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ASSESSING THE IMPACT OF EXCHANGE RATES ON ECONOMIC GROWTH IN SOUTH AFRICA.

BY

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APPROVAL FORM

I the undersigned Sithole Tafadzwa student number B191085A, do hereby declare that this research project is a submission of my own original and independent work and hasnt been copied or extracted from previous sources without due acknowledgement of the sources.

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DEDICATION

The path to success is paved with those who leave enduring imprints in one's life, and as one progresses through life, it is inevitable that one will lose touch with some of the most admirable individuals. Therefore, I dedicate this study to my late parents, whose influence on my life left footprints in some way or another. I would also like to dedicate this work to my wonderful guardians, Michael and Jannefer Muriro who were adamant that education is the key to success, in appreciation for their prayers, inspiration, financial support, and encouragement.

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ABSTRACT

This research looked at how exchange rates affect South Africa's economic expansion, with time series data on quarterly intervals from 2012 to 2022. The effect of real exchange on South Africa's economic expansion was examined using the Johansen cointegration and vector error correction model. Real interest rates, trade openness, money supply, real exchange rates, and gross fixed capital formation were variables in this study. The research's findings showed that broad money has a negative long-term effect on economic development in SA, as well as trade exchange rates, openness, gross fixed capital formation, and interest rates have a positive long-term effect. According to the regression results, depreciation of a nation's money substantially slows economic development over the long-term while substantially accelerating it over the short-term. Undervaluation of exchange rates with the intention of achieving higher development rates is therefore not sustainable over the long- term but only successful in the short-run. The researcher suggested that overvaluation and depreciation of the rand be desisted by all means in light of the study's findings. The study's findings also indicated that interest rates have a substantial effect of economic development, and due to this impact South Africa is advised to keep its current monetary policy in place.

CONTENTS

ACRONYMES

ADF - Augmented Dickey-Fuller

ARDL - Autoregressive Distributed Lag

BS - Balassa-Samuelson hypothesis

COSATU - Congress of South African Trade Union

DTI - Department of trade and industry

DW - Durbin-Watson

ELGH - Export-led growth hypothesis

EU - European Union

FCF - Fixed capital formation

GDE - Gross domestic expenditure

GDP - Gross Domestic Product

GEAR - Growth, Employment and Redistribution Policy

GLS - Generalized least squares

GMM – Generalized Method of Moments

JB - Jarque-Bera test

LDC - Least Developed Countries

M - Imports

MS- Money supply

OECD - Organization for Economic Co-operation and Development

OLS - Ordinary Least Squares

PP - Phillips-Perron

PPP- Purchasing Power Parity

EXCH- Exchange rates

RIR - Real interest rates

SA - South Africa

SACU - Southern African Customs Union

SADC- Southern African Development Community

SARB - South African Reserve Bank

StatsSA - Statistics South Africa

TFP - Total Factor Productivity growth

OP - Trade openness

VAR - Vector Auto-regression

VECM - Vector Error Correction Model

WB – World Bank

X - Exports

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CHAPTER ONE

1.1 Introduction

This research looks into the relationship amid South Africa's economic performance and exchange rates. According to Umargaliyev Kairat (2017), one of the most important topics for economists and decision-makers in recent decades has been the impact of exchange rates on economic growth. South Africa's public discourse on trade and trade policy is heavily influenced by exchange rates, with universal requests for currency stabilization. Thus, the exchange rates act as a global benchmark for assessing a country's level of competitiveness. According to Khondker (2012), managing the exchange rate is viewed as a key policy goal for achieving a variety of goals, including fostering economic growth, containing inflation, and maintaining international competitiveness. The chapter will focus on the background of the South African economy and exchange rates. Assumptions of the research, research objectives and questions, importance of the research, restrictions and delimitations. Problem statement and the research hypothesis.

1.2 Background of the study

In both developing and developed nations, research on the connection amid the exchange rate and economic development is gaining a lot of attention from almost every citizen Guzman (2018). Schaling (2014), states that appeals for an increase, decrease, and simple stabilization of exchange rates are frequently heard in South Africa's public discourse on trade and trade policy. According to Hamilton (2018), economists have understood for a long time that poorly controlled exchange rates can have cynical effects on economic development. Thus, the actual exchange rate acts as a benchmark price used globally to assess a nation's level of competitiveness. Ahn (2017), the exchange rate is the fundamental in determining how broadly output and spending are allocated in the local economy among foreign and local goods.

South Africa experienced high price increases (inflation), decreasing production, as well as high unemployment since 1994. In order to maintain the stability of prices and inflation parity with its major trading partners, the monetary authorities adopted an inflation targeting regime. As a result, the nation stopped using the fixed exchange rate regime in favor of a market based, free floating exchange rate, Vermeulen (2017). Adopting a free float exchange rate system made it easy for the economy to be affected by risks of currency misalignment. Khomo (2020), says that, misalignment is the difference between the actual versus the observed exchange rate and the equilibrium exchange rate. Currency misalignment can either be an overestimation or

an undervaluation. Nations that are still rising are normally guilty of the latter, that brings harm to the export division and also brings harm to the economic development. Torre (2013) contends that specifically soaring economies, are advised to conduct their policies in order to achieve an exchange rate that does not deviate far-off from its equilibrium value.

South Africa, like numerous developing market economies, is an open economy that engages in extensive worldwide trade. As a result, it heavily relies on imported capital products and specializes in commodity exports. To benefit from this trade, the nation must uphold a very competitive exchange rate which is not too frail or too strong. If a currency is overvalued it can be hazardous to South Africa's economy. According to Schaling (2014), an overvalued rand weakens exports. The basis is that if a rand is strong, it makes exports increase in price while imports become cheap, adding to an import rise which weakens the balance of payments' account. The exchange rate is also linked to South African manufacturing activity. According to Stewart Jennings, chairperson of the Manufacturing Circle, "the manufacturing sector which was contributing 25% to South Africa's gross domestic product during its heydays in the 1960s decreased to only about 15% in 2011." (Prinsloo, 2011). This was due to an overvalued rand, prompting calls from the sector to devalue the currency.

Real depreciation, according to proponents of a weaker currency, is advantageous for the economy. Real depreciation, according to Mclntyre (2018), boosts export competitiveness, increases export heterogeneity, safeguards local industries against imports, and eventually expands the trade balance, which encourages economic development. The majority of nations today acknowledge that competitive exchange rates are a key macroeconomic tool for assuring low inflation rates, encouraging exports, and boosting economic growth. To help cut inflation, the South African government relaxed currency controls as part of its Growth, Employment and Redistribution Policy (GEAR). The consensus among policymakers emphasizes on the necessity of a more competitive and stable exchange rate in the new growth path. Treasury (2012) states that in order to attain growth and employment goals over a more reliable exchange rate and reduced cost of capital, the government under the new growth route intends to support active monetary policy measures. In light of this, Warjiyo (2013) notes that recent policy talks tried to ensure exchange rate stability and proper exchange rate alignment as crucial components in the enhancement of economic development.

When doing international trade and aiming for economic development exchange rates are essential for decision making. It is clear that changes in exchange rates (whether they are

depreciating or appreciating) have broad-based and lasting consequences on the economy. Therefore, it is crucial to comprehend how South Africa's economic growth is impacted by currency rates. Maintaining sustainable economic growth is one of South Africa's macroeconomic goals. Adequate foreign reserves and a robust, globally aggressive exporting sector which will support the development of jobs and high earnings are both aided by high economic growth.

1.3 Statement of the problem

Since 1994, South Africa's fiscal discipline and generally traditional economic strategy have fallen short of expectations for employment and growth (Tendengu 2022). It is appropriate to know about how the policy framework the South African government has chosen has changed the state of the economy. Even after sixteen years of democracy, South Africa has struggled with challenging issues like high unemployment and slow economic growth. The main concerns that come to mind when considering the government's exchange-rate policy over some years are how the economy is performing in relation to economic growth and unemployment. Does the South African exchange rate have an impact on economic growth and unemployment reduction? What impact could a higher or lower rand have on the economy? By examining the impact of exchange rate on economic growth in SA, this research seeks to address these questions.

Different interpretations of theories and empirical data about the connection amid economic growth and exchange rates are offered. The debate over the impact of SA's exchange rate strenth is currently a topic of discussion, with the Washington content versus Rodrik's(2007) conclusions (Mishi, 2011). The theoretical literature is the source of these opposing viewpoints. Devaluation, according to the conventional view of exchange rates, has a stimulative effect on the economy Warjiyo (2013) and Kumar (2020). On the other side, the structuralist approach to currency rates is as persuasive that devaluation is contractionary to economic expansion Galebotswe, (2011). Different methodologies and empirical evidence from various nations, including South Africa, have produced conflicting results regarding the relationship Chisadza,(2018), Ajayi (2014).

Contradictory recommendations from various South African economic stakeholders, including the manufacturing sector, the monetary authorities, and the labor organizations like the Congress of South African Trade Union-COSATU, are justified by the lack of agreement in the literature concerned by high unemployment levels. The recommendation to lower the

currency entails some expenses associated with meddling with market dynamics. Exchange rates are a highly important factor in the economic process in South Africa because of the country's open economy. With this knowledge in mind, the study aims to determine if actual exchange rates directly and significantly affect the economic growth.

1.4 Research questions

- Does exchange rates affect economic development?
- Is there a relationship between exchange rates and economic development?
- Is there a substantial effect of the exchange rate of the South African economic development in the long-run and short-run?

1.4.1 Objectives of the study

The main objective of this research is to evaluate the impact of exchange rates on economic development in South Africa from 2012 to 2022. The detailed objectives of the study are as follows

- To identify the association between exchange rates and economic development.
- To evaluate the impact of exchange rates on SA's economic development since first quarter from 2012 to the second quarter 2022.
- To evaluate the role of exchange rates on economic development in the short and long run.

1.4.2 Hypothesis

$H_{0:}$ exchange rates' impact on economic development is not significant.

H_1: exchange rates' impact on economic development is significant.

1.4.3 Aim of the study

The aim of the study is to see if there exists a substantial effect of exchange rates on the South African economic development with the help of a regression model.

1.5 Assumptions

- Subjects under study will provide true information
- The information used for this research is reliable, accurate and unbiased and is to be obtained from relevant personal, authors and publication
- The information used and presented is only used for academic purposes.

1.6 Significance of the study

This research investigates the effects of exchange rates on South Africa's economic development between 2012 and 2022. The research helps to clarify the association between exchange rates and economic development in this regard. Real exchange rates and economic growth: Are there clear-cut explanations in economic theory or actual research? There has been much discussion both domestically and abroad about the association between economic development and exchange rates. Numerous academics are looking into this connection, however the empirical literature's findings about the link amid exchange rates and economic development are still up for debate. This study adds to the proceeding conversation on exchange rates and economic development in a valuable way because of this. The findings of this study should aid in the formation and planning of policies at all stages of government, in the financial industry, in the business world and in labor unions.

1.7 Limitation of the study

- The primary drawback was that some of the secondary data used in this study came from different sources that are prone to error and thus cannot be completely trusted.

1.7.1 Delimitation

- This study focused on the assessment of the impact of exchange rates on South Africa’s economic growth using the information collected from the year 2012 up to 2022.

1.8 Organization of study

Chapter 1 introduces the background of the research. The theoretical and empirical literature on the association between South Africa's exchange rates and economic growth is reviewed in Chapter 2. Chapter 3 presents a discussion on methodology. Chapter 4 presents the estimation techniques and interpretation of the results. Chapter 5 presents the summary, conclusions and policy recommendations.

1.9 Definition of key terms

Exchange rate – Boyce 30 April 2022 is the value at which one currency can be converted into another. In other words, it is the level or value at which one currency can purchase a different currency.

Exports – Amadeo (2021) defines exports as an element of global trade. These are products and services that are made in one nation and bought by citizens of another nation.

Imports – these are goods or raw materials that you purchase from another nation to use in your own. Collins dictionary

Overvalued currency – Harvey 2012 a circumstance where the value of a currency is greater than what the open market will pay. For instance, when other trading is flat, central banks may buy more of a currency than they typically do, leading to currency overvaluation.

Undervalued currency – means the rate at which it can be exchanged for other world currencies is too low. By Merrit 2019

Monetary policy - is the central bank's declared macroeconomic policy. It is a demand-side economic plan used by a government to attain macroeconomic goals like inflation, consumption, growth, and liquidity.

1.10 Summary

The study's introduction and background and overview of the country under study were discussed in this chapter. Together with the study's aims and objectives, the research problem was presented, where the government is having challenge in maintaining the inflation and the economic growth. Together with the study's goals and objectives, that is to assess if the exchange rates have a substantial impact on the GDP. The study's significance as well as its presumptions, restrictions, and delimitations were explained.

CHAPTER TWO

2.1 Introduction

The theoretical and empirical research that stands as the foundation for this study's analytical approach is represented in this chapter. It is crucial to understand the theoretical outline that supports this research so as to provide a conceptual foundation and relevant policy recommendations. The empirical literature is also offered, in addition to the numerous hypotheses that will be explored in this chapter. The purpose of presenting empirical literature is to examine previous research and the various research methodologies used in this area in order to spot any slits in the literature. There are two parts to this chapter. The first segment discusses the concepts which clarify how exchange rates and economic development are related, while the following half discusses the empirical research. The chapter's conclusion includes a summary of the literature and closing thoughts.

2.2 Theoretical literature

This section investigates exchange rate theories and how they might be linked to economic growth. The conventional (traditional) exchange rate approach, the structuralist approach, the Balassa-Samuelson Hypothesis, and the export-led hypothesis are all covered in the first section.

2.2.1 The traditional approach to exchange rates

According to the mentioned viewpoint, devaluation has an expansionary effect on economic development. This is commonly referred to as the traditional viewpoint. According to this viewpoint, devaluation of a currency causes local products to be more affordable abroad, which increases demand, resulting in an increase in exports (Warjiyo, 2013). The opinion that currency devaluation has expansionary effects on output is obvious in that devaluation expands trade balance, lightens balance of payments difficulties, and thus increases output and employment (Iyoboyi, 2014). The case for depreciation is that depreciation improves the cost competitiveness of a country's exports, which are a component of its GDP. The traditional view of exchange rates holds that exchange rates influence economic development through focal channels: total factor productivity growth and capital accumulation. An examination of the two is discussed in the following segment.

2.2.1.1 Total factor productivity growth channel

Total factor productivity growth channel assumes that as a result of currency devaluation, a country's output mix shifts from the production of non-traded to traded products. The production of some types of traded products (exported manufactured goods) is what establishes the link between output composition and growth through external mechanisms like technology and skill transfers linked to learning by doing (Kiriyama and Anand, 2012). This change to the production of goods and technological advancements has resulted in more local investments, increased exports and economic development.

The structure of local production is the central focus of the investigation according to the Total Factor Productivity growth channel (Cardarelli, 2015). This increase in productivity across the economy ultimately promotes growth (Mbaye, 2012). Currency depreciation shifts demand from imported commodities to locally produced items by raising the relative pricing of imports, according to Kohler (2014). By encouraging home production of tradeable goods and supporting local businesses to recruit more local inputs, export businesses, on the other hand, become more aggressive in global markets.

According to Hamilton, (2018), changes in exchange rates have an impact on aggregate demand through enhancing global competitiveness and net exports. In other words, locals choose domestic goods when the rand depreciates against other currencies, boosting the manufacturing sector's economic performance. Positive net exports emerge from the nation's simultaneous increase in exports and decrease in imports. Carroll, (2014) goes on explaining that a rise in exports is expected to upgrade aggregate demand, that will result in an increase in local production and employment through the multiplier effect. It is believed that, assuming there is unemployment in the economy, the rise in the general price level leads to the reduction of the real wage, which in turn leads to greater hiring and increased production because depreciation tends to be inflationary.

The Total Factor Productivity growth channel is criticized for not outlining its exact operational procedures, with the exception of the learning-by-doing presumption. Additionally, it lacks empirical backing; Mbaye (2012), for example, claims that there hasn't been any research on how actual exchange rate undervaluation affects growth via the TFP transmission channel. An undervalued exchange rate is linked to development through influence on the local saving rate in the second channel under the conventional view, which appears to be more prevalent in policy circles Khomo, (2020). According to this mechanism, exchange rate depreciation gives rise to local saving rates, which end up raising domestic capital rates and promote growth.

2.2.1.2 Capital accumulation growth channel

The capital accumulation approach holds that exchange rates affect economic development by resulting in savings. This approach contend that exchange rates undervaluation boosts development by adding the economy's total capital stock. This idea is reinforced by the observation local saving starts to rise when the exchange rates declines. Higher depreciation-induced saving rates stimulate development by giving rise to the rate of capital accumulation.

Despite the lack of agreement regarding the precise channels by which this effect is produced, Sibanda, (2012) claim that saving is the channel of transmission and that depreciated exchange rates raises local saving rates, which results in stimulation of growth by accelerating the rate of capital accumulation. Capital accumulation is said to come from two distinct places. According to Mbaye (2012), the first mechanism of capital accumulation only affects the sector of tradable goods, which sees an increase in GDP, whereas the second mechanism sees an increase in the economy's stock of capital due to an increase in overall savings and investment.

There is an association between a depreciated exchange rate and the saving rate because it has a tendency of shifting the aggregate demand away from traded goods and toward non-traded goods, necessitating an increase in the real interest rate to maintain internal balance by Ahn, (2017). The rise in domestic saving rates caused by the increase in interest rates restrains aggregate demand in part. From this vantage point, the exchange rates, the interest rates and saving rates all contribute to increased economic growth. Gluzmann (2012) contend that the quest of such an exchange rate policy (undervalued currency) in their export-driven economies has contributed to the high savings rates in several Asian countries, including China.

It is crucial to recognize that the casual chain that underpins the capital accumulation channel of exchange rates has two conceptual linkages in order to fully comprehend this channel. The exchange rates to the savings rates comes first, followed by the saving rate to growth (Razmi, 2011). Savings and economic growth's second relationship is well known and has long supported the growth process in general. However, there is debate concerning the initial connection between exchange rates and savings, both conceptually and empirically. According to Iyoboyi (2014), A country's current account balance will increase due to depreciation when the exchange rate is established as a policy objective, increasing the saving rate compared to investment rate.

Higher savings through a different channel can also be attained with a more depreciated real exchange rate Guzman (2018). When in result, a business will pay lower real salaries as the

real exchange rate falls. Reduced production costs as a result of lower wages encourage businesses to increase investment. As a result, businesses raise their savings to pay for their increased investment, which ultimately improves total savings. The legitimacy of the capital accumulation channel is questionable. For instance, Harmilton (2018) claims that, the cause of a depreciated exchange rate is a high saving rate rather than the other way around. If this theory is right, an empirical relationship between savings and exchange rates cannot be explained by the capital accumulation channel. The second connection between savings and GDP may not materialize even if the relationship between exchange rates and savings is accurate because a high real interest rate that encourages local saving rate might tend to discourage local investment. The presence of a relationship between the actual exchange rate and the saving rate, and also the interpretation of that relationship, according to Sibanda (2012), is still questionable.

The traditional approach is problematic, especially for less developed nations that rely heavily on imported capital goods and infrastructure. While currency depreciation lowers the cost of exports for foreign customers, it raises the price of imports for domestic consumers. Local businesses that rely on imported capital goods charge their customers higher costs as a result, which causes inflation. The Structuralist approach to exchange rates was developed in part as a result of this problem not being taken into account. According to Missio (2015), the consensus regarding the idea that devaluation causes an increase in output was destroyed at the end of the 1970s. An alternate strategy was developed, raising the prospect that depreciation would have a contractionary effect, particularly in developing nations. The structuralist approach is the name given to this method.

2.2.2 The structuralist approach

This viewpoint contends, in contrast to the traditional approach, that devaluation of the currency might have a recessive effect on production and employment, particularly for less economically developed nations. This strategy illustrates how a decline in output could result from currency depreciation. The effect of currency depreciation on output can be felt in a variety of ways, but the rise in import prices is a critical issue that needs to be addressed. Through imported inputs, depreciation raises the price of imports in specific and local production in general (Casas, 2017). If input cost increases it may result in higher manufacturing expenses, which businesses may pass along to customers in the form of higher prices. This is a result that enterprises can only offset an increase in their production

costs by raising their pricing. The general price level is raised as a result. According to Casas (2017), declining imports in this context reflect a lack of production-related inputs. Production will eventually slacken due to insufficient inputs and rising costs, which will result in a reduction in the overall supply. Depreciation in this situation would be contractionary because it slows or stops the percentage increase in economic output.

In a nutshell, the structuralist perspective on exchange rates believes that depreciations in exchange rates can have contractionary effects. According to this method, the recession effect is mostly caused by a rise in prices via a variety of channels. With this strategy, a policy to devalue the currency may end up at odds with macroeconomic policies that aim to stabilize the macroeconomy by lowering inflation.

2.2.3 Balassa-Samuelson Hypothesis

Based on the research of Balassa and Samuelson from 1964, the Balassa-Samuelson Hypothesis is a hypothetical description of long-term trends in exchange rates. Gubler (2019) claims that the Balassa-Samuelson Hypothesis is based on the notion that there is a positive correlation amid exchange rate and relative economic development. As a result, it is anticipated that, in contrast to countries with slower economic development, those with quick economic development will typically encounter higher exchange rates. This hypothesis asserts that depreciation actually encourages economic development, in contrast to what is generally believed. Numerous empirical studies have been done on it, and they have demonstrated that it is true in a number of countries, including Japan and Korea. In light of the aforementioned presumptions, the Balassa-Samuelson Hypothesis states:

1. The differentials in productivity growth rates between the tradable goods and non-tradable

2. The ratio of non-tradable prices to tradable prices is higher in nations that are growing faster.

3. The ratio of tradable prices across the nations stays constant.

4. Combining 2 and 3 causes the exchange rate to appreciate. Goods sectors cause relative price changes.

Exchange rates are primarily determined by the productivity gap between industries that can be traded and those that cannot (Berka, 2014). An association between relative economic development and the exchange rate is also hypothesized because increases in the productivity of the tradable sector are typically associated with economic growth. As a result, it is

anticipated that faster-growing countries will typically see real exchange rates increase in comparison to other, moderate-growing economies (Guzman, 2018). This hypothesis contests the idea that rapidly developing nations have depreciating currencies.

The Balassa-Samuelson Hypothesis, while applicable in some cases, is not in all situations. It typically benefits faster-growing nations more, than slower-growing ones. According to Eita, the Balassa-Samuelson Hypothesis may not be applicable when a country has recently transitioned from being the primary product exporter or planned economy, even if the economy is growing rapidly (2020).

2.2.4 Export-led Growth Hypothesis

The export-led growth theory says that increasing exports is the most important component in encouraging long-term economic development. The export-led growth hypothesis (ELGH) assumes that an increase in exports is one of the fundamentals influencing development, according to Kumar (2020). In relation to this theory, nations also improve their export markets in addition to more labor and capital to the economy. Exports can act as an "engine of development," according to proponents of the theory of export led growth (Sonnassee, 2014). According to Araujo and Soares (2011), increased exports expose more domestic businesses to foreign competition, which puts more pressure on them to control costs and encourage the use of new technologies. In this way, the expansion of exports is thought to boost the economy's overall productivity through the externalities of exports on other industries.

According to Kozul-Write (2014), many industrial economies have realized that relying on foreign markets, or an outward-looking approach, offers significantly more potential for economic growth than doing so with home markets. Instead of relying solely on domestic markets, outward-looking nations can benefit from expanded markets abroad, which helps to enhance the balance of trade and, ultimately, exports. According to Hong (2012), the East Asian countries' success in the 1970s was due to their adoption of export-led growth. According to Hong (2012), the impressive industrialization and growth of Japan, Hong Kong, Taiwan, and the Asian tigers (Singapore and Korea) challenged the notion that export-led growth strategies could not be applied to other less developed nations.

According to Mohanty (2012), exports can stimulate income broadening as a part of aggregate demand. This logic is constructed from the idea that in a small open economy, local market demand for goods cannot sustainably drive economic expansion. In contrast, export markets

are virtually endless and do not have demand-side growth constraints. According to Kubo (2011), exporting is advantageous because it enables associated firms to take advantage of benefits like improved resource allocation efficiency, exploitation of economies of scale, acquisition of foreign technological knowledge through learning-by-doing, and stimulation of technological innovation through exposure to foreign-market competition.

According to Palley (2011), export-led growth benefits both industrialized and developing nations. The notion of comparative advantage is applied globally to the benefit of both exporters and importers. The reason for this is that export-oriented tactics alarm the use of trade barriers and promote open trade, which will ultimately be advantageous to the concerned countries. On the other hand, free trade has its own drawbacks, such as the potential to fuel an import boom and undermine nations' efforts to increase exports. Unchecked free trade can result in dumping, where nations export subpar goods for low costs.

The export-led growth theory has its detractors as well. One such criticism, in accordance with Palley (2011), is that trade might diminish domestic demand in a Keynesian world of demand scarcity, resulting in decreased output, employment, and national welfare. Export subsidies are not a gift in the Keynesian universe; on the contrary, they may steal demand and jobs.

The export-led growth is also criticized for interfering with free trade. Usually, exporting nations will devalue their currencies to lower the cost of exports and increase the cost of imports. This tactic prompts retaliation from other nations, which could result in exchange rate wars in which participating nations depreciate their currencies. Furthermore, because monetary impacts are neutral, classical economists think that any employment brought about by depreciation is at most transient. According to the perspective of classical economics, money is neutral, hence inflation brought on by depreciation won't have an impact on the real economy (employment, economic growth and output).

2.3 Empirical literature

Numerous academics have investigated the consequence of exchange rate on economic development using various techniques and nations (Schweicker et al., 2006; Acar, 2000; Chen, 2012). Depending on the nation, method, and time of the investigation, they reached various conclusions. The numerous studies conducted, the methodologies employed, the research countries, and the findings are presented in this section. South African literature, literature from developing countries, and literature from wealthy nations make up the section.

2.3.1 Empirical literature from developed countries

Chen (2012) looked into how the exchange rate affected both economic growth and the convergence of growth rates across Chinese provinces. The generalized method of moments was used in the research (GMM). For the years 1992 to 2008, data from 28 Chinese provinces were used, along with dynamic panel data estimation. According to the study's findings, exchange rate appreciation has a favorable influence on provincial economic development. The GMM technique employed in this work performs better on finite samples. According to Bollen. (2014), the advantage of this GMM is that it has the possibility to produce constant parameter estimators even when measurement error and endogenous variables are present. The study's findings confirm the Balassa-Samuelson Hypothesis, which holds that there is a positive association between exchange rate and economic growth, by demonstrating how appreciation of the real exchange rate spurs economic expansion. But his outcomes don't line up with Rodrick's (2008). With a maximum of 184 countries and eleven 5-year time periods from 1950–1954 to 2000–2004 for emerging countries, the latter study revealed that depreciations are expansionary to growth.

In their 2009 study, Jaussaud and Rey looked at the long-term factors influencing Japanese exports to China and the US from 1971 to 2007. The Autoregressive Conditional Heteroscedasticity (ARCH) and Generalized ARCH (GARCH) models were used in the investigation. The findings showed that external demand and actual exchange rate variations had a significant impact on Japanese sectoral exports to China and the US (GDP of the country of destination). Real exchange rate fluctuations and GDP generally have had the undesirable results. Japanese exports have fallen, especially as a result of a real yen appreciation and increased uncertainty. The traditional perspective, which maintains that currency devaluation boosts exports and thus growth and vice versa, is consistent with the study's findings. The study's findings are also in line with those of Edwards and Garlick (2007), who discovered that trade volumes are sensitive to changes in exchange rates. However, Ito and Krueger (1999) examined the Balassa-Samuelson hypothesis by looking at the correlation between growth rates and changes in exchange rates in APEC member nations' and economies' economies. Japan and, to a much lesser extent, Chile both exhibit the positive correlation between economic development and appreciation that is a characteristic of the Balassa-Samuelson Hypothesis. High growth was combined with real depreciation, albeit one of modest extent, in Thailand and Malaysia. In Thailand and Malaysia, the findings of Jaussaud and Rey (2009) and Ito and Krueger (1999) are comparable but not identical.

Real exchange rate misalignments and growth were examined by Razin and Collins (1997) for a sizable sample of rich and developing nations. In order to determine whether real exchange rate misalignments and country growth rates are connected, regression analysis was employed in this study. The results showed that excessive valuations hinder economic expansion. Undervaluation that ranges from moderate to high (but not extremely high) are linked to faster economic expansion. The classic theory of exchange rates, which holds that depreciations are linked to rapid growth, supports the study's conclusions. For example, Kalyoncu et al. (2008) who evaluated the long-run and short-run effects of real exchange rate depreciation on output level in OECD nations discovered that the results are not consistent with those reported for developed nations. The findings, in contrast to Razin and Collins (1997), were contradictory: while a currency devaluation had a negative long-term effect on output expansion in Austria, Hungary, Poland, Portugal, Switzerland, and Turkey, it had a positive long-term effect in Finland, Germany, and Sweden. In the medium term, depreciation has an adverse effect on yield for Hungary and Switzerland while having a favorable influence on production progress for Finland, Germany, and Turkey.

Using panel data approaches, such as fixed and random effects, panel cointegration, and system GMM, Vieira and MacDonald (2010) empirically explored the link between exchange rate misalignment and long-run economic growth in approximately one hundred nations (generalized method of moments). The results of the two-step system GMM panel growth models demonstrated that the coefficients for exchange rate misalignment are positive for different model specifications and samples, indicating that a more devalued (appreciated) exchange rate benefits (harms) long-run development. Developing and emerging nations have higher estimated coefficients.

In conclusion, the reviewed studies in developed countries on the impact of exchange rates on economic growth are inconclusive. The empirical literature from developed countries yields conflicting results regarding the impact of real exchange rates on economic growth. Chen (2012), for example, agreed with the Balassa-Samuelson hypothesis that exchange rates have a positive effect on economic growth. In contrast, Razin and Collins (1997) discovered that currency overvaluations are associated with lower growth, which is consistent with the traditional view of exchange rates. Jaussaud and Rey (2009) found that when the Japanese currency appreciated, Japanese exports to China and the United States decreased. This, in turn, had a negative impact on growth. According to Vieira and MacDonald (2010), a more depreciated (appreciated) exchange rate helps (hurts) long-run growth. Although there is no

agreement, many studies have found that currency overvaluations are associated with lower growth.

2.3.2 Empirical literature from developing countries

Tarawalie (2010) used econometric techniques and quarterly data to investigate the association between Sierra Leone's real effective exchange rates and economic growth. In addition, as part of the methodology, he used a bivariate Granger causality test to investigate the causal relationship between the exchange rate and economic growth. The empirical findings indicate that effective exchange rates have a statistically substantial positive correlation with economic growth. The Balassa-Samuelson hypothesis reinforces these findings, reflecting an authentic relationship between the effective exchange rate and economic growth. Empirical findings are consistent with those of Ito and Krueger (1999), who discovered an authentic relationship between exchange rate and growth in Japan and Chile.

Ndlela (2011) looked into the implications of exchange rate misalignment in developing nations, with a focus on Zimbabwe's growth performance. The cointegration method was approached using the ARDL (autoregressive distributed lag) method. The ARDL method has the advantage of being applicable regardless of whether the variables are I(0), I(1), or fractionally integrated. The vital findings show that misalignment of exchange rates have an adverse and statistically significant impact on growth. Furthermore, the results encourages the notion that exchange rate overvaluation was a fundamental in Zimbabwe's post-2000 economic growth contraction. Masunda (2011) looked into the effects of real exchange rate misalignment on Zimbabwe's sectoral output. This was accomplished by using practical generalized least squares panel data techniques with data from a sample of Zimbabwean industries, including agriculture, manufacturing and mining, between the years 1980 to 2003. The research found that sectoral output is negatively impacted by actual exchange rate misalignment. According to the study's conclusions, undervaluation has an adverse influence on sectoral output, whereas exchange rate overvaluation has a bad and substantial impact.

For the years 1970 to 1996, McPherson et al. (2000) examined the direct and indirect links between Kenya's real and nominal exchange rates and GDP. Single equation regressions, a system of simultaneous equations, a VAR model test, and cointegration techniques were among the methods used. The study's outcomes did not support the assumption that there exists a strong, statistically significant association amid changes in exchange rates and GDP growth;

rather, the study found that GDP growth is influenced by monetary, fiscal, and foreign aid policies. The theories discussed in this chapter do not support the findings of this investigation.

Acar (2000) looked into the impact of depreciation on the growth in output in Least Developed Countries (LDCs). Data from 18 sample countries were used in a fixed-effect method. LDCs were divided in 2 groups, and each group underwent two separate regression analyses. Data from a group of ten countries were used for exporters of manufacturing products as well as agricultural and primary products in order to estimate a model of real output behavior over 25 years. To determine if there are any qualitative differences in the impact of depression on economic growth in the various countries, data (for 20years) from 2 distinct sets of nations were analyzed. According to the findings, depreciation has an expansionary effect on output in the year after it occurs, but a contractionary effect in the year before that.

Real exchange rate (RER) misalignments and their volatility were examined by Aguirre and Calderon (2005) for their effects on growth. Actual real exchange rates' departures from their equilibrium are useful to evaluate real exchange rate misalignments. Using panel and time series cointegration methods, the study covers the years 1965 to 2003 for 60 different nations. Real exchange misalignments have an adverse impact on growth, but the impacts are non-linear. For instance, development reductions are worse in straight percentage to magnitude misalignments in the research, which used dynamic data approaches to analyze the data. The study also discovered that while modest to moderate currency undervaluation promote growth while greater undervaluation impedes it. The other finding is that all oscillating exchange rate misalignments hinder development.

Munthali et al. (2010) investigated the effect of the real exchange rate on economic development in Malawi using a straightforward univariate GARCH model. The findings demonstrate that volatility in the Real Effective Exchange Rate (REER) has an adverse impact on economic performance. Additionally, economic growth is considerably and favorably connected with an appreciated REER, demonstrating Malawi's net importer status. REER volatility, on the other hand, has a strong negative correlation with growth and reflects investors' preference for a stable exchange rate. In Nigeria, researchers likewise discovered a strong correlation between the real exchange rate and economic growth. The relationship between the foreign exchange market and economic growth in a developing petroleum-based country (Nigeria) between 1970 and 2003 was examined by Akpan (2008) using the ordinary least squares method. According to the study, there is a link between Nigeria's exchange rate,

volatility, and economic growth. The results of these two researches supported the Balassa-Samuelson Hypothesis.

There are conflicting findings in the review of research from developing nations. For instance, Tarawalie (2010) and Akpan (2008) discovered a favorable relationship between exchange rates and economic growth. The Balassa-Samuelson theory is supported by these findings. Devaluations may be contractionary to growth, according to the structuralist perspective, which was supported by Acar (2000). Domac and Shabsigh (1999), Aguirre and Calderon (2005), and Aguirre and Calderon (2005) all support the conventional wisdom that devaluations promote economic growth. However, McPherson, Rakovski, and Kennedy (2000) did not discover a connection between exchange rates and economic development. As shown by Munthali et al., exchange rates fluctuation has a detrimental impact on development as well (2010).

In conclusion, the studies from developing nations that were analyzed projected a range of outcomes for the impact of exchange rates on economic development. According to the findings, different countries' economies respond differently to currency overvaluation or undervaluation. Exchange rate devaluations sometimes had a detrimental influence on economic development whilst other times they had a favorable effect. Although it is difficult to draw a general conclusion about how the exchange rate affects economic development in developing nations, the researcher supports the opinion which says currency undervaluation is more conducive to economic growth in developing nations than are overvaluations (Domac and Shabsigh, 1999; Akpan, 2008; Tarawali, 2010). However, economic growth reacts favorably to currency overvaluations to a lesser extent.

2.4 Assessment of the literature

The native approach to exchange rates serves as the foundation for the study's concept. The majority of empirical evidence appears to support this explanation, which is why it was chosen. The research alters the Acar model (2000). In order to explain changes in the dependent variable, economic development (GDP), Acar (2000) used changes in the explanatory variables exchange rate, terms of trade, government spending, and money supply. The analysis replaces trade terms with trade openness and government spending with fixed capital formation (Investment). One of the explanatory factors is the addition of real interest rates. The model's explanatory variables, the money supply and real exchange rate, are still present.

2.5 Summary

The hypothetical literature that demonstrates the connection between exchange rates and economic growth was discussed in this chapter. This made it easier to find prospective model-included variables. The theoretical literature was examined in the chapter's opening section. The classical exchange rate approach, maintains that a nation's money devaluation is expansionary on the economy, was discussed in theoretical literature together with the structuralist approach, which maintains that a currency devaluation is contractionary. According to the Balassa-Samuelson Hypothesis, growth and exchange rates are positively correlated. The export-led growth theory, which maintains that exports have a importance in a nation's development, was reviewed last.

This chapter's second section examined empirical evidence on the effects of exchange rates on economic development in industrialized and emerging nations including SA. To observe the effect of exchange rates on economic development, the studies we reviewed used a variety of quantitative models. The majority of studies came to the conclusion that real exchange rate devaluations/depreciations stimulate economic growth in SA as well as developed and developing nations. It's crucial to remember that South Africa has a significant literature gap when it comes to the effect of exchange rates on economic development.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides the model used to investigate the impact of exchange rates on economic growth in South Africa from 2012 to 2022 in order to establish the analytical foundation for this study. There are several models that have been used to analyze the connection between exchange rates and economic growth. From the reviewed literature there is the vector error correction model, the linear regression model, univariate GARCH model, autoregressive distributive method to mention only a few with solid no evidence of direct link since there are other variables that affect exchange rate as well as the economic growth. This research used the cointegration and vector error correction model to examine if the exchange rates have an impact on the economic growth hence this chapter will give more detail on the analysis. The data sources, research methods, and diagnostic tests used in this research are also verified in this chapter.

3.2 Research design

A research design, also known as a research strategy, is an approach for finding answers to a number of questions (McCombes, 2019). It is a framework with techniques and steps for gathering, analyzing, and interpreting data. The research was done applying the Vector Error correction modelling (VECM) approach, this study empirically investigates the impact of real exchange rates on economic development in SA. While testing for the unit root properties of the time series data, the variables were subjected to the Augmented Dickey-Fuller (ADF) and Philips-Peron unit root test. The cointegration and vector error correction modelling (VECM) by Johansen (1991, 1995) was used to assess the short and the long run effect of exchange rates.

3.2.1 Quantitative design

A quantitative investigation was used for this specific research. A quantitative design is used when statistical conclusions are required to collect actionable insights. Quantitative data was used because all the measurements are quantifiable and can be accessible in numerical form. This study was carried out by using 42 quarterly time periods from 2012Q1 to 2022Q2 as the dataset. Subsequently, we used time series analyses in the research, to analyze the economic development (GDP) and each factor throughout the 42 quarters. To understand more on the

association between explanatory variable and independent variables in this research, the researcher used the cointegration and vector error correction model. To study the relationships between the parameters the study used the cointegration technique to understand how the variables interact. This research design is advantageous because it allows researchers to understand what they are studying from various perspectives and provides a bigger picture than other types of research designs (Kothari, 2014). The computer packages that were chosen for data analysis are the Microsoft Excel and E-views.

3.3 Data sources and collection

Data is a collection of people's values in relation to qualitative or quantitative factors; it is unstructured information that must be processed (Sajjad Kabir, 2016). Secondary sources were used to obtain information concerning the research. Secondary data is information gathered from primary sources and made easily accessible to researchers for use in their own research.

Information was collected from publicly available sources that is, internet where the data was downloaded in excel sheet files from South Africa's bank website. The criteria for selecting the number of years for the study was constructed on the accessibility and quantity of data for 42 quarterly periods (2012Q1 to 2022Q2). The study was expected to be more comprehensive by incorporating secondary data form The South African Department of Trade and Industry that provides data on GDP and trade, the South African Reserve Bank (SARB) publishes information on investment and money supply, and the South African Department of Statistics provides data on interest rates and currency rates (StatsSA).

3.3.1 Description of variables

Variables	Definition
Gross Domestic Product (GDP) Y	This shows the Gross Domestic Product in South Africa measured in billion Rands. The growth rate is the percentage increase or decrease of GDP from the previous measurement cycle.
Investment (FCF)	This refers to Gross fixed capital formation in R billion. This is the government investment in infrastructure. This includes both public and private investments.
Real exchange rates	The nominal exchange rate that accounts for the differences in inflation rates between the countries is known as the real exchange

(EXCH)	rate. It serves as a gauge of a country's ability to compete internationally.
Trade openness (OP)	This gauges a nation's openness to international trade. Regardless of the trade openness measure employed, Fujii (2019) claims that the various trade openness measures offer a method for determining how open an economy is to global trade and the benefits to income growth that flow from trade. Exports + Imports/GDP is the simplest indicator of trade openness used in this study.
Real interest rate (RIR)	Real interest rates are nominal interest rates that have been adjusted for anticipated inflation. They are typically determined by comparing the nominal interest rate to either expected or actual inflation.
Broad money supply (MS)	is the most inclusive definition of the term "money supply" because it covers all currently circulating bank notes, coins, and domestic private sector deposits with banks. The aggregate of the money supply is unaffected by deposit shifts between different maturities and has the most consistent relationship with domestic demand.

3.4 .1 Data presentation

Data analysis is defined as organizing, coding, and arranging evidence required to execute quantitative or qualitative studies in accordance with the research strategy and data. It is the process of examining, describing, illustrating, condensing, recapitulating, and evaluating each component of the data provided by Sileyew (2019). To present the summary of the collected data the researcher used the Descriptive Statistics Analysis. The analysis table will show number of observations, mean, median, skewness, kurtosis, standard deviation, maximum and minimum values and the Jarque-Bera test. The main aim of the demonstration of this investigation is to show the changeability and analyze the normality of the variables.

For the analysis of Correlation, the study used a correlation matrix table to show the association of variables. Correlation analysis reveals whether there is a negative or positive correlation between variables. The outcome will indicate whether the association between the variables

under consideration is positive or negative. A perfect positive correlation between variables is when the value computed is +1, a 0 means no correlation, and a -1 means a perfect negative correlation. (Gogtay and Thatte, 2017). To accomplish this, the researcher employs Excel and E-views 10 software (E-views was chosen for its capacity to assist researchers in easy and efficient research analysis). Furthermore, the E-views software contains a variety of innovative analysis tools that a researcher requires to shape and manage their data, as well as attain and examine statistical outcomes).

3.4.2 Data analysis

3.4.2.1 Time series analysis

A time series, according to Osarumwense (2013), is a collection of ordered data. Although the ordering normally pertains to time, other orderings, such as over-space, etc., could also be envisioned. To find patterns of change in statistical data across predictable time intervals, time series analysis is performed (G, 2013). A time series is fixed if it has constant average and variance. The researcher made use of the availability of past data in order to observe patterns. The available secondary data was collected which consists of the quarterly changes from 2012Q1 to 2022Q2 to make them 42 observations. This sample of data will help the researcher to come up with a reliable and more realistic model for industrial exploration. In contrast to the analyses of random samples of observations discussed in most other statistics, time series analysis is built on the assumption that consecutive values in the data folder signify consecutive measurements obtained at corresponding time interludes.

3.4.2.2 Seasonality Analysis

Seasonality is the alternative overall element of the time series pattern. The autocorrelation correlogram was used to test for seasonality using the e-views. It is demarcated as a correlational dependency of order k between each ith element of the series and the element and measured by autocorrelation (i.e., a correlation between the two terms); k is commonly referred to as the lag. Seasonality can be visually recognized in the series as a pattern that duplicates every element if the measurement error is not too large.

3.4.2.3 Autocorrelation Correlogram

Correlograms reveal seasonal patterns in time series. The correlogram (auto-correlogram) shows the autocorrelation use graphically and numerically, that is, serial correlation coefficients (and their standard errors) for consecutive lags within a given range of lags (e.g.,

1 through 30). Correlograms typically show ranges of two standard errors for each lag, but the size of the autocorrelation is more important than its reliability because we are usually only interested in very strong autocorrelations. These are presented at the conclusion of the study.

3.4.2.4 Model specification

The explanatory variables used in this research to analyze how exchange rates affect economic growth in South Africa are fixed capital formation (FCF), real interest rates (RIR), trade openness (OP), broad money supply (MS), and real exchange rates (EXCH).

This study's primary goal is to study how the real exchange rates affects economic development (GDP). Real exchange rates (EXCH) are thus included in the list of explanatory variables to specify an output growth model. Economic growth (y) is the reliant variable in this study and is outlined by changes in the other variables, which include the real interest rate (RIR), fixed capital formation (FCF), broad money supply (MS), trade openness (OP), and real effective exchange rates (EXCH), which serves as the primary explanatory variable. Following are the model's specifications:

$$\Upsilon = \beta_0 + \beta_1 EXCH + \beta_2 RIR + \beta_3 OP + \beta_4 MS + \beta_5 FCF + \varepsilon \quad \text{.....3.1}$$

Where:

β_0: The intercept

β_1, β_2, β_3, β_4 and β_5: Coefficients of the explanatory variables

ε: Error term which represents omitted variables in the specification of the model

Υ: Economic growth (GDP)

EXCH: The real effective exchange rates

RIR: is the real interest rates

OP: represents trade openness

MS: is broad money supply

FCF: represents fixed capital formation investment.

The variables must be converted to logarithms in order to derive the elasticity coefficients and eliminate the impact of outliers. The function is expressed in logarithmic form as:

$$\text{Log}\Upsilon = \beta_0 + \beta_1 \text{LogEXCH} + \beta_2 \text{LogRIR} + \beta_3 \text{LogOP} + \beta_4 \text{LogMS} + \beta_5 \text{LogFCF} + \varepsilon \ldots\ldots\ldots 3.2$$

3.4.2.5 Priori Expectations

The parameter β_1 captures the effect of real exchange rate on output growth. For the purpose of this study, the sign of this parameter is critical. As long as the parameter is statistically significant, a positive sign will indicate an expansionary, while a negative sign will indicate a contractionary effect. An increase in real interest rates increases the cost of capital and can be contractionary and hence β_2 is expected to be below zero. β_3 is expected to be greater than 0, for instance, trade openness positively affect output. β_4 is also expected to be positive because an increase in money supply is expected to affect output positively. β_5 is anticipated to be positive as a rise in fixed capital formation is expansionary to economic growth.

3.5 Research techniques

The Johansen (1995) and Johansen and Juselius (1990) cointegration approach was used in this work. The method is well known for showing how variables are related over the long term. The long-run and short-run determining factor of the explanatory variable in a model are concurrently determined using this method, which uses maximum likelihood estimation to a vector error correction (VEC) model. First, the same sequence of the data must be combined. Unit root tests are run to check the stationarity of the data sets in order to do this. The unit root properties of the time series data will be investigated using the Augmented Dickey Fuller (ADF) and Phillips-Perron unit root tests on the variables.

3.5.1 Testing for stationarity

A process is fixed if the statistical characteristics, such as its average and standard deviation, remain fixed over time (Lyocsa 2011). The explanatory and independent variables must both be fixed, and errors must have a 0 mean and bounded variance according to the classical regression model's underlying assumptions. The impacts of non-stationarity, according to Jung (2015), include false regression, high R^2, and poor Durbin-Watson (DW) statistics. The fundamental justifications for testing data for non-stationarity are listed below.

First, a series' stationarity or lack of can significantly affect its behavior and attributes; for non-stationary series, shock persistence will be infinite. A regression of one variable, may take a big regression value even if the two are completely unconnected, which is known as a false regression if two variables are trending over time. Thirdly, it can be demonstrated that the asymptotic analysis' common assumptions will give false results if the parameters in the

regression model are non-stationary. Accordingly, it is impossible to conduct meaningful hypothesis tests regarding the regression parameters since the common "t-ratios" do not follow a t-distribution, as reported by some authors.

3.5.1.1 Augmented Dickey-Fuller (ADF) test

The augmented dickey fuller test modifies the work done by Dickey and Fuller (1979 and 1976 respectively). The aim of the Dickey Fuller theory was to test the hypothesis that Ø=1 in:

$$\Upsilon_t = Ø\ \Upsilon_{t-1} + \mu_t \quad \text{.....3.3}$$

Thus, the hypotheses are formulated:

H_0: Series contains a unit root

H_1: Series is stationary.

The rejection of the null hypothesis under these tests means that the series does not have a unit root problem.

The standard Dickey Fuller test estimates following equation:

$$\Delta\ \Upsilon_t = \beta_1 + \beta_{2t}\, \varphi\Upsilon\ \varepsilon_{t-1} + \mu_t \quad \text{.....3.4}$$

Where Υ_t is the relevant time series, Δ is a first difference operator, t is a linear trend and is the error term. The error term should satisfy the assumptions of normality, constant error variance and independent error terms. According to Solberger (2013) if the error terms are not independent in equation (3.4), results based on the Dickey-Fuller tests will be biased. The weakness of the DF test is that it does not take account of possible autocorrelation in the error process or term (μ_t). Solberger (2013) distinguished a well–known drawback of the Dickey–Fuller unit root test with I (1) as a null hypothesis is its possible mix-up of structural breaks in the series as sign of non-stationarity.

The Dickey-Fuller test's flaw, according to Solberger (2013), is that it fails to account for potential autocorrelation in the error process. If is auto-correlated, the OLS coefficient estimations will not be accurate, and the t-ratios will be skewed. The Augmented Dickey-Fuller test was proposed in light of the aforementioned flaws and is preferred over the Dickey-Fuller exam.

The Dickey-Fuller test's residuals contain serial correlation, which skews the results (Solberger 2013). The error terms are assumed to be uncorrelated when performing the Dickey-Fuller test. However, Dickey and Fuller created the Augmented Dickey-Fuller test to address the aforementioned issue in the event that the two are connected.

The Dickey-Fuller test is only valid if there is no correlation between the error terms. If the time series is correlated at higher lags, the augmented Dickey-Fuller test constructs a parameter correction for higher order correlation, by adding lag differences of the time series. The Augmented Dickey-Fuller test estimates the following equations:

$$\Delta \Upsilon_t = \beta_1 + \beta_{2t} + \delta \Upsilon_{t-1} + \Sigma^{m}_{i=1} \alpha_i \Delta \Upsilon_{t-1} + \varepsilon_t \quad \text{.....3.5}$$

Where ε_t is a pure white noise error term and where $\Delta \Upsilon_{t-1} = (\Upsilon_{t-1} - \Upsilon_{t-2})$, $\Delta \Upsilon_{t-2} = (\Upsilon_{t-2} - \Upsilon_{t-3})$ etc.

According to Nkoro (2016) the number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term in (3.5) is serially uncorrelated. In ADF as in DF the test is whether = 0 and the ADF test follows the same asymptotic distribution as the DF statistic, so the same critical values can be used.

The calculated value of ADF is then compared with the critical value. If the calculated value is bigger that the critical, we reject the null hypothesis that the series have unit root, thus confirming that the series are stationary. In a nutshell Nkoro (2016) states that an important hypothesis of the DF test is that the error terms are independently and identically distributed. The ADF test adjusts the DF test to take care of possible serial correlation in the error terms by adding the lagged difference terms of the regressand.

3.5.1.2 Phillips-Perron (PP) Tests

A more thorough theory of the unit root non-stationarity test is provided by the PP test. According to Nkoro (2016), the Phillips-Perron model does not require the addition of lagged difference terms to account for serial correlation in the error terms. Instead, it used non-parametric statistical approaches. The tests, according to Rothe (2015), are comparable to ADF tests but include an automatic correction to the DF process to accommodate residuals that are auto correlated. The asymptotic distribution of both the PP test and the ADF test is same.

According to Rothe (2015), the PP tests frequently reach the same conclusions as the ADF tests and share many of their significant limitations.

3.5.2 Cointegration and Vector Error Correction Model (VECM)

When working with time series data, it is necessary to determine if each time series is stationary or co-integrated. If it is not the case, there is a high likelihood that the regression analysis will be false or absurd (Gujarati, 2010). Two series moving together over time shows that there is an equilibrium relationship between them. In light of this, it can be seen that if two variables are co-integrated, even though they are non-stationary in the short run, they will eventually move in close proximity to one another and their difference will become stationary. A general framework for describing the dynamic interrelatedness amid stationary variables is the vector autoregressive (VAR) model. According to Shrestha (2018), the VAR framework must be adjusted if the time series are non-stationary in order to permit reliable assessment of the associations between the series. The vector error correction (VEC) model is merely a particular application of the VAR for variables whose differences are stationary, such as I (1). Any relationships of cointegration among the variables can also be taken into account by the VEC.

Cointegration must be tested in order to support the usage of the vector error correction model (VECM). A VECM is designed to be used to known cointegrated non-stationary series. According to Brooks (2008), the VECM includes cointegration relations integrated into the specification, preventing the endogenous variables' long-run behavior from converging to their co-integrating relationships but preserving short-run adjustment dynamics. According to Brooks (2008), the cointegration component is also referred to as the correction term since the departure from long-run equilibrium is gradually corrected through a series of approximated partial short-run adjustments. The vector error correction model (VECM) specification, thus, is predicated on the existence of one or more cointegration relations.

The Engle-Granger approach, which is residual-based, and the Johansen and Julius (1990) strategy, which is based on maximum likelihood estimation on a VAR system, are two techniques of testing for cointegration that frequently outperform the others. According to Brooks (2008), the Engle-Granger approach has issues with simultaneous equation bias, a lack of power in unit root testing, and the inability to do hypothesis tests regarding the real cointegration relationships.

Due to the aforementioned Engle-Granger method's shortcomings, this study employs Johansen's vector error correction modelling (VECM) (1991; 1995). To simultaneously find the long-run and short-run determinants of the explanatory variable in a model, this approach employs the maximum likelihood estimation to a vector error correction model. The method also offers the speed of adjustment coefficient, that gauges how fast the GDP returns to equilibrium after a brief shock to the system (Dey 2019).

3.5.2.1 IMPLUSE RESPONSE ANALYSIS

According to Brooks (2008), the level of responsiveness of the explanatory(dependent) variable in the VAR to shocks to each of the other variables is traced out via the impulse response analysis. Therefore, it demonstrates the direction, size, and persistence of real and nominal shocks to the real growth in this study. According to Brooks (2008), the VECM is subjected to impulse response analysis, and as long as the system is stable, the shock should progressively dissipate. The generalized impulse response analysis is used in this work. According to Kim (2013), this method fully accounts for historical patterns of correlations among the various shocks.

3.5.2.2 VARIANCE DECOMPOSITION ANALYSIS

Following the impulse response analysis, the variance decomposition analysis provides additional details on the relationship between economic growth and exchange rates. According to Brooks (2008), variance decomposition analysis shows the percentage of changes in the explanatory variables that are caused by their own shocks as opposed to shocks to other variables.

3.5.3 DIAGNOSTIC CHECKS

The diagnostic tests are crucial in analyzing how exchange rates affect economic growth of South Africa because they validate the results of parameter estimates obtained by the estimated model. Diagnostic tests examine the model's stochastic characteristics, including residual autocorrelation, heteroscedasticity, and normalcy, among many others. Since these tests are used in this study, a brief description of them is provided below.

3.5.3.1 Heteroscedasticity

The OLS makes the assumption that $V(\varepsilon_j) = \delta^2$ for all j. In other words, homoscedasticity is the property in which the variance of the error terms is constant, they are referred to as

heteroscedastic if their variance is not constant. The White heteroscedasticity test is used in the investigation. The White (1980) universal test for heteroscedasticity in the error distribution, according to Jiang (2021), is computed by regressing the squared residuals on all different regressors, cross product and squares of regressors. Under the H_0 of homoscedasticity, the test statistic, a Langrage multiplier measure is distributed as Chi-squared. Homoscedasticity is the null hypothesis for the White test, and if the null hypothesis is not rejected, homoscedasticity results. Heterogeneity exists if the null hypothesis is rejected.

3.5.3.2 Residual Normality Test

The assumption of normality is $\varepsilon_t \sim N(0, \delta^2)$. The null is that the skewness (α_3) and kurtosis (α_4) coefficients of the conditional distribution of Υ_t (or, equivalently, of the distribution of ε_t) are 0 and 3, respectively:

$H_0 : \alpha 3 = 0$, (if $\alpha 3 < 0$ then $f(y_t / x_t)$ is skewed to the left).

$\alpha_4 = 3$, (if $\alpha_4 > 0$ then $f(y_t / x_t)$ is leptokurtic)

The Jarque-Bera test was used to verify the aforementioned hypotheses (JB). The symmetric distribution of the series is the null hypothesis for the JB test. If the model's residuals are either significantly skewed or leptokurtic, the H_0 of normality will be rejected.

3.5.3.3 Autocorrelation LM Tests

When the error terms from various time periods (or cross-section data) are correlated, this is known as serial correlation. When mistakes related to observations from one time period continue into subsequent time periods, it happens in time series studies. The residuals' serial correlation, also known as autocorrelation, indicates that they contain information that has to be modelled. The study uses the Durbin-Watson statistic to determine if the residuals exhibit first order serial correlation. The null hypothesis states there is no serial correlation ($H_0 : \rho = 0$). The DW statistic lies in the 0 to 4 range, with a value near 2 indicating no first order serial correlation. The Lagrange Multiplier was used to test for serial correlation.

3.5.3.4 Misspecification Tests

Misspecification errors happens when some important variables are omitted from the model. The Ramsey Reset tests are used in this study.

3.6 Summary

The model of how exchange rates affect economic growth in South Africa was described in this chapter, which was informed by economic theory and empirical data. Economic growth is the dependent variable, and real effective exchange rates are the primary explanatory factor. Other explanatory variables as suggested by the theory include fixed capital formation as proxy for investment, exports, trade openness, real interest rates and broad money supply m3. In order to make sure that data is stationary the Dickey-Fuller and Augmented Dickey-Fuller unit root tests were employed. The Johansen (1991, 1995) technique for cointegration and vector error correction modelling (VECM) was also suggested.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter's primary goal is to respond to some of the issues brought up in the first chapter. Results from this chapter use quarterly data for the years between 2012 and 2022 to demonstrate how exchange rates affect economic development in South Africa. The analysis adheres to the conceptual framework introduced in Chapter 3. There are six subsections in this chapter. The cointegration tests are introduced after the unit root test. As a result, the vector error correction model (VECM) is created. Diagnostic checks, impulsive response, and variance decomposition are then performed. Finally, a summary is concluding the chapter.

4.2 Unit root/stationarity test results

Testing for stationarity in time series is the first step of the Johansen process. There exists two basic ways to determine if a time series is stationary or non-stationary that is, the informal graphical method and the formal test. The researcher used the graphical presentation first shown by figure 1 and 2 below. The Phillips-Peron and Augmented Dickey-Fuller tests are the official tests that were run for this study. These tests are crucial because they shed light on the data set's structural flaws, patterns, and stationarity (Brooks, 2008). On the next pages, in Figure 4.1(a), displays data in level form, and Figure 4.1(b), displays first-differenced data, these are the visual results from the test for stationarity. The Augmented Dickey-Fuller and the Phillips-Peron test results are shown in Tables 4.1(a) and 4.1(b).

4.2.1.1 Plots of variables in levels for 2012 – 2022

Figure 4.1(a)

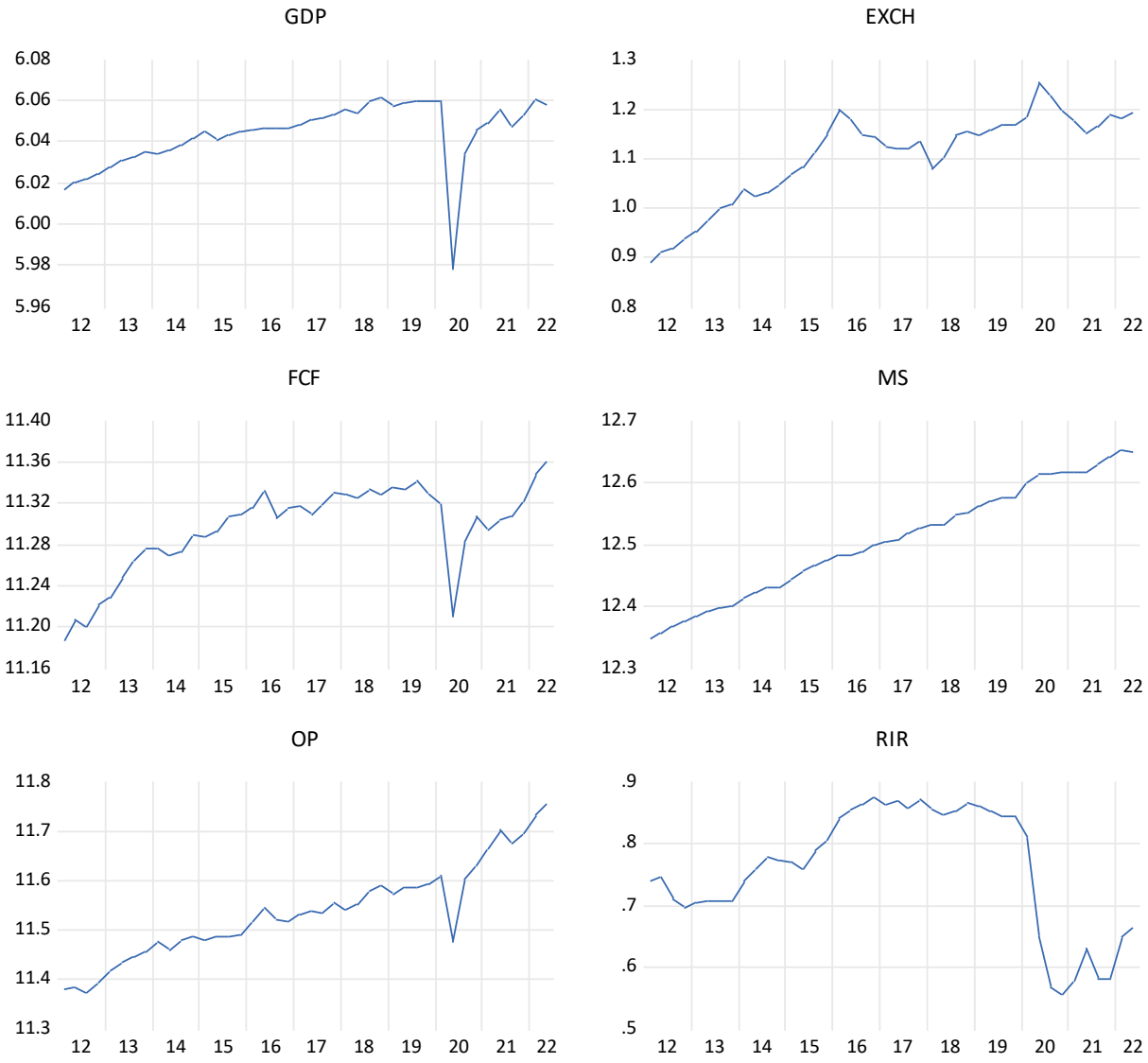


Figure 4.1(a) demonstrates the trending behavior of the Gross Domestic Product (GDP), Gross Fixed Capital Formation Investment (FCF), and Money Supply (MS). While Real interest rate (RIR), trade openness (OP) and real effective exchange rate (EXCH), exhibit a declining trend. These three variables all show a growth trend. EXCH exhibits a declining tendency from level 17 up until level 18, then a rising trend in the years that followed. RIR often exhibits a stable tendency, with the exception of the years between level 19 and 20, which exhibit a falling trend. It is obvious that the level series is non-stationary.

4.2.1.1 Plots of first differenced variables for 2012-2022

Figure 4.1 (b)

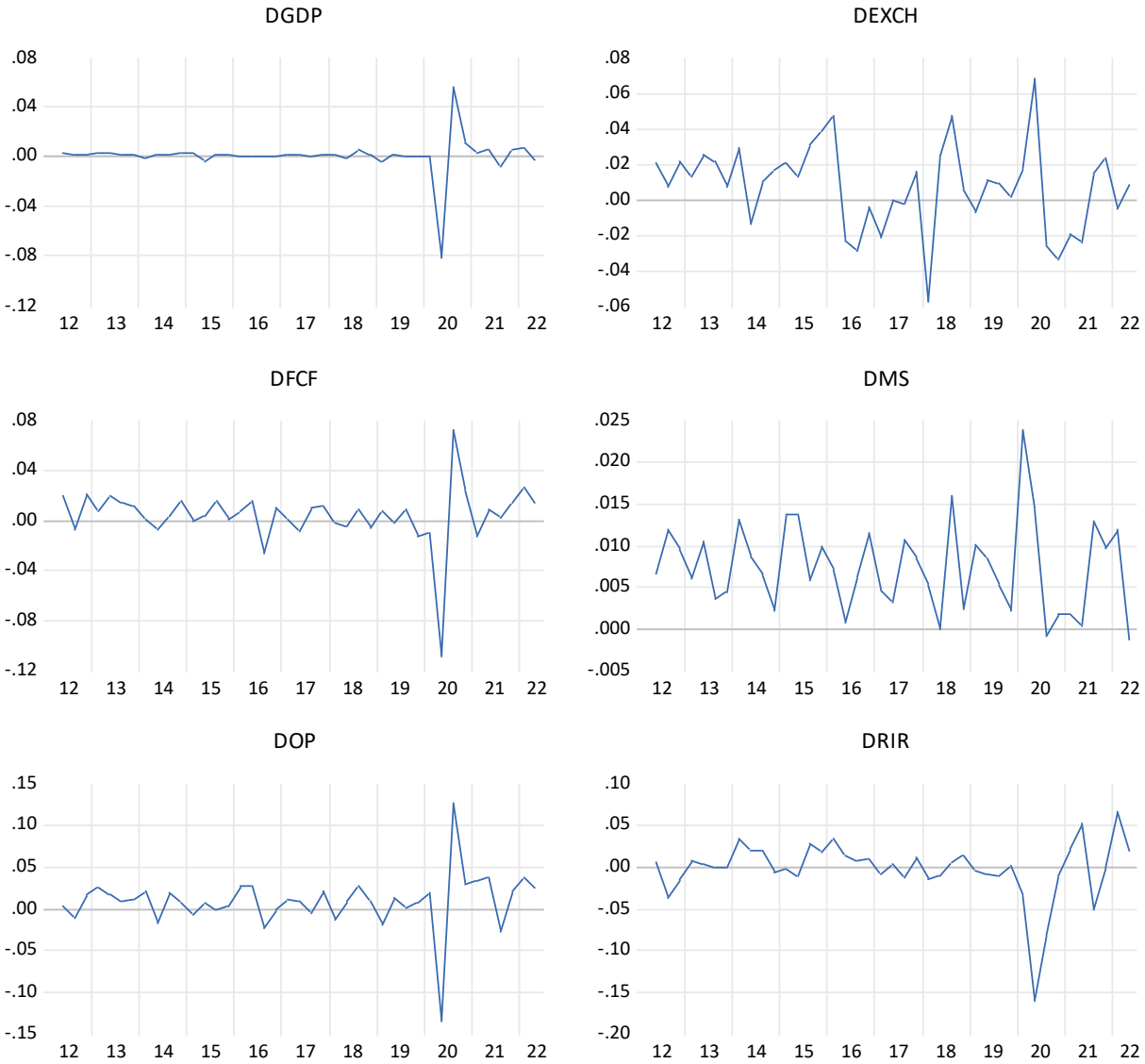


Figure 4.1(b) demonstrates that all of the differenced variables oscillate close to the zero mean, leading to order one integration of the variables. Data that fluctuate close to the 0-mean using the graphical method demonstrate stationarity. Figure 4.1(a) depicts series before differencing, which makes them non-stationary because the average is non zero. However, Figure 4.1(b) depicts stationary series after differencing, and the averages oscillate around 0. Therefore, it can be said that Figure 4.1(b) depicts stationary data following differencing. If the data are integrated of order one, it is implied that the data is stationary. To prevent inaccurate regressions, the first order integrated series makes sure that economic data is steady. However, because it is informal, the informal method is insufficient to draw the conclusion that the data is stationary, necessitating the use of a more formal method to supplement it. As a result,

additional formal tests were carried out to support the conclusions drawn from the graphical results.

Therefore, the Augmented Dickey-Fuller and Phillips-Peron tests are the formal tests used and the outcomes are shown in Tables 4.1(a) and 4.1(b) below.

4.2.1.2 Stationarity results of the Augmented Dickey-Fuller test

H_0: Unit root (individual unit root process)

Series: GDP, EXCH, FCF, MS, OP, RIR Date: 11/21/22 Time: 16:29 Sample: 2012Q1 2022Q2 Exogenous variables: Individual effects Automatic selection of maximum lags Automatic lag length selection based on SIC: 0 to 1 Total number of observations: 244 Cross-sections included: 6

Method	Statistic	Prob**
ADF - Fisher Chi-square	20.8177	0.0531
ADF - Choi Z-stat	-0.99191	0.1606

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 4.1 (a) Intermediate ADF test results UNTITLED

SERIES	PROB	LAG	MAX LAG	OBS
GDP	0.0047	0	9	41
EXCH	0.1725	0	9	41
FCF	0.1203	0	9	41
MS	0.7854	0	9	41
OP	0.9570	1	9	40
RIR	0.4125	1	9	40

The results from the Augmented Dickey-Fuller test are displayed in Table 4.1(a). The H_0 for the test is unit root. The critical value and the computed value of ADF were compared. The series are stationary if it happens that the computed value is higher than the critical value, which forces us to reject the H_0 which states that the series has a unit root. The ADF examines variables with intercepts, intercepts and trends, and intercepts but no trends or intercepts. The test in intercepts for variables in levels showed that all the variables were non-stationary. The

fact that the null hypothesis for the intercept was not rejected at both the 1% and 5% significance levels indicates that all of the data in levels were not stationary. We rejected the null hypothesis (H_0) of the unit root since all the differed variables were stationary at the 1% level of significance. For the test with trend and intercept and trend but no intercept, all datasets were not stationary in levels but turned stationary when the first difference was made at a 1% significant level.

4.2.1.3 Stationarity results of the Phillips-Perron test

H_0: Unit root (individual unit root process)

Series: GDP, EXCH, FCF, MS, OP, RIR Date: 11/21/22 Time: 16:33 Sample: 2012Q1 2022Q2 Exogenous variables: Individual effects Newey-West automatic bandwidth selection and Bartlett ke... Total (balanced) observations: 240 Cross-sections included: 6

Method	Statistic	Prob**
PP-Fisher Chi-square	165.164	0.0000
PP-Choi Z-stat	-11.2700	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 4.1 (b) Intermediate Phillips-Perron test results D(UNTITLED)

Series	Prob	Bandwidth	Obs
D(GDP)	0.0000	21.0	40
D(EXCH)	0.0001	2.0	40
D(FCF)	0.0000	3.0	40
D(MS)	0.0000	25.0	40
D(OP)	0.0000	7.0	40
D(RIR)	0.0052	5.0	40

The Phillips-Peron results are displayed in Table 4.1(b). The tests, according to Brooks (2008), are comparable to ADF tests but include an automatic correction to the DF process to accommodate residuals that are auto correlated. The test in intercepts for levels of variables showed that none of the variables were stationary. At 1% significance level, all differenced variables on the intercept were stationary. All variables were non-stationary on trend and intercept, but at the 1% level of significance, all variables on trend and intercept became

stationary. All of the variables in the levels were non-stationary for the test with no trend and no intercept. The variables became stationary at 1% significance when they were initially differenced.

The data series were nonstationary in levels and stationarity when first differenced, as shown by both of the tests employed to determine stationarity. As a result, the series are combined in the same sequence.

4.2.2 TESTS FOR COINTEGRATION

It is important to determine if there is a long-run equilibrium association between the variables if they are integrated in the same sequence. When 2 or more time series, each of which is independently non-stationary, have an equilibrium or stationarity connection, this is referred to as cointegration. Cointegration investigates the long-term relationship between the gross domestic product and its determinants for the purposes of this study. In order to draw a sound economic conclusion from the results, it is vital to evaluate if there are long-term relationships between the gross domestic product and the selected determinants. The cointegration approach enables researchers to incorporate the relationship between variables over the long and short terms within a single framework. In order to test for cointegration, the Johansen cointegration approach is preferred over the Engle and Granger residual-based methodology mostly because it allows for more than one cointegrating relationship between variables.

4.2.2.1 Pair-wise Correlation results

Table 4.2

Covariance Analysis: Ordinary Date: 11/21/22 Time: 16:52 Sample: 2012Q1 2022Q2 Included observations: 42

Correlation Probability	GDP	EXCH	FCF	MS	OP	RIR
GDP	1.000000					
EXCH	0.44022 0.0035	1.000000				
FCF	0.885466 0.0000	0.729427 0.0000	1.000000			

MS	0.490256 0.0010	0.885466 0.0000	0.676273 0.0000	1.000000		
OP	0.667437 0.0000	0.780133 0.0000	0.763656 0.0000	0.929370 0.0000	1.000000	
RIR	0.343960 0.0257	-0.007351 0.9632	0.337042 0.0291	-0.234652 0.1347	-0.239569 0.1347	1.000000

According to the pair-wise correlation statistics displayed in Table 4.2, FCF is closely associated to GDP, followed by OP. The dependent variable (GDP) and the variables (EXCH and RIR) are negatively associated. This negative link is consistent with theoretical assumptions that rising interest rates and exchange rates will deter exports and investment respectively, slowing down economic development. The fact that FCF and OP have a positive association with GDP supports the theory that rising investment and trade activities lead to higher economic growth.

The information criteria technique was used in this study as guide to select the lag order. The lag order and deterministic trend assumption of the VAR must be indicated for the Johansen approach to work. The lag lengths chosen by the various information criteria are confirmed in Table 4.3.

4.2.2.2 Lag order selection criteria

Table 4.3

VAR Lag Order Selection Criteria Endogenous variables: GDP EXCH FCF MS OP RIR Exogenous variables: C Date: 11/21/22 Time: 17:11 Sample: 2012Q1 2022Q2 Included observations: 37

Lag	LogL	LR	FPE	AIC	SC	HQ
0	483.0795	NA	2.54e-19	-25.78808	-25.52685	-25.69598
1	701.3566	353.9628*	1.38e-23	-35.64089	-33.8122*	-34.99622
2	739.4053	49.36050	1.45e-23	-35.75164	-32.35565	-34.55439
3	783.5063	42.90915	1.48e-23	-36.18953	-31.22616	-34.43971
4	847.1320	41.27070	9.95e-24	-37.68281	-31.15206	-35.38042
5	957.5040	35.79633	2.84e-24*	-41.70292	-41.70292	-38.8479*

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

It is confirmed in table 4.3 that the criteria selected 5 lag with the lowest value being the AIC. Besides, using the information criteria approach, the Johansen cointegration test was conducted using 5 lag for the VAR.

Table 4.4(b) displays the trace test outcomes based on the Johansen cointegration. The trace test's null hypothesis is that there are no co-integrating equations than there are relevant variables. If the test statistic is less than the critical values for the trace tests, then we fail to reject the H_0. The results of the Johansen cointegration test based on the maximum eigen value are shown in Table 4.4(b). The number of cointegration equations (r) was used as the null hypothesis, and the number of cointegration equations plus one (r +1) was used as the alternative hypothesis, in the maximum eigenvalue test. If the test statistic is less than the critical values of the maximum eigen value test, we fail to reject the null hypothesis.

4.2.2.3 Co-integration Rank Test (Trace)

Date: 11/21/22 Time: 17:18 Sample (adjusted): 2012Q3 2022Q2 Included observations: 40 after adjustments Trend assumption: Linear deterministic trend Series: GDP EXCH FCF MS OP RIR Lags interval (in first differences): 1 to 1

Table 4.2 (a) Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob**
None*	0.646746	109.6621	95.75365	0.0039
At most 1	0.561996	68.03947	69.81887	0.0687
At most 2	0.280653	35.01835	47.85614	0.4470
At most 3	0.268130	21.84189	29.79706	0.3074
At most 4	0.197220	9.355789	15.49471	0.3335
At most 5	0.014119	0.568782	3.841465	0.4507

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level. Denotes rejection of the hypothesis at the 0.05 level. MacKinnon-Haug-Michelis (1999) p-values

Figure 4.4(a) displays the trace test findings, which demonstrate the existence of at least one cointegrating equation at a 5% significance level. Since the trace (test) statistic of 109.6621 is

greater than the 5% critical value of 95.7537, the null hypothesis that there are no co-integrating vectors is rejected. According to a similar justification, the test statistic of about 68.0395 is less than the 5% critical value of approximately 69.8189, hence we fail to reject the null hypothesis that there is at most one 1 cointegrating vector. The trace statistics identified one cointegrating association at a 5% significance level as a result.

4.2.2.4 Co-integration Rank Test (Maximum Eigenvalue)

Table 4.4(b) Unrestricted Cointgration Rnk Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob**
None**	0.646746	41.62267	40.07757	0.0332
At most 1	0.561996	33.02112	33.87687	0.0630
At most 2	0.280653	13.17646	27.58434	0.8750
At most 3	0.268130	12.48610	21.13162	0.5005
At most 4	0.197220	8.787007	14.26460	0.3043
At most 5	0.014119	0.568782	3.841465	0.4507

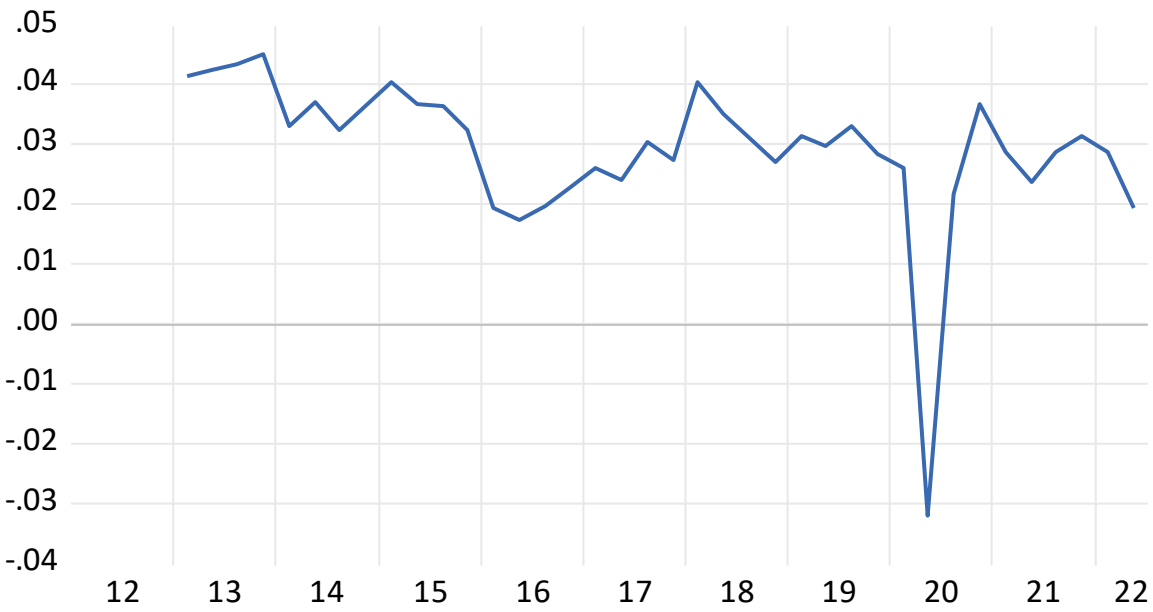
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values

According to table 4.4(b), maximum eigen value test, the gross domestic product model only has one co-integrating connection where the test statistic is 41.6227 is greater than the critical value of 40.0775. The maximum Eigen value test likewise rejected the hypothesis that there is no cointegration, but the test statistic of approximately 33.0211 is less than the 5% critical value of approximately 33.8768, failed to reject the null hypothesis that there exists at most 1 co-integrating vector. Therefore, one definitive long-term relationship (using the trace test) between the mentioned factors. A vector error correction model (VECM) is used to disaggregate these effects because variables might have either short-term or long-term impacts.

The existence of one cointegration vector is seen in Table 4.4(a). The endogenous variable's deviations from its long-run equilibrium level are represented by the cointegration vector. Figure 4.2 demonstrates that, from 2012 to 2022, the economic growth deviations from equilibrium remained constant, which is essential for using the figure as an error-correction model.

4.2.2.5 Cointegration vector

Figure 4.2



4.2.2.6 Vector error correction model (VECM)

A VECM can be employed because the preceding part found a cointegration equation. In order to determine the degree of influence the exchange rates have on economic development, it has become essential to distinguish between the long-run and short-run effects and of variables. The VECM was determined using the cointegration test findings. Tables 4.5 and 4.6 exhibit the VECM results.

4.2.2.7 Results of the long-run cointegration equation

Table 4.5

Variable	Coefficient	Std.Error	t-statistic	Prob
EXCH	0.103104	0.128246	0.803953	0.4332
FCF	-0.221583	0.358502	-0.618081	0.5452
MS	-0.078535	0.228561	-0.343609	0.7356
OP	0.244532	0.250701	0.975393	0.3439
RIR	0.126656	0.079936	1.584460	0.1327
C	6.467597	3.208298	2.015896	0.0609

The long-run impact of exchange rates on economic development as presented in table 4.5 is illustrated using equation 4.1:

*GDP = 6.4676 -0.1031*EXCH – 0.2216*FCF -0.0785*MS + 0.2445*OP + 0.1267*RIR ……eqn 4.1*

According to Equation 4.1, EXCH, MS, and FCF have a long-term, negative connection with GDP. However, RIR and OP exhibit a long-term positive association with GDP. Since all of the variables have absolute t-vales greater than 2, they are all statistically significant in explaining economic growth. According to the findings, a unit rise in EXCH, triggers a reduction of the South African rand relative to its trade partners, slows down economic growth by about 0.1031 over the long run. This demonstrates that even though a negative association does exist in the short term, as shown in Table 4.6 below, it is not sustainable over the long term. The long-term outcomes are consistent with the structuralist interpretation of exchange rates discussed in chapter 2, which holds that depreciation may have a contractionary effect on output and employment, particularly for less economically developed countries. Through imported inputs, depreciation raises the price of imports in particular and local manufacturing in general.

A unit rise in RIR over time boosts economic growth by about 0.1267. Long-term growth in RIR draws foreign direct investment, particularly portfolio investments, that strengthens South Africa's balance of payments accounts and boosts economic expansion. Economic growth is accelerated by about 0.2216 over the long run for every unit rise in FCF. The country's production capacities are increased by investment in public and commercial infrastructure like roads, plant and equipment. In turn, this ensures long-term growth in a nation's gross domestic output.

According to this research, MS has a detrimental long-term impact on economic development. A unit rise in MS slows economic growth by about 0.257 percent. In the long-run, an increase in MS can be inflationary, which has a detrimental impact on economic growth. Finally, it was discovered that OP was positively associated to economic growth. Each unit rise in OP increases GDP by about 0.2445. However, South Africa's global trade openness has its own drawbacks, like capital flight, the effects of worldwide financial instability, such as the global financial crisis and the South East Asian crises of 1998 and 1999, the Zimbabwean crisis, and imported inflation. These factors significantly contributed to the unfavorable effect of OP on development during the research time.

4.2.2.8 Error correction model results

Table 4.6

Variable	Coefficient	Std.Error	t-statistic	Prob
DEXCH	-0.043369	0.017569	-2.468428	0.0208
DFCF	0.100767	0.073161	1.377325	0.1806
DMS	-0.620154	0.171183	-3.622749	0.0013
DOP	0.055495	0.026800	2.070687	0.0489
DRIR	0.064980	0.019299	3.366968	0.0025
C	0.0049414	0.001431	3.452708	0.0020

The constant of 0.00494 in Table 4.6 indicates the rate of adjustment that is around 0.49 percent. Meaning if there exists a divergence from the equilibrium, only 0.49 percent gets rectified in the first quarter as the variable works toward restoring equilibrium. This means that anytime there is a disturbance, there is no great demand on economic development to restore long-run equilibrium. With an absolute t-value of about 3.4527, this rate of adjustment is statistically significant. The slow rate of adjustment by economic development may show the presence of other factors influencing economic growth in SA that are not accounted for in the model.

Table 4.6 shows that the exchange rate has a negative influence on growth in the short-run. A unit rise in exchange rates, resulting from the depreciation of the South African rand, boosts economic growth by around 4.3369 percent. This is consistent with the traditional view of exchange rates, which believes that depreciation has an expansionary influence on economic growth. A currency devaluation causes local goods to be cheaper abroad, increasing demand and resulting in an increase in exports, improving the trade balance and thus expanding output and employment. Depreciation might be a fast remedy in some instances, but it is not a long-term solution. As is the case in this research, in the long-run the relationship becomes positive.

In the short-run, real interest rates have an adverse impact on growth. RIR increases growth by approximately 6.498 percent. An increase in real interest rates in the short term raises the cost of borrowing, reducing investment in the country and ultimately leading to a fall in GDP in the short run. However, in the long-run, it is different because high interest rates help to maintain price stability and low inflation, which boosts economic prospects.

Absolute t-values above 2 indicate that trade openness and real interest rates are statistically important in explaining economic development in South Africa in the short-run. FCF, EXCH, and MS exhibit negligible t-values of less than 2.

4.3 Diagnostic checks

The economic growth model was put through rigorous diagnostic tests. Normality, serial correlation, autoregressive conditional heteroscedasticity and stability were all assessed in the model. Diagnostic tests were done on the GDP model to validate the parameter evaluation of the model's outcomes. Any fault with the estimated model's residuals causes the model to be inefficient, and the estimated parameters to be skewed. The VAR model was exposed to diagnostic testing for the purposes of this study. The diagnostic test results are represented in table 4.7 below, which can be used to check for serial correlation, normality and heteroscedasticity. The diagnostic tests are based on the null hypothesis that: serial correlation does not exist for the LM test; normality exists for the Jarque-Bera test; and heteroscedasticity exists for the White heteroscedasticity test.

4.3.1 Diagnostic checks results

Table 4.7

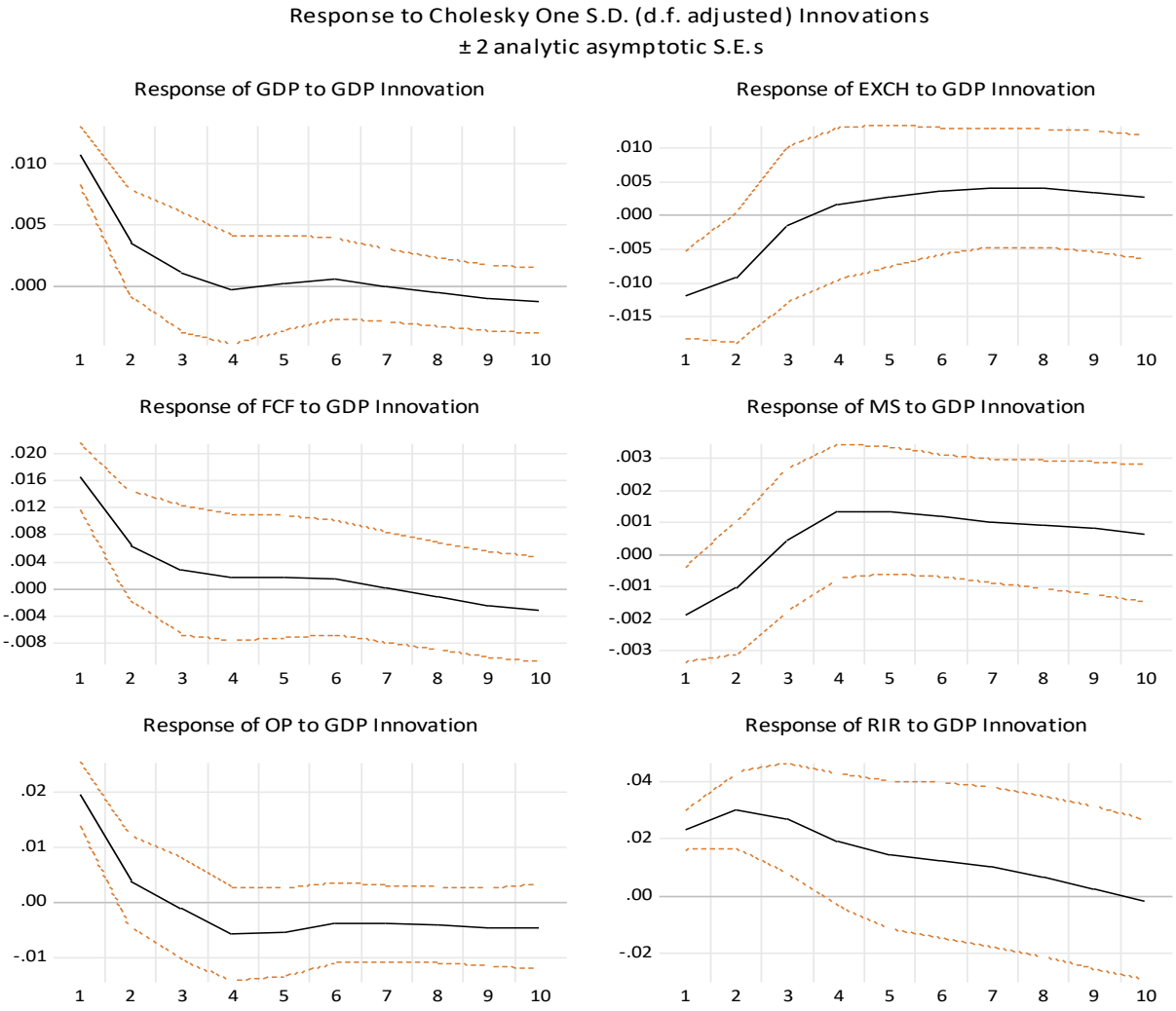
Test	Null hypothesis	t-statistic	Prob
Langrage Multiplier (LM)	No serial correlation	1.003758	0.3914
White (Chi-square)	No conditional heteroscedasticity	0.714464	0.4448
Jarque-Bera (JB)	No normal distribution	3.007833	0.222258

According to the results in the table above, the test for serial correlation generated an LM statistic of 1.003758 and a probability of 0.3914. Jarque-Bera is 3.007833 for the Histogram and Normality Test, and the probability is 0.22258. As a result, the Jarque-Bera statistic is insignificant because it exceeds the 5% significance level. Furthermore, because the histogram is bell-shaped the residuals are normally distributed. As a result, we failed to reject the null hypothesis of the normal distribution. The F-statistic for heteroscedasticity was 0.7144 and the

probability was 0.4448, indicating failure to reject the null hypothesis which says that there is no heteroscedasticity. The alternative theory proposed heteroscedasticity. Meaning the residuals are homoscedastic. The results of the serial correlation and heteroscedasticity diagnostic checks show that the data is reasonably well behaved. The results show the presence of non-normal residuals.

4.4 Impulse response analysis

The responsiveness of the explanatory variables in a VAR to shocks from each variable is determined by the impulse response analysis. Results from the impulse response analysis are represented in figure 4.3 below.



Because this research focused on the impact of exchange rates on economic growth, Figure 4.3 solely shows the responses of economic growth to exchange rates and vice versa. These impulse response functions depict the dynamic reaction of economic development to a one-period standard deviation shock to the system's innovations, as well as the directions and

persistence of the response to each shock over a 10-quarter period. These impulse response functions, for the most part, they follow the expected pattern that validate the results of the short-run relationship analysis. Shocks to all variables are significant, though not lasting. Shocks to MS have a very tumultuous nature, for example, in the first two quarters, a shock to MS dampens growth. From the second quarter, MS shocks have a positive influence on growth until 2.5 quarters later, when it achieves equilibrium and continues to grow positive until the fifth quarter, when it turns negative again until the eighth quarter, when it turns positive again. MS shocks from the eighth to tenth quarters have a negative impact on growth.

4.5 Variance decomposition analysis

Table 4.8

Variance Decomposition of GDP:

Period	S.E.	GDP	EXCH	FCF	MS	OP	RIR
1	0.010696	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.014347	61.75866	0.199601	13.71182	16.66822	4.902695	2.759001
3	0.016345	48.05383	0.394238	27.67015	16.34245	4.721634	2.817698
4	0.016654	46.31352	1.023453	29.20696	15.98593	4.736701	2.733433
5	0.017080	44.04916	1.143982	31.77811	15.22301	5.186239	2.619499
6	0.017368	42.73131	1.170560	32.97480	14.86019	5.729747	2.533388
7	0.017540	41.89758	1.185898	33.89924	14.59272	5.925381	2.499176
8	0.017699	41.21883	1.167012	34.35937	14.48854	6.234209	2.532043
9	0.017809	40.99922	1.152634	34.16940	14.49662	6.544990	2.637134
10	0.017919	40.95504	1.156211	33.75152	14.51356	6.820443	2.803229

Because this research focused on the fluctuations of the economic growth in response to shocks to exchange rates and itself, it solely analysis the variance decomposition of economic development and examines the relative relevance of exchange rates in affecting its movements.

The study allows for variance decompositions for ten quarters in order to determine the effects when the factors are permitted to affect economic growth for a longer period of time. According to Brooks (2008), all of the variation in economic growth in the first quarter is explained by its own innovations(shocks). Economic growth explains approximately 44 percent of the variation in the fifth quarter ahead projection error variance, as shown in column two of table 4.8 under the standard error, whereas the other variables explain 55.95 percent. EXCH explains 1.1439 percent of this, RIR explains around 2.619%, OP explains 5.186%, MS explains 15.223, and FCF explains about 31.778 percent.

However, after ten quarters, economic growth explains approximately 40% of its own fluctuation, while other variables explain the remaining 60%. EXCH's effect increased to

1.1562 percent, and RIR to around 2.8 percent, OP also increased to 6.8%, MS decreased to 14.5 percent, and FCF increased to about 33.7 percent. These findings are similar to those of the impulse response analysis in that all variables have a significant short-run impact on economic growth.

The majority of its changes are explained by economic growth, followed by fixed capital formation, real interest rates, trade openness. Money supply and real exchange rates though significant, do not explain much of the fluctuations in economic growth. Using the variance decomposition technique, it is clear that fixed capital formation is a key variable in explaining economic growth in South Africa over the research period.

4.6 Summary

This chapter was broken down into six sections. The first section described the unit root test, which used the Dickey-Fuller and Philips-Peron tests to determine stationarity. Both methods revealed that the data series are non-stationary at different levels but stationary when first differenced. As a result, the series of the same order I were integrated.

The cointegration tests were conducted in the second stage after the unity root tests. The maximum likelihood method developed by Johansen was used for the cointegration tests. The pair-wise correlation matrix and the lag order selection criteria were also covered in this chapter. To enable model adjustments and achieve well-behaved residuals, a maximum of 5 lags were used. Cointegration was examined using the trace and maximum Eigen value cointegration tests. The results indicated that both the Trace and Maximum Eigen value tests reject zero in favor of at least one cointegration vector. At a 5% level, the results were significant. These findings demonstrate that there is only one long run equilibrium relationship, or one way in which the variables are linked together over time.

Since variables can have either short-term or long-term effects, the (VECM) model was presented in the third section. Each variable had a statistically significant impact on South Africa's economic expansion. The findings indicated that while OP and MS have negative long-term effects on growth, EXCH, RIR, and FCF have positive long-term effects on economic growth.

The findings of the diagnostic procedures used in the study were presented in the final section. There were several residual diagnostics tests run, and these evaluated the model's fitness. The results of every diagnostic test confirmed that the equation was statistically sound. Any issue

with the estimated model's residuals causes the model to be ineffective and the estimated parameters to be skewed. It was discovered that the variance decomposition and the impulse response were both consistent with economic theory. Therefore, from this study, trustworthy conclusions and policy suggestions were drawn.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This research's main goal was to econometrically examine how real exchange rates affected South Africa's economic growth between 2012 and 2022. The research's background we re explained earlier in the first chapter. Objectives, hypothesis, problem statement, and study organization were all clearly outlined in previous chapters with relevant information. Chapter 2 explored relevant theoretical and empirical literature. Chapter three, provided the study's methodology which came after the chapter on literature review.

5.2 Summary and conclusions

In order to perform analysis of the data and to explain the behavior and trends of the variables over the duration of the research, data was graphically analyzed. Exchange rates were not stable, as evidenced by fluctuations over the study course in a South African trends review. The forces and demand in the global market exchange, not the government, determine the value of the rand in South Africa.

Exchange rates were found to be a significant variable in outlining changes in economic growth after a overall review of theoretical and empirical literature. The traditional approach, the structuralist, the Balassa-Samuelson and the export led hypothesis to exchange rates were the studies taken into consideration in this research. Although the underlying premises and foundations of these theories varied, they all shared the fundamental insight that real exchange rates can be used as a tool by policymakers to achieve rapid economic growth. Contrary to the structuralist approach, which claimed that exchange rates have a negative effect on growth, the other side (traditional approach) maintained that there is a positive correlation between real exchange rates and economic growth. Exchange rates have an impact on economic development in both developing and developed nations, also in SA, according to the majority of the empirical literature reviewed for this study.

It was necessary to also include other variables in the growth model, as suggested by both theoretical and empirical literature, in order to accomplish the primary goal of this study. An extensive review of the literature on exchange rates, economic growth, and data accessibility influenced the selection of these variables. This resulted in the empirical growth model's

specification. Real exchange rates, real interest rates, fixed capital formation, trade openness, and money supply were the explanatory variables in this study.

The Johansen cointegration and error correction methodology was used to identify both the long and short run relationships among the variables after the model had been specified. Due to the vast advantages described in Chapter 4 for example it allows for more than one cointegrating relationship, it was chosen over alternative methodologies like the Engle-Granger approach. When working with time series data, it is necessary to determine whether each individual time series is stationary or cointegrated. To do this, the graphical method was first used to perform a preliminary test for unit root. The formal unit root tests were run using the Augmented Dickey-Fuller and Phillips-Perron tests due to the shortcomings of the graphical method. All of the tests revealed that while the time series were initially non-stationary, they eventually became stationary.

To determine whether the dependent variable in the VAR was responsive to shocks to each of the other variables, the impulse response analysis was performed. All the variables experienced significant shocks, despite the fact that they did not last. To identify the factors that is responsible for the majority of the variations in the dependent variable, variance decomposition analysis was carried out. Fixed capital formation was found to be the main contributor to its variations, followed by GDP. The remaining went through diagnosis. This was done to guarantee that the residuals behaved properly. The model may not be effective if the residuals are serially correlated and have non-constant error variance, in which case the parameters estimated may be biased. According to the model's long-term findings, MS and OP have a long-term negative relationship with economic growth, while FCF, EXCH, and RIR have a long-term positive relationship with it. All of the explanatory factors were found to be statistically significant in explaining South Africa's economic expansion.

5.3 POLICY IMPLICATIONS AND RECOMMENDATIONS

The study's findings have several policy complications. They are divided into four categories in this section: monetary policy, trade policy, investment policy, and exchange rate policy.

5.3.1 Exchange rate policy

There are primarily two opposing viewpoints on how exchange rates affect economic growth. The traditional perspective claims that currency depreciation spurs economic growth, while the structuralist perspective contends that currency depreciation reduces a nation's prospects for

future growth (Kumar, 2020). The empirical literature on this subject offers contradictory results. However, it was suggested by the long run equation in chapter 3 that exchange rates have a detrimental effect on economic growth. According to the coefficient of EXCH from the long run equation suggested by the VECM results, a unit increase in South Africa's exchange rates results in a 0.1031 reduction in the nation's economic development. However, results from the short-run equation indicate that a unit increase in South Africa's exchange rates results in a 4.339% increase in the nation's economic growth.

In this regard, the devaluating of the currency policy can only be effective in the short term for South Africa to increase economic growth. According to the short-term relationship, depreciation boosts growth, but this is only a temporary solution with adverse long-term effects. Depreciation(devaluation) works well in the short run but has negative effects in the long run because it can only reduce economic growth over time. These findings suggest that the depreciation policy to boost exports and employment in the economy may not be the best course of action for South Africa. The best course of action is to let supply and demand, where the rand exchange returns to its own equilibrium, determine exchange rates in order to prevent misalignments (overvaluation or undervaluation of the rand).

5.3.2 Investment policy

According to estimation findings in this research, investment expenditure has a positive long-term impact on economic growth in South Africa, increasing fixed capital formation by one-unit results in a 0.2216 increase in economic growth. The policy implication is that the government should increase investment spending in order to boost national economic growth. The government needs to spend money on infrastructure, including roads, buildings, and medical facilities. By educating its citizens, the government should also make an investment in human capital. The short run equation in Chapter 4 demonstrates that investment returns are not immediate. Investments have a negative short-term effect on growth, but they have a positive and significant long-term effect. The justification for this is that while it may be difficult to recover some of the costs associated with investments in both human and physical capital in the short term, doing so will result in high returns over the long term. The government must make significant investments even though the short-term returns are not very high in order to achieve high rates of economic growth in the long run.

5.3.3 Monetary policy

The intentional manipulation of the money supply and its price (interest rates) through monetary policy is done to bring about desired changes in the economy. According to estimation findings in this study, both the short- and long-term effects of money supply on economic growth in South Africa are unfavorable. A unit increase in the money supply reduces growth by about 0.0785 according to the long run equation. Long-term findings also suggest that growth is increased by about 0.1267 for every unit increase in real interest rates. Short-term increases in real interest rates reduce growth by about 6,498 percentage points. The policy implication is that an expansionary monetary policy is successful in the short term. This suggests that a drop in the repo rate can encourage investment, boosting economic growth. However, a contractionary monetary policy's effects won't be felt for some time.

Furthermore, it can be seen that real interest rates account for a large portion of the variations in economic growth after taking into account impulse response analysis and variance decomposition analysis. As a result, interest rates play a critical role in determining SA's economic development. The central bank's current inflation targeting policy framework is appropriate and effective given the state of the South African economy. Repo rates are used by the government to manage both inflation and the money supply. The current monetary policy in South Africa should be maintained, according to this dissertation, given the long-term relationship and the variance decomposition analysis.

5.3.4 Trade openness policy

According to estimation findings from this study, trade openness in South Africa accelerates economic growth by about 0.2445% over the short term. But according to the long-run equation, a unit increase in the money supply lowers growth by about 0.554%. The terms of trade, trade diversification, trade balance, and the types of goods imported and exported are just a few of the many factors that must be taken into account for trade openness to be successful. South Africa needs to diversify its economy to make trade openness profitable and long-lasting. Gains from trade are diminished by an over-reliance on primary goods like mining and agricultural products. There is a need to grow the already thriving car manufacturing industry and other value-adding industries as well as diversify into products that add value and command high prices on the global market. To compete with developed nations, South Africa must also strengthen its service sector.

To safeguard and develop the domestic industry, South Africa should step up its import-reduction efforts. Imposing export subsidies and import tariffs can accomplish this. As a result,

local demand for local industries rises, strengthening them over time to compete with global industries and enhancing the trade balance and, ultimately, economic growth.

5.4 RESTRICTIONS OF THE STUDY AND AREAS FOR FURTHER RESEARCH

The first restriction was the lack of quarterly data for some variables related to the effects of real exchange rates and economic growth that were suggested by the theoretical model. In addition, most of the secondary information used in this research came from variety sources, which could have made mistakes, thus reliability of data cannot be assured. The effect of exchange rate volatility on economic growth in South Africa is a recommended area for further study.

5.5 SUMMARY

Examining the effects of real exchange rates on South Africa's economic growth from 2012 to 2022 was the primary goal of this study. This study's main hypothesis was that South Africa's economic growth is significantly influenced by real exchange rates. The null hypothesis that real exchange rates have a significant impact on economic growth in South Africa was not rejected in light of the regression results.

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5.7 APPENDICES

TEST FOR HETEROSSEDASTICITY

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	0.714464	Prob. F(10,31)	0.7044
Obs*R-squared	7.866762	Prob. Chi-Square(10)	0.6418
Scaled explained SS	9.389441	Prob. Chi-Square(10)	0.4956

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/21/22 Time: 15:04
Sample: 1 42
Included observations: 42
Collinear test regressors dropped from specification

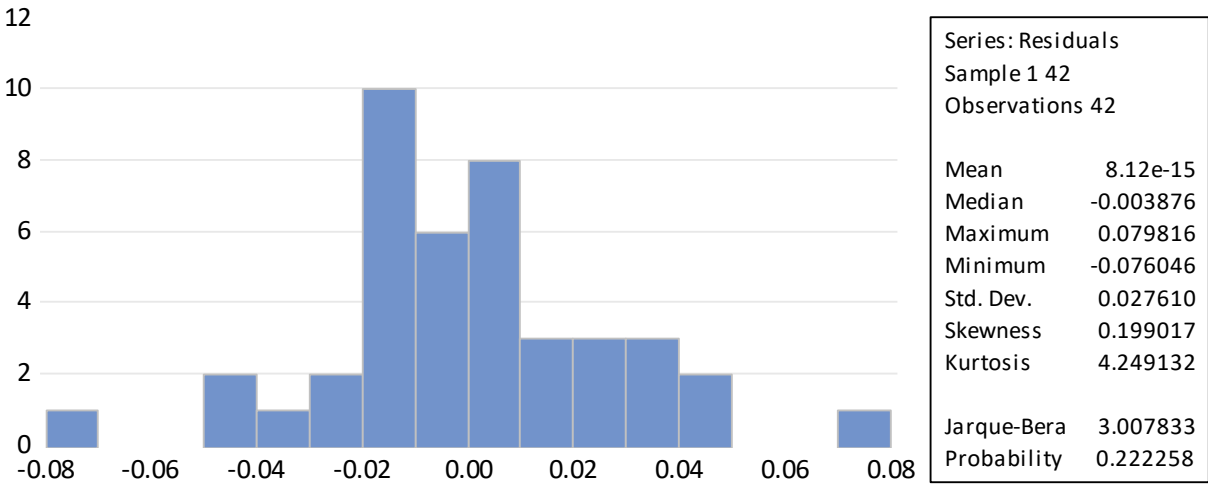
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.179885	1.634633	0.721805	0.4758
LOGFCF^2	-0.008194	0.019723	-0.415449	0.6807
LOGFCF*LOGGDP	-0.028547	0.064134	-0.445123	0.6593
LOGFCF*LOGMS	0.001099	0.011241	0.097789	0.9227
LOGFCF*LOGOP	0.012475	0.013904	0.897189	0.3765
LOGFCF*LOGRIR	0.292736	0.252467	1.159500	0.2551
LOGGDP*LOGRIR	0.454986	1.018693	0.446637	0.6582
LOGMS*LOGRIR	-0.025345	0.169547	-0.149486	0.8821
LOGOP*LOGRIR	-0.195919	0.212850	-0.920457	0.3644
LOGRIR^2	-0.057740	0.066880	-0.863334	0.3946
LOGRIR	-3.391010	4.508910	-0.752069	0.4577

R-squared	0.187304	Mean dependent var	0.000744
Adjusted R-squared	-0.074856	S.D. dependent var	0.001358
S.E. of regression	0.001408	Akaike info criterion	-10.07376
Sum squared resid	6.14E-05	Schwarz criterion	-9.618655
Log likelihood	222.5489	Hannan-Quinn criter.	-9.906946
F-statistic	0.714464	Durbin-Watson stat	1.837451
Prob(F-statistic)	0.704448		

DESCRIPTIVE STATISTICS

	GDP	EXCH	FCF	MS	OP	RIR
Mean	6.043751	1.103676	11.29489	12.50622	11.53664	0.758961
Median	6.046329	1.139089	11.30726	12.50614	11.53277	0.771709
Maximum	6.061555	1.254078	11.36164	12.65208	11.75625	0.873708
Minimum	5.978411	0.889792	11.18673	12.34835	11.37488	0.557106
Std. Dev.	0.015899	0.092438	0.043040	0.090900	0.094975	0.099120
Skewness	-1.806234	-0.789507	-0.993987	-0.059851	0.381938	-0.579846
Kurtosis	7.902400	2.656778	3.163716	1.830610	2.664999	2.148547
Jarque-Bera	64.89603	4.569400	6.962981	2.418152	1.217534	3.622255
Probability	0.000000	0.101805	0.030762	0.298473	0.544021	0.163470
Sum	253.8376	46.35438	474.3856	525.2611	484.5387	31.87638
Sum Sq. Dev.	0.010364	0.350333	0.075949	0.338772	0.369831	0.402819
Observations	42	42	42	42	42	42

RESIDUAL NORMALITY TEST: JARQUE-BERA



AUTOCORELLATION: BREUSCH-GODFREY

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

F-statistic	7.801702	Prob. F(2,34)	0.0016
Obs*R-squared	13.21165	Prob. Chi-Square(2)	0.0014

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 11/21/22 Time: 14:57
Sample: 1 42
Included observations: 42
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGFCF	-0.195145	0.306803	-0.636061	0.5290
LOGGDP	0.899603	0.735524	1.223077	0.2297
LOGMS	0.088196	0.158972	0.554789	0.5827
LOGOP	-0.128535	0.222892	-0.576671	0.5680
LOGRIR	-0.023386	0.083017	-0.281698	0.7799
C	-2.836064	3.192228	-0.888428	0.3806
RESID(-1)	0.531294	0.173877	3.055577	0.0043
RESID(-2)	0.145941	0.175769	0.830301	0.4122

R-squared	0.314563	Mean dependent var	8.12E-15
Adjusted R-squared	0.173444	S.D. dependent var	0.027610
S.E. of regression	0.025102	Akaike info criterion	-4.362087
Sum squared resid	0.021424	Schwarz criterion	-4.031103
Log likelihood	99.60383	Hannan-Quinn criter.	-4.240768
F-statistic	2.229058	Durbin-Watson stat	1.827754
Prob(F-statistic)	0.056063		

MISPECIFICATION TEST: RAMSEY-RESET TEST

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: LOGEXCH LOGFCF LOGGDP LOGMS LOGOP LOGRIR C

	Value	df	Probability
t-statistic	3.772544	35	0.0006
F-statistic	14.23209	(1, 35)	0.0006
Likelihood ratio	14.33030	1	0.0002

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.009035	1	0.009035
Restricted SSR	0.031256	36	0.000868
Unrestricted SSR	0.022220	35	0.000635

LR test summary:

	Value
Restricted LogL	91.67216
Unrestricted LogL	98.83730

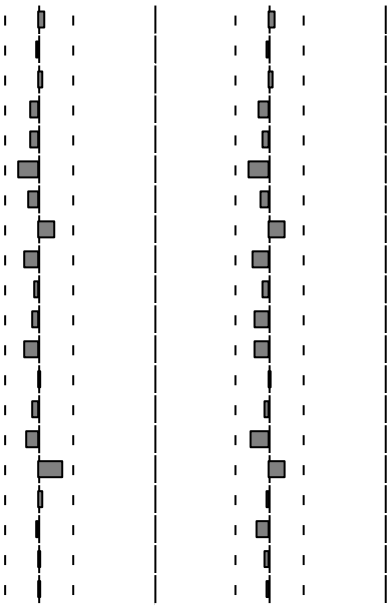
Unrestricted Test Equation:
Dependent Variable: LOGEXCH
Method: Least Squares
Date: 11/21/22 Time: 15:01
Sample: 1 42
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGFCF	11.50541	2.581383	4.457070	0.0001
LOGGDP	-20.36083	4.662992	-4.366474	0.0001
LOGMS	6.127200	1.388138	4.413970	0.0001
LOGOP	-2.130071	0.516798	-4.121669	0.0002
LOGRIR	0.109567	0.087986	1.245275	0.2213
C	-54.74387	12.51566	-4.374031	0.0001
FITTED^2	-2.599652	0.689098	-3.772544	0.0006

R-squared	0.936574	Mean dependent var	1.103676
Adjusted R-squared	0.925700	S.D. dependent var	0.092438
S.E. of regression	0.025197	Akaike info criterion	-4.373205
Sum squared resid	0.022220	Schwarz criterion	-4.083593
Log likelihood	98.83730	Hannan-Quinn criter.	-4.267051
F-statistic	86.13676	Durbin-Watson stat	0.910123
Prob(F-statistic)	0.000000		

AUTOCORRELATION CORRELOGRAM

Date: 11/28/22 Time: 13:47
Sample: 2012Q1 2022Q2
Included observations: 42



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.042	0.042	0.0794	0.778
		2	-0.010	-0.012	0.0844	0.959
		3	0.036	0.037	0.1442	0.986
		4	-0.081	-0.084	0.4620	0.977
		5	-0.072	-0.065	0.7219	0.982
		6	-0.182	-0.182	2.4236	0.877
		7	-0.083	-0.069	2.7852	0.904
		8	0.145	0.148	3.9330	0.863
		9	-0.124	-0.140	4.7928	0.852
		10	-0.043	-0.062	4.8989	0.898
		11	-0.060	-0.117	5.1153	0.925
		12	-0.115	-0.136	5.9325	0.919
		13	0.016	-0.005	5.9489	0.948
		14	-0.054	-0.042	6.1393	0.963
		15	-0.105	-0.164	6.8940	0.961
		16	0.212	0.135	10.102	0.861
		17	0.033	-0.009	10.181	0.896
		18	-0.022	-0.100	10.220	0.925
		19	0.005	-0.037	10.222	0.947
		20	0.004	-0.009	10.223	0.964

SOUTH AFRICAN DATA USED IN REGRESSION

Years	LogGDP	LogEXCH	LogMS	LogFCF	LogRIR	LogOP
2012-01-01	6.016863681	0.889792092	12.34835355	11.18672891	0.740625819	11.38167351
2012-04-01	6.020473861	0.909836937	12.35492169	11.20685028	0.745855195	11.38557722
2012-07-01	6.022235927	0.917323954	12.36687364	11.2001783	0.709552613	11.37488393
2012-10-01	6.024302347	0.938985854	12.3763247	11.22101198	0.694897555	11.3927327
2013-01-01	6.027659539	0.952314486	12.38227862	11.22895759	0.703291378	11.41724292
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2013-07-01	6.032862751	0.999619233	12.39647274	11.26360525	0.706717782	11.4447016
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2014-10-01	6.041627614	1.049677294	12.43121544	11.28873621	0.772566173	11.48793759
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2016-01-01	6.045937677	1.199732786	12.48149351	11.31569681	0.841568015	11.51632788
2016-04-01	6.046355333	1.176861906	12.48218231	11.33127051	0.855922775	11.54382669
2016-07-01	6.04630244	1.148073168	12.48841082	11.30562018	0.864115369	11.52074147
2016-10-01	6.046671032	1.143320108	12.49992409	11.31538369	0.873708019	11.51885596
2017-01-01	6.048716627	1.122182753	12.50455323	11.31675918	0.86431327	11.53005488
2017-04-01	6.051078435	1.121835776	12.5077261	11.30816578	0.868840287	11.53966138
2017-07-01	6.051876361	1.1194683	12.51849644	11.31828072	0.857332496	11.53547545
2017-10-01	6.053581319	1.134857983	12.52689601	11.33035027	0.870013528	11.55616415
2018-01-01	6.055400084	1.077508572	12.53207222	11.3290934	0.855317205	11.54252831
2018-04-01	6.054490638	1.101505592	12.53198636	11.32489969	0.845511457	11.55201586
2018-07-01	6.060025939	1.14904632	12.54804344	11.33328067	0.851869601	11.57989497
2018-10-01	6.061555348	1.15395107	12.55034443	11.32785987	0.865301426	11.58983367
2019-01-01	6.057602971	1.146543266	12.56045722	11.33564614	0.861335239	11.57111269
2019-04-01	6.059372506	1.157938113	12.56896682	11.33346911	0.852886446	11.58487036
2019-07-01	6.059973627	1.166700111	12.57411187	11.34236907	0.842817185	11.58503286
2019-10-01	6.059823462	1.167767872	12.57621588	11.32923865	0.843855423	11.59195867
2020-01-01	6.05982649	1.18585992	12.60000265	11.31900935	0.808210973	11.61086241
2020-04-01	5.978411486	1.254078483	12.61439633	11.21012259	0.648685203	11.47559545
2020-07-01	6.034420042	1.228041021	12.61351434	11.28210899	0.568201724	11.60149613
2020-10-01	6.045977566	1.194198283	12.61529559	11.30659048	0.557106006	11.63053765
2021-01-01	6.049536879	1.174779419	12.61700674	11.29447547	0.579402469	11.66347019
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2021-10-01	6.053534021	1.187904145	12.64007697	11.32166386	0.58130477	11.69488545
2022-01-01	6.061039099	1.182634852	12.65207791	11.34833114	0.648360011	11.73245328
2022-04-01	6.057829485	1.191508011	12.65061637	11.36163541	0.665580991	11.75624841