Industrial Sector Performance and Economic Growth in Nigeria

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Certification

This is to certify that **Adesoji Ebeneser OLOGBENLA** with matriculation number **LCU/PG/001122** carried out this research work titled "Industrial Sector Performance and Economic Growth in Nigeria" in the Department of Economics and Development Studies, Faculty of Management and Social Sciences, Lead City University Ibadan, Oyo State for the award of Master of Science (M.Sc.) Degree in Economics and that this has into been previously submitted.

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Dedication

This research work is dedicated to God Almighty.

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Abstract

The predictive power of the industrial sub-sector output on economic growth is a topical issue, especially with the outbreak of the COVID-19 pandemic and its effects on global industrial and economic activities. As such, this research study investigates the links between industrial sector performance (proxy by mining and quarrying, manufacturing, electricity, gas, stream and air conditioner, water supply, sewage and waste management, and construction sector) and economic growth measured by real income per capita growth in Nigeria. A secondary dataset from 1981 to 2021 which was sourced from Central Bank of Nigeria Statistical Bulletin and World Development Indicators was used in the study. The study employs the autoregressive distributed lag (ARDL) to investigate the short run and long run estimates. The study discovered that manufacturing sector performance significantly and positively impacted economic growth measured by income per capita both in short and long run. Similarly, mining and quarrying sector performance positively impacted economic growth in the short and long run. Also, the performance of electricity, gas, stream and air conditioner sector only influenced income per capita positively in the short run. Meanwhile, construction and water supply, sewage and waste management sector performance adversely affect short run economic growth in Nigeria. The study concludes that manufacturing sector act as the main industrial sector component that drives the per capita output growth of Nigeria compared to other sub-sectors. Thus, it is imperative to harmonize industrial policies with adequate infrastructural development to drive the industrial sub-sector towards enhancing economic growth in Nigeria.

Keywords: Industrial output, manufacturing, economic growth.

Word counts: 249.

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Chapter One

Introduction

1.1 Background of the Study

Economic growth is the most powerful tool for reducing poverty and improving living conditions in developing countries[1]. Cross-country research and country case studies show that rapid and sustained growth is critical to making faster progress toward the Sustainable Development Goals and achieving the three most important targets i.e. put an end to poverty, end hunger by achieve food security, and ensure god health and well-being. Growth has the potential to create virtuous circles of prosperity and opportunity[2]. Strong growth and job opportunities increase parents' incentives to invest in their children's education by sending them to school. This could result in the emergence of a powerful and growing group of entrepreneurs, putting pressure on the government to improve governance. Strong economic growth thus promotes human development, which in turn advances economic growth[1]. Industrialization has been widely described and accepted as a catalyst for economic growth and development all over the world, and industrial development is extensively regarded as a critical tool for accelerating economic growth and development[3].

Furthermore, the industrial sector provides a medium for producing goods and services, facilitating good jobs, and earning handsome rewards for economic agents. For instance, the manufacturing industry is defined as the production of goods for sale or use through the use of tools, machines, labour, chemical and biological formulation[4]. The sector combines human handicraft and high technology by transforming unfinished goods into finished goods. In today's modern economy, the development of industries (industrialization) is heavily reliant on technological advancements in productive strategies. This simply means that an economy is transitioning from a traditional low-production system to a modern mass-production system, which involves a more efficient and automated system through the sustained and deliberate combination and application of management techniques, appropriate technology, and other resources that promote high-tech production techniques[5]. It has been argued that industrial capacity, technological innovation, and enterprise development, rather than vast human resources and levels of endowed material resources, are the fastest channels for rapid sustainable growth and development in any economy[6]. Furthermore, some scholar proposed that industrial development is concerned with the use of modern equipment, machines, and technology in the production of goods and services, as well as the alleviation of human suffering and the improvement of societal welfare[7]. As a result, industrial sector processes necessitate the development of managerial and entrepreneurial skills, as well as high-tech innovations that frequently promote large-scale productivity and better living conditions.

Many African countries including Nigeria have faced difficulties as a result of the slowing and volatility of primary commodity prices. Economic growth in the region has slowed slightly in recent years as a result of the end of the upward trend in commodity prices[8]. Following that, both export revenues and investment have decreased. The manufacturing sector is thought to be a potential solution for reviving the economy. The reliance on primary commodities should be reduced, and more emphasis should be placed on the manufacturing sector, which has the potential to revitalize industries, thereby providing better opportunities for growth and development. According to the African Development Bank, African countries should strengthen their resilience to economic shocks and diversify their economies in order to transition to a new growth path driven by productivity and innovation[8]. The manufacturing sector has the potential to be a source of innovation by employing highly skilled laborers who can develop new technologies, thereby increasing productivity. This is critical as the world enters the Fourth Industrial Revolution[9].

According to the Kaldorian theory, the manufacturing sector is critical for economic growth; however, data shows that the manufacturing to GDP ratio has been declining in most African countries[10]. The development of the manufacturing sector has been identified as one of the key policy tools for any economy's structural transformation and is regarded as the best option for achieving full employment and economic growth[11]. Three laws represent Kaldor's hypothesis. To begin with, manufacturing is a major contributor to economic growth. Second, increases in manufacturing productivity have a positive impact on output in the manufacturing sector (Verdoorn's law), and finally, output growth in the manufacturing sector is linked to increases in productivity in other sectors of an economy[10].

Because of the industrial sector with other sectors, a thriving industrial sector is an important driver of long-term job creation and economic growth in any country. Furthermore, due to its labor-intensive nature, the sector may be more effective as a source of job creation in any given economy than other sectors. High growth rates in African countries over the last few decades have not resulted in the expected level of unemployment and poverty reduction. According to the African Development Bank, most countries' employment growth rates have been significantly lower than economic growth rates in recent years[8]. Thus, industrialization has the potential to reduce high unemployment, which is a major cause of high poverty rates and lack of development in African countries like Nigeria.

Globally, growth and development are inextricably linked with the industrial sector (comprised of mining and quarrying; manufacturing; electricity, gas, stream and air conditioner; water supply, sewage and waste management; and construction sectors), as industrialization is viewed as a critical means of accelerating them. According to some scholars, the manufacturing sector provides the standard for the production of goods and services, as well as the subsequent creation of jobs and the reward for factors of production[13]. Industrialization in a modern economy is dependent on technological advancement, a transition from a long-established mode of production to a mass-production system that typically employs automated systems and administrative regulation that encourages high output[14]. During the 2016 global financial crisis, Nigeria experienced a GDP growth rate of -6.617%, which increased to 0.806% in 2017 and 2.208% in 2019[15]. Nigeria's GDP growth rate fell to 1.87% in July 2020 as a result of the Covid-19 pandemic and subsequent lockdown in March 2020. In the second quarter of the same year, the growth rate fell to -6.10%, and in the third quarter, it fell to -3.62%. Nigeria's manufacturing sector is currently improving, with the manufacturing PMI rising to 50.2 index points[16].

The business cycle of every sector can be grouped into four stages, which are: expansion, peak, contraction, and depression. When the economy contracts and falls for at least two quarters, such economy is in a recession[17]. Because of the slowing rate of the Nigerian economic growth, it is necessary to investigate whether industrial (comprising mining and quarrying; manufacturing; electricity, gas, stream and air conditioner; water supply, sewage and waste management; and construction) sector output growth significantly predicts a recession in Nigeria and proposing a solution to that effect becomes imperative. Past studies have only provided insights into the manufacturing sector and its relationship to Nigeria's economic growth with lesser attention on other sub-sectors (like mining and quarrying; electricity, gas, stream and air conditioner; water supply, sewage and waste management; and construction)[3,18]. Despite the sub-sector's significant role in stimulating economic growth, few studies have been conducted to determine how their performance affects Nigeria's economic growth. It is against this backdrop that this study examines the effects of industrial sector performance on the economic growth of Nigeria.

1.2 Statement of Problem

Many structural issues limit Nigeria's economic potential, including inadequate infrastructure, tariff and non-tariff trade barriers, investment barriers, a lack of confidence in currency valuation, and limited foreign exchange capacity. One of the major causes of Nigeria's economic problems was the government's reliance on crude oil as a major source of revenue. With the current drop in crude oil prices, it is becoming increasingly difficult for the government to finance the nation's budget comfortably and meet the expectations of the masses[19]. Another source of the country's economic problems is the level of corruption and greed among some people. Corrupt practices have eaten deeply into the country. Nigeria has been ranked as the world's 27th most corrupt country at various times[20]. There are many politically motivated and terrorism-related violent activities today. The Boko-Haram saga in the North East has brought the region's economy to a halt. According to reports, Boko Haram's activities have resulted in the deaths of many people and the plight of others.

Nigeria has implemented a number of strategies aimed at increasing sector productivity in order to spur economic growth and development. For example, during the First National Development Plan (1962-1968), the country implemented an import substitution industrialization strategy with the goal of reducing the volume of finished goods imports and encouraging foreign exchange savings by producing some of the imported consumer goods locally[16]. During the Second National Development Plan period (1970-74) that coincided with the oil boom, the country consolidated her import substitution industrialization strategy. Because of the economy's weak technological foundation at the time, manufacturing activities were so organized that they relied on imported inputs. However, the earnings from oil exports were severely reduced as a result of the collapse of the world oil market in the early 1980s. As a result, the emerging import-dependent industrial structure became unsustainable due to a lack of earnings from oil exports, which could not adequately cover the massive import bills[13].

Various policy measures, such as the 1982 stabilization measures, the restrictive monetary policy, and stringent exchange control measures, all failed to improve the situation. This resulted in the establishment of the Structural Adjustment Programme (SAP) in 1986[16]. One of the primary reasons for the implementation of SAP was to reduce the economy's reliance on crude oil as the primary foreign earner by promoting non-oil exports, particularly manufactured goods. However, the manufacturing sub-contribution sector's to GDP has been steadily declining due to a variety of factors. As a result, the government implemented a slew of new economic policies. Despite the government's efforts, the performance of the industrial sectors remains unclear[13].

Weak industrial performance can be traced to three main factors. First, domestic policy failure both at the design and implementation phases contributed to low industrial performance. For instance, the adoption of import substitution industrialization (ISI) during post-independence era is hinged on infant industry argument and promotion of industrialization. While the ISI strategy made economic sense and actually led to an increase in the share of the manufacturing value-added in GDP and low performance in other sub-sectors, its implementation left more void to be filled. Government provided support to domestic industries but did not establish performance targets that they should meet in order to continue receiving support. Second, infrastructural constraints have also contributed to the low level of industrial development in Nigeria albeit it made giant strides in Information and Communication Technology. The sector faces serious challenges ranging from poor road networks to erratic power supply and lack of portable water. A study posited that part of the menace of infrastructure in Nigeria is that expenditure patterns are highly asymmetric as it tends towards investment with little or no provision for maintenance[21]. Final, structural factors are suggested as one of the reasons for weak manufacturing performance in Nigeria. For instance, the limited size of domestic market coupled with the prevalence of trade barriers in other economies meant that domestic firms could not really exploit economies of scale associated with large scale production and hence lacked competitiveness in international markets.

Despite the various ills that plague the Nigerian industrial sector, empirical studies have paid little attention to the effects of industrial sub-sector output performance on the overall economic activities of Nigeria. In light of this, a number of empirical studies on the impact of the industrial sector on economic growth have been conducted, for example, by perusing different macroeconomic dynamism in Nigeria and across borders[22,23,24,25,26,27,28,29,30]. However, little attention has been paid to the short and long run effects of industrial sub-sector performance on Nigerian economic growth. Hence, this study seeks to fill the gap in knowledge by examining the short run and long run impact of industrial sub-sector performance on economic growth in Nigeria.

1.3 Research Questions

The following research questions were answered in this study:

I. How has the mining and quarrying sector performance impacted the Nigerian economicgrowth?

II. What is the impact of the manufacturing sector performance on economic growth in Nigeria?

III. To what extent has the performance of electricity, gas, stream and air conditioner industry influenced the economic growth in Nigeria?

IV. What is the effect of water supply, sewage and waste management sector performance on economic growth in Nigeria?

V. In what way does the construction sector performance affect the economic growth in Nigeria?

1.4 Objectives of the Study

The broad objective of this study is to investigate the relationship between industrial sector performance and economic growth in Nigeria. More specifically,the study aims:

I. To examine the impact of mining and quarrying sector performance on the Nigerian economicgrowth?

II. To determine the impact of the manufacturing sector performance on economic growth in Nigeria.

III. To investigate how the performance of electricity, gas, stream and air conditioner industry influenced the economic growth in Nigeria.

IV. To evaluate the effect of water supply, sewage and waste management sector performance on economic growth in Nigeria.

V. To examine the effect of construction sector performance on economic growth in Nigeria?

1.5 Hypotheses

Following the research objectives of this study, the following research hypotheses tested are:

$H_0$1: There is no significant relationship between mining and quarrying sector performance and economicgrowth in Nigeria.

$H_0$2: Manufacturing sector performance has no significant impact on economic growth in Nigeria.

$H_0$3: The performance of electricity, gas, stream and air conditioner sector has no significant effect oneconomic growth in Nigeria.

$H_0$4: Water supply, sewage and waste management sector performance has no significant impact on economic growth in Nigeria.

$H_0$5: There is no significant relationship between construction sector performance and economicgrowth in Nigeria.

1.6 Significance of the Study

Nigeria is the most populated African country and the seventh most populated country in the world with an estimated population over 200 million and one of the largest producers of crude oil in the world[31]. The country's oil reserves make her the sixth most petroleum-rich country in the world, and the most affluent in Africa. Nonetheless, rather than moving towards the direction of self-reliance and development in view of its vast human, mineral and natural resources deposits, the country has come to beknown as one of the most miserable places in the world and ranked low in terms of development indicators by major global institutions. In 2018, the United Nations (UN) report ranked Nigeria as the 158th out of 189 countries and territories in Human Development Index while the World Bank revealed that the majority of Nigerians are poor with 84.5% ofpopulation living on less than $2 per day[32,33]. The paradox of poverty amidst plenty still remains unraveled in the Nigerian case.

Therefore, owing to the precarious state of the economy, it has been observed that the industrial sector can remedial the situation. Manufacturing sector being the major factor of industrialization and real growth of any economy plays a vital role in providing intermediate inputs, finished goods, increasing foreign exchange earnings, positive spillover effects and employment opportunities. Further, the industrial sub-sectors output are the major driver of economic growth in most developing countries. However, most African countries including Nigeria, despite several industrial policies implemented by various policy makers within the pre-structural adjustment programme (SAP) era such as Import Substitution Industrial Strategy (ISI) and the export promotion Strategy implemented in the post- SAP era and the Small and Medium Enterprise Scheme, have witnessed slow growth. The developmental success of the East Asian Tigers also called the emerging economies or newly industrialized countries (NICs) has been attributed to the not to their natural resource endowment but to transformation of their manufacturing sector, which has further culminated into rapid economic growth for these countries. However, Nigeria though endowed with natural resources is still bedeviled with the problems of widespread poverty, low standard of living and rising unemployment coupled with her over dependency on the oil sector and the drastic neglect of other sectors such as agriculture, mining, and the manufacturing sector there also exist the challenge of rather slow technological progress.

Hence, these precedents reveal that there is still a large vacuum to be filled in the Nigerian industrial sector especially in terms of empirical research in order to revamp the sector and diversify the economy. Thus, the motivation of this study is to peruse the industrial sector's activities over the years by examining it impact on the level of growth in the economy.

1.7 Scope of the Study

This study examines the impact of industrial sector performance (comprising mining and quarrying sector, manufacturing sector, electricity, gas, stream and air conditioner sector, water supply, sewage and waste management sector and construction sector) on economic growth in Nigeria. The study covers the period of 41 years that is, between 1981 and 2021 as the period signifies major structural and economic reforms in the Nigerian economy. The choice of this period is explained by the availability of data and policy changes over the past years. The study covers the beginning of the Structural Adjustment Programme (SAP) to the Economic Recovery Growth Plan era. More so, the scope of study relatively extends over a long period of time and it portrays major trends of industrial sector activities and macroeconomic dynamics over the period of coverage.

1.8 Limitation to the Study

This study investigates the effects of industrial sector performance on the Nigerian economy between the periods of 1981 and 2021. The choice of this study period is based on the availability of data from national and international institutions. The secondary source of data employed in this study is not within the control of the researcher. It therefore becomes difficult for the user to read accurately how industrial sector policy affects the overall economic activities in the country. The study is limited to industrial sector policies formulation and implementation on one hand and income per capita on the other and how has the sector's policies faired so far in the growth and development of Nigerian economy.

1.9 Operational Definition of Terms

Industrial Sector: It comprise of a segment of the economy made up of businesses that aid other businesses in manufacturing, shipping or producing their products.

Industrial Sector Performance: It assesses the success rate of economic and industrial policy objectives of an economy in terms of its sub-sector and overall output growth.

Mining and Quarrying Industry: It involves the extraction of minerals occurring naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas).

Manufacturing Industry: These are industries transforming goods, materials or substances into new products.

Electricity, Gas, Stream and Air Conditioner Industry: The industry involves the distribution of electricity, gas, steam, hot water and the like in industrial parks or residential buildings. It also includes the operation of electric and gas utilities, which generate, control and distribute electric power or gas.

Water Supply, Sewage and Waste Management Industry: This is defined as the industries that deal with the collection, treatment, and reuse of wastewater at or near the point of waste generation.

Construction Industry: This is an industry involved in providing residential and nonresidential facilities of a country. It is a subset of the assembly industry that connects different useful components, not to a single individual but the country at large.

Economic Growth: It is defined as the increase or improvement in the inflation-adjusted market value of an economy's goods and services over a given time period.

Income Per Capita: This is a measure of how much money income is earned per person in a country or region. Per capita income is used to calculate the average per-person income for a region and to assess the population's standard of living and quality of life.

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Chapter Two

Literature Review

2.1 Conceptual Review

2.1.1 Industrial Sector Performance

Industrialization can be described as a process in which a society undergoes the development of industry on an far-reaching scale and changes from a primarily dominant agrarian society intoone based on manufacturing of goods and services, culminating into a socioeconomic order in which industry is dominant[1]. In other words, industrialization is defined as a wide-ranging organization of an economy for the purpose of large scale manufacturing which involves the replacement of crude hand equipment bymachine and power tools, and the use of technology to solve evolving societal challenges[2]. More so, a country is said to industrialized if a greater part of its technological acquisitions and machinery originates from the country that is, improvement in domestic technological capability as opposed to dependence on foreign technology[3,4]. Industrialization is defined as a process by which a country reduces the relative importance of its extractive industries and attempts to increase the relative importance of the secondary and tertiary sectors[5]. This process will culminate in the expansion of a country's manufacturing activities, generation of electricity and improvement in communications network.

From the aforementioned definitions, industrialization can be used to mean a state in the economic and productive life of a nation where industrial activities are noticeably robust with a performing manufacturing sector that is able to produce goods, including machinery, for internal consumption as well as for export, and in the process generate employment for its citizens and increase general well-being[6]. Hence, the manufacturing sector is the major driver of the level of industrialization and real growth in any economy as it performs the role of providing intermediate inputs, finished goods, increasing foreign exchange earnings and employment generation. Furthermore, the composition of Nigeria manufacturing sub-sector has evolved through the passage of time and it is divided along thirteen products which include: oil refining, cement, food, beverage and tobacco, textile, apparel and footwear, wood and wood products, chemical and pharmaceutical products, non- metallic products, plastic and rubber products, electrical and electronics, basic metal, iron and steel, motor vehicles and assembly, and others[7].

Similarly, industrialization has been seen as a veritable channel of attaining the lofty and desirable conception and goals of improved quality of life for the populace. This is because; industrial development involves extensive technology-based development of the productive (manufacturing) system of the economy. In other words, it could be seen as a deliberate and sustained application and combination of suitable technology, management techniques and other resources to move the economy from the tradition low level of production to a more automated and efficient system of mass production of goods and services[8]. Inthe words of an author[10], he suggests that industrialization is the conversion, on a large scale of raw materials to finished products ready for public consumption or for further use in industry. It involves not only the processing of raw materials into finished products but also the preservation,packaging and storage of the finished products. Industrialization ensures that the finished products are in a quality acceptable to the consuming public. Raw materials for industry basically are agricultural produce or mined ore.

2.1.2 Various Drawbacks Facing the Nigerian Industrial Sector

The goal of Nigeria's industrialization is to accomplish international competitiveness in the production of specific processed and manufactured goods by effectively linking industrial activity, domestic and international trade, and service activity. In this regard, a variety of steps were taken. These steps include; privatization & commercialization, devaluation & convertibility of naira, reduction in custom tariffs, easy access for foreign direct investments, foreign technology, and institutional support measure. Notwithstanding, over the past three decades since the implementation of these policies, there has not been significant improvementin the industrial output in Nigeria[9].

The average capacity utilization which signals a major indicator of the performance of the industrial sector has continuously deteriorated. In 1981, the average capacity utilization stood at 73.3%, it fell precipitously to 42% in 1991 and 36.1% in 2000 but rose significantly to 53.84% in 2008 and stood at 56.22% in 2010[10]. Meanwhile, in 2010, the manufacturing sector accounts for only 4.16% of real GDP and has been able to create little job opportunities while in 2013 the industrial productivity amounted to ₦13,014.51 billion with a Gross Domestic Product at 2010 constant prices at ₦63, 218.72 billion[11]. Therefore, several challenges have been elicited for this precarious situation facing the Nigerian industrial sector. These drawbacksare discussed below:

i. **Low Capital Accumulation:**

Insufficient financing has made it seemingly difficult to make investments in modern technology, information and communication technology and human resources development which are pivotal in decreasing cost of production, improving the level of productivity and increasing international competitiveness. In the same vein, inadequate investment can be traced to commercial banks "reluctance to lend to manufacturers due to the misalliance between the short-term nature of banks" funds and the medium to long term nature of funds needed by industries[12]. Also, the high risk attached to the Nigeria business environment discourages the flow of funds to industrial sector as commercial banks prefer investment withlow risk to high risk investments.

ii. Inadequate Investment in Social Overhead Capital

This implies inadequate provision of infrastructural facilities which facilitate the ease of doing business and enhance productivity. Poor infrastructural facilities as evidenced in erratic power supply, uninspiring telecommunication and transportation systems are major setbacks experienced in the industrial sector with a declining productivity[13]. In a bid to provide these facilities by the industrial sector, their efficiency has continued to wane.

iii. Increased Cost of Production

This can be traced to increased poor social amenities, high interest rate and exchange rates have culminated into exorbitant prices of manufactured products, low effective demand for goods and low capacity utilization.

iv. Low level of Technology and Technical Know-how

This can be held to be the major constraining factor to the performance of the industrial sector as developments in technology and innovations are essential for industrialization in our contemporary world. New methods and processes of doing old things, artificial intelligence has revolutionized the industrial sector in industrialized countries. Sadly, industries in Nigeria cannot afford modern technologies that can reduce processes. This is also evidenced in frequent breakdown of machines and reduction in capacity utilization. Hence, low technology is accountable for the inability of indigenous industries to produce capital goods such as spare partsand machinery which is majorly imported resulting in low value added and productivity.

v. Low Level of Capacity Utilization

Capacity utilization which means the extent to which a nation or industry uses it installed productive capacity is at low ebb in Nigeria industrial sector. The average utilization rate between 2000 and 2004 was 43% which is tantamount to underutilization of resources. Epileptic power supply, inadequate funds to purchase factor inputs, and falling demand for manufactured products are some major factors responsible for the low level of capacity utilization.

vi. Corruption and Red Tapism

Corruption and red tapism pose as a challenge to the effectiveness of industrial policy and industrial sector performance in Nigeria as this raises the cost of doing business, frustration of project implementation processes and approval of white elephant projects which is more often than not void of good feasibility study. This could also be said of budgetary articulation and implementation[14].

2.1.3 Industrial Policy Regimes in Nigeria

Nigeria's industrial policy is inherently regimented. This stems mainly from vicissitudes of economic and political ideology coupled with confusion and lack of proper understanding of these and how they should be tailored in matters of policy design, the perspective of the government on the state of economic fundamentals and the trend of global politics and economics especially the influence they exert on the national economy. Therefore, three regimes of industrial policy have been recognized in Nigeria.

The first regime extended over the period of 1960 to 1985 which encapsulates the period of civil war and oil boom in Nigeria. The second regime ranged between 1986 and 1998. This period was characterized by deepen economic crisis and the institutionalization of austerity measures also the period elicited the implementation of different economic reforms. Lastly, the third regime between 1999 and 2014 heralded a renewed interest in political and economic democracy with hope keened on the efficacy of free-market system. These regimes are discussed explicitly below.

2.1.2.1 Regime 1: 1960-1985

This period is characterized with four National Development Plans with a view to achieving economic growth, and modernized socio-political development. This can be summarized in Table 2.1.

Table 2.1: Regime 1 of Nigeria's Industrial Policy (1960-1985)

Policy Description	Focus	Ideological Basis	Key Instruments
The regime is charged with the responsibility of putting theeconomy on the path of growth, development industrialization. This is accompanied by increased public sector's size while creating opportunities for private sector.	• Improved economicgrowth. • Ensuring equal society • Improving standardof living. • Building a self-reliant economy. • Diversification ofthe economy. • Promotion ofexports. • Import substitution. • Infant industryargument.	SocialistOriented Mixed economy	• Trade policy accompanied by trade restriction and ban; • Indigenization of foreign companies; • Differing agriculturalpolicies ensuring food security; • Development of industries and infrastructural development. • Banking sector reforms.

Source: Nwaogwugwu *et al*. (2016).

As pointed out earlier, the Development Plans served as a major driver of industrial policy exposition during this period. The first plan (1962-1968) is viewed as a wish, the second plan (1970-1974) is viewed as a radical and revolutionary plan while the third plan (1975-1980) is a continuation of the previous plan and the fourth plan (1981-1985) is considered to be miserable. Hence, the country did not record significant achievement and progress. Moreover, there are two important industrial policies adopted for the purpose of fostering industrialization between 1960 and 1985 in Nigeria which are the Import-Substitution Industrialization Policy (ISIP) and Indigenization Policy.

i. Import Substitution Industrialization Policy (1963-1966)

The import substitution strategy (ISI) policy advocates for the establishment of domestic production facilities in order to encourage local manufacturing and the building of local capacity for new incremental local demand. To this effect, the ISI in Nigeria seeks to achieve four underlying objectives as highlighted in Table 2.2.

Table 2.2: Import Substitution Industrialization Policy in Nigeria (1962-1968)

Objectives	Policy Attempts	Neglects
• Mobilization of national economic resources. • Initiate the take-off of industrialization in Nigeria. • Encourage indigenization. • Stimulate start-ups and growth of industries.	• Commissioning of energy projects. • Industrial infrastructure initiatives. • Financial infrastructure initiatives.	• Domestic factor endowmentwas ignored. • Management of technology transfer was ignored.

Source: Chete *et al*. (2014).

According to a study, the assemblage of items rather than manufacturing dominatedthis policy in Nigeria[15]. Although, in terms of job creation the achievement was relatively good however it contribution to fixed capital formation was not encouraging. Also, importation of goods was not curtailed and foreign exchange savings was not enhanced. Therefore, the ISI policy did little to bring desired changes to technological capacity and manufacturing prowess in Nigeria[16].

ii. Indigenization Policy (1972-1981)

Nigeria neglected the ISI policy for the indigenization policy upon the realization that shallow technical and manpower capability account for a greater proportion of the country's manufacturing poor performances. Hence, it is perceived that a public-sector led industrial strategy would make a difference. Importantly, this perception engendered two decrees which include; Nigeria Enterprises Promotion Decree in 1972 and Nigeria Enterprises Promotion Act in 1977 respectively. Consequentially, this policy seeks to enhance local industrial growth and inter-industry linkages through public-sector led machineries.

Table 2.3: The Indigenization Policy (1972-1981)

Objectives	Policy Attempts	Neglects
• Upgrading local production of intermediate and capital goods • Stimulating industrial linkages • Boosting public-sector led industrialization	• Increase in investment outlay • Expansion of public investment in heavy industries • Expansion of private investment in consumer industries.	• Neglect of local capacity • Neglect of industrial structure and planning.

Source: Chete *et al*. (2014).

However, the indigenization policy was short-lived because of two major barriers that is, poor capacity for technology adoption and implementation and poor industrial structure and planning. This necessitated the adoption of an alternative industrialization policy in Nigeria[16].

iii. Stabilization Era (1981-1985)

In the midst of falling crude oil prices and political instability, this plan was meant to replace the defunct plan. It had five policy objectives.

Table 2.4: Stabilization Era (1981-1985)

Objectives	Implementation	Barriers
• Diversification of the economy • Ensuring a self-sufficient and self-reliant economy • Reduce the propensity of importation • Mitigate raw material gap • Integration of rural development of small holder production	There was no solid implementation of the plan resulting in setback.	• Fierce international competition from imports • Over-valued exchange rates • Inadequate raw materials • Expansion of the oil sector.

Source: Chete et al. (2014).

Accordingly, raw material trap and backward integration pressure coupled with poor technological and man-power capacity elicited the need for improved local sourcing of manufacturing inputs[16].

2.1.2.2 Regime 2: 1986-1998

Importantly, the period, 1986, is greeted with the adoption of ill-fated, obnoxious, and mishandled Structural Adjustment Programme (SAP) or what can be described as medium term framework designed to tackle inherent weaknesses in the economy.

i. Structural Adjustment Programme Era (1986-1993)

The Structural Adjustment Programme is built on the cardinals of liberal thinking; the medium- term strategic elements of SAP included enterprises rich in market-driven orientations, state-led development with specified roles in the management of the economy, and a reorientation of the structure of the Nigerian economy for the purpose of driving production efficiency. Its objectivesare further enumerated in the Table 2.5.

Table 2.5: Structural Adjustment Programme Era (1986-1993)

Objectives	Policy Attempts	Neglects
• Promotion of non-oil based investments • Building a private sector led industrial development • Enhancing industrial sector efficiency • Promoting foreign direct investment into the economy • Boosting the demand for local raw materials and intermediate goods • Efficient utilization of indigenous technology.	• Implementation of the National Science and Technology policy • Establishment of Standard Organisation of Nigeria (S.O.N) • Establishment of the Raw Materials Research and Development Council.	• Neglect of local capacity building • Neglect of industrial structure andplanning • Little attention was paid to domestic innovation.

Source: Chete *et al*. (2014).

In order to achieve these objectives, science and technology gained ascendancy among other factors that can support the actualization of industrialization in Nigeria. In specific terms, complementary policies were enacted to backup industrial policy between 1986 and early 1990s.

ii. Period of Guided Deregulation (1994-1998)

The attempt by government to improve industrial output was beset by political upheaval and limited access to formal banks. Importantly, Nigeria embraced a macro-institutional approach towards privatization, which was designed to spur private-sector led industrialization in the country. This comprises a dual exchange rate system and other trade policies such as the duty drawback and or suspension scheme, Business Permits (BP), and Expatriate Quota. In 1995, the country promulgated two additional decrees namely; the Foreign Exchange (Monitoring and Miscellaneous Provision) Decree No. 17 and the Nigerian Investment Promotion Decree No 16 with a view to reducing the proportion of inefficient public sectors, and boost the import of raw material, as well as the import of intermediate goods. The Nigeria Export-Import Bank (NEXIM) also came to being during this period for the purpose of fostering access to credit, risk facilities, and inspire indigenous participation in the exploration ofexport market opportunities[17].

2.1.2.3 Regime 3: 1999-2014

The era is characterized by global resurgence of aggressive capitalism and a shift in the nation's economic ideology. Also, it witnessed the emergence of economic reform agenda, which comprises the following: the National Economic Empowerment and Development Strategy (NEEDS) in 2003 and 2007, Seven-Point agenda, Vision 2010, the Nigeria Vision 20:2020, Transformation Agenda of 2011, and the National Industrial Revolution Plan of 2014. However, amidst these plans, NEEDS is outstanding for three reasons which include; it is a people's plan for prosperity, it coordinates actions both the federal and state levels and it is practicable[18]. It also has to be pointed out that the government made tremendous efforts to boost the physical and financial infrastructure through the establishment of the Bank of Industry (BOI), Small and Medium Industries Equity Investment Schemes (SMIEIS), Small and Medium Enterprises Development Agency (SMEDAN).

i. National Economic Empowerment and Development Strategy (NEEDS)

Strategically, NEEDS focuses on value reorientation, poverty alleviation, wealth creation and employment generation through people empowerment, private enterprises promotion and changing the structure and dynamics of governance in Nigeria.

Table 2.6: Industrial Policy under NEEDS (2005)

Objectives	Policy Attempts	Drawbacks
• Acceleration of the pace of industrial development • Boosting value chains • Stimulating knowledge driven factor productivity • Encouraging forward and backward linkages • Promotion of innovation	• Establishment of well-organised SME sector • Improve the international competitiveness of Nigerian manufacturing • Development of science and engineering infrastructure	• Infrastructural constraints • Weak institutional supports • Poorly designed incentives and implementation • Weak intergovernmental coordination • Weak educational institution-industry collaborations.

Source: IMF (2005).

Despite NEEDS' emphasis on selected sectors like health, education, electricity, roads and water,it seeks to give special support to Small and Medium Scale Enterprises in the country.

ii. National Industrial Revolution Plan (NIRP)

The National Industrial Revolution Plan (NIRP) was inaugurated in February 2014 and it signals Nigeria's roadmap for "real" industrialization. In the light of this, it represents a living vision and an ambitious plan that seeks to achieve ₦5 trillion worth of manufacturing revenue within the next 3-5 years. The Federal Government of Nigeria designed the NIRP in 2014 with two focal points; comprehensiveness and ambitious. The NIRP is comprehensive and holistic as it is built on the linkages and partnership between the government and the larger private sector. Similarly, the NIRP 2014 is also ambitious as it seeks to accelerate industrialization by increasing manufacturing activities in Nigeria.

Furthermore, the NIRP was carefully drafted with emphasis on six strategic industries. That is, it seeks to foster the exploration of the country's comparative advantage in agro allied & agro processing, metal & solid mineral processing, oil and gas, construction, light manufacturing and services, enlarging existing industrial scope, and accelerating manufacturing sector expansion. Beyond these, the policy objectives of NIRP are hinged on economic incentives, policy and business coordination and vibrant private sector participation[19].

2.1.4 Multinationals and Industrial Policy in Nigeria

The inflow of multinational corporations to countries has been on the increase in the last few decades. This is usually encouraged through tax holidays, tariff exemption and subsidies for infrastructure because these countries expect that foreign firms will enable domesticenterprises to become technologically more advanced. In 1998, 103 countries offered tax concessions to foreign companies that set up production or other facilities within their borders. China, for example offered significantly low corporate tax rates to foreign companies located there until 2008 and continued to subsidize infrastructure investments for multinationals locating in foreign enterprise zones[19]. A study has referred to this as "nothing other than industrial policy…while economists are generally skeptical of the benefits of intervening in trade, they are much more likely to have interventionist priors when it comes to foreign investment"[20]. The implication of the foregoing for Nigeria is that industrial policies are most successful when they are associated with increasing exposure to trade (such as export promotion) are likely to be more successful than other types of interventions (such as tariffs or domestic content requirements). If such measures are part of a broader effort to achieve technological upgrading then they may be helpful, whereas if they are implemented in isolation they are likely to fail[21].

A scholar provided a framework for effective industrialization to include the meta-level elements of systemic competitiveness[22]. It posits that provided macro-economic conditions and physical infrastructure are appropriate, the progress of industrial development is a function of three sets of factors: incentives, capabilities and institutions.

Multinational investment policy interacts in close relationship with industrial development strategies[23]. Generally, countries promote or restrict foreign investment within this context, depending on the industry in question and on the role they want to assign to foreign investment in domestic development. In some countries documents stating guidelines and other official operations with respect to foreign investment have been produced. Some guidelines specifically address the use of investment promotion instruments (e.g. the Republic of Korea's

"FDI Promotion Policy in 2011", the Malaysian Industrial Development Authority's Invest in Malaysia" policy, the Thailand Board of Investment's "Investment Promotion Policy for Sustainable Development", and the Nigerian Investment Promotion Commission). These guidelines may also relate to the interpretation of national laws and policies at the sub-national level[23].

One direction taken by the implementation of such industrial cum FDI policies is to "nudge" foreign investors into certain areas of the economy that are deemed necessary for national development. The "targeting policies, often galvanized by the investment promotion agencies (IPAs), may be reinforced through linkage programmes, the promotion of industrial clusters, and incubation programmes to maximize spillover effects and other benefits. Policy measures taken usually involve imposition of both limitations and incentives on foreign ownership and investments for special development choices. Another aspect where Multinational Corporations could affect industrial policy is through the complex governance structure of these firms. An international organization highlighted the initial patterns of international production and operations of multinational corporations to include "FDI (equity holdings), creating an internalized system of affiliates in host countries owned and managed by the parent firm"[23]. The report also noted that recent international business spectrum have also included externalization of activities throughout their global value chains. These involve building of interdependent networks of operations involving both their affiliates and partner firms in home and host countries.

2.1.5 Nigeria's Industrial Performance in the Context of Globalisation, 1986 to Date

As the acceleration of globalisation create a new economic environment, the Nigerian government since 1986, has reorganized its industrial support system in line with international standard. As such economic openness has been adopted with regard to industrial production, trade and finance. A variety of measures were taken in these directions. These include; privatization and commercialization, devaluation and convertibility of Naira, reduction in customs tariffs, open door policy towards foreign direct investments, foreign technology, and institutional support measure among others. Excessive importance and interference of the government in economic activities started to be questioned.

The process of industrial openness culminated the more towards privatization and commercialization of public enterprises to promote industrial efficiency. Privatization is presumed to be the key in dismantling, reversing monopolies, reversing the nation's vicious circle of under development, corruption, debt burden and promoting corporate governance efficiency and better management of public enterprises.

In the wake of these developments, there has been a considerable pressure of the government to facilitate the creation of suitable environment for the free flow of direct foreign investment. To take on this challenge policy, measures were adopted to enhance the promotion of inflow of foreign investment and technology acquisition. Foreign investors are now free to establish and solely own companies in the country and can alsoremit their profit 100% back home. The procedures for investment in the non-oil sectors of the economy have been streamlined. In order to facilitate the inflow of foreign direct investment promotion, council has been mandated to negotiate with large internationally known firms and to expedite clearance required.

As a measure of encouraging capital inflows, the exchange market was deregulated to enhance access of firms to foreign exchange. To improve the nation's investment climate, the country hasimproved its infrastructural facilities. Moreover, the entire infrastructural sector, especially, telecommunication and every sector is being thrown open to private sector including foreign capital. Another important measure by the Nigerian government to enhance industrial performance is devaluation of the Naira. At the macroeconomic level, devaluation and full convertibility of the Naira on trade account were embarked upon to bring it nearer to acceptable parity and make Nigerian products cheaper in export market and enhance greater profitability of Nigerian manufactured export.

Another salient feature of the measures for industrial openness is the complete overhauling of industrial rested policies. The government has overhauled industrial related policies to enhance efficiency and investment. These industry – related changes include: granting of special tax incentives and tax holidays to enable local industries build up enough funds for expansion purposes and to encourage firms to invest in economically disadvantaged areas; reduction of corporate income tax rate; partial abolition of import license scheme, adoption of numerous export promotion schemes, simplification of industrial licensing except for a short list of industries related to strategic security and environmental reason. Other aspects of industrial openness that have greatly influenced industrial competitiveness is the special attention for growth of exports in the agricultural and allied sectors where export promotion incentives were put in place. These include, establishment of an Export Credit Guarantee and Insurance Scheme designed to assist Nigeria companies to compete effectively in the international market. A compensatory scheme was also put in place to enable exporters of locally manufactured goods to claim subsidies from the export adjustment scheme fund. Similarly, an export expansion fund was introduced to provide cash inducements for exporters.

The government also provides institutional support to the industrial sector through the following institutions: the Industrial Development Coordination Committee (IDCC); the Industrial Data Bank; the Raw Materials Research and Development Council (RMRDC); the Project Development Agency (PRODA); the Federal Institute of Industrial Research, Oshodi (FIIRO); the Export Processing Zone (EPZ), Calabar; Nigeria Investment Promotion Council (NIPC). The recently launched Small and Medium Industries Equity Investment Scheme (SMEIC) operated by Nigerian Banks was charged with the task of solving the problems of industrial underdevelopment and small financing of the sector. However, despite the increased governmentsupport of the informal sector over the years, the sector still remains weak[24].

2.2 Theoretical Review

In the theoretical fronts on industrialization and economic growth, numerous economists and researchers have attempted to offer explanation on the relationship between the duos. Hence, amidst the contentious debates on the subject, this present study seeks to review relevant theorieson the subject matter. The following theories are reviewed; Kaldor-Verdoorn's theory, Big Push theory, Rostow's theory of Development, Veblen's Technology and Institutional Change Perspective and Growth theories.

2.2.1 Kaldor-Verdoorn's Laws

The first law of Kaldor postulates that manufacturing industry is the engine of economic growth; the second law is that manufacturing productivity growth triggers output growth in manufacturing assuming a contemporaneous relationship and the existence of structural dynamic among manufacturing growth and macroeconomic variables known as Verdoorn's law and lastly the third law is that manufacturing growth induces productivity growth[25,26]. Kaldor originally tested these laws using data for twelve Organisations for Economic Community and Development (OECD) countries over the period 1953/1954 to 1963/1964. Here, Kaldor was following a long line of classical economic analysis, and was particularly influenced by the work of Professor Young who emphasized the overall macroeconomic spillover effects of the extension of manufacturing industry, the so called macroeconomic of linkages[27].

Kaldor features the phenomenon of increasing returns to scale as distinct from neoclassical economists. According to Kaldor, the income elasticity of demand for manufacturing good is much higher than that for agricultural good. This is the demand-side of Kaldor's law. On the supply side, Kaldor asserts that manufacturing was regarded to have greater potential for productivity growth[28]. Kaldor's first law states that the relationship between manufacturing production and economic growth is not only causal but also runs from the growth of manufacturing production to growth of GDP. The second law of Kaldor, also known as Kaldor-Verdoorn's law. Verdoorn has proved the presence of the positive relationship between labour productivity growth and output growth in a number of countries[29]. Kaldor-Verdoorn's law posits that there is a positive relation between the growth rate of labour productivity in manufacturing and manufacturing output growth. Kaldor-Verdoorn's law provides evidence of the existence of increasing return to scale within industry.

The fundamental argument is that an industrial growth in output causes growth in productivity that allow for fall in production cost and in prices, increasing the competition power of a country or region. This implies that there is positive relation between labour factor productivity and manufacturing production as a result of the increasing return to scale in industry[30]. Kaldor's third law posits that the surplus labour in nonmanufacturing sector keeps the wages from rising in the manufacturing sector increases in productivity. Increased labour demand in the manufacturing sector would decrease surplus labour in the nonmanufacturing sector, so productivity would increase[30].

2.2.2 Big Push Theory

Another theory on industrial development is the "Big Push" theory popularly associated with two notable scholars, postulates that a comprehensive programme is needed in form of a high minimum amount of investment to overcome the obstacles to development in an underdeveloped economy and to launch it on the path of progress[31]. The theory further states that successful industrialization of an underdeveloped economy requires a holistic and simultaneous approach; First there must be training of labour on skill acquisition, capacity building, simultaneously infrastructure facilities like good transport system, power and steel, telecommunication system etc. must be developed. Secondly other sectors of the economy like agriculture must be modernized to promote both forward and backward linkages[32]. This assertion is the view of the proponents of the doctrine of the "balanced growth". The theory of balanced growth advocated by Rodenstin- Rodan, Ragnar Nurkse and Arthur Lewis, which states that simultaneous investment in all sectors of the economy, is actually necessary to ensure that all sectors grow in unison because this will ensure economic growth and development. It also means the development of the manufacturing and agriculture sector[33].

Notably, the nucleus of the big-push theory lies in the benefits of external economies through the simultaneous installation of a host of technically interdependent industries. However, before this can be possible, we have to overcome the economic indivisibilities by moving forward by a certain "minimum indivisible step". This can be realized through the injection of an initial big dose of a certain size of investment. According to Rodan, he identified three kinds of indivisibilities and externalities with a view to specify the areas where big push needs to be applied. They include; indivisibilities in the production function, huge investment in providing infrastructural facilities, indivisibility of demand that is complementarity of demand and indivisibility of savings that is, kink in the supply of savings[34].

2.2.3 Rostow's Theory of Development

Rostow's theory was developed by Walt Whitman Rostow, an American economist and political theorist[35]. It is a variant of the stages theories of development propounded by a group of economists and historians who view the process of economic growth and development as involving consecutive stages governed by conditions characterizing such stages, and transition from one stage o the next. Diverse approaches were invented to describe the stages and their dynamics. The theory describes the stages of development as consisting five stages namely; the traditional stage, the precondition for take-off stage, the take off stage, the drive towards maturity stage and the age of mass consumption[36].

According to the proponent, the traditional stage is typified by rural primitive economy with little contacts, communication and interactions among people and products across geographical borders. The precondition for take-off stage creates the infrastructure for education and energy, transportation, communications and interactions, as well as the demolition of cultural barriers to modern production and movements of people and products. The take-off stage comprises the mobilization of considerable investment resources necessary for modern industrial development. Subsequently, the economy will drive towards maturity and then reach the final stage of high mass consumption[37]. However, the Rostow's stages of development have been criticized in some respects especially as the theory is unable to provide explanation on why some societies stagnate at one stage. It also failed to specify precisely what is practically required to transit from one stage to another[38].

2.2.4 Veblen's Technology and Institutional Change Perspective

This theoretical thought is an offshoot of the work of the Norwegian-American evolutionary economist and sociologist, Thorstein Bunde Veblen. The central theme of Veblen's idea is the concept of human instincts, comprising the "instinct of idle curiosity" and the "instinct of workmanship". Veblen noted that these instincts are basic to the development of a society when given the opportunity to flourish[39]. The "instinct of idle curiosity" is the urge within humans to want to know things and those who heed the instinct can lead humankind to the most substantial achievement of the race. Thus, the desire to seek, accumulate and systematically organize information is an inherent trait of the human mind; a trait singularly well adapted to the investigation of technology[39]. However, for these instincts to bloom, the carriers must be accorded the opportunity in form of employment to put them into use. By contrast, when the carriers of these instincts are not engaged as a result of unemployment, they are deprived of the opportunity to exercise their creative instincts. Consequently, these instincts are stunted resulting in lack of human development and its associated corollary of impeding societal and industrial development.

In Veblenian theoretical formulation, the bearer of change is to be located among other things, in technology. To the extent, a society will be able to overcome its industrialization quagmire if there is a proper application of the "instinct of idle curiosity" by the technologically adept. Through the exercise of technological power, Veblen argued, societies will proceed to a more harmonious and blissful world with technology. In addition, the author opined that technology advancements can help to drastically reduce corruption that pervades human society[39]. Although, the theory has been criticized as a technological utopia[39], it has however been applauded for emphasizing the role of human faculty in the process of industrialization. By way of application, it may be argued that part of the reasons for the failure of industrial development in Nigeria is the high rate of low capacity utilization and administrative bottlenecksat all levels coupled with lack of infrastructural facilities[40].

2.2.5 Economic Growth Theories

2.2.5.1 The Neo-classical growth theory

The Neo-classical growth theory which is jointly attributed to Solow and Swan describes how a steady rate (equilibrium) of economic growth is attained through the application of the requisite quantities of labour, capital and technology[41,42]. This theory succeeded capital fundamentalism which was the dominant construct for explaining economic growth in the 1950s and 1960s, capital fundamentalism suggests that rapid capital accumulation is key to increasing the rate of economic growth[43]. According to Solow and Swan, the first of the three underlying assumptions of the neo-classical growth theory is that capital accumulation, and its use are significant drivers of economic expansion. Additionally, it is predicated on the idea that the interaction of capital and labour determines the degree of economic output. The third assumption is that technology raises labour productivity to the point where it boosts economic output.

The Solow-Swan model is based on a Cobb-Douglas type production function in which output at time t denoted by Y_t is a function capital at time t as denoted by K_t, labour at time t denoted by L_t and technological advancement at time t denoted by A_t. Solow drew up his model based on the assumptions of constant and diminishing returns to scale, perfect competition and information and the absence of externalities. The Solow-Swan model is therefore thus:

$$Y_t = f(K_t, A_t L_t) \tag{2.1}$$

According to the model, technological advancement results in greater productivity per unit labour which in turn increases output. Given that labour is limited by the number of workers in an economy as well as the number of jobs available, economic output based on increase in labour alone is therefore limited. The model, however, considers the economic benefits related to technological advancement as infinite thereby resulting exponentially high economic growth; thus the model considers technological advancement as exogenous with economic output growing in tandem labour whilst holding output per capital constant (in the absence of technological advancement).

According to one study, the neoclassical growth model is consistent with empirical evidence in some cases, citing research that concludes that differences in measured inputs explain less than half of the large cross-country differences in GDP per capita, which is consistent with the model[44]. The study also notes how, empirically, there is a strong positive correlation between savings rates and growth across countries; this finding contradicts the neoclassical growth theory, which suggests that there would be no correlation if countries were in a steady state. The notion that only productivity growth can lead to long-run economic growth, as proposed by neoclassical growth theory, is also challenged by two scholarswho go on and propose a set of six stylized facts which they state is an attempt to address the neoclassical growth theory's narrow focus on physical capital alone[45].

Therefore, it is impossible to analyse the long-term economic impacts of the development of the JSE within the framework of neoclassical growth theory. The theory is inapplicable since it views savings growth as exogenous and there is empirical data that shows a positive association between the savings rate and economic growth. In the end, it was determined that the neoclassical growth theory was unsuitable as a theoretical foundation for the study because it was unable to explain how savings and investment rates, or how policies and regulations that affect savings and investment rates, can affect the steady-state growth rate.

2.2.5.2 The Endogenous growth theory

The endogenous growth theory (also known as the new growth theory) is essentially an extension of the neoclassical growth theory and a return of sorts to capital fundamentalism[46].The early proponents of the endogenous growth theory put forth a model in which investments in research and development and human capital have a greater impact on economic growth than do government policies, which have the potential to increase a country's growth rate by encouraging more intense competition, which in turn stimulates the development of new products and processes[47,48,49]. So, according to the endogenous growth paradigm, technical development is both endogenous and essential to economic growth. According to the endogenous growth theory, population growth, increased investment, and savings are other factors that can be used to explain technological advancement. Government policies can also have an impact on these factors, which in turn can affect the rate of long-term growth by affecting the capital accumulation process (physical and human capital),creation and diffusion of new knowledge through software development and other information technology provided services[49].

This endogenous theory can, therefore, be used to explain the financial development and economic growth nexus given how savings and investment within this theory catalyse economic growth.According to Howitt first version of the endogenous growth model is the *AK* model which is expressed as follows:

$$Y_t = AK_t \tag{2.2}$$

The *AK* model which was earlier expressed by Frankel is also based on a Cobb Douglas type production function in which output at time t denoted by Y_t is a function of the level of technological advancement, which is positive constant denoted by A and the physical and human capital at time t denoted by K_t[43,44]. The model suggests that aggregate output function can exhibit constant and sometimes increasing marginal product of capital due to the some of the capital accumulated capital accruing to firms being in the form of intellectual capital. Intellectual capital, according to Frankel, results in technological advancement which in turn offsets the tendency for marginal product of capital to diminish[48].

As shown by Howitt, the *AK* model demonstrates how long-run economic growth rate depends on an economy's savings rate[49]. According to the *AK* model, if an economy saves a fixed portion of output, s, and given a fixed rate of depreciation, δ, the rate of aggregate net investment is as follows:

$$\frac{dK}{dt} = sY_t - \delta K_t \qquad (2.3)$$

When considered in conjunction with equation (2.2) the growth rate, g, is presented as follows:

$$g \equiv \frac{1}{Y}\frac{dY}{dt} = \frac{1}{K}\frac{dK}{dt} = sA - \delta \qquad (2.4)$$

According to equation (2.4), an increase in the savings rate, s, results in a permanent increase in the growth rate, g. Based on the analysis of the *AK* model of endogenous growth a positive correlation between stock market development and economic growth should exist. The study is therefore couched in the endogenous growth theory, this is also despite the absence of any indication in the theory of the direction of the relationship between these two variables[49].

2.3 Empirical Review

On the empirical front, few empirical studies have been carried out on the impact of industrial sector performance on economic growth in which both time series data and panel data studies have been utilized in order to explain this relationship. Two researchers investigated manufacturing sector and economic growth in selectedAfrican countries from 1990 to 2017 by employing system generalized method of moment[50]. The study reveals that manufacturing value added has a positive effect on economic growth in African countries. A study examined the relationship between exchange rate volatility and manufacturing sector's performance in Ghana[51]. Adopting the Autoregressive Distributed Lag (ARDL) technique, the findings from the study revealed that the growth of manufacturing sector is positively related to exchange rate but negatively related to import. This result corroborates the findings of another study on manufacturing sector in Nigeria[52]. Similarly, some scholars evaluated the effect of industrial development on the Nigeria's economic growth between 1973 and 2013 using ordinary least square (OLS) approach[53]. The result reveals that industrial output does not significantly influence economic growth.

More so, two authors investigated the impact of fiscal policies on the output of the manufacturing sector in Nigeria between 1990 and 2010[54]. The empirical result show that a negative significant relationship exist between government tax revenue and manufacturing sector output in Nigeria while a significant positive relationship exist between government expenditure and the output of the manufacturing sector in Nigeria. Likewise, a scholar evaluated the determinants of manufacturing sector performance and its contribution to gross domestic product in Nigeria from 1981 to 2015 using Vector Error Correction Model (VECM)[55]. The empirical result reveals that while labour force, gross fixed capital formation and exchange rate showed a positive long run relationship with the manufacturing value added, the average manufacturing capacity utilization, lending interest rate and government expenditure showed a long run negative relationship.

Similarly, two researchers examined the service sector performance, industry and growth in Nigeria between 2010 and 2016 using ordinary least square approach[56]. The results indicate that while both services and the industrial sector contributed significantly to the economic growth (GDP) of Nigeria, some subsectors that is public administration, professional, scientific and technical services, transport (road, rail, pipeline, air, water), utilities (electricity, gas, and water supply, sewage, waste management) were found to be insignificant.

In addition, two authors evaluated financial sector and manufacturing sector performance in Nigeria from 1981 to 2016 using vector error correction model (VECM) and Dynamic Ordinary Least Square (DOLS) method[57]. The long run results show that manufacturing output has positive significant relationship with credit to private sector, prime interest rate, market capitalization and employment in manufacturing sector. On the other hand, broad money is not significant as deposit liability shows a significant long run negative relationship. Similarly, some scholars examined foreign direct investment and industrial sector performance by assessing the long run implication on economic growth in Nigeria between 1981 and 2015 using vector autoregressive (VAR) approach[58]. The empirical results show that FDI had a slight significant positive impact on GDP, while Industrial Sector Output had a small significantpositive impact on GDP at present, with a negative relationship observed at previous periods.

More so, a study investigated manufacturing subsector and economic growth in Nigeria between 1981 and 2013 using error correction model[59]. Empirical results show that manufacturing output, capital and technology were the major determinants of economic growth. Results also confirm that quality of institutions and labour force does not exert impact on economic growth. A study investigates the links between industrial development and unemployment in Nigeria from 1985 to 2016 using autoregressive distributed lag (ARDL)[60]. The result reveals that a negative and elastic relationship exists between industrial output and unemployment. The result suggests that the unemployment rate is very sensitive to changes in the industrial sector in Nigeria.

In addition, a study examined exchange rate volatility and the performance of manufacturing sector in Nigeria from 1981 to 2016 using autoregressive distributed lag (ARDL)[61]. Findings from the study revealed that the impact of exchange rate volatility on manufacturing sector's performance is positive and significant both in the long-run and short-run. Also, the study found that the impact of exchange rate on manufacturing sector's output is positive but not significant in the long-run while its impact is negative and significant in the short-run.

A study examines the extent at which the Nigeria's manufacturing output influence economic growth[62]. The ARDL model and OLS technique were employed in the empirical assessments, using a quarterly data series sourced from the CBN statistical bulletin for the periods of 2010-2020. The study finds that manufacturing output positively and significantly affects growth in Nigeria and therefore can significantly predict further economic growth and, by extension, recession in Nigeria.

Two researchers investigated the relationship between inflation, manufacturing output, and economic growth using the Ordinary Least Square and Error Correction techniques and found that increase in manufacturing productivity tends to raise economic growth[63]. Similarly, a scholar investigates the relationship between the manufacturing sector and the economic growth in the countries of ECOWAS using the first law of Kaldor[64]. The study employed a Granger causality approach and found that manufacturing output has a causal relationship with economic growth while non-manufacturing validates Kaldor's first law. In the same vein, a study used annual data between 1981 and 2016 with ARDL as the model[65]. It found a positive, though insignificant, relationship between Nigeria's manufacturing sector output and economic growth. Also, a study employed a disaggregated approach to the manufacturing sector and Nigeria's economic growth nexus using the VECM approach, and found that the refining sector, among other manufacturing sub-sectors, had an effective influence on Nigeria's long-term economic growth[66].

The study tests whether the industrial sector development is a veritable tool in addressing the issue of unemployment in the long run for the Nigerian economy[67]. The study makes use of the Autoregressive Distributed Lag model to determine whether industrial development is a veritable tool in addressing the issue of unemployment in the long run. The findings show that an inverse and elastic relationship exists between industrial output and unemployment. This suggests that the unemployment rate is very sensitive to changes in the industrial sector in Nigeria.

The study examines the industrial sector's influence in driving Nigeria's economic growth from 1981 to 2019[68]. Industrial sector was disaggregated into the mining and quarrying industry, construction industry, and manufacturing industry. The study utilized the ordinary least squares (OLS) and autoregressive distributed lag (ARDL) approaches. The OLS result indicated that all the selected three components of the industrial sector (manufacturing, construction, mining and quarrying) exerted a positive and significant effect on economic growth in Nigeria. The mining and quarrying industry was identified as the main industrial sector component that drives the growth of the Nigerian economy compared to the other two sub-components. The ARDL bounds test reported evidence of a long-run equilibrium relationship, while the error correction model reflected that 20.88% of the short-run distortions in economic growth are corrected annually for the restoration of long-run equilibrium to be achieved. A study assesses the impact of the manufacturing sector on economic growth in 37 African countries. The study employs the System-GMM Model for the period between 1990 and 2017[69]. The results show that manufacturing value has a positive effect on economic growth in African countries.

2.4 Theoretical Framework

The theoretical foundation of this study hinges on the endogenous growth theory as it proposes that industrial sector can boost overall output growth rates as it transform raw materials into finished products. Under the neoclassical model, industrial sector performance enhances human and physical capital, but in the long run, these affect only the equilibrium factor ratios, not the growth rate, though there will be transitional growth effects in general. Meanwhile, according to the endogenous growth model, the industrial sector will have an impact on the long-run growth rate. Furthermore, for simplicity, the production function is written in Cobb-Douglas form, with constant returns to scale in capital and labour. Before other variables are integrated, the function is presented as follows:

$$Y_t = AK_t^{\alpha} L_t^{\beta} e_t^{\mu_t} \quad (2.5)$$

Where: *Y* denotes economic performance, *A* is the constant term, *K* denotes fixed capital and *L* represents labour supply. α and β are the respective coefficients of capital and labour with values ranging between 0 and 1, implies $0 < \alpha, \beta < 1$. *t* is time period and μ is error term. This theoretical framework elucidates that industrial sector development apply a considerable effect on output growth. As this study examines the causation between industrial sector performance and economic growth, it integrates industrial sub-sector output variables in equation (2.6) gives equation (2.5) as follows:

$$Y_t = AK_t^{\alpha} L_t^{\beta} IS_t^{1-\alpha-\beta} e_t^{\mu_t} \quad (2.6)$$

The variables remained as earlier defined and the term *IS* is used to denote industrial sector performance. Taking the natural logarithm of the above equation, it becomes:

$$\ln Y_t = \ln A + \alpha \ln K_t + \beta \ln L_t + (1-\alpha-\beta) \ln IS_t + \mu_t \quad (2.7)$$

Note that $1-\alpha-\beta = \phi$ and $\ln e = 0$. The above equation represents the theoretical model of this study.

2.5 Summary of Gaps in Literature

Evidence from the review of relevant literatures revealed varying results especially between industrial sector performance and economic growth. However, no or little attention has been paid to examining the impact of industrial sector on economic growth especially the short run and long run impact of the industrial sector output performance on real gross domestic product proxy for economic growth in Nigeria. Hence, this current study aims to fill the gap in knowledge and also extend the scope of study of past literatures concerning the subject matter.

Although the industrial sector's potentials as a critical engine in economic growth are compelling, literature reveals divergent results on the relationship between industrial performance and economic growth. However, these studies have only focused on the sub-sectors of industrial output, with little attention paid to other sectors. Furthermore, previous studies used various methodologies. The studies present contradictory findings on the relationship between industrial performance and output growth. Furthermore, few country-specific studies on the relationship between industrial sector performance and economic growth in Nigeria have been conducted. The results of the studies are inconclusive, which motivates further research. Thus, this study examines the effects of industrial sub-sector performance on economic growth in Nigeria, the most populous black nation in the world.

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Chapter Three

Methodology

The methodology of this study is presented in a way to explain the empirical modeling and estimation approaches used to estimate the parameters. The discussion under this chapter is divided into five different sections. Thus, the empirical modeling is specified in line with the specific objectives of the study. For the second section, the theoretical expectation is presented to explain the a'priori presumptions between the variables in the model specifications. The third part provides the estimation techniques used to estimate the coefficients while the last part of the study provides data sources and measurements.

3.1 Model Specification

3.1.1 Empirical Model of Economic Growth and Mining and Quarrying Performance

Following the theoretical framework of the endogenous growth theory developed in the last section of the previous chapter and the models of previous studies, the adapted model relating to the links between mining and quarrying sector performance and economic growth including the relevant control variables (i.e. investment, exchange rate, inflation, and interest rate) is stated in a functional form as[1,2,3,4]:

$$gdppc_t = f(mqs_t, inv_t, exc_t, \inf_t, \text{int}_t) \tag{3.1}$$

In mathematical form, it becomes:

$$gdppc_t = \varphi_0 + \varphi_1 mqs_t + \varphi_2 inv_t + \varphi_3 exc_t + \varphi_4 \inf_t + \varphi_5 \text{int}_t + e_t \qquad (3.2)$$

Where: *gdppc* denotes gross domestic product (GDP) per capita growth; *mqs* is a mining and quarrying sector output; *inv* represents capital investment measured by gross fixed capital formation to GDP; *exc* is exchange rate; *inf* is inflation; *int* denotes interest rate; φ_0, φ_{1-5} are parameters; *t* denotes time; and *e* is error term.

3.1.2 Empirical Model of Manufacturing Sector Performance and Economic Growth

For this sub-section, the study adapts and modifies the model of previous studies to investigate the impact of manufacturing sector performance on economic growth in Nigeria[3,4]. The model specifies economic growth measured by income per capita (*gdppc*) as a function of manufacturing sector performance; including other controlling variables like investment (*inv*), exchange rate (exc), inflation (inf), interest rate (int). Consequently, the model is stated functionally as:

$$gdppc_t = f(man_t, inv_t, exc_t, \inf_t, \text{int}_t) \qquad (3.3)$$

In mathematical form, it becomes:

$$gdppc_t = \gamma_0 + \gamma_1 man_t + \gamma_2 inv_t + \gamma_3 exc_t + \gamma_4 \inf_t + \gamma_5 \text{int}_t + \nu_t \qquad (3.4)$$

Where: *gdppc* denotes gross domestic product (GDP) per capita growth; *man* is a manufacturing sector output; *inv* represents capital investment measured by gross fixed capital formation to

GDP; *exc* is exchange rate; *inf* is inflation; *int* denotes interest rate; γ_0, γ_{1-5} are parameters; *t* denotes time; and ν is error term.

3.1.3 Empirical Model of Economic Growth and Electricity, Gas, Stream and Air Conditioner Industry

To investigate the impact of electricity, gas, stream and air conditioner industry on economic growth, the study modelled economic growth as a function of electricity, gas, stream and air conditioner industry; including the relevant control variables i.e. investment (*inv*), exchange rate (exc), inflation (inf), interest rate (int). The baseline model for the time series analysis is specified below as:

$$gdppc_t = f(egsa_t, inv_t, exc_t, \inf_t, \text{int}_t) \tag{3.5}$$

To estimate the parameters, the function is transformed into the generalized equation below as:

$$gdppc_t = \theta_0 + \theta_1 egsa_t + \theta_2 inv_t + \theta_3 exc_t + \theta_4 \inf_t + \theta_5 \text{int}_t + \upsilon_t \tag{3.6}$$

Where: *gdppc* denotes gross domestic product (GDP) per capita growth; *efsa* is a electricity, gas, stream and air conditioner industrial output; *inv* represents capital investment measured by gross fixed capital formation to GDP; *exc* is exchange rate; *inf* is inflation; *int* denotes interest rate; θ_0, θ_{1-5} are parameters; *t* denotes time; and υ is error term.

3.1.4 Empirical Model of Economic Growth and Water Supply, Sewage and Waste Management Industrial Performance

Following the theoretical framework of the endogenous growth theory developed in the last section of the previous chapter and the models of previous studies, the adapted model relating to the links between water supply, sewage and waste management sector performance and economic growth including the relevant control variables (i.e. investment, exchange rate, inflation, and interest rate) is stated in a functional form as[2,3,4]:

$$gdppc_t = f(wswm_t, inv_t, exc_t, \inf_t, \text{int}_t) \quad (3.7)$$

In mathematical form, it becomes:

$$gdppc_t = \pi_0 + \pi_1 wswm_t + \pi_2 inv_t + \pi_3 exc_t + \pi_4 \inf_t + \pi_5 \text{int}_t + e_t \quad (3.8)$$

Where: *gdppc* denotes gross domestic product (GDP) per capita growth; *wswm* is water supply, sewage and waste management sector output; *inv* represents capital investment measured by gross fixed capital formation to GDP; *exc* is exchange rate; *inf* is inflation; *int* denotes interest rate; π_0, π_{1-5} are parameters; *t* denotes time; and *e* is error term.

3.1.5 Empirical Model of Construction Sector Performance and Economic Growth

For this sub-section, the study adapts and modifies the model of previous studies to investigate the impact of construction sector performance on economic growth in Nigeria[3,4]. The model specifies economic growth measured by income per capita (*gdppc*) as a function of construction sector performance; including other controlling variables like investment (*inv*), exchange rate (exc), inflation (inf), interest rate (int). Consequently, the model is stated functionally as:

$$gdppc_t = f(con_t, inv_t, exc_t, \inf_t, \text{int}_t) \quad (3.9)$$

In mathematical form, it becomes:

$$gdppc_t = \lambda_0 + \lambda_1 con_t + \lambda_2 inv_t + \lambda_3 exc_t + \lambda_4 \inf_t + \lambda_5 \text{int}_t + v_t \quad (3.10)$$

Where: *gdppc* denotes gross domestic product (GDP) per capita growth; *con* is a construction sector output; *inv* represents capital investment measured by gross fixed capital formation to GDP; *exc* is exchange rate; *inf* is inflation; *int* denotes interest rate; λ_0, λ_{1-5} are parameters; *t* denotes time; and v is error term.

3.2 Theoretical Expectation

For economic growth model, the study expects a direct relationship between industrial sector performance and real income per capita growth. It means that the development of the industrial sector have high tendency of enhancing the overall economic activities which in turn improve the welfare of people residing in the country. Similarly, capital investment has positive level of association with the GDP per capita growth. In contrary, inflation rate and interest rate have indirect impact on the level of economic growth measured by the country's output per capita growth. This means that stability in general price have the chances of improving the welfare of people residing in an economy.

3.3 Estimation Approaches

Given the results of the unit root test, the study employed ARDL developed by notable econometricians[5]. ARDL was preferred to other techniques because ARDL estimation yields consistent estimates of the parameters when some are I(0) and I(1) and a long run relationship exists[5]. This means that the ARDL approach avoids the pretesting problems associated with standard co-integration, which requires that the variables be already classified into I(1) or I(0)[6]. According to the notable scholars, the ARDL approach requires two steps. In the first step, the existence of long term relationship among the variables is determined using F-test[5,6]. The second step of the analysis estimates the coefficients of the long run relationship and determines their values, followed by the estimation of the short run elasticity of the variables with the error correction representation of the ARDL model. The second step also determines the appropriate lag length selection of the independent variables.

The empirical models represent only the long run equilibrium relationship among the variables. However, the short run adjustment of inflation rate to changes in monetary policy instruments is crucial for further estimation in the dynamic error correction model. The error correction modelis shown below:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p-1} \alpha_i \Delta Y_{t-1} + \sum_{j=0}^{q-1} \beta_j \Delta X_{t-1} + \gamma ECM_{t-1} + \mu_t \qquad (3.11)$$

Where Δ represents the first difference operator and ECM represents the error correction term estimated from the equation; γ represents the speed of adjustment from the short run to the long run so as to obtain equilibrium in the case of shock on the system. Y_t is the dependent variable at time t, Y_{t-1} is the lag value of dependent variable, $\sum$ represents summation, X_t represents the explanatory variables at time t, β is the coefficient and μ is the error term. The first part represents the short run estimates of the model while the second part is the long run relationship between the variables. Based on equation on the ECM specification, equation (3.11) can be re-represented as:

$$\Delta gdppc_t = \delta_0 + \sum_{i=1}^{p-1}\delta_1 \Delta gdppc_{t-1} + \sum_{t=0}^{q-1}\delta_2 \Delta ino_{t-1} + \sum_{t=0}^{q-2}\delta_3 \Delta exc_{t-1} + \sum_{t=0}^{q-3}\delta_4 \Delta inv_{t-1} + \sum_{t=0}^{q-4}\delta_5 \Delta \inf_{t-1} + \sum_{t=0}^{q-5}\delta_5 \Delta \text{int}_{t-1} + \gamma ect_{t-1} + e_t \quad (3.12)$$

When estimating ARDL, it is vital to determine whether the variables are co-integrated or not. This is done by restricting all the estimated coefficients of the lagged level variables to be equal to zero (0). Hence, the null hypothesis of no co-integration is given as:

$$H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0 \quad (3.13)$$

The above null hypothesis is tested against the alternative hypothesis that is the presence of co-integration among the variables:

$$H_0 : \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0 \quad (3.14)$$

This estimation test is carried out by the means of F-statistics (Bound test) of ARDL and asymptotic non- standard distribution variables to determine whether the variables are I(0) or otherwise. If the computed F-statistics lies above the upper bound, then the null hypothesis is rejected and if otherwise, the null hypothesis is accepted. The hypothesis indicates that there is no long run relationship between dependent and the explanatory variables. Other diagnostic tests were conducted so as to validate the result obtained from the ARDL estimation.

A pre-estimation test was carried out before estimation the regression equation with ARDL estimators. The methods as well as some estimation criterion used in this research study are discussed below as follows:

1. **Unit root test**

The study deploys Augmented Dickey-Fuller (ADF) test to examine the stationarity of the time series and test the null hypothesis of unit root[7,8]. It is expected that the series do not contain unit root in order to find relationship among the variables in the long run. The test is carried out both at a level and first difference using 1 and 5% Mackinnon Critical value.

2. **Coefficient of determination (R^2)**

This shows the percentage of the total variation of the dependent variable that can be explained by the independent variables. In other words, it shows the extent to which the explanatory variables influence the dependent variable. Thus a high value of R^2 (50% or above) depicts that the explanatory variables influences the dependent variable to a high degree (there is goodness of fit) and vice-versa. If R^2 is very low, then a greater proportion of the regression line remains unexplained.

3. **F- Test (ANOVA)**

The F-Test basically looks at the significance of the model being stated in the research work conducted. The criteria to be employed would be to check the significance of the F-Test result at 5% which will be judged by its p-value i.e. our result should have a minimum of 5% probability that our estimates are not significantly different from zero in order to test the significance of our R^2 result. We would therefore reject the null hypothesis formulated and accept the alternative hypothesis that there is a considerable harmony between the independent variables and the dependent variables if the p-value is less than 5%.

4. **Cointegration Test**

The Bound ARDL Test is employed to evaluate the long run relationship among the series. The null hypothesis that is no cointegration will be tested. Hence, if the F-statistics is greater than the upper bound I(1), the null hypothesis is rejected while if the F-statistics is less than the upper bound I(1), the null hypothesis is accepted that is no cointegration among the series and if the value of F-statistics lies between the lower bound I(0) and upper bound I(1), the result is said to be inconclusive.

5. **Serial Correlation Test**

The study carries out post estimation checks in order to ascertain if there is correlation between the present and past error terms of the time series data and the validity of the results thereby avoid making wrong policy insinuations. The Breusch-Godfrey Serial Correlation LM test willbe used to test the null hypothesis that states that there is no serial correlation in the model. Hence, the study rejects the null hypothesis if the p-value is significant at 5%

critical value.

6. **Heteroscedasticity Test**

Also, the study carries out heteroscedasticity test to ascertain if the assumption of a constant variance is violated. Therefore, the Breusch-Pagan-Godfrey heteroscedasticity test was employed to test the null hypothesis that states that there is no heteroscedasticity in the model. Hence, the study rejects the null hypothesis if the p-value is significant at 5% critical value.

3.4 Sources of Data

This study examines the effect of industrial sector performance on economic growth in Nigeria for the period 1981 to 2021. The study uses secondary type of time series data for the variables as earlier stated in the models. The variables were obtained from the Statistical Bulletin and Annual Report of the Central Bank of Nigeria (CBN) 2021 and World Bank Development Indicators 2021. Table 3.1 presents the source and measurement of the variables.

Table 3.1: Variable measurements and data sources

Variables	Identification	Measurement	Sources
Economic growth	*gdppc*	GrossDomestic Product per capita	Central BankStatistical Bulletin (2020)
Industrial sub-sector performance	*ino*	Output per capita of mining and quarrying; manufacturing; electricity, gas, steam & air conditioner; water supply, sewage, waste management; and construction.	Central Bank Statistical Bulletin (2020)
Exchange rate	*exc*	Nominal effective exchange rate divided by index of cost 2010=100	Central BankStatistical Bulletin (2020)
Gross Fixed Capital Formation	*inv*	Gross domestic investment % of GDP	World Development Indicators (WDI)
Inflation rate	*inf*	Annual % change of consumer priceindex	World Development Indicators (WDI)
Interest rate	*int*	Lending interest rate	World Development Indicators (WDI)

Source: Author's compilation (2021).

Endnotes

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Chapter Four

Result and Discussion of Findings

In this chapter, the study presets the details of data presentation, estimation and the results of the empirical investigation of the links between industrial sector performance and economic growth in Nigeria. Also, it addresses the long-run and short-run relationship between industrial sector performance and economic growth in Nigeria. This is divided into descriptive analysis which shows the measure of central tendency which include the mean, median as well measures of variation, it also takes into consideration the trend analysis which shows the trend of the time series data used from 1981-2021 and econometric analysis which focuses on test for unit root, co-integration test using the autoregressive distributed lagged model.

4.1 Data Presentation

The data used for analyzing the relationship between industrial sector performance and economic growth in Nigeria is presented in the Appendix.

4.2 Presentation of Results

4.2.1 Summary Statistics

The summary of the preliminary analysis showing the mean, standard deviation, skewness and peakedness of the variables employed for analyzing the relationship between industrial sector performance and economic growth in Nigeria is presented in Table 4.1.

Table 4.1 Descriptive Statistics

	GDPPC	MQS	MAN	EGSA	WSWM	SER01	INV	INT	EXC	INF
Mean	211705.2	21817.10	21750.98	1211.720	329.0596	9505.865	70820.47	17.44602	108.1675	18.94905
Median	65668.94	8175.105	9144.636	327.5611	115.3865	1199.449	66014.71	16.93917	111.9433	12.87658
Maximum	832899.3	69680.59	121692.4	8228.221	2418.371	78461.54	209299.6	31.65000	399.9636	72.83550
Minimum	1846.627	100.6837	361.1657	7.798282	30.27960	67.67675	47353.82	8.916667	0.610025	5.388008
Std. Dev.	254830.0	24359.64	28466.91	1900.087	508.5273	16651.47	30614.19	4.810706	109.9115	16.65935
Skewness	0.998091	0.761717	1.807207	1.917964	2.602139	2.590102	3.204178	0.319264	0.972937	1.854175
Kurtosis	2.645213	2.051276	5.912064	6.368777	9.577357	9.810468	13.55030	3.645661	3.172454	5.306552
Jarque-Bera	7.022305	5.502418	36.80452	44.52430	120.1746	125.0790	260.3089	1.408686	6.519282	32.58139
Probability	0.029862	0.063851	0.000000	0.000000	0.000000	0.000000	0.000000	0.494433	0.038402	0.000000
Observations	41	41	41	41	41	41	41	41	41	41

Source: Author's computation (2022).

From Table 4.1, it shows that the mean of gross domestic product per capita is ₦211,705.2. Correspondingly, the table revealed the maximum value to be ₦832,899.3 and minimum value to be ₦1,846.63. As to the components of industrial sector performance, the average values of mining and quarrying per capita, manufacturing per capita, electricity, gas, steam & air conditioner per capita, water supply, sewage, waste management per capita, and construction per capita are ₦21,817.10, ₦21,750.98, ₦1,211.720, ₦329.0596, and ₦9,505.865 respectively. Also their maximum values are ₦69,680.59, ₦121,692.4, ₦8,228.221, ₦2,418.371, and ₦78,461.54 whereas the minimum values are at ₦100.684, ₦361.166, ₦7.798, ₦30.279, and ₦67.677 correspondingly. The mean value of investment per capita stands at ₦70,820.47. Its respective maximum value is ₦209,299.6 while the minimum value is ₦47,353.82. In addition, the average values of interest rate, exchange rate and inflation rate are 17.45%, ₦108.16/US$1 and 18.95% respectively. Also their maximum values are 8.92%, ₦399.964/US$1 and 72.84% whereas the minimum values are at 8.92%, ₦0.610/US$1 and 5.39% correspondingly. The average value of inflation rate is high as it stood at a double digit.

Moreover, the skewness which measures the assymetry of the distribution of the series around its mean always has a normal distribution at zero. A positive skewness implies that the distribution has a long right tail and a negative skewness implies that the distribution has a long left tail. The outcomes from Table 4.1 showed that all the variables are positively skewed thereby implying long right tails. Also, Kurtosis measures the peakedness or flatness of the distribution of the series. If the kurtosis is above three, the distribution is peaked or leptokurtic relative to the normal and if the kurtosis is less than three, the distribution is flat or platykurtic relative to normal. The result from the table indicated that only the value of GDP per caita and mining and quarrying sector output per capita falls below three which implies flatness or platykurtic. As for the other variables, their values exceed three therefore implying peakedness or leptokurtic.

4.2.2 Correlation Analysis

The correlation analyses of the variables are presented in Table 4.2. The coefficients show that the level of association between the variables used to explain the existing relationship between industrial sector performance and economic growth in Nigeria.

Table 4.2: Correlation Matrix

	gdppc	*mqs*	*man*	*egsa*	*wswm*	*con*	*inv*	*int*	*exc*
mqs	0.702	1							
man	0.760	0.787	1						
egsa	0.753	0.782	0.892	1					
wswm	0.678	0.649	0.870	0.870	1				
con	0.695	0.692	0.879	0.878	0.893	1			
inv	-0.441	-0.457	-0.403	-0.367	-0.330	-0.335	1		
int	-0.198	-0.147	-0.214	-0.241	-0.227	-0.259	-0.373	1	
exc	0.751	0.626	0.740	0.718	0.783	0.684	-0.483	-0.089	1
inf	-0.309	-0.348	-0.254	-0.235	-0.170	-0.199	0.049	0.374	-0.318

Source: Author's computation (2022).

From Table 4.2, the results show that all the components of industrial sector output (mining and quarrying per capita, manufacturing per capita, electricity, gas, steam & air conditioner per capita, water supply, sewage, waste management per capita, and construction per capita) correlated positively with economic growth in Nigeria for the periods understudied. Also, inflation rate, investment and interest rate relate negatively with income per capita. However, the correlation result shows a direct level of association between exchange rate and income per capita growth. Regarding the controlling variables, all the components of industrial sector performance are indirectly related with inflation rate, investment and interest rate but directly correlated with exchange rate. It is imperative to note that the correlation coefficients are relatively moderate except for the one showing the relationship among the indicators of industrial sector performance (mining and quarrying per capita, manufacturing per capita, electricity, gas, steam & air conditioner per capita, water supply, sewage, waste management per capita, and construction per capita) which are not estimated in the same model so as to avert multicollinearity problem. Concerning the controlling variables, their correlation relationships differ among the three measures of industrial sector performance. Meanwhile, the correlation coefficients of these controlling variables are equally reported. Consequently, these results are just preliminary analysis subject to confirmation using the appropriate estimation method to reveal the parameter signs and magnitudes of the variables.

4.3 Pre-Estimation Tests (Unit Root Test)

In this section, the study presents the unit root test results by investigating the stationarity level of the variables. This estimator is used to check for the existence of a unit root i.e. if the variables are not stationary at levels. The estimators used to carry out the test are Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) tests. The test is first tested and presented before the co-integration analysis which also forms the pre-estimation test. The ADF and PP are carried out using the E-views software package and the results from the test are presented in Table 4.3.

The a'priori expectation while carrying out the ADF and PP tests is that the variable is stationary when the value of the ADF and PP test statistics are greater than the critical value at 5%. From the test result of ADF and PP reported in Table 4.3, investment and inflation rate were found not to accept the null hypothesis "it has unit root test" at 5% level using both ADF and PP estimators. It implies that investment and inflation rate is stationary at levels i.e. the series is integrated at order zero [I(0)].

Table 4.3: ADF and PP Test Results [Trend and Intercept]

Variables	Augmented Dickey Fuller Test		Phillip-Perron Test		Remarks
	Stat at level	Stat at first diff.	Stat at level	Stat at first diff.	
gdppc	1.2400(0) [-3.5266]	-5.7341***(0)[-3.5298]	1.3457(4)[-3.5266]	-5.7783***(2)[-3.5298]	I(1)
mqs	-2.2335(3)[-3.5366]	-4.2594***(3)[-3.5403]	-2.2474(10)[-3.5266]	-6.1066(3)[-3.5298]	I(1)
man	4.7160(5)[-3.5443]	-4.3410***(0)[-3.5298]	5.2027(1)[-3.5266]	-4.6792(1)[-3.5298]	I(1)
egsa	3.3016(1)[-3.5298]	-4.5591***(1)[-3.5331]	2.5294(1)[-3.5266]	-4.7704***(0)[-3.5298]	I(1)
wswm	2.3392(1)[-3.5298]	-3.8036**(0)[-3.5331]	2.0750(3)[-3.5266]	-3.5247**(1)[-3.5298]	I(1)
con	1.9682(1)[-3.5298]	-3.6009***(1)[-3.5331]	-1.0061(1)[-3.5266]	-3.8604***(1)[-3.5298]	I(1)
inv	-7.0883***(1)[-3.5298]	-	-10.077***(3)[-3.5266]	-	I(0)
int	-2.1235(0)[-3.5266]	-5.7462***(1)[-3.5331]	-2.0056(4)[-3.5266]	-7.1945***(3)[-3.5298]	I(1)
exc	0.0685(0)[-3.5266]	-4.7766***(0)[-3.5298]	0.02015(4)[-3.5266]	-4.6257***(8)[-3.5298]	I(1)
inf	-4.1023**(1)[-3.5298]	-	-3.5818(1)[-3.5366]	-	I(0)

Note: ***, ** and * signify significance level at 1%, 5% and 10% respectively.
Sources: Author's computation (2022).

Furthermore, the series of GDP per capita, mining and quarrying per capita, manufacturing per capita, electricity, gas, steam & air conditioner per capita, water supply, sewage, waste management per capita, construction per capita, interest rate and exchange rate are not stationary at levels. However, after differencing at level one, they are found to be stationary i.e. they are integrated at order one [I(1)]. Thus, the series (GDP per capita, mining and quarrying per capita, manufacturing per capita, electricity, gas, steam & air conditioner per capita, water supply, sewage, waste management per capita, construction per capita, interest rate and exchange rate) were found not to reject the null hypothesis "no stationary" at level but after several iterations based on the number of lag length and differencing, the series were found to reject the null hypothesis at first difference. This indicates that the first-difference of these series (GDP per capita, mining and quarrying per capita, manufacturing per capita, electricity, gas, steam & air conditioner per capita, water supply, sewage, waste management per capita, construction per capita, interest rate and exchange rate) were stationary.

4.4 Presentation of Results

4.4.1 Empirical Results of the Impact of Mining and Quarrying Sector Performance on Economic Growth

Cointegration Test Result

The study tests the long-run relationship among mining and quarrying sector performance, economic growth and other controlling variables using the autoregrssive distributed lag (ARDL) bound cointegration tests in the stated hypotheses before estimating both the short-run and long-run parameters. For the model showing the relationship among mining and quarrying sector performance, economic growth, and other controlling variables, the ARDL bound test is employed because it is suitable for variables at different order of integration. The F-statistics estimate for testing the existence of long-run relationship among mining and quarrying sector performance, economic growth and other controlling variables in Nigeria is presented in Table 4.4.

In Table 4.4, the estimated F-statistics of the normalized equation (F_{arb} = 21.896) are greater than the upper critical bounds at 1% significance level. This implies that the null hypothesis of no long-run relationship is rejected at 1% significance level. The implication of the above estimation is that mining and quarrying sector performance, control variables (such as investment, interest rate, exchange rate and inflation), and economic growth, all have equilibrium condition that keep them together in the long-run. Thus, there exists a long-run relationship between mining and quarrying sector performance and economic growth in Nigeria.

Table 4.4: Cointegration test of mining and quarrying sector and economic growth

Test Statistic	Value	K
F-statistics (gdppc| mqs, inv, int, exc, inf) ARDL(2, 0, 1, 3, 1, 3)	21.896	5
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.08	3.00
5%	2.39	3.38
2.5%	2.70	3.73
1%	3.06	4.15

Source: Author's computation (2022).

Short-run and Long-run Estimates of Mining and Quarrying Sector Performance on Economic Growth

The discussion in here answers the null hypothesis that mining and quarrying sector performance has no significant effect on economic growth in Nigeria. It examines both the short-run and long-run relationship estimates of mining and quarrying sector performance and other controlling variables in Nigeria using the estimated ARDL approach described extensively in the previous chapter. The estimated ARDL model is a composite of short-run and long-run estimates of the interrelationship among considered series in this study. The clear evidence of our empirical estimates from mining and quarrying sector performance, investment, interest rate, exchange rate and inflation are presented in Table 4.5.

The short-run estimation results show the error correction mechanism which measures the speed or degree of adjustment. It is the rate of adjustment at which the dependent variable changes due to changes in the independent variables. The short run analysis shows the dynamic pattern in the model and to ensure that dynamics of the model have not been constrained by inappropriate lag length specification. The ARDL test automatically choose the lag length on all variables as the model was set at three to ensure sufficient degree of the freedom based on automatic selection of Akaike Information Criterion. The short-run estimates of the relationship among mining and quarrying sector performance and economic growth are presented in Table 4.5. The coefficient of the error correction term (ECT) is found to be negative and statistically significant at the conventional level. The ECT value (-0.1875) implied that the model corrects its short-run disequilibrium by 18.75% speed of adjustment in order to return to the long run equilibrium.

Table 4.5: Estimated ARDL result of mining and quarrying sector performance on economic growth

Dependent Variable: Economic Growth (GDPPC)
Selected Model: ARDL(2, 0, 1, 3, 1, 3)
Sample: 1981 2021 **Included observations:** 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Short-Run Estimates				
DLOG(GDPPC(-1))	-0.433837	0.096565	-4.492712	0.0002
DLOG(MQS)	0.103467	0.023517	4.399699	0.0002
DLOG(INV)	0.073188	0.043036	1.700615	0.1031
D(INT)	-0.005944	0.002154	-2.759150	0.0114
D(INT(-1))	-0.018307	0.002215	-8.266650	0.0000
D(INT(-2))	-0.009788	0.002706	-3.617182	0.0015
DLOG(EXC)	-0.013381	0.021119	-0.633632	0.5329
D(INF)	0.002760	0.000482	5.721544	0.0000
D(INF(-1))	0.001976	0.000415	4.763122	0.0001
D(INF(-2))	0.001489	0.000546	2.727262	0.0123
ECT(-1)	-0.187503	0.013425	-13.96684	0.0000
Long-run Estimates				
LOG(MQS)	0.551814	0.093597	5.895667	0.0000
LOG(INV)	-0.284939	0.516420	-0.551757	0.5867
INT	0.044276	0.028691	1.543176	0.1371
LOG(EXC)	0.324261	0.127735	2.538543	0.0187
INF	0.010669	0.005260	2.028246	0.0548
C	8.251286	5.768102	1.430503	0.1666

Adj. R-squared	0.7143	**F-stat**	68.5712
D-Watson	2.0907	**Prob.(F-Statistics)**	(0.0000)

Diagnostic Tests of Selected ARDL Model

Serial Correlation: 3.44500 [0.1029]	**Normality Test:** 1.8025 [0.4061]
Functional Form: 0.4019 [0.6918]	**Heteroskedasticity Test:** 0.5736 [0.9994]

Source: Author's computation (2022).

The coefficient of the short-run lag one of change in real income per capita has negative and significant impact on the current changes in real per capita income at 5%. This implies that the previous level of income adversely influenced the current level of income per capita growth in the short. The short-run parameter estimate of mining and quarrying sector was found to be positive and statistically significant at 5% indicating that it influences real output per capita. Investment at current level has negative and significant impact on economic growth in Nigeria. Also, the current and first lag of interest rate had negative and significant effect on economic growth in Nigeria. Although, exchange rate at current level had a negative coefficient and it is not statistically significant at 5% level. More so, inflation at current, first and second lags positively and significantly affect economic growth in the short run.

The long-run estimates from Table 4.5 indicated that mining and quarrying sector output per capita has a positive and significant impact on the real income per capita growth in Nigeria. The result shows that the coefficient of mining and quarrying sector was in tandem with the theoretical expectations. On magnitude basis, 10% increase in mining and quarrying sector per capita will cause real income per capita growth to increase by 5.52%. Likewise, interest rate, exchange rate and inflation rate have a direct and on real income per capita growth in Nigeria for the periods understudy. Among all these factors, currency depreciation significantly improve income per capita at 5% significance level, whereas the direct impact of inflation rate on per capita income is significant at 10% level. Inflation and interest rate do not conform to the a'priori expectations. Consequently, the table reported that investment has an indirect effect on real income per capita growth, albeit not significant at 5% level. It does not conform to a'priori expectations.

The coefficient of determination (Adjusted-R^2) is high (71.43%) indicating that about 71.43% of the total variations in economic growth measured by real income per capita growth was explained by the variables in the model. It simply indicated that the variation of changes in economic growth measured by real income per capita growth was explained by 71.43% variations in mining & quarrying sector performance and other controlling variables. The overall test using the F-statistic (68.571) is statistically significant at 5% level of significance showing that model is well specified and statistically significant. The Durbin Watson statistic (2.0907) shows that there is absence of serial autocorrelation in the model.

The estimated ARDL model is tested for heteroscedasticity, serial correlation, functional form misspecification, parameter stability and normality. The results from these tests are shown in Table 4.5. The estimated ARDL model revealed that the model passed the serial correlation, normality test, and heteroskedasticity test. It means that the error terms are normally distributed with same variances and they are not serially correlated. Also, the Ramsey RESET test was satisfactory for the ARDL model indicating that the model is well distributed. As well, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) respectively presented in Figures 4.1 and 4.2 are stable.

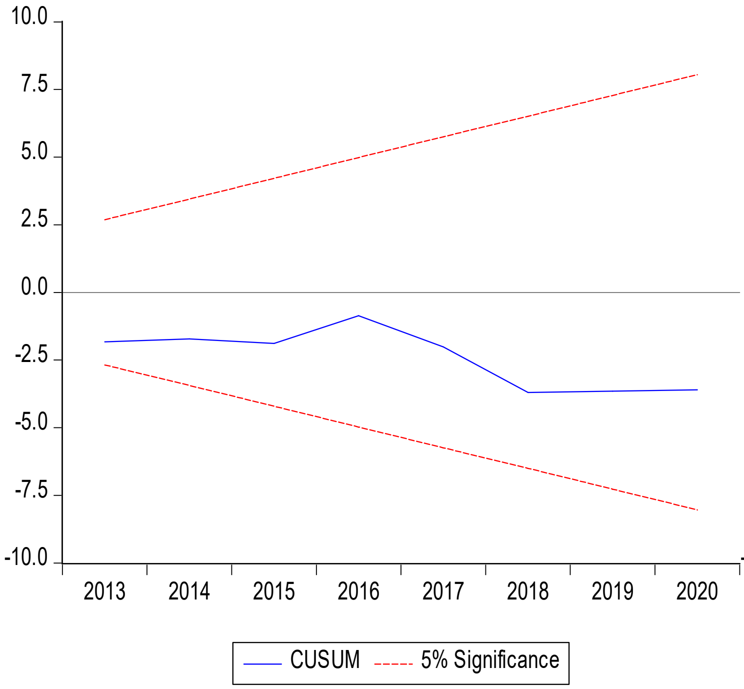

Figure 4.1: Cumulative sum

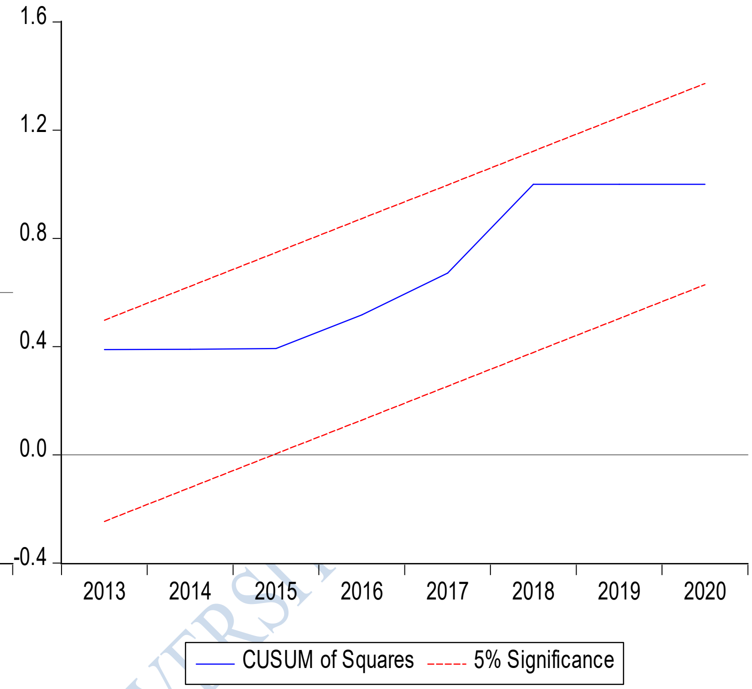

Figure 4.2: Cumulative sum of squares

4.4.2 Empirical Results of the Effects of Manufacturing Sector Performance on Economic Growth

Cointegration Test Result

The study tests the long-run relationship among manufacturing sector performance, economic growth and other controlling variables using the autoregrssive distributed lag (ARDL) bound cointegration tests in the stated hypotheses before estimating both the short-run and long-run parameters. For the first model showing the relationship among manufacturing sector performance, economic growth and other controlling variables, the ARDL bound test is employed because it is suitable for variables at different order of integration. The F-statistics estimate for testing the existence of long-run relationship among manufacturing sector performance, economic growth and other controlling variables in Nigeria is presented in Table 4.6.

In Table 4.6, the estimated F-statistics of the normalized equation (F_{arb} = 10.493) are greater than the upper critical bounds at 1% significance level. This implies that the null hypothesis of no long-run relationship is rejected at 1% significance level. The implication of the above estimation is that manufacturing sector performance, control variables (such as investment, interest rate, exchange rate and inflation), and economic growth, all have equilibrium condition that keep them together in the long-run. Thus, there exists a long-run relationship between manufacturing sector performance and economic growth in Nigeria.

Table 4.6: Cointegration between manufacturing sector and economic growth

Test Statistic	**Value**	**K**
F-statistics (gdppc| man, inv, int, exc, inf) ARDL(3, 4, 4, 4, 4, 3)	10.493	5
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.08	3.00
5%	2.39	3.38
2.5%	2.70	3.73
1%	3.06	4.15

Source: Author's computation (2022).

Short-run and Long-run Estimates of Manufacturing Sector and Economic Growth

The discussion in here answers the null hypothesis that manufacturing sector performance has no significant effect on the economic growth in Nigeria. It examines both the short-run and long-run relationship estimates of manufacturing sector performance and other controlling variables in Nigeria using the estimated ARDL approach described extensively in the previous chapter. The estimated ARDL model is a composite of short-run and long-run estimates of the interrelationship among considered series in this study. The evidence of the empirical estimates from manufacturing sector performance, investment, interest rate, exchange rate, inflation rate and economic growth are presented in Table 4.7.

The short-run estimation results show the error correction mechanism which measures the speed or degree of adjustment. It is the rate of adjustment at which the dependent variable changes due to changes in the independent variables. The short run analysis shows the dynamic pattern in the model and to ensure that dynamics of the model have not been constrained by inappropriate lag length specification. The ARDL test automatically choose the lag length on all variables as the model was set at three to ensure sufficient degree of the freedom based on automatic selection of Akaike Information Criterion. The short-run estimates of the relationship among manufacturing sector performance and economic growth is presented in Table 4.7. The coefficient of the ECT is found to be negative and statistically significant at the conventional level. The ECT value (-0. 2767) implied that the model corrects its short-run disequilibrium by 27.67% speed of adjustment in order to return to the long run equilibrium.

Table 4.7: Estimated ARDL Result of manufacturing sector and economic growth

Dependent Variable: Economic Growth (GDPPC)
Selected Model: ARDL(3, 4, 4, 4, 4, 3)
Sample: 1981 2021 **Included observations:** 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Short-Run Estimates				
DLOG(GDPPC(-1))	-0.619885	0.101290	-6.119891	0.0002
DLOG(GDPPC(-2))	-0.294111	0.092307	-3.186236	0.0111
DLOG(MAN)	-0.004132	0.046973	-0.087970	0.9318
DLOG(MAN(-1))	0.314817	0.070495	4.465794	0.0016
DLOG(MAN(-2))	0.379681	0.054115	7.016129	0.0001
DLOG(MAN(-3))	0.226980	0.041155	5.515241	0.0004
DLOG(INV)	0.440023	0.046204	9.523401	0.0000
DLOG(INV(-1))	-0.432211	0.054047	-7.997020	0.0000
DLOG(INV(-2))	-0.191946	0.035481	-5.409782	0.0004
DLOG(INV(-3))	-0.305259	0.035266	-8.655767	0.0000
D(INT)	-0.009168	0.001663	-5.511882	0.0004
D(INT(-1))	-0.010517	0.001773	-5.931235	0.0002
D(INT(-2))	-0.008655	0.002164	-3.998822	0.0031
D(INT(-3))	-0.002926	0.001914	-1.529128	0.1606
DLOG(EXC)	0.195011	0.018463	10.56210	0.0000
DLOG(EXC(-1))	0.026404	0.016369	1.613076	0.1412
DLOG(EXC(-2))	0.051403	0.017521	2.933744	0.0167
DLOG(EXC(-3))	0.108493	0.019526	5.556407	0.0004
D(INF)	0.002909	0.000387	7.519338	0.0000
D(INF(-1))	-0.002535	0.000572	-4.435092	0.0016
D(INF(-2))	-0.002552	0.000428	-5.963228	0.0002
ECT(-1)	-0.276654	0.025005	11.06406	0.0000
Long-run Estimates				
LOG(MAN)	2.116823	0.221846	9.541849	0.0000
LOG(INV)	-3.108315	0.599335	-5.186277	0.0006
INT	0.049129	0.024275	2.023871	0.0737
LOG(EXC)	-1.239674	0.262126	-4.729312	0.0011
INF	-0.030603	0.007138	-4.287228	0.0020
C	30.45711	6.073876	5.014444	0.0007

Adj. R-squared	0.8728	**F-stat**	85.1986
D-Watson	2.0322	**Prob(F-Statistics)**	(0.0000)

Diagnostic Tests of Selected ARDL Model	
Serial Correlation: 0.3971 [0.6865]	**Normality Test:** 1.6707 [0.4337]
Functional Form: 0.2947 [0.7757]	**Heteroskedasticity Test:** 1.1189 [0.4563]

Source: Author's computation (2022).

The coefficients of the short-run lags one and two of change in real income per capita has negative and significant impact on the current changes in per capita income at 5%. This further implies that previous level of income negatively influenced the current per capita income of Nigeria. The short-run estimate of lag one, two and three of manufacturing sector output was found to be positive and statistically significant at 5% while its current level was negative and insignificant at the conventional level. It means that manufacturing output per capita has positive influence on short run income per capita of Nigeria at 5% significance level. In the short run, investment significantly impacted income per capita negatively at 5% significance level. Similarly, interest rate had a negative and significant effect on economic growth in the short run. It means that low interest rate improve economic growth significantly at 5% level. However, exchange rate has a direct and significant effect on income per capita in Nigeria at 5% level. Inflation at first and second lags has negative effect on per capita income, but its current level is positive and significant at 5% level.

The long-run estimates from Table 4.7 indicated that manufacturing sector output per capita had direct impact on economic growth in Nigeria. The result shows that manufacturing sector was significant and also in tandem with the theoretical expectations. In magnitude term, 1% increase in manufacturing sector output will cause income per capita to increase by 2.12%. Equally, interest rate is directly and significantly related with income per capita in Nigeria at 10% level. On the other hand, the table reported that investment, exchange rate and inflation rate have indirect effects on economic growth in Nigeria. A 1% increase in investment, exchange rate and inflation rate reduce income per capita by 3.11%, 1.24% and 0.03% correspondingly.

The coefficient of determination (Adjusted-R^2) is high (87.28%) indicating that about 87.28% of the total variations in economic growth was explained by the variables in the model. It simply indicated that the variation of changes in economic growth was explained by 87.28% variations in manufacturing sector performance and other controlling variables. The overall test using the F-statistic (85.199) is statistically significant at 5% level of significance showing that model is well specified and statistically significant. The Durbin Watson statistic (2.0322) shows that there is absence of serial autocorrelation in the model.

Furthermore, the estimated ARDL model is tested for heteroscedasticity, serial correlation, functional form misspecification, parameter stability and normality. The results from these tests are shown in Table 4.7. The estimated ARDL model revealed that the model passed the serial correlation, normality test, and heteroskedasticity test. It means that the error terms are normally distributed with same variances and they are not serially correlated. Also, the Ramsey RESET test was satisfactory for the ARDL model indicating that the model is well distributed. In addition, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) respectively presented in Figures 4.3 and 4.4 are stable.

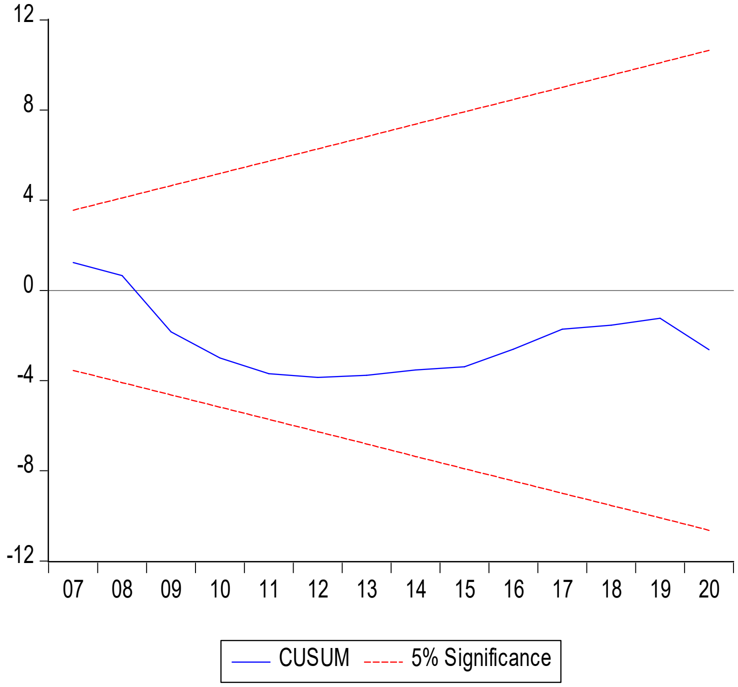

Figure 4.3: Cumulative sum

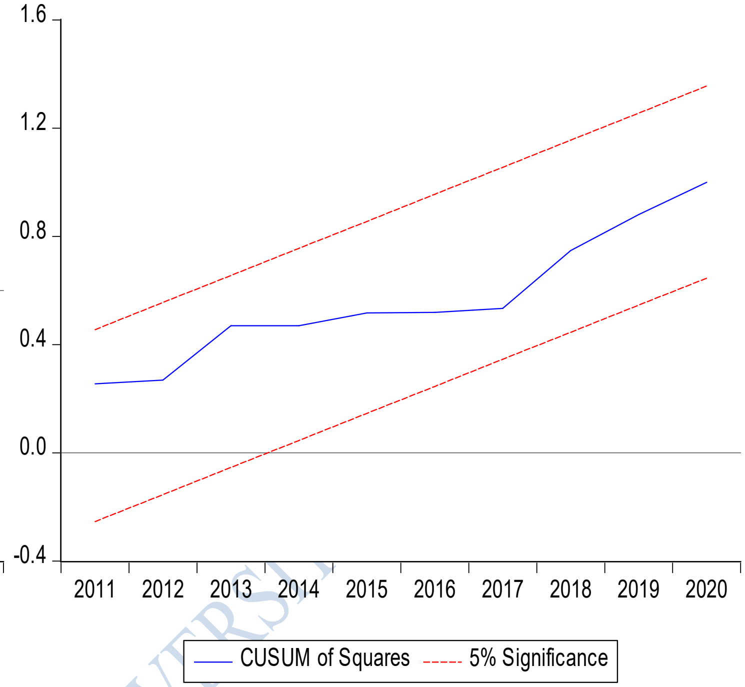

Figure 4.4: Cumulative sum of squares

4.4.3 Empirical Results of the Effects of Electricity, Gas, Stream and Air Conditioner Sector Performance on Economic Growth

Cointegration Test Result

The study tests the long-run relationship among electricity, gas, stream and air conditioner sector performance, economic growth and other controlling variables using the autoregrssive distributed lag (ARDL) bound cointegration tests in the stated hypotheses before estimating both the short-run and long-run parameters. For the first model showing the relationship among electricity, gas, stream and air conditioner sector performance, economic growth and other controlling variables, the ARDL bound test is employed because it is suitable for variables at different order of integration. The F-statistics estimate for testing the existence of long-run relationship among electricity, gas, stream and air conditioner sector performance, economic growth and other controlling variables in Nigeria is presented in Table 4.8.

In Table 4.8, the estimated F-statistics of the normalized equation (F_{arb} = 10.493) are greater than the upper critical bounds at 1% significance level. This implies that the null hypothesis of no long-run relationship is rejected at 1% significance level. The implication of the above estimation is that electricity, gas, stream and air conditioner sector performance, economic growth, control variables (such as investment, interest rate, exchange rate and inflation), and economic growth, all have equilibrium condition that keep them together in the long-run. Thus, there exists a long-run relationship between electricity, gas, stream and air conditioner sector performance, and economic growth in Nigeria.

Table 4.8: Cointegration of electricity, gas, stream and air conditioner sector and output growth

Test Statistic	Value	K
F-statistics (gdppc| egsa, inv, int, exc, inf) ARDL(1, 3, 4, 4, 3, 1)	20.612	5
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.08	3.00
5%	2.39	3.38
2.5%	2.70	3.73
1%	3.06	4.15

Source: Author's computation (2022).

Short-run and Long-run Estimates of Electricity, Gas, Stream and Air Conditioner Sector and Economic Growth

In this sub-section, the discussion answers the null hypothesis that electricity, gas, stream and air conditioner sector performance, economic growth has no significant effect on economic growth in Nigeria. It examines both the short-run and long-run relationship estimates of electricity, gas, stream and air conditioner sector performance, economic growth and other controlling variables in Nigeria using the estimated ARDL approach described extensively in the previous chapter. The estimated ARDL model is a composite of short-run and long-run estimates of the interrelationship among considered series in this study. The clear evidence of our empirical estimates from electricity, gas, stream and air conditioner sector performance, investment, interest rate, exchange rate, inflation and economic growth are presented in Table 4.9.

The short-run estimation results show the error correction mechanism which measures the speed or degree of adjustment. It is the rate of adjustment at which the dependent variable changes due to changes in the independent variables. The short run analysis shows the dynamic pattern in the model and to ensure that dynamics of the model have not been constrained by inappropriate lag length specification. The ARDL test automatically choose the lag length on all variables as the model was set at four to ensure sufficient degree of the freedom based on automatic selection of Akaike Information Criterion. The short-run estimates of the relationship between electricity, gas, stream and air conditioner sector performance and economic growth is presented in Table 4.9. The coefficient of the ECT is found to be negative and statistically significant at the conventional level. The ECT value (-0.1049) implied that the model corrects its short-run disequilibrium by 10.49% speed of adjustment in order to return to the long run equilibrium.

Table 4.9: Estimated ARDL results of electricity, gas, stream and air conditioner sector and economic growth

Dependent Variable: Economic Growth (GDPPC)
Selected Model: ARDL(1, 3, 4, 4, 3, 1)
Sample: 1981 2021 **Included observations:** 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Short-Run Estimates				
DLOG(EGSA)	0.112396	0.033461	3.358982	0.0043
DLOG(EGSA(-1))	0.015089	0.019416	0.777130	0.4492
DLOG(EGSA(-2))	-0.063872	0.020527	-3.111588	0.0071
DLOG(INV)	0.278382	0.085065	3.272567	0.0051
DLOG(INV(-1))	-0.049541	0.058080	-0.852975	0.4071
DLOG(INV(-2))	-0.033297	0.061551	-0.540971	0.5965
DLOG(INV(-3))	-0.203387	0.063764	-3.189669	0.0061
D(INT)	-0.008214	0.003477	-2.362398	0.0321
D(INT(-1))	-0.010927	0.003231	-3.382226	0.0041
D(INT(-2))	-0.001081	0.002836	-0.381110	0.7085
D(INT(-3))	0.005736	0.002889	1.985508	0.0657
DLOG(EXC)	0.016788	0.025263	0.664545	0.5164
DLOG(EXC(-1))	0.017367	0.031103	0.558373	0.5848
DLOG(EXC(-2))	-0.209043	0.063378	-3.298361	0.0049
D(INF)	0.004267	0.000682	6.256978	0.0000
ECT(-1)	-0.104851	0.007377	-14.21257	0.0000
Long-run Estimates				
LOG(EGSA)	0.103579	0.224892	0.460572	0.6517
LOG(INV)	0.686912	2.153031	0.319044	0.7541
INT	0.054668	0.085345	0.640550	0.5315
LOG(EXC)	0.889403	0.359999	2.470571	0.0260
INF	0.030211	0.016618	1.818001	0.0891
C	-0.424302	24.15476	-0.017566	0.9862

Adj. R-squared	0.8766	**F-stat**	28.7046
D-Watson	1.8753	**Prob(F-Statistics)**	(0.0000)

Diagnostic Tests of Selected ARDL Model

Serial Correlation: 0.2064 [0.8162]	**Normality Test:** 1.7057 [0.4262]
Functional Form: 1.9032 [0.0778]	**Heteroskedasticity Test:** 0.3560 [0.9851]

Source: Author's computation (2022).

The coefficient of the current level of electricity, gas, stream and air conditioner sector has positive and significant impact on the short-run income per capita at 5% while its lag two shows negative and insignificant impacts. It indicates that electricity, gas, stream and air conditioner sector output per capita plays a key role in income per capita of Nigeria. Overall, the short-run parameter estimate of current investment was found to be positive and statistically significant at 5% indicating that it influences change in income per capita. As to interest rate, it indirectly influences income per capita significantly at 5%. Thus, low interest rate positively impacted on economic growth in the short run. Concerning exchange rate, its lag two coefficient negatively affects economic growth but the coefficients of its current and first lag are positive and insignificant at 5%. The short run result of current inflation rate has positive influence on income per capita at 5% level.

Also, the long-run estimates in Table 4.9 indicated that electricity, gas, stream and air conditioner sector has positive and insignificant impact on economic growth in Nigeria. Thus, 10% increase in electricity, gas, stream and air conditioner sector will cause income per capita to increase by 1.04%. Likewise, investment, interest rate, exchange rate, and inflation rate have direct effects on income per capita for the periods understudy. Among these variables, exchange rate is significant at 5%, inflation rate significant at 10%, while investment and interest rate are not significant at 5%. Thus, a 1% increase in investment, interest rate, exchange rate, and inflation rate will enhance income per capita by 0.69%, 0.06%, 0.89% and 0.03% correspondingly.

Furthermore, the coefficient of determination (Adjusted-R^2) is high (87.66%) indicating that about 87.66% of the total variations in economic growth was explained by the variables in the model. It simply indicated that the variation of changes in economic growth was explained by 87.66% variations in electricity, gas, stream and air conditioner sector performance and other controlling variables. The overall test using the F-statistic (28.705) is statistically significant at 5% level of significance showing that model is well specified and statistically significant. The Durbin Watson statistic (1.8753) shows that there is absence of serial autocorrelation in the model.

In addition, the estimated ARDL model is tested for heteroscedasticity, serial correlation, functional form misspecification, parameter stability and normality. The results from these tests are shown in Table 4.9. The estimated ARDL model revealed that the model passed the serial correlation, normality test, and heteroskedasticity test. It means that the error terms are normally distributed with same variances and they are not serially correlated. Also, the Ramsey RESET test was satisfactory for the ARDL model indicating that the model is well distributed. Moreover, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) respectively presented in Figures 4.5 and 4.6 are stable.

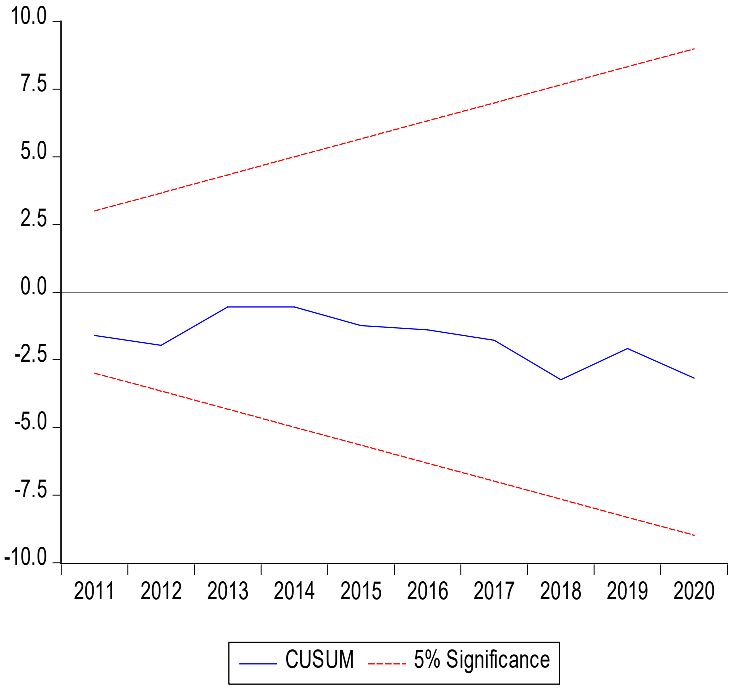

Figure 4.5: Cumulative sum

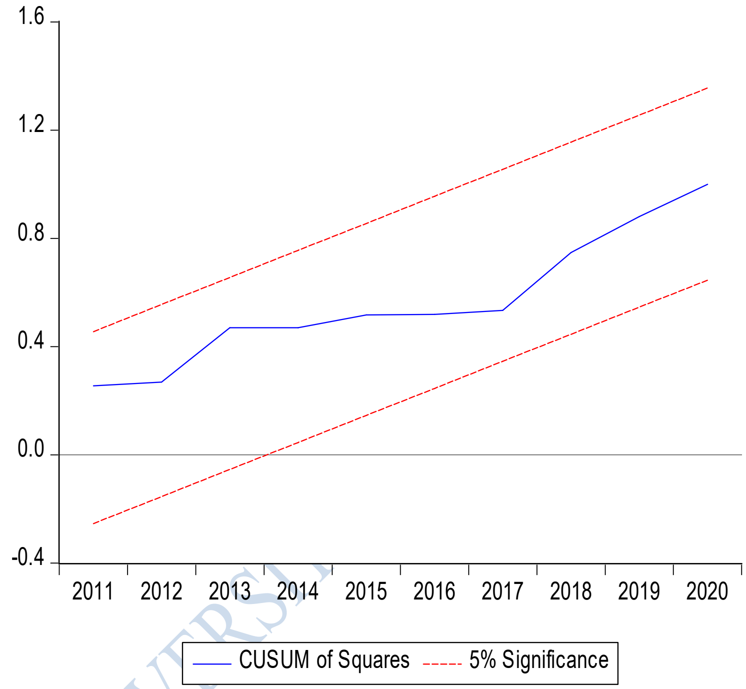

Figure 4.6: Cumulative sum of squares

4.4.4 Empirical Results of the Impact of Water Supply, Sewage and Waste Management Sector Performance on Economic Growth

Cointegration Results

In this section, the long-run relationship among water supply, sewage and waste management sector performance, economic growth and other controlling variables are tested using the autoregrssive distributed lag (ARDL) bound cointegration tests prior to the estimation of both the short-run and long-run parameters. For the first model showing the relationship among water supply, sewage and waste management sector performance, investment, interest rate, exchange rate, inflation, and economic growth measured by real GDP per capita, the ARDL bound test is employed because it is suitable for variables at different order of integration. The F-statistics estimate for testing the existence of long-run relationship among water supply, sewage and waste management sector performance and other controlling variables in Nigeria is presented in Table 4.10.

Table 4.10 showed that the estimated F-statistics of the normalized equation (F_{arb} = 10.916) are greater than the lower and upper critical bound at 5% significance level. This implies that the null hypothesis of no long-run relationship is rejected at 5% significance level. The implication of the above estimation is that water supply, sewage and waste management sector performance, control variables (such as investment, interest rate, exchange rate and inflation) and economic growth, all have equilibrium condition that keep them together in the long-run. Thus, there exists a long-run relationship between water supply, sewage and waste management sector performance and economic growth in Nigeria.

Table 4.10: Cointegration of water supply, sewage & waste management sector and output growth

Test Statistic	**Value**	**K**
F-statistics (gdppc| wswm, inv, int, exc, inf) ARDL(2, 0, 0, 2, 3, 1)	10.9158	5
Critical Value Bounds		
Significance	**I(0) Bound**	**I(1) Bound**
10%	2.08	3.00
5%	2.39	3.38
2.5%	2.70	3.73
1%	3.06	4.15

Source: Author's computation (2022).

Short-run and Long-run Estimates of Water Supply, Sewage and Waste Management Sector Performance on Economic Growth

In this sub-section, this discussion provides answer to the null hypothesis that water supply, sewage and waste management sector performance has no significant effect on economic growth measured by real GDP per capita in Nigeria. It examines both the short-run and long-run estimates of water supply, sewage and waste management sector performance and other controlling variables in Nigeria using the estimated ARDL approach described extensively in the previous chapter. The estimated ARDL model is a composite of short-run and long-run estimates of the interrelationship among considered series in this study. The clear evidence of our empirical estimates from water supply, sewage and waste management sector performance, investment, interest rate, exchange rate, inflation and economic growth are presented in Table 4.11.

The short-run estimation results show the error correction mechanism which measures the speed or degree of adjustment. It is the rate of adjustment at which the dependent variable changes due to changes in the independent variables. The short run analysis shows the dynamic pattern in the model and to ensure that dynamics of the model have not been constrained by inappropriate lag length specification. The ARDL test automatically choose the lag length on all variables as the model was set at three to ensure sufficient degree of the freedom based on automatic selection of Akaike Information Criterion. The short-run estimate of the relationship between water supply, sewage and waste management sector performance, and economic growth is presented in Table 4.11. The coefficient of the ECT is found to be negative and statistically significant at the conventional level. The ECT value (-0.1207) implied that the model corrects its short-run disequilibrium by 12.07% speed of adjustment in order to return to the long run equilibrium.

Table 4.11: Estimated ARDL result of water supply, sewage and waste management sector and economic growth

Dependent Variable: Economic Growth (GDPPC)
Selected Model: ARDL(2, 0, 0, 2, 3, 1)
Sample: 1981 2021 **Included observations:** 38

Variables	Coefficient	Std. Error	t-Statistic	Prob.
Short-Run Estimates				
DLOG(GDPPC(-1))	-0.241633	0.112772	-2.142670	0.0425
D(LOG(WSWM))	-0.055811	0.023135	-2.412435	0.0239
D(LOG(INV)	-0.023108	0.112073	-0.206185	0.8384
D(INT)	-0.004103	0.002605	-1.574868	0.1284
D(INT(-1))	-0.006859	0.002929	-2.341457	0.0278
DLOG(EXC)	0.018626	0.024478	0.760936	0.4541
DLOG(EXC(-1))	-0.010816	0.032708	-0.330667	0.7438
DLOG(EXC(-2))	-0.102751	0.032407	-3.170696	0.0041
D(INF)	0.003743	0.000618	6.058032	0.0000
ECT(-1)	-0.120645	0.012345	-9.773102	0.0000
Long-run Estimates				
LOG(WSWM)	-0.462603	0.269813	-1.714533	0.0993
LOG(INV)	-0.191536	0.936686	-0.204482	0.8397
INT	-0.040045	0.038922	-1.028847	0.3138
LOG(EXC)	1.326260	0.182392	7.271474	0.0000
INF	0.044839	0.016065	2.791052	0.0101
C	12.12476	10.47926	1.157024	0.2586

Adj. R-squared	0.8547	**F-stat**	47.5227
D-Watson	2.0015	**Prob(F-Statistics)**	(0.0000)

Diagnostic Tests of Selected ARDL Model

Serial Correlation: 2.4089 [0.1132]	**Normality Test:** 0.9602 [0.6187]
Functional Form: 1.3592 [0.1873]	**Heteroskedasticity Test:** 1.1749 [0.3529]

Source: Author's computation (2022).

The coefficient of the short-run lag one of change in income per capita has negative and significant impact on the current changes in income per capita at 5%. This means that the previous rate of income per capita accounts for the present low level of income per capita in Nigeria. The short-run parameter estimates of water supply, sewage and waste management sector was found to be negative and significant at 5%. This indicates that water supply, sewage and waste management sector negatively contribute to current income per capita in the short run. Similarly, interest rate negatively influences income per capita at 5% significance level. It means that low interest rate impacted income per capita positively in the short run. Also, investment had a negative impact on short run income per capita, albeit not significant at 5% level. The negative impact of exchange rate at lag two on short run income per capita is statistically significant at 5%, while its current and lag one are insignificant. However, the coefficient of inflation was positive and statistically significant at 5%. Thus, inflation rate affects income per capita positively in the short run.

Concerning the long run estimates, Table 4.11 indicated that water supply, sewage and waste management sector has negative and significant impact on income per capita in Nigeria at 10% level. This does not corroborate the a'priori expectation. Also, investment and interest rate have negative and insignificant impact on income per capita. On the contrary, exchange rate and inflation rate positively and significantly impacted income per capita in Nigeria for the periods understudy. In magnitude terms, a 1% increase in exchange rate and inflation rate will cause an increase in income per capita by 1.33% and 0.05% respectively.

The coefficient of determination (Adjusted-R^2) is high (85.47%) indicating that about 85.47% of the total variation in economic growth was explained by the variables in the model. It simply indicated that the variation of changes in economic growth was explained by 85.47% variations in water supply, sewage and waste management sector performance and other controlling variables. The overall test using the F-statistic (47.523) is statistically significant at 5% level of significance showing that model is well specified and statistically significant. The Durbin Watson statistic (2.0015) shows that there is absence of serial autocorrelation in the model.

The estimated ARDL model is tested for heteroscedasticity, serial correlation, functional form misspecification, parameter stability and normality. The results from these tests are shown in Table 4.11. The estimated ARDL model revealed that the model passed the serial correlation, normality test, and heteroskedasticity test. It means that the error terms are normally distributed with same variables and they are not serially correlated. Also, the Ramsey RESET test was satisfactory for the ARDL model indicating that the model is well distributed. Besides, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) respectively presented in Figures 4.7 and 4.8 are stable.

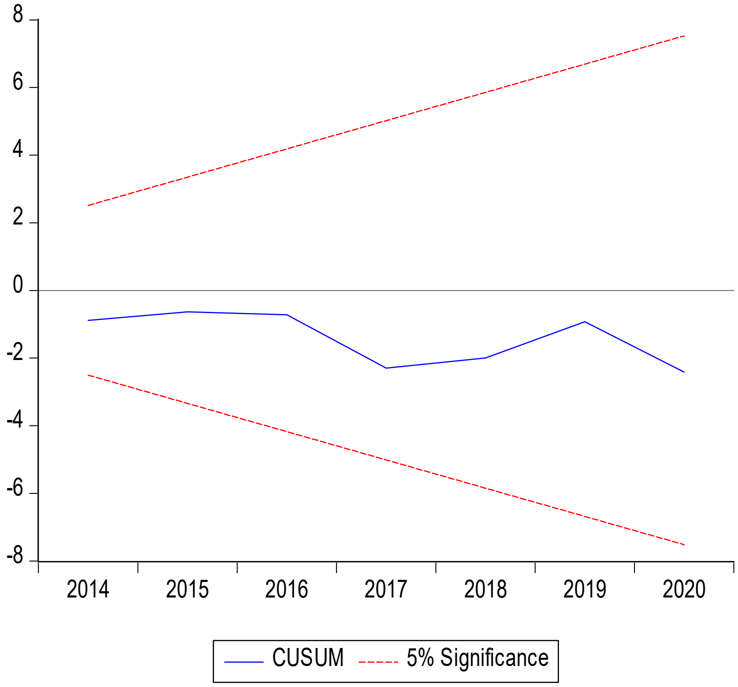

Figure 4.7: Cumulative sum

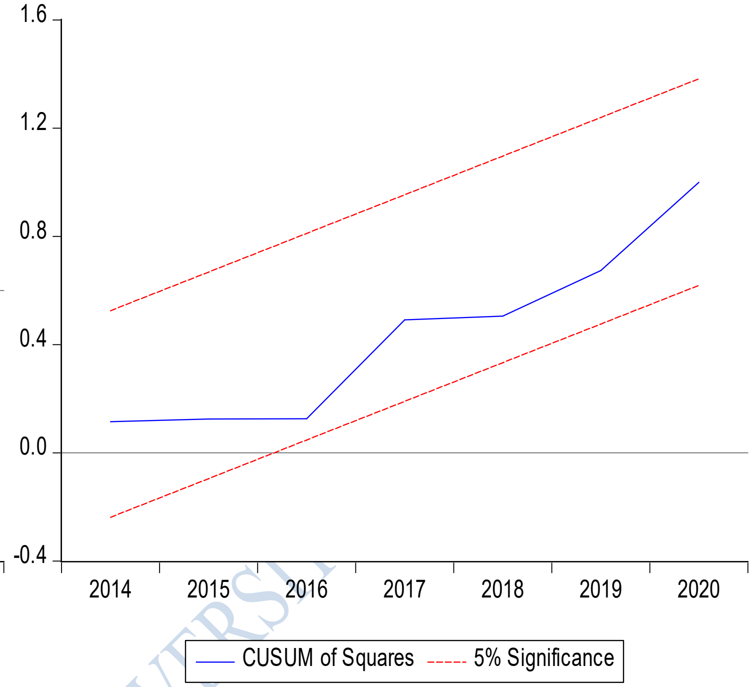

Figure 4.8: Cumulative sum of squares

4.4.5 Empirical Results of the Effect of Construction Sector Performance and Economic Growth

Cointegration Results

In this section, the long-run relationship among the indices of construction sector performance, economic growth and other controlling variables are tested using the autoregrssive distributed lag (ARDL) bound cointegration tests prior to the estimation of both the short-run and long-run parameters. For the first model showing the relationship among construction sector performance, economic growth, investment, interest rate, exchange rate, inflation and economic growth measured by real GDP per capita, the ARDL bound test is employed because it is suitable for variables at different order of integration. The F-statistics estimate for testing the existence of long-run relationship among construction sector performance and other controlling variables in Nigeria is presented in Table 4.12.

Table 4.12 showed that the estimated F-statistics of the normalized equation (F_{arb} = 9.8420) is greater than the lower and upper critical bound at 5% significance level. This implies that the null hypothesis of no long-run relationship is rejected at 5% significance level. The implication of the above estimation is that construction sector performance, control variables (such as investment, interest rate, exchange rate and inflation) and economic growth, all have equilibrium condition that keep them together in the long-run. Thus, there exists a long-run relationship between construction sector performance and economic growth in Nigeria.

Table 4.12: Cointegration of construction sector and economic growth

Test Statistic	Value	K
F-statistics (gdppc| con, inv, int, exc, inf) ARDL(2, 2, 3, 3, 1, 3)	9.8420	5
Critical Value Bounds		
Significance	**I(0) Bound**	**I(1) Bound**
10%	2.08	3.00
5%	2.39	3.38
2.5%	2.70	3.73
1%	3.06	4.15

Source: Author's computation (2022).

Short-run and Long-run Estimates of Construction Sector Performance and Economic Growth

In this sub-section, this discussion answers the null hypothesis that construction sector performance has no significant effect on economic growth in Nigeria. This examines both the short-run and long-run estimates of stock traded and other controlling variables in Nigeria using the estimated ARDL approach described extensively in the previous chapter. The estimated ARDL model is a composite of short-run and long-run estimates of the interrelationship among considered series in this study. The clear evidence of our empirical estimates from construction sector performance, investment, interest rate, exchange rate, inflation, and economic growth are presented in Table 4.13.

The short-run estimation results show the error correction mechanism which measures the speed or degree of adjustment. It is the rate of adjustment at which the dependent variable changes due to changes in the independent variables. The short run analysis shows the dynamic pattern in the model and to ensure that dynamics of the model have not been constrained by inappropriate lag length specification. The ARDL test automatically choose the lag length on all variables as the model was set at three to ensure sufficient degree of the freedom based on automatic selection of Akaike Information Criterion. The short-run estimate of the relationship between construction sector performance and economic growth is presented in Table 4.13. The coefficient of the ECT is found to be negative and statistically significant at the conventional level. The ECT value (-0.1354) implied that the model corrects its short-run disequilibrium by 13.54% speed of adjustment in order to return to the long run equilibrium.

Table 4.13: Estimated ARDL results of construction sector and economic growth

Dependent Variable: Economic Growth(GDPPC)

Selected Model: ARDL(2, 2, 3, 3, 1, 3)

Sample: 1981 2021 **Included observations:** 38

Variables	Coefficient	Std. Error	t-Statistic	Prob.
Short-Run Estimates				
DLOG(GDPPC(-1))	-0.479884	0.136050	-3.527269	0.0024
DLOG(CON)	-0.131273	0.047939	-2.738357	0.0135
DLOG(CON(-1))	-0.064337	0.046454	-1.384965	0.1830
DLOG(INV)	0.078193	0.054457	1.435869	0.1682
DLOG(INV(-1))	0.252417	0.072524	3.480483	0.0027
DLOG(INV(-2))	0.153069	0.059469	2.573945	0.0191
D(INT)	-0.008984	0.002859	-3.141932	0.0056
D(INT(-1))	-0.034404	0.004143	-8.304694	0.0000
D(INT(-2))	-0.016266	0.004184	-3.888005	0.0011
DLOG(EXC)	-0.064408	0.029505	-2.182931	0.0425
D(INF)	0.001185	0.000599	1.978544	0.0634
D(INF(-1))	0.004155	0.000622	6.683743	0.0000
D(INF(-2))	0.002076	0.000709	2.926871	0.0090
ECT(-1)	-0.135380	0.014125	-9.584294	0.0000
Long-run Estimates				
LOG(CON)	0.015515	0.243168	0.063804	0.9498
LOG(INV)	-2.138580	1.240746	-1.723624	0.1019
INT	0.119449	0.061888	1.930090	0.0695
LOG(EXC)	0.531312	0.243163	2.185005	0.0424
INF	-0.002329	0.011314	-0.205879	0.8392
C	32.64093	14.55561	2.242499	0.0378

Adj. R-squared	0.8707	**F-stat**	34.2451
D-Watson	2.0103	**Prob(F-Statistics)**	(0.0000)

Diagnostic Tests of Selected ARDL Model

Serial Correlation: 0.8844 [0.4322]	**Normality Test:** 7.6453 [0.0219]
Functional Form: 0.9132 [0.3739]	**Heteroskedasticity Test:** 0.3075 [0.9929]

Source: Author's computation (2022).

The coefficients of the short-run lag one of change in income per capita at lag 1 have negative and significant impact on the current changes in income per capita respectively. The short-run parameter estimate of construction sector output per capita at current and lag one was found to have negative impact on income per capita but only the former is significant at 5% level. Investment at lag one and two has a direct and significant effect on income per capita which are significant statistically at 5%. Meanwhile, interest rate at current, lag one and two negatively and significantly influence income per capita at 5%. As to inflation rate, its coefficients exact positive and significant impact on income per capita at 5% level. Exchange rate has a significant negative impact on income per capita at the conventional level.

The long-run estimates in Table 4.13 indicated that construction sector income per capita has positive impact on income per capita in Nigeria. This corroborates the a'priori expectation but not significant at 5% level. Similarly, interest rate and exchange rate have positive impact on income per capita in Nigeria. The coefficient of the former was found significant at 10% while the later was significant at 5%. A 10% change in construction sector income per capita, interest rate and exchange rate influence income per capita positively by 0.16%, 1.2% and 5.31% respectively. However, investment and inflation rate negatively and insignificantly influence income per capita at 5% level.

The coefficient of determination (Adjusted-R^2) is high (87.07%) indicating that about 87.07% of the total variations in economic growth was explained by the variables in the model. It simply indicated that the variation of changes in economic growth was explained by 87.07% change in construction sector performance and other controlling variables. The overall test using the F-statistic (34.245) is statistically significant at 5% level of significance showing that model is well specified and statistically significant. The Durbin Watson statistic (2.0103) shows that there is absence of serial autocorrelation in the model.

Besides, the estimated ARDL model is tested for heteroscedasticity, serial correlation, functional form misspecification, parameter stability and normality. The results from these tests are shown in Table 4.13. The estimated ARDL model revealed that the model passed the serial correlation, normality test, and heteroskedasticity test. It means that the error terms are normally distributed with same variables and they are not serially correlated. Also, the Ramsey RESET test was satisfactory for the ARDL model indicating that the model is well distributed. As well, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) respectively presented in Figures 4.9 and 4.10 are stable.

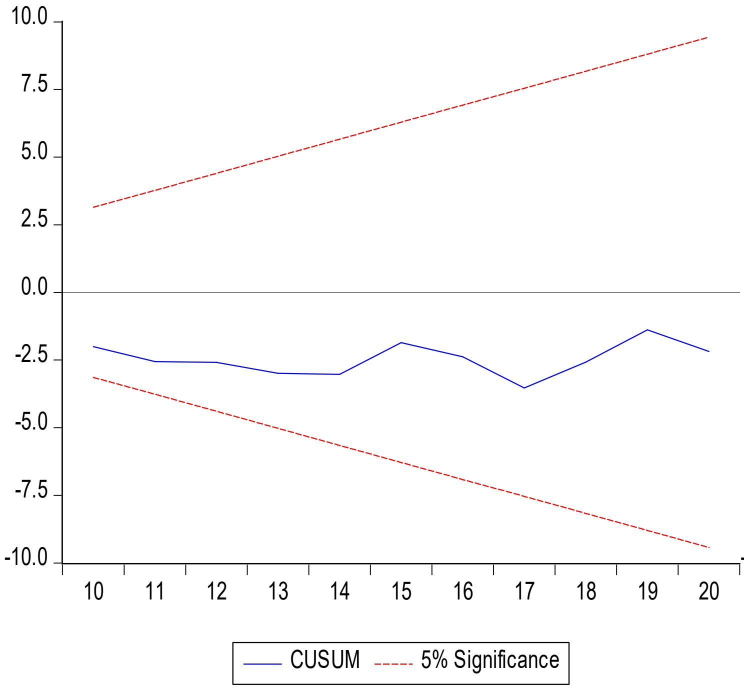

Figure 4.9: Cumulative sum

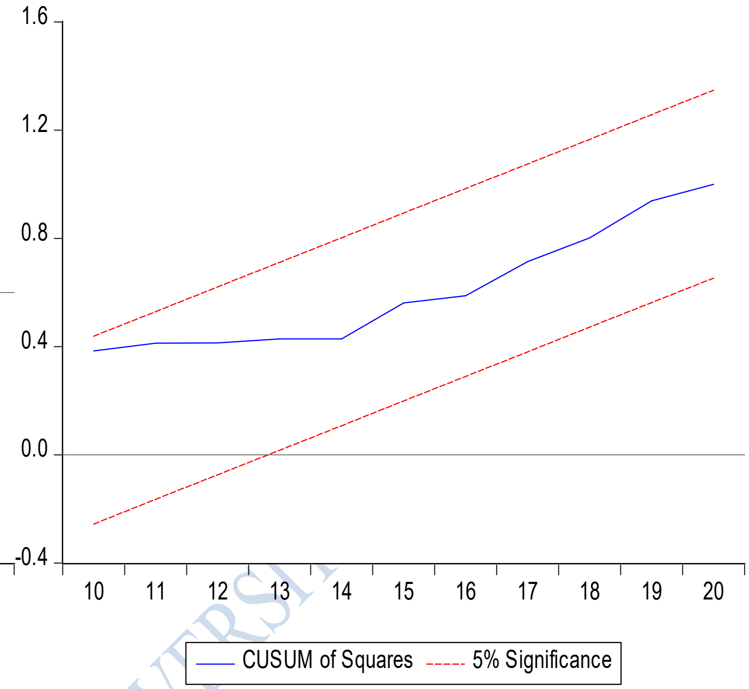

Figure 4.10: Cumulative sum of squares

4.5 Discussion of Findings

This research study investigates the links between industrial sector performance (proxy by mining and quarrying, manufacturing, electricity, gas, stream and air conditioner, water supply, sewage and waste management, and construction sector) and economic growth measured by real income per capita growth in Nigeria. The study discovered that manufacturing sector performance significantly and positively impacted economic growth measured by income per capita both in short and long run. This indicates that manufacturing sector performance plays a key role in ensuring improvement in the overall economic growth of the Nigerian economy. It is achieved as the sector plays a key role in integrating other sectors together towards enhancing income per capita growth of Nigeria. It aligns with a study that conducted for African countries that found a positive relationship between manufacturing value added and economic growth[1,2]. This is similar to past studies that discovered positive impact of manufacturing sector on economic growth[3,4,5,6].

Similarly, mining and quarrying sector performance positively impacted economic growth in the short and long run. It aligns with a study that identified mining and quarrying industry as the main industrial sector component that drives the growth of the Nigerian economy[6]. This shows that the mining and quarrying industry also act as one of the main industrial sector component that drives the income growth of Nigeria compared to other sub-sectors like electricity, gas, stream and air conditioner, construction and water supply, sewage and waste management sectors.

Also, the performance of electricity, gas, stream and air conditioner sector only influenced income per capita positively in the short run. Meanwhile, construction and water supply, sewage and waste management sector performance adversely affect short run economic growth in Nigeria. This aligns with the result of previous studies that found an insignificant relationship between industrial sector and economic growth. For example, a study discovered that industrial output does not significantly influence economic growth in Nigeria for the periods of 1973 and 2013 using OLS estimator[7]. It goes against the result of a study that found a positive links between construction sector performance and economic growth in Nigeria[6].

Endnotes

1) A. Abdul-Mumuni. *Exchange Rate Variability and Manufacturing Sector Performance in Ghana: Evidence from Cointegration Analysis*. **International Economics and Business**. 2(1), 2016, 2377-2301.

2) C. Moyo & L. Jeke. *Manufacturing sector and economic growth: A panel study of selected African countries*. **Journal of Business and Economic Review**, 4(3), 2019, 114-130.

3) A. Umaru, Y. Egede, & J. Ayuba. *Does Manufacturing Sector Output Significantly Predict Economic Growth in Nigeria*? **Asian Journal of Economic Modelling**, 10(2), 2022, 136-145.

4) O. K. Adeleye, & M. O. Q. Shittu. *Inflation, manufacturing output and economic growth; Nigeria experience (1980-2018)*. **The Social and Management Scientist**, 10(1), 2018, 43-47.

5) A. Afolabi, & O. T. Laseinde. *Manufacturing sector performance and economic growth in Nigeria*. **Journal of Physics: conference series**, 1378(3), 2019, 032067.

6) N. F. Inyang, U. E. Effiong, & M. A. Udofia. *Revisiting the Nexus between Industrial Sector and Economic Growth in Nigeria: a Disaggregated Approach*. **Law, Business and Sustainability Herald**, 2(2), 2022, 20-39.

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

Chapter Five

Conclusion

5.1 Summary

In this study, the existing relationship between industrial sector performance and economic growth in Nigeria is investigated to understand how mining and quarrying, manufacturing, electricity, gas, stream and air conditioner, water supply, sewage and waste management, and construction sub-sectors influence income per capita growth in Nigeria. Understudying this research study became necessary because it makes enquiries on the findings of past studies which can best be described as inconclusive. The study is conducted for developing countries in Sub-Saharan countries such as Nigeria. The datasets employed were obtained from the Central Bank of Nigeria (2021) and World Development Indicators (2021) which spans from 1981 to 2021. The ARDL estimator was used to evaluate the parameters based on the characteristics of the datasets.

For the first objective, a long-run relationship exists between mining and quarrying sector performance and income per capita in Nigeria. The short-run change in real income per capita negatively and significantly impacted the current changes in real per capita income at 5%. The short-run parameter estimate of mining and quarrying sector was found to be positive and statistically significant at 5% indicating that it influences real output per capita. Investment at current level has negative and significant impact on economic growth in Nigeria. The long-run estimates indicated that mining and quarrying sector output per capita has a positive and significant impact on the real income per capita growth in Nigeria. Likewise, interest rate, exchange rate and inflation rate have a direct and on real income per capita growth in Nigeria for the periods understudy.

Regarding the second objective, the results show that there exists a long-run relationship between manufacturing sector performance and income per capita in Nigeria. The short-run lags one and two of change in real income per capita has negative and significant impact on the current changes in per capita income at 5%. The short-run estimate of lag one, two and three of manufacturing sector output was found to be positive and statistically significant at 5% while its current level was negative and insignificant at the conventional level. It means that manufacturing output per capita has positive influence on short run income per capita of Nigeria at 5% significance level. In the short run, investment significantly impacted income per capita negatively at 5% significance level. Similarly, interest rate had a negative and significant effect on economic growth in the short run. However, exchange rate has a direct and significant effect on income per capita in Nigeria. Inflation at first and second lags has negative effect on per capita income, but its current level is positive and significant. The long-run estimates indicated that manufacturing sector output per capita had direct and significant impact on economic growth in Nigeria. Equally, interest rate is directly and significantly related with income per capita in Nigeria at 10% level. On the other hand, investment, exchange rate and inflation rate have indirect effects on economic growth in Nigeria.

Concerning the third objective, the study found that there exist a long run relationship between electricity, gas, stream and air conditioner sector and economic growth in Nigeria. In the short run, electricity, gas, stream and air conditioner sector output per capita plays a key role in income per capita of Nigeria. Overall, the short-run parameter estimate of current investment was found to have positive and statistically significant influence on change in income per capita. As to interest rate, it indirectly influences income per capita significantly. Thus, low interest rate positively impacted on economic growth in the short run. Also, the long-run estimates of electricity, gas, stream and air conditioner sector has positive and insignificant impact on economic growth in Nigeria. Likewise, investment, interest rate, exchange rate, and inflation rate have direct effects on income per capita for the periods understudy.

The results of the fourth objective revealed that water supply, sewage and waste management sector performance has long run relationship with economic growth in Nigeria. The short-run parameter estimates of water supply, sewage and waste management sector was found to be negative and significant at 5%, which means that water supply, sewage and waste management sector negatively contribute to current income per capita in the short run. Concerning the long run estimates, water supply, sewage and waste management sector has negative and significant impact on income per capita in Nigeria at 10% level. Also, investment and interest rate have negative and insignificant impact on income per capita. On the contrary, exchange rate and inflation rate positively and significantly impacted income per capita in Nigeria for the periods understudy.

As to the last objective, the study found a long run relationship between construction sector performance and economic growth in Nigeria. The short-run construction sector output per capita at current and lag one was found to have negative impact on income per capita but only the former is significant at 5% level. Investment at lag one and two has a direct and significant effect on income per capita which are significant statistically. Meanwhile, interest rate at current, lag one and two negatively and significantly influence income per capita. As to inflation rate, its coefficients exact positive and significant impact on income per capita. The long-run estimates of construction sector income per capita positively impacted on income per capita in Nigeria. Similarly, interest rate and exchange rate have positive impact on income per capita in Nigeria. However, investment and inflation rate negatively and insignificantly influence income per capita.

5.2 Conclusion

This study investigates the effects of industrial sector performance (measured by mining and quarrying, manufacturing, electricity, gas, stream and air conditioner, water supply, sewage and waste management, and construction sector) on economic growth in Nigeria for a period of 1981 to 2021 using the ARDL bound testing approach. The study found that manufacturing sector performance significantly and positively impacted economic growth in short and long run. It means that manufacturing sector performance plays a key role in ensuring improvement in the overall economic growth of the Nigerian economy. Likewise, mining and quarrying sector performance positively impacted economic growth in the short and long run. Also, the performance of electricity, gas, stream and air conditioner sector only influenced income per capita positively in the short run. Meanwhile, construction and water supply, sewage and waste management sector performance adversely affect short run economic growth in Nigeria. The study concludes that manufacturing sector act as the main industrial sector component that drives the per capita output growth of Nigeria compared to other sub-sectors like mining and quarrying, electricity, gas, stream and air conditioner, construction and water supply, sewage and waste management sectors.

5.3 Recommendations

Following the reported findings discussed in the subsequent parts of the chapter in this research study, the following policy recommendations are discussed below:

a) It is important to harmonize industrial policies with adequate infrastructural development to drive the industrial sub-sector towards enhancing economic growth in Nigeria;

b) The creation of a favourable climate for the industrial sector to function well cannot be overemphasized. This will ensure the provision of the required economic overheads (infrastructure) that will aid smooth running of industrial activities in Nigeria;

c) The government should expand investment in solid minerals to stimulate mining activity in Nigeria. Such stimulation will drive up the revenue of the nation which can be utilized to drive other growth-led sectors of the economy for overall economic progress; and

d) Lastly, adequate allocation and management of existing industries is also required to guarantee roper and beneficial linking effects on the economy. By harmonizing industrial policies and embarking on adequate funding of industrial enterprises through the Bank of Industry (BOI), the industrial sector will live up to its expectation as the drive of growth and economic prosperity.

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Appendix

Years	GDP per capita (N)	Mining and Quarrying per capita (N)	Manufacturing per capita (N)	Electricity, Gas, Steam & Air conditioner per capita (N)	Water Supply, Sewage, Waste Mangement per capita (N)	Construction per capita (N)	Gross fixed capital formation per capita (N)	Interest rate	Exchange rate	Inflation, consumer prices (annual %)
	gdppc	mqs	man	egsa	wswm	con	inv	int	exc	inf
1981	1846.627	173.8978	374.1952	10.6508	30.2796	135.6872	209299.6	8.916667	0.610025	20.81282
1982	1925.041	117.8817	391.4042	11.08213	31.10614	118.6174	166527.4	9.5375	0.672867	7.697747
1983	1998.999	100.6837	421.7538	10.32556	44.39904	104.8651	128417.6	9.976667	0.724142	23.21233
1984	2036.301	121.4355	361.1657	9.865118	39.08434	86.38374	87432.63	10.24167	0.764942	17.82053
1985	2247.778	167.5598	473.2586	10.64112	33.11879	67.67675	72188.34	9.433333	0.89375	7.435345
1986	2310.032	144.9357	485.3378	7.798282	37.69235	82.63759	70487.48	9.959167	2.020575	5.717151
1987	2778.94	253.1405	521.9826	7.945633	39.6515	91.18706	64383.82	13.96167	4.017942	11.29032
1988	3491.502	249.5704	733.9013	7.801142	46.73252	100.7435	66903.41	16.61667	4.536733	54.51122
1989	4471.06	537.0625	820.6197	21.78308	49.58053	153.343	69425.98	20.44167	7.391558	50.46669
1990	5195.157	668.9687	923.8338	23.14404	54.9955	168.6801	76997.87	25.3	8.037808	7.3644
1991	6041.508	786.1479	1177.767	24.79569	59.35524	185.2116	74131.97	20.04167	9.909492	13.00697
1992	9045.665	1495.659	1596.966	25.22998	68.05866	225.1714	72656.83	24.75833	17.29843	44.58884
1993	12241.15	1408.887	2249.464	25.71772	88.61698	288.2343	76198.92	31.65	22.05106	57.16525
1994	16798.64	1262.228	3515.466	28.92115	92.48704	361.9632	72495	20.48333	21.8861	57.03171
1995	28719.62	4151.18	5742.119	29.39042	100.2264	471.3732	66014.71	20.23333	21.8861	72.8355
1996	36921.57	6104.55	7052.419	29.82303	103.5697	535.0971	68766.68	19.83667	21.8861	29.26829
1997	38945.88	5505.435	7477.038	29.00715	105.6149	610.8813	70997.48	17.795	21.8861	8.529874
1998	41309.89	3724.256	7208.809	27.15784	107.2216	789.5008	70215.53	18.18417	21.8861	9.996378
1999	45969.75	5034.917	7473.471	27.40661	110.5689	852.0511	70316.63	20.29	92.69335	6.618373
2000	57757.02	10422.32	8047.517	27.63476	113.8377	923.8501	73574.02	21.27417	102.1052	6.933292
2001	65668.94	7781.691	9144.636	327.5611	115.3865	1199.449	54711.08	23.43833	111.9433	18.87365
2002	89438.58	8175.105	10564.32	367.7626	122.7643	1377.448	58786.64	24.77083	120.9702	12.87658
2003	102781.7	12120.76	12396.1	428.4759	131.8489	1648.549	69583.96	20.71417	129.3565	14.03178
2004	133934.4	18299.04	14547.38	501.8335	145.3085	4530.473	54303.25	19.18083	133.5004	14.99803
2005	166506.2	23774.41	16752.32	534.8439	159.5967	5736.2	54156.72	17.94833	132.147	17.86349
2006	213101.9	28591.28	18865.64	765.0721	172.1852	6483.042	74070.56	16.89333	128.6516	8.225222
2007	236954.7	30059.83	19907.46	796.9628	200.1469	6721.546	56349.69	16.93917	125.8331	5.388008
2008	265883.5	35342.81	21719.79	892.9712	224.2586	7531.275	53448.74	15.13583	118.5669	11.58108
2009	281623	28142.32	22074.77	1028.091	245.7352	8316.691	57209.21	18.99083	148.8802	12.55496
2010	349957.3	53339.96	22577.72	1132.294	269.9777	9911.304	57936.11	17.585	150.298	13.7202
2011	391347.5	68173.41	27808.99	1694.379	278.0185	11704.64	51753.68	16.02	153.8616	10.84003
2012	434133.5	68089.48	33420.21	2247.484	285.9215	13088.17	51670.32	16.79167	157.4994	12.21778
2013	471630.3	60436.77	42111.54	2868.296	410.9754	15581.01	54261.94	16.7225	157.3112	8.475827
2014	510966.4	55082.14	49235.76	3015.531	510.4017	18076.72	59928.84	16.54833	158.5526	8.062486
2015	525444.8	33676.13	49541.23	2962.795	584.4539	19169.17	57592.88	16.84917	193.2792	9.009387
2016	551598.6	29412.44	47877.1	2821.447	737.5086	19394.25	53383.76	16.86802	253.4923	15.67534
2017	601966.2	54915.88	52623.85	3499.274	857.9039	22432.56	50461.22	17.55333	305.7901	16.52354

2018	659028	69680.59	63589.27	4449.544	1079.892	30790.4	53961.03	16.9039	306.0802	12.09473
2019	724704.1	63540.98	83503	5163.992	1465.608	44768.78	56954.91	15.37659	306.9206	11.39679
2020	748290.6	52642.81	94787.96	5557.569	1718.983	56464.08	47353.82	13.64202	358.8108	13.24602
2021	832899.3	50792.56	121692.4	8228.221	2418.371	78461.54	48329.15	11.48313	399.9636	16.95285

Source: CBN bulletin and WDI(2021)

	GDPPC	MQS	MAN	EGSA	WSWM	SER01	INV	INT	EXC	INF
Mean	211705.2	21817.10	21750.98	1211.720	329.0596	9505.865	70820.47	17.44602	108.1675	18.94905
Median	65668.94	8175.105	9144.636	327.5611	115.3865	1199.449	66014.71	16.93917	111.9433	12.87658
Maximum	832899.3	69680.59	121692.4	8228.221	2418.371	78461.54	209299.6	31.65000	399.9636	72.83550
Minimum	1846.627	100.6837	361.1657	7.798282	30.27960	67.67675	47353.82	8.916667	0.610025	5.388008
Std. Dev.	254830.0	24359.64	28466.91	1900.087	508.5273	16651.47	30614.19	4.810706	109.9115	16.65935
Skewness	0.998091	0.761717	1.807207	1.917964	2.602139	2.590102	3.204178	0.319264	0.972937	1.854175
Kurtosis	2.645213	2.051276	5.912064	6.368777	9.577357	9.810468	13.55030	3.645661	3.172454	5.306552
Jarque-Bera	7.022305	5.502418	36.80452	44.52430	120.1746	125.0790	260.3089	1.408686	6.519282	32.58139
Probability	0.029862	0.063851	0.000000	0.000000	0.000000	0.000000	0.000000	0.494433	0.038402	0.000000
Sum	8679912.	894501.1	891790.0	49680.52	13491.44	389740.5	2903639.	715.2870	4434.867	776.9108
Sum Sq. Dev.	2.60E+12	2.37E+10	3.24E+10	1.44E+08	10344001	1.11E+10	3.75E+10	925.7158	483221.4	11101.36
Observations	41	41	41	41	41	41	41	41	41	41

Unit Root

Null Hypothesis: GDPPC has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.240036	0.9999
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDPPC)
Method: Least Squares
Date: 11/23/22 Time: 06:53
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPPC(-1)	0.025420	0.020499	1.240036	0.2228
C	-7041.518	5566.277	-1.265032	0.2138
@TREND("1981")	1113.710	416.6659	2.672908	0.0111

R-squared	0.690070	Mean dependent var	20776.32
Adjusted R-squared	0.673317	S.D. dependent var	22474.98
S.E. of regression	12845.85	Akaike info criterion	21.83147
Sum squared resid	6.11E+09	Schwarz criterion	21.95813
Log likelihood	-433.6293	Hannan-Quinn criter.	21.87727
F-statistic	41.19083	Durbin-Watson stat	2.016005
Prob(F-statistic)	0.000000		

Null Hypothesis: D(GDPPC) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.734049	0.0002
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDPPC,2)
Method: Least Squares
Date: 11/23/22 Time: 06:53
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDPPC(-1))	-1.050722	0.183243	-5.734049	0.0000
C	-13351.49	4915.754	-2.716062	0.0101
@TREND("1981")	1696.634	324.8030	5.223580	0.0000

R-squared	0.483868	Mean dependent var	2167.443
Adjusted R-squared	0.455194	S.D. dependent var	17825.50
S.E. of regression	13157.18	Akaike info criterion	21.88113
Sum squared resid	6.23E+09	Schwarz criterion	22.00909
Log likelihood	-423.6820	Hannan-Quinn criter.	21.92704
F-statistic	16.87480	Durbin-Watson stat	1.846798
Prob(F-statistic)	0.000007		

Null Hypothesis: GDPPC has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		1.345660	1.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.53E+08
HAC corrected variance (Bartlett kernel)	1.38E+08

Phillips-Perron Test Equation
Dependent Variable: D(GDPPC)
Method: Least Squares
Date: 11/23/22 Time: 06:56
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPPC(-1)	0.025420	0.020499	1.240036	0.2228
C	-7041.518	5566.277	-1.265032	0.2138
@TREND("1981")	1113.710	416.6659	2.672908	0.0111

R-squared	0.690070	Mean dependent var	20776.32
Adjusted R-squared	0.673317	S.D. dependent var	22474.98
S.E. of regression	12845.85	Akaike info criterion	21.83147
Sum squared resid	6.11E+09	Schwarz criterion	21.95813
Log likelihood	-433.6293	Hannan-Quinn criter.	21.87727
F-statistic	41.19083	Durbin-Watson stat	2.016005
Prob(F-statistic)	0.000000		

Null Hypothesis: D(GDPPC) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.778327	0.0001
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.60E+08
HAC corrected variance (Bartlett kernel)	1.72E+08

Phillips-Perron Test Equation
Dependent Variable: D(GDPPC,2)
Method: Least Squares
Date: 11/23/22 Time: 06:57
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDPPC(-1))	-1.050722	0.183243	-5.734049	0.0000
C	-13351.49	4915.754	-2.716062	0.0101
@TREND("1981")	1696.634	324.8030	5.223580	0.0000

R-squared	0.483868	Mean dependent var	2167.443
Adjusted R-squared	0.455194	S.D. dependent var	17825.50
S.E. of regression	13157.18	Akaike info criterion	21.88113
Sum squared resid	6.23E+09	Schwarz criterion	22.00909
Log likelihood	-423.6820	Hannan-Quinn criter.	21.92704
F-statistic	16.87480	Durbin-Watson stat	1.846798
Prob(F-statistic)	0.000007		

Null Hypothesis: MQS has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.233504	0.4580
Test critical values:	1% level	-4.226815	
	5% level	-3.536601	
	10% level	-3.200320	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MQS)
Method: Least Squares
Date: 11/23/22 Time: 06:58
Sample (adjusted): 1985 2021
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MQS(-1)	-0.308146	0.137965	-2.233504	0.0329
D(MQS(-1))	0.437566	0.177293	2.468035	0.0193
D(MQS(-2))	-0.232004	0.176674	-1.313177	0.1988
D(MQS(-3))	-0.074111	0.181982	-0.407243	0.6866
C	-5996.741	3955.586	-1.516018	0.1396
@TREND("1981")	650.2340	282.1482	2.304583	0.0281

R-squared	0.377079	Mean dependent var	1369.490
Adjusted R-squared	0.276608	S.D. dependent var	8531.912
S.E. of regression	7256.602	Akaike info criterion	20.76460
Sum squared resid	1.63E+09	Schwarz criterion	21.02583
Log likelihood	-378.1452	Hannan-Quinn criter.	20.85670
F-statistic	3.753106	Durbin-Watson stat	2.025625
Prob(F-statistic)	0.008994		

Null Hypothesis: D(MQS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.259395	0.0094
Test critical values:	1% level	-4.234972	
	5% level	-3.540328	
	10% level	-3.202445	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MQS,2)
Method: Least Squares
Date: 11/23/22 Time: 06:59
Sample (adjusted): 1986 2021
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MQS(-1))	-1.571440	0.368935	-4.259395	0.0002
D(MQS(-1),2)	0.821369	0.289790	2.834361	0.0081
D(MQS(-2),2)	0.363302	0.232733	1.561028	0.1290
D(MQS(-3),2)	0.213560	0.192126	1.111563	0.2752
C	411.1639	3104.935	0.132423	0.8955
@TREND("1981")	91.18957	129.3808	0.704816	0.4864

R-squared	0.528039	Mean dependent var	-52.67709
Adjusted R-squared	0.449378	S.D. dependent var	10495.65
S.E. of regression	7788.181	Akaike info criterion	20.90961
Sum squared resid	1.82E+09	Schwarz criterion	21.17353
Log likelihood	-370.3731	Hannan-Quinn criter.	21.00173
F-statistic	6.712906	Durbin-Watson stat	2.103097
Prob(F-statistic)	0.000264		

Null Hypothesis: MQS has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.247414	0.4516
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	56300738
HAC corrected variance (Bartlett kernel)	42129525

Phillips-Perron Test Equation
Dependent Variable: D(MQS)
Method: Least Squares
Date: 11/23/22 Time: 07:00
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MQS(-1)	-0.264802	0.107453	-2.464353	0.0185
C	-3592.614	3055.644	-1.175731	0.2472
@TREND("1981")	509.4380	222.6060	2.288519	0.0279

R-squared	0.142381	Mean dependent var	1265.466
Adjusted R-squared	0.096023	S.D. dependent var	8205.545
S.E. of regression	7801.645	Akaike info criterion	20.83410
Sum squared resid	2.25E+09	Schwarz criterion	20.96076
Log likelihood	-413.6819	Hannan-Quinn criter.	20.87989
F-statistic	3.071341	Durbin-Watson stat	1.341791
Prob(F-statistic)	0.058338		

Null Hypothesis: D(MQS) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 38 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.106641	0.0001
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	62564171
HAC corrected variance (Bartlett kernel)	5513061.

Phillips-Perron Test Equation
Dependent Variable: D(MQS,2)
Method: Least Squares
Date: 11/23/22 Time: 07:01
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MQS(-1))	-0.736492	0.161246	-4.567491	0.0001
C	656.3942	2791.698	0.235124	0.8154
@TREND("1981")	13.73541	117.3387	0.117058	0.9075

R-squared	0.367150	Mean dependent var	-46.00602
Adjusted R-squared	0.331991	S.D. dependent var	10072.86
S.E. of regression	8232.731	Akaike info criterion	20.94343
Sum squared resid	2.44E+09	Schwarz criterion	21.07139
Log likelihood	-405.3968	Hannan-Quinn criter.	20.98934
F-statistic	10.44275	Durbin-Watson stat	1.777744
Prob(F-statistic)	0.000265		

Null Hypothesis: MAN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		4.716042	1.0000
Test critical values:	1% level	-4.243644	
	5% level	-3.544284	
	10% level	-3.204699	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MAN)
Method: Least Squares
Date: 11/23/22 Time: 07:02
Sample (adjusted): 1987 2021
Included observations: 35 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MAN(-1)	0.646631	0.137113	4.716042	0.0001
D(MAN(-1))	-1.291811	0.418397	-3.087525	0.0046
D(MAN(-2))	0.149449	0.390583	0.382629	0.7050
D(MAN(-3))	-2.089124	0.450759	-4.634683	0.0001
D(MAN(-4))	-0.404242	0.512092	-0.789395	0.4368
D(MAN(-5))	-1.257957	0.553758	-2.271672	0.0313
C	2488.013	1674.259	1.486038	0.1489
@TREND("1981")	-174.2708	109.4076	-1.592859	0.1228

R-squared	0.844801	Mean dependent var	3463.060
Adjusted R-squared	0.804564	S.D. dependent var	5925.346
S.E. of regression	2619.482	Akaike info criterion	18.77697
Sum squared resid	1.85E+08	Schwarz criterion	19.13248
Log likelihood	-320.5970	Hannan-Quinn criter.	18.89969
F-statistic	20.99577	Durbin-Watson stat	1.988536
Prob(F-statistic)	0.000000		

Null Hypothesis: D(MAN) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.341041	0.0000
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MAN,2)
Method: Least Squares
Date: 11/23/22 Time: 07:03
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MAN(-1))	-0.211022	0.186070	-1.134104	0.2642
C	-1589.388	1339.696	-1.186379	0.2432
@TREND("1981")	132.8410	68.06746	1.951609	0.0588

R-squared	0.095977	Mean dependent var	689.4174
Adjusted R-squared	0.045754	S.D. dependent var	3815.077
S.E. of regression	3726.778	Akaike info criterion	19.35828
Sum squared resid	5.00E+08	Schwarz criterion	19.48625
Log likelihood	-374.4864	Hannan-Quinn criter.	19.40419
F-statistic	1.911008	Durbin-Watson stat	1.879120
Prob(F-statistic)	0.162640		

Null Hypothesis: MAN has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		5.202657	1.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	9922712.
HAC corrected variance (Bartlett kernel)	11724421

Phillips-Perron Test Equation
Dependent Variable: D(MAN)
Method: Least Squares
Date: 11/23/22 Time: 07:05
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MAN(-1)	0.255329	0.043955	5.808821	0.0000
C	1166.787	1291.979	0.903101	0.3723
@TREND("1981")	-148.7575	89.65927	-1.659142	0.1055

R-squared	0.681337	Mean dependent var	3032.956
Adjusted R-squared	0.664112	S.D. dependent var	5651.282
S.E. of regression	3275.249	Akaike info criterion	19.09821
Sum squared resid	3.97E+08	Schwarz criterion	19.22488
Log likelihood	-378.9643	Hannan-Quinn criter.	19.14401
F-statistic	39.55504	Durbin-Watson stat	1.492634
Prob(F-statistic)	0.000000		

Null Hypothesis: D(MAN) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.679243	0.0000
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	12820500
HAC corrected variance (Bartlett kernel)	10959218

Phillips-Perron Test Equation
Dependent Variable: D(MAN,2)
Method: Least Squares
Date: 11/23/22 Time: 07:06
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MAN(-1))	-0.211022	0.186070	-1.134104	0.2642
C	-1589.388	1339.696	-1.186379	0.2432
@TREND("1981")	132.8410	68.06746	1.951609	0.0588

R-squared	0.095977	Mean dependent var	689.4174
Adjusted R-squared	0.045754	S.D. dependent var	3815.077
S.E. of regression	3726.778	Akaike info criterion	19.35828
Sum squared resid	5.00E+08	Schwarz criterion	19.48625
Log likelihood	-374.4864	Hannan-Quinn criter.	19.40419
F-statistic	1.911008	Durbin-Watson stat	1.879120
Prob(F-statistic)	0.162640		

Null Hypothesis: EGSA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		3.301636	1.0000
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EGSA)
Method: Least Squares
Date: 11/23/22 Time: 07:07
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EGSA(-1)	0.251132	0.076063	3.301636	0.0022
D(EGSA(-1))	-0.114567	0.331486	-0.345616	0.7317
C	39.19619	148.9230	0.263198	0.7939
@TREND("1981")	-3.764794	9.096169	-0.413888	0.6815

R-squared	0.496764	Mean dependent var	210.6959
Adjusted R-squared	0.453629	S.D. dependent var	477.7933
S.E. of regression	353.1700	Akaike info criterion	14.66869
Sum squared resid	4365516.	Schwarz criterion	14.83931
Log likelihood	-282.0395	Hannan-Quinn criter.	14.72991
F-statistic	11.51661	Durbin-Watson stat	1.553035
Prob(F-statistic)	0.000021		

Null Hypothesis: D(EGSA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.559138	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EGSA,2)
Method: Least Squares
Date: 11/23/22 Time: 07:08
Sample (adjusted): 1984 2021
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EGSA(-1))	-0.494166	0.392464	-1.259138	0.2166
D(EGSA(-1),2)	-0.183461	0.373668	-0.490973	0.6266
C	-219.9405	160.1249	-1.373556	0.1786
@TREND("1981")	16.94267	8.282980	2.045480	0.0486

R-squared	0.148150	Mean dependent var	70.30021
Adjusted R-squared	0.072987	S.D. dependent var	423.3797
S.E. of regression	407.6364	Akaike info criterion	14.95793
Sum squared resid	5649693.	Schwarz criterion	15.13031
Log likelihood	-280.2007	Hannan-Quinn criter.	15.01926
F-statistic	1.971044	Durbin-Watson stat	1.368506
Prob(F-statistic)	0.136864		

Null Hypothesis: EGSA has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		4.529428	1.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	109541.3
HAC corrected variance (Bartlett kernel)	86070.83

Phillips-Perron Test Equation
Dependent Variable: D(EGSA)
Method: Least Squares
Date: 11/23/22 Time: 07:09
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EGSA(-1)	0.236810	0.063064	3.755057	0.0006
C	34.19446	134.7247	0.253810	0.8010
@TREND("1981")	-3.617708	8.372796	-0.432079	0.6682

R-squared	0.497401	Mean dependent var	205.4392
Adjusted R-squared	0.470233	S.D. dependent var	472.7983
S.E. of regression	344.1265	Akaike info criterion	14.59193
Sum squared resid	4381653.	Schwarz criterion	14.71860
Log likelihood	-288.8387	Hannan-Quinn criter.	14.63773
F-statistic	18.30867	Durbin-Watson stat	1.583883
Prob(F-statistic)	0.000003		

Null Hypothesis: D(EGSA) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.770361	0.0000
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	146799.0
HAC corrected variance (Bartlett kernel)	146799.0

Phillips-Perron Test Equation
Dependent Variable: D(EGSA,2)
Method: Least Squares
Date: 11/23/22 Time: 07:10
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EGSA(-1))	-0.577317	0.326101	-1.770361	0.0851
C	-213.1619	144.3211	-1.476997	0.1484
@TREND("1981")	17.32096	7.313796	2.368258	0.0234

R-squared	0.137419	Mean dependent var	68.46718
Adjusted R-squared	0.089497	S.D. dependent var	417.9286
S.E. of regression	398.7885	Akaike info criterion	14.88854
Sum squared resid	5725162.	Schwarz criterion	15.01651
Log likelihood	-287.3266	Hannan-Quinn criter.	14.93446
F-statistic	2.867597	Durbin-Watson stat	1.324970
Prob(F-statistic)	0.069888		

Null Hypothesis: WSWM has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.339221	1.0000
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(WSWM)
Method: Least Squares
Date: 11/23/22 Time: 07:13
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WSWM(-1)	0.642669	0.052083	12.33922	0.0000
D(WSWM(-1))	-1.287015	0.216779	-5.936975	0.0000
C	0.288364	13.31872	0.021651	0.9828
@TREND("1981")	-3.110447	0.779859	-3.988471	0.0003

R-squared	0.935177	Mean dependent var	61.21191
Adjusted R-squared	0.929621	S.D. dependent var	133.6142
S.E. of regression	35.44655	Akaike info criterion	10.07084
Sum squared resid	43976.02	Schwarz criterion	10.24147
Log likelihood	-192.3814	Hannan-Quinn criter.	10.13206
F-statistic	168.3114	Durbin-Watson stat	2.255650
Prob(F-statistic)	0.000000		

Null Hypothesis: D(WSWM) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.803571	0.0123
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(WSWM,2)
Method: Least Squares
Date: 11/23/22 Time: 07:14
Sample (adjusted): 1984 2021
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(WSWM(-1))	0.579489	0.152354	3.803571	0.0006
D(WSWM(-1),2)	-1.514195	0.211389	-7.163083	0.0000
C	-12.12159	20.82285	-0.582129	0.5643
@TREND("1981")	0.674440	1.057111	0.638003	0.5277

R-squared	0.648103	Mean dependent var	18.05512
Adjusted R-squared	0.617053	S.D. dependent var	84.64544
S.E. of regression	52.38089	Akaike info criterion	10.85426
Sum squared resid	93287.74	Schwarz criterion	11.02664
Log likelihood	-202.2310	Hannan-Quinn criter.	10.91559
F-statistic	20.87305	Durbin-Watson stat	2.725584
Prob(F-statistic)	0.000000		

Null Hypothesis: WSWM has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		2.074981	1.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	2209.515
HAC corrected variance (Bartlett kernel)	779.1689

Phillips-Perron Test Equation
Dependent Variable: D(WSWM)
Method: Least Squares
Date: 11/23/22 Time: 07:16
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WSWM(-1)	0.362034	0.030309	11.94459	0.0000
C	2.119959	17.23464	0.123006	0.9028
@TREND("1981")	-2.079927	1.005822	-2.067887	0.0457

R-squared	0.870402	Mean dependent var	59.70228
Adjusted R-squared	0.863397	S.D. dependent var	132.2352
S.E. of regression	48.87397	Akaike info criterion	10.68841
Sum squared resid	88380.62	Schwarz criterion	10.81507
Log likelihood	-210.7681	Hannan-Quinn criter.	10.73420
F-statistic	124.2491	Durbin-Watson stat	2.778471
Prob(F-statistic)	0.000000		

Null Hypothesis: D(WSWM) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.524671	0.0109
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	6032.812
HAC corrected variance (Bartlett kernel)	3307.906

Phillips-Perron Test Equation
Dependent Variable: D(WSWM,2)
Method: Least Squares
Date: 11/23/22 Time: 07:17
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(WSWM(-1))	0.131541	0.211197	0.622835	0.5373
C	-23.79321	30.04803	-0.791839	0.4336
@TREND("1981")	1.714728	1.538861	1.114284	0.2725

R-squared	0.112587	Mean dependent var	17.91182
Adjusted R-squared	0.063287	S.D. dependent var	83.52906
S.E. of regression	80.84273	Akaike info criterion	11.69669
Sum squared resid	235279.7	Schwarz criterion	11.82466
Log likelihood	-225.0855	Hannan-Quinn criter.	11.74260
F-statistic	2.283685	Durbin-Watson stat	2.323576
Prob(F-statistic)	0.116483		

Null Hypothesis: CONN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.968160	0.9931
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CONN)
Method: Least Squares
Date: 11/23/22 Time: 07:19
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONN(-1)	0.285715	0.072002	3.968160	0.0003
D(CONN(-1))	0.409017	0.235765	1.734848	0.0916
C	751.2282	689.2782	1.089877	0.2832
@TREND("1981")	-76.79169	41.23560	-1.862267	0.0710

R-squared	0.871818	Mean dependent var	2008.793
Adjusted R-squared	0.860831	S.D. dependent var	4504.499
S.E. of regression	1680.422	Akaike info criterion	17.78839
Sum squared resid	98833576	Schwarz criterion	17.95901
Log likelihood	-342.8736	Hannan-Quinn criter.	17.84961
F-statistic	79.34957	Durbin-Watson stat	1.889719
Prob(F-statistic)	0.000000		

Null Hypothesis: D(CONN) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.600895	0.0087
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CONN,2)
Method: Least Squares
Date: 11/23/22 Time: 07:20
Sample (adjusted): 1984 2021
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CONN(-1))	0.385694	0.148293	2.600895	0.0137
D(CONN(-1),2)	-0.533361	0.250606	-2.128287	0.0406
C	-469.1061	747.4413	-0.627616	0.5344
@TREND("1981")	29.80667	36.37162	0.819504	0.4182

R-squared	0.305197	Mean dependent var	579.2426
Adjusted R-squared	0.243890	S.D. dependent var	2216.209
S.E. of regression	1927.094	Akaike info criterion	18.06472
Sum squared resid	1.26E+08	Schwarz criterion	18.23709
Log likelihood	-339.2296	Hannan-Quinn criter.	18.12605
F-statistic	4.978236	Durbin-Watson stat	1.952784
Prob(F-statistic)	0.005706		

Null Hypothesis: CONN has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		1.006067	0.9399
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	2705609.
HAC corrected variance (Bartlett kernel)	3428614.

Phillips-Perron Test Equation
Dependent Variable: D(CONN)
Method: Least Squares
Date: 11/23/22 Time: 07:21
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONN(-1)	0.392294	0.034110	11.50074	0.0000
C	910.5466	636.0027	1.431671	0.1606
@TREND("1981")	-97.81567	36.83971	-2.655169	0.0116

R-squared	0.860363	Mean dependent var	1958.146
Adjusted R-squared	0.852815	S.D. dependent var	4457.897
S.E. of regression	1710.258	Akaike info criterion	17.79871
Sum squared resid	1.08E+08	Schwarz criterion	17.92538
Log likelihood	-352.9743	Hannan-Quinn criter.	17.84451
F-statistic	113.9864	Durbin-Watson stat	1.383345
Prob(F-statistic)	0.000000		

Null Hypothesis: D(CONN) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.860352	0.0002
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	3674314.
HAC corrected variance (Bartlett kernel)	2670166.

Phillips-Perron Test Equation
Dependent Variable: D(CONN,2)
Method: Least Squares
Date: 11/23/22 Time: 07:22
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CONN(-1))	0.233167	0.132474	1.760101	0.0869
C	-494.6153	728.5389	-0.678914	0.5015
@TREND("1981")	34.39634	35.91876	0.957615	0.3446

R-squared	0.212871	Mean dependent var	564.4752
Adjusted R-squared	0.169141	S.D. dependent var	2188.797
S.E. of regression	1995.121	Akaike info criterion	18.10860
Sum squared resid	1.43E+08	Schwarz criterion	18.23657
Log likelihood	-350.1177	Hannan-Quinn criter.	18.15451
F-statistic	4.867903	Durbin-Watson stat	2.232569
Prob(F-statistic)	0.013453		

Null Hypothesis: INV has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.088315	0.0000
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INV)
Method: Least Squares
Date: 11/23/22 Time: 07:25
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INV(-1)	-0.530268	0.074809	-7.088315	0.0000
D(INV(-1))	0.040017	0.100845	0.396816	0.6939
C	40604.56	6864.289	5.915333	0.0000
@TREND("1981")	-356.7785	124.0901	-2.875157	0.0068

R-squared	0.696802	Mean dependent var	-3030.723
Adjusted R-squared	0.670814	S.D. dependent var	11353.44
S.E. of regression	6514.007	Akaike info criterion	20.49821
Sum squared resid	1.49E+09	Schwarz criterion	20.66883
Log likelihood	-395.7151	Hannan-Quinn criter.	20.55943
F-statistic	26.81209	Durbin-Watson stat	2.365225
Prob(F-statistic)	0.000000		

Null Hypothesis: INV has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.07706	0.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	46378459
HAC corrected variance (Bartlett kernel)	29590012

Phillips-Perron Test Equation
Dependent Variable: D(INV)
Method: Least Squares
Date: 11/23/22 Time: 07:26
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INV(-1)	-0.400131	0.047740	-8.381530	0.0000
C	29140.32	5539.748	5.260226	0.0000
@TREND("1981")	-224.4934	125.7315	-1.785499	0.0824

R-squared	0.711851	Mean dependent var	-4024.261
Adjusted R-squared	0.696276	S.D. dependent var	12848.35
S.E. of regression	7080.881	Akaike info criterion	20.64022
Sum squared resid	1.86E+09	Schwarz criterion	20.76689
Log likelihood	-409.8045	Hannan-Quinn criter.	20.68602
F-statistic	45.70295	Durbin-Watson stat	2.101871
Prob(F-statistic)	0.000000		

Null Hypothesis: INT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.123516	0.5175
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INT)
Method: Least Squares
Date: 11/23/22 Time: 07:27
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT(-1)	-0.206210	0.097108	-2.123516	0.0405
C	4.575866	1.835296	2.493257	0.0173
@TREND("1981")	-0.043094	0.039665	-1.086437	0.2843

R-squared	0.150004	Mean dependent var	0.064162
Adjusted R-squared	0.104058	S.D. dependent var	3.024688
S.E. of regression	2.862995	Akaike info criterion	5.013652
Sum squared resid	303.2794	Schwarz criterion	5.140318
Log likelihood	-97.27304	Hannan-Quinn criter.	5.059451
F-statistic	3.264799	Durbin-Watson stat	2.134660
Prob(F-statistic)	0.049456		

Null Hypothesis: D(INT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.746231	0.0002
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INT,2)
Method: Least Squares
Date: 11/23/22 Time: 07:28
Sample (adjusted): 1984 2021
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INT(-1))	-1.466505	0.255212	-5.746231	0.0000
D(INT(-1),2)	0.249555	0.166524	1.498608	0.1432
C	1.917323	1.120160	1.711652	0.0961
@TREND("1981")	-0.084271	0.046396	-1.816332	0.0781

R-squared	0.611792	Mean dependent var	-0.068370
Adjusted R-squared	0.577539	S.D. dependent var	4.636780
S.E. of regression	3.013768	Akaike info criterion	5.143560
Sum squared resid	308.8151	Schwarz criterion	5.315938
Log likelihood	-93.72764	Hannan-Quinn criter.	5.204891
F-statistic	17.86067	Durbin-Watson stat	1.845891
Prob(F-statistic)	0.000000		

Null Hypothesis: INT has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.005641	0.5806
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	7.581986
HAC corrected variance (Bartlett kernel)	6.500683

Phillips-Perron Test Equation
Dependent Variable: D(INT)
Method: Least Squares
Date: 11/23/22 Time: 07:28
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT(-1)	-0.206210	0.097108	-2.123516	0.0405
C	4.575866	1.835296	2.493257	0.0173
@TREND("1981")	-0.043094	0.039665	-1.086437	0.2843

R-squared	0.150004	Mean dependent var	0.064162
Adjusted R-squared	0.104058	S.D. dependent var	3.024688
S.E. of regression	2.862995	Akaike info criterion	5.013652
Sum squared resid	303.2794	Schwarz criterion	5.140318
Log likelihood	-97.27304	Hannan-Quinn criter.	5.059451
F-statistic	3.264799	Durbin-Watson stat	2.134660
Prob(F-statistic)	0.049456		

Null Hypothesis: D(INT) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.194474	0.0000
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	8.459218
HAC corrected variance (Bartlett kernel)	7.527753

Phillips-Perron Test Equation
Dependent Variable: D(INT,2)
Method: Least Squares
Date: 11/23/22 Time: 07:29
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INT(-1))	-1.171975	0.164462	-7.126103	0.0000
C	1.471024	1.044847	1.407885	0.1677
@TREND("1981")	-0.066681	0.043884	-1.519472	0.1374

R-squared	0.585282	Mean dependent var	-0.071275
Adjusted R-squared	0.562242	S.D. dependent var	4.575399
S.E. of regression	3.027235	Akaike info criterion	5.126980
Sum squared resid	329.9095	Schwarz criterion	5.254946
Log likelihood	-96.97611	Hannan-Quinn criter.	5.172893
F-statistic	25.40294	Durbin-Watson stat	2.081280
Prob(F-statistic)	0.000000		

Null Hypothesis: EXC has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.068481	0.9958
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXC)
Method: Least Squares
Date: 11/23/22 Time: 07:30
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXC(-1)	0.005195	0.075862	0.068481	0.9458
C	-4.215306	7.476612	-0.563799	0.5763
@TREND("1981")	0.667078	0.653851	1.020230	0.3142

R-squared	0.185285	Mean dependent var	9.983841
Adjusted R-squared	0.141246	S.D. dependent var	19.25040
S.E. of regression	17.83915	Akaike info criterion	8.672706
Sum squared resid	11774.70	Schwarz criterion	8.799372
Log likelihood	-170.4541	Hannan-Quinn criter.	8.718505
F-statistic	4.207326	Durbin-Watson stat	1.572502
Prob(F-statistic)	0.022574		

Null Hypothesis: D(EXC) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.776618	0.0023
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXC,2)
Method: Least Squares
Date: 11/23/22 Time: 07:31
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXC(-1))	-0.789430	0.165270	-4.776618	0.0000
C	-4.085095	6.033502	-0.677069	0.5027
@TREND("1981")	0.589967	0.272766	2.162909	0.0373

R-squared	0.389137	Mean dependent var	1.053590
Adjusted R-squared	0.355200	S.D. dependent var	22.01666
S.E. of regression	17.67925	Akaike info criterion	8.656463
Sum squared resid	11252.01	Schwarz criterion	8.784430
Log likelihood	-165.8010	Hannan-Quinn criter.	8.702377
F-statistic	11.46652	Durbin-Watson stat	1.902266
Prob(F-statistic)	0.000140		

Null Hypothesis: EXC has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.020149	0.9952
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	294.3675
HAC corrected variance (Bartlett kernel)	304.0511

Phillips-Perron Test Equation
Dependent Variable: D(EXC)
Method: Least Squares
Date: 11/23/22 Time: 07:32
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXC(-1)	0.005195	0.075862	0.068481	0.9458
C	-4.215306	7.476612	-0.563799	0.5763
@TREND("1981")	0.667078	0.653851	1.020230	0.3142

R-squared	0.185285	Mean dependent var	9.983841
Adjusted R-squared	0.141246	S.D. dependent var	19.25040
S.E. of regression	17.83915	Akaike info criterion	8.672706
Sum squared resid	11774.70	Schwarz criterion	8.799372
Log likelihood	-170.4541	Hannan-Quinn criter.	8.718505
F-statistic	4.207326	Durbin-Watson stat	1.572502
Prob(F-statistic)	0.022574		

Null Hypothesis: D(EXC) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.625688	0.0034
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	288.5130
HAC corrected variance (Bartlett kernel)	218.6699

Phillips-Perron Test Equation
Dependent Variable: D(EXC,2)
Method: Least Squares
Date: 11/23/22 Time: 07:33
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXC(-1))	-0.789430	0.165270	-4.776618	0.0000
C	-4.085095	6.033502	-0.677069	0.5027
@TREND("1981")	0.589967	0.272766	2.162909	0.0373

R-squared	0.389137	Mean dependent var	1.053590
Adjusted R-squared	0.355200	S.D. dependent var	22.01666
S.E. of regression	17.67925	Akaike info criterion	8.656463
Sum squared resid	11252.01	Schwarz criterion	8.784430
Log likelihood	-165.8010	Hannan-Quinn criter.	8.702377
F-statistic	11.46652	Durbin-Watson stat	1.902266
Prob(F-statistic)	0.000140		

Null Hypothesis: INF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.102317	0.0131
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 11/23/22 Time: 07:34
Sample (adjusted): 1983 2021
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.588495	0.143454	-4.102317	0.0002
D(INF(-1))	0.345009	0.154737	2.229650	0.0323
C	18.48310	5.993241	3.083990	0.0040
@TREND("1981")	-0.334544	0.193068	-1.732778	0.0919

R-squared	0.327716	Mean dependent var	0.237310
Adjusted R-squared	0.270091	S.D. dependent var	14.84038
S.E. of regression	12.67883	Akaike info criterion	8.014659
Sum squared resid	5626.344	Schwarz criterion	8.185281
Log likelihood	-152.2858	Hannan-Quinn criter.	8.075876
F-statistic	5.687106	Durbin-Watson stat	1.807882
Prob(F-statistic)	0.002789		

Null Hypothesis: INF has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.581751	0.0071
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	167.8316
HAC corrected variance (Bartlett kernel)	198.9246

Phillips-Perron Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 11/23/22 Time: 07:35
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.428229	0.134855	-3.175467	0.0030
C	12.07466	5.788566	2.085949	0.0439
@TREND("1981")	-0.196842	0.194586	-1.011592	0.3183

R-squared	0.214164	Mean dependent var	-0.096499
Adjusted R-squared	0.171686	S.D. dependent var	14.80023
S.E. of regression	13.46995	Akaike info criterion	8.110838
Sum squared resid	6713.263	Schwarz criterion	8.237504
Log likelihood	-159.2168	Hannan-Quinn criter.	8.156636
F-statistic	5.041799	Durbin-Watson stat	1.586962
Prob(F-statistic)	0.011578		

Objective I

Dependent Variable: LOG(GDPPC)
Method: ARDL
Date: 11/23/22 Time: 07:42
Sample (adjusted): 1984 2021
Included observations: 38 after adjustments
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (3 lags, automatic): LOG(MQS) LOG(INV) INT LOG(EXC) INF
Fixed regressors: C
Number of models evaluated: 3072
Selected Model: ARDL(2, 0, 1, 3, 1, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(GDPPC(-1))	0.378660	0.126691	2.988856	0.0068
LOG(GDPPC(-2))	0.433837	0.116289	3.730673	0.0012
LOG(MQS)	0.103467	0.023517	4.399699	0.0002
LOG(INV)	0.073188	0.082589	0.886170	0.3851
LOG(INV(-1))	-0.126615	0.064256	-1.970490	0.0615
INT	-0.005944	0.002964	-2.005252	0.0574
INT(-1)	-0.004061	0.003507	-1.158100	0.2592
INT(-2)	0.008519	0.003642	2.338785	0.0288
INT(-3)	0.009788	0.003326	2.942647	0.0075
LOG(EXC)	-0.013381	0.029469	-0.454086	0.6542
LOG(EXC(-1))	0.074181	0.033457	2.217216	0.0372
INF	0.002760	0.000698	3.953580	0.0007
INF(-1)	0.001216	0.000838	1.451537	0.1607
INF(-2)	-0.000486	0.000889	-0.546750	0.5901
INF(-3)	-0.001489	0.000720	-2.070019	0.0504
C	1.547143	1.060113	1.459414	0.1586

R-squared	0.999786	Mean dependent var	11.12889
Adjusted R-squared	0.999640	S.D. dependent var	1.989652
S.E. of regression	0.037732	Akaike info criterion	-3.421031
Sum squared resid	0.031322	Schwarz criterion	-2.731522
Log likelihood	80.99960	Hannan-Quinn criter.	-3.175709
F-statistic	68.57122	Durbin-Watson stat	2.090652
Prob(F-statistic)	0.000000		

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

ARDL Long Run Form and Bounds Test
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(2, 0, 1, 3, 1, 3)
Case 2: Restricted Constant and No Trend
Date: 11/23/22 Time: 07:45
Sample: 1981 2021
Included observations: 38

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.547143	1.060113	1.459414	0.1586
LOG(GDPPC(-1))*	-0.187503	0.027787	-6.747786	0.0000
LOG(MQS)**	0.103467	0.023517	4.399699	0.0002
LOG(INV(-1))	-0.053427	0.095507	-0.559405	0.5815
INT(-1)	0.008302	0.004604	1.803153	0.0851
LOG(EXC(-1))	0.060800	0.027976	2.173310	0.0408
INF(-1)	0.002001	0.001033	1.936845	0.0657
DLOG(GDPPC(-1))	-0.433837	0.116289	-3.730673	0.0012
DLOG(INV)	0.073188	0.082589	0.886170	0.3851
D(INT)	-0.005944	0.002964	-2.005252	0.0574
D(INT(-1))	-0.018307	0.003871	-4.729411	0.0001
D(INT(-2))	-0.009788	0.003326	-2.942647	0.0075
DLOG(EXC)	-0.013381	0.029469	-0.454086	0.6542
D(INF)	0.002760	0.000698	3.953580	0.0007
D(INF(-1))	0.001976	0.000721	2.739691	0.0120
D(INF(-2))	0.001489	0.000720	2.070019	0.0504

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(MQS)	0.551814	0.093597	5.895667	0.0000
LOG(INV)	-0.284939	0.516420	-0.551757	0.5867
INT	0.044276	0.028691	1.543176	0.1371
LOG(EXC)	0.324261	0.127735	2.538543	0.0187
INF	0.010669	0.005260	2.028246	0.0548
C	8.251286	5.768102	1.430503	0.1666

EC = LOG(GDPPC) - (0.5518*LOG(MQS) -0.2849*LOG(INV) + 0.0443 *INT + 0.3243*LOG(EXC) + 0.0107*INF + 8.2513)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	21.89592	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
Actual Sample Size	38		Finite	

	Sample: n=40	
10%	2.306	3.353
5%	2.734	3.92
1%	3.657	5.256
	Finite Sample: n=35	
10%	2.331	3.417
5%	2.804	4.013
1%	3.9	5.419

ARDL Error Correction Regression
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(2, 0, 1, 3, 1, 3)
Case 2: Restricted Constant and No Trend
Date: 11/23/22 Time: 07:45
Sample: 1981 2021
Included observations: 38

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(GDPPC(-1))	-0.433837	0.096565	-4.492712	0.0002
DLOG(INV)	0.073188	0.043036	1.700615	0.1031
D(INT)	-0.005944	0.002154	-2.759150	0.0114
D(INT(-1))	-0.018307	0.002215	-8.266650	0.0000
D(INT(-2))	-0.009788	0.002706	-3.617182	0.0015
DLOG(EXC)	-0.013381	0.021119	-0.633632	0.5329
D(INF)	0.002760	0.000482	5.721544	0.0000
D(INF(-1))	0.001976	0.000415	4.763122	0.0001
D(INF(-2))	0.001489	0.000546	2.727262	0.0123
CointEq(-1)*	-0.187503	0.013425	-13.96684	0.0000

R-squared	0.835127	Mean dependent var	0.158744
Adjusted R-squared	0.714276	S.D. dependent var	0.114234
S.E. of regression	0.033446	Akaike info criterion	-3.736821
Sum squared resid	0.031322	Schwarz criterion	-3.305877
Log likelihood	80.99960	Hannan-Quinn criter.	-3.583494
Durbin-Watson stat	2.090652		

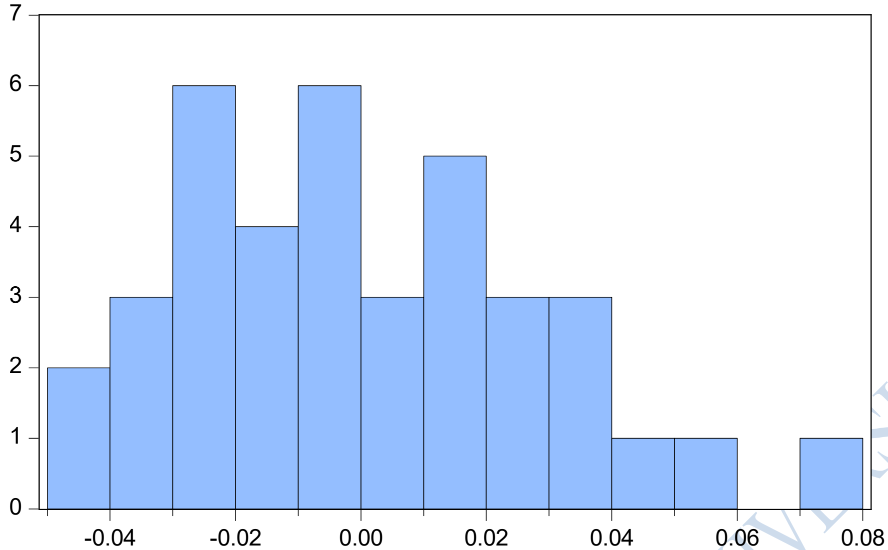
* p-value incompatible with t-Bounds distribution.

F-Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	21.89592	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.450021	Prob. F(2,20)	0.1029
Obs*R-squared	13.40456	Prob. Chi-Square(2)	0.0012



Series: Residuals	
Sample 1984 2021	
Observations 38	
Mean	-1.91e-15
Median	-0.004176
Maximum	0.074351
Minimum	-0.049992
Std. Dev.	0.029095
Skewness	0.522052
Kurtosis	2.780349
Jarque-Bera	1.802468
Probability	0.406068

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.573546	Prob. F(15,22)	0.8647
Obs*R-squared	10.68258	Prob. Chi-Square(15)	0.7748
Scaled explained SS	3.187348	Prob. Chi-Square(15)	0.9994

Ramsey RESET Test
Equation: UNTITLED
Specification: LOG(GDPPC) LOG(GDPPC(-1)) LOG(GDPPC(-2))
LOG(MQS) LOG(INV) LOG(INV(-1)) INT INT(-1) INT(-2) INT(-3)
LOG(EXC) LOG(EXC(-1)) INF INF(-1) INF(-2) INF(-3) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.401898	21	0.6918
F-statistic	0.161522	(1, 21)	0.6918

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.000239	1	0.000239
Restricted SSR	0.031322	22	0.001424
Unrestricted SSR	0.031083	21	0.001480

Objective II

Dependent Variable: LOG(GDPPC)
Method: ARDL
Date: 11/23/22 Time: 08:02
Sample (adjusted): 1985 2021
Included observations: 37 after adjustments
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): LOG(MAN) LOG(INV) INT LOG(EXC) INF
Fixed regressors: C
Number of models evalulated: 9375
Selected Model: ARDL(3, 4, 4, 4, 4, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(GDPPC(-1))	0.656768	0.142117	4.621312	0.0013
LOG(GDPPC(-2))	0.325775	0.124353	2.619755	0.0278
LOG(GDPPC(-3))	0.294111	0.137433	2.140031	0.0610
LOG(MAN)	-0.004132	0.070274	-0.058802	0.9544
LOG(MAN(-1))	-0.266677	0.095923	-2.780116	0.0214
LOG(MAN(-2))	0.064863	0.090620	0.715773	0.4923
LOG(MAN(-3))	-0.152701	0.090067	-1.695408	0.1242
LOG(MAN(-4))	-0.226980	0.098470	-2.305076	0.0466
LOG(INV)	0.440023	0.091780	4.794317	0.0010
LOG(INV(-1))	-0.012308	0.083425	-0.147539	0.8860
LOG(INV(-2))	0.240265	0.090294	2.660929	0.0260
LOG(INV(-3))	-0.113313	0.067654	-1.674890	0.1283
LOG(INV(-4))	0.305259	0.076441	3.993362	0.0031
INT	-0.009168	0.002960	-3.096853	0.0128
INT(-1)	-0.014941	0.002872	-5.201604	0.0006
INT(-2)	0.001863	0.003578	0.520640	0.6152
INT(-3)	0.005728	0.004425	1.294400	0.2278
INT(-4)	0.002926	0.003495	0.837247	0.4241
LOG(EXC)	0.195011	0.048476	4.022807	0.0030
LOG(EXC(-1))	0.174353	0.029335	5.943556	0.0002
LOG(EXC(-2))	0.024999	0.033269	0.751425	0.4716
LOG(EXC(-3))	0.057090	0.036895	1.547363	0.1562
LOG(EXC(-4))	-0.108493	0.034780	-3.119419	0.0123
INF	0.002909	0.000791	3.677413	0.0051
INF(-1)	0.003022	0.000827	3.654610	0.0053
INF(-2)	-1.69E-05	0.000833	-0.020355	0.9842
INF(-3)	0.002552	0.000884	2.887385	0.0180
C	-8.426068	2.068371	-4.073771	0.0028

R-squared	0.999961	Mean dependent var	11.22376
Adjusted R-squared	0.999844	S.D. dependent var	1.928005
S.E. of regression	0.024119	Akaike info criterion	-4.511844
Sum squared resid	0.005235	Schwarz criterion	-3.292771
Log likelihood	111.4691	Hannan-Quinn criter.	-4.082063
F-statistic	8519.863	Durbin-Watson stat	2.322374
Prob(F-statistic)	0.000000		

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

ARDL Long Run Form and Bounds Test
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(3, 4, 4, 4, 4, 3)
Case 2: Restricted Constant and No Trend
Date: 11/23/22 Time: 08:03
Sample: 1981 2021
Included observations: 37

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.426068	2.068371	-4.073771	0.0028
LOG(GDPPC(-1))*	0.276654	0.056198	4.922804	0.0008
LOG(MAN(-1))	-0.585627	0.088492	-6.617817	0.0001
LOG(INV(-1))	0.859926	0.191113	4.499559	0.0015
INT(-1)	-0.013592	0.007126	-1.907272	0.0888
LOG(EXC(-1))	0.342960	0.064504	5.316849	0.0005
INF(-1)	0.008466	0.001616	5.239649	0.0005
DLOG(GDPPC(-1))	-0.619885	0.146436	-4.233148	0.0022
DLOG(GDPPC(-2))	-0.294111	0.137433	-2.140031	0.0610
DLOG(MAN)	-0.004132	0.070274	-0.058802	0.9544
DLOG(MAN(-1))	0.314817	0.105748	2.977049	0.0155
DLOG(MAN(-2))	0.379681	0.091212	4.162633	0.0024
DLOG(MAN(-3))	0.226980	0.098470	2.305076	0.0466
DLOG(INV)	0.440023	0.091780	4.794317	0.0010
DLOG(INV(-1))	-0.432211	0.140615	-3.073722	0.0133
DLOG(INV(-2))	-0.191946	0.082948	-2.314052	0.0459
DLOG(INV(-3))	-0.305259	0.076441	-3.993362	0.0031
D(INT)	-0.009168	0.002960	-3.096853	0.0128
D(INT(-1))	-0.010517	0.007048	-1.492142	0.1699
D(INT(-2))	-0.008655	0.005970	-1.449581	0.1811
D(INT(-3))	-0.002926	0.003495	-0.837247	0.4241
DLOG(EXC)	0.195011	0.048476	4.022807	0.0030
DLOG(EXC(-1))	0.026404	0.035585	0.741989	0.4770
DLOG(EXC(-2))	0.051403	0.032572	1.578145	0.1490
DLOG(EXC(-3))	0.108493	0.034780	3.119419	0.0123
D(INF)	0.002909	0.000791	3.677413	0.0051
D(INF(-1))	-0.002535	0.001065	-2.380651	0.0412
D(INF(-2))	-0.002552	0.000884	-2.887385	0.0180

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(MAN)	2.116823	0.221846	9.541849	0.0000
LOG(INV)	-3.108315	0.599335	-5.186277	0.0006
INT	0.049129	0.024275	2.023871	0.0737
LOG(EXC)	-1.239674	0.262126	-4.729312	0.0011
INF	-0.030603	0.007138	-4.287228	0.0020
C	30.45711	6.073876	5.014444	0.0007

EC = LOG(GDPPC) - (2.1168*LOG(MAN) -3.1083*LOG(INV) + 0.0491*INT -1.2397*LOG(EXC) -0.0306*INF + 30.4571)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	10.49257	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
			Finite Sample: n=40	
Actual Sample Size	37			
		10%	2.306	3.353
		5%	2.734	3.92
		1%	3.657	5.256
			Finite Sample: n=35	
		10%	2.331	3.417
		5%	2.804	4.013
		1%	3.9	5.419

ARDL Error Correction Regression
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(3, 4, 4, 4, 4, 3)
Case 2: Restricted Constant and No Trend
Date: 11/23/22 Time: 08:04
Sample: 1981 2021
Included observations: 37

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(GDPPC(-1))	-0.619885	0.101290	-6.119891	0.0002
DLOG(GDPPC(-2))	-0.294111	0.092307	-3.186236	0.0111
DLOG(MAN)	-0.004132	0.046973	-0.087970	0.9318
DLOG(MAN(-1))	0.314817	0.070495	4.465794	0.0016
DLOG(MAN(-2))	0.379681	0.054115	7.016129	0.0001
DLOG(MAN(-3))	0.226980	0.041155	5.515241	0.0004
DLOG(INV)	0.440023	0.046204	9.523401	0.0000
DLOG(INV(-1))	-0.432211	0.054047	-7.997020	0.0000
DLOG(INV(-2))	-0.191946	0.035481	-5.409782	0.0004
DLOG(INV(-3))	-0.305259	0.035266	-8.655767	0.0000
D(INT)	-0.009168	0.001663	-5.511882	0.0004
D(INT(-1))	-0.010517	0.001773	-5.931235	0.0002
D(INT(-2))	-0.008655	0.002164	-3.998822	0.0031
D(INT(-3))	-0.002926	0.001914	-1.529128	0.1606
DLOG(EXC)	0.195011	0.018463	10.56210	0.0000
DLOG(EXC(-1))	0.026404	0.016369	1.613076	0.1412
DLOG(EXC(-2))	0.051403	0.017521	2.933744	0.0167
DLOG(EXC(-3))	0.108493	0.019526	5.556407	0.0004
D(INF)	0.002909	0.000387	7.519338	0.0000
D(INF(-1))	-0.002535	0.000572	-4.435092	0.0016
D(INF(-2))	-0.002552	0.000428	-5.963228	0.0002
CointEq(-1)*	-0.276654	0.025005	11.06406	0.0000

R-squared	0.988683	Mean dependent var	0.162535
Adjusted R-squared	0.872840	S.D. dependent var	0.113361
S.E. of regression	0.018682	Akaike info criterion	-4.836168
Sum squared resid	0.005235	Schwarz criterion	-3.878325
Log likelihood	111.4691	Hannan-Quinn criter.	-4.498484
Durbin-Watson stat	2.032237		

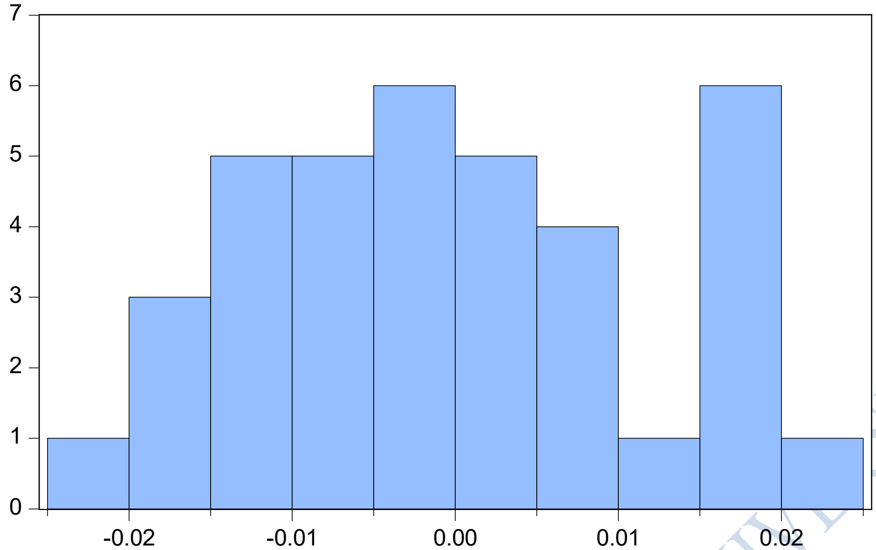
* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	10.49257	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.397085	Prob. F(2,7)	0.6865
Obs*R-squared	3.770039	Prob. Chi-Square(2)	0.1518



Series: Residuals
Sample 1985 2021
Observations 37

Mean	-2.50e-15
Median	-0.000912
Maximum	0.023928
Minimum	-0.021022
Std. Dev.	0.012059
Skewness	0.195642
Kurtosis	2.035330
Jarque-Bera	1.670692
Probability	0.433724

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.118929	Prob. F(27,9)	0.4563
Obs*R-squared	28.50750	Prob. Chi-Square(27)	0.3852
Scaled explained SS	0.873151	Prob. Chi-Square(27)	1.0000

Ramsey RESET Test
Equation: UNTITLED
Specification: LOG(GDPPC) LOG(GDPPC(-1)) LOG(GDPPC(-2)) LOG(GDPPC(-3)) LOG(MAN) LOG(MAN(-1)) LOG(MAN(-2)) LOG(MAN(-3)) LOG(MAN(-4)) LOG(INV) LOG(INV(-1)) LOG(INV(-2)) LOG(INV(-3)) LOG(INV(-4)) INT INT(-1) INT(-2) INT(-3) INT(-4) LOG(EXC) LOG(EXC(-1)) LOG(EXC(-2)) LOG(EXC(-3)) LOG(EXC(-4)) INF INF(-1) INF(-2) INF(-3) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.294710	8	0.7757
F-statistic	0.086854	(1, 8)	0.7757

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	5.62E-05	1	5.62E-05
Restricted SSR	0.005235	9	0.000582
Unrestricted SSR	0.005179	8	0.000647

Objective III

Dependent Variable: LOG(GDPPC)
Method: ARDL
Date: 11/23/22 Time: 08:19
Sample (adjusted): 1985 2021
Included observations: 37 after adjustments
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): LOG(EGSA) LOG(INV) INT LOG(EXC) INF
Fixed regressors: C
Number of models evalulated: 9375
Selected Model: ARDL(1, 3, 4, 4, 3, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(GDPPC(-1))	0.895149	0.044464	20.13204	0.0000
LOG(EGSA)	0.112396	0.058172	1.932117	0.0725
LOG(EGSA(-1))	-0.086446	0.054139	-1.596739	0.1312
LOG(EGSA(-2))	-0.078961	0.040796	-1.935484	0.0720
LOG(EGSA(-3))	0.063872	0.030944	2.064134	0.0567
LOG(INV)	0.278382	0.160336	1.736236	0.1030
LOG(INV(-1))	-0.255900	0.156768	-1.632341	0.1234
LOG(INV(-2))	0.016244	0.130918	0.124076	0.9029
LOG(INV(-3))	-0.170090	0.127809	-1.330810	0.2031
LOG(INV(-4))	0.203387	0.104708	1.942426	0.0711
INT	-0.008214	0.005599	-1.466919	0.1630
INT(-1)	0.003018	0.006305	0.478736	0.6390
INT(-2)	0.009846	0.004771	2.063711	0.0568
INT(-3)	0.006817	0.005112	1.333463	0.2023
INT(-4)	-0.005736	0.004606	-1.245242	0.2321
LOG(EXC)	0.016788	0.037921	0.442715	0.6643
LOG(EXC(-1))	0.093833	0.045305	2.071163	0.0560
LOG(EXC(-2))	-0.226410	0.108826	-2.080481	0.0550
LOG(EXC(-3))	0.209043	0.089191	2.343766	0.0333
INF	0.004267	0.001135	3.760828	0.0019
INF(-1)	-0.001099	0.000979	-1.122187	0.2794
C	-0.044489	2.531397	-0.017575	0.9862

R-squared	0.999751	Mean dependent var	11.22376
Adjusted R-squared	0.999403	S.D. dependent var	1.928005
S.E. of regression	0.047111	Akaike info criterion	-2.986310
Sum squared resid	0.033291	Schwarz criterion	-2.028466
Log likelihood	77.24673	Hannan-Quinn criter.	-2.648625
F-statistic	28.70459	Durbin-Watson stat	1.875248
Prob(F-statistic)	0.000000		

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

ARDL Long Run Form and Bounds Test
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(1, 3, 4, 4, 3, 1)
Case 2: Restricted Constant and No Trend
Date: 11/23/22 Time: 08:21
Sample: 1981 2021
Included observations: 37

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.044489	2.531397	-0.017575	0.9862
LOG(GDPPC(-1))*	-0.104851	0.044464	-2.358115	0.0324
LOG(EGSA(-1))	0.010860	0.023708	0.458089	0.6535
LOG(INV(-1))	0.072023	0.226107	0.318537	0.7545
INT(-1)	0.005732	0.007623	0.751946	0.4637
LOG(EXC(-1))	0.093255	0.062151	1.500458	0.1542
INF(-1)	0.003168	0.000965	3.282079	0.0050
DLOG(EGSA)	0.112396	0.058172	1.932117	0.0725
DLOG(EGSA(-1))	0.015089	0.040277	0.374628	0.7132
DLOG(EGSA(-2))	-0.063872	0.030944	-2.064134	0.0567
DLOG(INV)	0.278382	0.160336	1.736236	0.1030
DLOG(INV(-1))	-0.049541	0.121329	-0.408320	0.6888
DLOG(INV(-2))	-0.033297	0.092359	-0.360521	0.7235
DLOG(INV(-3))	-0.203387	0.104708	-1.942426	0.0711
D(INT)	-0.008214	0.005599	-1.466919	0.1630
D(INT(-1))	-0.010927	0.007073	-1.544903	0.1432
D(INT(-2))	-0.001081	0.005668	-0.190717	0.8513
D(INT(-3))	0.005736	0.004606	1.245242	0.2321
DLOG(EXC)	0.016788	0.037921	0.442715	0.6643
DLOG(EXC(-1))	0.017367	0.072859	0.238362	0.8148
DLOG(EXC(-2))	-0.209043	0.089191	-2.343766	0.0333
D(INF)	0.004267	0.001135	3.760828	0.0019

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(EGSA)	0.103579	0.224892	0.460572	0.6517
LOG(INV)	0.686912	2.153031	0.319044	0.7541
INT	0.054668	0.085345	0.640550	0.5315
LOG(EXC)	0.889403	0.359999	2.470571	0.0260
INF	0.030211	0.016618	1.818001	0.0891
C	-0.424302	24.15476	-0.017566	0.9862

EC = LOG(GDPPC) - (0.1036*LOG(EGSA) + 0.6869*LOG(INV) + 0.0547 *INT + 0.8894*LOG(EXC) + 0.0302*INF -0.4243)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	20.61195	10%	2.08	3

k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
Actual Sample Size	37		Finite Sample: n=40	
		10%	2.306	3.353
		5%	2.734	3.92
		1%	3.657	5.256
			Finite Sample: n=35	
		10%	2.331	3.417
		5%	2.804	4.013
		1%	3.9	5.419

ARDL Error Correction Regression
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(1, 3, 4, 4, 3, 1)
Case 2: Restricted Constant and No Trend
Date: 11/23/22 Time: 08:20
Sample: 1981 2021
Included observations: 37

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(EGSA)	0.112396	0.033461	3.358982	0.0043
DLOG(EGSA(-1))	0.015089	0.019416	0.777130	0.4492
DLOG(EGSA(-2))	-0.063872	0.020527	-3.111588	0.0071
DLOG(INV)	0.278382	0.085065	3.272567	0.0051
DLOG(INV(-1))	-0.049541	0.058080	-0.852975	0.4071
DLOG(INV(-2))	-0.033297	0.061551	-0.540971	0.5965
DLOG(INV(-3))	-0.203387	0.063764	-3.189669	0.0061
D(INT)	-0.008214	0.003477	-2.362398	0.0321
D(INT(-1))	-0.010927	0.003231	-3.382226	0.0041
D(INT(-2))	-0.001081	0.002836	-0.381110	0.7085
D(INT(-3))	0.005736	0.002889	1.985508	0.0657
DLOG(EXC)	0.016788	0.025263	0.664545	0.5164
DLOG(EXC(-1))	0.017367	0.031103	0.558373	0.5848
DLOG(EXC(-2))	-0.209043	0.063378	-3.298361	0.0049
D(INF)	0.004267	0.000682	6.256978	0.0000
CointEq(-1)*	-0.104851	0.007377	-14.21257	0.0000

R-squared	0.928038	Mean dependent var	0.162535
Adjusted R-squared	0.876637	S.D. dependent var	0.113361
S.E. of regression	0.039816	Akaike info criterion	-3.310634
Sum squared resid	0.033291	Schwarz criterion	-2.614021
Log likelihood	77.24673	Hannan-Quinn criter.	-3.065045
Durbin-Watson stat	1.875248		

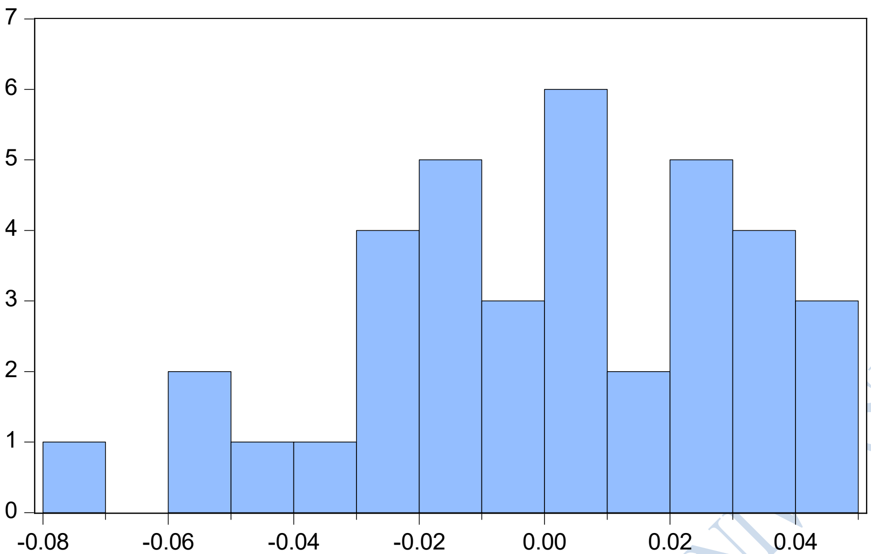
* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	20.61195	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.206346	Prob. F(2,13)	0.8162
Obs*R-squared	1.138442	Prob. Chi-Square(2)	0.5660



Series: Residuals
Sample 1985 2021
Observations 37

Mean	-6.49e-16
Median	0.002468
Maximum	0.048200
Minimum	-0.074838
Std. Dev.	0.030410
Skewness	-0.504126
Kurtosis	2.700280
Jarque-Bera	1.705707
Probability	0.426197

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.355966	Prob. F(21,15)	0.9851
Obs*R-squared	12.30620	Prob. Chi-Square(21)	0.9310
Scaled explained SS	1.719466	Prob. Chi-Square(21)	1.0000

Ramsey RESET Test
Equation: UNTITLED
Specification: LOG(GDPPC) LOG(GDPPC(-1)) LOG(EGSA) LOG(EGSA(-1)) LOG(EGSA(-2)) LOG(EGSA(-3)) LOG(INV) LOG(INV(-1)) LOG(INV(-2)) LOG(INV(-3)) LOG(INV(-4)) INT INT(-1) INT(-2) INT(-3) INT(-4) LOG(EXC) LOG(EXC(-1)) LOG(EXC(-2)) LOG(EXC(-3)) INF INF(-1) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.903204	14	0.0778
F-statistic	3.622185	(1, 14)	0.0778

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.006843	1	0.006843
Restricted SSR	0.033291	15	0.002219
Unrestricted SSR	0.026448	14	0.001889

Objective IV

Dependent Variable: LOG(GDPPC)
Method: ARDL
Date: 11/23/22 Time: 08:33
Sample (adjusted): 1984 2021
Included observations: 38 after adjustments
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (3 lags, automatic): LOG(WSWM) LOG(INV) INT
LOG(EXC) INF
Fixed regressors: C
Number of models evaluated: 3072
Selected Model: ARDL(2, 0, 0, 2, 3, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(GDPPC(-1))	0.637723	0.141777	4.498071	0.0001
LOG(GDPPC(-2))	0.241633	0.133554	1.809253	0.0830
LOG(WSWM)	-0.055811	0.023135	-2.412435	0.0239
LOG(INV)	-0.023108	0.112073	-0.206185	0.8384
INT	-0.004103	0.003682	-1.114245	0.2762
INT(-1)	-0.007588	0.004163	-1.822752	0.0808
INT(-2)	0.006859	0.003916	1.751563	0.0926
LOG(EXC)	0.018626	0.035085	0.530894	0.6004
LOG(EXC(-1))	0.130564	0.044511	2.933335	0.0073
LOG(EXC(-2))	-0.091936	0.049285	-1.865402	0.0744
LOG(EXC(-3))	0.102751	0.040756	2.521110	0.0188
INF	0.003743	0.000813	4.604186	0.0001
INF(-1)	0.001666	0.000916	1.819597	0.0813
C	1.462788	1.247084	1.172966	0.2523

R-squared	0.999612	Mean dependent var	11.12889
Adjusted R-squared	0.999401	S.D. dependent var	1.989652
S.E. of regression	0.048682	Akaike info criterion	-2.929692
Sum squared resid	0.056879	Schwarz criterion	-2.326370
Log likelihood	69.66414	Hannan-Quinn criter.	-2.715034
F-statistic	4752.270	Durbin-Watson stat	2.001522
Prob(F-statistic)	0.000000		

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

ARDL Long Run Form and Bounds Test
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(2, 0, 0, 2, 3, 1)
Case 2: Restricted Constant and No Trend
Date: 11/23/22 Time: 08:33
Sample: 1981 2021
Included observations: 38

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.462788	1.247084	1.172966	0.2523
LOG(GDPPC(-1))*	-0.120645	0.036981	-3.262322	0.0033
LOG(WSWM)**	-0.055811	0.023135	-2.412435	0.0239
LOG(INV)**	-0.023108	0.112073	-0.206185	0.8384
INT(-1)	-0.004831	0.005474	-0.882632	0.3862
LOG(EXC(-1))	0.160006	0.041902	3.818609	0.0008
INF(-1)	0.005410	0.001024	5.283850	0.0000
DLOG(GDPPC(-1))	-0.241633	0.133554	-1.809253	0.0830
D(INT)	-0.004103	0.003682	-1.114245	0.2762
D(INT(-1))	-0.006859	0.003916	-1.751563	0.0926
DLOG(EXC)	0.018626	0.035085	0.530894	0.6004
DLOG(EXC(-1))	-0.010816	0.045743	-0.236439	0.8151
DLOG(EXC(-2))	-0.102751	0.040756	-2.521110	0.0188
D(INF)	0.003743	0.000813	4.604186	0.0001

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(WSWM)	-0.462603	0.269813	-1.714533	0.0993
LOG(INV)	-0.191536	0.936686	-0.204482	0.8397
INT	-0.040045	0.038922	-1.028847	0.3138
LOG(EXC)	1.326260	0.182392	7.271474	0.0000
INF	0.044839	0.016065	2.791052	0.0101
C	12.12476	10.47926	1.157024	0.2586

EC = LOG(GDPPC) - (-0.4626*LOG(WSWM) -0.1915*LOG(INV) -0.0400
*INT + 1.3263*LOG(EXC) + 0.0448*INF + 12.1248)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	10.91583	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
			Finite Sample:	
Actual Sample Size	38		n=40	

10%	2.306	3.353
5%	2.734	3.92
1%	3.657	5.256
	Finite Sample: n=35	
10%	2.331	3.417
5%	2.804	4.013
1%	3.9	5.419

ARDL Error Correction Regression
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(2, 0, 0, 2, 3, 1)
Case 2: Restricted Constant and No Trend
Date: 11/23/22 Time: 08:34
Sample: 1981 2021
Included observations: 38

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(GDPPC(-1))	-0.241633	0.112772	-2.142670	0.0425
D(INT)	-0.004103	0.002605	-1.574868	0.1284
D(INT(-1))	-0.006859	0.002929	-2.341457	0.0278
DLOG(EXC)	0.018626	0.024478	0.760936	0.4541
DLOG(EXC(-1))	-0.010816	0.032708	-0.330667	0.7438
DLOG(EXC(-2))	-0.102751	0.032407	-3.170696	0.0041
D(INF)	0.003743	0.000618	6.058032	0.0000
CointEq(-1)*	-0.120645	0.012345	-9.773102	0.0000

R-squared	0.882195	Mean dependent var	0.158744
Adjusted R-squared	0.854708	S.D. dependent var	0.114234
S.E. of regression	0.043543	Akaike info criterion	-3.245481
Sum squared resid	0.056879	Schwarz criterion	-2.900726
Log likelihood	69.66414	Hannan-Quinn criter.	-3.122820
Durbin-Watson stat	2.001522		

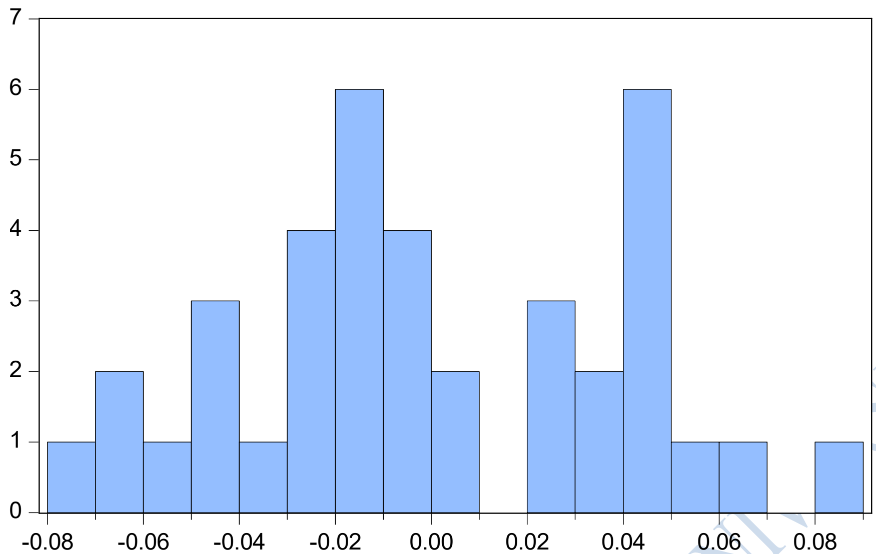
* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	10.91583	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.408873	Prob. F(2,22)	0.1132
Obs*R-squared	6.826611	Prob. Chi-Square(2)	0.0329



Series: Residuals
Sample 1984 2021
Observations 38

Mean	3.94e-16
Median	-0.004041
Maximum	0.083895
Minimum	-0.071153
Std. Dev.	0.039208
Skewness	0.091415
Kurtosis	2.243014
Jarque-Bera	0.960219
Probability	0.618716

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.174911	Prob. F(13,24)	0.3529
Obs*R-squared	14.77844	Prob. Chi-Square(13)	0.3214
Scaled explained SS	3.663785	Prob. Chi-Square(13)	0.9943

Ramsey RESET Test
Equation: UNTITLED
Specification: LOG(GDPPC) LOG(GDPPC(-1)) LOG(GDPPC(-2)) LOG(WSWM) LOG(INV) INT INT(-1) INT(-2) LOG(EXC) LOG(EXC(-1)) LOG(EXC(-2)) LOG(EXC(-3)) INF INF(-1) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.359216	23	0.1873
F-statistic	1.847468	(1, 23)	0.1873

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.004229	1	0.004229
Restricted SSR	0.056879	24	0.002370
Unrestricted SSR	0.052650	23	0.002289

Objective V

Dependent Variable: LOG(GDPPC)
Method: ARDL
Date: 11/23/22 Time: 08:49
Sample (adjusted): 1984 2021
Included observations: 38 after adjustments
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (3 lags, automatic): LOG(CONN) LOG(INV) INT
LOG(EXC) INF
Fixed regressors: C
Number of models evalulated: 3072
Selected Model: ARDL(2, 2, 3, 3, 1, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(GDPPC(-1))	0.384736	0.180090	2.136355	0.0466
LOG(GDPPC(-2))	0.479884	0.172916	2.775244	0.0125
LOG(CONN)	-0.131273	0.067543	-1.943565	0.0678
LOG(CONN(-1))	0.069037	0.086644	0.796793	0.4360
LOG(CONN(-2))	0.064337	0.063160	1.018627	0.3219
LOG(INV)	0.078193	0.127382	0.613846	0.5470
LOG(INV(-1))	-0.115298	0.096094	-1.199845	0.2458
LOG(INV(-2))	-0.099347	0.123529	-0.804244	0.4318
LOG(INV(-3))	-0.153069	0.095495	-1.602909	0.1264
INT	-0.008984	0.004218	-2.129931	0.0472
INT(-1)	-0.009249	0.004358	-2.122321	0.0479
INT(-2)	0.018138	0.004599	3.943936	0.0010
INT(-3)	0.016266	0.005112	3.181582	0.0052
LOG(EXC)	-0.064408	0.040558	-1.588052	0.1297
LOG(EXC(-1))	0.136337	0.044029	3.096525	0.0062
INF	0.001185	0.000951	1.246098	0.2287
INF(-1)	0.002654	0.001193	2.225403	0.0391
INF(-2)	-0.002079	0.001232	-1.687873	0.1087
INF(-3)	-0.002076	0.001027	-2.021064	0.0584
C	4.418942	1.812246	2.438379	0.0253

R-squared	0.999723	Mean dependent var	11.12889
Adjusted R-squared	0.999432	S.D. dependent var	1.989652
S.E. of regression	0.047440	Akaike info criterion	-2.953298
Sum squared resid	0.040509	Schwarz criterion	-2.091411
Log likelihood	76.11266	Hannan-Quinn criter.	-2.646645
F-statistic	34.24511	Durbin-Watson stat	2.010272
Prob(F-statistic)	0.000000		

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

ARDL Long Run Form and Bounds Test
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(2, 2, 3, 3, 1, 3)
Case 2: Restricted Constant and No Trend
Date: 11/23/22 Time: 08:49
Sample: 1981 2021
Included observations: 38

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.418942	1.812246	2.438379	0.0253
LOG(GDPPC(-1))*	-0.135380	0.046349	-2.920915	0.0091
LOG(CONN(-1))	0.002100	0.033459	0.062777	0.9506
LOG(INV(-1))	-0.289522	0.155078	-1.866948	0.0783
INT(-1)	0.016171	0.006669	2.424643	0.0261
LOG(EXC(-1))	0.071929	0.038760	1.855774	0.0799
INF(-1)	-0.000315	0.001532	-0.205861	0.8392
DLOG(GDPPC(-1))	-0.479884	0.172916	-2.775244	0.0125
DLOG(CONN)	-0.131273	0.067543	-1.943565	0.0678
DLOG(CONN(-1))	-0.064337	0.063160	-1.018627	0.3219
DLOG(INV)	0.078193	0.127382	0.613846	0.5470
DLOG(INV(-1))	0.252417	0.104993	2.404130	0.0272
DLOG(INV(-2))	0.153069	0.095495	1.602909	0.1264
D(INT)	-0.008984	0.004218	-2.129931	0.0472
D(INT(-1))	-0.034404	0.006209	-5.541081	0.0000
D(INT(-2))	-0.016266	0.005112	-3.181582	0.0052
DLOG(EXC)	-0.064408	0.040558	-1.588052	0.1297
D(INF)	0.001185	0.000951	1.246098	0.2287
D(INF(-1))	0.004155	0.001187	3.498728	0.0026
D(INF(-2))	0.002076	0.001027	2.021064	0.0584

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(CONN)	0.015515	0.243168	0.063804	0.9498
LOG(INV)	-2.138580	1.240746	-1.723624	0.1019
INT	0.119449	0.061888	1.930090	0.0695
LOG(EXC)	0.531312	0.243163	2.185005	0.0424
INF	-0.002329	0.011314	-0.205879	0.8392
C	32.64093	14.55561	2.242499	0.0378

EC = LOG(GDPPC) - (0.0155*LOG(CONN) -2.1386*LOG(INV) + 0.1194
*INT + 0.5313*LOG(EXC) -0.0023*INF + 32.6409)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	9.842002	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73

		1%	3.06	4.15
Actual Sample Size	38		Finite Sample: n=40	
		10%	2.306	3.353
		5%	2.734	3.92
		1%	3.657	5.256
			Finite Sample: n=35	
		10%	2.331	3.417
		5%	2.804	4.013
		1%	3.9	5.419

ARDL Error Correction Regression
Dependent Variable: DLOG(GDPPC)
Selected Model: ARDL(2, 2, 3, 3, 1, 3)
Case 2: Restricted Constant and No Trend
Date: 11/23/22   Time: 08:50
Sample: 1981 2021
Included observations: 38

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(GDPPC(-1))	-0.479884	0.136050	-3.527269	0.0024
DLOG(CONN)	-0.131273	0.047939	-2.738357	0.0135
DLOG(CONN(-1))	-0.064337	0.046454	-1.384965	0.1830
DLOG(INV)	0.078193	0.054457	1.435869	0.1682
DLOG(INV(-1))	0.252417	0.072524	3.480483	0.0027
DLOG(INV(-2))	0.153069	0.059469	2.573945	0.0191
D(INT)	-0.008984	0.002859	-3.141932	0.0056
D(INT(-1))	-0.034404	0.004143	-8.304694	0.0000
D(INT(-2))	-0.016266	0.004184	-3.888005	0.0011
DLOG(EXC)	-0.064408	0.029505	-2.182931	0.0425
D(INF)	0.001185	0.000599	1.978544	0.0634
D(INF(-1))	0.004155	0.000622	6.683743	0.0000
D(INF(-2))	0.002076	0.000709	2.926871	0.0090
CointEq(-1)*	-0.135380	0.014125	-9.584294	0.0000

R-squared	0.916100	Mean dependent var	0.158744
Adjusted R-squared	0.870653	S.D. dependent var	0.114234
S.E. of regression	0.041084	Akaike info criterion	-3.269088
Sum squared resid	0.040509	Schwarz criterion	-2.665766
Log likelihood	76.11266	Hannan-Quinn criter.	-3.054431
Durbin-Watson stat	2.010272		

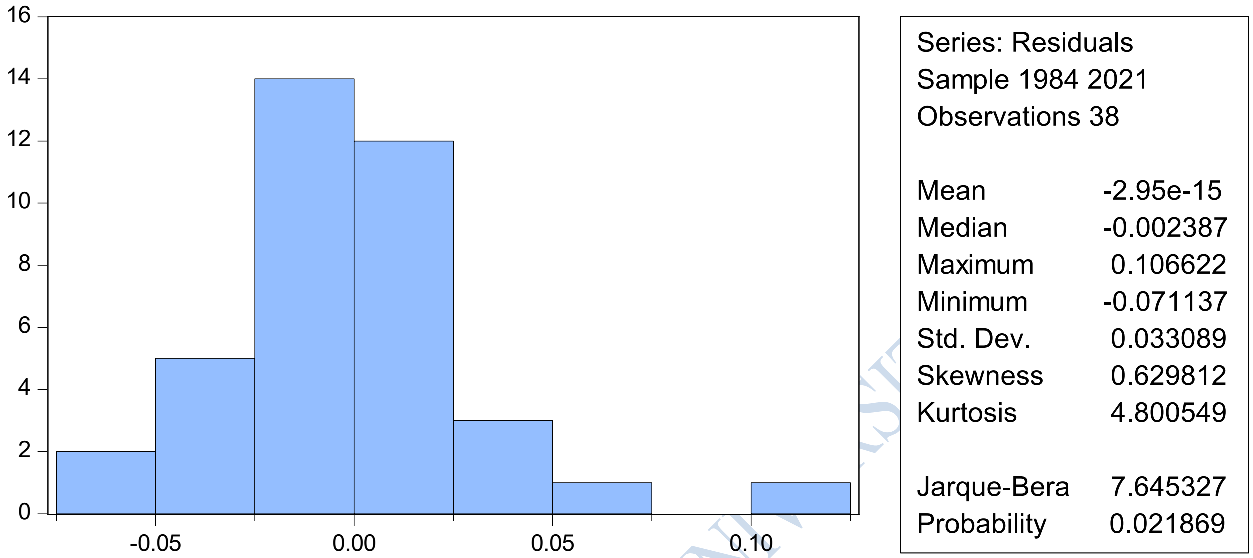
* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	9.842002	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.884355	Prob. F(2,16)	0.4322
Obs*R-squared	3.782547	Prob. Chi-Square(2)	0.1509



Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.307482	Prob. F(19,18)	0.9929
Obs*R-squared	9.311327	Prob. Chi-Square(19)	0.9679
Scaled explained SS	3.970139	Prob. Chi-Square(19)	0.9999

Ramsey RESET Test
Equation: UNTITLED
Specification: LOG(GDPPC) LOG(GDPPC(-1)) LOG(GDPPC(-2)) LOG(CONN) LOG(CONN(-1)) LOG(CONN(-2)) LOG(INV) LOG(INV(-1)) LOG(INV(-2)) LOG(INV(-3)) INT INT(-1) INT(-2) INT(-3) LOG(EXC) LOG(EXC(-1)) INF INF(-1) INF(-2) INF(-3) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.913190	17	0.3739
F-statistic	0.833916	(1, 17)	0.3739

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.001894	1	0.001894
Restricted SSR	0.040509	18	0.002251
Unrestricted SSR	0.038615	17	0.002271