THE EFFECT OF ECONOMIC GROWTH, INFLATION RATE AND INTEREST RATE ON NATIONAL SAVINGS IN SOUTH AFRICA

by

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DECLARATION

I declare that **THE EFFECT OF ECONOMIC GROWTH, INFLATION RATE AND INTEREST RATE ON NATIONAL SAVINGS IN SOUTH AFRICA** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

Ramadimetja Boledi Maja 15/03/2024

Full names **Date**

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ABSTRACT

Comprehending how macroeconomic variables affect national savings in South Africa is the primary aim of this study. The real rate of GDP growth, the rate of inflation, and the real interest rate are the macroeconomic variables employed in the study for the years 1980 through 2022. The variables taken into consideration in this study proved to be I(0) and I(1), according to the unit root test. To establish whether variables were cointegrated, the Autoregressive Distributed Lag (ARDL) bound test was used. Using the ARDL technique, the relationship between the long-term and short-term equilibrium was estimated. The standard Granger causality test was used to determine causality, and then the impulse response function (IRF) and variance decomposition were employed to forecast the macroeconomic variables. Cointegration test results demonstrated that the GDP growth rate, interest rate, inflation rate, and gross domestic savings had a stable long-term equilibrium relationship. The ARDL long-term results demonstrated that the gross domestic savings were significantly impacted negatively by the inflation. The real interest rate and GDP growth were not found to have a significant impact on gross domestic savings. In the short-term gross domestic savings were found to be significantly positively impacted by GDP growth, inflation rate, and the real interest rate. Further, the error correction term displayed that the model's speed of convergence to equilibrium was 21.19%. The diagnostic tests did not reject the null hypothesis and no causal relationship was found between gross domestic savings and explanatory variables. Lastly, the results from employing the impulse response function and variance decomposition to the variables showed that the inflation rate has the strongest influence on gross domestic savings over the long and short terms, followed by the real interest rate and GDP growth rate.

KEY CONCEPTS: Gross domestic savings, Real GDP growth rate, Inflation, interest rate, Autoregressive Distributed Lag (ARDL), causality, Impulse response, variance decomposition

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ACRONYMS

ADF:	Augmented Dickey-Fuller
AIC:	Akaike Information Criterion
ARDL:	Autoregressive Distributed Lag Model
ARMA:	Autoregressive and moving average
CLRM:	Classical normal linear regression model
CPI:	Consumer Price Index
CUSUM:	Cumulative sum of recursive residuals
CUSUMQ:	Cumulative sum of squares of recursive residuals
ECM:	Error correction model
FPE:	Final prediction error
GDP:	Gross domestic product
GDS:	Gross domestic savings
GSGDA:	Ghana Shared Growth and Development Agenda
HQ:	Hannan-Quin Information Criterion
INF:	Inflation rate
IRF:	Impulse response function
JB:	Jarque-Bera

LCH:	Life cycle hypothesis
L.O.S:	Level of significance
LR:	Sequential modified test static
MPS:	Marginal propensity to save
NDP:	National Development Plan
OLS:	Ordinary least squares
PP:	Phillips Perron
RIH:	Relative income hypothesis
RIR:	Real interest rate
SADC:	Southern African Development Community
SC:	Schwarz Information Criterion
SSA:	Sub-Saharan Africa
SARB:	South African Reserve Bank
VAR:	Vector autoregression
VECM:	Vector Error Correction Model
WTO:	World Trade Organisation

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CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION AND BACKGROUND

National savings are mobilised for domestic investment and in turn such investment give rise to industrial growth, stable prices, employment opportunities, and economic development (Zwane, Greyling & Maleka, 2016). In the same vein, Kudaisi (2013) maintains that in order to ensure economic growth through capital formation, when designing policies, understanding the behaviour of national savings is critical. Hence, one of the objectives of macroeconomic policies in developing and developed economies is to attain higher savings with high Gross Domestic Product (GDP) and low inflation rates and interest rates. Savings is an essential factor for the country's economy to improve (Ilyas, Hazoor, Shehzadi & Shoukat, 2014). According to Tang and Ch'ng (2012), savings and GDP have a positive relationship. Therefore, nations with greater growth rates tend to have larger savings rates. Life cycle hypothesis and permanent income hypothesis shows that savings is positively correlated with GDP growth, and increased GDP growth will generate more savings for the economy (Dornbusch, et al., 2011).

It can be emphasised that interest rates are expected to boost savings when the substitution effects dominate income effect (Abou El-Seoud, 2014). Thus, the higher interest rate leads to higher savings as it encourages savers. Iyer (2018) asserts that savings depends on interest rate; therefore, when there is high inflation, the real interest rate is low which impacts savings negatively.

Globally, savings vary greatly. According to the World Economic Outlook (2022), between 2008 and 2015, the average savings rate as a percentage of GDP was 21.5% in advanced economies, and 19.5% in Sub-Saharan Africa. When comparing the savings rates of developed and emerging economies, it is notable to observe that advanced economies have higher levels of prosperity since they rely less on external debt (Govdeli, 2022). As a result, low levels of national savings constrain emerging countries' ability to invest in capital formation, which contributes to their slow rate of development (Govdeli, 2022).

According to Lings & Netshitenzhe (2020), one of the lowest savings rates among developing countries is found in South Africa and the past two years have been challenging for South African economy. Major components such as production, trade and business activities of the country have been hampered, causing contraction in economic activities and in turn resulting in high government debt (Lings & Netshitenzhe, 2020). Ahmad & Mahmood (2013) maintain that there is general agreement that a low national saving rate is a setback in achieving high and sustainable economic growth. The period of Covid-19 emphasised the importance of having access to financial resources to help manage challenges faced by countries. To address the issue of low-savings rate, South Africa implemented a National Development Plan (NDP) to have an economy that is inclusive and more dynamic in growth and increasing national savings from 16% of GDP to 25% by 2030 (National Planning Commission, 2011).

Over the years, there have been changes to South Africa's savings rate. Gross domestic savings as a percentage of GDP has been fluctuating around 16% and 17% which is below the national benchmark of 25% according to the National Development Plan (World Bank, 2022). In 2014 and 2017, the gross domestic savings as a percentage of GDP was 16.99% and 17.76% respectively and then declined to 16.58% in 2019 (World Bank, 2022). According to Eladawy & Abdelmoneim (2020), when there is a low domestic savings rate, the country will be unable to fund its investment and therefore will become dependent on foreign sources such as portfolio investment, foreign direct investment, remittances, aid, and external debt. Literature indicates that South Africa has not been extensively investigated recently, so there is a gap of contribution from a South African perspective, and there is a need to enhance the understanding from South African point of view.

There is a strong relationship between gross domestic savings and the chosen macroeconomic variables. These factors are interrelated and collectively affect a country's overall economic stability. Interest rates are used by central banks to control inflation (SARB, 2019), which affects growth and savings. Long-term investments are encouraged by stable inflation and moderate interest rates, which promote sustainable growth. In order to foster an environment where savings are adequate for funding growth without allowing inflation and interest rates to make

investments unaffordable, these factors must be balanced.Through literature review it is revealed that some researchers using other countries' data, focused their research on gross domestic savings as a percentage of GDP, inflation and other variables (Aric, 2015; Sahin, 2016; Mojekwu & Ogbulu, 2017; Yakubu, Oumarou & Abdallah, 2022), excluding the interest rate variable which is of paramount importance in this study.

The empirical findings that have not considered interest rate variable are inconsistent. The findings employed similar variables yet different approaches, including Vector Error Correction Model and Fully Modified Ordinary Least Squares. While Yakubu, Oumarou & Abdallah (2022), exhibits a positive inflation impact and negative GDP impact on savings, some (Sahin, 2016; Mojekwu & Ogbulu, 2017), have discovered that inflation rate has a negative effect and GDP has a favourable effect. Therefore, an investigation of the GDP-inflation rate-interest rate-national savings nexus and gaining knowledge of the nature of such relationship, is vital for monetary authorities to stabilise the economy through suitable policies in an endeavour to stimulate economic growth.

1.2 STATEMENT OF THE PROBLEM

Although national savings are used as an indicator to measure a country's health, it can be noted that South Africa has been facing low savings since the dawn of democracy (World Bank, 2022). According to the World Bank (2022), for the years 1994 through 2020, the gross domestic savings as a percentage of GDP for South Africa did not surpass the NDP benchmark of 25%, and on average gross domestic savings as a percentage of GDP for the period was 18.41%. In 2020 Sub-Saharan countries' gross domestic savings as a percentage of GDP was 19.66%, while South Africa realised 17.1% (World Bank, 2022). A cycle of low investment stems from slower economic growth hindered by a lower domestic savings rates. A nation will thus be unable to generate enough savings to finance its investment projects. Therefore, lower domestic investments mobilised from meagre domestic savings negatively affect the economic health of theeconomy. The majority of central banks, such as the South African Reserve Bank (SARB) have hiked the bank rate which has an effect on the South African economy and world economy at large in an effort to

moderate the inflation rate (Chanz, Sidat & Pienaar, 2022). Hence, it is imperative to investigate the effect of real GDP, inflation rate and interest rate on national savings from a South African perspective.

1.3 RESEARCH AIM AND OBJECTIVES

1.3.1 Aim of the study

The aim of the study is to investigate the effects of economic growth, inflation rate, interest rate on national savings in South Africa.

1.3.2 Objectives of the study

The objectives of the study are:

To establish the relationship between GDP and national savings.
To examine the effect of inflation rate on national savings.
To determine the impact of interest rate on national savings.
To determine the causal relationship that exists between GDP, inflation rate, interest rate and national savings.
To assess the behaviour of national savings to shocks emanating from GDP, inflation rate and interest rate.

1.4 RESEARCH QUESTIONS

What is the relationship between GDP and national savings?
What is the effect of inflation rate on national savings?
How does interest rate affect national savings?
What is the causal relationship between GDP, inflation rate, interest rate and national savings?
What is the behaviour of national savings in response to shocks emanating from GDP, inflation rate and interest rate?

1.5 DEFINITION OF CONCEPTS

Gross domestic savings

National savings are calculated as a country's income less its government purchases and consumption (Abou El-Seoud, 2014). National savings is represented by the gross domestic savings rate. It is an aggregate domestic savings of households, businesses and government in a specified period (Arok, 2014). A high gross domestic savings rate provides resources to attain sustainable growth which will encourage capital formation.

Real GDP growth

In the view of Mohr and Associates (2015), the annual growth in real production or income serves as a proxy for economic growth. Real GDP is commonly used to describe total real production. In this study, economic growth is expressed in terms of real GDP.

It is based on valuing all goods produced at constant prices and the GDP is a measure of changes in output between different time periods (Dornbusch et al., 2011). Real GDP is adjusted for inflation as it is a reflection of nominal GDP. Economies with greater GDP growth have higher savings rates than those with low growth rates (Abou El-Seoud, 2014). Thus, developing countries will have lower investment opportunities.

Inflation rate

Khan, Teng, Nauman & Jadoon (2017) define inflation rate as an increase in prices of products in an economy and when an economy is experiencing inflation too much money is chasing few goods and this situation impact national savings. Mohr and Associates (2015) argues that, the process of most products and services becoming more expensive year after year or even month after month is known as inflation. They further add that a price increase for certain goods do not constitute inflation and that inflation is quite considerable. Only when the vast majority of products and services in the economy are becoming priced higher can inflation occur. Therefore, when there is an increase in price, you have to pay more which decreases the national savings amount and resulting in a negative trend.

Real interest rate

Real interest rate refers to the price of current consumption expressed as a percentage

of future consumption (Abel, Bernanke & Croushore, 2014). A high real interest rate means that each rand of current saving will be higher in terms of future increased consumption. Thus, the real interest rate has an effect on savings as it makes it more attractive when it is high.

1.6 ETHICAL CONSIDERATIONS

I declare the study maintained standards of honesty and integrity. There was no fabrication of information and honesty was upheld when using information from secondary sources. The study acknowledged the contribution of other scholars and hence, there was no plagiarism and proper referencing was employed by matching the reference list with in text sources.

1.7 SIGNIFICANCE OF THE STUDY

Most existing studies that has explored savings model have focused on the determinants of national savings (Aric, 2015; Kwaka,2013; Sahin, 2016; Nagawa, Wasswa & Bbaale, 2020). In South Africa, the effect of GDP, inflation rate, and interest rate on national savings has not been interrogated extensively as revealed through the literature review. Although Abou El-Seoud (2014) estimated the effect of interest rate, inflation rate, and GDP on national savings for Kingdom of Bahrain, he used outdated data and nominal interest rate variable which was not adjusted for inflation. Thus, the proposed study aims to fill the gap in the literature by including the real interest rate and also using recent data to estimate the South African national savings model for South Africa

The study intends to expand knowledge on the national savings model by assessing the behaviour of national savings to shocks emanating from GDP, inflation rate, and interest rate in the South African economy, as well as exploring casual relationships that exists among the variables from a South African perspective. The research will provide insight into potential policy outcomes, prompting policymakers to consider reviewing resilience mechanisms in order to stabilise the sensitivity of national savings. Furthermore, priorities interventions that deal with the core causes of savings constraints in order to address drivers of savings rates. The study's findings will be of vital importance to central banks, who will use them as a guide when proposing policies that can improve the domestic savings meant for investment and

hence the economy's performance.

1.8 STRUCTURE OF THE STUDY

Chapter 1 introduces, discusses and highlights the intended research topic, the problem statement, research aim and objectives, research questions and definition of terms. The remainder of the dissertation is structured as follows: Chapter 2 contains the discussion of the macroeconomic trends, while Chapter 3 discusses theoretical and related empirical literature. Chapter 4 lays out the methodological framework, approaches or techniques adopted in the study. Chapter 5 discusses and interprets the findings of the study based on the techniques outlined in Chapter 4. Lastly, Chapter 6 provides conclusions and recommendations.

CHAPTER 2

MACROECONOMIC TRENDS OF SOUTH AFRICA'S NATIONAL SAVINGS

2.1 INTRODUCTION

In Chapter 1, the research study was introduced, the research gap was highlighted, the aim and objectives were made clear, and the research study's overall structure was given. This chapter focuses on the trends of South Africa's gross domestic savings, real GDP, inflation, and real interest rates. The South African economy is then analysed in relation to other economies for comparative purposes only. Among these economies are the BRICS, selected Southern Africa Development Community (SADC), selected sub Saharan countries and also G7 countries.

2.2 TRENDS OF GROSS DOMESTIC SAVINGS

Gross domestic savings compromises of a country's savings from the public, private, and household sectors (Khan, et al., 2017). The South African sectors' contributions from 2013 to 2022 is analysed.

2.2.1 Trend of Public savings, Private savings and household savings

Table 2-1: Savings of public, private and households as a % total of gross domestic savings

	YEAR									
Sector	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Private	12.9	18.7	17.2	16.7	13.5	16.8	16.3	18.8	15.1	17.8
Public	2.3	0.3	6.2	3.4	-1.2	-2.1	-5.3	-40.5	-11.4	-8.8
Household	4.9	7.2	10.3	10.9	14.4	14.0	12.5	17.6	16.4	14.6

Source: SARB (2022)

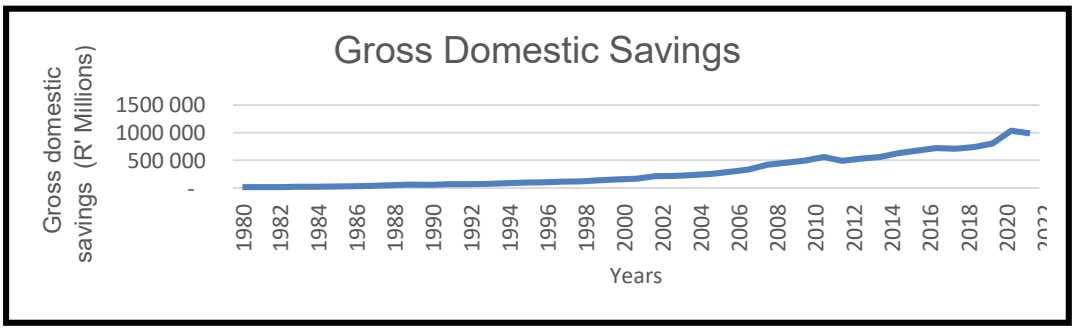
Table 2-1 shows the contributions of the sectors to total of gross domestic savings. Saving by private sector decreased to 17.8% in 2022 from 18.8% in 2020. Saving by public sector was -40.5% in 2020 to a dissaving rate of 8.8%. Household saving decreased slightly to 14.6% in 2022 from 17.6% in 2020. In the private sector, savings averaged 16.38%, in the government sector, savings averaged -5.71%, and in the household sector, savings averaged 12.28%, according to the SARB (2022) for the period 2013 to 2022. For the period, the three sectors collectively accounted for 22.95%. The gross domestic savings remained below the threshold when compared to the 25% national savings benchmark. It does, however, showed evidence of resilience.

The corporate sector emerged as the biggest driver of domestic savings, followed by the household sector, while the government sector contributed the least, with a dissaving pattern that has persisted through 2022 according to SARB (2022). This decline is driven by high government expenditure. As the country faced the Covid-19 pandemic, the public sector showed savings of -40.5% in 2020, with increases in spending for social protection, health care, and general public services (StatsSA, 2022).

2.2.2 Trend of gross domestic savings

Gross domestic savings (GDS) trend from 1980 to 2022 is depicted in Figure 2-1. The data indicates that GDS steadily increased from 1980, with the biggest growth between 2006 and 2011 reaching a peak of R560 501 in 2011 from R297 572 in 2006. GDS picked up again in 2014 and as seen in Table 2-1 private sector was the largest contributor by 18.7%, reaching a peak of R10 36 614 in 2021.

Figure 2-1: The trend of gross domestic savings during 1980-2022

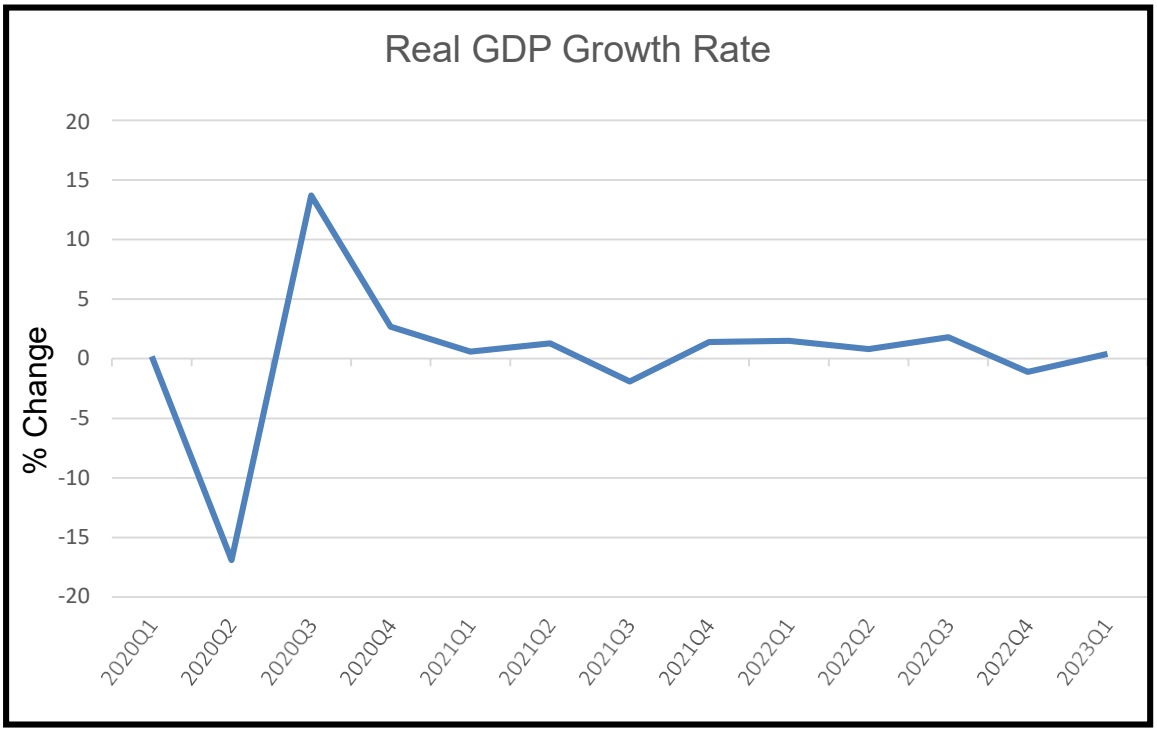


Source: Author's construction using SARB (2022) data

2.3 TRENDS OF REAL GROSS DOMESTIC PRODUCT GROWTH RATE

Figure 2-2 shows the real gross domestic product trend for the 2020 Q1 to 2023 Q1 duration. The economic activity of South Africa drastically decreased in the second quarter of 2020 after seeing growth in the first quarter of 2022. After growing by 0.2% in the first quarter, real GDP contracted by 16.9% in the second quarter of 2022. This was due to Covid-19 where the lockdown restrictions were the stringent and prevented production activities taking place (StatsSA, 2023).

Figure 2-2: Real gross domestic product



Source: Author's construction using Stats SA (2023) data

In Figure 2-2, real gross domestic product grew from the fourth quarter of 2021 to the third quarter of 2022 on average. This marked the four consecutive quarters of economic expansion. However, in 2022's fourth quarter, real GDP contracted by 1.1%. Despite a decline in the fourth quarter of 2022, a 0.4% recovery is seen in the first quarter of 2023.

The economic sector growth rate trend for the years 2021 Q1 to 2023 Q1 is shown in Table 2-2. Agriculture, forestry, and fishing industries experienced a 12.3% decline in the first quarter of 2023. The main reason for the decline, according to Stats SA (2023), was the economic activity reported for field crops and animal products dropped. The mining sector recovered in the first quarter of 2023 by 0.9% after seeing a 3.0% decline in the fourth quarter of 2022.

Table 2-2: Economic sectors growth rate

Sector	**2021**					**2022**					**2023**
Primary Sector	**Q1**	**Q2**	**Q3**	**Q4**	**Year***	**Q1**	**Q2**	**Q3**	**Q4**	**Year***	**Q1**
Mining	4.1	2.0	-1.2	3.2	12.0	-2.6	-3.1	1.9	-3.0	-7.1	0.9
Agriculture, forestry and fishing	5.0	10.1	-25.8	15.3	7.4	-0.9	-11.8	31.4	-2.4	0.9	-12.3
Secondary Sector	**Q1**	**Q2**	**Q3**	**Q4**	**Year***	**Q1**	**Q2**	**Q3**	**Q4**	**Year***	**Q1**
Manufacturing	0.1	-1.3	-3.7	1.9	6.7	4.3	-5.6	1.6	-1.2	-0.4	1.5
Construction	0.3	-1.3	-1.1	-2.7	-2.0	-0.6	-2.6	4.1	0.4	-3.4	1.1

Electricity, gas and water	-0.8	0.6	0.3	-3.1	1.9	2.5	-1.4	-2.6	-2.0	-2.5	-1.0
Tertiary Sector	**Q1**	**Q2**	**Q3**	**Q4**	**Year***	**Q1**	**Q2**	**Q3**	**Q4**	**Year***	**Q1**
Trade, catering and accommodation	0.8	3.3	-4.6	4.0	6.2	2.9	-1.1	1.2	-2.2	3.5	0.7
Finance, real estate and business services	0.6	-0.9	0.8	-0.5	2.5	1.9	2.1	1.1	-1.6	3.4	0.6
General government services	0.1	-0.5	0.3	-0.2	0.0	1.3	-1.5	0.4	-0.7	0.1	0.2

Source: Stats SA (2023)

In Table 2-2, the manufacturing experienced the biggest contraction of 5.6% in the second quarter of 2022 as a result of floods in KwaZulu-Natal, which had adverse impact on the manufacturing industry (StatsSA, 2022). Weakening the country's economy that had just recovered to pre-pandemic (StatsSA, 2022). Table 2-2, also reveals that the manufacturing and construction industries grew in the first quarter of 2023 and the electricity, gas and water decreased by 2.0% in the fourth quarter of 2022 and also revealed another contraction of 1.0% in the first quarter of 2023 due to electricity load shedding. Trade, catering and accommodation; finance, real estate and

business services; and general government services industries decreased in the fourth quarter of 2022, following an expansion in the first quarter of 2023.

2.4 TRENDS OF INFLATION RATE

The consumer price index (CPI) headline inflation target of 3%–6% was adopted in 2000 (SARB, 2019)**.** This framework is used by the central bank (SARB) to maintain inflation within the set target. Furthermore, it assures price stability in the long run to promote sustainable and balanced economic development and growth (Mokgola, 2015). Wolassa (2015), holds that inflation targeting minimises the volatility of the inflation rate since an excessively fluctuating inflation rate has the potential to negatively affect economic performance.

The headline annually inflation rate from 2019 to 2022 is shown in Table 2-3 along with the average headline index number. The yearly inflation rate is displayed in Figure 2-3 for the period of January 2019 to June 2023. The CPI Index measures a change in inflation rate between the relevant month of the current year and the same month of the prior year, whereas the inflation rate is the change in the CPI Index over a year or a month (StatsSA, 2023).

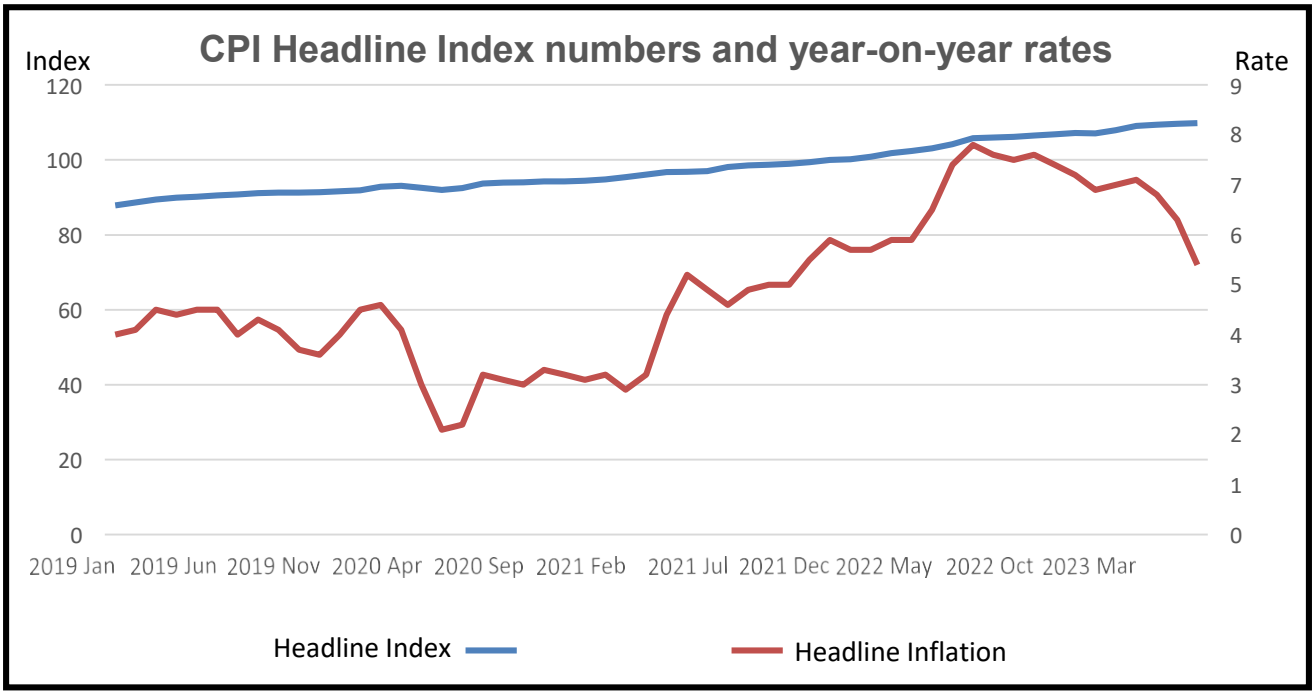
Table 2-3: The average CPI headline index numbers and annual rates.

Year	CPI headline index number	CPI rates
2019	90.3	4.1
2020	93.3	3.3
2021	97.5	4.5
2022	104.2	6.9

Source: Stats SA (2023)

As displayed in Figure 2-3, the CPI in 2019 was within the target range and it accelerated to a high of 4.5% in March, May and June. For four consecutive months in 2020, up until April, it remained below the upper limit of the inflation target range. In contrast, between May and June it was below the target range, with 2.1% and 2.2% respectively. Overall, according to Figure 2-3, the year's average CPI headline remained at 3.3%.

Figure 2-3: CPI headline index numbers and annual rates.



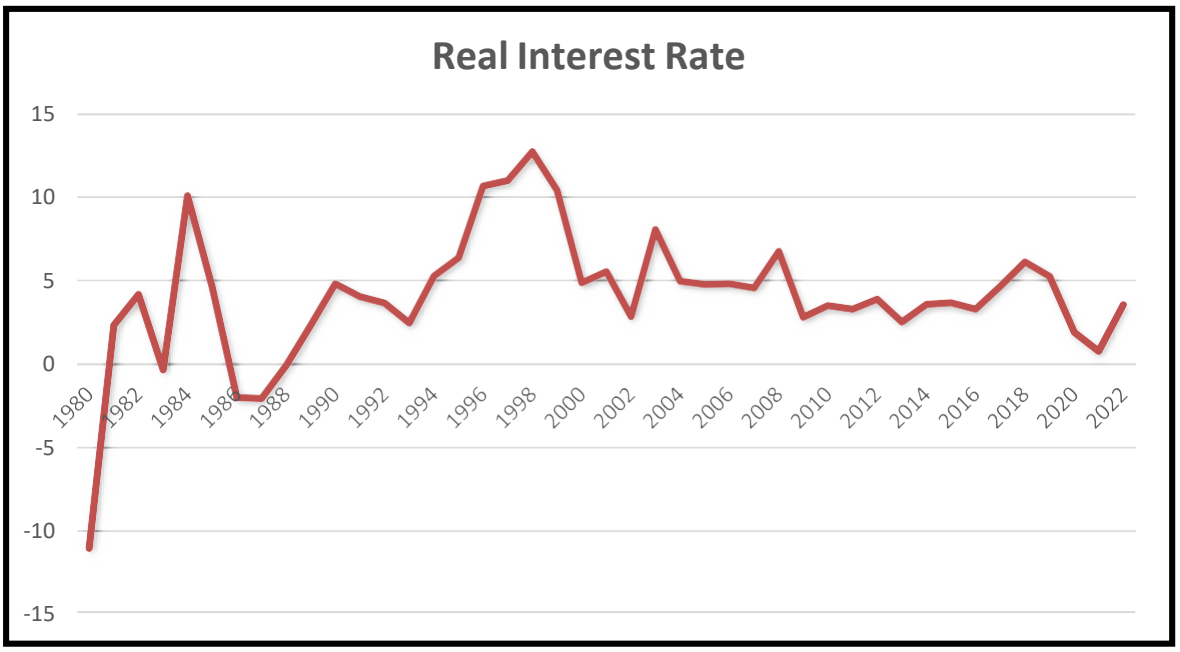
Source: Author's construction using Stats SA (2023) data

In 2021 observed 2.9% in February and it increased to a high of 5.9% in December. The headline consumer price inflation hiked to 7.8% in July 2022 and it stayed above the upper limit of the inflation target range for six months consecutively until December as shown in Figure 2-3. The inflation rate was above the target range at the start of 2023 until June, when it dropped to 5.4% in June and 6.3% in May, sinking below the upper limit of the target range according to (StatsSA, 2023). The last time inflation was below 6% was in April 2022, when it was 5.9% and the prevailing rate of 5.4% was the lowest since it was reported to be 5.0% in October 2021 (StatsSA, 2023).

2.5 TRENDS OF REAL INTEREST RATE

The South African real interest rate's movement from 1980 to 2022 is shown in Figure 2-4. Inflation is the primary driver of in interest rates. Interest rate cycles with high amplitudes are caused by the high and volatile inflation (SARB, 2019).

Figure 2-4: Real interest rate



Source: Author's construction using World Bank data

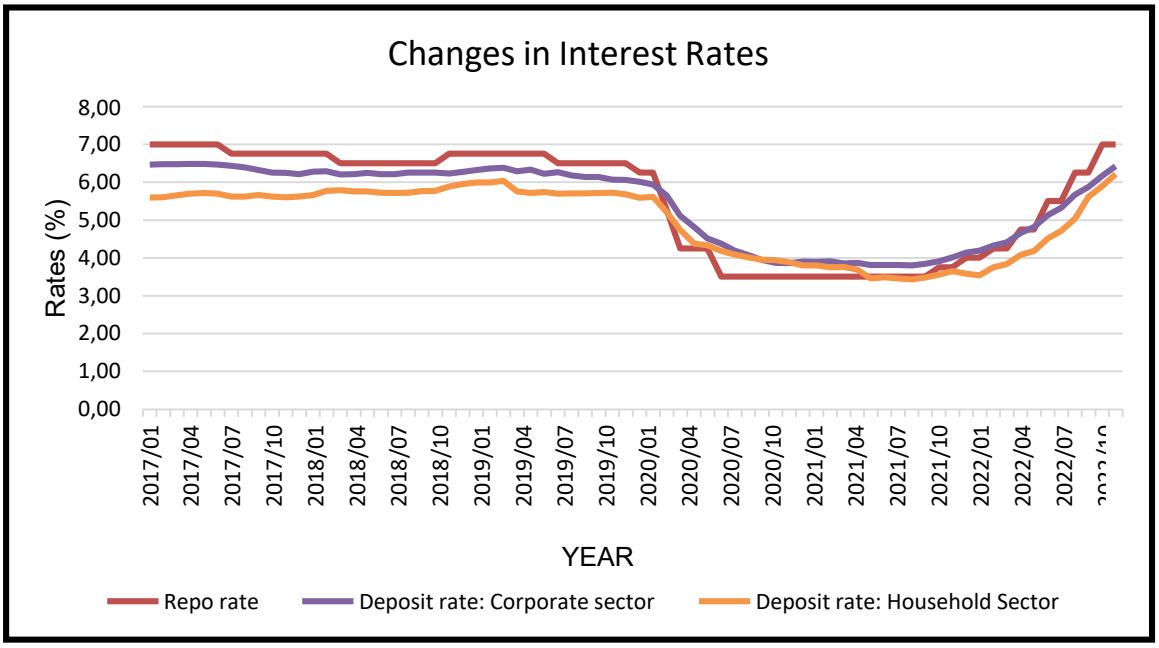
In Figure 2-4, the real interest rate peaked in 1984 at 10.06%, reaching its highest point between 1980 and 1993, from its lowest point of -11%. The real interest rate began to rise steadily in the 1994–1998 period and accelerated to a high of 12.69% in 1998 as shown in Figure 2-4. From 1999 through 2000, the figure shows consistent downward trend and the real interest rate fluctuated around 4% between 2004 and 2007. As South Africa felt the effects of the global financial crises in 2009, real interest rates fell sharply and between the years 2008 and 2009, it dropped from 6,75% to 2.80% as displayed in Figure 2-4.

According to Figure 2-4, the interest rate began to increase in 2016 and peaked in 2018 at 6.11%. After the world was hit by an outbreak of the corona virus in 2020, the interest rate decreased until it reached 0.77% in 2021 as shown in Figure 2-4. Savings were discouraged during this period due to interest rates were unattractive. Lower interest rates tend not to strengthen the currency's exchange rate through enhancing

returns on rand-based investments (Mishkin, 2012). Overall, the adverse effect of the COVID-19 pandemic on real interest rates was greater than that of the global financial crisis' recession in 2009 as displayed on Figure 2-4.

Figure 2-5 exhibits the monthly variations in the repo rate and deposit rate for the corporate and household sectors from January 2017 to December 2020. An efficient functioning of the financial markets is ensured by repo rate adjustments. The repo rate, in accordance with Meyer & Morope (2021), is a measure of funding costs which influences the deposit rates that banks provide. The graph demonstrates that banks provide households lower interest rates on deposits than they do for corporates. This is attributable to a higher volume of corporate deposits (Meyer & Morope, 2021). The repo rate was higher than the deposit rates for households and corporations from January 2017 to February 2020. In the household sector, the average deposit rate ranged from 5% to 6%, while it was around 6% for corporates. The repo rate in January 2020 was 6.25%, down from 7% respectively in January 2017.

Figure 2-5: Changes in interest rates



Note: Deposit rate of household sector and corporate sector are weighted average rates.

Source: Author's construction using SARB data

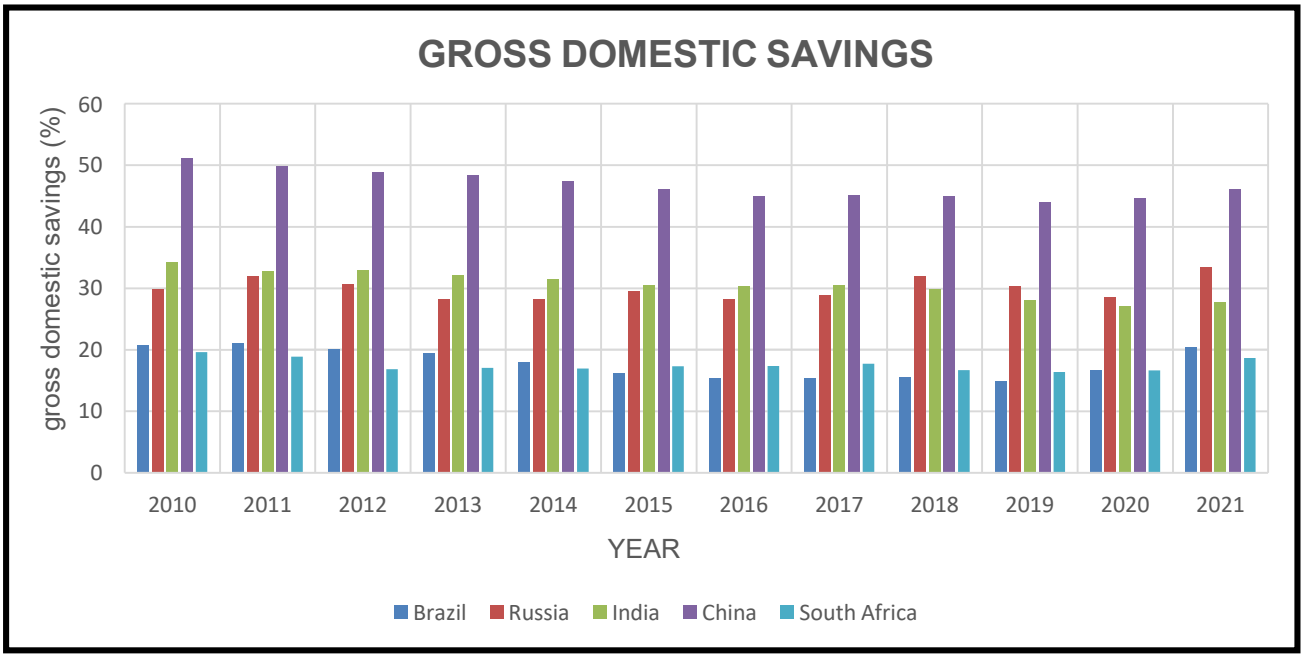
According to Figure 2-5, repo rates and deposit rates for corporations and households declined and moved considerably closer together during the 2020 pandemic, however the repo rate was lower than all deposit rates with a rate of 3.50%. The respective rates began to rise and drifted apart in November 2021. The SARB raised the repo rate again in May, July, September, and November 2022, bringing it from 4.25% in April 2022 to a high of 7% in November 2022, where it remained and returned to pre-pandemic levels (SARB, 2022). As a result, the hike in the repo rate influenced both corporate and household rates, however the increase in household rates lagged behind that of corporates by 6.21% and 6.42%, respectively as shown in Figure 2-5.

2.6 SOUTH AFRICAN ECONOMY IN COMPARISON WITH OTHER ECONOMIES

According to World Bank (2022), developing countries' savings rate ratio has been decreasing throughout the years, which is any country's concern since the attainment of the level of investment that is necessary to sustain long-term growth becomes elusive. Figure 2-6, which was derived utilising data from the World Bank, displays the gross domestic savings of South Africa in contrast of those of other economies. Brazil, Russia, India, China, and South Africa are the five countries that comprise the BRICS economic alliance. As of 2010, South Africa became a member of this bloc of emerging markets. Therefore, in the study the BRICS economies are used to analyse and compare South Africa's performance to that of other BRICS countries during 2010 to 2021. The Figure 2-6 highlights that China has the greatest gross domestic savings for the whole period, followed by India and Russia, but the positions of these two countries interchange with time.

According to Figure 2-6, China recorded the highest level of gross domestic savings in 2011, followed by India, Russia, Brazil, and South Africa, respectively, with totals of 49.84%, 32.71%, 31.99%, 21.06%, and 18,87%. China remained in the lead in 2015, reaching a peak of 46.01%. India lagged with 30.56%, followed by Russia with 29.55%, South Africa overtook Brazil with 17.33%, and Brazil had the lowest savings rate at 16.26%.

Figure 2-6: Gross Domestic savings in BRICS



Source: Author's construction using World Bank data

Figure 2-6 demonstrates that India lagged behind China from 2010 to 2017 and with a gross domestic savings rate of 31.92% in 2018, Russia surpassed India and accelerated from 29.79% in 2010, while India dropped from 34,27% in 2010 to 29,89% in 2018. This was followed by South Africa with savings rate of 16.69%, while Brazil continued to have the lowest savings of 15,49% as shown in Figure 2-6.

In Figure 2-6, China's total domestic savings decreased significantly over a ten-year period, falling from 51.09% in 2010 to 44.67% in 2020 and South Africa's total domestic savings also fell, from 19.64% to 16.68%, which it was still below the target of 25%. This divergent pattern pointed to a widening gap between South Africa and China. In 2021, China reached a peak of 46.08%, while South Africa reached a peak of 18.68%, resulting in China's gross domestic savings being 27.4% (46.08%-18.68%) points higher than South African savings.

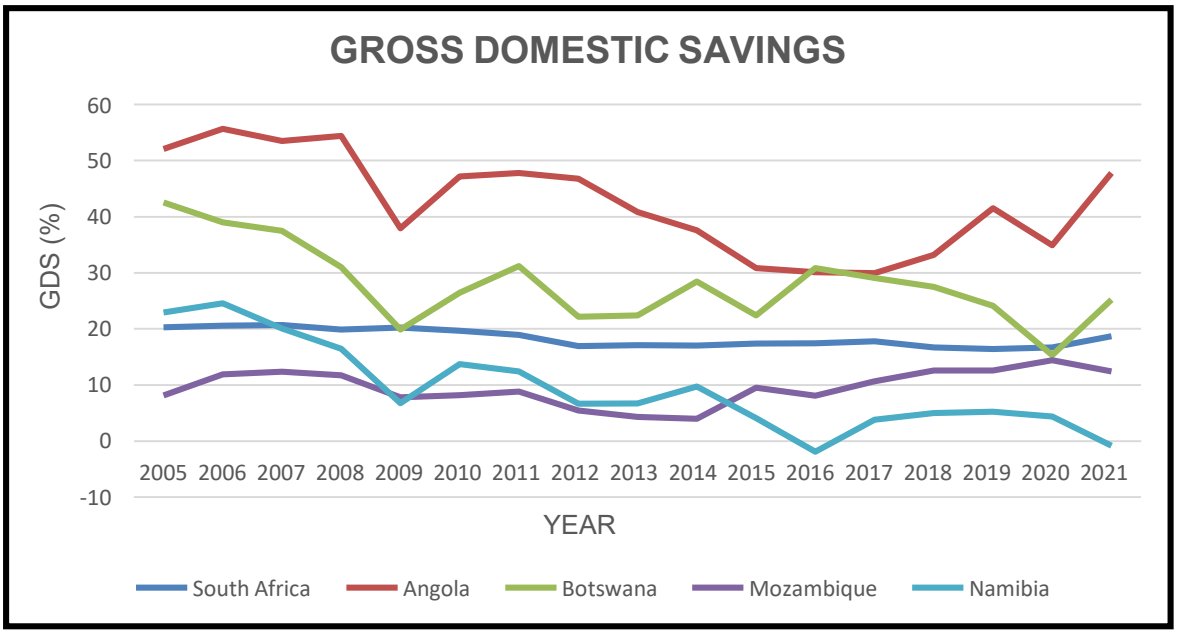
China has one of the highest rates of savings across worldwide, and their household sector has emerged as the primary driver of expanding savings (IMF, 2018). Lugauer, Ni & Yin (2017) argues that, the demographic structural change in China influences the country's savings patterns, and households make significant contributions to the investment-led expansion of the economy by helping to finance the purchase of assets

denominated in foreign currencies. The structural changes that boost China's gross domestic savings include low social spending and high public investment levels that results in large government savings, the World Trade Organisation(WTO) membership resulted in a boom in export growth and a sharp increase in corporate savings, and a rise in income inequality as now households have larger saving propensities (IMF, 2018).

South Africa, Angola, Botswana, Mozambique, and Namibia are among the SADC countries with their gross domestic savings shown in Figure 2-7 over the period 2005–2021. As shown by the Figure 2-7, Angola has the highest gross domestic savings, which is subsequently followed by Botswana and South Africa. Angola's gross domestic savings fell from 54.39% in 2008 to 37.89% in 2009 as a result of the global financial crisis. Botswana has been steadily declining since 2005, reaching its lowest point of 19.88% in 2009, down from 38.96% in 2005. With a peak of 30.83% in 2016, Botswana outperformed Angola's gross domestic savings, which fell to 30.09%.

According to Figure 2-7, Botswana was surpassed by South Africa in 2009 with rates of 20.20% and 19.88%, respectively. Botswana was in the lead from 2010 to 2019, however in 2020 it lagged behind South Africa with 15.31%, while South Africa showed 16.68%, causing South Africa to lag behind Angola.

Figure 2-7: Gross domestic savings in selected SADC



Source: Author’s construction using World Bank data

Namibia has seen both upward and downward trends according to Figure 2-7. Prior to Covid-19, Namibia had the lowest savings rate among the four states, with a downward trend of -1.92% in 2016 respectively. It began to accelerate from 2017 and peaked in 2020 at 4.36%. It began to progressively drop and hit its lowest point in 2021 at -0.84%. Throughout the period, Mozambique have shown progression as reflected in Figure 2-7. It had the lowest rate of national savings among the four countries from 2005 to 2008. As of 2009, it outperformed Namibia. It had a rate of 3.96% at its lowest point between 2010 and 2014. As opposed to that, Mozambique began to progressively increase from 2015 and peaked in 2020 at 14.39%.

Table 2-4 displays the economic activity performance for the chosen SADC member states from 2011 to 2020. The SADC region's real GDP growth rate has been declining, from 4.2% in 2011 to a contraction of 4.5% in 2020. The global pandemic driven by Covid-19 restricted economic activity in the SADC region (SADC, 2021).

According to Table 2-4, at a country-specific level, all 5 of the countries experienced negative growth rates in 2020, ranging from -1.2% to -8.5%. Botswana recorded the highest decline in the overall economic growth rate at -8.5%, followed by Namibia (-8.0%) and South Africa (-6.4%). Moreover, South Africa's GDP growth rate overall between 2011 and 2020 never surpassed that of the SADC’s growth rate as a whole.

Table 2-4: GDP at current prices, Annual Real Growth Rates in SADC (%)

SADC members	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Angola	3.5	8.5	5.0	4.8	0.9	-2.6	-0.1	-2.0	-0.6	-5.2
Botswana	6.0	4.5	9.9	3.2	-1.7	7.0	4.0	4.0	3.0	-8.5

Mozambique	7.4	7.3	7.0	7.4	6.7	3.8	3.7	3.4	2.3	-1.2
Namibia	5.1	5.1	5.6	6.1	4.3	0.0	-1.0	1.1	-0.6	-8.0
South Africa	3.2	2.4	2.5	1.4	1.3	0.7	1.2	1.5	0.1	-6.4
SADC Total	4.2	4.3	3.9	3.2	2.2	1.4	2.1	2.2	1.2	-4.5

Source: SADC Macroeconomic Statistics Bulletin (2021)

Table 2-5 and Figure 2-8 represent the GDP growth rates of the BRICS countries from 2012 to 2021, with Figure 2-8 displaying that from 2012-2015 showing that China had the highest GDP growth rate, ranging between 7.0% and 7.9%, and it had the highest rate for two years, followed by Russia in 2012 and in 2013 and Brazil with 3.0%. India, however, surpassed China in 2014 by 9.8% while Brazil and Russia both had contractions in 2015 of 3.5% and 2.0%, respectively. China's output decreased from 2015 to 2020, falling from 7.0% to 2.2%, whereas South Africa's output decreased from 1.3% in 2015 to -6.4% in 2020. Brazil, Russia, and India were experiencing growth on the other hand. But, Brazil, Russia, India, and South Africa all experienced decline in 2020 as a result of Covid-19 disruptions, while China had a positive growth. The largest contraction was in South Africa, followed by India and Brazil and India recorded the biggest growth of 19.5% during the Covid-19 recovery in 2021, followed by China with 8.1% and South Africa with 4.9%.

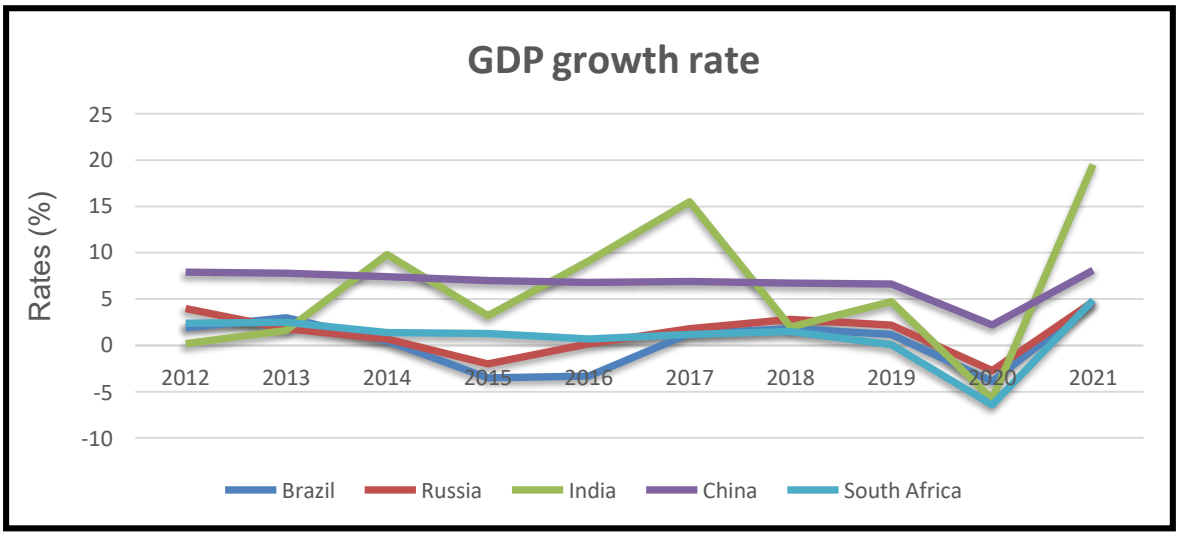
Table 2-5: GDP growth rate of BRICS (change from the preceding year) %

Country	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Brazil	1.9	3.0	0.5	-3.5	-3.3	1.3	1.8	1.2	-3.9	4.6

Russia	4.0	1.8	0.7	-2.0	0.2	1.8	2.8	2.2	-2.7	4.7
India	0.2	1.6	9.8	3.2	9.1	15.5	2.0	4.7	-5.8	19.5
China	7.9	7.8	7.4	7.0	6.8	6.9	6.7	6.6	2.2	8.1
South Africa	2.4	2.5	1.4	1.3	0.7	1.2	1.5	0.1	-6.4	4.9

Source: BRICS Joint statistical publication (2022)

Figure 2-8: GDP growth in BRICS (%)



Source: Author's construction using BRICS statistical publication data

Based on Table 2-6 and Figure 2-9, the yearly inflation rate for the SADC region as a whole has been rising, from 6.3% in 2014 to 37.0% in 2020. As shown in Table 2-6 and Figure 2-9, three member states South Africa, Angola, and Namibia registered rates higher than the regional average, compared to the SADC region's annual average inflation rate of 6.3% for 2014. Two member states recorded annual inflation rates below the regional average.

All of the selected state members saw a decrease in inflation between 2016 and 2018. The highest inflation rate in 2016 was 32.3% in Angola, and the lowest inflation rate was 3.1% in Botswana. From 2019, the inflation rate increased in Botswana, Namibia, and South Africa while declining in Angola and Mozambique according to Table 2-6 and Figure 2-9. However, Angola continued to experience the highest inflation rate and had a rate of 16,4%, which was greater than the regional average.

Table 2-6: Annual Headline Inflation rate in selected SADC members

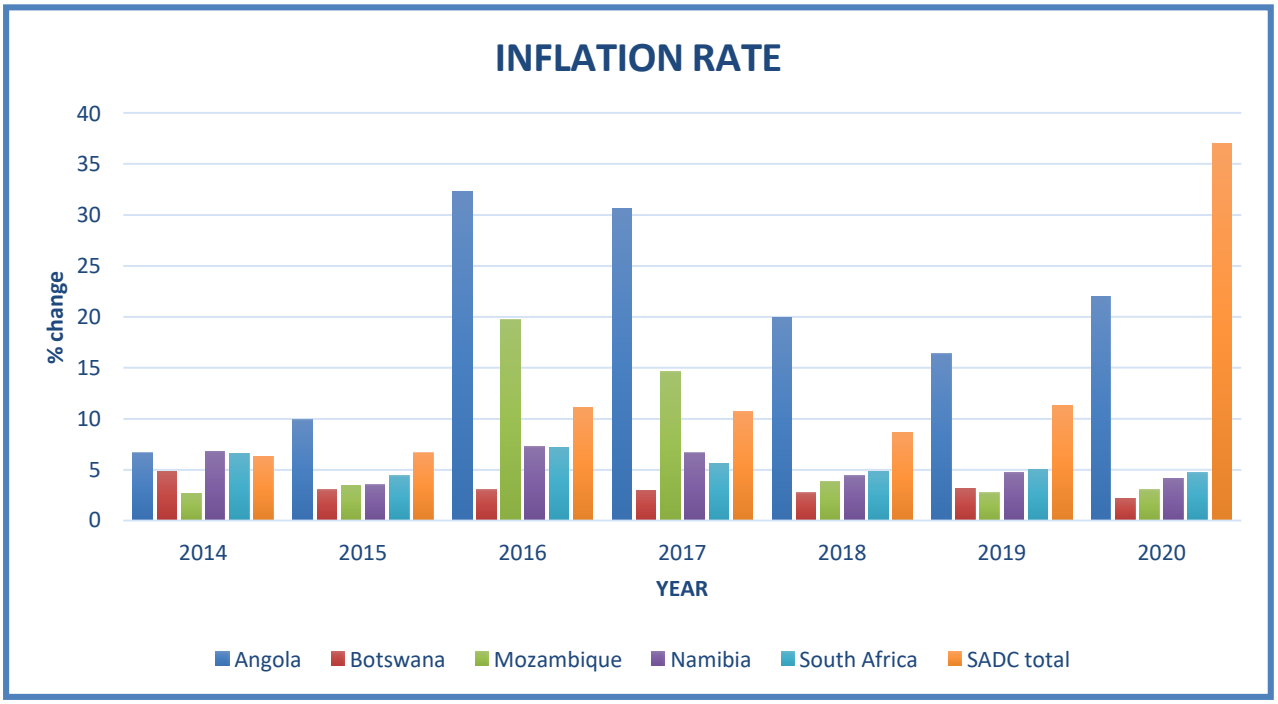
SADC members	2014	2015	2016	2017	2018	2019	2020
Angola	6.7	9.9	32.3	30.6	19.9	16.4	22.0
Botswana	4.8	3.1	3.1	3.0	2.8	3.2	2.2
Mozambique	2,7	3.5	19.8	14.6	3.8	2.8	3.1
Namibia	6.8	3.6	7.3	6.7	4.4	4.7	4.2
South Africa	6.6	4.4	7.2	5.6	4.8	5.0	4.7
SADC total	6.3	6.7	11.1	10.7	8.7	11.3	37.0

Source: SADC Macroeconomic Statistics Bulletin (2021)

The inflation rate in the BRICS countries between 2014 and 2020 is displayed in Table 2-7 and Figure 2-10 showing that all five countries experienced a reduction over the period, although India reverted to 6.6% in 2020. Prior to the Covid-19 interruptions, in 2015, Russia had the highest inflation rate at 15.5%, followed by Brazil at 10.7% and India at 4.9%. While China maintained the lowest inflation rate at 1.6% and 2.1%, South Africa surpassed Russia in 2017 and 2018 with rates of 5.3% and 4.7%,

respectively. Russia took the lead once more in 2019, followed by Brazil and South Africa.

Figure 2-9: Annual Headline Inflation rate in selected SADC members



Source: Author's construction using SADC Macroeconomic Statistics Bulletin data

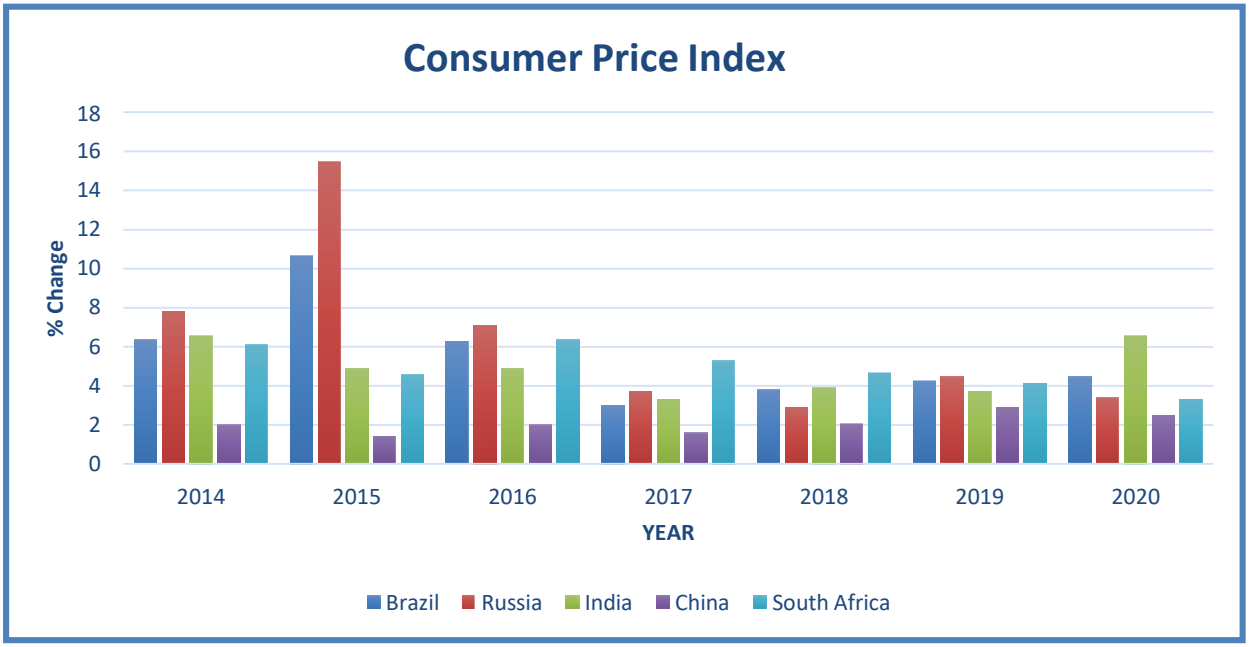
Table 2-7: Annual inflation rate (CPI) in BRICS

Countries	2014	2015	2016	2017	2018	2019	2020
Brazil	6.4	10.7	6.3	3.0	3.8	4.3	4.5
Russia	7.8	15.5	7.1	3.7	2.9	4.5	3.4
India	6.6	4.9	4.9	3.3	3.9	3.7	6.6
China	2.0	1.4	2.0	1.6	2.1	2.9	2.5

South Africa	6.1	4.6	6.4	5.3	4.7	4.1	3.3

Source: BRICS Joint statistical publication (2022)

Figure 2-10: Annual Inflation rate (CPI) in BRICS



Source: Author's construction using BRICS Joint statistical publication data

2.6.1. Trends of Savings, GDP growth rate, Inflation rate between G7 countries and Sub Saharan countries (South Africa and Ghana)

In a developing country, the relationship nature of GDP, inflation, and national savings may differ with a developed economy therefore, Table 2-8(a) and 2-8(b) demonstrates the nature of the relationship in comparison with South Africa and Ghana as a developing countries and G7 countries as the world's advanced economies.

The selected countries have substantial differences in real GDP, inflation, and gross domestic savings. Tables 2-8(a) and 2-8(b) show this distinction between richer and poorer countries as well as highlighting differences that have grown within rich countries. The two tables make it evident that advanced economies perform optimally, highlighting the clear performance difference between emerging and developed

economies. Table 2-8(a) displays the gross domestic savings and real GDP growth rate, while Table 2-8(b) displays changes in inflation rate between G7 countries and selected Sub-Saharan African (SSA) countries (South Africa and Ghana) between 2018 and 2021.

2.6.1.1 Changes in Gross domestic savings

According to Table 2-8(a), the changes in savings prior to 2020 (Covid-19) have decreased for both developed and developing economies. Germany had the highest savings rate in 2018 at 29.9%, while the United Kingdom had the lowest at 14.0%. Canada's savings rate remained constant in 2019, although Germany was in the leading with a savings rate of 29.7% and the United Kingdom grew to 15.3%, but it was still the lowest savings rate among the G7 countries. With 16.4%, South Africa, outperformed the United Kingdom too. Post Covid-19, the majority of nations recovered, and their savings rate gradually increased. The advanced economies' savings rates ranged from 14.5% to 30.1%. Germany continues to have one of the highest savings rates, followed by Japan. Ghana led in terms of savings rate over the course of the four-year period, which ranged from 19.9% to 18.7% in developing economies. It can be noted that policy makers in Ghana implemented several policies, namely Ghana Shared Growth and Development Agenda (GSGDA) among others to overcome the low level of savings (Kwaka, 2013).

Table 2-8 (a): Changes in gross domestic savings and GDP growth rate

	Gross Domestic Savings				**Real GDP growth rate**			
Countries	**2018**	**2019**	**2020**	**2021**	**2018**	**2019**	**2020**	**2021**
Canada	21.0	21.0	20.5	23.8	1.9	1.6	-5.3	4.5
France	23.0	24.1	21.8	24.1	1.7	1.3	-8.0	6.8

Germany	29.9	29.7	28.2	30.1	1.5	0.6	-4.6	2.6
Italy	21.1	21.5	21.5	23.3	0.9	0.3	-8.9	6.7
Japan	29.1	29.3	28.4	28.1	0.8	0.7	-4.6	1.7
United Kingdom	14.0	15.3	14.2	14.5	1.4	1.4	-9.8	7.4
United States	19.6	19.4	19.2	20.0	2.9	2.3	-3.4	5.7
South Africa	16.7	16.4	16.9	18.7	0.8	0.2	-6.4	4.9
Ghana	21.6	17.7	22.0	19.9	6.2	6.5	0.5	5.4

Source: World Economic Outlook (2022), World Bank

2.6.1.2 Changes in Real GDP growth rate

Global real GDP has been falling from 2018 to 2020 as shown in Table 2-8(a). This analysis is consistent with Er, Tugcu & Coban (2014)'s argument that the global GDP tends to drop. According to Table 2-8(a), in 2020 real GDP of United Kingdom contracted with 9.8% from 1.4% in 2018. United States has declined from 2.9% in 2018 to -3.4%. France, on the other hand, recorded the largest overall G7 countries contraction of 8.0%. United States recorded the lowest output in 2020, while the United Kingdom had the highest reduction level (-9.8%), followed by Italy (-8.9%) and France (-8.0%). Ghana experienced the lowest decline of 0.5% among developed and emerging economies in 2020, followed by the United States, which experienced a decline of -3.4%. Ghana's real GDP for 2019 was 6.5%, which was also higher than the G7. United Kingdom saw a significant growth of 7.4% in 2021, followed by France (6.7%), Italy (6.7%), the United States (5.7%), Ghana (5.4%), South Africa (4.9%), Canada (4.5%), Germany (2.6%), and Japan (1.7%).

Table 2-8 (b): Changes in inflation rate

	Inflation rate (CPI)			
Countries	**2018**	**2019**	**2020**	**2021**
Canada	2.2	1.9	0.7	3.4
France	2.1	1.3	0.5	2.1
Germany	1.9	1.3	0.4	3.2
Italy	1.2	0.6	-0.1	1.9
Japan	1.0	0.5	0.0	-0.2
United Kingdom	2.5	1.8	0.9	2.6
United States	2.4	1.8	1.2	4.7
South Africa	4.6	4.1	3.3	4.6
Ghana	9.8	7.1	9.9	10.0

Source: World Economic Outlook (2022)

2.6.1.3 Changes in Inflation rate

Inflation is a significant macroeconomic factor that has an impact on both advanced and emerging countries. It also promotes growth by stabilizing prices and encouraging savings for expanding investments (Er, et al., 2014). Based on Table 2-8(b), the inflation rates for all the members of G7 in 2020, including South Africa, decreased while rising in Ghana. Ghana had the highest inflation rate among all the countries in 2021, at 10.0%, followed by the US (4.7%), and then South Africa (4.6%). Japan, on the other hand, had the lowest inflation rate, at -0.2%. According to Mavikela, Mhaka,

& Phiri (2019), the Bank of Ghana implemented the inflation target ranging from 6%to 10%. Despite Ghana's continually high inflation rate, it is still not above the upper limit of the inflation target.

2.7 SUMMARY

The gross domestic savings, GDP growth rate, inflation, and interest rate changes in South Africa were covered in this chapter. Gross domestic savings for the BRICS, selected SADC and G7 states, as well as selected SSAs, were analysed, along with GDP growth and inflation rates. In South Africa, private sector was found to contribute the most to gross domestic savings and among the BRICS countries, it had the lowest gross domestic savings over the period. On the other hand, South Africa is among the top 3 economies with the highest gross domestic savings, based on data on selected SADC member states. Thus, Chapter 3 will cover literature review.

CHAPTER 3
LITERATURE REVIEW

3.1 INTRODUCTION

In Chapter 2, the macroeconomic trends of South Africa's national savings provided an exhaustive overview of the country's state development. The purpose of this chapter is to review theoretical frameworks as well as empirical literature. The theoretical framework outlines the theories namely, mathematical theory of saving, relative income hypothesis, life cycle hypothesis and permanent-income hypothesis. The four frameworks provide evidence for the relationship between GDP, inflation, interest rates, and national savings. The empirical literature which reviews findings of previously studies is also discussed in this chapter in an endeavour to determine the research gap and justify the importance of the study.

3.2 THEORETICAL FRAMEWORK

There are economic theories that can be utilised as frameworks to support the relationship between GDP, inflation rate, interest rate and national savings. The theories include the mathematical theory of saving, the relative income hypothesis, the life cycle hypothesis, and the permanent income hypothesis.

3.2.1 A mathematical theory of saving

It was proposed by Ramsey (1928) in a quest to establish how much of one's salary one should put away and spend if one had an indefinite lifespan. The amount saved can either be spent or put into investments that will raise the economy's capital stock. Consequently, cutting back on current spending increases investment and consumption in the future (Ahmad, 2015).

Ramsey (1928) went on to assert that until consumers' current sacrifices in terms of consumption are equal to their future rewards in terms of consumption, they will continue to save money and reduce their consumption. Additionally, he asserted that the short-term saving rate influences the rate of capital accumulation and economic growth, leading to an economy's long-term stabilisation. In order to increase future

consumption, the model emphasises the trade-off between present consumption or savings and capital investment. It illustrates further how critical domestic savings are and how they affect the economy as a whole. High domestic savings, according to the model, increase capital accumulation, which in turn promotes economic growth by raising output.

3.2.2 The relative income hypothesis

Duesenberry (1949) proposed an individual consumption function that postulates that each individual's consumption is dependent on the current income of others. Consumption was seen by Duesenberry as a societal process rather than an individual one. He further asserted that a family's proportion of income saved is independent of their household's overall income. As a result, the aggregated saving ratio will be independent of absolute income level (Alimi, 2013). This demonstrates that when income fluctuates, the marginal propensity to save (MPS) will change. Duesenberry (1949), proceeded to the additional conclusion that the total saving rate is independent to total income and that an individual's propensity to save increases with his percentile location in the income distribution.

3.2.3 Permanent-income hypothesis

It was developed by Friedman (1957) who argued that a person's consumption at a particular time is influenced by both their current earnings and the anticipated future income. Income and consumption in this hypothesis have two components which are transitory and permanent (Dornbusch, Fischer & Startz, 2011). Friedman argues that consumption of an individual is connected to permanent income as they utilise saving and borrowing to balance their consumption in response to transitory changes in their income. Hence, the transitory income does not have a substantial effect on consumption. Therefore, changes in transitory income will affect savings, since higher transitory income results in increased savings.

Additionally, consumption is argued to be proportional to permanent income in the theory where: $C \quad cYP$ and C represents consumption while YP stands for permanent disposable income

Both the life cycle hypothesis and permanent income hypothesis rely on the assumption that people are concerned about the future opportunities for consumption. In the models, saving is seen as a method to stabilise consumption in the face of fluctuating income (Beverly & Sherraden, 1999). Individuals may even borrow money to pay for their spending when current income is below normal levels, which reduces predicted lifetime income savings. The models also postulate that people have nearly perfect perception when it comes to income flows, pricing, and household spending as they get ready for retirement. However, individuals with low incomes are not likely to make the best long-term decisions on consumption and saving since they are likely to have little financial knowledge. Additionally, low-income people may never earn enough to significantly surpass their consumption demands.

South Africa has been dealing with high interest rates and high inflation rates since COVID-19. As a result, Permanent income hypothesis is important for comprehending the dynamics of fluctuating interest rates and inflation. Permanent-income hypothesis emphasises how crucial it is to manage interest rate and inflation volatility in the South African setting in order to promote stable domestic savings. Thus, keeping inflation under control will promote consistency in behaviour since it lessens uncertainty, which provides people more confidence to save, boosting national savings.

3.2.4 Life cycle hypothesis

Ando & Modigliani (1963) developed the life cycle hypothesis (LCH) theory. It states that people plan their consumption and saving pattern over a certain period of time. The intention is to allocate their consumption in the best possible way throughout their lifetime (Dornbusch et al., 2011). To maintain the same standard of consumption, individuals save a percentage of their income while they are working to make provision for their retirement. Abou El-Seoud (2014) argues that individuals save more money when they are working than after they are retired. The increase in per capita income will lead to rise in total savings because it increases an individual's lifetime savings and earnings. Thus, countries with a high GDP growth rate will generate more savings

which will result in a country having enough funds available to finance its investments.

Real interest rates' overall impact on savings can be in a form of substitution effect and income effect (Abou El-Seoud, 2014). Abou El-Seoud (2014) further emphasise that the substitution effect predicts that high interest rate increases current consumption price relative to future prices. On the other hand, the income effect implies that if an individual is a net borrower high interest rate will boost income and consumption while savings declines. Therefore, the aggregate consumption function is modelled as follows:

$$\boldsymbol{C_t^T = \Omega_t^T V_t^T} \quad (3.1)$$

C_t^T – total consumption in the year t,

Ω_t^T – proportionality factor that is dependent on the particular form of utility function, asset return rate, and person's current age,

T, V_t^T- net wealth total carried over from the prior period.

To find V_t^T:

$$V_t^T = a_{t-1}^T + y_t^T + \sum_{c=T+1}^{N} \frac{y_t^{eTr}}{(1+r_t)^{r-T}} \quad (3.2)$$

where:

a_{t-1}^T - present value of nonproperty income that an individual anticipates to earn for the rest of his earning life,

y_t^T – current nonproperty income,

y_t^{eTr} – nonproperty income an individual of age T expects to earn in the rth year of his life,

N- Earning span and

r_t – The asset return rate.

The derivation of the average annual expected income is as follows:

$$y_t^{eT} = \frac{1}{N-T} \sum_{c=T+1}^{N} \frac{y_t^{eTr}}{(1+r_t)^{r-T}} \quad (3.3)$$

where: y_t^{eT} – average annual expected income.

According to the model (3.1), the utility function is homogeneous with regard to consumption at various times. The consumer, regardless of age, intends to proportionally distribute all of the resources during the duration of his lifespan. The average earning is the same for every age group in the earning range in every given year, 't'. The average expected by any age group T for each subsequent period t within the earning range is the same in a given year r (Ando & Modiglian, 1963).

The study relies on the permanent-income hypothesis and life cycle hypothesis to understand the savings behaviour. These theories assert that savings are influenced by current and future consumption, as well as income that is currently earned and income anticipated in the future, where a rise in income leads to increased savings. Thus, these theories serve as a guide for the explanatory variables used in the research methodology.

3.3 EMPIRICAL LITERATURE

There are few existing studies that have been developed to examine how GDP, inflation rate and interest rate affect national savings.

3.3.1 GDP and national savings

Tang & Ch'ng (2012) employed Bartlett corrected trace test and time series data from 1970 to 2010 for cointegration to look into the long run relationships in five ASEAN economies. Their study confirmed a positive correlation between gross domestic savings and real GDP in all five economies. They also concluded that high savings rate results to economic expansion and development. The study went further to estimate the effect of real interest rates and the results demonstrated that real interest rate have a favourable effect on savings in Singapore, Indonesia, Thailand, and Malaysia while the effect is negative in Philippines. Jilani & Sheikh (2013) explored Pakistan, and their study similarly indicated that the GDP has a significant impact on national savings, however, inflation and interest rates have a negative impact.

The factors that influenced Ethiopian's national savings for the period 1980 to 2016

was investigated using ARDL approach as well as ECM. The long run results showed that real GDP growth and national savings are positively correlated while other variables such as inflation rate as a proxy of consumer price index is reported to be negatively and statistically insignificant (Anulo, 2015). Abasimi & Martin (2018) analysed national savings in four West African countries including Togo, Ghana, Cote d' Ivoire and Burkina Faso. ARDL approach was employed, and the study revealed in the long and short run that gross domestic savings and GDP have a positively related. Also, the real interest rate has a positive effect on gross domestic savings in the short and long run. These results also concur the findings obtained by (Tang & Ch'ng, 2012).

Odhiambo (2019) also used ARDL approach to investigate the responsiveness of Kenya's gross national savings rate to fiscal and monetary policy changes from 1980 to 2018 period. He found that real GDP growth has both long and short run positive significant impact on national savings. Furthermore, in the long run inflation rate revealed a positive relationship with national savings indicating a precautionary motive for holding money during inflationary pressures.

Adopting an ARDL bound test approach, Nagawa, Wasswa & Bbaale (2020) examined the determinants of Uganda's gross domestic savings from 1980 to 2017. Their findings revealed that GDP growth rate and gross domestic savings are positively correlated. Inflation, interest rates, and real GDP growth are the three factors that are explored in the study. GDP has a significant impact on national savings over the long term and insignificant in the short term. Both the rates of inflation and interest positively impact savings over the long-term (Ahmad, 2020).

3.3.2 Inflation rate and national savings

The Augmented Dickey-Fuller and cointegration tests were adopted to look into the effect of variables on national savings rate in the Kingdom of Bahrain from 1993 through 1999. The study indicates that real GDP growth positively impacts national savings whereas the nominal interest rate positively impacts national savings significantly at 1% level of significance in the short-term. The nominal interest rate variable was used and inflation was not taken into account. Lastly it was found that both the short and long run effect of inflation on national savings is positive and significant (Abou El-Seoud, 2014). The results of Odhiambo (2019) support the

findings of Abou El-Seoud (2014) were both their studies pointed out a positive effect of inflation rate on national savings. However, Anulo (2015)'s study of the Ethiopian national savings determinants from 1980 to 2016 contradicts the results obtained by Odhiambo (2019) and Abou El-Seoud (2014).

In Pakistan, between 1974 and 2010, ARDL was used to assess robustness for long-term relationships and ECM for short-term dynamics. The national savings is found to be negatively impacted by the inflation rate (Ahmad & Mahmood, 2013). Aric (2015), evaluated the determinants of savings in APEC countries and he used Panel data for 16 APEC countries in the years of 2010 to 2012. The findings demonstrated that the rate of inflation has not significantly impacted savings. In the long-term inflation has a negative effect on gross domestic savings and there's no significance to the relationship (Sahin, 2016).

Mojekwu & Ogbulu (2017) also analysed the Nigerian national savings' determinants from 1981-2015 based on Keynesian Theory of absolute income, relative income hypothesis, and the Life Cycle hypothesis. The results of their research concluded that inflation rate is inversely correlated with national savings and it is an insignificant determinant of Nigerian national savings. The results of the review of Ethiopia indicated that the country's national savings were positively impacted by inflation rate. (Tage, 2017).

Yakubu, Oumarou & Abdallah (2022) observed that inflation rate significantly positively impacts gross domestic savings in Ghana. ARDL technique was utilised andthe findings revealed that inflation rate and gross domestic savings are positively related in the short-term.

3.3.3 Interest rate and national savings

Some researchers had different views where Kwakwa (2013) employed the Johansen cointegration and ECM to investigate the determinants of national savings in Ghana from 1975 to 2008. He used annual time series data and he found that real interest rate has a negative impact on savings in the long run while it has an insignificant effect in the short run. Khan, Teng, Nauman & Jadoon (2017) revealed that inflation rate has statistically significant impact on gross domestic savings while interest rate

has an insignificant effect on the gross domestic savings. The analysis of Dash and Kumar (2018) showed that real interest rates significantly and negatively affect on gross domestic savings.

Alvi & Fatima (2017) focuses on various factors on domestic savings in Pakistan including interest rate, unemployment and inflation rate. This analysis makes use of ARDL, which demonstrates that the interest rate has a negative insignificant impact on domestic savings. They also emphasise how the rate of inflation significantly and negatively affects domestic saving.

3.3.4 Causal relationship between the variables

Elias & Worku (2015) used the Vector Error Correction method and Johnson's approach to analyse the causal relationship between savings and economic growth in East Africa (1981-2014). Granger's Causality results between GDP and gross domestic savings demonstrated that unidirectional causality exists for Ethiopia and Uganda. This implies that economic growth has expanded gross domestic savings. A study by Mohanty (2018) utilised ARDL approach and it reported a unidirectional causality in Ethiopia. However, a study by Mohanty (2019) contradicted with Mohanty (2018), and Elias & Worku (2015)'s study where he found a bidirectional causality.

Pickson, Enning & Siaw (2017) and Yaya (2018) explored causality in Ghana and presented different views. The findings of Pickson, Enning & Siaw (2017) displayed a unidirectional causality that exists between GDS and economic growth. On the other hand, Yaya (2018) found a bidirectional causality between the two variables. For seven Caucasus and Central Asian nations, a panel VECM granger causality study was conducted between 1993 and 2017. According to the econometric analysis, gross domestic savings were discovered to be the cause of economic expansion. The causality of gross domestic savings further suggests that savings rate is an essential for development in developing economies (Govdeli, 2022).

The study looked into the relation between domestic savings and other explanatory variables including inflation rate through VECM in Bangladesh and it revealed a causal relationship between GDS and inflation rate in the long run. In the short run, there's no causal relationship (Khan & Sarker, 2016). Tage (2017) looked at a study to

demonstrate how Ethiopia's small open economy's inflation rate affected savings. Although saving does not granger cause inflation, the direction of causality test revealed the presence of a unidirectional causality that runsfrom inflation to saving. Toda Yamonte method and Granger Causality were used to examine the short term causality in Pakistan, and the results suggested that both private savings and inflation rate does not granger cause each other (Ahmad, 2015).

In Nigeria, Bulo (2019) carried out a study that examined the dynamic relationships between inflation, interest rates, and savings. The findings proved two things: first, that the inflation rate does not have a causal relationship with the growth of gross national savings, and second, that the interest rate does not have a causal relationship with savings. Thus, neither the interest rate nor the inflation rate encourage the mobilisation of savings in Nigeria. A causal relationship between interest rates and domestic savings was not identified by Elom-Obed, Odo, Udude & Okonkwo (2019), who also looked at the factors influencing Nigerian domestic private saving. Yet, the findings of Adelakun (2015)’s study suggested a unidirectional causality between interest rate and gross national savings.

According to Tjiho (2020) investigation into the relation between Namibia's gross domestic savings and interest rates, the repo rate was used as a proxy for interest rates. Since the probability values were above the level of significance (5%), it implies that there’s a non-directional relationship between the interest rate and gross domestic savings. As a result, the null hypothesis is not rejected.

3.3.5 The behaviour of national savings to shocks applied to GDP, inflation rate and interest rate

According to the analysis of Ahmad (2015), savings responded immediately to the shocks. Savings had a mixed response to inflation. Savings responded positively in the first two years, but then began to drop and reached the lowest point. Between the years, savings had both positive and negative responses. One standard deviation shock of inflation given to gross domestic savings initially increased. The inflation rate was in the positive range at the start of the period and in the negative range throughout. The variance decomposition of gross domestic savings found that the inflation rate had the least influence in both the short and long run (Khan & Sarker,

2016).

Bulo (2019), demonstrated the variance decomposition and the results displayed that gross national savings rate is strongly influenced by its variation in its shock. The influence of interest rates lagged behind the inflation rate, where they had little impact on the mobilization of savings. According to Tjiho (2020)'s study findings, the response to interest rates fluctuates by one standard deviation. In the first year, there is a positive and statistically significant change in gross domestic savings. It then responded negatively since it had been in the negative region for the entire period. The empirical results reveal that between 2012 and the post-pandemic era, there is a knowledge gap from a South African perspective. This chapter aims to fill the gap in understanding South African national savings.

3.4 SUMMARY

The theoretical literature supporting the study were outlined in this chapter. The chapter also covered the empirical literature which examined the impact of GDP, inflation rate and interest rate on the national savings. Researchers revealed a positive correlation between GDP and national savings. On how the inflation rate affects national savings, several revelations have been made. While other scholars pointed out a positive impact others revealed a negative impact. There were also different views on the relationship of interest rate and national savings. Several studies showed a negative significant effect of interest rate on national savings and on the other handother researchers found a negative insignificant impact. Finally, some research showed no causal relationship between the explanatory variables and savings, while others revealed a bidirectional or unidirectional relationship. In Chapter 4 the study's proposed research methodology is outlined**.**

CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

In Chapter 3, gaps were identified and the correlations between the variables were highlighted through a review of both theoretical and empirical literature. This chapter details the methodology that is used to achieve the study objectives. The research design, data collection and model specification are discussed followed by a thorough explanation of the estimation techniques in the form of unit root tests, cointegration analysis, Autoregressive Distributed Lag model (ARDL), diagnostic tests, stability tests, impulse response and variance decomposition.

4.2 RESEARCH DESIGN

This research employs a quantitative approach to uncover, analyse, and describe how economic growth, inflation rate and interest rate affects South Africa's national savings.

4.3 DATA COLLECTION

The study uses annual time series data spanning from1980-2022. Data for real interest rate, Gross domestic savings as a percentage of GDP, real GDP growth and inflation rate is obtained from the World Bank.

4.4 MODEL SPECIFICATION

The study adopted the model used by Abou El-seoud (2014), however that study included a nominal interest rate; therefore, this study incorporated the real interest rate that was used in the model by Bulo (2019). The national savings model is specified as follows:

$$GDS_t = \beta_0 + \beta_1 GDP_t + \beta_2 INF_t + \beta_3 RIR_t + \varepsilon_t \quad (4.1)$$

where, GDS_t denotes Gross domestic savings as a percentage of GDP which is used as a proxy for national savings. Gross domestic savings is the dependent variable that is analysed to highlight its important significance in the nation's development given

that it serves as the primary financing source for investment activities and creation of initiatives that foster socioeconomic development.

GDP_t represents Real Gross Domestic Product Growth rate and is a proxy for economic growth. The main factor determining national savings is the real GDP growth (Abou El-Seoud, 2014). Where there is a positive relationship between real GDP growth and savings. This means that increased savings will allow for a more rapid expansion of capital investment. According to the marginal propensity to save theory, savings rise as income increases. As a result, when the economy grows, so does the amount of savings (Elias & Worku, 2015). Thus, β_1 is anticipated to be positive in the long and short run.

INF_t stands for inflation rate; Epaphra (2014) postulates that inflation indicates the influence of macroeconomic uncertainty on savings principally through its impact on precautionary savings. It is projected that high inflation could reduce savings. Therefore, β_2 it is assumed to be both positive and negative sign.

RIR_t denotes the real interest rate. According to life cycle theory, interest rates on savings are divided into two effects. The substitution effect implies that savings are positively impacted, whereas the income effect implies that an individual is a net borrower. As a result, if the income effect is surpassed by the substitution effect, interest rates are predicted to positively impact savings. β_3 is anticipated to be positive as an increase in real interest rate is projected to increase national savings.

and ε denotes error term.

4.5 ESTIMATION TECHNIQUES

All of the econometric techniques utilised in the study are detailed in this section.

4.5.1 Stationarity/Unit root test

Time series data is non- stationary when it has unit root therefore unit root test should be performed as the first step. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) are used. Brooks (2008) state that unit root tests are performed to determine

order of integration since it can influence its behaviour and to avoid spurious regressions.

The criteria as follows must be met in a stationary time series:

Mean: $E(Y_t) = \mu$ (4.2)

Variance: $E(Y_t - \mu)^2 = \sigma^2$ (4.3)

Covariance: $\gamma_k = E(X_t - \mu)(X_{t+k} - \mu)$ (4.4)

4.5.1.1 Augmented Dickey-Fuller test (ADF)

ADF is used for unit root testing based on an autoregressive (AR). It tests the null hypothesis of an autoregressive integrated moving average (ARIMA) (Cheung & Lai, 1995).

$$\Delta x_t = \mu + \gamma t + \alpha x_{t-1} + \sum_{j=1}^{k-1} \beta_j \, \Delta x_{t-j} + \mu_t \quad (4.5)$$

x_t is time series to be tested for unit root, where Δ is the difference operator and μ_t is a white-noise error term.

4.5.1.2 Phillips-Perron test

Phillips-Perron is another test for testing the presence of unit root in a model. It is similar to ADF test, however, the difference is PP is nonparametric with respect to parameters and it allows a wide class of time series in which there is a unit root where the ADF test use parametric autoregression to estimate the autoregressive and moving average (ARMA) structure of errors in the test regression (Phillips & Perron, 1988). Both the tests give the same conclusions. The criticism of ADF and PP test is that their power is low against I (0) alternatives that are close to being I (1). That is a unit root test cannot differentiate persistent stationary process from non-stationary process (Brooks, 2008).

4.5.2 Lag length criteria

The purpose of selecting the optimal lag is to minimise residual correlation using statistical measures like Sequential modified test static (LR), Final prediction error (FPE), Akaike Information Criterion (AIC), Hannan-Quin Information Criterion (HQ) and Schwarz Information Criterion (SC). In accordance with the thumb rule, the autocorrelation function can be used to calculate the lag length up to a third or fourth of the time series' overall length (Gujarati, 2003).

The equation of AIC is given by:

$$AIC = nlog\ (\frac{RSS}{n}) + 2k \quad (4.6)$$

RSS is residual sum of squares of fitted model, k is the number of coefficients and n is the sample size.

A model with a minimum value is preferred (Hu, 2007). Thus, to avoid the challenges of using too few lags and too many lags, the lag length estimated by the statistical measures will be utilised to perform the cointegration test.

4.5.3 Cointegration analysis

When the variable's order of integration is identified through a stationary test the next step is to perform a cointegration test. Engle & Granger (1987) state that a cointegration is a technique that is used to find a correlation between several time series in the long run relationship. When a linear combination of time series is cointegrated it means they will be stationary although some linear combinations of time series have a lower order of integration. A cointegrating relationship is seen as a long run relationship since non-stationary variables are integrated together in a way that prevents them from deviating from equilibrium over a long-term (Brooks, 2008).

After unit root testing on the time series is completed, bounds test is performed between each variable in the model under the assumption that not all variables are integrated in the same order. Pesaran, Shin & Smith (2001) asserted that a long-term relationship between the levels of y_t and x_t is estimated by the bounds testing approach. The approach is based on a statistic known as the Wald or F-statistic, which is utilised in a generalised Dickey-Fuller type regression to examine the significance

of lagged variables under condition in unrestricted error correction regression. It is assumed in this technique that, regardless of whether the regressors are I (0), I (1), or mutually cointegrated, the asymptotic distributions of both statistics are non-standardunder the null hypothesis that there is no relationship in levels between the included variables. (Perasan, et al., 2001).

4.5.3.1 Johansen cointegration test

Johansen's technique is implemented in the model following unit root testing, assuming that all variables in a time series are integrated in the same order. In order to determine how many cointegrating relationships exist among variables, Johansen (1988) estimate and test vector error correction model(VECM) based on vector autoregressive(VAR) equations.

The given equation is:

$$Y_t = \mu + A_1 y_{t-1} + \ldots + A_p y_{y-p} + \varepsilon_t \quad (4.7)$$

Y_t is an nx1 vector of variables that are integrated of I(1) and ε_t is nx1 vector of innovations.

The VAR equation can also be expressed as:

$$\Delta Y_t = \mu + \prod_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-1} + \varepsilon_t \quad (4.8)$$

Where:

$$\prod = \sum_{i=1}^{P} A_i - I \quad (4.9)$$

$$\Gamma_i = -\sum_{j=i+1}^{p} A_j \quad (4.10)$$

If the coefficient matrix $\prod$ has reduced rank r<n, then there are nxr matrices each α and β with rank r such that $\prod = \alpha\beta'$ and $\beta' y_t$ are stationary. r is the number of cointegrating relationships, the elements of α are known as vector error correction model adjustment parameters and each column of β is a cointegrating vector.

Johansen presents two likelihood ratio tests, the maximum eigenvalue test and the trace test, which are illustrated in equations (4.11) and (4.12) (Hjalmarsson & Österholm, 2007).

$$J_{max} = -T1n(1 - \lambda_{r+1}) \quad (4.11)$$

$$J_{trace} = -T \sum_{i=r+1}^{n} 1n(1 + \lambda_i) \quad (4.12)$$

T is the sample size and λ_i is the $i'th$ largest standardised correlation in equations (4.11) and (4.12). The trace test compares the alternative hypothesis, n cointegrating vectors, with the null hypothesis, r cointegrating vectors. The maximum eigenvalue test compares the alternative hypothesis, r+1 cointegrating vectors, to the null hypothesis of r cointegrating vectors. Thus in order choose the relevant technique, the Johansen test was discussed. Since the Johansen technique is unsuitable for this study, it will not be employed.

4.5.4 Autoregressive Distributed Lag (ARDL)

Pesaran, Shin & Smith (2001) proposed the ARDL approach, which is also known as a bound test. It is used to determine whether there is a relationship between the variables regardless of their order of integration. If there is cointegration it means that there's a long-term relationship between variables. Two critical values are given which are the lower and upper bound (Pesaran et al., 2001). When the computed F statistic falls outside the critical values of both lower and upper bound it means cointegration exists. If the F statistic is less than the lower bound then there is no cointegration however, if F statistic is between critical values of lower and upper bound then the results are inconclusive.

The alternative hypothesis of cointegration and the null hypothesis of no cointegration:

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 \quad (4.13)$$

$$H_1 = \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0 \quad (4.14)$$

ARDL approach is adopted due to limitations of Johansen's technique. When it is compared to other cointegration tests like Johansen (1988), the bounds test is superior

because you cannot use Johansen test if one or more variables are stationary at level (I0) while other variables are stationary at first level (I1) however, with bound testing you can examine the long run relationship even if the variables are stationary at different levels as it gives desired results. Thus, the model that is estimated in this paper will adapt the ARDL approach.

The null hypothesis of a bound test is rejected when F statistic exceeds the level of significance as it indicates cointegration in the long run.

The equation of ARDL is given by:

$$yt = \alpha_0 + \alpha_i t + \sum_{i=1}^{p} \emptyset y_{t-1} + \beta' x_t + \sum_{i=0}^{q-1} \beta i^{*'} \Delta x_{t-1} + \mu_t \quad (4.15)$$

$$\Delta x_t = P1\Delta x_{t-1} + P2\Delta x_{t-2} + \cdots + P_s \Delta x_{t-s} + \varepsilon_t \quad (4.16)$$

x_t represent the k-dimensional I(1) variables that are not cointegrated among themselves, where the μ_t and ε_t are serially not correlated disturbances with zero means and constant variance-covariance. P_i are $k \times k$ coefficient matrices that vector autoregressive in Δx_t is stable. Lastly, it is assumed that $1 - \sum_{i=0}^{p} \emptyset_i z^i = 0$ all fall outside the unit circle and a unique stable long run relationship exists between y_t and x_t.

ARDL specification for the National Savings model:

$$\Delta GDS_t = \beta_0 + \beta_1 GDS_t + \beta_2 GDP_{t-1} + \beta_3 INF_{t-1} + \beta_4 RIR_{t-1} + \sum_{i=1}^{p} \beta_5 i \Delta GDS_{t-1} + \sum_{i=1}^{q} \beta_6 i \Delta GDP_{t-1} + \sum_{i=1}^{r} \beta_7 i \Delta INF_{t-1} + \sum_{i=1}^{s} \beta_8 i \Delta RIR_{t-1} + \varepsilon_t \quad (4.17)$$

Δ- first difference

β- Coefficients

ε_t –white noise residuals

The gross domestic savings is indicated on the left side of the equation, and the long-term relationship between the variables and coefficients is represented by the

numbers $\beta_0 - \beta_4$. $\beta_5 - \beta_8$ represent the short-term relationships between the variables as well as the short-term coefficients of the model.

The ARDL approach provides the error correction model (ECM) and it depicts the speed of adjustment, and it must be negative and significant (Brooks, 2008). The negative coefficient shows how much the model will converge back to equilibrium and the higher the coefficient the greater speed of adjustment of the model.

The equation is: $\Delta y_t = \beta_1 \Delta x_t + \beta_2 (y_{t-1} - yx_{t-1}) + \mu_t$ (4.18)

Y represent the long run relationship between x and y. β_1 symbolises short run relationship between changes in x and changes in y. Where β_2 describes the speed of adjustment back to equilibrium.

As a result, the equation below can be used to represent the ARDL version of the ECM for the National savings model:

$$\Delta GDS_t = \beta_0 + \sum_{i=1}^{p} \beta_1 i \Delta GDS_{t-1} + \sum_{i=1}^{q} \beta_2 \Delta GDP_{t-1} + \sum_{i=1}^{r} \beta_3 i \Delta INF_{t-1} + \sum_{i=1}^{s} \beta_4 i \Delta + \sum_{i=1}^{t} \beta_5 i \Delta RIR_{t-1} + \gamma ECT + \varepsilon_t \quad (4.19)$$

γ - Adjustment speed

ECT- denotes error correction term derived from the residuals obtained from the ARDL equation (3.17).

4.5.5 Granger causality analysis

Time series' integration and cointegration are examined prior to the granger causality test. Through unit root tests, the integration is performed to check whether the series is stationary. A cointegration test is used to determine whether the series is cointegrated (Ahmad, 2015).

The direction of the causal relationship between two variables is determined by Granger causality. Causality is derived when lagged values of a variable x_t indicate explanatory power in a regression of a variable y_t on lagged values of $y_t$and x_t, as described by (Granger, 1969; Sims, 1972 & Green, 2002).

Causality can be bidirectional, indicating that x_t causes $y_t$and y_t causes x_t, or it can be unidirectional, meaning that x_t causes $y_t$but y_t does not cause x_t. The null hypothesis is rejected, implying causality, if the probability value is less than the level of significance. On the other hand, a null hypothesis is not rejected when the probability value surpasses the level of significance, demonstrating no causality.

The Granger Causality equation established by VAR in a multivariate regression:

$$Y_t = \begin{bmatrix}\mu_1 \\ \mu_2\end{bmatrix} + \begin{bmatrix}\alpha_1 & \alpha_2 \\ \beta_1 & \beta_2\end{bmatrix} y_{t-1} + \begin{bmatrix}\varepsilon_{1t} \\ \varepsilon_{2t}\end{bmatrix} \quad (4.20)$$

4.5.6 Diagnostic testing

Diagnostic tests are conducted to identify whether one of the assumptions of the classical normal linear regression model (CLRM) have been violated (Gujarati, 2004). It includes a test for heteroscedasticity, serial correlation, normality and misspecification.

4.5.6.1 Normality test

Jarque-Bera test is applied to test for normality. It is used to determine whether a variable is normally distributed. The residuals are distributed normally with zero mean and variance. Jarque-Bera test entails coefficient of skewness and kurtosis of random variable. Skewness measures the asymmetric of mean value and kurtosis measures how fat the tails of the distribution are (Brooks, 2008). Normal distribution

is not skewed and kurtosis is 3 (Gujarati, 2004).

$$JB = \frac{n}{6}\left[S^2 + \frac{(K-3)^2}{4}\right] \quad (4.21)$$

N- sample size

S-Skewness

K- Kurtosis

When variable is normally distributed S is zero and (K-3) is also zero and therefore,the value of JB statistic is zero (Gujarati, 2004).

The null hypothesis:

H0: variable is normally distributed

H0: rejected when p-value is ≤ level of significance.

4.5.6.2 Serial correlation

Gujarati (2004) asserted that in the context of regression, CLRM assumes that there is no correlation in disturbances μi.

$$E(Ui, Uj) = 0;\ i \neq j \quad (4.22)$$

Where Ui and Uj is zero.

The Breusch-Godfrey test is used for testing a serial correlation up to the rth order (Brooks, 2008).

The null and alternative hypothesis:

H0: P1=0 and P2=0 and…and Pr=0

H1: P1≠0 or P2 ≠0 or… or Pr ≠0

4.5.6.3 Heteroscedasticity

If the variance of error term changes, they are said to be heteroscedastic therefore, classical regression model assumptions are violated. White general test is used to test heteroscedasticity.

The model is: $Yi = \beta 1 + \beta 2X_{2i} + \beta 3X_{3i} + \mu i.$ (4.23)

Regression is estimated by Ordinary Least Squares (OLS) and obtaining the residuals μi.

Then auxiliary regression should be estimated:

$$\mu^2 i = A1 + A2X_{2i} + A3X_{3i} + A4X^2 2i + A5X^2 3i + A6X_{2i}X_{3i} + vi \quad (4.24)$$

Where vi is a normally distributed disturbance term independent of μi. In null hypothesis there is no heteroscedasticity (Gujarati, 2004). It can be concluded that if p-value of computed Chi-square is higher than the significance level, null hypothesis is not rejected. When p-value of computed Chi-square is less than level of significance null hypothesis is rejected. The conclusion would be that there is significant evidence of heteroscedasticity.

4.5.6.4 Misspecification

Ramsey's reset test is developed to test misspecification. Misspecification is when either functional form or regressors, or measured data in an equation is not correct (Gujarati, 2004). Ramsey asserts that when testing the significance of the variables and they are found to be significant the model is misspecified.

Misspecification happens when:

- Relevant variables are omitted.
- Irrelevant variables are included.
- Relevant variables are excluded.

The null and alternative hypothesis are estimated:
H1: misspecification
H0: no misspecification

4.5.6 Stability testing

The cumulative sum of squares of recursive residuals (CUSUMSQ) and the cumulative sum of recursive residuals (CUSUM) test the stability of the short run and long run parameters. Brooks (2008) state that, the perfect parameter stability of CUSUM has zero null hypothesis and the null hypothesis of CUSUMSQ parameter stability will start at zero and end with a value of 1. Furthermore, a model that is stable is observed when the CUSUMQ and CUSUM lines move inside the confidence bands. The conclusion would be the null hypothesis of stability is not rejected.

The CUSUM test is based on:

$$cusumt = (1/s)\sum_{i=k+1}^{t} W_1 \quad (4.25)$$

The CUSUMQ:

$$CusumQ = (\sum_{i=k+1}^{t} {W_1}^2 / \sum_{t=k+1}^{n} W_i{}^2) = RSS_t / RSS_n \quad (4.26)$$

Where:

RSS_t = residual sum of squares of the recursive residuals

RSS_n = residual sum of squares of OLS residuals for null sample period

4.5.7 Impulse Response Function and Variance Decomposition

To predict the shock effect from the regressor to macroeconomic indicators, the VAR's impulse response and variance decomposition approaches are applied.

4.5.7.1 Impulse Response function

Sims (1980) established Cholesky decomposition, in which the underlying shocks are orthoganalised. The method, nevertheless, was insensitive to the VAR's variable ordering. Pesaran and Shin (1998) proposed the Impulse response function (IRF) as a solution to this.

The impulse response illustrates how each variable's dependent variables in the VAR respond to shocks (Brooks, 2008). This dependent variable is an indigenous variable. Brooks (2008), further points out that the standard deviation of the error term applies a unit shock for each variable, and the effect is seen over time in the VAR system. The importance of IRF resides in how it tracks the effects of a one standard deviation shock to one of the innovations on the current and future values of the endogenous variable.

As stated by Ahmad (2015), the zero line on impulse response plots indicates whether a response is statistically significant or insignificant. When a response is statistically significant, it is above the zero line and statistically insignificant responses are those that fall below the zero line.

4.5.7.2 Variance decomposition

Variance decomposition provides an alternative technique for analysing the dynamics of the VAR system (Brooks, 2008)**.** The proportion of changes in the dependent variables that are attributable to their own shocks as opposed to shocks to the other variable is given. Brooks (2008) postulate that the variance decomposition estimates

the proportion of a given variable's forecast error variance that can be accounted for by innovations in each explanatory variable. To some extent, the information provided by impulse response and variance decomposition are the same.

4.1 SUMMARY

This chapter detailed the methodology used in order to determine the relationship that exists between economic growth, inflation rate, interest rate and national savings. In addition, it provided a clear explanation of the econometric techniques employed in the study. Lastly, ARDL approach has been chosen as the best estimation method due to its superiority over other methods. Therefore, ARDL will be utilised to estimate the national savings model. In Chapter 5, the objectives of the study stated in Chapter 1 will be achieved by an application of the analytical framework that has been outlined in this chapter and relate it to the South African context.

CHAPTER 5

DISCUSSION AND PRESENTATION OF FINDINGS

5.1 INTRODUCTION

The research methods which were discussed in Chapter 4 are applied in this chapter. The descriptive analysis is performed first, then informal unit root test, followed by ADF and PP tests to determine whether the series contain unit roots. ARDL bound test is applied to test the relationship between the variables. The short and long run estimated relationships are discussed, as well as the results of diagnostic and stability testing. Additionally, the causality test and the impulse response function and variance decomposition results are discussed.

5.2 EMPIRICAL TESTS RESULTS

5.2.1 Descriptive analysis

To determine the statistical properties of the variables, descriptive analysis is used (Epaphra, 2014). Table 5-1 presents the descriptive statistics of the variables.

Table 5-1: Descriptive statistics results

Statistical test	GDS	GDP	INF	RIR
Mean	20.00205	2.099958	8.504760	4.073968
Median	18.67852	2.400000	7.039727	4.027493
Maximum	33.69330	6.620583	18.65492	12.69103
Minimum	16.39346	-6.342471	-0.692030	-11.00901

Standard deviation	3.834820	2.565199	4.609310	3.941672
Skewness	1.747736	-0.809198	0.430097	-0.897377
Kurtosis	5.881351	4.110212	2.211543	6.891121
Jarque-Bera	36.76591	6.901096	2.439529	32.89852
Probability	0.000000	0.031728	0.295300	0.000000
Sum	860.0881	90.29819	365.7047	175.1806
Sum Sq. Dev.	617.6455	276.3703	892.3209	652.5447
Observations	43	43	43	43

Source: Author's computation using Eviews 12

Table 5-1 demonstrates descriptive statistics that point to positive means for GDS, GDP, INF, and RIR. This shows that the variables are improving. INF, however, has a higher share than GDP, with a mean of 8.50%, while GDP has a lower share, at 2.10%, respectively. Kurtosis, which measures how flat a distribution is, must be 3, as previously explained in Chapter 4. All variables other than INF have kurtosis values greater than 3, hence the value of INF indicates a flat distribution. All of the variables, with the exception of INF, reveal non-normality, with a probability value below the 5% level of significance. Positive skewness is shown by GDS and INF, whereas negative

skewness is shown by GDP and RIR. The distribution is shown to be skewed to the right by the positive skewness and to the left by the negative skewness.

The correlation and covariance of GDP and inflation are both positive, as seen in Table 5-2. Inflation and GDP covariance's are 9.89 and 2.39 respectively. This indicates that the GDP is moving in the same direction as inflation as measured against GDS. A positive relationship between GDP, inflation, and GDS is seen by the correlation. However, the correlation of inflation is 0.57, showing a strong positive correlation, whereas the correlation of GDP of 0.25, indicating a weak correlation. The real interest rate covariance is negative, suggesting that they are moving in the opposite direction. The correlation is also negative, indicating an adverse relationship with GDS, but the correlation coefficient of -0.52 shows a strong negative correlation

Table 5-2: Covariance Analysis

Covariance **Correlation** **Probability**	**GDS**	**GDP**	**INF**	**RIR**
GDS	14.36385 1.000000			
GDP	2.390773 0.248823 0.1076	6.427217 1.000000		
INF	9.893916	-2.285777	20.75165	

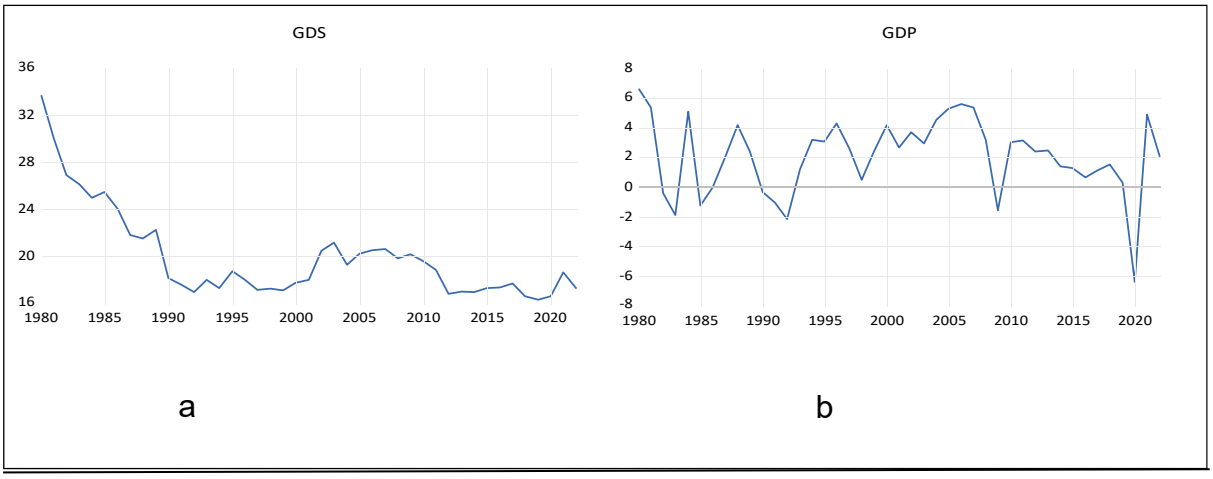
	0.573068 0.0001	-0.197923 0.2033	1.000000	
RIR	-7.648249 -0.518031 0.0004	-0.023833 -0.002413 0.9877	-6.228589 -0.350988 0.0210	15.17546 1.000000

Source: Author's computations using Eviews 12

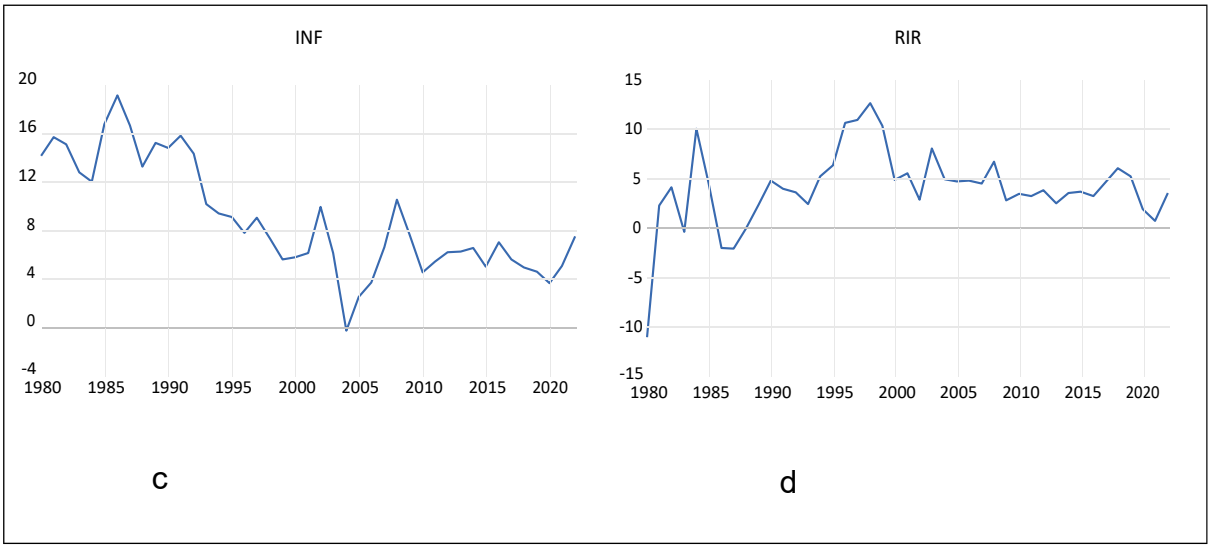
5.2.2 Unit root tests results

Figure 5-1 illustrate informal unit root testing. It reveals that GDS, GDP, INF and RIR are at level. The graph does not appear to move around the mean, indicating that graph (a), (b), (c) and (d) are trending both upwards and downwards. GDS, GDP, INF and RIR are not stationary and must be differenced in order to become stationary.

Figure 5-1: Time series at level



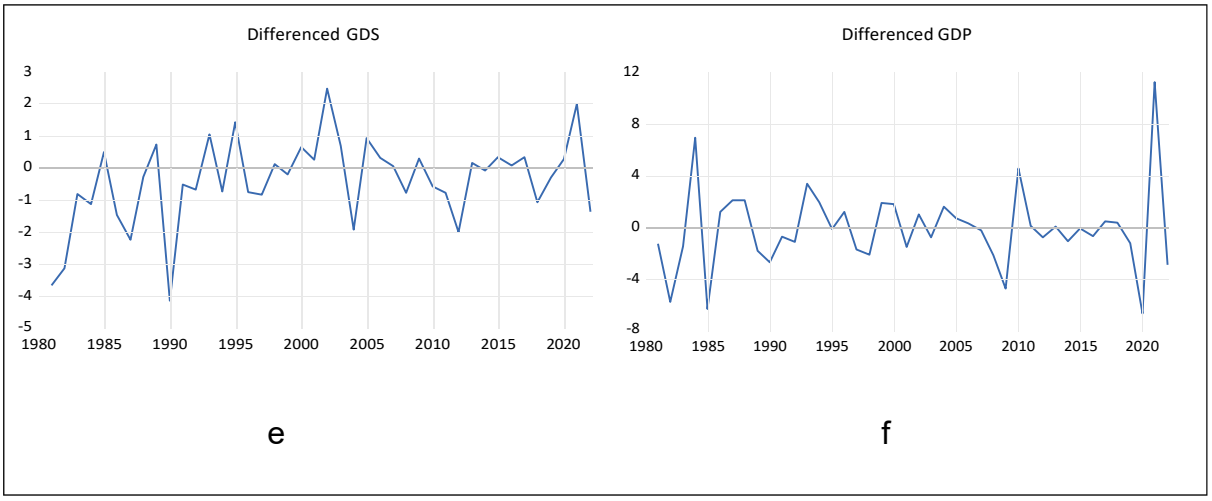
Source: Author's construction using Eviews12



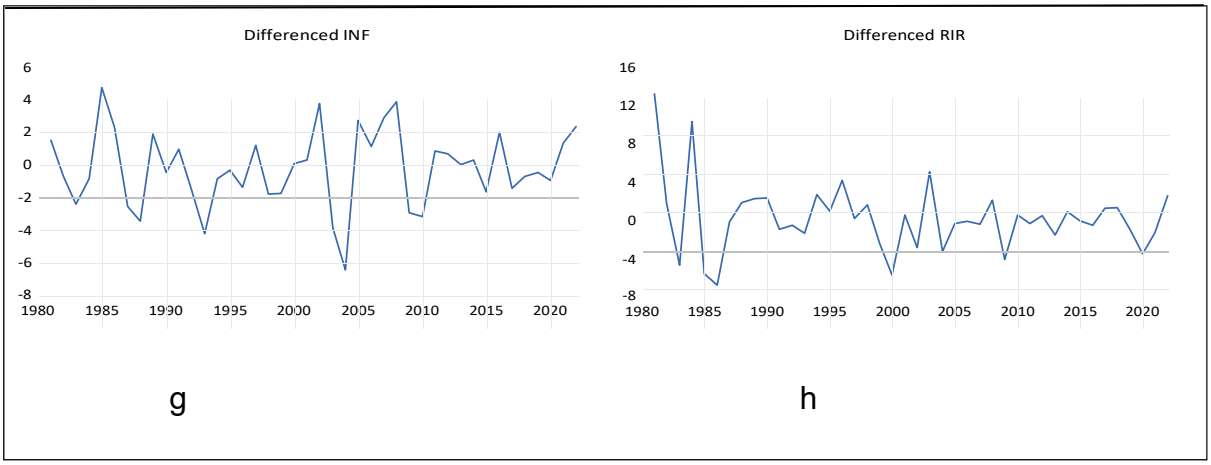
Source: Author's construction using Eviews12

Figure 5-2: Time series at 1st difference

Figure 5-2 depicts how GDS, GDP, INF and RIR are integrated of order 1. However, the graphical approach is not wholly reliable. Therefore, the ADF and PP unit root tests were used for stationarity in Table 5-1 and Table 5-2 to complement the informal unit root methodology.



Source: Author's construction using Eviews12



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Source: Author's construction using Eviews12

5.2.2.1 ADF unit root test

The ADF computed results are summarised in Table 5-3, and the complete findings are displayed in Appendix A.

Table 5-3: ADF Unit root test results

Variables	**Model**	**Phillips Perron**	**Order of integration and conclusion**
GDS	Intercept	-4.852131 (0.0003) ***	I(0) Reject H0:stationary
	Trend and Intercept	-4.002954 (0.0161)**	I(0) Reject H0:stationary
	None	-2.680968 (0.0086)**	I(0) Reject H0:stationary

Δ GDS	Intercept	-6.084444 (0.0000)***	I (1) Reject H0: stationarity
	Trend and Intercept	-6.368242 (0.0000)***	I (1) Reject H0: stationarity
	None	-5.883797 (0.0000)***	I (1) Reject H0: stationarity
GDP	Intercept	-5.328269 (0.0001)***	I(0) Reject H0: stationary
	Trend and Intercept	-5.239920 (0.0006)***	I(0) Reject H0: stationary
	None	-3.898667 (0.0002)***	I(0) Reject H0: stationary
Δ GDP	Intercept	-9.019342 (0.0000)***	I(1) Reject H0: stationary

	Trend and Intercept	-8.948068 (0.0000)***	I(1) Reject H0: stationary
	None	-9.127587 (0.0000)***	I(1) Reject H0: stationary
INF	Intercept	-0.927402 (0.7685)	I(0) Do not reject H0: contains unit root, implying non-stationarity
	Trend and Intercept	-0.946589 (0.9396)	I(0) Do not reject H0: contains unit root, implying non-stationarity
	None	-1.556983 (0.1109)	I(0) Do not reject H0: contains unit root, implying non-stationarity
Δ INF	Intercept	-5.598179 (0.0000)***	I(1) Reject H0: stationary
	Trend and Intercept	-5.557600 (0.0003) ***	I(1) Reject H0: stationary

	None	-2.881473 (0.0052)**	I(1) Reject H0: stationary
RIR	Intercept	-5.479210 (0.0000)***	I(0) Reject H0: stationary
	Trend and Intercept	-5.235145 (0.0006)***	I(0) Reject H0: stationary
	None	-2.664514 (0.0089)**	I(0) Reject H0: stationary
Δ RIR	Intercept	-8.574878 (0.0000) ***	I(1) Reject H0:stationary

	Trend and Intercept	-8.394508 (0.0000)***	I(1) Reject H0:stationary
	None	-8.697509 (0.0000)***	I(1) Reject H0:stationary

Source: Author's computations using Eviews 12

Note: () denotes probability values; Δ denotes variable is differenced; *imply significant at 5% and H0 is rejected; **imply significant at 5% and 10% and H0 is rejected; ***imply significant 1%, 5% and 10% and H0 is rejected; ****imply significant at 1% and H0 is rejected; *****imply significant at 10% and H0 is rejected.

Table 5-3 reveals that INF variable contains unit root, hence it is not stationary at level and thus the null hypothesis cannot be rejected. GDS, GDP and RIR exhibited stationarity at level and the null hypothesis is rejected. At the first difference, when ADF was applied all the variables were integrated. GDS, GDP, INF and RIR became stationary at all levels.

5.2.2.2 Phillips Perron test

Table 5-4 presents a summary of the Phillips Perron results, and Appendix A presents the full data.

Table 5-4: PP unit root test results

Variables	**Model**	**Phillips Perron**	**Order of integration and conclusion**
GDS	Intercept	-5.110903 (0.0001) ***	I(0) Reject H0: stationary

	Trend and Intercept	-4.054891 (0.0142) **	I(0) Reject H0: stationary
	None	-2.601669 (0.0105) **	I(0) Reject H0: stationary
Δ GDS	Intercept	-6.129512 (0.0000) ***	I(1) Reject H0: stationary
	Trend and Intercept	-6.431862 (0.0000) ***	I(1) Reject H0: stationary
	None	-5.90824 (0.000) ***	I(1) Reject H0: stationary
GDP	Intercept	-5.317965 (0.0001) ***	I(0) Reject H0: stationary

	Trend and Intercept	-5.227283 (0.0006) ***	I(0) Reject H0: stationary
	None	-3.870316 (0.003) ***	I(0) Reject H0: stationary
Δ GDP	Intercept	-15.17902 (0.0000) ***	I(1) Reject H0: stationary
	Trend and Intercept	-13.00475 (0.0000) ***	I(1) Reject H0: stationary
	None	-15.15645 (0.0000) ***	I(1) Reject H0: stationary
INF	Intercept	-1.623892 (0.4618)	I(0) Do not reject H0: contains unit root, implying non-stationarity

	Trend and Intercept	-2.682049 (0.2488)	I(0) Do not reject H0: contains unit root, implying non-stationarity
	None	-1.322341 (0.1692)	I(0) Do not reject H0: contains unit root, implying non-stationarity
Δ INF	Intercept	-7.992549 (0.0000) ***	I(1) Reject H0: stationary
	Trend and Intercept	-11.15753 (0.0000) ***	I(1) Reject H0: stationary
	None	-6.304223 (0.0000) ***	I(1) Reject H0: stationary
RIR	Intercept	-5.409140 (0.0001) ***	I(0) Reject H0: stationary

	Trend and Intercept	-5.197753 (0.0006) ***	I(0) Reject H0: stationary
	None	-2.777880 (0.0066) **	I(0) Reject H0: stationary
Δ RIR	Intercept	-14.09113 (0.0000) ***	I(1) Reject H0:stationary
	Trend and Intercept	-18.15038 (0.0000) ***	I(1) Reject H0:stationary
	None	-14.29806 (0.0000) ***	I(1) Reject H0:stationary

Source: Author's computation using Eviews 12

Note: () denotes probability values; Δ denotes variable is differenced; *imply significant at 5% and H0 is rejected **imply significant at 5% and 10% and H0 is rejected ***imply significant 1%, 5% and 10% and H0 is rejected; ****imply significant at 1% and H0 is rejected; *****imply significant at 10% and H0 is rejected.

Table 5-4 shows that at level INF is non-stationary while GDS, GDP and RIR are stationary, hence the null hypothesis is rejected. When Phillips Perron test is applied, all the variables are integrated to the first level; GDS, GDP, INF and RIR became stationary at all models.

5.2.3 Lag Length Criteria

A lag selection process using a VAR prior cointegration test is required for the chosen National Savings model. The selected lag length is depicted in Table 5-5 below and all the results are presented in Appendix B. Utilising all the criteria, Lag 1 is chosen based on the lowest values of AIC, SC, and HQ as it balances model fit and complexity. In this case, AIC (17.07111*) is chosen as it improves forecasting whilst minimising information criteria. Cavanaugh & Neath (2019) holds that AIC is an appropriate selection for a predictive modeling application.

Table 5-5: Lag length criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-392.6627	NA	4815.860	19.83114	20.0002	19.89220
1	-321.4222	124.6010*	306.3897*	17.07111*	17.91555*	17.37643*
2	-313.2809	12.61891	465.8533	17.46405	18.98404	18.01363
3	-296.3775	22.81958	475.8910	17.41888	19.61442	18.21272

Source: Author's computation using Eviews 12

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

5.2.4 Cointegration test

In Table 5-6, presents the long run relationship between GDS and explanatory variables using bound test approach. In Appendix C, the complete results are presented. The model compromises of 3 independent variables, hence k=3. The calculated F statistic is 8.974896 and it is greater than all the lower bound and upper bound critical values at the 10%, 5% and 1% level of significance. As a result, cointegration exists in the long run relationship.

The national savings model's long run relationships between its variables were sufficiently proven by the bound test method which yielded results depicted in Table 5-6 which explicitly displays these relationships and the model's stipulated coefficients.

Table 5-6: ARDL bound test results

Calculated F statistic: 8.974896 No of independent variable: K=3			
Significance	Lower bound I(0)	Upper bound I(1)	Outcome
10%	3.47	4.45	Cointegration
5%	4.01	5.07	Cointegration
1%	4.52	5.62	Cointegration

Source: Author’s computation using Eviews 12

Table 5-7 illustrate long run relationship and complete data is displayed in Appendix C. GDP with -5.19% coefficient indicates a negative relationship between GDP and gross domestic savings and the relationship is insignificant. This implies that the proportion of savings tends to decline, which raises the possibility of a vulnerability to economic stability and confidence, which limits domestic investment and increases dependency on external funding. Furthermore, the result does not concur with the studies of (Tang & Ch’ng, 2012; Anulo, 2015 and Nagawa,Wassa, & Bhaale, 2020) as they found a positive relationship.

Table 5-7: ARDL estimated long run results

Variable	Coefficient	Standard error	t-statistic	Probability value
GDP	-5.185765	3.335788	-1.554585	0.1375
INF	-5.160951	2.848482	-1.811825	0.0867*
RIR	-0.799710	0.544578	-1.468494	0.1592

Source: Author's computation using Eviews 12

Note: *imply significant at 10%

Inflation stands at -5.16%, revealing a negative relationship with gross domestic savings that is significant at 10%. If inflation increases by 1%, holding everything constant, gross domestic savings is expected to decrease by 5.16%. The negative coefficient coincides with the prior expectation, while Ahmad & Mahmood (2013), Anulu (2015), and Aric (2015) also found a significant negative relationship between inflation and gross domestic savings over the long run. Excessive inflation in an inflationary environment may have an unfavourable effect on domestic savings, which are crucial for investment and long-term economic stability.

The RIR coefficient of -0.80%, shows a negative and insignificant relationship. Dash & Kumar (2018) also highlighted that real interest rate has a negative impact on gross domestic savings however, the relationship is significant. Moreover, Alvi & Fatima (2017) discovered an insignificantly negative relationship. This indicates that it does not influence savings behaviour. This implies that to enhance domestic savings, alternative measures could be taken into consideration.

Table 5-8 presents the short run coefficients. Appendix C shows the full findings of the short run relationship. All the variables significant, as shown in Table 5-8. If GDP expand by 1 unit ceteris paribus, gross domestic savings is predicted to rise by 0.42 units. This suggest a positive relationship between GDP and gross domestic savings in the short run; relationship is significant at 5%. This means that the more GDP increases then gross domestic savings will increase in the short run.

Table: 5-8: ARDL estimated short run results

Variable	Coefficient	Standard error	t-statistic	Probability value
$D(GDS)_{t-1}$	-0.405155	0.141258	-2.868200	0.0102**
$D(GDP)_{t-1}$	0.423370	0.136727	3.096461	0.0062**
$D(INF)_{t-1}$	0.800017	0.151887	5.267193	0.0001***
$D(RIR)_{t-1}$	0.175714	0.065163	2.696508	0.0148**
CointEq(-1)*	-0.211857	0.032736	-6.471696	0.0000***
R-squared	0.771237			
Adjusted R-square	0.586049			
F-statistic	4.164603			
Prob.(F-statistic)	0.001258			

Source: Author's computation using Eviews 12

Note: **imply significant at 5% and 10%; ***imply significant 1%, 5% and 10%

The INF of 0.80, revealing a positive and significant relationship at 5% level of significance. A 1-unit increase of inflation rate will lead to an increase in gross domestic savings ceteris paribus. While RIR with a coefficient of 0.18 shows that if it increases by 1 unit ceteris paribus, gross domestic savings is predicted to rise by 0.18 units. The relation between RIR and gross domestic savings is positive and significant at 5% level. This result is line with economic theory, notably the life cycle theory, which holds that when substitution effect exceeds income effect, interest rate will have a positive impact on savings (Abou El-Seoud, 2014). Overall, the relationship between domestic savings and these macroeconomic variables indicates a positive interconnection influences the propensity to save within an economy in the short run.

The error correction term is negative and it is -0.211857, and the probability value is 0.0000. This implies that the model converges to equilibrium at a speed of 21.19% which is relatively high. The R^2 indicates how closely the regression model fits the data (Brooks, 2008). The R^2 is 77%, this indicate the regression gives a good fit. Adjusted R^2 is 59% implying that changes in real GDP growth, inflation and real interest rate explain 59% of the variations in the gross domestic savings in South Africa. The overall model is statistically significant given that the Probability value of the F-statistic is 0.00.

5.2.5 Granger Causality test results for ARDL

The Granger Causality approach is used to analyse the causal relationship between variables. Table 5-9 demonstrates that the direction of causation is dependent on probability value, and the null hypothesis is rejected at 1%, 5%, and 10%, which is consistent with previous studies including Yaya (2018); Bulo (2019) and Tjiho (2020). Appendix E has the complete results.

Table 5-9: Granger Causality test results

	GDS	**GDP**	**INF**	**RIR**
Dependent Variable				
GDS		1.61123 (0.2137)	1.41559 (0.2560)	1.70683 (0.1958)
GDP	0.06160 (0.9404)		1.54871 (0.2263)	1.23499 (0.3029)
INF	0.64371 (0.5313)	3.56481 (0.0387)**		0.43384 (0.6514)
RIR	0.40957 (0.6670)	3.12129 (0.0562)*****	0.37410 (0.6906)	

Source: Author's computation using Eviews 12

Note: () denotes probability values; ** imply significant at 5% and 10%; *****imply significant at 10%

The findings demonstrate that GDS does not granger cause GDP, INF and RIR whilst they jointly do not granger cause GDS. These results conform with Bulo (2019)'s analysis, that found no causality between GDP, inflation rate, real interest rate, and gross national savings. Thus, the findings imply that they do not positively influence savings, which will hinder the facilitation of gross domestic savings in South Africa. GDP does not granger cause INF and RIR, while INF and RIR jointly granger cause

GDP. The unidirectional relationship signifies the inflation rate and interest rate foster the growth in the economy. Furthermore, the results also indicated that RIR does not granger cause INF, whereas INF does not also granger cause RIR.

5.2.6 Diagnostic test results

Table 5-10 summarises the diagnostic test results and the detailed data is presented in Appendix F. The model's residuals are normally distributed, as shown by the Jarque-Bera test and the null hypothesis of 0.4655 is not rejected at 5% level. The absence of autocorrelation in the model is evidenced by the Ljung-Box Q test which did not reject the null hypothesis of 0.170 at 5% level of significance. The LM test also revealed no serial correlation, hence the null hypothesis of 0.2504 is not rejected at 5% level. All five heteroscedasticity tests indicated there is no heteroscedasticity in the model hence the null hypothesis of no heteroscedasticity is not rejected at 5% level. The Ramsey RESET test results reveal that, the null hypothesis of no misspecification of the model is not rejected at 5% level of significance and the model can be concluded to be correctly specified.

Table: 5-10: Diagnostic test results

Test	Null hypothesis	t-statistic	Probability value	Conclusion
Jarque Bera	Residuals are normally distributed	1.529109	0.465541	Do not reject H0, PV> 5% L.O.S, meaning residuals are normally distributed

Ljung-Box Q: autocorrelation	No autocorrelation	25.862	0.170	Do not reject H0, PV> 5% L.O.S, therefore model doesn't suffer from autocorrelation
Breusch-Godfrey serial correlation LM test	No serial correlation	2.769243	0.2504	Do not reject H0, PV> 5% L.O.S, implying there is no serial correlation in the model
ARCH test: Heteroscedasticity	No heteroscedasticity	0.581292	0.4458	Do not reject H0, PV> 5% L.O.S, indicating no heteroscedasticity in the model
Harvey	No heteroscedasticity	2.456204	0.7831	Do not reject H0, PV> 5% L.O.S, implies there's no heteroscedasticity in the model
Glejser	No heteroscedasticity	1.526275	0.9100	Do not reject H0, PV> 5% L.O.S, therefore there's no heteroscedasticity

Breusch-Pagan-Godfrey	No heteroscedasticity	1.416070	0.9225	Do not reject H0, PV> 5% L.O.S, meaning there's no heteroscedasticity
White	No heteroscedasticity	22.58132	0.3098	Do not reject H0: PV> 5% L.O.S, implies that there is no heteroscedasticity
Ramsey Reset Test	No misspecification	0.483714	0.4913	Do not reject H0: PV> 5% L.O.S, This shows no misspecification

Source: Author's computation using Eviews 12

5.2.7 Ramsey RESET test

The results of the Ramsey Reset test are presented in Table 5-11. In Appendix F, detailed results for the Ramsey RESET test are provided. The model is properly specified, in accordance to the null hypothesis. The null hypothesis is not rejected since the associated p-value is higher than the 5% level of significance

Table 5-11: Ramsey RESET test

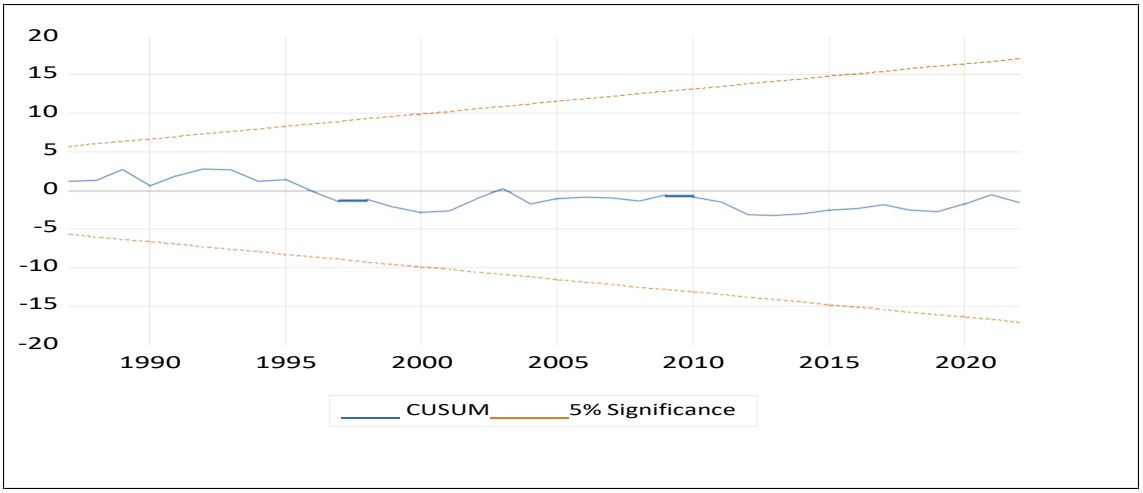
Test	Null hypothesis	Likelihood Ratio	Probability Value	Conclusion
Ramsey RESET	No misspecification	0.576482	0.4477	Do not reject H0: PV> 5% L.O.S

Source: Author's computation using Eviews 12

5.2.8 Stability tests results

Figure 5-3 shows that the CUSUM line is within the 5% level of significance lines and therefore, this indicates stability of the estimated parameters of the whole period.

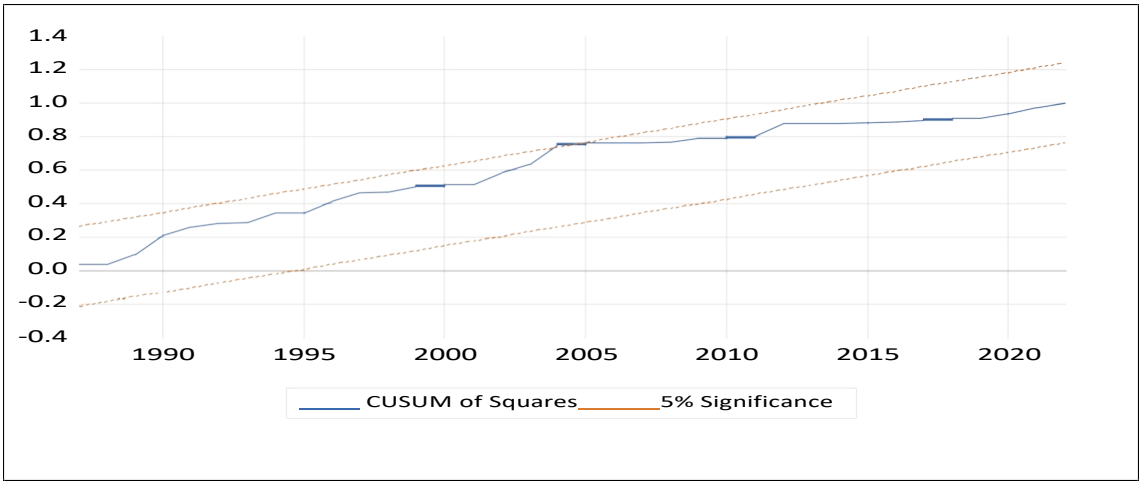
Figure 5-3: CUSUM test



Source: Author's construction using Eviews 12

Figure 5-4: CUSUM of squares test

Figure 5-4 presents the CUSUM of squares test is and it shows the cumulative sum of squares remains between the two critical lines, also demonstrating stability of residual variance. Therefore, the null hypothesis of stability is not rejected.



Source: Author's construction using Eviews 12

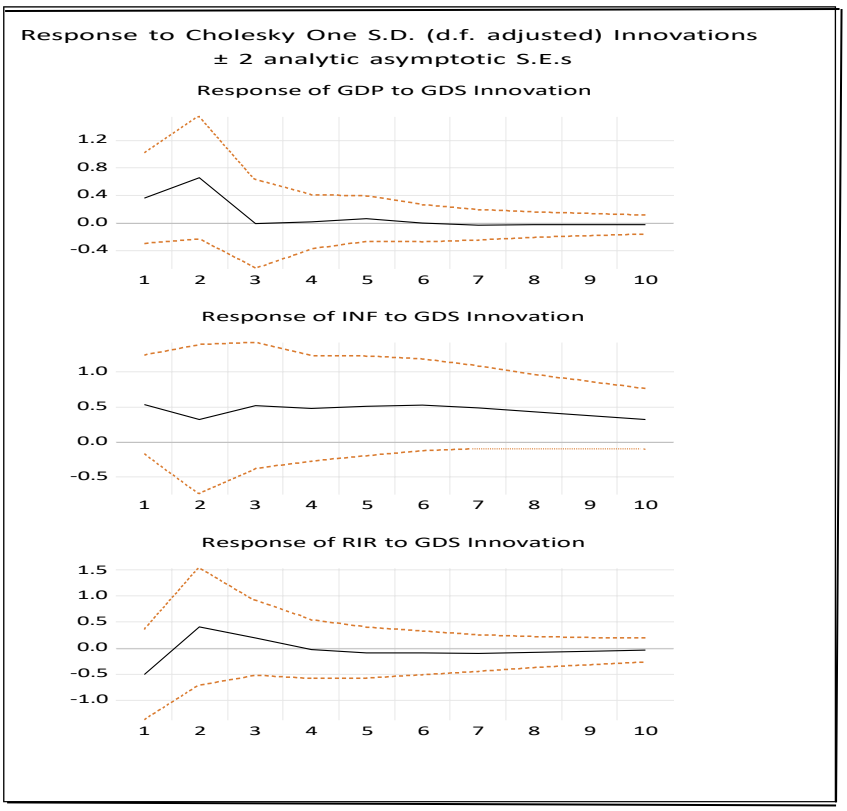
5.2.9 Impulse Response Function Results

To test the persistence of gross domestic savings over the long and short terms, the findings were projected for a 10-year time frame. The figures of impulse response function show the generalised gross domestic savings responses to the shocks in the explanatory variables. Figure 4-5 shows that gross domestic savings responds instantly to real GDP growth rate, inflation, and real interest rate. The 95% confidence interval is represented by the red line on the IRF graph, and the impulse response function is shown by the black line.

5.2.9.1 The response of GDP to GDS innovation

According to Figure 5-5, one standard deviation shock (innovation) given to GDS will result in an increase in GDP in period1. The response starts to pick up about period 2 and continues until period 3. From period 3 onwards, it starts to fall and the reaction becomes insignificant to draw any conclusions on.

Figure 5-5: Impulse response function to GDS shock



Source: Author's construction using Eviews 12

5.2.9.2 The response of INF to GDS innovation

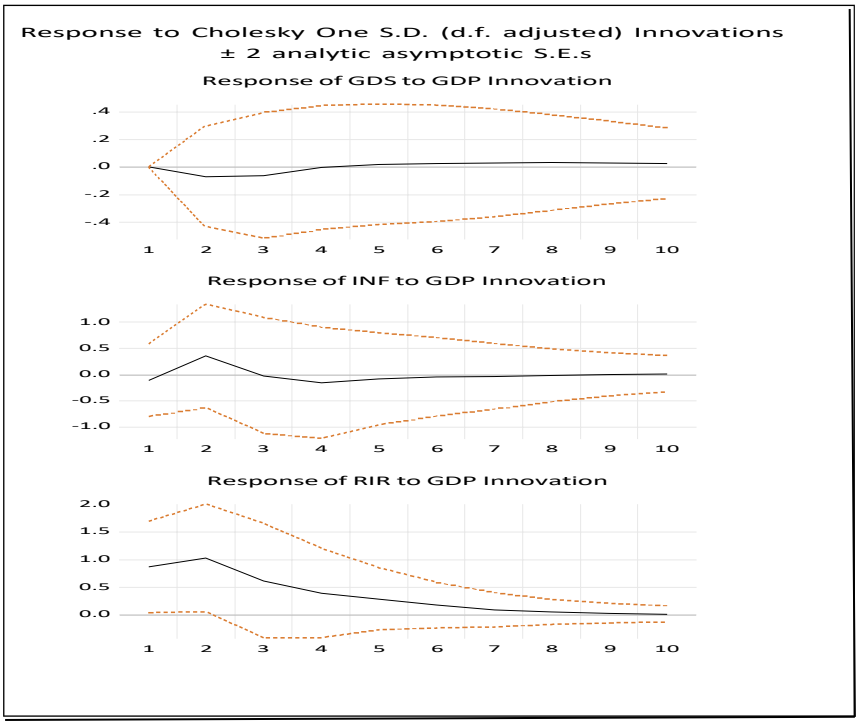
Figure 5-5 shows that INF increases when GDS receives a shock of one standard deviation. INF had a positive reaction throughout the duration indicating stability.

5.2.9.3 Response of RIR to GDS innovation

A one standard deviation shock (innovation) to GDS at the beginning of the period as observed in Figure 5-5, RIR was in the negative region. It was in a positive region throughout period 2 and 3 and It remained in the negative region from period 4 to period 10. As a result, during the period, shocks occurred in both the positive and negative region. GDS has both a short-term and long-term asymmetric effect on RIR.

According to the findings in Figure 5-6, a shock to GDP of one standard deviation had a negative influence on GDS, but period 4 observed an increase in GDS. The GDP fell into both the positive and negative segments overall. Up until period 2, INF responds positively to innovations applied in GDP. From that point on, however, the reaction is negative until period 6. RIR also responds positively up to period 9, at which point it react insignificantly.

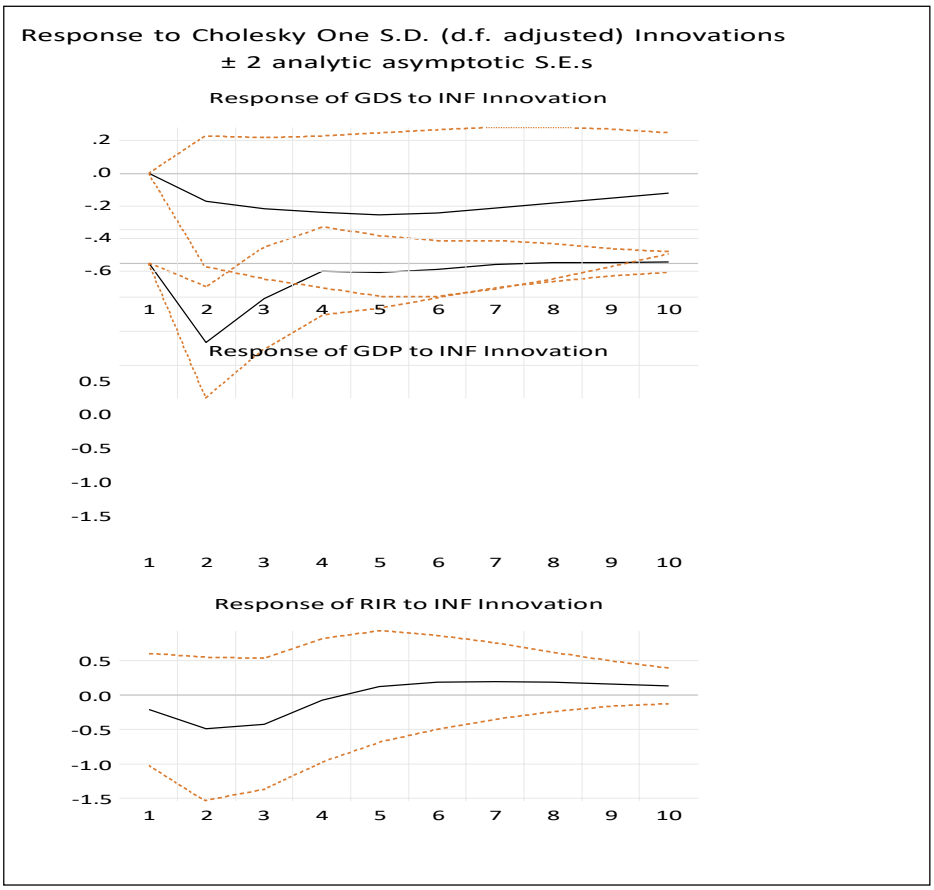
Figure 5-6: Impulse response function to GDP shock



Source: Author's construction using Eviews 12

When one standard deviation was applied to INF in Figure 5-7, the GDS reaction was negative for all ten periods. Furthermore, the findings suggest that GDP had a negative reaction throughout however, it gradually picked up until period 7 and it became insignificant. Lastly, RIR initially reacted negative to an INF shock, but it increased ata more gradual rate in period 2 and it stayed in the positive region starting at period 5.

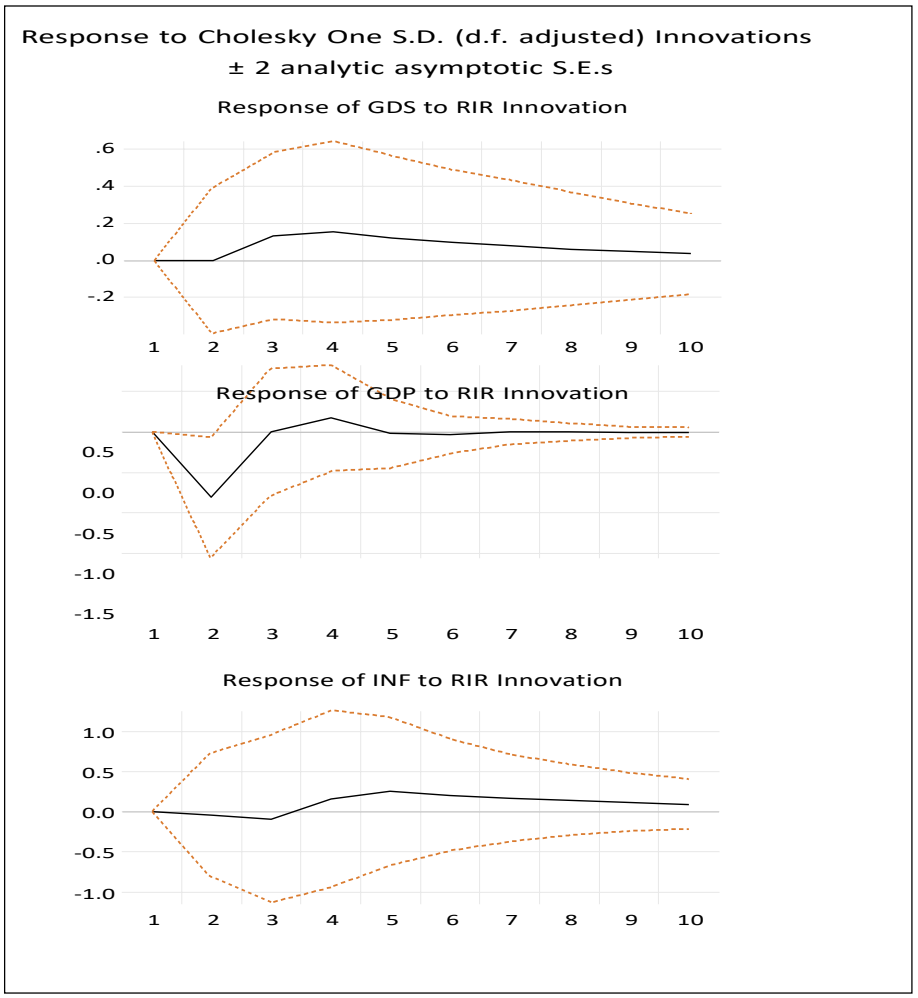
Figure 5-7: Impulse response function to INF shock



Source: Author's construction using Eviews 12

In Figure 5-8 a one standard deviation shock applied to RIR was depicted. GDS begins in the positive region from period 2 and RIR influences GDS positively throughout the period. GDP's response remained in the negative region until period 3, when it crosses over to the positive region it started to decline and it became insignificant. INF exhibits similar responses, remaining in the negative region until the third period, at that point it started to rise and was in the positive range.

Figure 5-8: Impulse response function to RIR shock



Source: Author's construction using Eviews 12

5.2.10 Variance Decomposition Results

As an alternate to IRF, variance decomposition can be used for determining the impact of shocks to the dependent variable.

5.2.10.1 Variance decomposition results of Gross Domestic Savings

Table 5-12 presents the variance decomposition results of GDS and Appendix G shows the full findings. For a given period, the forecast error variance is 100. In the short term, 100% of the forecast error variance in GDS is explained by the variable itself. Since the second period, INF has been steadily rising over time, which indicates that it has a strong influence on GDS both in the short term and over the long term than other variables in the model which do not have a strong exogenous impact.

Table 5-12: Variance decomposition results of GDS

Variance Decomposition of GDS					
Period	**S.E**	**GDS**	**GDP**	**INF**	**RIR**
1	1.161799	100.0000	0.000000	0.000000	0.000000
2	1.430281	98.30497	0.232811	1.462127	9.53E-05
3	1.606026	96.02046	0.333885	2.981060	0.664598
4	1.732443	93.89813	0.287300	4.463920	1.350646
5	1.824183	92.07647	0.268924	6.000393	1.654210
6	1.886898	90.64815	0.268476	7.278039	1.805335
7	1.928536	89.62000	0.282723	8.205828	1.891448
8	1.955766	88.90665	0.302853	8.856450	1.934045
9	1.973170	88.42599	0.321374	9.298374	1.954266
10	1.984050	88.11240	0.336498	9.586434	1.964664

Source: Author’s computation using Eviews 12

In period 3, the GDS's variance contribution is 96.02%, whereas the GDP's variance contribution to the GDS is 0.33%. INF contributes 2.98% to GDS. while RIR's contribution to GDS is 0.66%.

In period 10 the variance contribution of GDS is 88.11% and the variance contribution of GDP to GDS is 0.34% while that of INF to GDS is 9.59%. The contribution of RIR

to GDS is 1.96%. Thus, inflation contributes more to the variance of savings than all other variables in the long run. Additionally, Bulo (2019) also observed that gross national savings is strongly influenced by its own variation and that the interest rate's contribution lagged behind the inflation rate.

Table 5-13: Variance decomposition results of GDP

Variance Decomposition of GDP					
Period	**S.E**	**GDS**	**GDP**	**INF**	**RIR**
1	2.125605	2.900213	97.09979	0.000000	0.000000
2	2.650675	7.985870	63.53024	19.18468	9.299212
3	2.701776	7.688081	61.22154	22.13960	8.950784
4	2.718045	7.599969	61.07980	22.06665	9.253583
5	2.726245	7.606994	61.02935	22.15971	9.203947
6	2.728271	7.595700	60.96907	22.22680	9.208435
7	2.728685	7.604074	60.96739	22.22289	9.205645
8	2.728983	7.610034	60.96698	22.21922	9.203766
9	2.729169	7.615727	60.96189	22.21887	9.203514
10	2.729336	7.621284	60.95507	22.22089	9.202753

Source: Author's computation using Eviews 12

5.2.10.2 Variance decomposition of Real GDP Growth Rate

Appendix G shows the full findings shown in Table 5-13. The fraction of the South African GDP forecast error variance attributed to fluctuation in GDS, INF, and RIR is 7.69%, 22.14%, and 8.95%, respectively, as shown in Table 5-13 at a 3-year horizon. While in year 10, innovations to the GDS, GDP, INF, and RIR contribute 7.62%, 60.96%, 22.22%, and 9.20% over the long term, respectively. As a result, GDP's contribution declines while GDS's contribution to GDP is the lowest. While from year 3 to year 10, inflation consistently explains just above 22% of GDP

5.2.10.3 Variance decomposition results of Inflation Rate

The variance decomposition results in Table 5-14 indicate that the shock to the GDS, GDP, INF (own shock), and RIR in period 3 can result in short-run variation in inflation of 5.14%, 1.137%, 93.38%, and 0.08%. In the long run, a shock to GDS, GDP, INF, and RIR in the 10th period accounts for 13.87%, 1.13%, 83.61%, and 1.39% of the variation in INF, respectively. INF is strongly influenced by variations in itself as well as GDS while contributions by GDS increase over time.

Table 5-14: Variance decomposition results of Inflation rate

Variance Decomposition of Inflation Rate					
Period	**S.E**	**GDS**	**GDP**	**INF**	**RIR**
1	2.279039	5.541213	0.219634	94.23915	0.000000
2	3.188167	3.882708	1.359044	94.73944	0.018813
3	3.505558	5.414761	1.127346	93.37603	0.081866
4	3.659845	6.668861	1.214655	91.85760	0.258880
5	3.752256	8.213059	1.199249	89.88768	0.700014

6	3.807444	9.906777	1.176634	87.94530	0.971290
7	3.844409	11.34420	1.160918	86.35284	1.142039
8	3.871805	12.45370	1.145546	85.13562	1.265138
9	3.892755	13.28119	1.133379	84.24200	1.343438
10	3.908566	13.87009	1.125286	83.61473	1.389891

Source: Author's computation using Eviews 12

5.2.10.4 Variance decomposition results of Real Interest rate

Impulse of GDS, GDP, INF, and RIR (own innovative shock) accounts for 4.02%, 19.17%, 4.08%, and 72.74%, respectively, of the short-term fluctuation in RIR using results in a 3-year horizon as shown in Table 5-15.

In the long run, as determined by period 10, an innovation to GDS, LGDP, INF, or RIR can result in variations in RIR of 4.16%, 20.64%, 5.31%, or 6.88%, respectively. The variance in RIR (own shock) may greatly contribute to RIR, which is then followed by GDP and the INF. The observation that real interest rate is being significantly influenced by GDP throughout the 10-year period demonstrates that, when all other things are held constant, an increase real GDP will result in an increase in real interest rate in an economy (Krugman, et al., 2018).

Table 5-15: Variance decomposition results of real interest rate

Variance Decomposition of Real Interest Rate					
Period	**S.E**	**GDS**	**GDP**	**INF**	**RIR**
1	2.780757	3.263624	9.757187	0.572196	86.40699

2	3.282018	3.910844	16.89418	2.665566	76.52941
3	3.385752	4.018282	19.16759	4.075267	72.73887
4	3.410833	3.964428	20.17409	4.073461	71.78802
5	3.426044	3.990568	20.67986	4.163470	71.16610
6	3.436367	4.041760	20.80436	4.413874	70.74001
7	3.444377	4.098898	20.77503	4.713623	70.41245
8	3.450640	4.137910	20.71852	4.986455	70.15712
9	3.454845	4.156893	20.67259	5.184084	69.98643
10	3.457390	4.164371	20.64271	5.309409	69.88351

Source: Author's computation using Eviews 12

5.3 SUMMARY

The results of the methods outlined were presented in this chapter. ADF and PP tests were applied to achieve the variables' stationarity, while the ARDL bound test proved cointegration in the long run. All the short run coefficients indicated the explanatory variables' positive relationship with gross domestic savings. Unidirectional causality was identified between GDP, inflation and real interest rate and there was no causality found between real interest rate, GDP growth rate, inflation rate and gross domestic savings. All of the diagnostic tests did not reject the null hypothesis and lastly the parameters demonstrated stability throughout the study period. In addition, forecasts for impulse response function and variance decomposition were made. The impulse response function findings revealed that the response to shocks fluctuated upward and downward throughout the period, indicating that gross domestic savings have a

larger effect on all the variables. Since inflation rate started to rise in the second period, the findings of the decomposition of gross domestic savings showed that inflation rate has a stronger impact on gross domestic savings. This study is concluded in Chapter 6, which also offers a summary of the findings and some recommendations.

CHAPTER 6

SUMMARY, RECOMMENDATIONS, CONCLUSION

6.1 INTRODUCTION

Chapter 5 explored the effects of Real GDP Growth rate, inflation rate and real interest rate on the national savings in South Africa by utilising econometric techniques. The results provided an insight into such a relationship. The summary and recommendations for the study's findings are presented in this chapter. It also outlines the study's shortcomings and future areas of research.

6.2 SUMMARY AND INTERPRETATION OF FINDINGS

The analysis of the impact of explanatory variables that include economic growth, inflation rate, and interest rate on national savings in the South African economy was the primary aim of this dissertation. The objectives included establishing the relationship between GDP and national savings, investigating the impact of interest rates and inflation rates on national savings, and identifying the direction of causality between the variables. Lastly, assessing the behaviour of national savings to shocks from GDP, inflation rate and interest rate.

The study is quantitative in nature and used annual data covering the years 1980–2022. The long & short-run effects of the explanatory variables on the regressor were examined using an adaptation of the ARDL technique. The background of this study was based on the theories of savings that were discussed in Chapter 3 in order to achieve the specified objectives.

A mathematical theory of saving state that consumers' present consumption sacrifices are equivalent to their future consumption gains. Savings affects the rate of capital accumulation and economic growth, which leads to long-term economic stabilisation. The life cycle theory was discussed and emphasised how interest rates affect savings through the substitution effect and income effect. The theories back up the study's findings.

It was evidenced from the study's findings that a declining real GDP will negatively affect gross domestic savings and lead to a low savings rate. In Chapter 4, it was predicted that real interest rates would increase over the long and short terms, with inflation having a positive and negative sign. The findings of the research show that the impact of inflation on gross domestic savings is negative but significant in the long run while in the short it is positive**.** The real interest rate had a negative impact on gross domestic savings yet in the short run, real interest rates had a positive relationship with gross domestic savings. The error correction model revealed that 21.19% of the national savings model converge back to the equilibrium in each year.

The Granger causality test was used to confirm the relationship between the explanatory factors and gross domestic savings. The method that is most frequently used to establish the direction of causality between variables while analysing time series. As a result, there is unidirectional causality between the real GDP growth and inflation rate, as well as between real interest rate and real GDP growth rate. Furthermore, a causal relationship between gross domestic savings, real GDP growth, inflation and real interest rate was not established.

An extension of granger causality is the impulse response function and variance decomposition. The findings imply that real GDP growth, inflation, and real interest rates responded to gross domestic savings in both a positive and a negative region, indicating that GDS had an asymmetric effect on the variables**.** Gross domestic savings will be stimulated in periods 1 to 3 by a shock of a unit standard deviation of the real GDP growth rate. Real GDP will therefore increase in line with GDS. There is a positive response from inflation to GDS throughout the period, suggesting inflationary pressure for the period. This will slow savings and have a negative impact. Real interest rates in period 4-10 were in the negative region, showing an inverse response. This shows that it cannot boost savings. However, starting in period 2, it began to rise, and until period 3, it was in the positive region. This has a positive impact on GDS.

Variance decomposition shows how much of the variability in the dependent variable is explained by its own shocks as opposed to the shocks in the other variables in the system. Based on the findings, inflation has a stronger impact on GDS over the time

period with 9.59%. Real interest rate effect followed behind and contributed only 1.96% of the variation in South African savings mobilisation. Due to a smaller contribution of 0.34%, real GDP has the least impact on efforts to mobilise savings.

6.3 CONCLUSIONS

Savings can lead to accumulation of capital, which can boost the economy. Studies have shown that savings have a significant influence in the economic development and prosperity of nations. As stated by Bulo (2019), because investment is equal to saving, a good policy must be in place for savings mobilisation to operate at its best for an economy to thrive and expand. The analysis utilised time series and data from the World Bank to answer questions outlined in Chapter1.

The ARDL bound test findings demonstrated that the variables in the model have a long run cointegration relationships. A negative relation between real GDP, inflation, real interest rate and GDS was found when estimating the long-term relationship. In the short term estimates, it was discovered that real GDP and GDS had a significant positive relationship. The savings rate will rise as a result. Inflation rate was also found to have a positive significant relationship with gross domestic savings. Lastly, RIR was found to have a positive impact, confirming the life cycle theory. The error correction model revealed that it takes 21.19% to converge to equilibrium.

The granger causality test revealed no causality between gross domestic savings, real GDP growth rate, inflation rate and real interest rate. This could be brought on by factors like an unstable interest rate structure along with weak confidence in the financial sector. Nevertheless, it demonstrated a unidirectional causality between real GDP growth inflation rate and interest rate.

The impulse response function demonstrated that GDS has an asymmetric impact on the explanatory variables while variance decomposition revealed that inflation rate has a stronger impact on GDS over the time period with 9.59% and real GDP has smaller impact with 0.34%.

6.4 RECOMMENDATIONS OF THE STUDY

The current study's findings have policy implications for increasing South Africa's gross domestic savings. The economy can be significantly affected by policy implications in the short run, affecting vital economic indicators like GDP growth rate, inflation rate, and interest rate. Inflation rate is the only significant variable and was showed to be negatively correlated with gross domestic savings. Therefore, to ensure that financial markets are developed when benchmarked to international standards in addition to price stability, the current interest rate framework should continue to be tightened and extremely regulated. This will influence confidence in the financial markets to be maintained. Savings will be promoted, and financial stability in South Africa will facilitate sustainable development.

Even though real GDP and real interest rate were found to be insignificant in the long run, the government can focus on improving real GDP growth and reducing the real interest rate in order to impact the level of savings. In order to stimulate GDS, regulatory authorities (SARB) can assist financial institutions in offering new investment alternatives. The government can improve real GDP by prioritising the infrastructure projects that have economic and social significance in order to promote South Africa as an attractive place for investment and acquire foreign and domestic direct investment.

6.5 LIMITATIONS OF THE STUDY

This study focused on how South Africa's national savings are affected by economic growth, inflation, and interest rates. This indicates that it is exclusive to a South African setting and is therefore not applicable to any other region. Due to lack of data, the analysis period spanned the years 1980 through 2022.

6.6 FUTURE RESEARCH AREAS

The study's scope was constrained to a South African setting. To examine cases from other nations, a similar method can be applied. The study and comparison of developed and emerging economies could additionally be done using panel data. Furthermore, the current study concentrated on a few of explanatory variables and thus, it may still be necessary to investigate other relevant variables in order to

determine their impact, significance and to also compare the results to those found in this study.

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APPENDICES

APPENDIX A- UNIT ROOT TEST RESULTS

GROSS DOMESTIC SAVINGS (ADF)

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

t-Statistic	Prob.*		
Augmented Dickey-Fuller test statistic		-4.852131	0.0003
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDS)
Method: Least Squares
Date: 07/13/23 Time: 13:32
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

	Variable	Coefficient	Std. Error	t-Statistic	Prob.
	GDS(-1)	-0.211648	0.043620	-4.852131	0.0000
C		3.857062	0.890922	4.329290	0.0001

Null Hypothesis: GDS has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.680968	0.0086
Test critical values:	1% level	-2.621185	
	5% level	-1.948886	
	10% level	-1.611932	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDS)
Method: Least Squares
Date: 07/13/23 Time: 13:39
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDS(-1)	-0.026124	0.009744	-2.680968	0.0105

R-squared	0.075546	Mean dependent var	-0.389859
Adjusted R-squared	0.075546	S.D. dependent var	1.341493
S.E. of regression	1.289826	Akaike info criterion	3.370413
Sum squared resid	68.20965	Schwarz criterion	3.411786
Log likelihood	-69.77866	Hannan-Quinn criter.	3.385577
Durbin-Watson stat	1.729224		

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.002954	0.0161
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDS)
Method: Least Squares
Date: 07/13/23 Time: 13:38
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDS(-1)	-0.240578	0.060100	-4.002954	0.0003
C	4.723955	1.522151	3.103474	0.0036
@TREND("1980")	-0.013320	0.018901	-0.704748	0.4852

R-squared	0.378423	Mean dependent var	-0.389859
Adjusted R-squared	0.346547	S.D. dependent var	1.341493
S.E. of regression	1.084415	Akaike info criterion	3.068708
Sum squared resid	45.86228	Schwarz criterion	3.192827
Log likelihood	-61.44286	Hannan-Quinn criter.	3.114202
F-statistic	11.87180	Durbin-Watson stat	2.047839
Prob(F-statistic)	0.000094		

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.084444	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDS,2)
Method: Least Squares
Date: 07/13/23 Time: 13:40
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDS(-1))	-0.900425	0.147988	-6.084444	0.0000
C	-0.273964	0.204536	-1.339443	0.1882

R-squared	0.486980	Mean dependent var	0.055784
Adjusted R-squared	0.473826	S.D. dependent var	1.740965
S.E. of regression	1.262859	Akaike info criterion	3.352184
Sum squared resid	62.19769	Schwarz criterion	3.435773
Log likelihood	-66.71977	Hannan-Quinn criter.	3.382622
F-statistic	37.02045	Durbin-Watson stat	2.145011
Prob(F-statistic)	0.000000		

Null Hypothesis: D(GDS) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.883797	0.0000
Test critical values:	1% level	-2.622585	
	5% level	-1.949097	
	10% level	-1.611824	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDS,2)
Method: Least Squares
Date: 07/13/23 Time: 13:42
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDS(-1))	-0.847903	0.144108	-5.883797	0.0000

R-squared	0.463380	Mean dependent var	0.055784
Adjusted R-squared	0.463380	S.D. dependent var	1.740965
S.E. of regression	1.275333	Akaike info criterion	3.348379
Sum squared resid	65.05896	Schwarz criterion	3.390174
Log likelihood	-67.64178	Hannan-Quinn criter.	3.363599
Durbin-Watson stat	2.164207		

REAL GDP GROWTH RATE (ADF)

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.328269	0.0001
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 07/13/23 Time: 13:46
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.790496	0.148359	-5.328269	0.0000
C	1.552087	0.491956	3.154931	0.0030

R-squared	0.415123	Mean dependent var	-0.109007
Adjusted R-squared	0.400501	S.D. dependent var	3.185388
S.E. of regression	2.466361	Akaike info criterion	4.689812
Sum squared resid	243.3174	Schwarz criterion	4.772559
Log likelihood	-96.48606	Hannan-Quinn criter.	4.720142
F-statistic	28.39045	Durbin-Watson stat	2.031582
Prob(F-statistic)	0.000004		

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.239920	0.0006
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 07/13/23 Time: 13:47
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.789427	0.150656	-5.239920	0.0000
C	1.485018	0.866725	1.713367	0.0946
@TREND("1980")	0.003015	0.031884	0.094562	0.9251

R-squared	0.415257	Mean dependent var	-0.109007
Adjusted R-squared	0.385270	S.D. dependent var	3.185388
S.E. of regression	2.497494	Akaike info criterion	4.737202
Sum squared resid	243.2616	Schwarz criterion	4.861321
Log likelihood	-96.48125	Hannan-Quinn criter.	4.782697
F-statistic	13.84799	Durbin-Watson stat	2.034166
Prob(F-statistic)	0.000029		

Null Hypothesis: GDP has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.898667	0.0002
Test critical values:	1% level	-2.621185	
	5% level	-1.948886	
	10% level	-1.611932	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 07/13/23 Time: 13:48
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.493886	0.126681	-3.898667	0.0004

R-squared	0.269582	Mean dependent var	-0.109007
Adjusted R-squared	0.269582	S.D. dependent var	3.185388
S.E. of regression	2.722376	Akaike info criterion	4.864408
Sum squared resid	303.8645	Schwarz criterion	4.905781
Log likelihood	-101.1526	Hannan-Quinn criter.	4.879573
Durbin-Watson stat	2.198382		

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.019342	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 07/13/23 Time: 13:49
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.359746	0.150759	-9.019342	0.0000
C	-0.095921	0.475736	-0.201626	0.8413

R-squared	0.675941	Mean dependent var	-0.039293
Adjusted R-squared	0.667632	S.D. dependent var	5.283362
S.E. of regression	3.045930	Akaike info criterion	5.113040
Sum squared resid	361.8299	Schwarz criterion	5.196629
Log likelihood	-102.8173	Hannan-Quinn criter.	5.143479
F-statistic	81.34853	Durbin-Watson stat	2.128445
Prob(F-statistic)	0.000000		

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.948068	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 07/13/23 Time: 13:50
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.368187	0.152903	-8.948068	0.0000
C	-0.588667	1.017995	-0.578261	0.5665
@TREND("1980")	0.022382	0.040775	0.548900	0.5863

R-squared	0.678490	Mean dependent var	-0.039293
Adjusted R-squared	0.661569	S.D. dependent var	5.283362
S.E. of regression	3.073587	Akaike info criterion	5.153923
Sum squared resid	358.9836	Schwarz criterion	5.279307
Log likelihood	-102.6554	Hannan-Quinn criter.	5.199581
F-statistic	40.09621	Durbin-Watson stat	2.131051
Prob(F-statistic)	0.000000		

Null Hypothesis: D(GDP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.127587	0.0000
Test critical values:	1% level	-2.622585	
	5% level	-1.949097	
	10% level	-1.611824	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 07/13/23 Time: 13:51
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.359345	0.148927	-9.127587	0.0000

R-squared	0.675603	Mean dependent var	-0.039293
Adjusted R-squared	0.675603	S.D. dependent var	5.283362
S.E. of regression	3.009182	Akaike info criterion	5.065302
Sum squared resid	362.2071	Schwarz criterion	5.107096
Log likelihood	-102.8387	Hannan-Quinn criter.	5.080521
Durbin-Watson stat	2.126869		

INFLATION RATE (ADF)

Null Hypothesis: INF has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.927402	0.7685
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 07/13/23 Time: 13:58
Sample (adjusted): 1985 2022
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.078650	0.084807	-0.927402	0.3607
D(INF(-1))	-0.003205	0.171981	-0.018638	0.9852
D(INF(-2))	-0.546645	0.168932	-3.235893	0.0028
D(INF(-3))	-0.135337	0.162320	-0.833765	0.4106
D(INF(-4))	-0.370302	0.164240	-2.254640	0.0311
C	0.214850	0.799743	0.268649	0.7899

R-squared	0.346292	Mean dependent var	-0.118072
Adjusted R-squared	0.244151	S.D. dependent var	2.435198
S.E. of regression	2.117151	Akaike info criterion	4.481959
Sum squared resid	143.4346	Schwarz criterion	4.740526
Log likelihood	-79.15723	Hannan-Quinn criter.	4.573955
F-statistic	3.390309	Durbin-Watson stat	1.633132
Prob(F-statistic)	0.014346		

Null Hypothesis: INF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.946589	0.9396
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 07/13/23 Time: 13:59
Sample (adjusted): 1985 2022
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.168475	0.177981	-0.946589	0.3512
D(INF(-1))	0.061758	0.207208	0.298047	0.7677
D(INF(-2))	-0.488279	0.198545	-2.459287	0.0197
D(INF(-3))	-0.098584	0.176021	-0.560070	0.5795
D(INF(-4))	-0.340461	0.173884	-1.957984	0.0593
C	1.870471	2.986521	0.626304	0.5357
@TREND("1980")	-0.037923	0.065855	-0.575853	0.5689

R-squared	0.353211	Mean dependent var	-0.118072
Adjusted R-squared	0.228026	S.D. dependent var	2.435198
S.E. of regression	2.139615	Akaike info criterion	4.523951
Sum squared resid	141.9165	Schwarz criterion	4.825611
Log likelihood	-78.95507	Hannan-Quinn criter.	4.631279
F-statistic	2.821513	Durbin-Watson stat	1.617911
Prob(F-statistic)	0.026159		

Null Hypothesis: INF has a unit root
Exogenous: None
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.556983	0.1109
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 07/13/23 Time: 13:59
Sample (adjusted): 1985 2022
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.058277	0.037430	-1.556983	0.1290
D(INF(-1))	-0.019531	0.158609	-0.123137	0.9027
D(INF(-2))	-0.562084	0.156607	-3.589143	0.0011
D(INF(-3))	-0.144518	0.156435	-0.923820	0.3623
D(INF(-4))	-0.379642	0.158245	-2.399080	0.0222

R-squared	0.344818	Mean dependent var	-0.118072
Adjusted R-squared	0.265402	S.D. dependent var	2.435198
S.E. of regression	2.087176	Akaike info criterion	4.431581
Sum squared resid	143.7581	Schwarz criterion	4.647053
Log likelihood	-79.20003	Hannan-Quinn criter.	4.508244
Durbin-Watson stat	1.632469		

Null Hypothesis: D(INF) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.598179	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 07/13/23 Time: 13:59
Sample (adjusted): 1985 2022
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-2.198274	0.392677	-5.598179	0.0000
D(INF(-1),2)	1.144698	0.310436	3.687392	0.0008
D(INF(-2),2)	0.551431	0.227385	2.425103	0.0209
D(INF(-3),2)	0.392508	0.162140	2.420796	0.0212
C	-0.448354	0.357279	-1.254915	0.2183

R-squared	0.637240	Mean dependent var	0.084336
Adjusted R-squared	0.593270	S.D. dependent var	3.312653
S.E. of regression	2.112658	Akaike info criterion	4.455850
Sum squared resid	147.2897	Schwarz criterion	4.671322
Log likelihood	-79.66116	Hannan-Quinn criter.	4.532514
F-statistic	14.49234	Durbin-Watson stat	1.632253
Prob(F-statistic)	0.000001		

Null Hypothesis: D(INF) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.557600	0.0003
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 07/13/23 Time: 14:00
Sample (adjusted): 1985 2022
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-2.210106	0.397673	-5.557600	0.0000
D(INF(-1),2)	1.153254	0.314304	3.669233	0.0009
D(INF(-2),2)	0.557730	0.230221	2.422586	0.0212
D(INF(-3),2)	0.394482	0.163985	2.405603	0.0221
C	-0.844150	0.832354	-1.014173	0.3181
@TREND("1980")	0.016711	0.031661	0.527816	0.6013

R-squared	0.640371	Mean dependent var	0.084336
Adjusted R-squared	0.584179	S.D. dependent var	3.312653
S.E. of regression	2.136136	Akaike info criterion	4.499814
Sum squared resid	146.0185	Schwarz criterion	4.758380
Log likelihood	-79.49646	Hannan-Quinn criter.	4.591809
F-statistic	11.39614	Durbin-Watson stat	1.640067
Prob(F-statistic)	0.000002		

Null Hypothesis: D(INF) has a unit root
Exogenous: None
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.881473	0.0052
Test critical values:	1% level	-2.628961	
	5% level	-1.950117	
	10% level	-1.611339	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 07/13/23 Time: 14:00
Sample (adjusted): 1986 2022
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-1.390331	0.482507	-2.881473	0.0070
D(INF(-1),2)	0.492553	0.390855	1.260192	0.2167
D(INF(-2),2)	0.010276	0.324848	0.031632	0.9750
D(INF(-3),2)	0.066264	0.220006	0.301191	0.7652
D(INF(-4),2)	-0.296650	0.159335	-1.861803	0.0718

R-squared	0.667562	Mean dependent var	-0.063235
Adjusted R-squared	0.626007	S.D. dependent var	3.229237
S.E. of regression	1.974838	Akaike info criterion	4.323939
Sum squared resid	124.7996	Schwarz criterion	4.541630
Log likelihood	-74.99286	Hannan-Quinn criter.	4.400685
Durbin-Watson stat	2.078413		

REAL INTEREST RATE (ADF)

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.479210	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RIR)
Method: Least Squares
Date: 07/13/23 Time: 14:03
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIR(-1)	-0.604555	0.110336	-5.479210	0.0000
C	2.817193	0.626373	4.497628	0.0001

R-squared	0.428749	Mean dependent var	0.346823
Adjusted R-squared	0.414468	S.D. dependent var	3.682615
S.E. of regression	2.817940	Akaike info criterion	4.956337
Sum squared resid	317.6315	Schwarz criterion	5.039084
Log likelihood	-102.0831	Hannan-Quinn criter.	4.986667
F-statistic	30.02175	Durbin-Watson stat	1.658389
Prob(F-statistic)	0.000003		

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.235145	0.0006
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RIR)
Method: Least Squares
Date: 07/13/23 Time: 14:03
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIR(-1)	-0.594338	0.113528	-5.235145	0.0000
C	3.148331	0.946995	3.324550	0.0019
@TREND("1980")	-0.017344	0.036911	-0.469872	0.6411

R-squared	0.431965	Mean dependent var	0.346823
Adjusted R-squared	0.402835	S.D. dependent var	3.682615
S.E. of regression	2.845795	Akaike info criterion	4.998311
Sum squared resid	315.8435	Schwarz criterion	5.122431
Log likelihood	-101.9645	Hannan-Quinn criter.	5.043806
F-statistic	14.82884	Durbin-Watson stat	1.686430
Prob(F-statistic)	0.000016		

Null Hypothesis: RIR has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.664514	0.0089
Test critical values:	1% level	-2.621185	
	5% level	-1.948886	
	10% level	-1.611932	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RIR)
Method: Least Squares
Date: 07/13/23 Time: 14:04
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIR(-1)	-0.247354	0.092833	-2.664514	0.0110

R-squared	0.139858	Mean dependent var	0.346823
Adjusted R-squared	0.139858	S.D. dependent var	3.682615
S.E. of regression	3.415399	Akaike info criterion	5.317987
Sum squared resid	478.2630	Schwarz criterion	5.359360
Log likelihood	-110.6777	Hannan-Quinn criter.	5.333152
Durbin-Watson stat	1.683568		

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.574878	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RIR,2)
Method: Least Squares
Date: 07/13/23 Time: 14:06
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RIR(-1))	-1.131749	0.131984	-8.574878	0.0000
C	0.067854	0.484869	0.139942	0.8894

R-squared	0.653421	Mean dependent var	-0.257414
Adjusted R-squared	0.644535	S.D. dependent var	5.191398
S.E. of regression	3.095159	Akaike info criterion	5.145106
Sum squared resid	373.6204	Schwarz criterion	5.228695
Log likelihood	-103.4747	Hannan-Quinn criter.	5.175545
F-statistic	73.52852	Durbin-Watson stat	2.259510
Prob(F-statistic)	0.000000		

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.394508	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RIR,2)
Method: Least Squares
Date: 07/13/23 Time: 14:06
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RIR(-1))	-1.146341	0.136558	-8.394508	0.0000
C	0.528758	1.058522	0.499525	0.6203
@TREND("1980")	-0.020760	0.042269	-0.491129	0.6262

R-squared	0.655607	Mean dependent var	-0.257414
Adjusted R-squared	0.637481	S.D. dependent var	5.191398
S.E. of regression	3.125716	Akaike info criterion	5.187559
Sum squared resid	371.2638	Schwarz criterion	5.312943
Log likelihood	-103.3450	Hannan-Quinn criter.	5.233217
F-statistic	36.16957	Durbin-Watson stat	2.248733
Prob(F-statistic)	0.000000		

Null Hypothesis: D(RIR) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.697509	0.0000
Test critical values:	1% level	-2.622585	
	5% level	-1.949097	
	10% level	-1.611824	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RIR,2)
Method: Least Squares
Date: 07/13/23 Time: 14:06
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RIR(-1))	-1.130304	0.129957	-8.697509	0.0000

R-squared	0.653247	Mean dependent var	-0.257414
Adjusted R-squared	0.653247	S.D. dependent var	5.191398
S.E. of regression	3.056992	Akaike info criterion	5.096828
Sum squared resid	373.8081	Schwarz criterion	5.138622
Log likelihood	-103.4850	Hannan-Quinn criter.	5.112047
Durbin-Watson stat	2.260904		

GROSS DOMESTIC SAVINGS (PP)

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.110903	0.0001
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Residual variance (no correction)	1.105865
HAC corrected variance (Bartlett kernel)	0.943536

Phillips-Perron Test Equation
Dependent Variable: D(GDS)
Method: Least Squares
Date: 07/13/23 Time: 14:39
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

	Variable	Coefficient	Std. Error	t-Statistic	Prob.
	GDS(-1)	-0.211648	0.043620	-4.852131	0.0000
C		3.857062	0.890922	4.329290	0.0001

R-squared	0.370507	Mean dependent var	-0.389859
Adjusted R-squared	0.354769	S.D. dependent var	1.341493
S.E. of regression	1.077571	Akaike info criterion	3.033743
Sum squared resid	46.44634	Schwarz criterion	3.116489
Log likelihood	-61.70861	Hannan-Quinn criter.	3.064073
F-statistic	23.54318	Durbin-Watson stat	2.083356
Prob(F-statistic)	0.000019		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.054891	0.0142
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Residual variance (no correction)	1.091959
HAC corrected variance (Bartlett kernel)	1.024721

Phillips-Perron Test Equation
Dependent Variable: D(GDS)
Method: Least Squares
Date: 07/13/23 Time: 14:39
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDS(-1)	-0.240578	0.060100	-4.002954	0.0003
C	4.723955	1.522151	3.103474	0.0036
@TREND("1980")	-0.013320	0.018901	-0.704748	0.4852

R-squared	0.378423	Mean dependent var	-0.389859
Adjusted R-squared	0.346547	S.D. dependent var	1.341493
S.E. of regression	1.084415	Akaike info criterion	3.068708
Sum squared resid	45.86228	Schwarz criterion	3.192827
Log likelihood	-61.44286	Hannan-Quinn criter.	3.114202
F-statistic	11.87180	Durbin-Watson stat	2.047839
Prob(F-statistic)	0.000094		

Null Hypothesis: GDS has a unit root
Exogenous: None
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.601669	0.0105
Test critical values:	1% level	-2.621185	
	5% level	-1.948886	
	10% level	-1.611932	

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

Residual variance (no correction)	1.624039
HAC corrected variance (Bartlett kernel)	1.743781

Phillips-Perron Test Equation
Dependent Variable: D(GDS)
Method: Least Squares
Date: 07/13/23 Time: 14:39
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDS(-1)	-0.026124	0.009744	-2.680968	0.0105

R-squared	0.075546	Mean dependent var	-0.389859
Adjusted R-squared	0.075546	S.D. dependent var	1.341493
S.E. of regression	1.289826	Akaike info criterion	3.370413
Sum squared resid	68.20965	Schwarz criterion	3.411786
Log likelihood	-69.77866	Hannan-Quinn criter.	3.385577
Durbin-Watson stat	1.729224		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.129512	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Residual variance (no correction)	1.517017
HAC corrected variance (Bartlett kernel)	1.248780

Phillips-Perron Test Equation
Dependent Variable: D(GDS,2)
Method: Least Squares
Date: 07/13/23 Time: 14:41
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDS(-1))	-0.900425	0.147988	-6.084444	0.0000
C	-0.273964	0.204536	-1.339443	0.1882

R-squared	0.486980	Mean dependent var	0.055784
Adjusted R-squared	0.473826	S.D. dependent var	1.740965
S.E. of regression	1.262859	Akaike info criterion	3.352184
Sum squared resid	62.19769	Schwarz criterion	3.435773
Log likelihood	-66.71977	Hannan-Quinn criter.	3.382622
F-statistic	37.02045	Durbin-Watson stat	2.145011
Prob(F-statistic)	0.000000		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.431862	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Residual variance (no correction)	1.414248
HAC corrected variance (Bartlett kernel)	1.110719

Phillips-Perron Test Equation
Dependent Variable: D(GDS,2)
Method: Least Squares
Date: 07/13/23 Time: 14:42
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDS(-1))	-1.004649	0.157759	-6.368242	0.0000
C	-0.961738	0.459710	-2.092054	0.0432
@TREND("1980")	0.029527	0.017769	1.661726	0.1048

R-squared	0.521734	Mean dependent var	0.055784
Adjusted R-squared	0.496562	S.D. dependent var	1.740965
S.E. of regression	1.235273	Akaike info criterion	3.330817
Sum squared resid	57.98418	Schwarz criterion	3.456200
Log likelihood	-65.28174	Hannan-Quinn criter.	3.376474
F-statistic	20.72686	Durbin-Watson stat	2.077915
Prob(F-statistic)	0.000001		

Null Hypothesis: D(GDS) has a unit root
Exogenous: None
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.908247	0.0000
Test critical values:	1% level	-2.622585	
	5% level	-1.949097	
	10% level	-1.611824	

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

Residual variance (no correction)	1.586804
HAC corrected variance (Bartlett kernel)	1.343126

Phillips-Perron Test Equation
Dependent Variable: D(GDS,2)
Method: Least Squares
Date: 07/13/23 Time: 14:42
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDS(-1))	-0.847903	0.144108	-5.883797	0.0000

R-squared	0.463380	Mean dependent var	0.055784
Adjusted R-squared	0.463380	S.D. dependent var	1.740965
S.E. of regression	1.275333	Akaike info criterion	3.348379
Sum squared resid	65.05896	Schwarz criterion	3.390174
Log likelihood	-67.64178	Hannan-Quinn criter.	3.363599
Durbin-Watson stat	2.164207		

REAL GDP GROWTH RATE (PP)

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.317965	0.0001
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Residual variance (no correction)	5.793272
HAC corrected variance (Bartlett kernel)	5.628515

Phillips-Perron Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 07/13/23 Time: 14:44
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

	Variable	Coefficient	Std. Error	t-Statistic	Prob.
	GDP(-1)	-0.790496	0.148359	-5.328269	0.0000
C		1.552087	0.491956	3.154931	0.0030

R-squared	0.415123	Mean dependent var	-0.109007
Adjusted R-squared	0.400501	S.D. dependent var	3.185388
S.E. of regression	2.466361	Akaike info criterion	4.689812
Sum squared resid	243.3174	Schwarz criterion	4.772559
Log likelihood	-96.48606	Hannan-Quinn criter.	4.720142
F-statistic	28.39045	Durbin-Watson stat	2.031582
Prob(F-statistic)	0.000004		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.227283	0.0006
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Residual variance (no correction)	5.791944
HAC corrected variance (Bartlett kernel)	5.615520

Phillips-Perron Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 07/13/23 Time: 14:45
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.789427	0.150656	-5.239920	0.0000
C	1.485018	0.866725	1.713367	0.0946
@TREND("1980")	0.003015	0.031884	0.094562	0.9251

R-squared	0.415257	Mean dependent var	-0.109007
Adjusted R-squared	0.385270	S.D. dependent var	3.185388
S.E. of regression	2.497494	Akaike info criterion	4.737202
Sum squared resid	243.2616	Schwarz criterion	4.861321
Log likelihood	-96.48125	Hannan-Quinn criter.	4.782697
F-statistic	13.84799	Durbin-Watson stat	2.034166
Prob(F-statistic)	0.000029		

Null Hypothesis: GDP has a unit root
Exogenous: None
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.870316	0.0003
Test critical values:	1% level	-2.621185	
	5% level	-1.948886	
	10% level	-1.611932	

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

Residual variance (no correction)	7.234868
HAC corrected variance (Bartlett kernel)	6.929830

Phillips-Perron Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 07/13/23 Time: 14:45
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.493886	0.126681	-3.898667	0.0004

R-squared	0.269582	Mean dependent var	-0.109007
Adjusted R-squared	0.269582	S.D. dependent var	3.185388
S.E. of regression	2.722376	Akaike info criterion	4.864408
Sum squared resid	303.8645	Schwarz criterion	4.905781
Log likelihood	-101.1526	Hannan-Quinn criter.	4.879573
Durbin-Watson stat	2.198382		

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant
Bandwidth: 18 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-15.17902	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Residual variance (no correction)	8.825120
HAC corrected variance (Bartlett kernel)	1.653231

Phillips-Perron Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 07/13/23 Time: 14:47
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.359746	0.150759	-9.019342	0.0000
C	-0.095921	0.475736	-0.201626	0.8413

R-squared	0.675941	Mean dependent var	-0.039293
Adjusted R-squared	0.667632	S.D. dependent var	5.283362
S.E. of regression	3.045930	Akaike info criterion	5.113040
Sum squared resid	361.8299	Schwarz criterion	5.196629
Log likelihood	-102.8173	Hannan-Quinn criter.	5.143479
F-statistic	81.34853	Durbin-Watson stat	2.128445
Prob(F-statistic)	0.000000		

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-13.00475	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Residual variance (no correction)	8.755699
HAC corrected variance (Bartlett kernel)	2.352725

Phillips-Perron Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 07/13/23 Time: 14:48
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.368187	0.152903	-8.948068	0.0000
C	-0.588667	1.017995	-0.578261	0.5665
@TREND("1980")	0.022382	0.040775	0.548900	0.5863

R-squared	0.678490	Mean dependent var	-0.039293
Adjusted R-squared	0.661569	S.D. dependent var	5.283362
S.E. of regression	3.073587	Akaike info criterion	5.153923
Sum squared resid	358.9836	Schwarz criterion	5.279307
Log likelihood	-102.6554	Hannan-Quinn criter.	5.199581
F-statistic	40.09621	Durbin-Watson stat	2.131051
Prob(F-statistic)	0.000000		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-15.15645	0.0000
Test critical values:	1% level	-2.622585	
	5% level	-1.949097	
	10% level	-1.611824	

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

Residual variance (no correction)	8.834319
HAC corrected variance (Bartlett kernel)	1.727171

Phillips-Perron Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 07/13/23 Time: 14:48
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.359345	0.148927	-9.127587	0.0000

R-squared	0.675603	Mean dependent var	-0.039293
Adjusted R-squared	0.675603	S.D. dependent var	5.283362
S.E. of regression	3.009182	Akaike info criterion	5.065302
Sum squared resid	362.2071	Schwarz criterion	5.107096
Log likelihood	-102.8387	Hannan-Quinn criter.	5.080521
Durbin-Watson stat	2.126869		

INFLATION RATE(PP)

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.623892	0.4618
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Residual variance (no correction)	4.998073
HAC corrected variance (Bartlett kernel)	3.335100

Phillips-Perron Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 07/13/23 Time: 14:53
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.142057	0.076784	-1.850084	0.0717
C	1.055483	0.744919	1.416910	0.1643

R-squared	0.078825	Mean dependent var	-0.157631
Adjusted R-squared	0.055796	S.D. dependent var	2.357561
S.E. of regression	2.290846	Akaike info criterion	4.542168
Sum squared resid	209.9191	Schwarz criterion	4.624914
Log likelihood	-93.38552	Hannan-Quinn criter.	4.572497
F-statistic	3.422809	Durbin-Watson stat	1.726232
Prob(F-statistic)	0.071698		

Null Hypothesis: INF has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.682049	0.2488
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Residual variance (no correction)	4.593801
HAC corrected variance (Bartlett kernel)	4.828211

Phillips-Perron Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 07/13/23 Time: 14:53
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.332380	0.126932	-2.618557	0.0125
C	4.601029	2.045921	2.248879	0.0302
@TREND("1980")	-0.089314	0.048210	-1.852604	0.0715

R-squared	0.153335	Mean dependent var	-0.157631
Adjusted R-squared	0.109916	S.D. dependent var	2.357561
S.E. of regression	2.224224	Akaike info criterion	4.505442
Sum squared resid	192.9397	Schwarz criterion	4.629561
Log likelihood	-91.61428	Hannan-Quinn criter.	4.550937
F-statistic	3.531536	Durbin-Watson stat	1.574599
Prob(F-statistic)	0.038938		

Null Hypothesis: INF has a unit root
Exogenous: None
Bandwidth: 41 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.322341	0.1692
Test critical values:	1% level	-2.621185	
	5% level	-1.948886	
	10% level	-1.611932	

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

Residual variance (no correction)	5.248930
HAC corrected variance (Bartlett kernel)	1.518809

Phillips-Perron Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 07/13/23 Time: 14:53
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.046290	0.036881	-1.255117	0.2165

R-squared	0.032591	Mean dependent var	-0.157631
Adjusted R-squared	0.032591	S.D. dependent var	2.357561
S.E. of regression	2.318826	Akaike info criterion	4.543520
Sum squared resid	220.4551	Schwarz criterion	4.584893
Log likelihood	-94.41393	Hannan-Quinn criter.	4.558685
Durbin-Watson stat	1.804985		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.992549	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Residual variance (no correction)	5.457880
HAC corrected variance (Bartlett kernel)	0.790388

Phillips-Perron Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 07/13/23 Time: 14:56
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-0.933899	0.161118	-5.796383	0.0000
C	-0.185766	0.375779	-0.494349	0.6238

R-squared	0.462796	Mean dependent var	0.020343
Adjusted R-squared	0.449021	S.D. dependent var	3.227038
S.E. of regression	2.395364	Akaike info criterion	4.632498
Sum squared resid	223.7731	Schwarz criterion	4.716087
Log likelihood	-92.96622	Hannan-Quinn criter.	4.662937
F-statistic	33.59806	Durbin-Watson stat	1.904268
Prob(F-statistic)	0.000001		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.15753	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Residual variance (no correction)	5.402170
HAC corrected variance (Bartlett kernel)	0.328890

Phillips-Perron Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 07/13/23 Time: 14:56
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-0.936160	0.162429	-5.763511	0.0000
C	-0.625230	0.797674	-0.783817	0.4380
@TREND("1980")	0.019953	0.031874	0.625996	0.5351

R-squared	0.468279	Mean dependent var	0.020343
Adjusted R-squared	0.440294	S.D. dependent var	3.227038
S.E. of regression	2.414261	Akaike info criterion	4.671019
Sum squared resid	221.4890	Schwarz criterion	4.796403
Log likelihood	-92.75590	Hannan-Quinn criter.	4.716677
F-statistic	16.73302	Durbin-Watson stat	1.920927
Prob(F-statistic)	0.000006		

Null Hypothesis: D(INF) has a unit root
Exogenous: None
Bandwidth: 40 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.304223	0.0000
Test critical values:	1% level	-2.622585	
	5% level	-1.949097	
	10% level	-1.611824	

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

Residual variance (no correction)	5.492079
HAC corrected variance (Bartlett kernel)	1.949073

Phillips-Perron Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 07/13/23 Time: 14:57
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	-0.926363	0.158872	-5.830857	0.0000

R-squared	0.459429	Mean dependent var	0.020343
Adjusted R-squared	0.459429	S.D. dependent var	3.227038
S.E. of regression	2.372632	Akaike info criterion	4.589965
Sum squared resid	225.1753	Schwarz criterion	4.631759
Log likelihood	-93.09427	Hannan-Quinn criter.	4.605184
Durbin-Watson stat	1.900744		

REAL INTEREST RATE (PP)

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.409140	0.0001
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Residual variance (no correction)	7.562655
HAC corrected variance (Bartlett kernel)	9.313383

Phillips-Perron Test Equation
Dependent Variable: D(RIR)
Method: Least Squares
Date: 07/13/23 Time: 14:59
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIR(-1)	-0.604555	0.110336	-5.479210	0.0000
C	2.817193	0.626373	4.497628	0.0001

R-squared	0.428749	Mean dependent var	0.346823
Adjusted R-squared	0.414468	S.D. dependent var	3.682615
S.E. of regression	2.817940	Akaike info criterion	4.956337
Sum squared resid	317.6315	Schwarz criterion	5.039084
Log likelihood	-102.0831	Hannan-Quinn criter.	4.986667
F-statistic	30.02175	Durbin-Watson stat	1.658389
Prob(F-statistic)	0.000003		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.197753	0.0006
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Residual variance (no correction)	7.520084
HAC corrected variance (Bartlett kernel)	9.106948

Phillips-Perron Test Equation
Dependent Variable: D(RIR)
Method: Least Squares
Date: 07/13/23 Time: 14:59
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIR(-1)	-0.594338	0.113528	-5.235145	0.0000
C	3.148331	0.946995	3.324550	0.0019
@TREND("1980")	-0.017344	0.036911	-0.469872	0.6411

R-squared	0.431965	Mean dependent var	0.346823
Adjusted R-squared	0.402835	S.D. dependent var	3.682615
S.E. of regression	2.845795	Akaike info criterion	4.998311
Sum squared resid	315.8435	Schwarz criterion	5.122431
Log likelihood	-101.9645	Hannan-Quinn criter.	5.043806
F-statistic	14.82884	Durbin-Watson stat	1.686430
Prob(F-statistic)	0.000016		

Null Hypothesis: RIR has a unit root
Exogenous: None
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.777880	0.0066
Test critical values:	1% level	-2.621185	
	5% level	-1.948886	
	10% level	-1.611932	

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

Residual variance (no correction)	11.38721
HAC corrected variance (Bartlett kernel)	13.54778

Phillips-Perron Test Equation
Dependent Variable: D(RIR)
Method: Least Squares
Date: 07/13/23 Time: 15:00
Sample (adjusted): 1981 2022
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIR(-1)	-0.247354	0.092833	-2.664514	0.0110

R-squared	0.139858	Mean dependent var	0.346823
Adjusted R-squared	0.139858	S.D. dependent var	3.682615
S.E. of regression	3.415399	Akaike info criterion	5.317987
Sum squared resid	478.2630	Schwarz criterion	5.359360
Log likelihood	-110.6777	Hannan-Quinn criter.	5.333152
Durbin-Watson stat	1.683568		

Null Hypothesis: D(RIR) has a unit root
Exogenous: Constant
Bandwidth: 17 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.09113	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Residual variance (no correction)	9.112694
HAC corrected variance (Bartlett kernel)	1.937228

Phillips-Perron Test Equation
Dependent Variable: D(RIR,2)
Method: Least Squares
Date: 07/13/23 Time: 15:02
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RIR(-1))	-1.131749	0.131984	-8.574878	0.0000
C	0.067854	0.484869	0.139942	0.8894

R-squared	0.653421	Mean dependent var	-0.257414
Adjusted R-squared	0.644535	S.D. dependent var	5.191398
S.E. of regression	3.095159	Akaike info criterion	5.145106
Sum squared resid	373.6204	Schwarz criterion	5.228695
Log likelihood	-103.4747	Hannan-Quinn criter.	5.175545
F-statistic	73.52852	Durbin-Watson stat	2.259510
Prob(F-statistic)	0.000000		

Null Hypothesis: D(RIR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 18 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-18.15038	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Residual variance (no correction)	9.055215
HAC corrected variance (Bartlett kernel)	0.987316

Phillips-Perron Test Equation
Dependent Variable: D(RIR,2)
Method: Least Squares
Date: 07/13/23 Time: 15:02
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RIR(-1))	-1.146341	0.136558	-8.394508	0.0000
C	0.528758	1.058522	0.499525	0.6203
@TREND("1980")	-0.020760	0.042269	-0.491129	0.6262

R-squared	0.655607	Mean dependent var	-0.257414
Adjusted R-squared	0.637481	S.D. dependent var	5.191398
S.E. of regression	3.125716	Akaike info criterion	5.187559
Sum squared resid	371.2638	Schwarz criterion	5.312943
Log likelihood	-103.3450	Hannan-Quinn criter.	5.233217
F-statistic	36.16957	Durbin-Watson stat	2.248733
Prob(F-statistic)	0.000000		

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.29806	0.0000
Test critical values:	1% level	-2.622585	
	5% level	-1.949097	
	10% level	-1.611824	

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

Residual variance (no correction)	9.117270
HAC corrected variance (Bartlett kernel)	1.961708

Phillips-Perron Test Equation
Dependent Variable: D(RIR,2)
Method: Least Squares
Date: 07/13/23 Time: 15:02
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RIR(-1))	-1.130304	0.129957	-8.697509	0.0000

R-squared	0.653247	Mean dependent var	-0.257414
Adjusted R-squared	0.653247	S.D. dependent var	5.191398
S.E. of regression	3.056992	Akaike info criterion	5.096828
Sum squared resid	373.8081	Schwarz criterion	5.138622
Log likelihood	-103.4850	Hannan-Quinn criter.	5.112047
Durbin-Watson stat	2.260904		

APPENDIX B - LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria
Endogenous variables: GDS GDP INF RIR
Exogenous variables: C
Date: 07/14/23 Time: 15:05
Sample: 1980 2022
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-392.6227	NA	4815.860	19.83114	20.00002	19.89220
1	-321.4222	124.6010*	306.3897*	17.07111*	17.91555*	17.37643*
2	-313.2809	12.61891	465.8533	17.46405	18.98404	18.01363
3	-296.3775	22.81958	475.8910	17.41888	19.61442	18.21272

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

APPENDIX C - ARDL BOUNDS TEST/ SHORT AND LONG RUN RESULTS

Dependent Variable: GDS
Method: ARDL
Date: 07/14/23 Time: 10:40
Sample (adjusted): 1984 2022
Included observations: 39 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): GDP INF RIR
Fixed regressors: C @TREND
Number of models evaluated: 500
Selected Model: ARDL(4, 4, 4, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDS(-1)	0.382988	0.169340	2.261647	0.0363
GDS(-2)	0.187080	0.209905	0.891258	0.3845
GDS(-3)	-0.053077	0.203205	-0.261197	0.7969
GDS(-4)	0.271152	0.150119	1.806243	0.0876
GDP	-0.201326	0.108615	-1.853567	0.0803
GDP(-1)	-0.473947	0.115318	-4.109899	0.0007
GDP(-2)	-0.212175	0.108523	-1.955119	0.0663
GDP(-3)	0.036596	0.123640	0.295988	0.7706
GDP(-4)	-0.247791	0.105001	-2.359896	0.0298
INF	-0.129198	0.096005	-1.345734	0.1951
INF(-1)	-0.164171	0.119914	-1.369073	0.1878
INF(-2)	-0.492208	0.147104	-3.345999	0.0036
INF(-3)	0.093857	0.118748	0.790386	0.4396
INF(-4)	-0.401666	0.115882	-3.466156	0.0028
RIR	0.030255	0.081043	0.373321	0.7133
RIR(-1)	-0.023966	0.088862	-0.269693	0.7905
RIR(-2)	-0.292677	0.087095	-3.360435	0.0035
RIR(-3)	-0.114617	0.087552	-1.309129	0.2070
RIR(-4)	0.231580	0.081647	2.836346	0.0109
C	23.63638	6.035776	3.916047	0.0010
@TREND	-0.336669	0.081894	-4.111027	0.0007

R-squared	0.940273	Mean dependent var	19.05851
Adjusted R-squared	0.873909	S.D. dependent var	2.344914
S.E. of regression	0.832661	Akaike info criterion	2.775352
Sum squared resid	12.47983	Schwarz criterion	3.671116
Log likelihood	-33.11937	Hannan-Quinn criter.	3.096745
F-statistic	14.16854	Durbin-Watson stat	2.277310
Prob(F-statistic)	0.000000		

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

ARDL Long Run Form and Bounds Test
Dependent Variable: D(GDS)
Selected Model: ARDL(4, 4, 4, 4)
Case 5: Unrestricted Constant and Unrestricted Trend
Date: 07/14/23 Time: 10:40
Sample: 1980 2022
Included observations: 39

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	23.63638	6.035776	3.916047	0.0010
@TREND	-0.336669	0.081894	-4.111027	0.0007
GDS(-1)*	-0.211857	0.116127	-1.824364	0.0847
GDP(-1)	-1.098643	0.293139	-3.747854	0.0015
INF(-1)	-1.093386	0.251914	-4.340318	0.0004
RIR(-1)	-0.169425	0.153538	-1.103469	0.2844
D(GDS(-1))	-0.405155	0.187037	-2.166171	0.0440
D(GDS(-2))	-0.218075	0.160085	-1.362244	0.1899
D(GDS(-3))	-0.271152	0.150119	-1.806243	0.0876
D(GDP)	-0.201326	0.108615	-1.853567	0.0803
D(GDP(-1))	0.423370	0.182936	2.314303	0.0327
D(GDP(-2))	0.211195	0.152664	1.383396	0.1835
D(GDP(-3))	0.247791	0.105001	2.359896	0.0298
D(INF)	-0.129198	0.096005	-1.345734	0.1951
D(INF(-1))	0.800017	0.198310	4.034177	0.0008
D(INF(-2))	0.307809	0.139376	2.208469	0.0404
D(INF(-3))	0.401666	0.115882	3.466156	0.0028
D(RIR)	0.030255	0.081043	0.373321	0.7133
D(RIR(-1))	0.175714	0.114932	1.528856	0.1437
D(RIR(-2))	-0.116964	0.094069	-1.243378	0.2297
D(RIR(-3))	-0.231580	0.081647	-2.836346	0.0109

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	-5.185765	3.335788	-1.554585	0.1375
INF	-5.160951	2.848482	-1.811825	0.0867
RIR	-0.799710	0.544578	-1.468494	0.1592

EC = GDS - (-5.1858*GDP -5.1610*INF -0.7997*RIR)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	8.974896	10%	3.47	4.45
k	3	5%	4.01	5.07
		2.5%	4.52	5.62
		1%	5.17	6.36
Actual Sample Size	39		Finite Sample: n=40	
		10%	3.76	4.795
		5%	4.51	5.643
		1%	6.238	7.74
			Finite Sample: n=35	
		10%	3.8	4.888
		5%	4.568	5.795
		1%	6.38	7.73

ARDL Error Correction Regression
Dependent Variable: D(GDS)
Selected Model: ARDL(4, 4, 4, 4)
Case 5: Unrestricted Constant and Unrestricted Trend
Date: 07/14/23 Time: 10:50
Sample: 1980 2022
Included observations: 39

ECM Regression
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	23.63638	3.758318	6.289085	0.0000
@TREND	-0.336669	0.055799	-6.033631	0.0000
D(GDS(-1))	-0.405155	0.141258	-2.868200	0.0102
D(GDS(-2))	-0.218075	0.137887	-1.581544	0.1312
D(GDS(-3))	-0.271152	0.129091	-2.100470	0.0500
D(GDP)	-0.201326	0.086850	-2.318092	0.0324
D(GDP(-1))	0.423370	0.136727	3.096461	0.0062
D(GDP(-2))	0.211195	0.123953	1.703833	0.1056
D(GDP(-3))	0.247791	0.081391	3.044446	0.0070
D(INF)	-0.129198	0.073145	-1.766335	0.0943
D(INF(-1))	0.800017	0.151887	5.267193	0.0001
D(INF(-2))	0.307809	0.111782	2.753641	0.0131
D(INF(-3))	0.401666	0.100228	4.007534	0.0008
D(RIR)	0.030255	0.054100	0.559244	0.5829
D(RIR(-1))	0.175714	0.065163	2.696508	0.0148
D(RIR(-2))	-0.116964	0.059482	-1.966355	0.0649
D(RIR(-3))	-0.231580	0.060660	-3.817656	0.0013
CointEq(-1)*	-0.211857	0.032736	-6.471696	0.0000

R-squared	0.771237	Mean dependent var	-0.225908
Adjusted R-squared	0.586049	S.D. dependent var	1.198175
S.E. of regression	0.770894	Akaike info criterion	2.621506
Sum squared resid	12.47983	Schwarz criterion	3.389304
Log likelihood	-33.11937	Hannan-Quinn criter.	2.896985
F-statistic	4.164603	Durbin-Watson stat	2.277310
Prob(F-statistic)	0.001259		

* 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	8.974896	10%	3.47	4.45
k	3	5%	4.01	5.07
		2.5%	4.52	5.62
		1%	5.17	6.36

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-6.471696	10%	-3.13	-3.84
		5%	-3.41	-4.16
		2.5%	-3.65	-4.42
		1%	-3.96	-4.73

APPENDIX D

DESCRIPTIVE STATISTICS RESULTS

	GDS	GDP	INF	RIR
Mean	20.00205	2.099958	8.504760	4.073968
Median	18.67852	2.400000	7.039727	4.027493
Maximum	33.69330	6.620583	18.65492	12.69103
Minimum	16.39346	-6.342471	-0.692030	-11.00901
Std. Dev.	3.834820	2.565199	4.609310	3.941672
Skewness	1.747736	-0.809198	0.430097	-0.897377
Kurtosis	5.881351	4.110212	2.211543	6.891121
Jarque-Bera	36.76591	6.901096	2.439529	32.89852
Probability	0.000000	0.031728	0.295300	0.000000
Sum	860.0881	90.29819	365.7047	175.1806
Sum Sq. Dev.	617.6455	276.3703	892.3209	652.5447
Observations	43	43	43	43

COVARIANCE ANALYSIS: ORDINARY

Covariance Analysis: Ordinary

Date: 09/05/23 Time: 15:40

Sample: 1980 2022

Included observations: 43

Covariance

Correlation

Probability	GDS	GDP	INF	RIR
GDS	14.36385			
	1.000000			

	- - -			
GDP	2.390773	6.427217		
	0.248823	1.000000		
	0.1076	-----		
INF	9.893916	-2.285777	20.75165	
	0.573068	-0.197923	1.000000	
	0.0001	0.2033	-----	
RIR	-7.648249	-0.023833	-6.228589	15.17546
	-0.518031	-0.002413	-0.350988	1.000000
	0.0004	0.9877	0.0210	-----

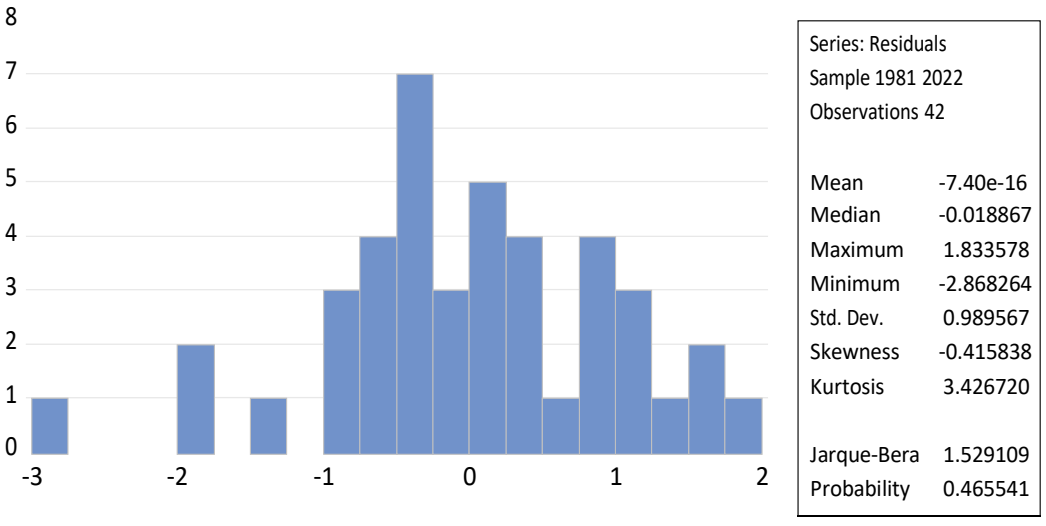
APPEDNIX E- GRANGER CAUSALITY TEST RESULTS

Pairwise Granger Causality Tests
Date: 07/20/23 Time: 12:32
Sample: 1980 2022
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
GDP does not Granger Cause GDS	41	0.06160	0.9404
GDS does not Granger Cause GDP		1.61123	0.2137
INF does not Granger Cause GDS	41	0.64371	0.5313
GDS does not Granger Cause INF		1.41559	0.2560
RIR does not Granger Cause GDS	41	0.40957	0.6670
GDS does not Granger Cause RIR		1.70683	0.1958
INF does not Granger Cause GDP	41	3.56481	0.0387
GDP does not Granger Cause INF		1.54871	0.2263
RIR does not Granger Cause GDP	41	3.12129	0.0562
GDP does not Granger Cause RIR		1.23499	0.3029
RIR does not Granger Cause INF	41	0.37410	0.6906
INF does not Granger Cause RIR		0.43384	0.6514

APPENDIX F (DIAGNOSTIC TESTS RESULTS)

Jarque-Bera Residual test:



Ljung-Box Q: Autocorrelation

Date: 07/20/23 Time: 14:05
Sample (adjusted): 1981 2022
Q-statistic probabilities adjusted for 1 dynamic regressor

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.062	-0.062	0.1718	0.679
		2	-0.205	-0.210	2.1224	0.346
		3	-0.068	-0.101	2.3434	0.504
		4	0.223	0.176	4.7709	0.312
		5	-0.217	-0.239	7.1182	0.212
		6	-0.052	-0.007	7.2564	0.298
		7	0.055	-0.000	7.4163	0.387
		8	-0.001	-0.104	7.4164	0.492
		9	-0.214	-0.149	9.9929	0.351
		10	0.076	0.010	10.327	0.412
		11	-0.086	-0.223	10.769	0.463
		12	-0.079	-0.117	11.155	0.516
		13	-0.091	-0.140	11.684	0.554
		14	0.257	0.078	16.035	0.311
		15	-0.149	-0.202	17.562	0.286
		16	-0.165	-0.233	19.503	0.243
		17	0.013	-0.139	19.516	0.300
		18	0.279	-0.004	25.514	0.111
		19	-0.066	-0.075	25.862	0.134
		20	-0.001	-0.054	25.862	0.170

*Probabilities may not be valid for this equation specification.

Breusch-Godfrey Serial correlation LM test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.200006	Prob. F(2,34)	0.3136
Obs*R-squared	2.769243	Prob. Chi-Square(2)	0.2504

Heteroscedasticity test: ARCH

Heteroskedasticity Test: ARCH

F-statistic	0.560888	Prob. F(1,39)	0.4584
Obs*R-squared	0.581292	Prob. Chi-Square(1)	0.4458

Heteroscedasticity test: HARVEY

Heteroskedasticity Test: Harvey
Null hypothesis: Homoskedasticity

F-statistic	0.447217	Prob. F(5,36)	0.8124
Obs*R-squared	2.456204	Prob. Chi-Square(5)	0.7831
Scaled explained SS	1.731766	Prob. Chi-Square(5)	0.8849

Heteroscedasticity test: GLESJER

Heteroskedasticity Test: Glejser
Null hypothesis: Homoskedasticity

F-statistic	0.271514	Prob. F(5,36)	0.9257
Obs*R-squared	1.526275	Prob. Chi-Square(5)	0.9100
Scaled explained SS	1.392642	Prob. Chi-Square(5)	0.9251

Heteroscedasticity test: BREUSCH-PEGAN-GODFREY

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.251225	Prob. F(5,36)	0.9364
Obs*R-squared	1.416070	Prob. Chi-Square(5)	0.9225
Scaled explained SS	1.262353	Prob. Chi-Square(5)	0.9388

Heteroscedasticity test: WHITE

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	1.221009	Prob. F(20,21)	0.3263
Obs*R-squared	22.58132	Prob. Chi-Square(20)	0.3098
Scaled explained SS	20.13008	Prob. Chi-Square(20)	0.4498

Ramsey RESET Test

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: GDS GDS(-1) GDP INF RIR RIR(-1) C

	Value	df	Probability
t-statistic	0.695495	35	0.4913
F-statistic	0.483714	(1, 35)	0.4913
Likelihood ratio	0.576482	1	0.4477

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.547310	1	0.547310
Restricted SSR	40.14895	36	1.115249
Unrestricted SSR	39.60164	35	1.131475

LR test summary:

	Value
Restricted LogL	-58.64888
Unrestricted LogL	-58.36064

Unrestricted Test Equation:
Dependent Variable: GDS
Method: Least Squares
Date: 07/20/23 Time: 14:23
Sample: 1981 2022
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDS(-1)	0.392698	0.579252	0.677941	0.5023
GDP	0.102941	0.102969	0.999732	0.3243
INF	0.021956	0.050712	0.432959	0.6677
RIR	-0.073676	0.089958	-0.819002	0.4183
RIR(-1)	0.071720	0.072497	0.989282	0.3293
C	6.899493	5.241549	1.316308	0.1966
FITTED^2	0.011458	0.016475	0.695495	0.4913

R-squared	0.906980	Mean dependent var	19.67607
Adjusted R-squared	0.891034	S.D. dependent var	3.222377
S.E. of regression	1.063708	Akaike info criterion	3.112411
Sum squared resid	39.60164	Schwarz criterion	3.402023
Log likelihood	-58.36064	Hannan-Quinn criter.	3.218565
F-statistic	56.87715	Durbin-Watson stat	2.049755
Prob(F-statistic)	0.000000		

APPENDIX G: VARIANCE DECOMPOSITION

Variance Decomposition of GDS:

Period	S.E.	GDS	GDP	INF	RIR
1	1.161799	100.0000	0.000000	0.000000	0.000000
2	1.430281	98.30497	0.232811	1.462127	9.53E-05
3	1.606026	96.02046	0.333885	2.981060	0.664598
4	1.732443	93.89813	0.287300	4.463920	1.350646
5	1.824183	92.07647	0.268924	6.000393	1.654210
6	1.886898	90.64815	0.268476	7.278039	1.805335
7	1.928536	89.62000	0.282723	8.205828	1.891448
8	1.955766	88.90665	0.302853	8.856450	1.934045
9	1.973170	88.42599	0.321374	9.298374	1.954266
10	1.984050	88.11240	0.336498	9.586434	1.964664

Variance Decomposition of GDP:

Period	S.E.	GDS	GDP	INF	RIR
1	2.125605	2.900213	97.09979	0.000000	0.000000
2	2.650675	7.985870	63.53024	19.18468	9.299212
3	2.701776	7.688081	61.22154	22.13960	8.950784
4	2.718045	7.599969	61.07980	22.06665	9.253583
5	2.726245	7.606994	61.02935	22.15971	9.203947
6	2.728271	7.595700	60.96907	22.22680	9.208435
7	2.728685	7.604074	60.96739	22.22289	9.205645
8	2.728983	7.610034	60.96698	22.21922	9.203766
9	2.729169	7.615727	60.96189	22.21887	9.203514
10	2.729336	7.621284	60.95507	22.22089	9.202753

Variance Decomposition of INF:

Period	S.E.	GDS	GDP	INF	RIR
1	2.279039	5.541213	0.219634	94.23915	0.000000
2	3.188167	3.882708	1.359044	94.73944	0.018813
3	3.505558	5.414761	1.127346	93.37603	0.081866
4	3.659845	6.668861	1.214655	91.85760	0.258880
5	3.752256	8.213059	1.199249	89.88768	0.700014
6	3.807444	9.906777	1.176634	87.94530	0.971290
7	3.844409	11.34420	1.160918	86.35284	1.142039
8	3.871805	12.45370	1.145546	85.13562	1.265138
9	3.892755	13.28119	1.133379	84.24200	1.343438
10	3.908566	13.87009	1.125286	83.61473	1.389891

Variance Decomposition of RIR:

Period	S.E.	GDS	GDP	INF	RIR
1	2.780757	3.263624	9.757187	0.572196	86.40699
2	3.282018	3.910844	16.89418	2.665566	76.52941
3	3.385752	4.018282	19.16759	4.075267	72.73887
4	3.410833	3.964428	20.17409	4.073461	71.78802
5	3.426044	3.990568	20.67986	4.163470	71.16610
6	3.436367	4.041760	20.80436	4.413874	70.74001
7	3.444377	4.098898	20.77503	4.713623	70.41245
8	3.450640	4.137910	20.71852	4.986455	70.15712
9	3.454845	4.156893	20.67259	5.184084	69.98643
10	3.457390	4.164371	20.64271	5.309409	69.88351

Cholesky One S.D. (d.f. adjusted)
Cholesky ordering: GDS GDP INF RIR