)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	-2.593391	2.612788	-0.216141
							(0.31903)	(1.05057)	(0.81868)

Adjustment coefficients (standard error in parentheses)

D(MUP)	-0.005048	0.781233	8.992148	-1.033820	1.089934	-0.032060	1.446281
	(0.17266)	(0.73475)	(5.54096)	(0.94773)	(0.92401)	(0.01779)	(0.76817)
D(LOG(K))	0.038018	-0.174528	2.322421	-0.794434	0.714212	-0.004289	0.863255
	(0.04301)	(0.18302)	(1.38024)	(0.23608)	(0.23017)	(0.00443)	(0.19135)
D(LOG(L))	0.012399	0.018885	-0.188682	-0.029447	0.025052	-0.000729	0.101593
	(0.00526)	(0.02239)	(0.16883)	(0.02888)	(0.02815)	(0.00054)	(0.02341)
D(INTR)	0.574568	-2.267635	-21.26371	-1.028282	0.607666	0.024477	2.080757
	(0.40438)	(1.72090)	(12.9778)	(2.21973)	(2.16416)	(0.04167)	(1.79916)

D(MSGR)	0.643552	-2.338085	-23.77848	0.251543	-0.703016	0.028441	2.246052
	(0.42687)	(1.81659)	(13.6994)	(2.34316)	(2.28450)	(0.04398)	(1.89920)
D(INF)	2.318224	-4.764121	-150.9395	-14.01995	16.10401	-1.017297	-1.096939
	(1.42638)	(6.07011)	(45.7763)	(7.82962)	(7.63361)	(0.14696)	(6.34614)
D(LOG(EXR))	0.002509	-0.135293	-0.009510	0.329968	-0.286075	-0.007677	-0.471322
	(0.04721)	(0.20091)	(1.51512)	(0.25915)	(0.25266)	(0.00486)	(0.21005)
D(LOG(PCRE))	0.178979	-0.393162	0.613165	-0.611844	0.580248	-0.020586	1.149783
	(0.08981)	(0.38221)	(2.88234)	(0.49300)	(0.48066)	(0.00925)	(0.39959)
D(LOG(WOP))	-0.078376	0.384170	2.204851	-0.004108	0.049292	0.000712	-0.142042
	(0.03300)	(0.14045)	(1.05920)	(0.18117)	(0.17663)	(0.00340)	(0.14684)
D(LOG(FFR))	-0.028328	-0.183370	-2.007309	-0.179212	0.143719	0.002969	-0.031410
	(0.01855)	(0.07892)	(0.59517)	(0.10180)	(0.09925)	(0.00191)	(0.08251)

8 Cointegrating Equation(s): Log likelihood 23.25360

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-14.33232	16.55416
								(3.74414)	(2.91433)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-9.687478	2.152617
								(1.91957)	(1.49414)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-0.159666	0.248461
								(0.06469)	(0.05036)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	74.00228	-4.642017
								(17.0671)	(13.2845)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	73.75443	-4.008587
								(16.9697)	(13.2087)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	146.4435	0.268267
								(43.8891)	(34.1619)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	7.603293	-1.629353
								(1.60737)	(1.25113)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	1.924317	-0.544928
								(0.58239)	(0.45332)

Adjustment coefficients (standard error in parentheses)

D(MUP)	0.005547	0.789288	7.302225	-1.174291	1.251617	-0.027375	1.206592	0.916939
	(0.16916)	(0.71869)	(5.64733)	(0.93631)	(0.91643)	(0.01795)	(0.78436)	(0.39178)
D(LOG(K))	0.033888	-0.177668	2.981203	-0.739675	0.651183	-0.006116	0.956693	0.355869
	(0.04073)	(0.17305)	(1.35976)	(0.22544)	(0.22066)	(0.00432)	(0.18886)	(0.09433)
D(LOG(L))	0.012055	0.018623	-0.133717	-0.024879	0.019793	-0.000882	0.109389	0.035918
	(0.00514)	(0.02183)	(0.17152)	(0.02844)	(0.02783)	(0.00055)	(0.02382)	(0.01190)
D(INTR)	0.547758	-2.288018	-16.98716	-0.672805	0.198508	0.012621	2.687320	-2.030884
	(0.39470)	(1.67688)	(13.1766)	(2.18465)	(2.13827)	(0.04188)	(1.83010)	(0.91412)
D(MSGR)	0.614944	-2.359835	-19.21529	0.630846	-1.139598	0.015790	2.893270	-2.043833
	(0.41641)	(1.76910)	(13.9012)	(2.30479)	(2.25586)	(0.04418)	(1.93074)	(0.96439)
D(INF)	2.329148	-4.755815	-152.6821	-14.16480	16.27073	-1.012466	-1.344095	5.598866
	(1.42837)	(6.06839)	(47.6842)	(7.90591)	(7.73808)	(0.15154)	(6.62284)	(3.30808)
D(LOG(EXR))	-0.000560	-0.137627	0.480148	0.370669	-0.332923	-0.009034	-0.401872	0.012788
	(0.04613)	(0.19597)	(1.53990)	(0.25531)	(0.24989)	(0.00489)	(0.21388)	(0.10683)
D(LOG(PCRE))	0.178058	-0.393862	0.760044	-0.599635	0.566196	-0.020994	1.170616	-0.764634
	(0.08991)	(0.38200)	(3.00167)	(0.49767)	(0.48710)	(0.00954)	(0.41690)	(0.20824)
D(LOG(WOP))	-0.083170	0.380525	2.969546	0.059455	-0.023870	-0.001408	-0.033582	0.041391
	(0.02877)	(0.12222)	(0.96036)	(0.15923)	(0.15584)	(0.00305)	(0.13338)	(0.06662)
D(LOG(FFR))	-0.028064	-0.183170	-2.049327	-0.182705	0.147739	0.003086	-0.037370	-0.009872
	(0.01856)	(0.07883)	(0.61946)	(0.10271)	(0.10052)	(0.00197)	(0.08604)	(0.04297)

9 Cointegrating Equation(s): Log likelihood 27.28668

Normalized cointegrating coefficients (standard error in parentheses)

MUP	LOG(K)	LOG(L)	INTR	MSGR	INF	LOG(EXR)	LOG(PCRE)	LOG(WOP)	LOG(FFR)
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	17.28057
									(2.48042)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	2.643613
									(1.14275)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.256553
									(0.03956)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-8.392712
									(8.77191)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	-7.746721
									(8.72452)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	-7.154007
									(20.2303)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	-2.014715
									(0.95277)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	-0.642459
									(0.33606)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.050684
									(0.19869)

Adjustment coefficients (standard error in parentheses)

D(MUP)	-0.063444	0.956614	8.054928	-1.208873	1.262376	-0.024907	1.107573	0.915533	3.419708
	(0.17924)	(0.72348)	(5.58451)	(0.91830)	(0.89825)	(0.01776)	(0.77492)	(0.38398)	(1.50308)
D(LOG(K))	0.039024	-0.190125	2.925170	-0.737101	0.650382	-0.006300	0.964064	0.355974	1.114954
	(0.04395)	(0.17740)	(1.36937)	(0.22517)	(0.22026)	(0.00435)	(0.19002)	(0.09416)	(0.36857)
D(LOG(L))	0.012713	0.017025	-0.140905	-0.024548	0.019690	-0.000905	0.110335	0.035931	0.058901
	(0.00554)	(0.02238)	(0.17273)	(0.02840)	(0.02778)	(0.00055)	(0.02397)	(0.01188)	(0.04649)
D(INTR)	0.249039	-1.563530	-13.72810	-0.822538	0.245094	0.023307	2.258584	-2.036968	0.119348
	(0.39667)	(1.60116)	(12.3592)	(2.03231)	(1.98793)	(0.03930)	(1.71500)	(0.84980)	(3.32649)
D(MSGR)	0.300789	-1.597907	-15.78780	0.473374	-1.090604	0.027028	2.442379	-2.050232	-0.011946
	(0.41869)	(1.69004)	(13.0453)	(2.14513)	(2.09829)	(0.04148)	(1.81021)	(0.89697)	(3.51115)
D(INF)	1.699701	-3.229205	-145.8147	-14.48031	16.36890	-0.989949	-2.247508	5.586046	40.88655
	(1.50821)	(6.08782)	(46.9914)	(7.72711)	(7.55838)	(0.14943)	(6.52067)	(3.23105)	(12.6478)
D(LOG(EXR))	-0.010185	-0.114285	0.585151	0.365845	-0.331422	-0.008690	-0.415685	0.012592	-0.217806
	(0.04961)	(0.20025)	(1.54568)	(0.25417)	(0.24862)	(0.00492)	(0.21448)	(0.10628)	(0.41602)
D(LOG(PCRE))	0.231678	-0.523908	0.175039	-0.572758	0.557833	-0.022912	1.247574	-0.763542	2.905674
	(0.09302)	(0.37545)	(2.89811)	(0.47656)	(0.46615)	(0.00922)	(0.40215)	(0.19927)	(0.78003)
D(LOG(WOP))	-0.088622	0.393747	3.029024	0.056722	-0.023020	-0.001213	-0.041406	0.041280	-0.713514
	(0.03097)	(0.12500)	(0.96484)	(0.15866)	(0.15519)	(0.00307)	(0.13388)	(0.06634)	(0.25969)
D(LOG(FFR))	-0.025205	-0.190104	-2.080523	-0.181272	0.147293	0.002983	-0.033266	-0.009813	0.029733
	(0.02000)	(0.08074)	(0.62326)	(0.10249)	(0.10025)	(0.00198)	(0.08649)	(0.04285)	(0.16775)

Vector Error Correction Estimates
Date: 10/28/22 Time: 04:14
Sample (adjusted): 1982 2019
Included observations: 38 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
MUP(-1)	1.000000
LOG(K(-1))	0.105877
	(0.018979)
	[5.58073]
LOG(L(-1))	-0.092750
	(0.020816)
	[-4.33756]
INTR(-1)	-0.097251
	(0.003148)
	[-15.8070]
MSGR(-1)	-0.066761
	(0.506950)
	[-15.2064]
INF(-1)	-0.078319
	(0.00727)
	[-1.36765]
LOG(EXR(-1))	-0.482207
	(0.022085)
	[-11.2406]
LOG(PCRE(-1))	8.852140
	(7.31240)
	[6.74498]
LOG(WOP(-1))	-0.484287
	(0.049748)
	[-9.73474]
LOG(FFR(-1))	0.879372
	(0.042942)
	[2.04757]
@TREND(80)	6.463129

C	11.75454

Error Correction:	D(MUP)	D(LOG(K))	D(LOG(L))	D(INTR)	D(MSGR)	D(INF)	D(LOG(EXR))	D(LOG(PCRE))	D(LOG(WOP))	D(LOG(FFR))
CointEq1	-0.026323	-0.017676	9.64E-05	-0.005368	0.009850	0.104344	0.003829	-0.022975	0.000701	-0.000302
	(0.01725)	(0.00550)	(0.00067)	(0.03207)	(0.03354)	(0.19039)	(0.00359)	(0.00870)	(0.00276)	(0.00244)
	[-1.52605]	[-3.21662]	[0.14406]	[-0.16739]	[0.29370]	[0.54807]	[1.06741]	[-2.64141]	[0.25354]	[-0.12390]
D(MUP(-1))	-0.244755	-0.099233	0.005030	0.730018	0.731943	-3.896595	-0.034103	0.095189	-0.035855	-0.017264
	(0.04662)	(0.07857)	(0.00956)	(0.45854)	(0.47949)	(2.72201)	(0.05129)	(0.12436)	(0.03951)	(0.03489)
	[-0.99244]	[-1.26302]	[0.52591]	[1.59206]	[1.52650]	[-1.43152]	[-0.66495]	[0.76545]	[-0.90759]	[-0.49477]
D(LOG(K(-1)))	0.404483	0.093340	-0.020065	-1.253918	-1.129934	5.415833	0.218550	-0.305927	0.168284	0.042331
	(0.02454)	(0.23083)	(0.02810)	(1.34714)	(1.40870)	(7.99699)	(0.15067)	(0.36535)	(0.11606)	(0.10251)
	[0.55826]	[0.40437]	[-0.71413]	[-0.93080]	[-0.80211]	[0.67723]	[1.45048]	[-0.83736]	[1.44994]	[0.41293]
D(LOG(L(-1)))	-10.26421	-2.833377	-0.148938	-14.32660	-14.00344	-54.19953	-2.114663	-4.522254	0.653647	-0.190142
	(7.32625)	(2.33403)	(0.28410)	(13.6217)	(14.2442)	(80.8622)	(1.52356)	(3.69423)	(1.17358)	(1.03657)
	[-1.40102]	[-1.21394]	[-0.52424]	[-1.05175]	[-0.98310]	[-0.67027]	[-1.38797]	[-1.22414]	[0.55697]	[-0.18343]
D(INTR(-1))	-0.966817	0.613099	0.015841	0.541187	0.180208	-13.41211	-0.241501	0.630431	-0.006033	-0.085547
	(0.01656)	(0.32386)	(0.03942)	(1.89010)	(1.97647)	(11.2201)	(0.21140)	(0.51260)	(0.16284)	(0.14383)
	[0.95106]	[1.89309]	[0.40183]	[0.28633]	[0.09118]	[-1.19536]	[-1.14237]	[1.22987]	[-0.03705]	[-0.59477]
D(MSGR(-1))	-0.964134	-0.607330	-0.014625	-0.833012	-0.514615	11.34700	0.218058	-0.587075	0.007411	0.080093
	(0.97036)	(0.30914)	(0.03763)	(1.80418)	(1.88663)	(10.7101)	(0.20179)	(0.48930)	(0.15544)	(0.13729)
	[-0.99359]	[-1.96458]	[-0.38867]	[-0.46171]	[-0.27277]	[1.05946]	[1.08060]	[-1.19983]	[0.04768]	[0.58337]
D(INF(-1))	-4.82E-05	0.001197	-9.83E-05	0.071022	0.069052	0.125924	0.002824	-0.006371	0.001764	0.002234
	(0.01669)	(0.00532)	(0.00065)	(0.03104)	(0.03245)	(0.18424)	(0.00347)	(0.00842)	(0.00267)	(0.00236)
	[-0.00289]	[0.22500]	[-0.15182]	[2.28835]	[2.12765]	[0.68348]	[0.81346]	[-0.75688]	[0.65958]	[0.94573]
D(LOG(EXR(-1)))	-1.286621	0.113842	-0.047000	3.496252	3.919875	18.10548	0.169488	-0.495552	-0.003498	0.017192
	(0.97684)	(0.31121)	(0.03788)	(1.81624)	(1.89923)	(10.7817)	(0.20314)	(0.49257)	(0.15648)	(0.13821)
	[-1.31713]	[0.36581]	[-1.24076]	[1.92500]	[2.06392]	[1.67928]	[0.83433]	[-1.00606]	[-0.02236]	[0.12439]
D(LOG(PCRE(-1)))	-0.435501	-0.193298	-0.021050	0.472721	0.546085	6.114117	0.013999	-0.319911	-0.099280	-0.008259
	(0.37799)	(0.12042)	(0.01466)	(0.70280)	(0.73492)	(4.17202)	(0.07861)	(0.19060)	(0.06055)	(0.05348)
	[-1.15214]	[-1.60517]	[-1.43611]	[0.67262]	[0.74306]	[1.46551]	[0.17809]	[-1.67843]	[-1.63963]	[-0.15443]
D(LOG(WOP(-1)))	1.844746	-0.646722	0.068950	-1.786067	-1.096175	3.360743	0.114317	0.567276	-0.427310	-0.257573
	(1.60415)	(0.51106)	(0.06221)	(2.98259)	(3.11889)	(17.7055)	(0.33360)	(0.80889)	(0.25697)	(0.22697)
	[1.14998]	[-1.26546]	[1.10840]	[-0.59883]	[-0.35146]	[0.18981]	[0.34268]	[0.70131]	[-1.66291]	[-1.13485]
D(LOG(FFR(-1)))	-3.505150	-0.858969	-0.005655	-4.273047	-4.270285	-5.764876	-0.306370	-0.903004	0.144735	0.342186
	(1.37331)	(0.43752)	(0.05326)	(2.55340)	(2.67008)	(15.1577)	(0.28559)	(0.69249)	(0.21999)	(0.19431)
	[-2.55233]	[-1.96329]	[-0.10619]	[-1.67347]	[-1.59931]	[-0.38033]	[-1.07275]	[-1.30400]	[0.65792]	[1.76106]
C	0.394128	0.084677	0.083295	0.681562	0.554395	-2.167638	0.411655	0.700588	0.142139	-0.054496
	(0.75593)	(0.24083)	(0.02931)	(1.40550)	(1.46973)	(8.34345)	(0.15720)	(0.38117)	(0.12109)	(0.10695)
	[0.52138]	[0.35161]	[2.84149]	[0.48492]	[0.37721]	[-0.25980]	[2.61863]	[1.83797]	[1.17382]	[-0.50952]
@TREND(80)	-0.017981	-0.002669	-0.002626	-0.028045	-0.025340	-0.008212	-0.012581	-0.021534	-0.004459	0.002270
	(0.02762)	(0.00880)	(0.00107)	(0.05135)	(0.05370)	(0.30483)	(0.00574)	(0.01393)	(0.00442)	(0.00391)
	[-0.65107]	[-0.30331]	[-2.45215]	[-0.54616]	[-0.47191]	[-0.02694]	[-2.19050]	[-1.54630]	[-1.00778]	[0.58090]
R-squared	0.679559	0.527259	0.379553	0.479845	0.473313	0.247967	0.297818	0.477348	0.252082	0.310232
Adj. R-squared	0.429748	0.300343	0.081738	0.230171	0.220503	-0.113008	-0.039229	0.226476	-0.106919	-0.020856
Sum sq. resids	53.19814	5.399386	0.079998	183.9057	201.0975	6480.726	2.300658	13.52637	1.365082	1.064952

S.E. equation	1.458741	0.464732	0.056568	2.712237	2.836177	16.10059	0.303358	0.735564	0.233673	0.206393
F-statistic	1.919685	2.323586	1.274459	1.921887	1.872209	0.686937	0.883611	1.902751	0.702176	0.937006
Log likelihood	-60.31197	-16.84495	63.18378	-83.87957	-85.57753	-151.5607	-0.636236	-34.29371	9.281400	13.99881
Akaike AIC	3.858525	1.570787	-2.641252	5.098925	5.188291	8.661089	0.717697	2.489143	0.195716	-0.052569
Schwarz SC	4.418752	2.131014	-2.081025	5.659152	5.748518	9.221316	1.277923	3.049370	0.755943	0.507658
Mean dependent	-0.202871	-0.008212	0.019744	0.282873	0.289474	0.132257	0.144558	0.115417	0.033603	-0.029336
S.D. dependent	1.662118	0.555596	0.059032	3.091225	3.212374	15.26134	0.297578	0.836342	0.222101	0.204274

Determinant resid covariance (dof adj.)	1.60E-07
Determinant resid covariance	2.43E-09
Log likelihood	-162.2892
Akaike information criterion	15.90996
Schwarz criterion	21.94317
Number of coefficients	140

Diagnostics

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 01/17/22 Time: 04:19
Sample: 1980Q1 2019Q4
Included observations: 157

Lags	LM-Stat	Prob
1	41.44842	1.0000
2	131.7356	0.0684

Probs from chi-square with 100 df.

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 01/17/22 Time: 04:27
Sample: 1980Q1 2019Q4
Included observations: 157

Joint test:

Chi-sq	df	Prob.
2538.789	2750	0.9982

Individual components:

Dependent	R-squared	F(50,106)	Prob.	Chi-sq(50)	Prob.
res1*res1	0.128160	0.311640	1.0000	20.12118	0.9999
res2*res2	0.129440	0.315214	1.0000	20.32207	0.9999
res3*res3	0.130527	0.318259	1.0000	20.49276	0.9999
res4*res4	0.145472	0.360902	0.9999	22.83912	0.9997
res5*res5	0.139507	0.343703	1.0000	21.90252	0.9998
res6*res6	0.139433	0.343491	1.0000	21.89091	0.9998
res7*res7	0.216932	0.587300	0.9812	34.05832	0.9587
res8*res8	0.172909	0.443200	0.9991	27.14667	0.9966
res9*res9	0.186932	0.487407	0.9973	29.34828	0.9913
res10*res10	0.190276	0.498175	0.9965	29.87330	0.9894
res2*res1	0.129207	0.314564	1.0000	20.28556	0.9999
res3*res1	0.132902	0.324936	1.0000	20.86555	0.9999
res3*res2	0.134131	0.328406	1.0000	21.05852	0.9999
res4*res1	0.124326	0.300991	1.0000	19.51914	1.0000
res4*res2	0.123630	0.299068	1.0000	19.40984	1.0000
res4*res3	0.133595	0.326892	1.0000	20.97436	0.9999
res5*res1	0.121361	0.292823	1.0000	19.05372	1.0000
res5*res2	0.118480	0.284937	1.0000	18.60135	1.0000
res5*res3	0.131312	0.320462	1.0000	20.61602	0.9999
res5*res4	0.142552	0.352453	1.0000	22.38064	0.9997
res6*res1	0.126629	0.307376	1.0000	19.88072	1.0000
res6*res2	0.117814	0.283122	1.0000	18.49682	1.0000
res6*res3	0.253114	0.718450	0.9033	39.73883	0.8504
res6*res4	0.155413	0.390103	0.9998	24.39987	0.9991
res6*res5	0.160559	0.405490	0.9997	25.20774	0.9987
res7*res1	0.163332	0.413859	0.9996	25.64305	0.9983
res7*res2	0.146096	0.362715	0.9999	22.93709	0.9996
res7*res3	0.128416	0.312352	1.0000	20.16125	0.9999

res7*res4	0.187767	0.490088	0.9971	29.47941	0.9908
res7*res5	0.185505	0.482839	0.9975	29.12422	0.9920
res7*res6	0.214140	0.577680	0.9839	33.61993	0.9635
res8*res1	0.137202	0.337121	1.0000	21.54067	0.9999
res8*res2	0.119804	0.288555	1.0000	18.80923	1.0000
res8*res3	0.127599	0.310074	1.0000	20.03301	1.0000
res8*res4	0.163101	0.413160	0.9996	25.60678	0.9984
res8*res5	0.160157	0.404281	0.9997	25.14465	0.9987
res8*res6	0.254412	0.723394	0.8986	39.94273	0.8448
res8*res7	0.139004	0.342265	1.0000	21.82363	0.9998
res9*res1	0.198742	0.525840	0.9937	31.20252	0.9829
res9*res2	0.186904	0.487320	0.9973	29.34400	0.9913
res9*res3	0.160400	0.405013	0.9997	25.18286	0.9987
res9*res4	0.222060	0.605146	0.9753	34.86344	0.9487
res9*res5	0.222302	0.605995	0.9750	34.90144	0.9482
res9*res6	0.229367	0.630984	0.9645	36.01056	0.9316
res9*res7	0.158042	0.397940	0.9998	24.81256	0.9989
res9*res8	0.201213	0.534025	0.9926	31.59047	0.9805
res10*res1	0.147174	0.365854	0.9999	23.10638	0.9996
res10*res2	0.159786	0.403166	0.9997	25.08639	0.9988
res10*res3	0.188078	0.491088	0.9970	29.52825	0.9907
res10*res4	0.138665	0.341296	1.0000	21.77045	0.9998
res10*res5	0.145136	0.359926	0.9999	22.78632	0.9997
res10*res6	0.155372	0.389981	0.9998	24.39340	0.9991
res10*res7	0.236770	0.657669	0.9500	37.17291	0.9106
res10*res8	0.189182	0.494643	0.9968	29.70154	0.9900
res10*res9	0.149573	0.372866	0.9999	23.48299	0.9995

VEC Residual Normality Tests

Orthogonalization: Residual Correlation (Doornik-Hansen)
Null Hypothesis: residuals are multivariate normal
Date: 01/17/22   Time: 04:36
Sample: 1980Q1 2019Q4
Included observations: 157

Component	Skewness	Chi-sq	df	Prob.
1	-0.352780	3.366149	1	0.0665
2	-0.566793	8.092308	1	0.0044
3	0.079208	0.178137	1	0.6730
4	-0.722958	12.35740	1	0.0004
5	-1.057990	22.74980	1	0.0000
6	0.169625	0.809111	1	0.3684
7	3.734509	101.3960	1	0.0000
8	-2.267776	61.53403	1	0.0000
9	-1.260825	29.39570	1	0.0000
10	0.086148	0.210619	1	0.6463
Joint		240.0892	10	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	9.466371	106.5121	1	0.0000
2	12.57261	160.6523	1	0.0000
3	10.97726	152.5525	1	0.0000
4	9.431466	74.03646	1	0.0000
5	12.29679	89.71075	1	0.0000
6	15.59468	261.6462	1	0.0000
7	40.22364	1.667193	1	0.1966
8	24.18025	70.48820	1	0.0000
9	18.98441	196.1311	1	0.0000
10	10.83286	149.0125	1	0.0000
Joint		1262.409	10	0.0000

Component	Jarque-Bera	df	Prob.
1	19.18783	2	0.0510
2	18.71446	2	0.0599
3	152.7307	2	0.0000
4	86.39386	2	0.0000
5	112.4606	2	0.0000
6	12.45835	2	0.0917
7	103.0632	2	0.0000
8	132.0222	2	0.0000
9	225.5268	2	0.0000
10	14.22381	2	0.0641
Joint	1502.499	20	0.0000

Roots of Characteristic Polynomial
Endogenous variables: MUP INTR INF MSGR
LOG(EXR) LOG(K) LOG(L) LOG(WOP) LOG(FFR)
Exogenous variables: C
Lag specification: 1 2
Date: 10/31/22 Time: 06:16

Root	Modulus
0.904444 - 0.015032i	0.904568
0.904444 + 0.015032i	0.904568
0.679765 - 0.377884i	0.777738
0.679765 + 0.377884i	0.777738
0.403626 - 0.582701i	0.708840
0.403626 + 0.582701i	0.708840
-0.303907 - 0.547414i	0.626117
-0.303907 + 0.547414i	0.626117
0.171218 - 0.550625i	0.576631
0.171218 + 0.550625i	0.576631
-0.510342	0.510342
0.447880	0.447880
-0.051064 - 0.141436i	0.150372
-0.051064 + 0.141436i	0.150372

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial