INVESTIGATING THE IMPACT OF FINANCIAL DEEPENING ON ECONOMIC GROWTH IN NAMIBIA

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Abstract

The main objective of the study was to investigate the impact of financial deepening on economic growth with specific reference to the Namibian economy. The study utilized quarterly time series data from 2004 to 2019. The paper used the ratio of money supply as percentage of gross domestic product, domestic credit to private sector as percentage of gross domestic product, and bank liquid reserves to asset ratio as proxies for financial deepening, whereas gross domestic product represented economic growth. The data were tested for unit root, where stationarity outcomes indicate that the variables were integrated of order zero (I(0)) and order one (I(1)). In that light, the study conducted a cointegration test using Wald test to determine the long-run relationship between financial deepening and economic growth. The Wald test results reveal the presence of long-run relationship between the financial deepening variables and real gross domestic product. Further, the study employed autoregressive distributed lag error correction model to estimate the dynamics of the financial deepening variable to the study. Additionally, pairwise Granger causality test was applied to determine the direction of causality among financial proxies and gross domestic product. From the error correction model, the results show that the ratio of money supply as percentage of gross domestic product was significant to the model, although the impact is very minimal. Lastly, the findings did not indicate any Granger causality among financial deepening variables and economic growth in Namibia. Hence, apart from money supply, the study recommends policy makers to focus more on other indicators to boost economic growth in Namibia.

Keywords: *ARDL Error Correction model, Economic Growth, Cointegration, Gross Domestic Product*

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List of Abbreviations and/or Acronyms

ADF	Augmented Dickey-Fuller
ARDL	Autoregressive Distributed Lag
BON	Bank of Namibia
CPS	Domestic Credit to Private Sector
ECM	Error Correction Model
GDP	Gross Domestic Product
INF	Inflation rate
LL	Bank Liquid Reserves to Assets ratio
M2	Broad Money Supply
PP	Phillips Peron
SA	Net Savings
NAMFISA	Namibia Financial Institutions Supervisory Authority
SARB	South African Reserve Bank
CMA	Common Monetary Area
OECD	Organisation for Economic Co-operation and Development
SSA	Sub-Sahara Africa
CUSUM	Cumulative Sum of Recursive Residuals

Declaration

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Mika Munepapa		October 2022
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Dedication

I dedicate this thesis to my beloved parents, Mr. Lukas Munepapa Lutte and Mrs. Hilya Mbwale, for their love and support. They surely did everything in their power to ensure I understand the importance of education.

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 Introduction

Over the years, countries have been striving to enhance their economic growth. For that reason, factors that stimulate economic growth have been continuing to attract much attention in both academic and practical research. Thus, studies on the nexus between financial deepening and economic growth became very crucial thereof. That being so, financial system through financial intermediaries plays a key role in stimulating economic growth through various functions to create economic stability (Wasiaturrahma, et al., 2019), and ensure that capital is available for investments. Financial deepening is defined as an enhancement in the provision of financial services aimed to be provided to all levels of the society (Kinyondo, 2018). That is, an increase in accessibility of financial services through efficient allocation of resources, diversification and expansion of opportunities, risk reduction in the financial systems, and improved payment system. The study carried out by Best, et al. (2017) reveals that numerous developing countries attempt to deregulate interest rates, eliminate, or reduce credit controls, allow free entry into the banking sector, give autonomy to commercial banks, enable private ownership of banks and the liberalization of international capital flows in order to enhance the financial development and economic growth. As a result, financial assets increase through the liberalization of financial markets, which reflect an improvement or an increase in financial intermediaries. Thus, development and innovations in the financial system remain the key drivers for financial deepening, which eventually enhance economic growth.

While majority of the economists believe that economic growth comes as a result of financial deepening, others believe that economic growth delivers and enhance financial innovation (Levine, 1997). Nonetheless, the classical economists place capital accumulation as the main factor for economic growth. Based on the classical economists, high degree of savings that results into increased investment encourages income and economic growth to advanced (Bhattarai, 2015). When the central bureau of a country decides to bring down the interest rate, the cost of borrowing from a financial institution becomes less and the amount borrowed increases. Thereafter, the investments rise as well, and eventually lead to multiple productions of goods and services. Bhattarai (2015) underscores that economists such as Schumpeter believe that financial development is pre-condition for economic growth, although Robinson argued otherwise in 1953. In brief, Robinson (1953) viewed financial development as a by-product that is obtained in the process of economic growth since the growth rate of output have little impact on the development of the financial sector. However, in 1993 King and Levine tested Schumpeter hypothesis using four indicators of financial development obtained from about 119 countries for the period of 1960-1989 and proved that financial development leads to economic growth.

However, financial development does not always warrant economic growth. When a country's economy is experiencing financial crises financial development, which is derived from financial liberalization, may lead to uncontrolled credit growth (Boratava, 1993). The uncontrolled credit growth is more likely to occur when an economy faces higher inflation coupled with a large margin between the loans and deposits interest rates. The financial crises promote over lending due to limited monitoring and inability of banks to discriminate between good and bad projects. As a result, exchange and interest rates are no longer effective and policy makers face challenges of reviving the economy. Other consequences of uncontrolled credit growth include bank failures and few resources towards production of goods and services, which eventually leads to low economic growth. A study that was conducted by Atiq (2014) indicated that as financial sector becomes more liberalised the positive growth begins to slowly decline. Hence, financial deepening does not always result in economic growth and development efficiency.

1.2 Background of the study

In countries like Jamaica and Indonesia, financial deepening plays a crucial role to stimulate economic growth (Best, et al., 2017). More, the findings of Best, et al. (2017) imply that full concentration on financial sector was required in order to have a positive economic growth in Jamaica, while in Indonesia, financial deepening variables had a significant impact on economic growth. However, the underdeveloped countries lack the necessary financial institutions and services to get the financial sector operate smoothly.

According to Ndebbio (2004) on the financial deepening, economic growth and development identified a range of financial assets that adequately estimated financial deepening, simply implying an increase in the supply of financial assets in the economy. The paper suggests that policies should be formulated and implemented to improve the financial development or intermediation in sub-Sahara countries. The paper further accentuates those improvements in the financial sector or intermediation that include price stabilisation, elimination of fiscal deficit and removal of restrictions on financial institutions would result in growth of real money balances. Ho et al (2018) believe that in the process of creating and enhancing positive impact on financial deepening, it is significant for policymakers to reform more effective financial institutions and facilitate innovations.

Developing countries like Namibia encourage various projects and investments intendent to stimulate the country's development and reduce unemployment. Thus, it is the duty of the financial sector to ensure that funds are readily available for investments. In that respect, every economy requires an effective financial system for smooth operation. Like any other economy, the Namibian financial sector consists of financial institutions, financial markets, as well as financial regulators that enable a smooth functioning of the economy. Over the years, the Namibian financial system has been recording some improvements where various financial intermediaries were developed. Briefly, a report done by the Bank of Namibia (BoN) in 2019 indicates that the financial system remained sound, profitable and resilient, despite unfavourable domestic and global economic conditions. According to the Bank of Namibia and NAMFISA (2020), the banking and non-banking sectors maintain the liquidity levels above the prudential requirements while the payment system and infrastructure remained stable, enabling safety and reliability in payments, which facilitate financial stability in the country.

Since independence, the Namibian financial sector has been categorised as one of the key contributors to the country's economic growth. The Namibia Statistics Agency (2018) asserts that its contribution to Gross Domestic Product (GDP) stood at 8% in 2018. Furthermore, the Namibian financial system is also well equipped with instruments that smoothen the transactions processes (Kinyondo, 2018). Thus, the Namibian financial sector is regarded as a crucial influencer for enhanced financial development in the economy.

Moreover, the Namibian economic growth has also improved since independence, although its structure remains unchanged. In terms of contribution to GDP by sector, the tertiary industry continues to dominate, followed by primary industry before secondary industry. A report compiled by the National Planning Commission (2020) on the development journey of the Namibian economic development provides a comparison of contribution by each industry toward the GDP for the period of 1990 and 2018. The composition of the three industries discussed by the National Planning Commission fluctuated in such a manner that; firstly, the primary industry contribution to GDP growth in 1990 stood at 23.9% in comparison to 21.9% recorded in the year 2018, indicating a downfall of 2.7% in performance of 2018. The decline was mainly attributed to the continuous poor performance in the agriculture sector, forestry sector, livestock farming, as well as mining and quarrying activities.

Secondly, the secondary industry prevailed in 2018 compared to the year 1990. That is, in 2018, the industry recorded a contribution of 15.3% to GDP growth with an improvement of 0.9% compared to that of 1990. The secondary industry emerged over the years since independence due to the improvements on productions of certain products. Since then, the value was added to certain products through diamond processing, textile and wearing apparel, leather and related products, wood and wood products, publishing and printing, chemical and related products, basic non- ferrous metals, rubber and plastics products, as well as non-metallic minerals products and fabricated metals.

Lastly, the tertiary industry has been the main attributor to GDP growth since independence, contributing 57.7% to gross domestic product growth compared to a 53.7 percent recorded in 1990. The improvements are mainly associated with the advancement in real estates and business services that were still underdeveloped in 1990. Furthermore, improvements in financial intermediation and increased in hotels and restaurants since 1990 have also resulted in an increase of 4% of the contribution of the tertiary sector to the GDP growth in 2018.

Nonetheless, in real terms, gross domestic product growth has bees fluctuating over the years. In that view, the National planning commission (2020) provides a summary of GDP growth in an essence that in 1990, the GDP growth was recorded as low as 2% followed by a 3.9% growth, five years later. In 2000, the GDP growth recorded a downturn compared to that of 1995 accounted for 0.4%, followed by a further drop of 2.5% in 2005. In 2010, Namibia recorded a peak of 6 % for GDP growth which was followed by declines afterwards. Precisely, the year 2015 registered 4.5% of growth whereas only a small growth of 0.3% was observed in 2018. Asides of that, the private sector credit extension for individuals and businesses slowed down, and such low uptakes of credit for individuals and businesses have resulted in low economic activities. While the regulators instigated a low policy rate against the high rates in the 1990s and early 2000s, which was intended to boost economic activities, there were no exciting improvements recorded in terms of GDP growth.

According to the National Planning Commission (2020) the country's Gross Domestic Product (GDP) per capita stood at N$ 5 030.00 in 1990 and has increased to N$ 73 341 by 2018. Conversely, various researchers outlined that since 2016, declines in economic growth were experienced and the downturn was mainly attributed to contractions in construction sector, wholesale, and retail sectors (National Planning Commission, 2018). Overall, real GDP has been fluctuating with low figures recorded in 2009 due to great depression before the signs of growth began to show afterwards. Furthermore, the outlook compiled by the Bank of Namibia (BoN) in 2018 anticipated a contraction in the financial intermediation sector for the year 2018, although a recovery was expected in 2019. Unexpectedly, the world was surprised by the pandemic that had major effects on the economies where the Namibia economy was no exception. The Central Bank of Namibia (2020) projects an enormous fall real GDP for Namibia in 2020 due to the outbreak of the Coronavirus Disease pandemic, following a slight contraction recorded in 2019. In details, the crisis did not only create a reverse in the purchasing power but also hampered major entities with businesses experiencing a very large decline in their production capacities. Despite the challenges encountered, the economy was expected to slowly pick up towards the end of 2020 and early 2021 (Bank of Namibia, 2020). Given this background, it is crucial for the financial sector to operate innovatively and efficiently in order to revive and speed up the economic recovery. Figure 1.2 demonstrates the trend of gross domestic product from 2004 until 2019, the period covered in this study.

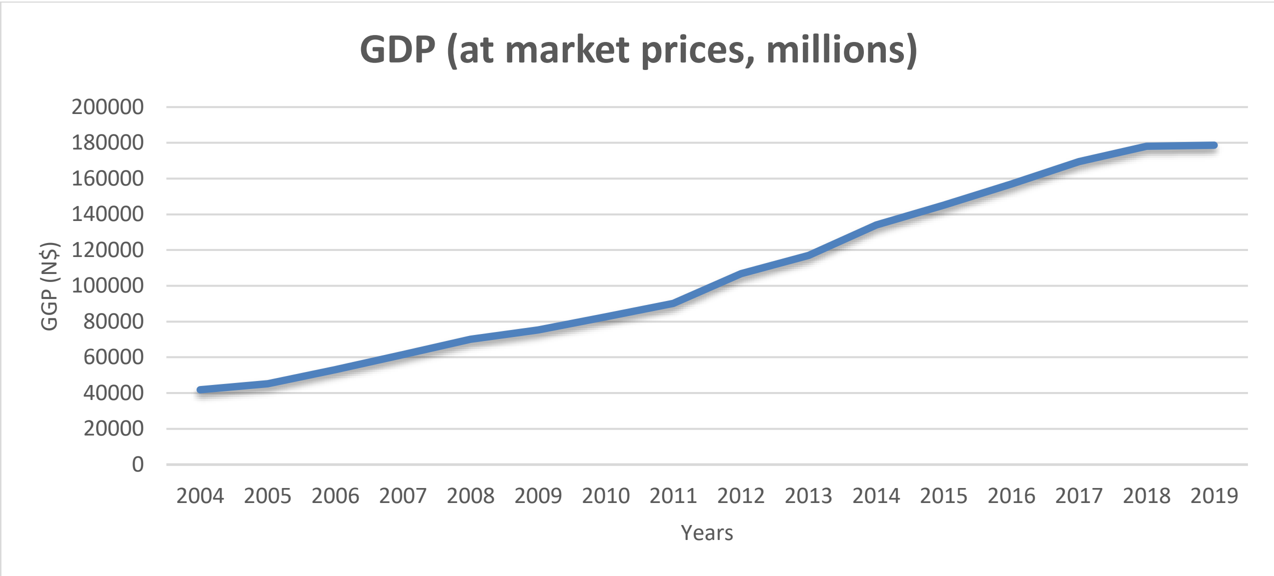

Figure 1: Gross Domestic Product for Namibia

Data source: Namibia Statistic Agency

1.3 Financial structure of Namibia

Namibia comprises of both formal and informal financial sectors. The formal sector consists of the Central Bank of Namibia, the commercial banks, the Development Bank of Namibia, the Agricultural bank of Namibia, the Namibia Post Telecom (Nampost), the Trustco Bank of Namibia, pension funds institutions, insurance companies, and unit trusts. On the other hand, the informal sector is made up of micro lenders. The institutions have different purposes in the economy; hence, it is equally important to discuss the role of these institutions.

Historically, with respect to the formal sector, the Bank of Namibia was formally formed in 1990 after independence, under the section Bank of Namibia Act, 1990 (Act 8 of 1990), and took over the functions and responsibilities from South African Reserve (SAR) bank. After the establishment, the Bank of Namibia could operate independently but later joined the Common Monetary Area (CMA) with the aim of maintaining price stability. Being a member of CMA sees a lot of decisions mainly depending on outcome from the SAR bank as they continue to ensure that the Namibian dollar maintains a one-to-one ratio with South African Rand (Alweendo, 1999).

More on the formal sector, licensed commercial banks in Namibia include First National Bank (FNB), Standard Bank of Namibia, Nedbank of Namibia, and Bank Windhoek among others. These banks play an important role in the economy by acquiring the deposits from the savers and avail funds for the borrowers. They also smoothen the process of funding projects through the transfers of funds from one party to another at lower cost. In so doing, they generate their revenues through charges and interest rates such as lending rates, account holding fees, and others.

The Agricultural Bank of Namibia and the Development Bank of Namibia are both state owned institutions that were formed with the aim of reviving economic growth in Namibia. Particularly, the mandate of the Agricultural Bank of Namibia is to avail money to persons, public or private entities intended to promote agriculture projects and/or other activities related to agriculture in Namibia. Asides of that, the

Development Bank of Namibia aims to provide financial resources to viable enterprises and sustainable initiatives that contribute to the development of the country. Overall, the two banks play a vital role of ensuring that investments and economic development projects are facilitated accordingly.

Nevertheless, the non-financial institutions do not receive deposits like commercial banks but act as intermediaries for the financial services provided. Such non-financial institutions in Namibia that comprise pension funds institutions, insurance companies and unit trust, which are regulated by the Namibia Financial Institution Supervisory Authority (NAMFISA) (Kinyondo, 2018). The pension funds are companies that receive the employees' contributions to pay out a package after they retire while the insurance companies enter into contractual agreements with the individuals or organisations to secure the cost or a loss that may arise in a certain event (Organisation for economic co-operation and development, 2006). In this case, some entities require the parties to have insurance before they enter into an agreement. Lastly, the unit trust is a collective fund that is sold in units from different individuals where profits is earned.

Regarding the informal sector, there are plenty of micro lenders in Namibia under the micro lending Act 7 of 2018. This Act was brought into power to attain threefold objectives. First, to regulate the carrying on of microlending business in Namibia. Second, to establish an effective and consistent enforcement framework relating to microlending. Third, to promote responsible borrowing and lending while also providing for the incidental matters.

1.4. Statement of the problem

The financial sector proved to have a crucial role in world's economic growth and economic development. Over the years, there have been improvements in the financial industry worldwide, which resulted in improved payment system, and subsequently in easily mobilised savings. In this instance, firms and households can cope with the ever-unpredictable economic uncertainties through hedging, pooling, and risk sharing. Moreover, firms and households can increase their expenditure today and compensate for their borrowing in future. When financial markets and financial institutions operate efficiently, it offers optimal allocation of resources and efficient capital allocation (Santomero & Herring, 1996). Hence, financial sector development accelerates and augments the economic growth to have the same effect on financial sector development. Therefore, financial deepening is widely believed to be a crucial determinant of economic growth in an economy through the functions of financial intermediaries. In this regard, the financial system performs intermediation functions by channelling funds from areas where there in excess to where they are scarce (Edeh, et al., 2014). That being so, the improvement in financial intermediaries in Namibia resulted in increased financial assets. However, it remains unclear whether an increase in economic growth in Namibia was partially a result of financial deepening or entirely other factors. Thus, the rationalisation for this study to determine the extent to which financial deepening variables impact economic growth in Namibia.

1.5. Objectives of the study

The main aim of the research was to investigate the impact of financial deepening on economic growth in Namibia.

The study aimed further to attain the following two specific objectives:

- To examine the long-run relationships between financial deepening variables and real GDP in Namibia.
- To determine the causal relationship between real GDP and financial deepening variables.

1.6. Hypotheses of the study

H_{01}: There is no long-run relationship between financial deepening variables and real GDP in Namibia.

H_{A1}: There is a long-run relationship between financial deepening variables and real GDP in Namibia.

H_{02}: Financial deepening does not granger cause real GDP.

H_{A2}: Financial deepening does granger cause real GDP.

1.7. Significance of the study

The findings of this study maybe significant in many essences. The results may be crucial to policy makers in determining the financial deepening variables that contribute to economic growth. Thus, the study will shed more light on the financial deepening variables and their potential contribution to economic growth in Namibia, which will eventually provide policy makers and regulatory bodies a favourable directive or direction in this regard. Over the years different researchers investigated the linkage between financial development and economic growth for Namibia, such Kinyondo (2018), Sindano (2009) and Sunde (2013). This study further makes significant contribution to the literature regarding the phenomenon being investigated, specifically within Namibia. That is the study deliberate on the possible existing relationship between financial deepening and economic growth in the Namibian economy by using most recent data (2004-2019), therefore providing guidance to scholars, researchers and policy makers.

1.8. Limitation of the study

Generally, quantitative studies require a sample size of at least 30. However, the available data for some of the variables constituted in the study were limited to less than 30 years, making the acquisition of the required sample unattainable. Hence, the yearly available data for the period covered in the study were converted into quarterly data to ensure a sufficient sample that fits the nature of the study.

1.9. Delimitation of the study

While there are many variables related to financial development with the ability to influence economic growth, the study used only three, which are deemed to be more aligned with the phenomenon being assessed. These variables comprise broad money supply as a percentage of GDP, ratio of domestic credit to private sector as a percentage of GDP and bank liquid reserves to assets ratio.

1.10 Structure of the study

Following the introduction and background of the study, chapter two explored different theories of financial development and summarized various studies conducted by different authors on the relationship between financial deepening and economic growth. Subsequent to that, chapter three discussed the methods employed in the study while chapter four and five present the data analysis and results discussion, as well as the conclusion and recommendation drawn from analysis of the study, respectively.

CHAPTER TWO: LITERATURE REVIEW

This chapter discusses theories of financial development developed by different economists. Further, the chapter also offers empirical literature from different research on the topic.

2.1 Theoretical literature

2.1.1 Solow growth model

The Solow Growth model is an expansion of the Harrod-Domar model that was developed in 1956, suggesting that growth is stimulated by exogenous factors which include savings, population growth and technological change. In 1957, Solow acknowledged the work of neoclassical growth model that identified capital accumulation, including the increments in stock of capital goods to expand productivity as a factor of economic growth (Edeh, et al., 2014). Through the banking system, financial intermediaries play a key role in efficiently allocating funds from saving to increase investments, leading to an increase in capital stock. Improvements in capital stock generate technological progress that sustain economic growth. King and Levine (1993) popularised the financed-led-growth theory in their study that investigated whether higher levels of financial development are significantly correlated with the current and future rates of growth, physical capital accumulation as well as economic efficiency improvements. They concluded that high level of financial development improves the allocation of capital. Additionally, they discovered that financial services stimulate economic growth by increasing the rate of capital accumulation and efficiency use of capital.

Given the two inputs which are capital and labour, the Solow model focused on capital (K), labor (L), technological progress (A) and output (Y). The inputs under the Solow growth models vary with time unlike the Harrod-Damor model that assumes fixed inputs. Romer (2012) defined the simple Solow growth model as follows:

$$Y = AF(K, L) \ldots\ldots\ldots\ldots\ldots\ldots (2.1.1)$$

The output model is a function of capital and labour, as well as technological progress that is sometimes referred to as just technology (Romer, 2012). The model explains that apart from changes in capital and labour, output grows as a result of improved technology, which is an exogenous variable in the model. It can be noted that, an increase in technological progress can significantly result in more outputs without changing any input of labour or capital. More on equation 2.1.1, Solow explained that high savings lead to an increase in investment that results in an increase in capital stock. The capital stock brings about technological progress that sustains an increase in high standard of living, and the improvement on growth in output per worker. However, at some point, capital diminishes and these forces the economy to approach a steady state in which growth only depends on technological progress (Mankiw, 2009). Therefore, an improved financial system is more likely to encourage more savings that will boost investment and enhance capital stock, as well as technology that leads to more productivity in the economy.

2.1.2 Supply –leading hypothesis

This theory was developed by Mckinnon and Shaw in 1993, suggesting that markets should be allowed to determine rates by eliminating credit controls. Unlike the Solow theory, the supply-leading hypothesis argues that adequate financial markets lead to a rise in financial assets that ultimately increase production within an economy. The hypothesis reasons that well-established financial markets promote economic efficiency, create, and increase liquidity, improve saving mobilisation and capital accumulation, and transfer productive factors from rural to modern use, where contributions to manufacturing and industries are enhanced (Edeh, et al., 2014). Wasiaturrahma et al. (2019) assert that liberalised interest rates in developing countries will lead to an increase in savings, spur investment and ultimately boost economic growth since financial suppression by government controls lowers savings, increase consumption, lower investment, and lead to depressed economic growth.

2.1.3 Demand-following hypothesis

The directional causality between economic growth and financial development has received plenty of discussions from different empirical studies. According to Odhiambo (2008), majority of the studies in the past focused more on financed-led growth with little discussion on the demand-following response. The demand-following hypothesis predicts that economic growth leads to the improvements of financial services; or financial development comes as a bi-product of economic growth. Therefore, when the economy improves, the demand for the use of money rises, leading to an increase in financial development. Furthermore, Odhiambo (2008) states that financial development induces real innovation of investment up to a point where economic growth is sustained. Thus, the supply-leading hypothesis becomes less as demand-following response is regarded dominant.

2.1.4 Endogenous growth model

Another related theory is the Endogenous growth model that was developed by Lucas in the 1880s. The model assumes that human capital that consists of education, training, and experience, as well as innovation, and knowledge produce investment, which enable persistent growth. Moreover, the model is attributed by the assumptions of non-decreasing returns to the set of reproducible factors of production (Mankiw, et al., 1992). It paints endogenous factors as key inputs that determine economic growth by triggering productions output, and not exogenous factors. Mankiw (2009) illustrates the basic endogenous model as follows:

Y=AK…………………………… (2.2)

For simplicity, the model only consists of output (Y) and capital stock (K), then A is a constant measuring the amounts of units of output produced for each unit of capital (K). The model suggests that an extra unit of capital will increase output with extra unit of A. Hence, the model does not exhibit the property of diminishing return. To account for economic growth, it is assumed that a fraction of income (Y) is saved and invested, and that allows the capital accumulation equation to be ΔK= sY-ʒK, whereby s is a fraction of income that is saved and ʒ is a depreciation rate of capital stock. Further, ΔK denotes change in capital accumulation, equivalent to investment (sY) minus capital depreciation (ʒK). According to Mankiw (2009) a combination of the production function (Y=AK) and accumulation equation can be denoted as follows:

ΔY/Y=ΔK/K=sA-ʒ, where ΔY/Y represents growth rate of output and ΔK/K is capital stock growth rate.

Therefore, for as long as sA>ʒ the economy grows forever even without the assumption of exogenous technological progress. Therefore, savings and investments are very crucial under endogenous growth model.

Adenutsi (2011) underscores the main macroeconomic factors that explain short-run variation in endogenous growth in Ghana, encompassing investment, initial rate of economic growth, government expenditure, international migrant remittance inflows, human capital development, and the rate of inflation. Additionally, Kang and Sawada (1999) deployed a model of endogenous growth that combined financial development, human capital investment and external openness, and their results indicate that financial development and openness produce an increase human capital accumulation, and consequently affecting the economic growth by decreasing the net marginal cost of human investment.

Based on these different hypotheses, empirical literature was carried out in different countries to assess the relationship between financial deepening and economic growth. The results consist of mixed findings.

2.2 Empirical Literature

The discovery of the prominence of financial deepening on economic growth has grown into extensive empirical literature as researchers seek to determine the influence of financial development on economic growth in different economies. This section provides a discussion on empirical studies from previous researchers. In that view, Calderon and Liu (2002) obtained interesting results on the theory of supply-leading hypothesis by testing the direction of causality between financial development and economic growth for developing countries. Their results indicate that the desired outcome of financial development is a requirement for economic development, supporting the theory of supply leading hypothesis. Hence, developing countries have more rooms for financial and economic development.

Moreover, Apergis, et al. (2007) conducted a study to examine whether there exists a long-run relationship between financial development and economic growth using integration and cointegration techniques for a dynamic different panel of 15 OECD and 50 non-OECD countries for the period of 1975 to 2000. The results reveal a bi-directional causality between financial deepening and economic growth, as well as a single long-run equilibrium relation between the variables of interest.

Darrat and Al-Sowaidi (2009) assessed the role of information technology and financial deepening in Qatar’s fast-growing economy. The study sought to employ vector-error-correction modelling technique that can explore long-run relations and short-run causal dynamics. In addition to the causal dynamics, the paper investigated the common permanent components of co-integrating system to determine the main driving forces. The results suggest a long run link between economic growth for both technology and financial deepening, clearly detailing that IT is more crucial than the financial development with respect to growth in the long run, while financial development is crucial for the short-run economic growth.

Also, Nzotta and Okereke (2009) inspected the relationship between financial deepening and economic development in Nigeria for the period 1986 to 2007. The paper aimed to find out if high level of financial deepening is a necessary condition for accelerating economic development in an economy. Making use of a two stages least square analytical framework of secondary data, the outcomes determine that financial deepening affects economic development positively. Despite obtaining significant results from the variables used in the study, the paper concludes that effective financial intermediation has not been sustained in Nigeria (Nzotta & Okereke, 2009).

In the same view, a study by Sunde (2010) determined the nature of the nexus between financial development and economic growth with specific reference to the Namibian economy. After carrying out unit root tests and cointegration tests, the study used the Granger causality test to establish the relationship between the chosen financial development indicators and economic growth. The results show a bidirectional Granger causality between the indicators and economic growth. This implies that when the economy grows, the financial sector gains a positive response and vice versa. Thus, concluding that the Namibia financial sector has the ability to influence economic growth.

In their study, Akinlo and Egbetunde (2010) studied the long-run and causal relationship between financial development and economic growth for ten countries in sub-Sahara Africa using the vector error correction model (VECM). Results from the analysis found financial development to be cointegrated with economic growth in selected countries. More, the study also reveals the existence of a long run relationship between financial development and economic growth in the selected sub-Sahara African countries. Lastly, the study found a Granger causality of financial development on economic growth in some countries. Based on the findings, the study underscores a need to develop the financial sector through appropriate regulatory and macroeconomics policies (Akinlo & Egbetunde, 2010).

Additionally, Karahan and Yilgor (2011) analysed the relationship between financial deepening and economic growth in Turkey using the data from the period 1980 to 2010. In particular, the study applied the VAR model approach to investigate the effect of broad money supply to GNP ratio and per capita GDP. After the analysis, results indicate a bidirectional relationship between financial deepening and economic growth within the Turkish economy.

Also, AL-Naif, (2012) provide evidence that the relationship between financial development and economic growth in Jordan follows the supply-leading hypothesis. The results also reveal the presence of a long-run equilibrium between financial development and economic growth as well as a one-directional causality relationship from financial development to economic growth in both long-run and short-run.

Again, Sunde (2012) investigated the nexus between financial sector development and economic growth in South Africa with the help of cointegration and error correction models. The study used the data from 1977 to 2009, and the results show that economic growth is explained by the selected financial sector variables and control variables like inflation, exchange rate and real interest rate. More to the results, Granger causality displays a bidirectional outcome, implying that financial sector development triggers economic growth and vice versa. Against these results that reveal a bidirectional nexus between financial development and economic growth, Sunde (2013) discovered a unidirectional relationship between the variables in Namibia, running from economic growth to financial development. The results support the demand-following hypothesis that suggests that financial sector in Namibia grows, as a result of economic growth. Asides of that, the findings of Kar and Pentecost (2000) support the theory of growth leading the financial development.

Edeh, et al. (2014) determined the impact of financial deepening on economic growth in Nigeria using the data for the period 1981-2012. The impact was measured using the Engle-Granger cointegration technique as well as the error correction model, and the results reveal a positive but weak significance of money supply to economic growth. Thus, leading to a conclusion that financial deepening in Nigeria has a weak impact on economic growth.

In their study, Marashdeh and Al-Malkawi (2014) examined the relationship between financial deepening and economic growth in one of the emerging economies, specifically Saudi Arabia. The study employed an autoregressive distributed lag-approach to determine the integration with time series data running from 1970 to 2010. The result shows a positive and statistically significant relationship between financial deepening and economic growth, although no evidence of bidirectional relationship between the variables could be traced in short-run dynamics.

Another study by Abosedra, et al., (2015) modelled the causality between financial deepening and poverty reduction in Egypt. The study applied a distributed lag-bounds testing approach to assess for cointegration, vector error-correction model and Granger correction model to explore the causal relationship between financial deepening, economic and poverty reduction. After the analyses, the study discovers an indirect channel where financial sector development contributes to poverty reduction through economic growth in Egypt. The paper further elaborates that when money supply was used as a proxy, financial development causes growth, resulting into poverty reduction.

Aizenman, et al. (2015) used a Groningen Growth and Development Centre (GGDC) database to perform preliminary empirical analysis of financial development and output growth in Asia and Latin America. The analysis looked at the financed-growth nexus in 41 economies, and results suggest that the impact of financial development on growth may be non-linear while financial development may promote growth up to a certain point.

Bakang (2015) investigated the effects of financial deepening on economic growth in the Kenyan banking sector using the quarterly data time series from 2000 to 2013. The paper employed an error correction model and found out that the banking sector in Kenya plays important role in the process of economic growth.

Additionally, an empirical study was conducted by Ghildiyal, et al. (2015) to investigate the causal impact of financial deepening on economic growth in one of the fastest emerging economies, precisely India. An autoregressive distributed lag bound test approach and Granger error correction model technique were employed to analyse the data and the discoveries suggest that there exists an equilibrium relationship in both the short-run and long-run between financial development and economic development. Thus, it was concluded that, to attain enhancement in economic growth, then the government should play a crucial role in improving financial deepening.

Also, Bhattarai (2015) pursued a comparison of financial deepening and economic growth in advanced and emerging economies. The paper utilised the multisectoral and multi-households' dynamic general equilibrium models to indicate how economies are vulnerable to overfinancing in Germany, France, UK, China and India. The solution to the general equilibrium models confirms that advanced countries like Germany, France and UK recorded financial crises as a result of overfinancing whereas emerging economies like China and India have hugely benefited and continue to benefit from overfinancing. The conclusion drawn from the paper states that emerged economies are vulnerable to overfinancing while the emerging economies excel as a result of overfinancing.

Further, a study by Trabelsi and Cherif (2016) looked at capital liberalisation and financial deepening to determine whether private sector matters. The study used cross sectional and generalised method of moment dynamic panel estimation technique on 90 developed and developing countries to investigate the effects of freeing cross-border financial transactions on financial sector development for the period of 1975 to 2009. The paper also tested if financial deepening is a prerequisite for financial development and the results indicate that financial integration cannot influence financial development in developing countries unless the prerequisites are already in place.

Alrabadi and Kharabsheh, (2016) explored the dynamic relationship between financial deepening and economic growth in Jordan. The study applied a Vector Autoregressive model, Granger causality and Johansen-Juselius cointegration tests using quarterly data for the period of 1992 to 2014. Although the study indicates a no significant impact in a short-run, it shows a statistically significant long-run equilibrium between the selected variables. More, Best, et al. (2017) examined the relationship between financial deepening and economic growth in Jamaica using liquid reserves to the bank assets ratio and credit to private sector as a percentage of GDP to measure financial deepening. The study used Granger causality approach on annual data running from 1980 to 2014 and the results imply that Jamaica has a supply-leading hypothesis in both the short-run and long-run.

Nwanna and Chinwudu (2016) examined financial deepening and economic growth in Nigeria using time series from 1985 to 2014. The study adopted the supply leading hypothesis where OLS technique was employed. The results from the analyses found that all financial deepening proxies to have significant and positive effects on economic growth. Moreover, Shabbir (2016) studied the impact of financial development on economy sector of Pakistan using Johnson co-integration test to check whether there exists a long-run relationship between the chosen variables. Overall, results show a positive and significant impact of financial development on economic growth in Pakistan.

Another study by Gezer (2018) investigated the causal relationship between financial deepening and economic growth for 14 upper middle-income countries for the period of 1987 to 2015. The study adopted bootstrap panel Granger causality approach based on Seemingly Unrelated Regression (SUR) model. The conclusions were clustered according to the supply-leading and demand following approach. In details, some countries follow a supply-leading hypothesis while others were found to be following the demand following hypothesis. Besides, evidence reveals the presence of a bidirectional causality in some countries.

A further study by Ho, et al., (2018) investigated the effects of financial deepening on innovation for various democratic levels of political institutions using panel data from 74 countries for the period of 1970 to 2010. The study analysed the results using a semi-log model and the outcome includes the deepening of the banking markets, which is associated with an increase in innovation only when political institutions are sufficiently democratic. This indicates that the intervention of political democracy is minimally required. Therefore, the study suggests that when innovations dominate the political involvements, then the economic growth improves.

Zhao, et al. (2018) used a panel data for 31 Chinese provinces from 2000 to 2016 to investigate the impact of population ageing and financial deepening on economic growth. The study used a dynamic panel system GMM estimators and empirical results found both population ageing and financial deepening to have positive and significant impacts on economic growth. Similarly, Kinyondo (2018) investigated the relationship between financial development and economic growth in Namibia using quarterly data for the period 1995 to 2014. After the analyses, co-integration results reveal the existence of a long-run relationship among the variables. Further, Wasiaturrahma, et al. (2019) analysed the impact of financial deepening on economic growth in Indonesia using the time series annual data from 1975 until 2016. The study used autoregressive distributed lag as well as the error correction model, and results indicate a negative and significant impact of financial deepening on economic growth in Indonesia.

The study by Andohola, et al., (2019) examined the financial inclusion and economic growth in Nigeria using a modified Solow growth model. The paper studied the effect of financial inclusion on growth relatively to total productivity, capital accumulation, natural resources rent and labour services. Using the Solow growth function, the results from the analyses show that financial inclusions enhance economic growth when capital accumulation improves. Mankiw, et al., (1992) conclude that international differences in per capita income are better explained in augmented Solow growth model. Thus, validating the Solow growth theory that state that capital accumulation leads to growth.

In addition, Abeka, et al. (2021) studied the financial development and economic growth nexus in Sub-Saharan Africa (SSA) economies focusing on the moderating role of telecommunication development. The study used the General Method system of moment estimation technique, and the results probed that telecommunication infrastructure improves the effect financial development on economic growth in SSA economies. It is for that reason that SSA economies are recommended to apply appropriate measure that will enhance telecommunication infrastructure to boost the financial sector that will eventually channel the improvements to economic growth. On the other hand, Ibrahim and Alagidede (2018) examined the overall economic growth effect when the growth in finance and real sector is disproportionate relying on panel data for 29 sub-Saharan African countries over the period 1980 to 2014. The results presented showed that credit growth comes at a cost of economic growth with consequences stemming from financing risky and unsustainable investments coupled with high consumption that leads to inflation.

Further, Tariq, et al. (2020) examined the nonlinear relationship between financial development and economic growth in Pakistan using the threshold regression model for the period 1980-2017. The study revealed a U-shaped relationship between financial development and economic in Pakistan. Whereas Yang (2017) tested how financial system development positively impacts a nation's economic development by applying the World Bank's standard to divide middle-income economies into trapped middle-income economies and graduated middle income economies and compare them with high-income economies. The results showed that financial development contributes significantly to economic growth via channels of physical stock and total factor productivity. Moreover, Zhang and Zhou (2021) reviewed different theoretical schools of thought and empirical findings on the financial development and economic growth nexus, building on which was aimed to develop a unified, microfounded model in a small open economy setting to accommodate various theoretical possibilities and empirical observations. The numerical simulations reviewed revealed price channel (interest rate) dominate the financial productivity that ultimately submit the benefits to growth of the economy.

Lastly, Saud, et al. (2019) analysed the impact of financial development, foreign direct investment, economic growth, electricity consumption, and trade openness on environmental quality for a panel of 59 Belt and Road Initiative over the period 1980 to 2016. The study adopted environmental Kuznets curve, cross-sectional augmented Dickey-Fuller and Westerlund cointegration test methodologies, and the results confirmed the bidirectional relationship between economic growth and financial development, among other variables.

2.3 Summary of the chapter

Few things can be articulated from the literature. Notable observation from the review of the literature is aligned with the fact that evidence from most of the studies reveal that economies follow the Solow growth model and supply-leading hypothesis on the expenses of the endogenous theory and demand following theory. Nevertheless, the effect of financial deepening on economic growth differs between the nature of varying economies. That being so, financial development plays a crucial role to positively impact economic growth in some economies while in other countries, other macroeconomic and microeconomic factors stand out to be the major contributors to gross domestic product. Again, few empirical studies seem to support growth stimulating financial development. Based on the reviewed literature, there is no country or economy that has reached an agreement on the causality relationship between financial development and economic growth. Thus, a call for further investigation into the matter. Lastly, it is also evident from the empirical literature that overfinancing has a significant positive impact on financial deepening in emerging and developing economies while it is likely to cause financial crises in developed economies. The following chapter looks at the methods used in this paper in attempt to estimate the impact of financial deepening on economic growth with reference to the Namibian economy.

CHAPTER THREE: RESEARCH METHODS

3.1 Research methods

The aim of this research was to investigate the impact of financial deepening on economic growth in Namibia through broad money supply, ratio of domestic credit to private sector as percentage of GDP. and bank liquid reserves to assets ratio (as proxies) on real GDP. Besides the proxies, net savings and inflation rate were used as control variables. The study was grounded in positivism paradigm and applied quantitative research approach where quarterly time series data were used.

3.2 Definition of variables

The study utilised three independent variables to determine the impact of financial deepening on economic growth in Namibia, under the assumption that all the variables have different effects on the role of financial deepening on economic growth. The broad money supply (M2) is the amount of money in circulating and it has commonly been used as a proxy for financial development (Kinyondo, 2018). It plays a pivotal role in the economy, following the role of money in terms of transactions. Hence, it has a dominant effect on the economic activity. As money supply increases, interest rates decline while saving increases, which eventually leads to more investments. In the same vein, society has now more money to enhance capital accumulation to improve the financial sector (Ihsan & Anjum, 2013).

The ratio of domestic credit to private sector (CPS) as a percentage of GDP provides the level of financial services and measures the private resources, which are used to finance the private sector, and also the most vital measure for financial deepening (Bakang, 2015). Hence, it is the financial resources provided to the private sector by financial institutions. This variable captures the channelling of funds from savers to investors in the private sectors.

The bank liquid reserves to assets ratio (LL) provides a measure of the size of the financial intermediaries (Bakang, 2015). It also measures the degree to which commercial banks, or the central banks allocate the society's savings (Best, et al., 2017). Bank liquid reserves to bank assets are holding of domestic currency with central bureau (central banks).

Other independent variables included in the model comprise net savings and inflation rate. The national savings (SA) is the income that is spared by individuals, private sector, as well as government for investment. Savings promote investment. Hence, countries promote higher savings to boost investments. Inflation rate (INF) is described as an overall rise in the prices of goods and services overtime (Oner, 2010). High or unpredictable inflation rate causes businesses to perform poorly, which leads to a reduction in firms' production that eventually deters economic growth (Barro, 2013).

3.3 Empirical Framework and Model specification

In order to investigate the long-run relationships between financial deepening indicators and economic growth, this study followed the Autoregressive Distributed Lag test modelling (ARDL) approach of Pesaran, Shin and Smith (2001). Generally, real gross domestic product (GDP) is a famous proxy for economic growth. It captures the growth or the decline of an economy. Thus, in the current study, GDP represents economic growth. On the other hand, financial development is mainly attributed to improvements in quality, quantity, and efficiency of financial intermediary services (Calderon & Liu, 2002). The process entails a lot of activities undertaken by financial institutions. In that view, measuring it cannot be captured in a single variable, and it was for that reason that the paper had to adopt variables used by Calderon and Liu (2000) to evaluate the influence of financial deepening on the Namibian economic growth. The three measures constituted the ratio of money supply (M2) to real GDP, ratio of domestic credit to private sector (CPS) and the bank liquid reserves to asset ratio (LL). M2 was used to measure the largeness of financial sector where a higher a M2 implies a larger financial sector. On the other hand, CPS was used to illustrates how the funds are channelled to the private sector. Moreover, the bank liquid reserves to asset ratio was included in the model to assess stability of the banking sector within the economy. In that regard, saving (SA) determines whether a country can absorb external shocks as well as domestic weaknesses while low and stable inflation rate encourages economic growth (Van-Wyka & Kapingura, 2021). Stable inflation rate (INF) allows the firms to increase their productions, given that the cost of production is reasonable. Thus, when production goes up, then the firms and households increase their spending which eventually improves the gross domestic product. Therefore, net savings and inflation rate were used as control variables in this study. Hence, the function was specified as:

$$GDP = f(M2, CPS, , LL, SA, INF) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.1)$$

Econometric model was specified is as follows:

$$ln\, GDP = \beta_0 + \beta_1\, lnM2 + \beta_2\, lnCPS + \beta_3\, lnLL + \beta_4\, lnSA + lnINF + \mu_t \ldots\ldots\ldots\ldots\ldots (3.2)$$

Based on equation 3.2, economic growth is measured by real Gross Domestic Product (GDP). The financial deepening variables are represented by the ratio of broad money supply (M2) to real GDP, the ratio of domestic credit to private sector as percentage of GDP, (CPS) and bank liquid reserves to bank assets ratio (LL). Net savings (SA) and inflation rate (INF) represent the control variables while μ_t is the white noise error term, *t* is the time period (2004-2019 quarterly) and β represents the parameters. Finally, the study used secondary data which were collected from the Central Bank of Namibia as well as the Namibia Statistic Agency.

3.4 Data Analysis

Firstly, the data collected were cleaned using Excel Sheet. Subsequently, EVIEWS 10 was used as a tool of econometrics to analyse the data. As a norm, unit root testing was carried out first to ensure the stationarity in time series variables. After that, the Wald test was applied to determine whether the variables were cointegrated in the long run. Also, ARDL model was used to evaluate the short-run or long-run dynamics in variables. Finally, in order to determine the direction of causality among the variables pairwise Granger causality was applied.

3.4.1 Stationarity

The data was tested for unit root to determine if they are stationary or non-stationary using Augmented Dickey-Fuller and Phillips–Perron (PP) tests. A unit root test is ordered to test for trends in time series variables (Gujarati, 2004). Unit root test is always the first step undertaken prior to estimating regression models. Variables are tested for unit root in order to determine the order of integration, which is either zero I(0) (integrated of order zero), one I(1) (integrated of one) or higher order I(n). Gujarati (2004) highlights that it is a test ordered to test for trends in variables which can be either stationary or non-stationary. A stationary variable has a mean of zero and a constant variance overtime, as well as a covariance that has an error term with the mean equal to zero. On the other hand, non-stationary variables have the presence of unit root. This means that if the variables are to be regressed without determining the order of trends and without differencing the variables, there will be a problem of spurious results of the regression estimated. For that reason, it is very important for variables to be differenced in the presence of unit root afore the regression estimation. In this study, the unit root tests were carried out using both the Augmented Dicky-fuller (ADF) and Phillips Peron (PP).

Equations 3.3, 3.4 and 3.5 below illustrate three types of unit root test, whereby Δ shows difference operator, although a variable can be differenced more than once. In addition, model specification for unit root can be displayed in many ways. The model can include both constant and trend, or include constant only, or exclude both constant and trend. The following models gives an illustration of the explanation above:

$\Delta y_t = b_0 + b_1 t + b_2 y_{t-1} + u_t$ (Model with constant and trend)……….. (3.3)

$\Delta y_t = b_0 + b_2 y_{t-1} + u_t$ (Model with constant but no trend)………….... (3.4)

$\Delta y_t = b_2 y_{t-1} + u_t$ (Model exclude both constant and trend)…………… (3.5)

The hypotheses of unit testing were specified as:

H_0: Variables are non-stationary (unit root)

H_1: Variables are stationary (no unit root)

The unit root tests hypotheses are tested by the means of a t-test. If the t-calculated is smaller than the t-critical value, then we fail to reject the null hypothesis and the variable is considered non-stationary. However, when the t-calculated is greater than the t-critical, then the null hypothesis is rejected in favour of the alternative hypothesis.

3.4.2 Co-integration and long-run estimation

Co-integration provides a long-run equilibrium among the variables estimated. If Y and X are integrated by one or two order but their error term is integrated of order zero, then a long-run relationship or equilibrium between Y and X exists. To determine whether co-integration exist or not the residuals from the equation three above are tested for stationarity.

Autoregressive Distributed Lag (ARDL) approach is suitable for this study because it includes the lagged values of the dependent variable as well as the lagged values of the explanatory variables (Gujarati, 2004). More, the ARDL technique is unbiased and has the advantage of fitting well for studies with small samples such as the sample size for this study. Additionally, it also simultaneously allows the estimation of the long-run and short-run components of the model, thereby solving the problems arises due to omitted variables and autocorrelation.

In general, many economics models are found to be explained by past values due to the changes that occur in some explanatory variables, which do not instantly have effects on the dependent variables. The changes rather take time to have an impact on the dependent variables. In this regard, Wald test becomes the suitable test to determine whether the variables are integrated of order zero, integrated of order one, or mutually integrated (Pesaran, et al., 2001), if the variables are not integrated of order high then one. Following these elucidations, the study adopted the general ARDL equation proposed by Pesaran and Yongcheol (1995) and the equation below is derived from equation 3.2 as per the Persaran and Yongcheol methodology in standard least square.

$$\Delta lnGDP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta lnGDP_{t-i} + \sum_{i=0}^{q1} \alpha_{2i} \Delta lnM2_{t-i} + \sum_{i=0}^{q2} \alpha_{3i} \Delta lnCPS_{t-i} + \sum_{i=0}^{q3} \alpha_{4i} \Delta lnLL_{t-i} + \sum_{i=0}^{q4} \alpha_{5i} \Delta lnSA_{t-i} + \sum_{i=0}^{q5} \alpha_{6i} \Delta lnINF_{t-i} + \beta_1 lnGDP_{t-1} + \beta_2 lnM2_{t-1} + \beta_3 lnCPS_{t-1} + \beta_4 lnSA_{t-1} + \beta_5 lnLL_{t-1} + \beta_6 lnINF_{t-1} + u_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.6)$$

Equation 3.6 above demonstrates the ARDL approach utilised in the study. The coefficient of a_{is} gives details of the impact of differenced lagged GDP values on the current GDP in the short term, β_{is} (coefficients for exogenous variables only) offers the effect on GDP in the long run, while Δ is the difference operator. Hence, the ARDL test offers the impact of lagged financial development variables values to the model of real GDP. In addition, u_t represent the white noise error term that is normally distributed with constant variance and zero mean. The variables included in the model are broad money supply (M2) as % of GDP, domestic credit to private sector as % of GDP (CPS), bank liquid reserves to asset ratio (LL), net savings (SA) and inflation rate (INF). The Wald test was applied to determine whether the null hypothesis should be rejected or not. The null hypothesis state that there is no long run relationship between financial deepening and real GDP, while the alternative hypothesis indicates otherwise. The hypotheses were specified as:

H$_0$: $\beta_1 = \beta_2 = \beta_3 = \ \beta_4 = \ \beta_5 = \beta_6 = 0$ (no cointegration)

H$_1$: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$ (presence of cointegration)

The test is conducted by means of an F-test. If the computed F-statistics is greater than the upper bound critical values, then the null hypothesis is rejected, implying the presence of cointegration. However, if the F-computed is smaller than the lower bound critical values then we fail to reject the null, signifying the absence of cointegration. If the F-computed lies between the lower bound and the upper bound, then the test is deemed to be inconclusive. In the presence of co-integration, the modelling of error correction model (ECM) becomes essential. The ECM is assessed to obtain the short-rum equilibrium, as well as the long-run equation. The error term from equation 3.6 above is treated as an "equilibrium error" (Gujarati, 2004), consequently, the ECM model was estimated as follows:

$$\begin{aligned}\Delta lnGDP_t = \alpha_0 & \\ & + \sum_{i=1}^{p} \alpha_{1i} \Delta lnGDP_{t-i} \\ & + \sum_{i=0}^{q1} \alpha_{2i} \Delta lnM2_{t-i} \\ & + \sum_{i=0}^{q2} \alpha_{3i} \Delta lnCPS_{t-i} + \sum_{i=0}^{q3} \alpha_{4i} \Delta lnLL_{t-i} \\ & + \sum_{i=0}^{q4} \alpha_{5i} \Delta lnSA_{t-i} + \sum_{i=0}^{q5} \alpha_{6i} \Delta lnINF_{t-i} + \\ & + \lambda ECT_{t-1} + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (3.7)\end{aligned}$$

Where ECT_{t-1} in this error correction equation represents the error is term, while u_t is the white noise error term at ECM. The coefficients from a_{is} demonstrate the short-term effects of the error correction model, whereas λ is the coefficient of ECT_{t-1} that provides information about the speed at which real gross domestic product adjust towards its long run equilibrium level.

3.4.3 Granger Causality

In addition to co-integration test, the study tested for Granger causality between real GDP and financial deepening variables using the pairwise Granger causality test. The approach gives the causal effects of one variable to another variable. This approach has been used in finance-growth causality studies including Sidano (2009), and the estimation are presented as follows:

$$\Delta lnGDP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta lnGDP_{t-i} + \sum_{i=j}^{qs} \alpha_{2j} \Delta FD_{t-j} + u_{1t} \ldots\ldots\ldots (3.8)$$

$$\Delta lnFD_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta lnGDP_{t-i} + \sum_{i=j}^{qs} \beta_{2j} \Delta FD_{t-j} + \pi_{1t} \ldots\ldots\ldots\ldots (3.9)$$

Where U and π represents the white noise error terms whereas α and β are he coefficients for the two functions accordingly; GDP denotes economic growth; and FD represents financial deepening variables (ratio of broad money supply to real GDP, the ratio of domestic credit to private sector as percentage of GDP, and bank liquid reserves to bank assets ratio)

The tested null hypotheses are as follows:

H_0: $\alpha_{2j} = 0$, financial deepening does not Granger cause economic growth.

H_1: $\beta_{1i} = 0$, economic growth does not Granger cause financial deepening.

If none of these null hypotheses are rejected, then it is concluded that financial deepening and economic growth are independent of each other. On the other hand, if the null hypotheses are rejected, then a bi-directional relationship between economic growth and financial deepening is concluded.

3.4.4 Stability and heteroscedasticity

The study implemented the following diagnostic testing as stipulated in Gujarati (2004). The study employed the Cumulative Sum of Recursive Residuals (CUSUM) of squares approach to evaluate the stability of the models undertaken. Moreover, auto-relation test is also carried out. Further, heteroscedasticity was estimated to ensure the goodness fit of the model. Heteroscedasticity is one of the classical linear regression model assumptions that requires a good model to have residuals that have constant variance. In order to investigate the presence of heteroscedasticity, ARCH was employed, and the hypothesis were specified as:

H_0: There is homoscedasticity

H_1: There is heteroscedasticity

The null hypothesis is rejected when the ARCH p-value is less than 5% level of significance. Nevertheless, if the p-value is greater than the 5% level of significance, then that implies that there is homoscedastic; thus, failing to reject the null hypothesis. The following chapter illustrates the estimations and the results obtained from the regressions. The outcomes are elaborated.

3.5. Summary of chapter four

Chapter three provides the research methods adopted by the study. The chapter first provided the definitions of variables that describes the relationship between independent variables and GDP. Secondly, the chapter offered an in-depth discussion on the empirical framework and model specification followed by the study. Then the chapter concluded with data analysis methods discussion. The following chapter presents the results from the estimation of the study.

CHAPTER FOUR: EMPERICAL ANALYSIS AND RESULTS

4.1 Introduction

This chapter outlines the empirical results from the models proposed in the previous chapter. The chapter displays the unit root results for stationarity, the ARDL regressions estimations results and the diagnostic outcomes from the regression models. E-views was used for all estimation.

4.2 Model estimation and discussion of results

4.2.1 Descriptive Statistics

Before beginning with the estimations and analysis, a brief discussion of descriptive statistics is provided below. This is essential in either quantitative or qualitative research in order to understand the nature of data before engaging in any analysis.

Table 1: The descriptive statistics

	GDP	**M2**	**CPS**	**LL**	**SA**	**INF**
Mean	30,360	5.37	0.55	0.11	7,105	0.06
Median	30,111	5.73	0.49	0.11	7,821	0.05
Maximum	37,223	9.54	0.72	0.15	16,052	0.11
Minimum	20,764	1.91	0.47	0.09	(7,988)	0.01
Std. Dev.	5,177	2.19	0.08	0.02	4,895	0.02
Skewness	(0)	(0.08)	0.79	1.07	(1)	0.71
Kurtosis	2	1.97	1.92	3.30	4	3.62
Jarque-Bera	6	2.91	9.83	12.45	6	6.45
Probability	0	0.23	0.01	0.00	0	0.04
Sum	1,943,062	343.36	35.00	6.97	454,732	3.54
Sum Sq. Dev.	1,690,000,000	301.87	0.45	0.01	1,510,000,000	0.03
Observations	64	64.00	64.00	64.00	64	64.00

Author compilation using eviews. Please note note GDP, and SA are in millions, whereas CPS, M2 and LL are in percentages.

A mean of a range or dataset is an average value of such dataset. The median is a middle value after sorting out the data in the dataset, either in an ascending or descending order, while the mode is the value that appears most in the dataset. Overall, all three (mean, median and mode) are known as the measure of the central tendency. Further, descriptive statistics also display a measure of dispersion that shows the way in which the data are spread out from the central tendency. These measures of dispersion include the standard deviation which shows how observations varies from the sample average, the maximum value, as well as the minimum value. Finally, there is a measure of normality that includes the kurtosis and skewness. Kurtosis measures the peak and flatness of the distributions in variables or series, and a normal distribution of kurtosis is normally regarded to be three. If the series' kurtosis value is positive, then a variable is regarded to have more higher values than average while a negative value indicates that the variable carries more values that are lower than the average. Another measure of normality is the skewness that measures the degree of asymmetry in the variables. Normal skewness has a zero symmetric around its mean. Lastly, the Jarque-Bera test tests the normal distribution of the variables.

Table 1 depicts the mean, median, maximum, and minimum values of all variables that are later estimated in this study. The standard deviation shows that GDP varies from the average value with N$ 5 177 million. The ratio of money supply to real GDP differs from average with 219%, while CPS is with 8.40%, LL is with 2%, SA is with N$ 4 895 million while inflation rate with 2%.

The skewness of GDP and M2 nears 0, implying normal distribution of the data. However, CPS, LL, SA and INF are closer to 1, signifying that the data are not normally distributed. Moreover, kurtosis values of GDP, M2 and CPS are all less than 3, indicating that most of the values in these variables fell below the average values. On the other hand, the Kurtosis values for LL, SA and INF are very close to 3, revealing that they are above the averages but not much of the differences from the averages. Thus, indicating that the data for LL and SA were found to be normally distributed.

As for the Jarque-Bera results, the null hypothesis state that the variable is normally distributed, and the alternative implies otherwise. In that regard, GDP, CPS, LL, SA and INF are normally distributed while M2 is not.

4.2.2 Unit root testing

While there exist many unit root testing techniques in econometrics, this study used the Augmented Dicky-fuller (ADF) test that was complemented by the Phillips Peron (PP) methods to carry out the purpose robustly. The two methods were used to determine the order of integration for all variables used in the study. Although the ARDL do not require the pre-test of unit root, it is however decisive to proceed with the testing of stationary and non-stationary of the data in the variables to ensure the variables are not integrated of an order that is more than two [I(2)]. The outcomes from the ADF and PP tests are displayed below where Cons stands for Constant.

Table 2: Unit root tests results

		Augmented Dicky Fuller test (ADF)		Phillips Perron test (PP)		
Variable	Model specification	Levels	First Difference	Levels	First Difference	Integration order
lnGDP	None	3.467859	-2.693093***	2.882550	-11.90251***	I(1)
	Cons	-1.705666	-8.520072***	-1.195106	-18.85890***	I(1)
	Cons&trend	-0.366249	-8.811726***	-3.936733**	-21.62846***	I(0)
lnM2	None	1.610807	-2.676440***	2.407152	-8.399305***	I(1)
	Cons	-1.486368	-7.285576***	-1.526966	-9.695646***	I(1)
	Cons&trend	-2.343132	-7.316110***	-2.191905	-10.23009***	I(1)
lnCPS	None	-0.963758	-2.840638***	-1.627873*	-2.980008***	I(1)
	Cons	-0.554072	-2.952308**	0.070534	-3.126210**	I(1)
	Cons&rend	-2.616092	-3.122777	-1.409243	-3.284093*	I(1)
lnLL	None	-1.129470	-8.129936***	-0.926330	-10.56577***	I(1)
	Cons	-0.420786	-8.219957***	-1.296697	-10.71234***	I(1)
	Cons&trend	-3.934498**	-8.263358***	-3.792270**	-11.36137***	I(0)

lnSA	None	-0.876512	-6.948135***	0.064001	-6.879600***	I(1)
	Cons	-0.926647	-6.836276***	-2.662297*	-6.790969***	I(0)
	Cons&trend	-1.916258	-6.708863***	-3.237511***	-6.672881***	I(0)
lnINF	None	-0.081650	-5.379229***	-0.097762	-5.208196***	I(1)
	Cons	-3.071088**	-5.339792***	-1.940997	-5.167140***	I(0)
	Cons&trend	-3.008019	-5.354641***	-1.883104	-5.058530***	I(0)

*Source: Authors compilation using eviews. Notes: (i) *** denotes that the variable is stationary (no unit root) at all levels of significance (1%, 5% and 10%); (ii) ** signifies that the variable is stationary after 5% level of significance; and (iii) * shows that the stationary in the variable is only at 10% level of significance.*

Table 2 above displays the results of the unit root testing for the series. Unit root testing was conducted on all variables at levels (without differencing) and the outcomes are discussed as follows:

When tested for unit root using the ADF approach, the results indicate that the logarithm of GDP (lnGDP) is not stationary (unit root presence) in all models (none, constant only and constant & trend). However, Phillip-Perron (PP) approach non-stationarity was only discovered in the model that exclude both (constant and trend) and the one that consist of constant only, whereas the constant & trend obtained no unit root in lnGDP at all levels of significance. Logarithm of broad money supply (lnM2) and logarithm of domestic credit to private sector as percentage of GDP (lnCPS) are not stationary (unit root presence) in all models, using ADF approach. Moreover, Phillip-Perron (PP) approach, when applied on same variables (lnM2 and lnCPS), attained similar outcomes except for lnCPS on constant model. This concludes that lnM2 and lnCPS are not stationary at levels in both approaches. Logarithm of bank liquid reserves to assets ratio (lnLL) is non-stationary (using ADF) at the model that exclude both (constant and trend) and the model that have constant only. While the model that include both constant and trend detected a no unit root in lnLL (at five percent level of significance). Again, the same applies when PP approach was utilized. Lastly for unit root testing at levels was logarithm of net saving (lnSA). lnSA poses unit root or non-stationary only at the model without constant and trend. The constant only and constant & and trend models revealed no unit root for lnSA at all levels of significance for ADF and at five and ten percent for Constant only and constant & trend models respectively. lnINF is significant at model with constant only in levels.

The tests conducted on variables at levels have different results but none of the variables obtained a stationary at all levels of significance. Consequently, the results motivated differencing of variables to ensure the ARDL method application. Therefore, variables were differenced, and the results specified that ADF and PP techniques did not detect unit root for lnGDP, lnM2, lnLL, lnSA and lnINF at all levels of significance. Whereas lnCPS is stationary at mixture levels of significance.

The results above illustrate that the variables are integrated of I(0) and I(1). This alludes that all variables become stationary after the first difference. For that reason, the unit root presence hypothesis is rejected, and the conclusion is drawn that variables are integrated of the mixtures of I(0) and I(1). Hence, the ARDL technique was applied for this study as suggested, to obtain the result of cointegration.

4.2.3 Lag length criteria

It is necessary to determine the lag length before estimating the intended model. Choosing the appropriate lag length ensure accuracy in the model. The lag length was determined from VAR model and the results are presented in the table below.

Table 3: Lag length criteria

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
-	125.76	NA	0.00	(4.89)	(4.66)	(4.80)
1.00	426.98	516.38	0.00	(15.71)	-14.09*	(15.10)

2.00	486.93	88.09*	2.46e-15*	(16.69)	(13.68)	-15.55*
3.00	506.51	23.97	0.00	(16.02)	(11.62)	(14.35)
4.00	540.20	33.00	0.00	(15.93)	(10.14)	(13.73)
5.00	597.69	42.24	0.00	-16.80*	(9.62)	(14.08)

Source: Author compilation using eviews.

Table 3 above illustrates the result from the lag length test. The rule of thumb indicates that the method with the least value is chosen. In that view, Akaike Information Criterion (AIC) was the lowest. Hence, it results is preferred in this regard, indicating that the estimations in this study utilised five lags.

4.2.4 Co-integration test

As alluded before, the bound test is the appropriate technique to test for cointegration since the variables are integrated of different orders. ARDL determines the long-run relationships among variables. The results are presented in table 4 below. As specified in the previous section the study used five lags in the estimation.

Table 4: Co-integration test results

Wald test						
F-statistics	Significance level	Narayan (2005)		Pesaran, et al. (2001)		Conclusion
		I(0)	I(1)	I(0)	I(1)	
5.081332	1%	3.501	5.051	3.15	4.43	Cointegration

Source: Author compilation using eviews.

Table 4 above presents the Wald test for co-integration. The F-statistics is compared to the Narayan (2005) and Pesaran (2001) critical value. Initially, the hypotheses were formulated as follow:

H_0: There is no long-run relationship between financial deepening variables and real GDP in Namibia.

H_1: There is a long-run relationship between financial deepening variables and real GDP in Namibia.

The calculated F value (5.0813) was compared to the critical values. Theory advised that if the F-value falls below the lower bound critical value we fail to reject the null hypothesis while when the F-value lies above the upper bound then null hypothesis is rejected. However, when the F-value lies between the lower bound and upper bound then the results are inconclusive. For this study, the F-calculated lies above the upper bound critical values at 1% level of significance. That being so, the null hypothesis was rejected to conclude that there is long-run relationship between financial deepening variables and real GDP in Namibia. The outcome validates the findings by Sidano (2009) that found a stable long run relation between financial development and economic growth. This gives a license to the ARDL error correction model estimation.

4.2.5 ARDL error correction model (ECM)

To obtain the short run ARDL model in the current study, lnGDP was estimated using lnGDP, lnM2, lnCPS, lnLL, lnSA and lnINF as regressors. The variables were regressed in differenced form, and the study applied automated E-views ARDL approach. Further, the model used five lags as per the outcomes in table 4.2.2. Table 4.2.5 presents the results from the estimation.

Table 5: ARDL ECM results

Dependent: Variables	D(LNGDP)					
C	2.582486					
	(0.0041)	Independent Variables				
Lags		D(LNGDP)	D(LNM2)	D(LNCPS)	D(LNSA)	D(LNINF)
0			-0.2185	0.0617	0.0160	-0.0535
			(0.0015)	(0.8902)	(0.6666)	(0.0783)
1		-0.5925	-0.3086	0.4138	-0.0305	0.0590
		(0.0005)	(0.0011)	(0.536)	(0.6176)	(0.0836)

2		-0.3097	-0.1234	-0.6742	-0.0706	-0.0132
		(0.091)	(0.1908)	(0.3316)	(0.2456)	(0.6957)
3		-0.2088	0.0148	-0.5386	-0.0018	0.0342
		(0.1706)	(0.8551)	(0.4306)	(0.9453)	(0.2532)
4				0.4691		
				(0.4887)		
ECT(-1)	-0.31006					
	(0.0044)					
R-squared	0.821675					
Adjusted R-squared	0.687931					
F-statistic	6.14364					
P-value	(0.0000)					
D-W	2.209433					
AIC	-3.90582					

Source: Author compilation using eviews. Please note: the values in parathesis represents the probability values.

Table 5a gives the error correction model (ECM) results. ARDL ECM results were estimated using five lags as suggested by AIC. The ARDL models are theoretical approaches that derive the effects of both current and previous periods on the variables. From the ARDL ECM model estimated, the econometrics tools utilised automatically dropped some lags, as well as the bank liquid reserves to asset ratio variable since they have no impact on the model. This is evident from table 4.2.5 that is presented with logarithm of GDP, logarithm of M2 as a percentage of GDP, logarithm of SA, and logarithm of INF returning only three lags whereas logarithm of CPS retained four lags. According to the theory, all explanatories included in the model are expected to carry positive signs except inflation rate which has a negative relationship with real GDP. LNGDP opposed the theory, money supply retained an inverse relationship except lag three, the result confirms the result obtained by Kinyondo (2018) that found a negative relationship between money supply and economic growth. LNCPS registered a negative relationship with real GDP except for the current period, lag one and lag four, this results support Sidano (2009) and Sunde (2010) findings on the nexus of financial development and economic growth using credit to private sector as a proxy for financial development. Another variable included in the model was LNSA that again showed a negative relationship with real GDP. The last variable in the model was LNINF where current period and lag two complied with the theory while lag one and lag three registered positive relationship with real GDP.

In terms of significance, gross domestic product was found to be statistically significant to the model of itself at 5% level of significance (lag one and two) while money supply was significant at current period and first lag at 5% level of significancy. Domestic credit to private sector as a percentage of gross domestic product and net savings were not found to be statistically significant to the model of gross domestic product. Finally, inflation rate was found to be statistically significant at lag 2.

In terms of measure of impact to lnGDP, an upward movement in lag 1 and 2 of lnGDP with 1% results in 0.59% and 0.30% decrease in lnGDP, respectively, ceteris paribus. Similarly, a 1% rise in the current period and first lag of lnM2 reduces lnGDP by 0.22% and 0.31% correspondingly, holding all other factors constant. Moreover, a percent increase in inflation rate in the current period will reduce lnGDP by 0.05%, keeping other factors constant whilst a 1% increment in inflation rate in lag 2 causes an upward movement in lnGDP by 0.06 %, when all other factors are unchanged. As discussed earlier, ECT provides information about the speed at which real gross domestic product model adjusts towards its long run equilibrium level. In this essence, the speed at which the model of gross domestic product adjust toward the long-run equilibrium was determined to be 31%. Lastly, while the measure of impacts of explanatory variables discussed were found to be statistically significant to the model, the effects are relatively small.

Asides the afore-elucidated, r-squared denotes the proportion of variance for an independent variable that is explained by the model or explanatory variables. Based on the results, 82% of variation in logarithm of gross domestic product is explained by the explanatory variables or the model. Overall, the model is significant as proven by the p-value, corresponding to the F-value, of 0.00 which is less than five (or one percent) percent level of significance. The Durbin-Watson stat is 2.21, implying that the model is not suffering from autocorrelation.

Table 6: Long-run form result

Long-run model	Unrestricted Constant and No Trend			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNM2	0.345	0.104	3.307	0.003
LNCPS	0.677	0.376	1.801	0.085
LNLL	-0.280	0.609	-0.459	0.650
LNSA	0.155	0.093	1.662	0.110
LNINF	0.008	0.091	0.092	0.927

The table above illustrate the long run model, that shows ratio of broad money supply to real GDP and the ratio of domestic credit to private sector as percentage of GDP the only significant variables that are significant to the model, at 5% and 10% significant model respectively, again in supportive of Sidano (2009) findings. The results indicates that a one percent increase in ratio of broad money to real GDP will result in a 0.35 percent rise in GDP in the long run. Whereas a one percent increases the ratio of domestic credit to private sector as percentage of GDP results in 0.68 percent in GDP in the long run

4.2.6 Model Efficiency: ARDL short run model

The model was scanned through diagnostics tests and the results are revealed below.

Table 7: Serial correlation LM test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.483209	Prob. F(2,21)	0.2497
Obs*R-squared	6.188696	Prob. Chi-Square(2)	0.0453

Eviews output for serial correlation LM test.

Breusch-Godfrey test for serial correlation is a test in the errors for autocorrelation. The null hypothesis states that there is no serial correlation while the alternative hypothesis opposes the null hypothesis. As presented in table 4.2.6a from the analysis, probability for the F-value of Breusch-Godfrey test was found to be 0.24, lying above 5% level of significance. However, at 10% the model suffers from autocorrelation. In this respect, the null hypothesis cannot be rejected, hence the conclusion is that the model shows the presence of autocorrelation.

Heteroskedasticity Test: ARCH

Table 8: Heteroskedasticity test results

F-statistic (prob. Value)	Obs*R-squared (prob. Value)
0.4399	0.4292

Source: Author compilation using eviews

Heteroskedasticity test was also conducted to determine the efficiency of the model. The ARCH test for heteroskedasticity is generally popular in linear regression models and it is for that ultimate reason that it was employed in the study. The test regresses the squared residuals on lagged squared residuals and a constant. The null hypothesis signifies that there is no heteroskedasticity (there is homoskedasticity) whereas the alternative hypothesis suggests the presence of heteroskedasticity. Following the results displayed in table 4.2.6b, the ARCH result is 0.43 (probability F-value) which is greater than 10% level of significance. In this case, the null hypothesis could not be rejected. Thus, concluding that the model is not suffering from heteroskedasticity.

4.2.7 Stability test

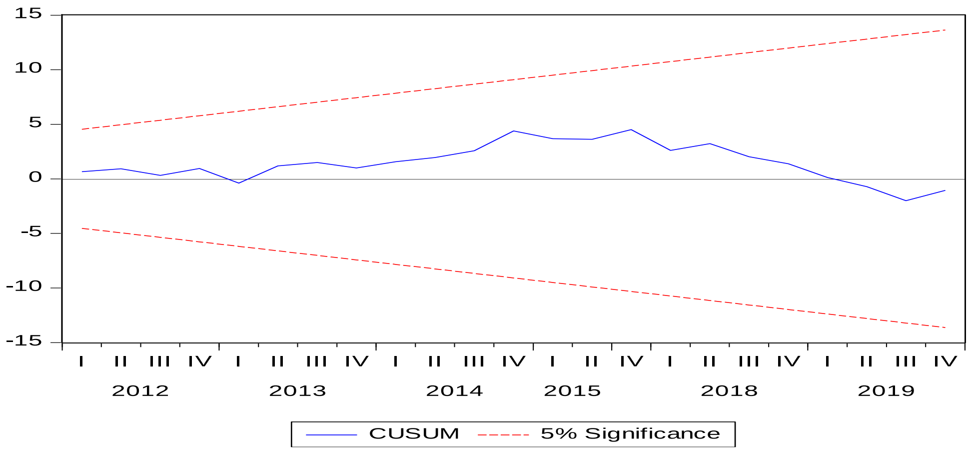

Figure 2: CUSUM stability test: Source: Author compilation.

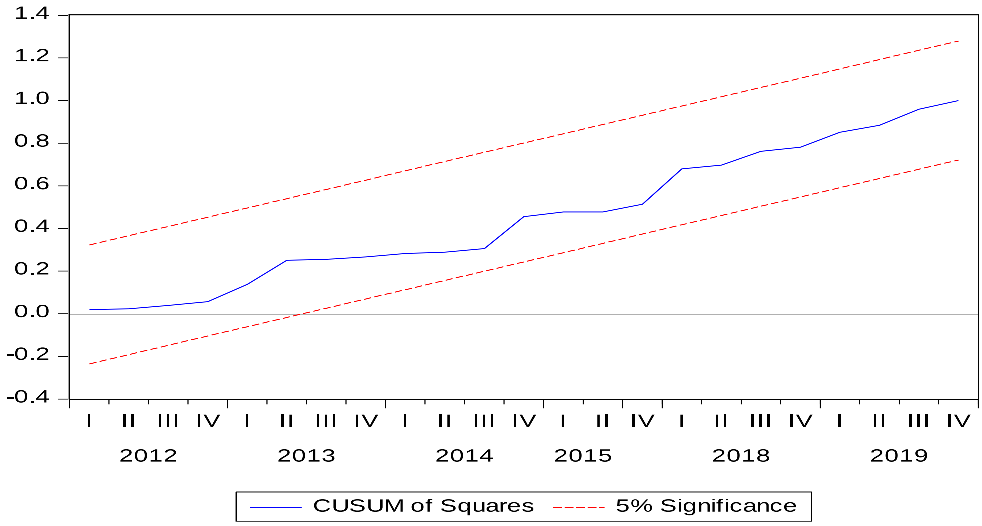

Figure 3: CUSUM of square stability test: Source: Author compilation.

The CUSUM of square stability test was conducted for stability at 5% level of significance. Results indicate that the model is within the recommended range, implying that it is stable. The following section discusses the Granger causality to estimate the causal relationship between the variables.

4.2.8 Granger Causality

To determine direction of causality between real gross domestic product and financial deepening variables, the study employed the pairwise Granger causality test. Given

Y=f(X), it is said that X Granger causes Y if the past information of X helps to predict Y (Amornbunchornvej, et al., 2019). The stationarity check that was conducted earlier in this chapter verified that all series have no unit root at first difference. Thus, the test used differenced variables. To maintain the approach, five lags were still applied for Granger causality test. Table 4.2.8 presents the results from the analysis.

Table 9: VAR results for Granger causality.

Null Hypothesis:	F-Statistic	Prob.
D(LNM2) does not Granger Cause D(LNGDP)	1.30185	0.2793
D(LNGDP) does not Granger Cause D(LNM2)	0.60089	0.6994
D(LNCPS) does not Granger Cause D(LNGDP)	0.24656	0.9395
D(LNGDP) does not Granger Cause D(LNCPS)	0.08222	0.9947
D(LNLL) does not Granger Cause D(LNGDP)	0.3319	0.8911
D(LNGDP) does not Granger Cause D(LNLL)	1.02038	0.4165
D(LNCPS) does not Granger Cause D(LNM2)	0.57303	0.7203
D(LNM2) does not Granger Cause D(LNCPS)	0.0877	0.9938
D(LNLL) does not Granger Cause D(LNM2)	0.13513	0.9834
D(LNM2) does not Granger Cause D(LNLL)	0.11356	0.9888
D(LNLL) does not Granger Cause D(LNCPS)	0.25578	0.9348
D(LNCPS) does not Granger Cause D(LNLL)	2.38929	0.0519

Source: Author construction using eviews.

Table 4.2.8 gives the pairwise Granger causality results. Initially, the Granger causality hypotheses were stated with the null hypothesis noting a no causal relationship between financial deepening variables and gross domestic product. The alternative hypothesis indicates otherwise. In this manner, the null hypothesis is rejected if the p-values obtained are less than the chosen level of significances (five or ten percent). From the analysis, the p-values of financial deepening variables, namely, M2, CPS and LL to gross domestic product were all found to be greater than 5% level of significance. Therefore, all the null hypotheses concerning them were not rejected, leading to a conclusion that financial deepening variables in terms of M2, CPS and LL do not Granger cause gross domestic product in Namibia. Hence, this outcome opposes findings from previous studies, such as Sidano (2009) and Sunde (2013) on the causality of finance-growth and verse versa.

Similarly, the p-values of gross domestic product to financial deepening variables were greater than 5% level of significance. This signifies a no causal relationship, concluding that gross domestic product does not granger cause financial deepening. Additionally, there was also no detected causal relationships from money supply to CPS and LL. On the other hand, domestic credit to private sector does Granger cause bank liquid reserve to bank asset ratio.

In a nutshell, it is evident from the outcomes depicted in table 4.2.8 that there are no causal relationships from financial deepening to gross domestic product, just as much as no causal relationship from gross domestic product to financial deepening in Namibia could be revealed. This indicates that the variables are independent to each other. Subsequent to this is chapter five that presents the conclusion based on findings obtained from the estimations and finally provides the policy recommendations and suggestions for future studies.

4.3 Summary of the chapter

The fourth chapter of this study presented the estimation results accompanied by the respective interpretations. The results include the descriptive results, Unit root testing for stationarity analysis, cointegration results, error correction model results and long run estimation, model diagnostic testing and Granger causality results. The final chapter of the study concludes the study as well as providing recommendation.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The previous chapter analysed the data using various econometric techniques for data analysis. The current chapter draws the conclusions based on the outcomes presented in the previous chapter and gives policy recommendations as well as a direction of areas that future researchers should focus on.

5.2 Conclusions

The study investigated the impact of financial deepening (broad money supply as a percentage of GDP, ratio of domestic credit to private sector as a percentage of GDP and bank liquid reserves to assets ratio) on economic growth in Namibia. The study aimed to attain twofold specific objectives. First, to establish the nature of the relationship between financial deepening variables and real GDP in Namibia (whether it is long-run or short-run). Second, to determine the Granger causal relationships between the variables.

Cointegration test was conducted on Autoregressive distributed Lag model (ARDL). In this regard, the Wald test was applied to determine if there exist long-run relationships among GDP and financial deepening proxies. Based on Wald test results, the null hypothesis was rejected, resulting into a conclusion that the nature of the relationship between gross domestic product and financial deepening variables is long run. Thus, the error correction ARDL model was performed. However, the results obtained from the ECM reveal mixed conclusions. Precisely, gross domestic product of the error correction model (previous period of gross domestic product), broad money supply ratio of GDP and inflation rate were found to be statistically significant to the model of real GDP whereas domestic credit to private sector ratio of GDP, bank liquid reserves to bank assets ratio and net saving were not significant in defining the gross domestic product in Namibia.

Although the significance could not be obtained at all lags, evidence obtained from the analyses remains adequate to conclude that gross domestic product in the past period, broad money supply ratio of GDP and inflation rate trigger real gross domestic products in Namibia. Similarly, while broad money supply ratio of GDP did not carry positive signs at all levels, a positive and significant effect was obtained in the current period and lag one, meaning that there is an inverse relationship between money supply and real GDP in Namibia. This opposes the theory that postulates that an increase of money in circulation brings about an increase in production and household consumption (Jędruchniewicz, 2014) that stimulate economic growth. Further, results of inflation correspond to the theory, where an inverse relationship was expected. In details, an inverse relationship between inflation rate and gross domestic product represents the effect that high prices have on cost of production and the purchasing power. Higher prices decline consumption; thus, lessening the production capacity that eventually drags down the total production in the economy (gross domestic product).

Moreover, a positive coefficient in the first lag of inflation rate predicts a stable inflation. This implies that stable or low inflation rate in the previous periods is more likely to bring about an increase in gross domestic product in the near future. Lastly, it is evident from the model that the previous period of GDP has an inverse effect on gross domestic product. Despite the mixed results from the error correction model, the effects were found to be relatively small, leading to a conclusion that the impact of financial deepening on economic growth in Namibia is minimal.

On causal relationship test, Granger causality test was conducted using the pairwise Granger test and the results assert a no causal relationship between financial deepening and economic growth in Namibia. This is an indication that financial deepening variables do not play a crucial role in forecasting gross domestic product. Also, the same applies on gross domestic product on predicting financial deepening.

5.3 Policy Recommendations

Generally, the Namibian economy has recorded a contraction in real GDP with an estimated of 8.0 percent in 2020 (Bank of Namibia, 2021). The contraction was attributed to all industries including the tertiary industry that consists of the financial sector that is not considered to be deep enough; yet deemed to be sound and well-functioning (Ministry of finance, 2021). Based on the analyses of this study, improvements are highly required to fully equip the financial industry in order to successfully integrate and positively influence real GDP in Namibia. Against the negative link between broad money supply and real GDP (although it is minimal), the study recommends that policymakers should focus more on other variables that have high potential to hugely stimulate economic growth in Namibia. In addition, inflation rate has a negative effect on real gross domestic product in Namibia, decoding that a well-managed inflation rate will mean that prices are reasonable within the country, and this will boost purchasing which eventually raises final consumption as well as intermediate consumption. Therefore, stable inflation rate sector will assist the financial sector to strengthen their establishments by improving their resources.

In the final analysis, the Namibian banking system is dominated by big banks that makes it difficult for smaller ones to enter the market (Ikhide, 2000). Attracting more commercial banks can improve competition and lead to products innovation that brings efficiency. Again, Namibia has a Competition Commission that is responsible for laws that ensure proper competition within the economy. Hence, the effective regulation of financial industry will prosper for Namibia.

5.4 Suggestions for Future Studies

While there are plenty of financial deepening proxies in Namibia, this study has only used three of them. Thus, a call for future researchers to explore the effects of other financial development variables on economic growth in Namibia such as total deposits by banking institutions and financial intermediation services indirectly measured (FISIM) among others. FISIM provides a clear picture on the role of banks through intermediation in the economy (Widodo, n.a). In addition, researchers are encouraged to conduct more research on the current topic using a longer period determine effectiveness of financial deepening variable(s) on economic growth.

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7. Appendix

Appendix1: Raw Data

Period	GDP (N$)	M2 (ratio of GDP)	CPS (%)	LL (%)	SA
2004Q1	22,627	1.91	47.09	10%	8,028
2004Q2	22,557	1.94	48.26	10%	8,199
2004Q3	21,579	2.14	49.42	10%	8,370
2004Q4	22,915	2.13	50.59	10%	8,540
2005Q1	23,083	2.10	51.75	11%	8,711
2005Q2	23,062	2.22	51.09	10%	9,835
2005Q3	20,764	2.51	50.43	9%	10,960
2005Q4	24,163	2.16	49.77	10%	12,084
2006Q1	24,159	2.23	49.11	9%	13,208
2006Q2	24,849	2.38	48.90	9%	12,852
2006Q3	22,949	2.75	48.69	9%	12,496
2006Q4	25,701	2.62	48.47	9%	12,140
2007Q1	24,628	2.80	48.26	10%	11,785
2007Q2	25,055	2.76	47.84	10%	11,990
2007Q3	25,831	2.92	47.43	9%	12,195
2007Q4	27,668	2.75	47.01	9%	12,400
2008Q1	27,109	2.97	46.60	10%	12,605
2008Q2	25,669	3.25	46.95	9%	10,727
2008Q3	26,804	3.24	47.31	9%	8,849
2008Q4	26,334	3.35	47.66	10%	6,971
2009Q1	25,458	5.60	48.01	9%	5,093
2009Q2	24,534	5.66	48.30	10%	5,479

2009Q3	27,036	5.15	48.58	9%	5,865
2009Q4	29,201	4.97	48.86	10%	6,251
2010Q1	27,132	5.54	49.14	11%	6,636
2010Q2	27,588	5.55	49.19	10%	6,421
2010Q3	28,750	5.29	49.23	10%	6,205
2010Q4	29,175	5.38	49.28	11%	5,989
2011Q1	29,284	5.25	49.32	10%	5,773
2011Q2	28,382	5.47	49.15	10%	6,578
2011Q3	31,415	5.21	48.98	11%	7,382
2011Q4	29,299	5.94	48.80	12%	8,187
2012Q1	32,586	5.24	48.63	11%	8,992
2012Q2	30,158	5.90	48.59	11%	9,118
2012Q3	30,063	6.00	48.54	11%	9,244
2012Q4	31,563	5.80	48.49	11%	9,370
2013Q1	31,488	5.88	48.45	10%	9,496
2013Q2	32,723	5.89	48.82	10%	11,135
2013Q3	34,182	5.92	49.19	11%	12,774
2013Q4	32,963	6.32	49.56	11%	14,413
2014Q1	32,662	6.24	49.93	10%	16,052
2014Q2	34,367	6.04	53.41	11%	13,942
2014Q3	35,520	6.26	56.89	12%	11,833
2014Q4	36,369	6.16	60.37	12%	9,723
2015Q1	35,347	6.51	63.85	12%	7,614
2015Q2	36,110	6.56	64.18	12%	3,713
2015Q3	37,223	6.51	64.51	12%	(187)

2015Q4	36,528	6.78	64.84	11%	(4,088)
2016Q1	36,358	6.88	65.17	12%	(7,988)
2016Q2	35,248	7.40	64.82	11%	(4,874)
2016Q3	36,637	7.05	64.46	11%	(1,759)
2016Q4	36,557	7.07	64.11	11%	1,356
2017Q1	35,772	7.21	63.76	10%	4,470
2017Q2	35,480	7.70	64.27	11%	3,955
2017Q3	36,042	7.97	64.78	14%	3,441
2017Q4	37,134	7.92	65.29	13%	2,926
2018Q1	36,476	7.94	65.80	13%	2,411
2018Q2	36,947	8.03	67.05	14%	2,212
2018Q3	36,299	8.54	68.30	15%	2,013
2018Q4	35,714	8.88	69.55	14%	1,814
2019Q1	35,598	8.76	70.80	14%	1,615
2019Q2	36,030	9.01	71.08	14%	2,673
2019Q3	35,866	9.30	71.35	14%	3,731
2019Q4	36,293	9.54	71.63	13%	4,789

Appendix 2: Unit root testing

ADF test and PP test

Null Hypothesis: LNGDP has a unit root
Exogenous: None
Lag Length: 3 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		3.467859	0.9998
Test critical values:	1% level	-2.604073	
	5% level	-1.946348	

	10% level	-1.613293	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGDP)
Method: Least Squares
Date: 09/07/21 Time: 18:58
Sample (adjusted): 2005Q1 2019Q4
Included observations: 60 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)	0.001913	0.000552	3.467859	0.0010
D(LNGDP(-1))	-0.652910	0.122236	-5.341370	0.0000
D(LNGDP(-2))	-0.472809	0.134880	-3.505395	0.0009
D(LNGDP(-3))	-0.396968	0.120511	-3.294027	0.0017

R-squared	0.365882	Mean dependent var	0.003329
Adjusted R-squared	0.331912	S.D. dependent var	0.021324
S.E. of regression	0.017429	Akaike info criterion	-5.196997
Sum squared resid	0.017012	Schwarz criterion	-5.057374
Log likelihood	159.9099	Hannan-Quinn criter.	-5.142382
Durbin-Watson stat	1.893621		

Null Hypothesis: LNGDP has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.705666	0.4233
Test critical values:	1% level	-3.544063	
	5% level	-2.910860	
	10% level	-2.593090	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGDP)
Method: Least Squares
Date: 09/07/21 Time: 18:58
Sample (adjusted): 2005Q1 2019Q4
Included observations: 60 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)	-0.052564	0.030818	-1.705666	0.0937
D(LNGDP(-1))	-0.643583	0.120096	-5.358894	0.0000
D(LNGDP(-2))	-0.477402	0.132416	-3.605313	0.0007
D(LNGDP(-3))	-0.404083	0.118356	-3.414148	0.0012
C	0.244173	0.138106	1.768014	0.0826

R-squared	0.399984	Mean dependent var	0.003329
Adjusted R-squared	0.356346	S.D. dependent var	0.021324
S.E. of regression	0.017108	Akaike info criterion	-5.218941
Sum squared resid	0.016097	Schwarz criterion	-5.044412
Log likelihood	161.5682	Hannan-Quinn criter.	-5.150673
F-statistic	9.166044	Durbin-Watson stat	1.906653
Prob(F-statistic)	0.000010		

Null Hypothesis: LNGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.366249	0.9867
Test critical values:	1% level	-4.118444	
	5% level	-3.486509	
	10% level	-3.171541	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGDP)
Method: Least Squares
Date: 09/07/21 Time: 18:58
Sample (adjusted): 2005Q1 2019Q4
Included observations: 60 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)	-0.054765	0.149528	-0.366249	0.7156
D(LNGDP(-1))	-0.641732	0.172732	-3.715196	0.0005
D(LNGDP(-2))	-0.475999	0.162988	-2.920453	0.0051
D(LNGDP(-3))	-0.403245	0.131812	-3.059249	0.0035
C	0.253699	0.648454	0.391237	0.6972

@TREND("2004Q 1")	9.48E-06	0.000630	0.015042	0.9881

R-squared	0.399986	Mean dependent var	0.003329
Adjusted R-squared	0.344429	S.D. dependent var	0.021324
S.E. of regression	0.017265	Akaike info criterion	-5.185612
Sum squared resid	0.016097	Schwarz criterion	-4.976177
Log likelihood	161.5684	Hannan-Quinn criter.	-5.103690
F-statistic	7.199586	Durbin-Watson stat	1.906152
Prob(F-statistic)	0.000032		

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: None
Lag Length: 4 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.693093	0.0079
Test critical values:	1% level	-2.605442	
	5% level	-1.946549	
	10% level	-1.613181	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGDP,2)
Method: Least Squares
Date: 09/07/21 Time: 18:59
Sample (adjusted): 2005Q3 2019Q4
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDP(-1))	-1.188722	0.441397	-2.693093	0.0095
D(LNGDP(-1),2)	-0.322257	0.398546	-0.808582	0.4224
D(LNGDP(-2),2)	-0.512927	0.319021	-1.607817	0.1138
D(LNGDP(-3),2)	-0.584319	0.230049	-2.539972	0.0141
D(LNGDP(-4),2)	-0.209043	0.132246	-1.580711	0.1199

R-squared	0.767122	Mean dependent var	9.56E-05
Adjusted R-squared	0.749546	S.D. dependent var	0.036840
S.E. of regression	0.018437	Akaike info criterion	-5.066662
Sum squared resid	0.018016	Schwarz criterion	-4.889038

Log likelihood	151.9332	Hannan-Quinn criter.	-4.997474
Durbin-Watson stat	1.872001		

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.520072	0.0000
Test critical values:	1% level	-3.544063	
	5% level	-2.910860	
	10% level	-2.593090	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGDP,2)
Method: Least Squares
Date: 09/07/21 Time: 19:00
Sample (adjusted): 2005Q1 2019Q4
Included observations: 60 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDP(-1))	-2.526389	0.296522	-8.520072	0.0000
D(LNGDP(-1),2)	0.872666	0.220823	3.951884	0.0002
D(LNGDP(-2),2)	0.398280	0.120307	3.310547	0.0016
C	0.008647	0.002468	3.504349	0.0009

R-squared	0.782413	Mean dependent var	-0.000349
Adjusted R-squared	0.770757	S.D. dependent var	0.036334
S.E. of regression	0.017397	Akaike info criterion	-5.200730
Sum squared resid	0.016948	Schwarz criterion	-5.061107
Log likelihood	160.0219	Hannan-Quinn criter.	-5.146115
F-statistic	67.12279	Durbin-Watson stat	1.894872
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.811726	0.0000
Test critical values:	1% level	-4.118444	
	5% level	-3.486509	
	10% level	-3.171541	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNGDP,2)
Method: Least Squares
Date: 09/07/21 Time: 19:00
Sample (adjusted): 2005Q1 2019Q4
Included observations: 60 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDP(-1))	-2.618518	0.297163	-8.811726	0.0000
D(LNGDP(-1),2)	0.932241	0.220352	4.230688	0.0001
D(LNGDP(-2),2)	0.422952	0.119378	3.542947	0.0008
C	0.016211	0.005156	3.144007	0.0027
@TREND("2004Q1")	-0.000216	0.000130	-1.663143	0.1020

R-squared	0.792832	Mean dependent var	-0.000349
Adjusted R-squared	0.777765	S.D. dependent var	0.036334
S.E. of regression	0.017129	Akaike info criterion	-5.216464
Sum squared resid	0.016137	Schwarz criterion	-5.041935
Log likelihood	161.4939	Hannan-Quinn criter.	-5.148196
F-statistic	52.62122	Durbin-Watson stat	1.917781
Prob(F-statistic)	0.000000		

Null Hypothesis: LNGDP has a unit root
Exogenous: None
Bandwidth: 17 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		2.882550	0.9989
Test critical values:	1% level	-2.602185	
	5% level	-1.946072	
	10% level	-1.613448	

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

Residual variance (no correction)	0.00044 3
HAC corrected variance (Bartlett kernel)	7.81E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNGDP)
Method: Least Squares
Date: 09/07/21 Time: 19:01
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)	0.000714	0.000597	1.194861	0.2367

R-squared	-0.000928	Mean dependent var	0.003257
Adjusted R-squared	-0.000928	S.D. dependent var	0.021204
S.E. of regression	0.021214	Akaike info criterion	-4.852576
Sum squared resid	0.027902	Schwarz criterion	-4.818558
Log likelihood	153.8561	Hannan-Quinn criter.	-4.839197
Durbin-Watson stat	2.879043		

Null Hypothesis: LNGDP has a unit root
Exogenous: Constant
Bandwidth: 22 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.195106	0.6716
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

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

Residual variance (no correction)	0.00042 9
HAC corrected variance (Bartlett kernel)	0.00016 3

Phillips-Perron Test Equation
Dependent Variable: D(LNGDP)
Method: Least Squares
Date: 09/07/21 Time: 19:01
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)	-0.049354	0.035016	-1.409499	0.1638
C	0.224093	0.156699	1.430083	0.1578

R-squared	0.031541	Mean dependent var	0.003257
Adjusted R-squared	0.015665	S.D. dependent var	0.021204
S.E. of regression	0.021037	Akaike info criterion	-4.853807
Sum squared resid	0.026997	Schwarz criterion	-4.785771
Log likelihood	154.8949	Hannan-Quinn criter.	-4.827048
F-statistic	1.986687	Durbin-Watson stat	2.829312
Prob(F-statistic)	0.163766		

Null Hypothesis: LNGDP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.936733	0.0160
Test critical values:	1% level	-4.110440	
	5% level	-3.482763	
	10% level	-3.169372	

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

Residual variance (no correction)	0.000344
HAC corrected variance (Bartlett kernel)	0.000299

Phillips-Perron Test Equation
Dependent Variable: D(LNGDP)
Method: Least Squares

Date: 09/07/21 Time: 19:01
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)	-0.471158	0.114139	-4.127923	0.0001
C	2.052977	0.496131	4.137976	0.0001
@TREND("2004Q1")	0.001827	0.000475	3.846073	0.0003

R-squared	0.223081	Mean dependent var	0.003257
Adjusted R-squared	0.197184	S.D. dependent var	0.021204
S.E. of regression	0.018999	Akaike info criterion	-5.042431
Sum squared resid	0.021657	Schwarz criterion	-4.940377
Log likelihood	161.8366	Hannan-Quinn criter.	-5.002293
F-statistic	8.614082	Durbin-Watson stat	2.245563
Prob(F-statistic)	0.000514		

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: None
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.90251	0.0000
Test critical values:	1% level	-2.602794	
	5% level	-1.946161	
	10% level	-1.613398	

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

Residual variance (no correction)	0.000384
HAC corrected variance (Bartlett kernel)	0.000405

Phillips-Perron Test Equation
Dependent Variable: D(LNGDP,2)
Method: Least Squares
Date: 09/07/21 Time: 19:02
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDP(-1))	-1.406989	0.117014	-12.02415	0.0000

R-squared	0.703276	Mean dependent var	0.000105
Adjusted R-squared	0.703276	S.D. dependent var	0.036276
S.E. of regression	0.019760	Akaike info criterion	-4.994281
Sum squared resid	0.023819	Schwarz criterion	-4.959972
Log likelihood	155.8227	Hannan-Quinn criter.	-4.980811
Durbin-Watson stat	2.132288		

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Bandwidth: 40 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-18.85890	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

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

Residual variance (no correction)	0.000362
HAC corrected variance (Bartlett kernel)	9.91E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNGDP,2)
Method: Least Squares
Date: 09/07/21 Time: 19:02
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDP(-1))	-1.440327	0.115864	-12.43120	0.0000
C	0.004752	0.002485	1.912472	0.0606

R-squared	0.720325	Mean dependent var	0.000105

Adjusted R-squared	0.715664	S.D. dependent var	0.036276
S.E. of regression	0.019343	Akaike info criterion	-5.021196
Sum squared resid	0.022450	Schwarz criterion	-4.952579
Log likelihood	157.6571	Hannan-Quinn criter.	-4.994255
F-statistic	154.5347	Durbin-Watson stat	2.208314
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 27 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-21.62846	0.0001
Test critical values:	1% level	-4.113017	
	5% level	-3.483970	
	10% level	-3.170071	

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

Residual variance (no correction)	0.000359
HAC corrected variance (Bartlett kernel)	7.02E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNGDP,2)
Method: Least Squares
Date: 09/07/21 Time: 19:03
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGDP(-1))	-1.444598	0.116538	-12.39595	0.0000
C	0.007862	0.005152	1.525851	0.1324
@TREND("2004Q1")	-9.52E-05	0.000138	-0.689814	0.4930

R-squared	0.722563	Mean dependent var	0.000105
Adjusted R-squared	0.713158	S.D. dependent var	0.036276
S.E. of regression	0.019429	Akaike info criterion	-4.996971

Sum squared resid	0.022271	Schwarz criterion	-4.894045
Log likelihood	157.9061	Hannan-Quinn criter.	-4.956560
F-statistic	76.83026	Durbin-Watson stat	2.219966
Prob(F-statistic)	0.000000		

Null Hypothesis: M2 has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.876432	0.9847
Test critical values:	1% level	-2.602185	
	5% level	-1.946072	
	10% level	-1.613448	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M2)
Method: Least Squares
Date: 10/10/21 Time: 11:10
Sample (adjusted): 2 64
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	0.012386	0.006601	1.876432	0.0653

R-squared	-0.034139	Mean dependent var	0.011078
Adjusted R-squared	-0.034139	S.D. dependent var	0.036643
S.E. of regression	0.037263	Akaike info criterion	-3.725882
Sum squared resid	0.086089	Schwarz criterion	-3.691864
Log likelihood	118.3653	Hannan-Quinn criter.	-3.712502
Durbin-Watson stat	2.293856		

Null Hypothesis: M2 has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on AIC, maxlag=2)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-1.317875	0.6160
Test critical values:	1% level	-3.542097	
	5% level	-2.910019	
	10% level	-2.592645	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M2)
Method: Least Squares
Date: 10/10/21 Time: 11:11
Sample (adjusted): 4 64
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	-0.031164	0.023648	-1.317875	0.1928
D(M2(-1))	-0.207387	0.126672	-1.637194	0.1071
D(M2(-2))	-0.219426	0.126717	-1.731624	0.0887
C	0.036999	0.017225	2.148024	0.0360

R-squared	0.101896	Mean dependent var	0.010637
Adjusted R-squared	0.054628	S.D. dependent var	0.037028
S.E. of regression	0.036002	Akaike info criterion	-3.747150
Sum squared resid	0.073881	Schwarz criterion	-3.608732
Log likelihood	118.2881	Hannan-Quinn criter.	-3.692902
F-statistic	2.155684	Durbin-Watson stat	2.047629
Prob(F-statistic)	0.103235		

Null Hypothesis: M2 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.343132	0.4051
Test critical values:	1% level	-4.110440	
	5% level	-3.482763	
	10% level	-3.169372	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(M2)
Method: Least Squares
Date: 10/10/21 Time: 11:13
Sample (adjusted): 2 64
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	-0.161055	0.068735	-2.343132	0.0225
C	0.071136	0.025022	2.842940	0.0061
@TREND("1")	0.001551	0.000774	2.003384	0.0497

R-squared	0.090377	Mean dependent var	0.011078
Adjusted R-squared	0.060056	S.D. dependent var	0.036643
S.E. of regression	0.035526	Akaike info criterion	-3.790684
Sum squared resid	0.075724	Schwarz criterion	-3.688630
Log likelihood	122.4065	Hannan-Quinn criter.	-3.750545
F-statistic	2.980686	Durbin-Watson stat	2.189489
Prob(F-statistic)	0.058324		

Null Hypothesis: D(M2) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.399305	0.0000
Test critical values:	1% level	-2.602794	
	5% level	-1.946161	
	10% level	-1.613398	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M2,2)
Method: Least Squares
Date: 10/10/21 Time: 11:16
Sample (adjusted): 3 64
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2(-1))	-1.072989	0.127747	-8.399305	0.0000

R-squared	0.536291	Mean dependent var	6.57E-05
Adjusted R-squared	0.536291	S.D. dependent var	0.056546
S.E. of regression	0.038506	Akaike info criterion	-3.660011
Sum squared resid	0.090445	Schwarz criterion	-3.625703
Log likelihood	114.4603	Hannan-Quinn criter.	-3.646541
Durbin-Watson stat	1.998314		

Null Hypothesis: D(M2) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.285576	0.0000
Test critical values:	1% level	-3.542097	
	5% level	-2.910019	
	10% level	-2.592645	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M2,2)
Method: Least Squares
Date: 10/10/21 Time: 11:17
Sample (adjusted): 4 64
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2(-1))	-1.421614	0.195127	-7.285576	0.0000
D(M2(-1),2)	0.214673	0.127467	1.684143	0.0975
C	0.015311	0.005118	2.991415	0.0041

R-squared	0.607178	Mean dependent var	-0.000507
Adjusted R-squared	0.593633	S.D. dependent var	0.056834
S.E. of regression	0.036230	Akaike info criterion	-3.749922
Sum squared resid	0.076132	Schwarz criterion	-3.646108
Log likelihood	117.3726	Hannan-Quinn criter.	-3.709236
F-statistic	44.82488	Durbin-Watson stat	2.047649
Prob(F-statistic)	0.000000		

Null Hypothesis: M2 has a unit root
Exogenous: None
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		2.407152	0.9958
Test critical values:	1% level	-2.602185	
	5% level	-1.946072	
	10% level	-1.613448	

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

Residual variance (no correction)	0.00136 6
HAC corrected variance (Bartlett kernel)	0.00089 5

Phillips-Perron Test Equation
Dependent Variable: D(M2)
Method: Least Squares
Date: 10/10/21 Time: 11:19
Sample (adjusted): 2 64
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	0.012386	0.006601	1.876432	0.0653

R-squared	-0.034139	Mean dependent var	0.011078
Adjusted R-squared	-0.034139	S.D. dependent var	0.036643
S.E. of regression	0.037263	Akaike info criterion	- 3.725882
Sum squared resid	0.086089	Schwarz criterion	- 3.691864
Log likelihood	118.3653	Hannan-Quinn criter.	- 3.712502
Durbin-Watson stat	2.293856		

Null Hypothesis: M2 has a unit root
Exogenous: Constant
Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*

Phillips-Perron test statistic		-1.526966	0.5136
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

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

Residual variance (no correction)	0.001282
HAC corrected variance (Bartlett kernel)	0.000467

Phillips-Perron Test Equation
Dependent Variable: D(M2)
Method: Least Squares
Date: 10/10/21 Time: 11:20
Sample (adjusted): 2 64
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	-0.030496	0.022384	-1.362398	0.1781
C	0.031848	0.015920	2.000493	0.0499

R-squared	0.029530	Mean dependent var	0.011078
Adjusted R-squared	0.013620	S.D. dependent var	0.036643
S.E. of regression	0.036392	Akaike info criterion	-3.757680
Sum squared resid	0.080789	Schwarz criterion	-3.689644
Log likelihood	120.3669	Hannan-Quinn criter.	-3.730921
F-statistic	1.856127	Durbin-Watson stat	2.341731
Prob(F-statistic)	0.178082		

Null Hypothesis: M2 has a unit root
Exogenous: Constant
Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.526966	0.5136
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

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

Residual variance (no correction)	0.00128 2
HAC corrected variance (Bartlett kernel)	0.00046 7

Phillips-Perron Test Equation
Dependent Variable: D(M2)
Method: Least Squares
Date: 10/10/21 Time: 11:20
Sample (adjusted): 2 64
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	-0.030496	0.022384	-1.362398	0.1781
C	0.031848	0.015920	2.000493	0.0499

R-squared	0.029530	Mean dependent var	0.011078
Adjusted R-squared	0.013620	S.D. dependent var	0.036643
S.E. of regression	0.036392	Akaike info criterion	-3.757680
Sum squared resid	0.080789	Schwarz criterion	-3.689644
Log likelihood	120.3669	Hannan-Quinn criter.	-3.730921
F-statistic	1.856127	Durbin-Watson stat	2.341731
Prob(F-statistic)	0.178082		

Null Hypothesis: M2 has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.191905	0.4856
Test critical values:	1% level	-4.110440	
	5% level	-3.482763	
	10% level	-3.169372	

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

Residual variance (no correction)	0.001202
HAC corrected variance (Bartlett kernel)	0.001015

Phillips-Perron Test Equation
Dependent Variable: D(M2)
Method: Least Squares
Date: 10/10/21 Time: 11:21
Sample (adjusted): 2 64
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	-0.161055	0.068735	-2.343132	0.0225
C	0.071136	0.025022	2.842940	0.0061
@TREND("1")	0.001551	0.000774	2.003384	0.0497

R-squared	0.090377	Mean dependent var	0.011078
Adjusted R-squared	0.060056	S.D. dependent var	0.036643
S.E. of regression	0.035526	Akaike info criterion	-3.790684
Sum squared resid	0.075724	Schwarz criterion	-3.688630
Log likelihood	122.4065	Hannan-Quinn criter.	-3.750545
F-statistic	2.980686	Durbin-Watson stat	2.189489
Prob(F-statistic)	0.058324		

Null Hypothesis: D(M2) has a unit root
Exogenous: None
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.399305	0.0000
Test critical values:	1% level	-2.602794	
	5% level	-1.946161	
	10% level	-1.613398	

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

Residual variance (no correction)	0.001459
HAC corrected variance (Bartlett kernel)	0.001459

Phillips-Perron Test Equation
Dependent Variable: D(M2,2)
Method: Least Squares
Date: 10/10/21 Time: 11:23
Sample (adjusted): 3 64
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2(-1))	-1.072989	0.127747	-8.399305	0.0000

R-squared	0.536291	Mean dependent var	6.57E-05
Adjusted R-squared	0.536291	S.D. dependent var	0.056546
S.E. of regression	0.038506	Akaike info criterion	-3.660011
Sum squared resid	0.090445	Schwarz criterion	-3.625703
Log likelihood	114.4603	Hannan-Quinn criter.	-3.646541
Durbin-Watson stat	1.998314		

Null Hypothesis: D(M2) has a unit root
Exogenous: Constant
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.695646	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

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

Residual variance (no correction)	0.001303
HAC corrected variance (Bartlett kernel)	0.000871

Phillips-Perron Test Equation
Dependent Variable: D(M2,2)
Method: Least Squares
Date: 10/10/21 Time: 11:24

Sample (adjusted): 3 64
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2(-1))	-1.171594	0.127171	-9.212719	0.0000
C	0.013044	0.004868	2.679440	0.0095

R-squared	0.585848	Mean dependent var	6.57E-05
Adjusted R-squared	0.578945	S.D. dependent var	0.056546
S.E. of regression	0.036692	Akaike info criterion	-3.740775
Sum squared resid	0.080779	Schwarz criterion	-3.672158
Log likelihood	117.9640	Hannan-Quinn criter.	-3.713834
F-statistic	84.87418	Durbin-Watson stat	2.059424
Prob(F-statistic)	0.000000		

Null Hypothesis: D(M2) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.23009	0.0000
Test critical values:	1% level	-4.113017	
	5% level	-3.483970	
	10% level	-3.170071	

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

Residual variance (no correction)	0.001288
HAC corrected variance (Bartlett kernel)	0.000666

Phillips-Perron Test Equation
Dependent Variable: D(M2,2)
Method: Least Squares
Date: 10/10/21 Time: 11:24
Sample (adjusted): 3 64
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(M2(-1))	-1.180715	0.127995	-9.224697	0.0000
C	0.020156	0.009924	2.031089	0.0468
@TREND("1")	-0.000216	0.000262	-0.823144	0.4137

R-squared	0.590550	Mean dependent var	6.57E-05
Adjusted R-squared	0.576670	S.D. dependent var	0.056546
S.E. of regression	0.036791	Akaike info criterion	-3.719936
Sum squared resid	0.079862	Schwarz criterion	-3.617010
Log likelihood	118.3180	Hannan-Quinn criter.	-3.679525
F-statistic	42.54782	Durbin-Watson stat	2.068696
Prob(F-statistic)	0.000000		

Null Hypothesis: LNCPS has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.836638	0.8892
Test critical values:	1% level	-2.602794	
	5% level	-1.946161	
	10% level	-1.613398	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPS)
Method: Least Squares
Date: 09/02/21 Time: 19:32
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPS(-1)	0.000321	0.000384	0.836638	0.4061
D(LNCPS(-1))	0.755206	0.083229	9.073886	0.0000

R-squared	0.580176	Mean dependent var	0.002767
Adjusted R-squared	0.573179	S.D. dependent var	0.007437
S.E. of regression	0.004858	Akaike info criterion	-7.784495
Sum squared resid	0.001416	Schwarz criterion	-7.715877

Log likelihood	243.3193	Hannan-Quinn criter.	-7.757554
Durbin-Watson stat	1.806989		

Null Hypothesis: LNCPS has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.554072	0.8726
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPS)
Method: Least Squares
Date: 09/02/21 Time: 19:33
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPS(-1)	-0.005773	0.010418	-0.554072	0.5816
D(LNCPS(-1))	0.768007	0.086499	8.878795	0.0000
C	0.010530	0.017992	0.585283	0.5606

R-squared	0.582599	Mean dependent var	0.002767
Adjusted R-squared	0.568450	S.D. dependent var	0.007437
S.E. of regression	0.004885	Akaike info criterion	-7.758026
Sum squared resid	0.001408	Schwarz criterion	-7.655100
Log likelihood	243.4988	Hannan-Quinn criter.	-7.717614
F-statistic	41.17546	Durbin-Watson stat	1.827670
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNCPS) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-2.840638	0.0052
Test critical values:	1% level	-2.602794	
	5% level	-1.946161	
	10% level	-1.613398	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPS,2)
Method: Least Squares
Date: 09/02/21 Time: 19:35
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPS(-1))	-0.218824	0.077033	-2.840638	0.0061

R-squared	0.116127	Mean dependent var	-0.000144
Adjusted R-squared	0.116127	S.D. dependent var	0.005155
S.E. of regression	0.004846	Akaike info criterion	-7.805154
Sum squared resid	0.001433	Schwarz criterion	-7.770845
Log likelihood	242.9598	Hannan-Quinn criter.	-7.791684
Durbin-Watson stat	1.830944		

Null Hypothesis: D(LNCPS) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.952308	0.0452
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPS,2)
Method: Least Squares
Date: 09/02/21 Time: 19:36

Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPS(-1))	-0.244743	0.082899	-2.952308	0.0045
C	0.000568	0.000662	0.858114	0.3942

R-squared	0.126842	Mean dependent var	-0.000144
Adjusted R-squared	0.112290	S.D. dependent var	0.005155
S.E. of regression	0.004857	Akaike info criterion	-7.785094
Sum squared resid	0.001415	Schwarz criterion	-7.716477
Log likelihood	243.3379	Hannan-Quinn criter.	-7.758153
F-statistic	8.716125	Durbin-Watson stat	1.807510
Prob(F-statistic)	0.004496		

Null Hypothesis: D(LNCPS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.122777	0.1102
Test critical values:	1% level	-4.113017	
	5% level	-3.483970	
	10% level	-3.170071	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPS,2)
Method: Least Squares
Date: 09/02/21 Time: 19:36
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPS(-1))	-0.266702	0.085406	-3.122777	0.0028
C	-0.000584	0.001278	-0.456605	0.6496
@TREND("2004Q1")	3.74E-05	3.55E-05	1.053540	0.2964

R-squared	0.142966	Mean dependent var	-0.000144
Adjusted R-squared	0.113914	S.D. dependent var	0.005155
S.E. of regression	0.004852	Akaike info criterion	-7.771474
Sum squared resid	0.001389	Schwarz criterion	-7.668548
Log likelihood	243.9157	Hannan-Quinn criter.	-7.731063
F-statistic	4.921021	Durbin-Watson stat	1.803295
Prob(F-statistic)	0.010555		

Null Hypothesis: LNCPS has a unit root
Exogenous: None
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		1.726923	0.9787
Test critical values:	1% level	-2.602185	
	5% level	-1.946072	
	10% level	-1.613448	

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

Residual variance (no correction)	5.43E-05
HAC corrected variance (Bartlett kernel)	0.000174

Phillips-Perron Test Equation
Dependent Variable: D(LNCPS)
Method: Least Squares
Date: 09/02/21 Time: 19:38
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPS(-1)	0.001689	0.000540	3.126983	0.0027

R-squared	0.003716	Mean dependent var	0.002892
Adjusted R-squared	0.003716	S.D. dependent var	0.007442
S.E. of regression	0.007429	Akaike info criterion	-6.951234
Sum squared resid	0.003421	Schwarz criterion	-6.917216

Log likelihood	219.9639	Hannan-Quinn criter.	-6.937855
Durbin-Watson stat	0.475025		

Null Hypothesis: LNCPS has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.070534	0.9609
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

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

Residual variance (no correction)	5.35E-05
HAC corrected variance (Bartlett kernel)	0.000164

Phillips-Perron Test Equation
Dependent Variable: D(LNCPS)
Method: Least Squares
Date: 09/02/21 Time: 19:39
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPS(-1)	0.016660	0.015164	1.098623	0.2763
C	-0.025950	0.026269	-0.987843	0.3271

R-squared	0.019403	Mean dependent var	0.002892
Adjusted R-squared	0.003327	S.D. dependent var	0.007442
S.E. of regression	0.007430	Akaike info criterion	-6.935359
Sum squared resid	0.003367	Schwarz criterion	-6.867323
Log likelihood	220.4638	Hannan-Quinn criter.	-6.908600
F-statistic	1.206972	Durbin-Watson stat	0.490648
Prob(F-statistic)	0.276250		

Null Hypothesis: LNCPS has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.409243	0.8488
Test critical values:	1% level	-4.110440	
	5% level	-3.482763	
	10% level	-3.169372	

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

Residual variance (no correction)	5.10E-05
HAC corrected variance (Bartlett kernel)	0.00015 0

Phillips-Perron Test Equation
Dependent Variable: D(LNCPS)
Method: Least Squares
Date: 09/02/21 Time: 19:39
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPS(-1)	-0.021673	0.027001	-0.802692	0.4253
C	0.035414	0.044339	0.798714	0.4276
@TREND("2004Q1")	0.000156	9.17E-05	1.704051	0.0935

R-squared	0.064669	Mean dependent var	0.002892
Adjusted R-squared	0.033492	S.D. dependent var	0.007442
S.E. of regression	0.007317	Akaike info criterion	-6.950875
Sum squared resid	0.003212	Schwarz criterion	-6.848821
Log likelihood	221.9526	Hannan-Quinn criter.	-6.910736
F-statistic	2.074215	Durbin-Watson stat	0.494917
Prob(F-statistic)	0.134573		

Null Hypothesis: D(LNCPS) has a unit root
Exogenous: None
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.980008	0.0035
Test critical values: 1% level	-2.602794	
5% level	-1.946161	
10% level	-1.613398	

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

Residual variance (no correction)	2.31E-05
HAC corrected variance (Bartlett kernel)	2.66E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNCPS,2)
Method: Least Squares
Date: 09/02/21 Time: 19:40
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPS(-1))	-0.218824	0.077033	-2.840638	0.0061

R-squared	0.116127	Mean dependent var	-0.000144
Adjusted R-squared	0.116127	S.D. dependent var	0.005155
S.E. of regression	0.004846	Akaike info criterion	-7.805154
Sum squared resid	0.001433	Schwarz criterion	-7.770845
Log likelihood	242.9598	Hannan-Quinn criter.	-7.791684
Durbin-Watson stat	1.830944		

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

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-3.126210	0.0297
Test critical values: 1% level	-3.540198	
5% level	-2.909206	
10% level	-2.592215	

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

Residual variance (no correction)	2.28E-05
HAC corrected variance (Bartlett kernel)	2.67E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNCPS,2)
Method: Least Squares
Date: 09/02/21 Time: 19:41
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPS(-1))	-0.244743	0.082899	-2.952308	0.0045
C	0.000568	0.000662	0.858114	0.3942

R-squared	0.126842	Mean dependent var	-0.000144
Adjusted R-squared	0.112290	S.D. dependent var	0.005155
S.E. of regression	0.004857	Akaike info criterion	-7.785094
Sum squared resid	0.001415	Schwarz criterion	-7.716477
Log likelihood	243.3379	Hannan-Quinn criter.	-7.758153
F-statistic	8.716125	Durbin-Watson stat	1.807510
Prob(F-statistic)	0.004496		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.284093	0.0785
Test critical values:	1% level	-4.113017	
	5% level	-3.483970	
	10% level	-3.170071	

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

Residual variance (no correction)	2.24E-05
HAC corrected variance (Bartlett kernel)	2.60E-05

Phillips-Perron Test Equation
Dependent Variable: D(LNCPS,2)
Method: Least Squares
Date: 09/02/21 Time: 19:41
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPS(-1))	-0.266702	0.085406	-3.122777	0.0028
C	-0.000584	0.001278	-0.456605	0.6496
@TREND("2004Q1")	3.74E-05	3.55E-05	1.053540	0.2964

R-squared	0.142966	Mean dependent var	-0.000144
Adjusted R-squared	0.113914	S.D. dependent var	0.005155
S.E. of regression	0.004852	Akaike info criterion	-7.771474
Sum squared resid	0.001389	Schwarz criterion	-7.668548
Log likelihood	243.9157	Hannan-Quinn criter.	-7.731063
F-statistic	4.921021	Durbin-Watson stat	1.803295
Prob(F-statistic)	0.010555		

Null Hypothesis: LNLL has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.129470	0.2326
Test critical values:	1% level	-2.603423	
	5% level	-1.946253	
	10% level	-1.613346	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNLL)
Method: Least Squares
Date: 09/02/21 Time: 19:55
Sample (adjusted): 2004Q4 2019Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNLL(-1)	-0.004027	0.003565	-1.129470	0.2633
D(LNLL(-1))	-0.389138	0.126116	-3.085544	0.0031
D(LNLL(-2))	-0.286323	0.126123	-2.270182	0.0269

R-squared	0.166866	Mean dependent var	0.002150
Adjusted R-squared	0.138138	S.D. dependent var	0.028831
S.E. of regression	0.026765	Akaike info criterion	-4.355480
Sum squared resid	0.041551	Schwarz criterion	-4.251666
Log likelihood	135.8421	Hannan-Quinn criter.	-4.314794
Durbin-Watson stat	1.978260		

Null Hypothesis: LNLL has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.420786	0.8985
Test critical values:	1% level	-3.542097	
	5% level	-2.910019	
	10% level	-2.592645	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNLL)
Method: Least Squares
Date: 09/02/21 Time: 20:00
Sample (adjusted): 2004Q4 2019Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNLL(-1)	-0.028564	0.067884	-0.420786	0.6755
D(LNLL(-1))	-0.369288	0.138400	-2.668272	0.0099
D(LNLL(-2))	-0.272079	0.133032	-2.045224	0.0455
C	-0.023881	0.065975	-0.361973	0.7187

R-squared	0.168777	Mean dependent var	0.002150
Adjusted R-squared	0.125028	S.D. dependent var	0.028831
S.E. of regression	0.026968	Akaike info criterion	-4.324989

Sum squared resid	0.041455	Schwarz criterion	-4.186571
Log likelihood	135.9122	Hannan-Quinn criter.	-4.270742
F-statistic	3.857886	Durbin-Watson stat	1.973718
Prob(F-statistic)	0.013922		

Null Hypothesis: LNLL has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.934498	0.0165
Test critical values:	1% level	-4.121303	
	5% level	-3.487845	
	10% level	-3.172314	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNLL)
Method: Least Squares
Date: 09/02/21 Time: 20:01
Sample (adjusted): 2005Q2 2019Q4
Included observations: 59 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNLL(-1)	-0.532548	0.135353	-3.934498	0.0002
D(LNLL(-1))	-0.056718	0.152934	-0.370866	0.7122
D(LNLL(-2))	0.043460	0.153480	0.283166	0.7782
D(LNLL(-3))	0.255649	0.143270	1.784387	0.0802
D(LNLL(-4))	0.333461	0.127192	2.621710	0.0114
C	-0.567214	0.143074	-3.964472	0.0002
@TREND("2004Q1")	0.001555	0.000387	4.015458	0.0002

R-squared	0.397321	Mean dependent var	0.001714
Adjusted R-squared	0.327781	S.D. dependent var	0.029217
S.E. of regression	0.023955	Akaike info criterion	-4.514324
Sum squared resid	0.029839	Schwarz criterion	-4.267836
Log likelihood	140.1726	Hannan-Quinn criter.	-4.418105
F-statistic	5.713569	Durbin-Watson stat	2.010580

Prob(F-statistic)	0.000128

Null Hypothesis: D(LNLL) has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.129936	0.0000
Test critical values:	1% level	-2.603423	
	5% level	-1.946253	
	10% level	-1.613346	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNLL,2)
Method: Least Squares
Date: 09/02/21 Time: 20:02
Sample (adjusted): 2004Q4 2019Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNLL(-1))	-1.646911	0.202574	-8.129936	0.0000
D(LNLL(-1),2)	0.271146	0.125698	2.157124	0.0351

R-squared	0.671852	Mean dependent var	-0.000232
Adjusted R-squared	0.666290	S.D. dependent var	0.046441
S.E. of regression	0.026828	Akaike info criterion	-4.366510
Sum squared resid	0.042464	Schwarz criterion	-4.297301
Log likelihood	135.1786	Hannan-Quinn criter.	-4.339387
Durbin-Watson stat	1.970047		

Null Hypothesis: D(LNLL) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.219957	0.0000
Test critical values:	1% level	-3.542097	

	5% level	-2.910019	
	10% level	-2.592645	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNLL,2)
Method: Least Squares
Date: 09/02/21 Time: 20:04
Sample (adjusted): 2004Q4 2019Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNLL(-1))	-1.680377	0.204427	-8.219957	0.0000
D(LNLL(-1),2)	0.288312	0.126409	2.280795	0.0263
C	0.003841	0.003466	1.108141	0.2724

R-squared	0.678656	Mean dependent var	-0.000232
Adjusted R-squared	0.667575	S.D. dependent var	0.046441
S.E. of regression	0.026776	Akaike info criterion	-4.354674
Sum squared resid	0.041584	Schwarz criterion	-4.250861
Log likelihood	135.8176	Hannan-Quinn criter.	-4.313989
F-statistic	61.24589	Durbin-Watson stat	1.978844
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNLL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.263358	0.0000
Test critical values:	1% level	-4.115684	
	5% level	-3.485218	
	10% level	-3.170793	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNLL,2)
Method: Least Squares
Date: 09/02/21 Time: 20:27

Sample (adjusted): 2004Q4 2019Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNLL(-1))	-1.707475	0.206632	-8.263358	0.0000
D(LNLL(-1),2)	0.301721	0.127327	2.369653	0.0212
C	-0.002214	0.007300	-0.303232	0.7628
@TREND("2004Q1")	0.000186	0.000197	0.942700	0.3498

R-squared	0.683589	Mean dependent var	-0.000232
Adjusted R-squared	0.666936	S.D. dependent var	0.046441
S.E. of regression	0.026802	Akaike info criterion	-4.337358
Sum squared resid	0.040946	Schwarz criterion	-4.198940
Log likelihood	136.2894	Hannan-Quinn criter.	-4.283111
F-statistic	41.04845	Durbin-Watson stat	1.983248
Prob(F-statistic)	0.000000		

Null Hypothesis: LNLL has a unit root
Exogenous: None
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.926330	0.3115
Test critical values:	1% level	-2.602185	
	5% level	-1.946072	
	10% level	-1.613448	

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

Residual variance (no correction)	0.000792
HAC corrected variance (Bartlett kernel)	0.000396

Phillips-Perron Test Equation
Dependent Variable: D(LNLL)
Method: Least Squares
Date: 09/02/21 Time: 20:28
Sample (adjusted): 2004Q2 2019Q4

Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNLL(-1)	-0.002626	0.003685	-0.712582	0.4788

R-squared	0.002075	Mean dependent var	0.002200
Adjusted R-squared	0.002075	S.D. dependent var	0.028399
S.E. of regression	0.028369	Akaike info criterion	-4.271291
Sum squared resid	0.049898	Schwarz criterion	-4.237273
Log likelihood	135.5457	Hannan-Quinn criter.	-4.257912
Durbin-Watson stat	2.591666		

Null Hypothesis: LNLL has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.296697	0.6261
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

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

Residual variance (no correction)	0.000756
HAC corrected variance (Bartlett kernel)	0.000488

Phillips-Perron Test Equation
Dependent Variable: D(LNLL)
Method: Least Squares
Date: 09/02/21 Time: 20:29
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNLL(-1)	-0.110228	0.063392	-1.738833	0.0871
C	-0.104538	0.061486	-1.700201	0.0942

R-squared	0.047225	Mean dependent var	0.002200
Adjusted R-squared	0.031606	S.D. dependent var	0.028399
S.E. of regression	0.027946	Akaike info criterion	-4.285845
Sum squared resid	0.047640	Schwarz criterion	-4.217809
Log likelihood	137.0041	Hannan-Quinn criter.	-4.259086
F-statistic	3.023542	Durbin-Watson stat	2.434816
Prob(F-statistic)	0.087109		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.792270	0.0234
Test critical values:	1% level	-4.110440	
	5% level	-3.482763	
	10% level	-3.169372	

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

Residual variance (no correction)	0.000633
HAC corrected variance (Bartlett kernel)	0.000583

Phillips-Perron Test Equation
Dependent Variable: D(LNLL)
Method: Least Squares
Date: 09/02/21 Time: 20:30
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNLL(-1)	-0.393286	0.101257	-3.884042	0.0003
C	-0.412517	0.106334	-3.879426	0.0003
@TREND("2004Q1")	0.001059	0.000309	3.423742	0.0011

R-squared	0.202944	Mean dependent var	0.002200
Adjusted R-squared	0.176375	S.D. dependent var	0.028399

S.E. of regression	0.025773	Akaike info criterion	-4.432552
Sum squared resid	0.039854	Schwarz criterion	-4.330498
Log likelihood	142.6254	Hannan-Quinn criter.	-4.392414
F-statistic	7.638501	Durbin-Watson stat	2.169798
Prob(F-statistic)	0.001108		

Null Hypothesis: D(LNLL) has a unit root
Exogenous: None
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.56577	0.0000
Test critical values:	1% level	-2.602794	
	5% level	-1.946161	
	10% level	-1.613398	

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

Residual variance (no correction)	0.000739
HAC corrected variance (Bartlett kernel)	0.000739

Phillips-Perron Test Equation
Dependent Variable: D(LNLL,2)
Method: Least Squares
Date: 09/02/21 Time: 20:30
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNLL(-1))	-1.295297	0.122594	-10.56577	0.0000

R-squared	0.646615	Mean dependent var	-0.000482
Adjusted R-squared	0.646615	S.D. dependent var	0.046101
S.E. of regression	0.027405	Akaike info criterion	-4.340163
Sum squared resid	0.045814	Schwarz criterion	-4.305855

Log likelihood	135.5451	Hannan-Quinn criter.	-4.326693
Durbin-Watson stat	2.150749		

Null Hypothesis: D(LNLL) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.71234	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

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

Residual variance (no correction)	0.000731
HAC corrected variance (Bartlett kernel)	0.000668

Phillips-Perron Test Equation
Dependent Variable: D(LNLL,2)
Method: Least Squares
Date: 09/02/21 Time: 20:31
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNLL(-1))	-1.304142	0.123442	-10.56483	0.0000
C	0.002818	0.003505	0.804015	0.4246

R-squared	0.650382	Mean dependent var	-0.000482
Adjusted R-squared	0.644555	S.D. dependent var	0.046101
S.E. of regression	0.027485	Akaike info criterion	-4.318622
Sum squared resid	0.045326	Schwarz criterion	-4.250004
Log likelihood	135.8773	Hannan-Quinn criter.	-4.291681
F-statistic	111.6157	Durbin-Watson stat	2.161200
Prob(F-statistic)	0.000000		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.36137	0.0000
Test critical values:	1% level	-4.113017	
	5% level	-3.483970	
	10% level	-3.170071	

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

Residual variance (no correction)	0.000725
HAC corrected variance (Bartlett kernel)	0.000485

Phillips-Perron Test Equation
Dependent Variable: D(LNLL,2)
Method: Least Squares
Date: 09/02/21 Time: 20:32
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNLL(-1))	-1.310205	0.124334	-10.53779	0.0000
C	-0.001468	0.007271	-0.201849	0.8407
@TREND("2004Q1")	0.000132	0.000196	0.673566	0.5032

R-squared	0.653050	Mean dependent var	-0.000482
Adjusted R-squared	0.641289	S.D. dependent var	0.046101
S.E. of regression	0.027611	Akaike info criterion	-4.294024
Sum squared resid	0.044980	Schwarz criterion	-4.191098
Log likelihood	136.1147	Hannan-Quinn criter.	-4.253613
F-statistic	55.52657	Durbin-Watson stat	2.169426
Prob(F-statistic)	0.000000		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.36137	0.0000
Test critical values:	1% level	-4.113017	
	5% level	-3.483970	
	10% level	-3.170071	

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

Residual variance (no correction)	0.000725
HAC corrected variance (Bartlett kernel)	0.000485

Phillips-Perron Test Equation
Dependent Variable: D(LNLL,2)
Method: Least Squares
Date: 09/02/21 Time: 20:32
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNLL(-1))	-1.310205	0.124334	-10.53779	0.0000
C	-0.001468	0.007271	-0.201849	0.8407
@TREND("2004Q1")	0.000132	0.000196	0.673566	0.5032

R-squared	0.653050	Mean dependent var	-0.000482
Adjusted R-squared	0.641289	S.D. dependent var	0.046101
S.E. of regression	0.027611	Akaike info criterion	-4.294024
Sum squared resid	0.044980	Schwarz criterion	-4.191098
Log likelihood	136.1147	Hannan-Quinn criter.	-4.253613
F-statistic	55.52657	Durbin-Watson stat	2.169426
Prob(F-statistic)	0.000000		

Null Hypothesis: LNSA has a unit root
Exogenous: None

Lag Length: 2 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.356314	0.5524
Test critical values:	1% level	-2.603423	
	5% level	-1.946253	
	10% level	-1.613346	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNSA)
Method: Least Squares
Date: 09/02/21 Time: 20:40
Sample (adjusted): 2004Q4 2019Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSA(-1)	-0.006532	0.018332	-0.356314	0.7229
D(LNSA(-1))	-0.491774	0.128111	-3.838646	0.0003
D(LNSA(-2))	-0.228661	0.127766	-1.789684	0.0787

R-squared	0.208525	Mean dependent var	-0.001759
Adjusted R-squared	0.181233	S.D. dependent var	0.650801
S.E. of regression	0.588882	Akaike info criterion	1.826749
Sum squared resid	20.11338	Schwarz criterion	1.930563
Log likelihood	-52.71585	Hannan-Quinn criter.	1.867435
Durbin-Watson stat	2.071417		

Null Hypothesis: LNSA has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.596300	0.0000
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

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

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNSA)
Method: Least Squares
Date: 09/02/21 Time: 20:42
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSA(-1)	-0.678168	0.121182	-5.596300	0.0000
C	2.775547	0.500622	5.544192	0.0000

R-squared	0.339245	Mean dependent var	-0.001557
Adjusted R-squared	0.328413	S.D. dependent var	0.640219
S.E. of regression	0.524663	Akaike info criterion	1.579108
Sum squared resid	16.79152	Schwarz criterion	1.647144
Log likelihood	-47.74192	Hannan-Quinn criter.	1.605867
F-statistic	31.31858	Durbin-Watson stat	2.062512
Prob(F-statistic)	0.000001		

Null Hypothesis: LNSA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.897726	0.0000
Test critical values:	1% level	-4.110440	
	5% level	-3.482763	
	10% level	-3.169372	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNSA)
Method: Least Squares
Date: 09/02/21 Time: 20:43
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSA(-1)	-0.735484	0.124706	-5.897726	0.0000
C	3.204396	0.560375	5.718302	0.0000
@TREND("2004Q1")	-0.006067	0.003741	-1.621806	0.1101

R-squared	0.366994	Mean dependent var	-0.001557
Adjusted R-squared	0.345894	S.D. dependent var	0.640219
S.E. of regression	0.517789	Akaike info criterion	1.567951
Sum squared resid	16.08633	Schwarz criterion	1.670005
Log likelihood	-46.39044	Hannan-Quinn criter.	1.608089
F-statistic	17.39292	Durbin-Watson stat	2.026995
Prob(F-statistic)	0.000001		

Null Hypothesis: D(LNSA) has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.135496	0.0000
Test critical values:	1% level	-2.603423	
	5% level	-1.946253	
	10% level	-1.613346	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNSA,2)
Method: Least Squares
Date: 09/02/21 Time: 20:44
Sample (adjusted): 2004Q4 2019Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNSA(-1))	-1.726404	0.212206	-8.135496	0.0000
D(LNSA(-1),2)	0.230694	0.126691	1.820921	0.0737

R-squared	0.717265	Mean dependent var	0.000541
Adjusted R-squared	0.712473	S.D. dependent var	1.090063
S.E. of regression	0.584509	Akaike info criterion	1.796149
Sum squared resid	20.15741	Schwarz criterion	1.865358
Log likelihood	-52.78254	Hannan-Quinn criter.	1.823273
Durbin-Watson stat	2.072717		

Null Hypothesis: D(LNSA) has a unit root
Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.066541	0.0000
Test critical values:	1% level	-3.542097	
	5% level	-2.910019	
	10% level	-2.592645	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNSA,2)
Method: Least Squares
Date: 09/02/21 Time: 20:44
Sample (adjusted): 2004Q4 2019Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNSA(-1))	-1.726478	0.214030	-8.066541	0.0000
D(LNSA(-1),2)	0.230733	0.127778	1.805727	0.0762
C	-0.003567	0.075482	-0.047255	0.9625

R-squared	0.717276	Mean dependent var	0.000541
Adjusted R-squared	0.707526	S.D. dependent var	1.090063
S.E. of regression	0.589515	Akaike info criterion	1.828897
Sum squared resid	20.15663	Schwarz criterion	1.932711
Log likelihood	-52.78137	Hannan-Quinn criter.	1.869583
F-statistic	73.57340	Durbin-Watson stat	2.072738
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LNSA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.997350	0.0000
Test critical values:	1% level	-4.115684	
	5% level	-3.485218	
	10% level	-3.170793	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNSA,2)
Method: Least Squares
Date: 09/02/21 Time: 20:46
Sample (adjusted): 2004Q4 2019Q4
Included observations: 61 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNSA(-1))	-1.726564	0.215892	-7.997350	0.0000
D(LNSA(-1),2)	0.230769	0.128889	1.790442	0.0787
C	-0.013959	0.161745	-0.086302	0.9315
@TREND("2004Q1")	0.000315	0.004324	0.072823	0.9422

R-squared	0.717302	Mean dependent var	0.000541
Adjusted R-squared	0.702423	S.D. dependent var	1.090063
S.E. of regression	0.594636	Akaike info criterion	1.861591
Sum squared resid	20.15476	Schwarz criterion	2.000009
Log likelihood	-52.77853	Hannan-Quinn criter.	1.915838
F-statistic	48.20951	Durbin-Watson stat	2.072841
Prob(F-statistic)	0.000000		

Null Hypothesis: LNSA has a unit root
Exogenous: None
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.295644	0.5754
Test critical values:	1% level	-2.602185	
	5% level	-1.946072	
	10% level	-1.613448	

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

Residual variance (no correction)	0.400838
HAC corrected variance (Bartlett kernel)	0.068213

Phillips-Perron Test Equation
Dependent Variable: D(LNSA)
Method: Least Squares
Date: 09/02/21 Time: 20:48

Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSA(-1)	-0.012197	0.019463	-0.626664	0.5332

R-squared	0.006288	Mean dependent var	-0.001557
Adjusted R-squared	0.006288	S.D. dependent var	0.640219
S.E. of regression	0.638203	Akaike info criterion	1.955426
Sum squared resid	25.25281	Schwarz criterion	1.989444
Log likelihood	-60.59592	Hannan-Quinn criter.	1.968805
Durbin-Watson stat	2.788938		

Null Hypothesis: LNSA has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.608342	0.0000
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

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

Residual variance (no correction)	0.266532
HAC corrected variance (Bartlett kernel)	0.269873

Phillips-Perron Test Equation
Dependent Variable: D(LNSA)
Method: Least Squares
Date: 09/02/21 Time: 20:49
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSA(-1)	-0.678168	0.121182	-5.596300	0.0000
C	2.775547	0.500622	5.544192	0.0000

R-squared	0.339245	Mean dependent var	-0.001557
Adjusted R-squared	0.328413	S.D. dependent var	0.640219
S.E. of regression	0.524663	Akaike info criterion	1.579108
Sum squared resid	16.79152	Schwarz criterion	1.647144
Log likelihood	-47.74192	Hannan-Quinn criter.	1.605867
F-statistic	31.31858	Durbin-Watson stat	2.062512
Prob(F-statistic)	0.000001		

Null Hypothesis: LNSA has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.884382	0.0000
Test critical values:	1% level	-4.110440	
	5% level	-3.482763	
	10% level	-3.169372	

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

Residual variance (no correction)	0.255339
HAC corrected variance (Bartlett kernel)	0.251467

Phillips-Perron Test Equation
Dependent Variable: D(LNSA)
Method: Least Squares
Date: 09/02/21 Time: 20:49
Sample (adjusted): 2004Q2 2019Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSA(-1)	-0.735484	0.124706	-5.897726	0.0000
C	3.204396	0.560375	5.718302	0.0000
@TREND("2004Q1")	-0.006067	0.003741	-1.621806	0.1101

R-squared	0.366994	Mean dependent var	-0.001557
Adjusted R-squared	0.345894	S.D. dependent var	0.640219
S.E. of regression	0.517789	Akaike info criterion	1.567951

Sum squared resid	16.08633	Schwarz criterion	1.670005
Log likelihood	-46.39044	Hannan-Quinn criter.	1.608089
F-statistic	17.39292	Durbin-Watson stat	2.026995
Prob(F-statistic)	0.000001		

Null Hypothesis: D(LNSA) has a unit root
Exogenous: None
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-23.05098	0.0000
Test critical values:	1% level	-2.602794	
	5% level	-1.946161	
	10% level	-1.613398	

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

Residual variance (no correction)	0.343392
HAC corrected variance (Bartlett kernel)	0.051231

Phillips-Perron Test Equation
Dependent Variable: D(LNSA,2)
Method: Least Squares
Date: 09/02/21 Time: 20:51
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNSA(-1))	-1.402777	0.117196	-11.96952	0.0000

R-squared	0.701375	Mean dependent var	0.000531
Adjusted R-squared	0.701375	S.D. dependent var	1.081091
S.E. of regression	0.590780	Akaike info criterion	1.801251
Sum squared resid	21.29028	Schwarz criterion	1.835560
Log likelihood	-54.83880	Hannan-Quinn criter.	1.814722
Durbin-Watson stat	2.185662		

Null Hypothesis: D(LNSA) has a unit root

Exogenous: Constant
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-22.85994	0.0001
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

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

Residual variance (no correction)	0.34338 5
HAC corrected variance (Bartlett kernel)	0.05090 6

Phillips-Perron Test Equation
Dependent Variable: D(LNSA,2)
Method: Least Squares
Date: 09/02/21 Time: 20:52
Sample (adjusted): 2004Q3 2019Q4
Included observations: 62 after adjustments

Variable	Coefficien t	Std. Error	t-Statistic	Prob.
D(LNSA(-1))	-1.402790	0.118168	-11.87116	0.0000
C	-0.002538	0.075652	-0.033548	0.9733

R-squared	0.701380	Mean dependent var	0.000531
Adjusted R-squared	0.696403	S.D. dependent var	1.081091
S.E. of regression	0.595677	Akaike info criterion	1.833491
Sum squared resid	21.28988	Schwarz criterion	1.902108
Log likelihood	-54.83821	Hannan-Quinn criter.	1.860432
F-statistic	140.9244	Durbin-Watson stat	2.185682
Prob(F-statistic)	0.000000		

Appendix 3: Descriptive Statistics

	GDP	**M2**	**CPS**	**LL**	**SA**
Mean	30,360	172,946	0.55	0.11	7,105
Median	30,111	172,433	0.49	0.11	7,821

Maximum	37,223	346,380	0.72	0.15	16,052
Minimum	20,764	43,297	0.47	0.09	(7,988)
Std. Dev.	5,177	90,887	0.08	0.02	4,895
Skewness	(0)	0	0.79	1.07	(1)
Kurtosis	2	2	1.92	3.30	4
Jarque-Bera	6	4	9.83	12.45	6
Probability	0.058	0.152	0.007	0.002	0.040
Sum	1,943,062	11,068,547	35.00	6.97	454,732
Sum Sq. Dev.	1,690,000,000	520,000,000,000	0.45	0.01	1,510,000,000
Observations	64	64	64	64	64

Appendix 4: Wald test results

Dependent Variable: DLNGDP
Method: Least Squares
Date: 11/23/21 Time: 21:56
Sample (adjusted): 2005Q3 2019Q4
Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.817473	2.913730	0.623762	0.5428
DLNM2	-0.227198	0.065011	-3.494782	0.0036
DLNCPS	0.489073	0.577906	0.846286	0.4116
DLNLL	-0.304077	0.148837	-2.043029	0.0603
DLNSA	0.062311	0.037146	1.677455	0.1156
DLNINFL	-0.057757	0.057695	-1.001076	0.3338
LNGDP(-1)	-0.370462	0.278609	-1.329681	0.2049
LNCPS(-1)	0.333009	0.226511	1.470169	0.1636
LNM2(-1)	0.196387	0.086628	2.267009	0.0398
LNLL(-1)	-0.532972	0.298729	-1.784133	0.0961
LNSA(-1)	0.084413	0.039495	2.137277	0.0507
LNINF(-1)	-0.006471	0.037261	-0.173664	0.8646

DLNGDP(-1)	-0.791389	0.286104	-2.766084	0.0152
DLNGDP(-2)	-0.660835	0.251724	-2.625236	0.0200
DLNGDP(-3)	-0.492606	0.168063	-2.931080	0.0109
DLNGDP(-5)	0.182178	0.111216	1.638064	0.1237
DLNCPS(-3)	-1.574526	0.650075	-2.422069	0.0296
DLNCPS(-5)	2.223670	1.121526	1.982718	0.0674
DLNM2(-1)	-0.542408	0.113132	-4.794453	0.0003
DLNM2(-2)	-0.463963	0.138894	-3.340402	0.0049
DLNM2(-3)	-0.374367	0.140106	-2.672031	0.0182
DLNM2(-4)	-0.168738	0.125343	-1.346210	0.1996
DLNLL(-1)	0.217405	0.202612	1.073012	0.3014
DLNLL(-2)	0.213425	0.185901	1.148054	0.2702
DLNLL(-3)	0.230003	0.161700	1.422403	0.1768
DLNLL(-4)	0.228278	0.108624	2.101544	0.0542
DLNSA(-1)	-0.087640	0.058335	-1.502372	0.1552
DLNSA(-3)	-0.241824	0.087496	-2.763830	0.0152
DLNSA(-4)	-0.243584	0.119766	-2.033829	0.0614
DLNSA(-5)	0.046108	0.029882	1.542997	0.1451
DLNINFL(-1)	0.108828	0.035597	3.057247	0.0085
DLNINFL(-3)	0.091264	0.028308	3.223912	0.0061
DLNINFL(-4)	0.059732	0.034783	1.717273	0.1080

R-squared	0.937825	Mean dependent var	0.009433
Adjusted R-squared	0.795711	S.D. dependent var	0.054328
S.E. of regression	0.024555	Akaike info criterion	-4.382614
Sum squared resid	0.008441	Schwarz criterion	-3.083574
Log likelihood	135.9914	Hannan-Quinn criter.	-3.893777
F-statistic	6.599088	Durbin-Watson stat	2.690975
Prob(F-statistic)	0.000266		

Wald Test:
Equation: EQ02COINTEGRATION

Test Statistic	Value	Df	Probability
F-statistic	5.081332	(6, 14)	0.0058
Chi-square	30.48799	6	0.0000

Null Hypothesis: C(7)=C(8)=C(9)=C(10)=C(11)=C(12)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.

C(7)	-0.370462	0.278609
C(8)	0.333009	0.226511
C(9)	0.196387	0.086628
C(10)	-0.532972	0.298729
C(11)	0.084413	0.039495
C(12)	-0.006471	0.037261

Restrictions are linear in coefficients.

Appendix 5: ARDL Error Correction Regression and Long run form.

ARDL Error Correction Regression
Dependent Variable: D(LNGDP)
Selected Model: ARDL(4, 4, 5, 0, 4, 4)
Case 3: Unrestricted Constant and No Trend
Date: 11/24/21 Time: 22:38
Sample: 2004Q1 2019Q4
Included observations: 50

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.582486	0.809565	3.189966	0.0041
D(LNGDP(-1))	-0.592492	0.145856	-4.062177	0.0005
D(LNGDP(-2))	-0.309653	0.175543	-1.763973	0.0910
D(LNGDP(-3))	-0.208801	0.147625	-1.414403	0.1706
D(LNM2)	-0.218582	0.060564	-3.609130	0.0015
D(LNM2(-1))	-0.308622	0.082811	-3.726839	0.0011
D(LNM2(-2))	-0.123442	0.091581	-1.347894	0.1908
D(LNM2(-3))	0.014825	0.080289	0.184650	0.8551
D(LNCPS)	0.061674	0.441856	0.139578	0.8902
D(LNCPS(-1))	0.413827	0.658586	0.628357	0.5360
D(LNCPS(-2))	-0.674198	0.679809	-0.991746	0.3316
D(NCPS(-3))	-0.538670	0.671411	-0.802295	0.4306
D(LNCPS(-4))	0.469058	0.666620	0.703636	0.4887
D(LNSA)	0.016023	0.036714	0.436441	0.6666
D(LNSA(-1))	-0.030494	0.060249	-0.506140	0.6176
D(LNSA(-2))	-0.070608	0.059254	-1.191608	0.2456
D(LNSA(-3))	-0.001827	0.026357	-0.069324	0.9453
D(LNINF)	-0.053499	0.029038	-1.842417	0.0783
D(LNINF(-1))	0.059002	0.032626	1.808442	0.0836
D(LNINF(-2))	-0.013204	0.033336	-0.396086	0.6957
D(LNINF(-3))	0.034219	0.029197	1.172008	0.2532
CointEq(-1)*	-0.310058	0.098218	-3.156831	0.0044

R-squared	0.821675	Mean dependent var	0.009088

Adjusted R-squared	0.687931	S.D. dependent var	0.052883
S.E. of regression	0.029542	Akaike info criterion	-3.905821
Sum squared resid	0.024437	Schwarz criterion	-3.064531
Log likelihood	119.6455	Hannan-Quinn criter.	-3.585453
F-statistic	6.143640	Durbin-Watson stat	2.209433
Prob(F-statistic)	0.000007		

* 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	1.364336	10%	2.26	3.35
K	5	5%	2.62	3.79
		2.5%	2.96	4.18
		1%	3.41	4.68

t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-3.156831	10%	-2.57	-3.86
		5%	-2.86	-4.19
		2.5%	-3.13	-4.46
		1%	-3.43	-4.79

Long-run form

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNM2	0.345117	0.104353	3.307223	0.0031
LNCPS	0.677074	0.375868	1.801358	0.0848
LNLL	-0.279666	0.609079	-0.459162	0.6504
LNSA	0.155041	0.093304	1.661682	0.1101
LNINF	0.008396	0.091122	0.092139	0.9274

EC = LNGDP - (0.3451*LNM2 + 0.6771*LNCPS -0.2797*LNLL + 0.1550 *LNSA + 0.0084*LNINF)

Appendix 6: Diagnostic test

Serial correlation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.483209	Prob. F(2,21)	0.2497
Obs*R-squared	6.188696	Prob. Chi-Square(2)	0.0453

Heteroskedasticity Test

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 11/25/21 Time: 08:37
Sample: 2005Q2 2019Q4
Included observations: 50
Presample and interior missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)	0.682665	0.529309	1.289728	0.2112
LNGDP(-2)	0.383926	0.426758	0.899634	0.3785
LNGDP(-3)	-0.304217	0.247800	-1.227668	0.2332
LNGDP(-4)	-0.209723	0.235405	-0.890904	0.3831
LNM2	-0.050361	0.085678	-0.587799	0.5629
LNM2(-1)	0.136403	0.159252	0.856522	0.4014
LNM2(-2)	0.088243	0.156191	0.564967	0.5781
LNM2(-3)	-0.188453	0.156598	-1.203422	0.2422
LNM2(-4)	-0.162070	0.143155	-1.132127	0.2703
LNCPS	0.175408	0.545058	0.321815	0.7508
LNCPS(-1)	-0.569855	1.239776	-0.459644	0.6505
LNCPS(-2)	0.081197	1.407338	0.057695	0.9545
LNCPS(-3)	0.139171	1.357155	0.102546	0.9193
LNCPS(-4)	0.418722	1.368037	0.306075	0.7626
LNCPS(-5)	-0.668450	0.867146	-0.770862	0.4494
LNLL	0.042835	0.153629	0.278821	0.7831
LNSA	-0.022475	0.047872	-0.469494	0.6436
LNSA(-1)	-0.006725	0.096623	-0.069600	0.9452
LNSA(-2)	0.023521	0.111576	0.210808	0.8351
LNSA(-3)	-0.052854	0.083716	-0.631350	0.5346
LNSA(-4)	-0.025523	0.033718	-0.756950	0.4575
LNINF	-0.010004	0.042101	-0.237630	0.8145
LNINF(-1)	0.036019	0.068790	0.523612	0.6060
LNINF(-2)	-0.052031	0.081384	-0.639331	0.5295
LNINF(-3)	-0.001488	0.069036	-0.021560	0.9830
LNINF(-4)	0.005739	0.038021	0.150949	0.8815
C	-4.936918	3.645785	-1.354144	0.1901
RESID(-1)	-0.866644	0.581708	-1.489826	0.1511

RESID(-2)	-0.529775	0.497681	-1.064486	0.2992

R-squared	0.123774	Mean dependent var	7.73E-16
Adjusted R-squared	-1.044528	S.D. dependent var	0.022332
S.E. of regression	0.031931	Akaike info criterion	-3.757953
Sum squared resid	0.021412	Schwarz criterion	-2.648979
Log likelihood	122.9488	Hannan-Quinn criter.	-3.335649
F-statistic	0.105943	Durbin-Watson stat	2.161812
Prob(F-statistic)	1.000000		

Heteroskedasticity Test: ARCH

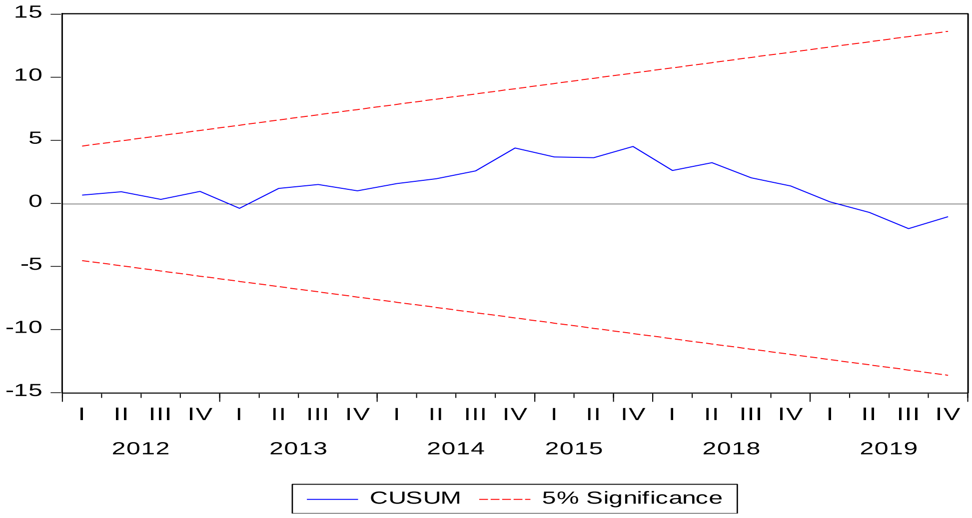
F-statistic	0.606904	Prob. F(1,46)	0.4399
Obs*R-squared	0.625044	Prob. Chi-Square(1)	0.4292

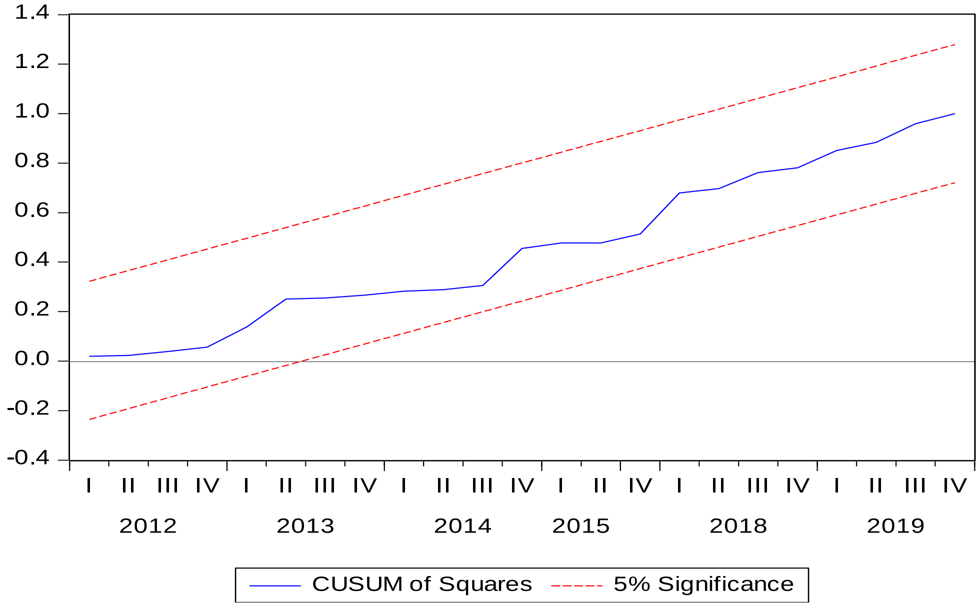
Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/25/21 Time: 08:41
Sample (adjusted): 2005Q3 2019Q4
Included observations: 48 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000556	0.000111	5.005474	0.0000
RESID^2(-1)	-0.114579	0.147077	-0.779040	0.4399

R-squared	0.013022	Mean dependent var	0.000498
Adjusted R-squared	-0.008434	S.D. dependent var	0.000570
S.E. of regression	0.000572	Akaike info criterion	-12.05278
Sum squared resid	1.51E-05	Schwarz criterion	-11.97481
Log likelihood	291.2667	Hannan-Quinn criter.	-12.02331
F-statistic	0.606904	Durbin-Watson stat	1.971253
Prob(F-statistic)	0.439946		

Normality test





Appendix 7: Granger Causality test

Pairwise Granger Causality Tests
Date: 10/11/21 Time: 21:30
Sample: 1 64
Lags: 5

Null Hypothesis:	Obs	F-Statistic	Prob.
D(LNM2) does not Granger Cause D(LNGDP)	58	1.30185	0.2793
D(LNGDP) does not Granger Cause D(LNM2)		0.60089	0.6994
D(LNCPS) does not Granger Cause D(LNGDP)	58	0.24656	0.9395

D(LNGDP) does not Granger Cause D(LNCPS)		0.08222	0.9947
D(LNLL) does not Granger Cause D(LNGDP)	58	0.33190	0.8911
D(LNGDP) does not Granger Cause D(LNLL)		1.02038	0.4165
D(LNSA) does not Granger Cause D(LNGDP)	58	0.16564	0.9740
D(LNGDP) does not Granger Cause D(LNSA)		0.30913	0.9050
D(LNCPS) does not Granger Cause D(LNM2)	58	0.57303	0.7203
D(LNM2) does not Granger Cause D(LNCPS)		0.08770	0.9938
D(LNLL) does not Granger Cause D(LNM2)	58	0.13513	0.9834
D(LNM2) does not Granger Cause D(LNLL)		0.11356	0.9888
D(LNSA) does not Granger Cause D(LNM2)	58	0.24825	0.9386
D(LNM2) does not Granger Cause D(LNSA)		0.09648	0.9923
D(LNLL) does not Granger Cause D(LNCPS)	58	0.25578	0.9348
D(LNCPS) does not Granger Cause D(LNLL)		2.38929	0.0519
D(LNSA) does not Granger Cause D(LNCPS)	58	0.94712	0.4597
D(LNCPS) does not Granger Cause D(LNSA)		4.87762	0.0011
D(LNSA) does not Granger Cause D(LNLL)	58	6.16132	0.0002
D(LNLL) does not Granger Cause D(LNSA)		0.19110	0.9645