ANALYSING THE EFFECTS OF PUBLIC EXPENDITURE ON ECONOMIC GROWTH IN SOUTH AFRICA.

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ABSTRACT

Since the commencement of South Africa's democracy in 1994, South Africa has made tremendous progress with a focus on sustainable economic growth. Due to data limitations because of the Covid-19 pandemic, the study drew on quarterly data for the period 1997 to 2018 to examine the effect of public investment on economic growth in South Africa. The study drew data from World Bank and The International Monetary Fund, making use of real gross domestic production, general government capital stock, private capital stock, research and development and total employment were used. The analysis was conducted with the use of EViews 12.

This study made use of the Vector Autoregressive (VAR), Vector Error Correction Model (VECM) and the cointegration test to determine the effect of public investment on economic growth. The cointegration test indicated that there exists a long run relationship between public spending and economic growth in South Africa. The VECM indicated a positive relationship between public spending and economic growth in the long run, while illustrating a negative relationship between public spending and economic growth in the short run. The need for the implementation of a fiscal policy is of importance as it would help regulate the flow of money within the economy.

Key words: South Africa, investment expenditure, economic growth.

CONTENTS

LIST OF ABBREVIATIONS

IDC	Industrial Development Corporation
OLS	Ordinary Least Squares
ADF	Augmented Dickey-Fuller
VAR	The Vector Auto-Regressive
KP	Private Capital Stock
KG	General Government Capital Stock
L	Total Employment
A	Research and Development
VECM	Vector Error Correction Model
GDP	Gross Domestic Product
PP	Phillips-Peron
SARB	South African Reserve Bank
Stats SA	Statistics South Africa

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CHAPTER ONE: INTRODUCTION

1.1. Introduction

The common notion that public expenditure and infrastructure will improve economic growth is a prominent feature of government economic platforms throughout the world. Since 1994 South Africa has successfully transitioned from apartheid to democracy; the country has also made impressive progress in stabilizing the economy, improving standards of living, and achieving higher economic growth since the end of the apartheid regime. Today, some international financial institutions call the idea of closing the infrastructure gap in developing countries to revive economic growth "the next big thing" to drive economic development (Lundahl & Petersson, 2009). Therefore, it is crucial to evaluate how public spending affects economic growth in order to identify how these effects might influence South Africa's future economic growth.

Low-income countries may face difficulties with public investment because they prefer to spend their limited resources on obtaining raw materials rather than on socio-economic infrastructure (Warner, 2014). Inequality in an economy is often caused by public investment. This occurs when it rises and employment falls, resulting in wage inequality. Because of the rise in inter-industry wage disparities, workers in industries are paid more than workers in government firms. In comparison, industrial workers' wages are so high that it causes economic conflict. In developing countries, public investment, economic capacity, and conflicts are all related to economic growth. Since these countries have limited public investment and financial burden, they must constantly increase their public investment in response to threats both internally and externally (Collier, 2007).

When the economic determinants of growth are held constant, there is a significant correlation between outputs. In contrast, if economic variables attempt to change while threats remain constant, there will be a significant relationship between public investment, output and economic growth (Smith, 2000). Initially, public investment increases output, which leads to an increase in output and employment in any country, thereby increasing economic growth. Ram (1995) is a seminal researcher whose work examines the effects of public investment on the economy. The literature revealed inconclusive and mixed results, depending on the country sampled and the time period. Infrastructure is also associated to

public investment, which has a positive impact when practical skills and labour force are obtained (MacNair et al., 1995).

The global financial crisis strained financial sectors as it is still felt around the world and also affected economies. The financial crisis happened because of the failure to fully oblige to the rules and regulations of the financial system. This further deteriorated the complications in terms of investment expenditure and future growth (Boujelbene & Ksantini, 2014). The 2008-2009 financial crisis defied countries to sustain expenditure that endorses economic development. Public investment expenditure was heavily affected throughout. Investments declined in huge amounts in certain countries because of stimulus expenditure. Boujelbene and Ksantini (2014) highlighted that public investments in many countries were condensed from 24.38% in 2007 to 21.08% in 2009. Public investment in 2008 had a major drawback and as a result investment norm for the period 2002 to 2007 were decent, but then declined from 2008-2009.

The financial crisis had a huge impact, especially on sub-Saharan African countries, as it changed investment expenditure due to a decrease in capital inflows and international trade investments as well as bonds slowing down which increased these countries' risks, evidently damaging international trade (African Development Bank, 2009). Countries are still attempting to recover from the financial crisis because its effects on numerous economies have been and continue to be felt (Boujelbene & Ksantini, 2014).

Furthermore, according to Musaba, Chilonda & Matchaya (2013), most developing countries pursue macroeconomic objectives such as sustainable economic growth and development by using public expenditure as an instrument to stimulate economic growth. To illustrate this point, the government is responsible for 18% of the total investment in the economy. Public spending stimulates economic growth by distributing resources to the underprivileged and building extensive infrastructure. Investments in the health and education sectors largely benefit the economy in the long run. The government distributed under R180 billion in 2017/2018 to economic affairs which increased by R9 billion since 2016/2017. Transport spending took more than half of the R180 billion as it took up R93 billion, which was used on the development and maintenance of road infrastructure. Therefore, money is spent on industries and infrastructure, aiming to increase economic growth and development. (Stats SA, 2019).

Public expenditure is an injection into the economy as it increases the flow of capital spent on public resources, to generate value in the future (Business Dictionary, 2016). In addition, Riley (2015) highlights that Governments contribute to public expenditure to enhance future expected profits or income to generate wealth and future growth prospects. This is supported by the multiplier analysis which measures the greater changes in economic activity due to an increase in public expenditure (Chipaumire et al., 2014).

In addition, the National Treasury is responsible for advising the Minister of Finance on tax policy issues in order to put tax measures in place to achieve an increase in economic activity to align with the country's goals. The former Minister of Finance, Pravin Gordhan, therefore detailed that an increase in both public and private investments boosts economic activities as it creates jobs and development, suggesting that more requests must be made to create a stronger investment within the country (National Treasury, 2017).

Authors Ahmad, Iuqman & Hyat (2012:680) specified that public expenditure makes a direct contribution to economic activities and is an increase in investment expenditure as it diminishes long-term debt, increases competitiveness, and increases profits. Moreover, public expenditure aims to ensure an improved standard of living for individuals in the future and high standards for the future production for firms and economic growth aspects (Mankiw & Taylor, 2008:540).

Public expenditure in the implementation of technological enhancements plays a major role in the economy. Technological innovation requires capital and the demand for it affects investment, as funds are necessary (Fourie and Burger, 2015:531). Markusen & Venables (1999) also highlighted that technological enhancements and growth are closely related to investment capacity, as investment encourages and stimulates technological upgrading and economic growth and development.

Many empirical studies support the Keynesian view which highlights economic growth as an outcome of public expenditure, as it creates an increase in consumers' purchasing power and therefore increases aggregate demand in times when demand is low. In contrast, other studies support Wagner's view, known as the "Law of increasing extension of economic activity", believing economic growth is stimulated by public sector growth as a response to the increase in economic activity and the expansion of new activities (Ngirande, Method & Ruswa, 2014).

Therefore, examining the effects of public expenditure on economic growth is extremely important to identify how these effects could influence future economic growth in South Africa.

1.2. Problem statement

This thesis aims at determining the impacts of public expenditure on economic growth in South Africa. Similar research has been conducted and it is evident that growth in public spending in South Africa has become an issue as it leads to a broadening government deficit. Measures were put in place to control the growth in spending and government was forced to reduced spending plans by R10,4 billion through savings, and a draw down on the contingency reserve and reprioritisation in the year 2013. However, despite this issue, the government remains committed to investing in infrastructural programmes as spending and recovery in revenue is expected to stabilize debt by higher than 40% of GDP. Thus, the budget fell from 5.2% of GDP in 2012/2013 to 3.1% in 2015/2016 (Stats SA, 2019). This is contrary to the theoretical proposition which argues that a rise in government expenditure leads to economic development. Moreover, the coronavirus pandemic caused a difficult economic situation and limited fiscal flexibility. Therefore, the study analyses the effects of public expenditure on economic growth in South Africa.

1.3. Objectives of the study

The primary goal of this research is to determine whether or not there is a relationship between public expenditure and economic growth in South Africa. The specific objectives of the study are as follows:

- To determine whether the relationship between public expenditure and economic growth is of long term in nature.
- To determine the causal relationship between public expenditure and economic growth.

1.4. Hypothesis

Null: Public expenditure and economic growth proxies do not have a long run relationship.

Alternate: Public expenditure and economic growth proxies do have a long run relationship.

Null: There is no causality between public expenditure and economic growth.

Alternate: There is causality between public expenditure and economic growth.

1.5. Rationale and significance of research

Trade and industrial policy strategies (TIPS) 2000, highlighted that there is worryingly limited analytical research in South Africa on the factors of public expenditure. In South Africa the importance of public expenditure is poorly understood as a means to sustain higher economic growth prospects. The government has created ways to attract investment through public expenditure and the implementation of programmes such as the Reconstruction and Development Programme (RDP) and Growth, Employment and Redistribution (GEAR). Unfortunately, the results of these programmes in the long run fell short.

Trade liberation in South Africa grew significantly after 1994 as the country opened to international trade and investment (TIPS, 2000). Public expenditure in South Africa has declined in areas such as infrastructure, because of an increase in factors such as high budget deficits, inflation, and high debts. This, therefore, gives rise to the question, what affects public expenditure and what is the cause of South Africa's decline in public expenditure? This is due to the impact that public spending has on economic growth, which is vital because economic growth is attained through public spending. However, these goals are hypothetical since there is no evidence of how public spending affects economic growth.

An empirical issue would arise if there is no clear theoretical association between public investment and economic growth. This thesis would therefore empirically analyse the correlation between public investment and economic growth in the context of South Africa's economy.

1.6. Chapters outlay

Chapter 2 will be an overview on public investment overtime and its effects on economic growth. Chapter 3 will be a literature overview on the conceptual, theoretical perspectives of public investment and the empirical framework underpinning the study. Chapter 4 will consist of a description of the data and methodology being used. Chapter 5 will provide an analysis of the empirical results estimated using the methodology mentioned in chapter 4. To conclude, chapter 6 will present a review of the main findings as well as recommendations.

CHAPTER TWO: OVERVIEW OF SOUTH AFRICA'S ECONOMIC PERFORMANCE

2.1. Introduction

Within the setting of making comprehensive development, focusing on public investment, the South African government implements measures to help accomplish its comprehensive development objective (Toyin et al., 2017). The government therefore formulates policies that help the country achieve its ultimate goals of increased development and growth.

The COVID-19 pandemic drove the world economy into the most profound recession since the Great Depression of the 1930s, with substantial employment misfortunes, expanded poverty, and inequity. Measures to contain its spread have taken a toll on economic activities worldwide. Lockdown limitations on business operations, production, and spending dropped within the first half of 2020. The pandemic has constrained many academic and industry research, resulting in no data value stored for variables in observations between 2019-2021. For this reason, the years 1996-2018 were chosen in order to avoid an inaccurate analysis and therefore exclude the years COVID-19 took place.

This chapter provides a summary of the economic composition in terms of investment performance. The domestic investment employed in the study is government and private capital stock. Investment will be a representation of government and private capital stock. Historical data will aid in the analysis of economic patterns.

2.2. South Africa's economic performance

South Africa is recognized as one of Africa's most developed nations in terms of growth and development (Legatum Organized, 2016; WEF, 2017). A rising tendency in financial development has been observed in South Africa since the removal of economic authorisations imposed on the nation prior to 1994. Over the course of 26 years, South Africa's economic growth has increased by 2.30% (IDC, 2013:1-2).

Given the shock of the Coronavirus pandemic at the end of 2019, the South African economy has been put under great strain, as it declined South Africa's GDP by 16.4%, within the second quarter of 2020. In an exceedingly adverse economic environment, many public

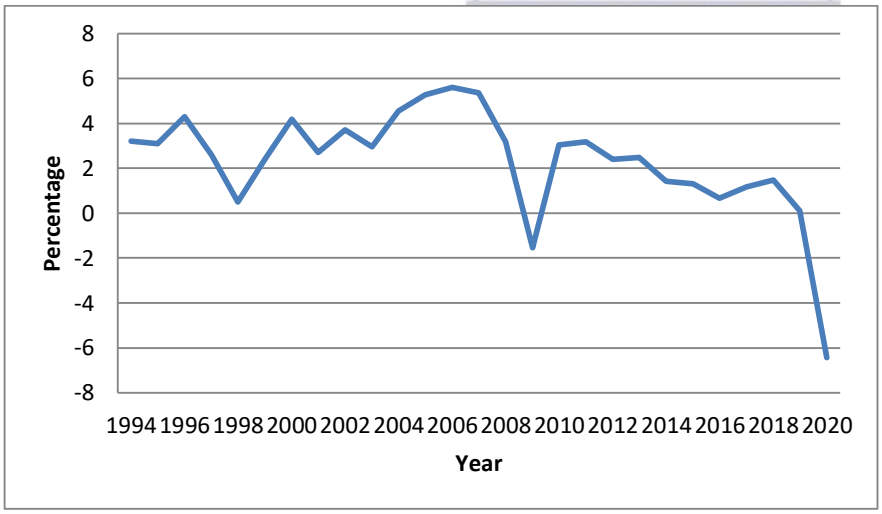
investment plans were postponed or re-evaluated. Nonetheless, impressive public investment inflows were still recorded within the start of the first two quarters of 2020 (IDC, 2021).

2.3. South Africa's annual average percentage growth rates

For the period 2001-2007, South Africa's public investment increased from 4.4% to 9.5% but then dropped in 2008-2012 to 2.2%. The financial crisis changes to South Africa's political cabinet and the country's economic position were all factors in this decline (National Treasury, 2013).

Presently, the Covid-19 pandemic and the actions taken to contain it caused significant harm to the South African economy, which had been encountering recessionary conditions since the second half of 2019. Real GDP later dropped by 7% in 2020. South Africa's budget shortfall is evaluated at 14% of GDP for the 2020/21 periods, whereas the debt-to-GDP proportion may reach 87.3% by 2023/24 (SARB, 2021).

Figure 2.1: Growth Rate



Source: Author's computations: Adapted from the International Monetary Fund

Despite experiencing sluggish economic growth since 1995, South Africa's GDP sharply increased from 1998 to 2007 before significantly declining during the financial crisis in 2008. South Africa was labelled the most developed and largest country in Africa until 2014 when it was surpassed by Nigeria. Figure 2.1 above depicts South Africa's annual GDP growth rate averaging 2.25% from 1994 until 2021, with record highs of 7.10% in the fourth quarter of 2006 and record lows of -17.80% in the second quarter of 2020. In the first quarter of 2021, South Africa's GDP fell by 3.20% compared to the same period the previous year. The South

African economy is still 2.7% smaller than it was in the first quarter of 2020, even though this is the third consecutive quarter of growth (OECD, 2020). South Africa's GDP annual growth rate is anticipated to be 15% by the end of this quarter, according to Trading economics (2022) global macro models and analyst estimates. In the next 12 months, South Africa's GDP annual growth rate is expected to be 2.60%. South Africa's GDP annual growth rate is anticipated to average 2.30% in 2022 and 2.40% in 2023 in the long run.

Moreover, due to the economic crisis caused by the Covid-19 pandemic and the steps taken to contain it, the South African economy declined at its fastest rate on record in 2020. Following a marginal 0.2% rise in 2019, real GDP declined by 7% in 2020. The steep drop in overall GDP was caused by low activity in industries like trade and accommodation, transportation and communication, financial and commercial services, and construction (OECD, 2020).

2.4. Investment climate in South Africa

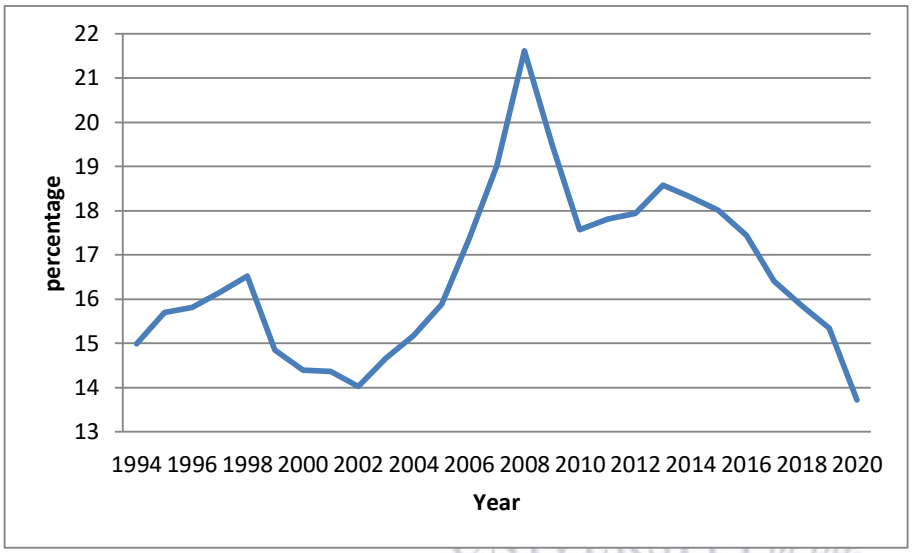
Investment is a crucial component of South Africa's strategy for achieving long-term economic growth (NPC, 2012). According to Kim & Won-Kyu, (2009), investment boosts a country's economic growth and employment. In addition, Eckart (2016) highlighted China's economic growth amongst the highest in the world, and this is owing to the country's investment activities, which are among the largest in the world. According to World Bank (2013), China was able to endure the global economic crisis better than most other countries, through investment stimulation, which contributed to the country's growth and development.

Investment allows for the launch of innovative industries as well as the attraction and advancement of current industries. Progress in some areas is required before the potential of others may be realised. For example, job creation as a result of infrastructure investments that attract new opportunities (Estache & Garsous, 2012).

South Africa's investment climate, on the other hand, has been deteriorating in recent years. Countries were still recovering from the impact of the Asian financial crisis of 1998 in the year 2000. Moreover, investment continued to be inadequate and significantly declined in 2002 (Laubscher, 2013). Nevertheless, investment rapidly increased before 2002. This trend continued until the peak of the global financial crisis in 2008, which further negatively impacted the state of the economy by decreasing commodity prices and rising interest rates (Essers, 2013).

Regardless of the 2008/09 worldwide financial crisis of, South Africa's investment growth grew (NPC, 2012). This surge in investment is backed up by the NDP manifesto, which emphasizes the importance of investment for economic growth and this research paper's importance and relevance. As a result, the NDP's goal was met, as investment climbed from -6.7% to 7.6% in the country's annual growth rate after its inception. In contrast to the gradual growth in investment rates in 2014, investment later decreased in 2015 as a result of load shedding and a dip in company confidence (SARB, 2017).

Figure 2.2: SA Gross Fixed Capital Formation



Source: Author's computations: Adapted from the International Monetary Fund

Global financial constraints primarily influenced the percentage change in investment in South Africa. In the periods 2000, 2002, and 2008 investment was negative, which was worsened by the Great Recession of the time. For an investment to succeed in a country, the global market must be steady. In addition, South Africa's investment-to-GDP ratio decreased drastically during the financial crises and then increased sharply subsequently peaking in 2008 before falling again.

The growth rate in South Africa increased by 1.7% in 2016, this increase in investment over the period 1995-2016 was due to the investment initiatives conducted. Theoretical propositions like Mckinnon (1973) show that when investment increases, so does growth. Mckinnon's hypothesis viewed investment as being key determinant of capital formation for financially repressed developing economies.

As per figure 2.2, South Africa's fixed investment activity has been hampered by difficult economic conditions and increased uncertainty, with -0.9% in 2019 to overall capital expenditure dropping by 17.5% in 2020. Although there were some improvements in the second half of 2020 as lockdown restrictions were eased and sentiment improved to some extent, overall fixed investment spending remained at its lowest in 14 years due to persistently low confidence among private businesses and constrained public sector finances. In 2020 its relative share of overall GDP further fell to 15.8% (IDC, 2021).

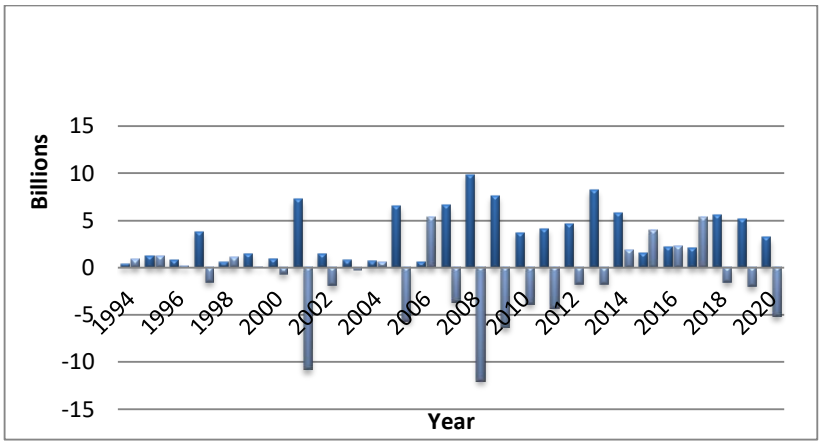
2.4.1. Ratio of investment to GDP

South Africa's investment contribution to GDP has been declining since 2015, which is a clear indication of why investors have lost faith in the country's ability to reform as a result of a combination of economic pressures brought on by downgrade ratings, political instability, and policy uncertainty. Furthermore, foreign investment policy undermines public investment and ignores the possibility of other elements that could boost economic growth (Tawiri, 2010:762).

The essential impacts of investment are visible when examining sectoral composition and institutions. In addition, this clearly shows that government organizations, public businesses, and the private sector invest differently. It is often assumed that the government, rather than the private sector, will spend a major portion of its budget to promote both foreign and public investment (IDC, 2021).

However, according to Mathebula (2019), South Africa's private sector outperforms the government and public corporations in terms of investment. Moreover, when compared to the private sector, the government allocates a significant percentage of its budget on social services and welfare. Government investment slowed as a result of the global financial crisis. Nonetheless, since the global financial crisis, the percentage change in the private sector and government investment has remained positive. Despite the current economic crisis, investment is expanding as indicated by the total percentage change in investment (IDC, 2021).

Figure 2.3: Foreign direct investment (FDI)



Source: Author's computations: Adapted from the International Monetary Fund

According to IDC (2021), when making use of the UNCTAD estimates, foreign direct investment (FDI) flows as depicted in figure 2.3, globally fell to R858 billion in 2020, from R1.5 trillion in 2019, due to the pandemic induced economic slowdown which hindered investment and tightened its grip on global production and trade. FDI into Africa declined by 18% to R38 billion in 2020, the lowest level in more than a decade. According to SA Reserve Bank data, the country saw a 31% drop in FDI inflows to R51.1 billion in 2020, down from R74 billion in 2019. FDI flows into South Africa have averaged 5.9% of total fixed investment expenditure over the last decade. This is a poor performance on a worldwide scale, but it is comparable to other BRICS economies, with the exception of Brazil, which has substantially higher ratios.

2.4.2. Measures to improve investment

Post-1994, the South African government took action to manage the impacts of prior inequalities brought about by the apartheid regime to attract investments and establish a positive repute for the country. Government expenditure grew by 57.7% in the post-apartheid era, resulting in the construction of over 1.6 million new homes and the creation of over two million new jobs (Padayachee & Desai, 2011). In addition, programs targeted toward development and growth, such as the Reconstruction and Development Programme (RDP) and the Growth Employment and Redistribution Strategy (GEAR), have been implemented. Nevertheless, the policies' accomplishments are still contested, leading to the formation of more policies. Most policies in South Africa are aimed at resolving socio-economic issues.

As additional problems occur, South Africa's ability to address socio-economic issues widens.

The South African government has been attempting to refocus on investment-driven growth rather than consumption-driven growth. The latter has been achieved by focusing on the economy that is less energy demanding, boosting tradable industries that have a strong potential for job creation, and investing in cities to alleviate inequality (Department of Treasury, 2015). Above all, the adjustments have aided the NDP's goal of unifying South Africa and reducing inequality and poverty by encouraging citizen participation, enhancing economic growth, and making it more labour absorptive and concentrating on the country's and people's capabilities, such as skills development, infrastructure, social security, and institutional accountability, among other things (NPC, 2012).

Despite the global economic crisis, South Africa's investment-to-GDP ratio increased, reflecting the effectiveness of its investment-improving policies. According to the OECD Economic Survey (2020), the South African government managed to pursue a strongly redistributive policy, approximately 68% of government expenditure is allocated to social objectives such as education, health, social grants, and basic services. In response to the pandemic, the government implemented a 10% GDP relief package. As the number of students enrolling in higher education increases, government spending on higher education is predicted to rise from 1.3% of GDP in 2017/18 to 2.3% in 2021/22.

To increase flexibility, private sector financing, and local government infrastructure expenditure, the government is strengthening local government infrastructure plans and urbanisation projects. The goal is to raise R 20 billion in additional spending at the municipal level each year. In addition, the government intends to establish an infrastructure fund in collaboration with the private sector and development finance institutions. The fund aims to increase the number of blended-finance projects to improve monitoring and boost the pace and efficiency of spending. Over the next three years, the government intends to invest R 526 billion in infrastructure (National Treasury of South Africa, 2019). The infrastructure fund's ability to attract private capital will be determined by a commercially viable strategy. The development of well-structured public and private partnerships could increase infrastructure investments, particularly private capital participation in ports and railways. Increasing public investment from 3.6% to 5% of GDP would increase potential economic growth (OECD Economic Survey, 2020).

The South African Reserve Bank (SARB, 2021) acted rapidly and forcefully, having brought down the repurchase (repo) rate by a cumulative 275 premise focuses since end-January 2020 to supply help to families and trade undertakings. The approach rate is at its lowest in nearly 50 years. The SARB obtained government bonds within the auxiliary advertisement to infuse liquidity into the budgetary framework and guarantee its effective functioning.

The degree to which computerized advances have been quickly grasped, particularly computerized communication advances, amid these uncommon times. A colossal speeding up within the take-up of the advanced insurgency may in this way result as the world develops from the current crisis (Qureshi, 2020).

2.5. Conclusion

South Africa's policy formulation relies heavily on economic growth. The economy of South Africa lacks independence and is susceptible to changes in the global market. However, despite the country's economic difficulties, the investment climate was able to improve. Positive outcomes have been achieved in South Africa with investment as the main goal for attaining inclusive growth, indicating that the country's future prosperity is possible.

This chapter provided an overview of investment-driven economic growth. The economic overview through investment provided a detailed picture of the country's economic performance in the past. Thus, Chapter 4 will describe how to utilize an appropriate model to accomplish the study's empirical goals.

CHAPTER THREE: LITERATURE REVIEW

3.1. Introduction

The literature review in this chapter explored the economic impact of public investment expenditure. The literature review will be used to evaluate the literature of numerous authors. This would help formulate a deeper understanding of the relationship between investment expenditure and future economic growth.

In this chapter, the results from past empirical studies are reviewed, with the following groups of literature being categorized: those that found a significant positive impact on investment spending, studies that did not find a significant impact on investment spending, and studies that examined the causality amongst public investment expenditure and economic growth.

3.2. Definition of key concepts

As discussed in this chapter, section 3.4.1 explains that public investment expenditure accelerates growth and helps the economy develop. Given these theories in section 3.3, this section focuses on creating an understanding of public investment expenditure and defines key concepts.

3.2.1. Public investment expenditure

Public investment expenditure is funded into the economy by the government as it increases capital flow within the economy, generating enough revenue to spend on public resources such as economic and social infrastructure, to generate value in the future (Business Dictionary, 2016). According to Adair et al. (1993), public investment is defined as funding that is anticipated to alter risky government decisions based on redistributive social and security expenditures as well as economic investments.

Investment expenditure is a strategy used to ensure an improvement in the standard of living for individuals in the future and ensure high standards for the future production for firms and economic growth prospects (Mankiw & Taylor, 2008:540).

In addition, the investment in the implementation of technological enhancements plays a major role in the economy. Technological innovation requires capital and the demand for it

affects investment, as funds are necessary (Fourie and Burger, 2015:531). Markusen & Venables (1999) also highlighted how technological enhancements and growth are closely related to investment capability, as investment encourages and stimulates technological advancement.

3.3. Theoretical literature

Public investment expenditure is crucial as it promotes future wealth generation (Romer, 1996). Various theories of public investment expenditure explain the behaviour of the government. All these theories assume the optimisation behaviour of the investor and each theory relates to the structure of public investment expenditure.

Solow model is an exogenous model of economic growth that provides reasoning for future economic growth. It examines economic output as a result of the change in technological enhancements financed by public investment. The model forecasts restricted convergence: along this convergence path, an inferior country develops faster. The Solow model does not forecast complete merging. When saving rates change; higher growth in a country with lower capital stock is not always the case. The model is therefore the basis for a contemporary theory of economic growth (CFI, 2015).

The Crowding out effect model suggests that an increase in public capital drives down private capital. Crowding out, therefore, takes place when the government has high public debt levels. This rate of borrowing can result in a significant rise in the real interest rate, which can result in a decrease in the economy's lending ability and refrains businesses from investing, as such projects are financially funded by firms, they are now incapable of this as the opportunity cost of borrowing increased, causing profitable projects financed by loans (Kenton, 2019).

Alternative procedures of "crowding out" can take place as a result of public spending on infrastructure improvements, which might discourage private initiatives in the same market region, making them unprofitable or undesirable. This often occurs with infrastructure, as public investment projects discourage companies from engaging in similar projects. In contrast, "crowding in" refers to government borrowing and how it increases demand by creating employment, which results in the stimulation of private spending. For example, during the Great Recession, the federal government made large purchases of bonds and other securities, which led to a decrease in the interest rates (Kenton, 2019).

The accelerator model of investment concentrates on output growth as it is the basis of investment decisions and related to the Keynesian approach, which focuses on fixed prices (Baddley, 2002). The model assumes that if output growth changes, then the level of investment in the economy will also be affected. This model also suggests that the correspondence between current output and the level of productivity are the determinants of investment (Clark, 1917; Chenery, 1952). Higher investment expenditure is generated when the output and sales are larger and vice versa. In this model, taxes, interest rates, wages and prices have no autonomous effect on capital expenditure. This theory therefore explains the relationship between capital investment and GDP growth rates (Du Toit & Moolman, 2004:650).

Moreover, Nghifenwa (2009:34) specified that when dealing with the accelerator theory, an increase in output or a decrease in the interest rate could rapidly raise the amount of investment, as firms will alter to obtain the new stock level equilibrium. The model depicts the level of investment and growth, as it is supposed to be the key to future growth prospects. To grow and flourish, any economic emerging market needs an immense amount of capital goods and output (Agénor & Montiel, 1999; Maepa, 2015:19).

Contrasting the foundation of the accelerator theory researchers, Pilat & Lee (2001), highlighted that technological improvement is the main factor in increasing productivity and not consumption. They further argued that the theory fails to account for all other aspects that could increase productivity.

3.4. Empirical literature

Although much research has been conducted internationally, in South Africa there is limited research endeavouring to analyse the role of public investment as a driving factor for future economic growth and how improved effort in public investment could lead to future growth.

Moreover, the importance of public investment in South Africa is poorly understood as a means to sustain higher economic development and growth prospects. This is the reason for this study, to understand how public investment expenditure could influence the country's future economic growth prospects.

Therefore, in this section, the results of the past empirical studies are reviewed, with the following groups of literature being categorized: those that found a significant positive

impact on investment spending, studies that did not find a significant impact on investment spending, and studies that looked at the causality amongst public investment expenditure and economic growth.

3.4.1. Significant impact of investment expenditure

The vector auto-regressive (VAR) technique was used in numerous empirical research studies to scrutinize the relationship between public spending and economic growth. Mittnik and Neumann (2001) used the VAR methodology to evaluate public investment in six industrial countries and found that it has a positive impact on GDP. Furthermore, there was little evidence of crowding out between public and private investment. Similarly, Naqvi (2002) examined the relationship between Pakistan's future economic growth, private investment, and public investment using the VAR approach. The data revealed that public investment has a beneficial impact on private investment and economic growth, encouraging both private and public investment, as predicted by accelerator-based models.

From 1987 to 1997, Yasin (2000) re-evaluated the impact of government spending on economic growth in 26 sub-Saharan African countries (SSA). The author used a model originated from an aggregate production function to serve as the foundation for the analysis. The study's findings demonstrated that government spending has a positive impact on economic growth in SSA, based on the estimation techniques applied when making use of both the fixed-effects and random-effects.

Moreover, Aschauer (2000) and Milbourne et al. (2003) forecasted the economic growth model, in which public investment supplements private investment, and discovered that in developing countries from the period 1975-2000 public capital had a positive influence on future growth prospects in various sectors, with investments in education, communication, and transportation having the greatest effects on future growth prospects.

Perkins (2005) gave a clear and positive analysis of the trends in investing in the development of South Africa's infrastructure concerning its economic growth. This author highlighted the importance of maintenance and the expansion of infrastructure to increase a country's economic activities. Specifically, the author conducted the PPS F-test in this study to analyse the relationship between gross domestic product (GDP) and infrastructure investment. The empirical evidence of the study indicated a strong relationship between GDP and infrastructure investment for future growth prospects in South Africa. Furthermore, the

study found that underinvestment in infrastructure would result in hold-ups, for example, unreliable railways and congestion of ports, and a slowdown in future growth aspects as potential economic growth areas are left unexploited.

Alexiou (2009) Used both the fixed effects model and the random coefficient model to empirically examine the link between economic growth and government spending in the South Eastern European economies from 1995 to 2005. The findings supported the hypothesis that government spending boosts economic growth in the study.

Lundahl & Petersson (2009) evaluated the growth trends in the South African economy since 1994. Investment plays a big role as one of the sources of future growth, as the two variables tend to have a strong correlation. From 1994-1996 economic programmes such as the RDP and GEAR focused on social economic infrastructure (housing, education, water, energy, and communication). These programmes were implemented to create a cautious fiscal and monetary policy to increase investment expenditure. Furthermore, the authors highlighted the effect of the fiscal policy on public expenditure and infrastructure and how it correlated with South Africa's macroeconomic stabilization, using the endogenous growth theory. Empirical evidence showed great progression since 1994 in South Africa's economic growth as infrastructure investment increased by 8% of the country's gross domestic product (GDP).

According to research conducted in Zambia by Muyaba (2016), using the ARDL approach there is a positive association between public spending and economic growth over the short and long term. The Granger causality test showed a one-way relationship between public expenditure and economic growth.

Furceri & Li (2017) also provided a positive empirical indication of the impact of public investment as being one of the key determinants of influencing future growth scenarios in developing economies. These authors used public investment forecast errors to prevent biased estimates and identify better responses of output, to increase public spending by aligning the economic proxies and the econometrician's information sets. The results proved that public investment increases output in developing economies and tends to reduce income inequalities. Empirical evidence displayed that the fiscal multiplier was at an average of 0.2% in the short run. However, other evidence depicted a much larger effect in economies that were more; closed, during periods of slack, in countries where public debt is low, countries

that have higher investment efficiency, and economies operating with fixed exchange rate governments.

In a recent study, Lupu et al. (2018) used data from 1995 to 2015 to examine the effect of disaggregated public expenditure on economic growth in the context of 10 chosen countries in Central and Eastern Europe. The study found public expenditure on health and education to have a significant effect on economic growth when using the ARDL technique.

3.4.2. Insignificant impact of investment expenditure

Ghura (1995) identified a negative association between government expenditure and economic growth using pooled time series and cross section data for 33 Sub-Saharan African countries over the years 1970-1990.

Devarajan et al. (1996) highlighted the fraction of public investment spending in total is insignificantly associated with economic growth and development reported from 43 nations. Previous findings were later proven by Sanchez-Robles (1998) who found no significant relationship between growth and public infrastructure spending in a sample of 76 nations. These authors, Devarajan et al. (1996) and Sanchez-Robles (1998) credit their findings to the fact that poorer countries spend disproportionately large amounts of money on communication and transportation, making them inefficient.

Milbourne et al. (2003) found that in both the steady state and the conversion into the steady state, the enhanced Solow-Swan growth model had an insignificant influence on public investment concerning the productivity level per labourer. The authors discovered that public investment expenditure is favourably connected with future growth prospects making use of the ordinary least squares (OLS) methodologies for the transition model. The associated standard errors were superior when the instrumental variables technique was applied, and the impact of public investment expenditure was statistically uncorrelated.

Schaltegger and Torgler (2006) empirically analysed the relationship between the size of the government and economic growth in Switzerland from 1981 to 2001. The study's conclusion, which was obtained using time-series analysis tools, highlighted a significantly negative relationship between the overall expenditure by the government as well as government expenditure from operating budgets in Switzerland on economic growth.

According to Forte and Magazzino (2011), public expenditure should not be used to increase economic growth. This study made use of panel data methodology for 27 EU member countries and established a negative relationship between economic growth and public spending.

Ndambiri et al. (2012) evaluated a panel of 19 sub-Saharan African countries between 1982 and 2000, to determine the factors that influenced economic growth. Public expenditure was one of the factors the model took into account. According to the study's findings, which were based on the Generalized Method of Moments (GMM), government spending has a negative impact on economic growth.

Altunc and Aydın (2013) used data from 1995 to 2011 to evaluate the correlation between government spending and the economic growth in three countries: Turkey, Romania, and Bulgaria. The study's aim was to determine if the relationship between these two variables is linear or takes the shape of a "inverted U," and to determine the ideal rate of government spending for each countries. Implementing the ARDL bounds test approach, the empirical results of the study exhibited the level of government expenditure to be higher than it should have been, thus resulting in a lower economic growth.

Lupu et al. (2018) studied the relationship between public spending and economic growth in 10 Central and Eastern European countries for the period 1995-2015. Using the ARDL technique, it was concluded that public spending on social welfare, economic affairs, public services, and defence has a negative effect on economic growth within the studied countries.

Moreover, these findings were also supported by Olaoye et al. (2019) who illustrated an insignificant relationship in ECOWAS countries between government spending and economic growth using the Panel VAR model for the period 2002-2014. This supports the neoclassical theory on public expenditure, as the theory highlights investment as a decelerating force of economic growth stating that fiscal policies cannot be used to enhance future growth. This theory believes in free markets to create employment and economic equilibrium, with minimal government intervention as government expenditure is believed to have no effect on future economic growth of a country (Chipaumire et al., 2014).

3.4.3. Causality amongst public investment expenditure and economic growth

Garba & Abdullahi (2013) studies the causal relationship between public spending and economic development in Nigeria from 1970 to 2008, making use of the Granger causality test and the Johansen co-integration approach. According to their research, government spending and economic growth in Nigeria has a positive long-term relationship. The Granger causality test revealed weak significant bidirectional causality at the 10% level, which was attributed to the pursuit of both policies supporting sustainable economic growth and public expenditure at the same time.

Chipaumire et al. (2014) used quarterly data from 1990 to 2010 to examine the validity of the Keynesian macroeconomic framework and the classical perspective of a long-run relationship and causality between government spending and economic growth in South Africa. The results of the Granger causality test revealed that government spending and economic growth have a negative causal relationship. As a result, the study discovered that greater public spending in South Africa has not resulted in real economic improvement, which contradicts the Keynesian position.

Eideh (2015) investigated the causal relationship between public expenditure and economic growth in the Palestinian territories for the period 1994 to 2013 using annual time series data. The Engle-Granger cointegration test was employed to evaluate the long-term relationship between public expenditure and economic growth. The study indicated a long-run relationship between public expenditure and economic growth, also depicting that both factors affect each other.

Moreover, Odhiambo (2015) used data from 1970 to 2013 in South Africa to analyse the causality between public expenditure and economic growth, employing the auto-regressive distribution lag model and the bound test technique to study the relationship between the variables. The Granger causality test results illustrated that economic growth influences public expenditure in the long run, but in the short run these variables cause each other.

3.5. Literature gap

This study aims to determine how public investment affects economic growth. Other studies have previously examined the effects of public investment on economic growth, but they are obsolete, thus this would be a more recent study. Furthermore, this study aims to fill the knowledge gap about the effects of public investment on economic growth in South Africa.

The study would be making improvements on past public investment literature in terms of the treatment of technology. Because technology cannot be directly measured, a deterministic temporal trend in production function requirements has to be used to approximate it. Instead, research and development (R&D) would be used as a proxy for knowledge stocks in this study.

3.6. Conclusion

Public investment spending is viewed as a key instrument for a country's future economic growth. Public investment expenditure was discussed and how it relates to social expenditure (education, hospitals, and infrastructure). The importance of public investment expenditure has been outlined and reviewed. Investment expenditure theories have been outlined and discussed in detail. Definitions of Public investment expenditure have been outlined. The empirical literature, conducted on public investment expenditure and future economic growth, has been outlined. As there is no clear study about the association between investment expenditure and growth prospects in South Africa, this will therefore be outlined in Chapter 6 to conclude whether the observed theoretical indication matches the variables being tested.

CHAPTER FOUR: METHODOLOGY AND DATA

4.1. Introduction

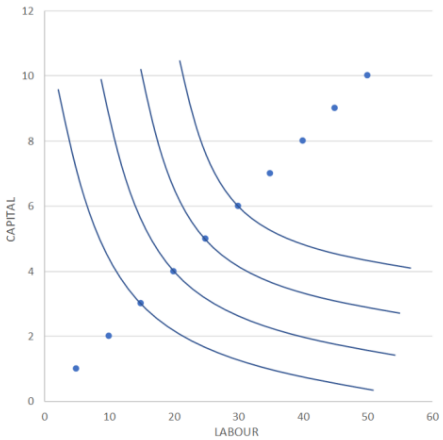
Chapter 4 defines the methodology and data utilised in this study. The data required to perform the empirical portion of the study will be obtained from numerous sources from the period 1994 to analyse the effects of public expenditure on economic growth in South Africa. Econometric techniques such as the unit root, lag order selection, Johansen cointegration, VECM, diagnostic tests, stability tests, and forecast tests will be used.

4.2. Theoretical framework

The empirical approach undertaken aims to examine the association between public investment expenditure and economic growth in South Africa. To this end, the elasticity of output to public investment in a production function framework will be estimated.

The production function method is a simplistic calculated expression for an input-output model that is inspired by a desire to understand how economies grow. It is the base of current growth theory, which seeks to account for economic growth by measuring the relative impacts of aggregate inputs. This model often comprises capital, labour, and technological change (a proxy for knowledge stock). The baseline production function is modified by allowing both private and public capital, to determine whether public investment affects future economic growth (Lewin, 1995: 288-290).

Figure 4.1: Cobb-Douglas production function



Source: Author's computations

The Cobb-Douglas production function is a straightforward production function, with the advantage to interpret the estimated coefficients. The Cobb-Douglas specification significantly simplifies the estimation of output elasticities, conditionally assuming returns to scale. Having high levels of competition within the goods market, output elasticities can be compared to their particular factor shares, which is unfortunately not a reasonable assumption in South Africa. Therefore, each input has a single estimated parameter. Although there are many different perspectives on alternative specifications to the Cobb-Douglas approach of constant factor shares, it's important to be aware of the ramifications of these alternatives. (Krussell et al., 2002).

As a result, it is critical to explain how the methodology works, as well as how the methodology is adapted to be used correctly in the context of this study.

4.2.1. Model specification

The Abdih and Joutz (2006) methodology approach used in this research paper addresses the disapproval of Aschauer's approach and the inadequacies of the incomplete co-integration analysis used in subsequent work. Furthermore, the production function is argued to include technology advancement measures. This paper aim to test and evaluate a Cobb-Douglas measurement for the aggregate production function in logged form:

$$Y_t = \beta_0 + \beta_1 LNA_t + \beta_2 LNKP_t + \beta_3 LNKG_t + \beta_4 LNL_t + \mu_t \quad (4.1)$$

This research paper would be using the Abdih and Jouz specification, which departed from former public capital literature in conducting technological advancement, which is a proxy for knowledge stock. Former literature estimated technological advancement by examining a time trend in the production function, imposing a deterministic economic growth level to the change in technological advancements (Abdih and Joutz, 2006). As an alternative, this research paper analyses past time series of research and development (R&D), retrieved from the World Bank in order to proxy knowledge stocks:

$$Y_t = A_{t-1} + R_t \quad (4.2)$$

This allows technology to be endogenously modelled as part of the equations within the co-integration structure, allowing the estimation impact of knowledge stock on aggregate output in the long run, where R represents the order of endogenous variables and A_t is the knowledge stock available at time by what is left at the end of the previous time period A_{t-1}.

This research paper treats technology similar to the endogenous growth models of Romer (1990), as this model emphasizes knowledge stock as determinant of future economic growth and modelled knowledge endogenously. The Abdih and Jouz specification uses patented applications as a proxy for knowledge stock. However, this is a data limitation as this data is not available in South Africa thereby, empirically modelling the stock as an endogenous variable this research paper would be alternatively using research and development (R&D).

This study would be making use of the Abdih and Joutz (2006) model to analyse the relationship between public investments on economic growth.

$$GDP = f(A, KP, KG, L) \quad (4.3)$$

The transformation of equation (4.3) into a log-linear form is given below by equation (4.4)

$$LNGDP_t = \beta_0 + \beta_1 LNA_t + \beta_2 LNKP_t + \beta_3 LNKG_t + \beta_4 LNL_t + \mu_t \quad (4.4)$$

This study would be employing the VAR model to examine the co-integration analysis between public investment expenditure and economic growth. Pan & Jarret (2012) implies that the VAR model is applied when variables are integrated of the same order. The model is used to detect and avoid issues such as non-stationary heteroscedasticity, autocorrelation and multicollinearity. The VAR technique treats all model variables as potentially endogenous and estimates them separately, allowing for the evaluation of any output-to-public capital stock input.

$$LNGDP_t = \beta_0 + \sum_{i-1}^{n} \propto_1 LNGDP_{t-1} + \sum_{i-2}^{n} \propto_2 LNA_{t-1} + \sum_{i-3}^{n} \propto_3 LNKP_{t-1} + \sum_{i-4}^{n} \propto_4 LNKG_{t-1} + \sum_{i-5}^{n} \propto_5 LNL_{t-1} + \mu_t \quad (4.5)$$

The VAR model above relates to the dependent variable ($LNGDP_t$) to the specified independent variables, where:

- n = is the number of lags
- ($\propto_1$- $\propto_5$) = coefficients
- β_0 = Drift component
- μ_t = Stochastic error terms

The derived equation from the VAR model will be used in equation 4.5 for the Vector error correction model (VECM) equation in this analysis, which is as follows:

$$\Delta LNGDP_t = \beta_0 + \sum_{i-1}^{n} \propto_1 \Delta LNGDP_{t-1} + \sum_{i-2}^{n} \propto_2 \Delta LNA_{t-1} + \sum_{i-3}^{n} \propto_3 \Delta LNKP_{t-1} + \sum_{i-4}^{n} \propto_4 \Delta LNKG_{t-1} + \sum_{i-5}^{n} \propto_5 \Delta LNL_{t-1} + \varphi\mu_{t-1} + \mu_t \quad (4.6)$$

Where:

- Δ = Difference operator
- (φ) = Long-run relationship coefficient
- ($\propto_1$- $\propto_5$) = Short-run dynamic model coefficients
- β_0 = Drift component
- μ_t = White noise error-term
- μ_{t-1} = Error correction term

The variables in the model are defined as they appear below.

General government capital stock (KG): Referred to as public capital is the aggregate body of government owned assets that are used in order to stimulate productivity. Land improvements; plant, machinery, and equipment purchases; and the construction of roads, railways, and other similar structures, such as schools, hospitals, private residential dwellings, commercial, industrial buildings, and telecommunications, are all examples of these assets. This is often defined as government expenditure, in terms of socio and economic infrastructure, grounded on general government investment flows. Logged variables show the change in capital stock available to produce output.

Private capital stock (KP): Private investment covers net capital expenditure by the private sector (including private non-profit agencies) in addition to its fixed domestic assets. Constructed based on private investment flows.

Research and development (A): Research and development (R&D), being a proxy for knowledge stock, are activities centred on the innovation of new products or services in the corporate or government world or the public and private sectors. One of the fundamental goals of R&D is to stay competitive by producing products that improve and elevate the current product range. R&D initiatives have long-term objectives, and these projects may eventually result in patents, trademarks, or breakthrough discoveries that benefit the economy in the long run.

Total employment (L): Full utilization of all available labour and capital resources, in order for the economy to produce at the limits of its potential gross national product. Data limitation, type of labour data employed by original AJ specification is not available for

South Africa over a lengthy period, which is necessary for testing long run relationships in time series. Therefore, this research paper would be using total employment as a substitute.

Real Gross domestic product (GDP): Real GDP is the total gross value added by all resident producers to the economy, plus any applicable product taxes. Subsidies that are not part of the product value are subtracted. The depreciation of fictitious assets and the depletion of natural resources are not taken into account in the calculation. Additionally, real GDP would be a proxy for economic growth estimates.

4.2.2. Data Analysis

4.2.2.1. Unit root test

To establish the VAR relationship (equation 4.5) between variables the unit root test first needs to be conducted. The unit-root tests are employed to evaluate if the variables are stationary or not. If variables are non-stationary the results will lead to spurious regression analysis. Therefore, before estimating the model, unit root tests are essential to determine the order of integration of the variables (Gujarati & Porter, 2010).

To test for unit root, this study will apply the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test (Sheefeni and Nyambe, 2016). Contrary to the alternative hypothesis that there is no unit root, the null hypothesis of the presence of a unit root is tested. The null hypothesis is rejected if the calculated statistic value exceeds the critical statistic value at a given level of significance.

4.2.2.2. Lag selection and Diagnostic tests

When employing the VAR model, having too few lag lengths will cause relevant omission of relevant variable bias. Similarly, selecting too many lag lengths may result in the inclusion of irrelevant variable bias and reduce the test's ability to identify a unit root (Enders, 2004:191). The ideal lag length is established using the lag length criterion. Standard terms will not experience non-normality, autocorrelation, or heteroscedasticity when the proper lag orders are employed (Nkoro & Uko, 2016:82). The VAR model's lag selection is therefore crucial. The analysis will make use of Eviews 12, which provides an automated technique for choosing the necessary lag order, to make sure that the right lag order is chosen.

The diagnostic tests for heteroscedasticity and serial correlation will be used to ensure that the results obtained are reliable and precise. The model fit will be tested using serial correlation, normality, and heteroscedasticity measures. The errors are said to be heteroscedastic if the variation is not constant, according to Brooks (2014:814). Homoscedasticity, on the other hand, occurs when the variance of the errors is constant.

When there is heteroscedasticity in the error terms, the results are unbiased coefficient estimates (Brooks, 2014). The graphical process, park test, Glejser test, Spearman's rank correlation test, GoldfeldQuandt test, Breusch-Pagan-Godfrey test, Koenker-Bassett test, and White's general heteroscedasticity test are all examples of ways to detect heteroscedasticity (Gujarati, 2003). All of these studies, on the other hand, are based on various assumptions. The simplest method, according to Gujarati (2003:415), is to use White general heteroscedasticity.

4.2.2.3. Co-integration test

Johansen's multivariate cointegration test, according to Brooks (2014), necessitates that all variables be stationary at the first difference I (1). The Johansen test is an effective approach for detecting co-integrating vectors. This approach is based on the VAR method, which explicitly estimates and regards all variables in the model as potentially endogenous, allowing for the testing of any potential feedback from output into the public capital stock. Furthermore, it supports many co-integrating relationships. Inference based on a single equation technique for co-integration is erroneous if there are several co-integrating relationships. Furthermore, the Johansen approach can deal with concerns like dynamic interaction of variables, endogeneity, and "causality" (Ericsson & Irons, 1994).

The Trace and Max-Eigenvalue tests will be used to determine co-integration in this study. The Trace statistics test the null hypothesis that there are only r co-integrating vectors against the alternative that there are more than r vectors, whereas the Max-Eigenvalue statistics test the null hypothesis that there are only r co-integrating vectors against the alternative that there are more than r vectors. At the 1% significance level, the null hypothesis of no cointegration (r = 0) is strongly rejected across all test statistics. The asymptotic Trace statistic rejects the null hypothesis that there is only one cointegrating vector when compared to the alternative that there are several vectors. In favour of the alternative of two

cointegrating vectors, the asymptotic Max-Eigenvalue statistic rejects the null hypothesis of just one (Johansen et al., 2000).

4.2.2.4. Generalised impulse response functions

The impulse response function determines how a researched variable responds to a unit change, which can be represented as a shock, and uses the spread of the vector to calculate the results of other variables (Nazifi & Milunovich, 2010). When a unit shock is presented to the error term, the IRF identifies the responsiveness of the system's endogenous variables (Swanson and Granger, 2012).

The GIRF can be equated as follows:

$$GR_{\Delta p}(m, \Theta_i, \Omega_{t-1}) = E(\Delta p_{t+m} |\, u_{it} = \Theta_{it}\Omega_{t-1}) - E(\Delta p_{t+m} |\, \Omega_{t-1}) \quad (4.7)$$

The Ω indicates that the past variables information is transparent up to the lagged period displayed by t – 1, Θ is the association of the form of shock represented by the vector and the size of the shock of the variable by i (Nazifi & Milunovich, 2010).

4.2.2.5. Forecast error variance decomposition

This method is commonly used in social research to disperse inputs among different groups in multivariate model average forecasts. The key is to break down the variation of the dependent variable Y's reaction into components originating from the dependent variables and their errors (Grömping, 2007). Exogenous shocks to other variables in the VAR system can explain how much of the forecast error variance of each of the variables can be described by the forecast error variance decomposition (FEVD) approach.

$$Y_t = \beta_0 + \beta_1\, LNA_t + \beta_2\, LNKP_t + \beta_3\, LNKG_t + \beta_4\, LNL_t + \mu_t \quad (4.8)$$

Y and β are the unknown constant variables, LNA_t to LNL_t denote the independent variables and the error term is depicted by μ_t, which is assumed to be zero and the variance is assumed to be greater than zero (Gromping, 2007).

4.2.2.6. Granger Causality test

To establish whether there is a statistically significant causal relationship between variables, the Granger causality test is used. The model assumes that variables are integrated in the same order, subjected to the Pairwise Granger causality test, the framework is constructed on

the belief that the past and present may cause the future, but not vice versa (Kesavorajah, 2013). Although the Granger causality model is a commonly used tool for determining the direction of a relationship between variables, it is sensitive to model specification and the number of lags (Gujarati, 1995). Non-stationary time series data can lead to erroneous regression. A simple Granger can be implemented if the variables are integrated of order zero I(0), it is therefore necessary to check for stationarity which must be done before doing any econometric test. Hence, if the variables are integrated at order one I(1), the Granger causality test within the VAR model is applicable. The stationarity test will therefore be conducted first.

4.3. Data

This study makes use of quantitative data to analyse the relationship between public expenditure and economic growth in South Africa. Secondary time-series and annual data, which would be converted into quarterly data, on real gross domestic production, general government capital stock, private capital stock, knowledge stock, and total employment were used. Data from the period 1997 to 2018 would be used. The data for general government capital stock and private capital stock will be acquired from the International Monetary Fund (IMF), total employment will be acquired from the UCT data first data portal, and real gross domestic production and knowledge stock will be acquired from the World Bank. To minimize the range between variables and evaluate the relationship between the growth rates of the variables, the variables were thus converted to the natural logarithm.

4.4. Conclusion

Chapter 4 discussed the methodology and data to be employed in this study. The section presented an overview of the Cobb-Douglas Abdih and Jouz specification for the aggregate production function, as well as the knowledge stock measure that this study intends to utilise. The chapter analysed the VAR/VEC model, which is an appropriate starting point for the cointegration analysis. The following chapter will make use of the mentioned models to establish the relationship between variables.

CHAPTER FIVE: DATA ANALYSIS AND FINDINGS

5.1. Introduction

This chapter presents the empirical outcomes of the study that has been defined in the previous chapter. The chapter explores the methodological approach to econometric modelling that was undertaken to critically analyse the data-specific variables. Chapter 5 will be structured as follows: section 5.2 presents the empirical results, whereas section 5.2.1 depicts the descriptive statistics of the data employed in the study. Section 5.2.2 methodically arranges the unit root analysis, thus presenting the variable's order of integration. Section 5.2.3 interprets the results of both the diagnostic and stability tests that were conducted for econometric modelling. Section 5.2.4 determines the optimal lag length. Section 5.2.5 evaluates the VAR Johansen cointegration test. Thereafter, section 5.2.6 constructs the vector error correction model (VECM). Section 5.2.7 makes use of the Granger causality test to concisely present the outcomes to determine the direction of causation. Lastly, section 5.2.8 illustrates the results of the Impulse Response and Variance Decomposition.

5.2. Empirical Results

5.2.1. Descriptive Statistic Analysis

Table 5.1 depicts the descriptive statistics used in this study. These statistics summarise the data of the variables to provide a statistical interpretation of crucial attributes that is pertinent to the variables in the study. Examining the descriptive statistics of the given variables before estimating the economic regressions is a crucial stage in data analysis as this process promotes a better understanding of the normality test and the degree of distribution of the data.

Table 5.1: Descriptive Statistics

	LNGDP	**LNKG**	**LNKP**	**LNL**	**LNA**
Mean	7.623	7.122	8.176	17.128	6.361
Median	7.714	7.147	8.202	17.116	7.592
Maximum	8.492	7.870	9.120	17.277	8.262

Minimum	6.571	6.372	6.199	17.025	6.033
Std. Dev.	0.593	0.459	0.600	0.068	0.647
Skewness	-0.220	0.034	0.013	0.720	-0.445
Kurtosis	1.753	1.686	1.642	2.675	2.007
Observations	85	85	85	85	85

Source: Author's computations

Table 5.1 illustrates the effects of public investment on economic growth in South Africa. The table above clearly depicts no analytical deviations within the economic variables investigated. The LNA mean at 6.361 is the lowest of the variables and LNL has the highest mean at 17.128. The standard deviations fall within the proximity of zero which is an indication that the variables exhibit a minimum variance from their initial means, with LNA indicating the most variation and LNL indicating the least. Overall, the statistical outcome above exhibits a prominent degree of stability. Skewness estimates for LNKG, LNKP, and LNL are positive which indicates that the variable distribution is skewed to the right, whereas the estimates for LNGDP and LNA are negatively skewed to the left. The estimates for skewness and kurtosis for the variables indicate that the distribution is skewed to the right.

5.2.2. Unit Root Analysis

Table 5.2 indicates the unit root analysis of the variables that were examined. The unit root analysis was conducted using the Augmented Dickey-Fuller test and the Phillips-Perron test. Testing for unit root is essential to determine the stationarity of the variables to prevent running spurious (nonsensical) regressions.

Table 5.2: Unit Root Tests: ADF & PP in levels and first difference

Variable	Model Specification	ADF	PP	ADF	PP	Order of Integration
		Levels	Levels	First Difference	First Difference	
LNDGP	Intercept	-2.323	-4.535 ***	-1.504	-2.321 ***	I(0)
	Intercept and Trend	1.358	1.835	-2.697	-3.550 **	I(1)
LNA	Intercept	-1.722	-1.940	-8.676 ***	-8.676 ***	I(1)
	Intercept and Trend	-0.371	-0.626	-9.160 ***	-9.123 ***	I(1)
LNKP	Intercept	-0.687	-0.410	-2.580	-2.675 ***	I(1)
	Intercept and Trend	-2.592	-1.672	-2.594	-2.686	I(1)
LNKG	Intercept	-0.344	-0.175	-2.989 ***	-3.216 ***	I(1)
	Intercept and Trend	-3.374 ***	-2.145	-2.973	-3.201 ***	I(0)
LNL	Intercept	0.137	0.158	-2.570	-2.744 ***	I(1)
	Intercept and Trend	-2.087	-0.997	-2.660	-2.833	I(1)

*Note: *, **, *** indicates the rejection of the null hypothesis at 1%, 5% and 10% .*

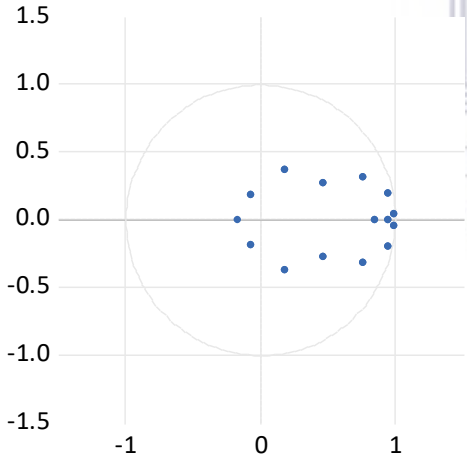
Table 5.2 above illustrates the order of integration of the economic variables differing between I(0) and I(1). GDP and KG are the only variables that present a mixed order of integration when the model specification is intercept and intercept and trend; all other variables are all integrated of order one, I(1). Since all the variables reflect the order of integration of order one, the data to be estimated enables this study to employ the VAR model.

5.2.3. Stability and diagnostic test

One of the crucial steps in the conformity with the conventional practice of VAR model specification, the model was exposed to stability and diagnostic testing to determine its robustness for forecasting purposes and policy measures. The Jarque-Bera test of normality was undergone to test for the normality of the distribution; the results established the model to be normally distributed. The Serial Correlation test was conducted in order to determine whether there was any autocorrelation between the variables. The results established that the model does not suffer from serial correlation in the long-run. Furthermore, the Breusch-Pagan-Godfrey test was undertaken to test for the presence of heteroscedasticity; the results depicted that the model does not suffer from heteroscedasticity. These results can be found under Appendix A.

5.2.3.1. VAR stability condition

Figure 5.1: VAR stability test



Source: Author's computations

Figure 5.1 above illustrates the roots of the characteristic polynomial, and the model was shown to satisfy the stability properties of a stable VAR model. The inverse of the AR characteristic polynomial confirms that the polynomial falls within the unit circle, indicating that it is stable.

5.2.4. Determination of optimal lag length

Table 5.3: Optimal lag length

LAG	LogL	LR	FPE	AIC	SC	HQ
0	668.495	N/A	5.28e-14	-16.383	-16.235	-16.323
1	1800.233	2095.812	7.17e-26	-43.709	-42.823	-43.354
2	1946.625	**253.023***	**3.60e-27***	**-46.707***	**-45.081***	**-46.054***
3	1955.050	13.522	5.52e-27	-46.298	-43.933	-45.349
4	1971.481	24.323	7.06e-27	-46.086	-42.982	-44.841

Source: Author's computations

The LR, FPE, AIC, SC, and HQ recommended the optimal lag length of two lags as depicted in table 5.3 above. Nevertheless, the use of the suggested lag was not chosen, in order to not have too few lags and prevent the regression from suffering from non-normality, autocorrelation, or heteroscedasticity. Consequently, the study made use of the lag length of three as it gave appropriate results as well as passed the stability tests.

5.2.5. Testing for cointegration

To establish whether the variables of interest are cointegrated, the following step is to test for cointegration. Cointegration is a process for achieving stationarity by combining two or more non-stationary time series of separate variables into a linear combination. Time series cointegration demonstrates an equilibrium or long-term relationship between variables (Gujarati, 2010).

Table 5.4: Johansen cointegration test

Maximum Eigen Test				Trace Test			
H0: rank=r	**H1: rank=r**	**Statistics**	**95% critical value**	**H0: rank=r**	**H1: rank=r**	**Statistics**	**95% critical value**
r=0	**r=0**	38.913	33.877	**r=0**	**r=0**	97.776	69.819
r<=1	**r<=1**	27.614	27.584	**r<=1**	**r<=1**	58.864	47.856
r<=2	**r<=2**	22.090	21.132	**r<=2**	**r<=2**	31.250	29.797

Source: Author's computations

The Johansen cointegration results in Table 5.4 illustrating that there is no cointegrating equation is rejected, given that the p-values for trace statistic and max-eigenvalue are less than the 5% level of significance. Hence, the null hypothesis that there are three cointegrating

equations is not rejected, inferring that there exists a long-run relationship between the indicated variables in the model.

5.2.6. The Vector error correction model

The VECM test was constructed to evaluate the short run relationship between variables, by determining the level of speed adjustment. The long-run equation estimated is presented below:

$$GDP_{t-1} = 1.00 - 1.07LNA_{t-1} - 0.50LNKP_{t-1} + 0.79\ LNKG_{t-1} + 2.43LNL_{t-1} - 42.79 \quad (5.1)$$

In the normalization process, the signs are reversed to enable proper interpretation. Equation 5.1 above shows that all variables are statistically significant according to the critical t-values. Long-run results show that a 1% increase in the level of research and development decreases the economic growth rate by 1.07% in the long run. A 1% increase in the level of private capital stock decreases the economic growth rate in the long run by 0.50%. In contrast, a 1% increase in government capital stock growth results in a 0.79% increase in long-term economic growth. Moreover, A 1% increase in the level of total employment increases economic growth by 2.43% in the long-run.

These numbers are approximately consistent with prior research. Griliches (1988) highlighted that R&D played an insignificant role in productivity as it declined. The relatively large estimation of the percent contribution of private investment to the slow growth is consistent with Bailey (1981) who debated that the flow of private capital has significantly decreased during the period and that the decline may be able to account for a significant portion of the slow productivity growth. The results of government expenditure are consistent with the results of Sedrakyan and Verela-Candamio (2017) who determined that government expenditure has a strong impact on economic growth, given the fact that government expenditure can promote economic growth and economic growth can promote government expenditure in return. In addition, this is in line with the Keynesian view, as an increase in government spending is anticipated to have a positive impact on the country's output through the multiplier effect. The result for labour is due to the fact that wages increased significantly, as more people become educated and experienced post-apartheid, allowing more individuals to gain skills and knowledge which helped increase productivity within the economy leading to strong growth.

Table 5.5: VECM

	D(LNGDP)	D(LNKP)	D(LNKG)	D(LNL)	D(LNA)	C
CointEq1	-0.270 (0.009) [-2.951]	-0.018 (0.012) [-1.537]	-0.029 (0.009) [-1.189]	0.010 (0.004) [2.342]	-0.031 (0.009) [-0.404]	0.0147 (0.004) [3.731]
R-squared	0.782					
Adj. R- squared	0.747					
F-Statistic	22.790					

Source: Author's computation
() Standard Error and [] t-statistic

The cointegrating vector in table 5.5 is obtained from the Johansen Maximum-likelihood Estimate. The short-run vector error correction model's findings, associated with the long-run relationship, which is interpreted as the rate of adjustment to the long-run equilibrium, demonstrates the significance of the GDP coefficients.

The coefficient of the error correction term is negative and substantial, which represents a long-run association. The error correction term is expected to be statistically significant with a negative connotation, implying that any short-term shock will be altered in the long run.

GDP's adjustment coefficient is moderately rapid, with a 2.69% speed of convergence to equilibrium in the equation. The error correction coefficients of GDP, KP, KG, and A, are all significant. Changes to the variables KP, KG, and A will have a considerable force on the model to bring it back to equilibrium whenever it moves too far. However, the error correction coefficient for L is insignificant indicating that there is not a long-run relationship between labour and economic growth; this illustrates a disturbance in the system.

5.2.7. Granger Causality test

To determine whether one variable is helpful in forecasting another, the Granger causality test is used (Granger, 1969). The pairwise Granger causality results in Table 5.6 below illustrate that LNKG Granger causes LNGDP and LNGDP Granger causes LNKG. As a result, the null hypothesis that there is causal relationship between the variables is rejected. Moreover, there is a unidirectional relationship between LNKP and LNGDP, this means that LNKP does not Granger cause LNGDP but LNGDP Granger causes LNKP. In addition, there

is an independent relationship between LNL and LNGDP. This means that LNL does not Granger cause LNGDP and LNGDP does not Granger cause LNL. There is also an independent relationship between LNA and LNGDP. This means that LNA does not Granger cause LNGDP and LNGDP does not Granger cause LNA.

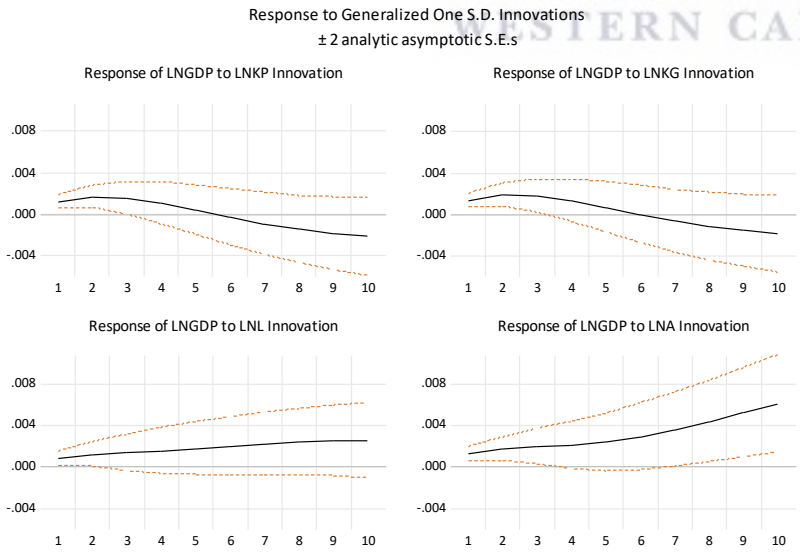
Table 5.6: Granger Causality

Null Hypothesis	*Obs*	*F-statistics*	*Prob.*
LNKP does not Granger Cause LNGDP LNGDP does not Granger Cause LNKP	*99*	*3.089* *4.063*	*0.050* *0.020*
LNKG does not Granger Cause LNGDP LNGDP does not Granger Cause LNKG	*99*	*3.849* *3.301*	*0.025* *0.041*
LNL does not Granger Cause LNGDP LNGDP does not Granger Cause LNL	*99*	*1.017* *1.539*	*0.365* *0.220*
LNA does not Granger Cause LNGDP LNGDP does not Granger Cause LNA	*83*	*3.366* *2.935*	*0.261* *0.340*

Source: Author's computations

5.2.8. Impulse Response and Variance Decomposition

Figure 5.2: Results of the impulse response function



Source: Author's computations

The impulse response function illustrates the response of economic growth to the independent variables over a period of 10 months. Figure 5.2 depicts the responses of economic growth to labour and Research and development throughout the 10 quarters are positive as it raises, the response of LNGDP to LNL increases where it hits a steady state value remaining in the positive region. The response of LNGDP is a positive and stagnant response to the shock of LNA as it increases in period 4 with strong increasing tendencies remaining in the positive region throughout the forecast. Hence, the response of economic growth towards the increase in labour and R&D is positive and permanent as it continues to increase towards the end.

Moreover, the response of LNGDP to LNKG is negative as it sharply declines while remaining in the negative region. The response of LNGDP is not initially noticeable until period 3 when it gradually decreases to the shock in LNKP. As depicted in figure 5.2 economic growth responds positively to public and private spending, and then after the third quarter economic growth responds negatively to public and private spending as it sharply declines. Economic growth appears to have found a new level of equilibrium as it continues to have a negative response to public and private spending.

The variance decomposition specifies evidence of how each variable in the auto-regression adds to the other variables. It specifies how much of each variable's forecast error variance can be described by external shocks to the other variable. In table 5.7 the results of the variance decomposition are depicted over the period of 10 quarters.

Table 5.7: Variance decomposition of economic growth

Variance Decomposition of LNGDP:						
Period	***S.E***	***LNGDP***	***LNKP***	***LNKG***	***LNL***	***LNA***
1	*0.0032*	*100.0000*	*0.0000*	*0.00000*	*0.0000*	*0.0000*
2	*0.0064*	*99.3979*	*0.0005*	*0.4144*	*0.1712*	*0.01594*
3	*0.0093*	*98.1441*	*0.0322*	*1 2668*	*0.5458*	*0.0111*
4	*0.0120*	*96.5114*	*0.1912*	*2.2139*	*1.0634*	*0.0120*
5	*0.0143*	*94.6783*	*0.5163*	*3.0594*	*1.6218*	*0.1243*
6	*0.0165*	*92.5929*	*1.0035*	*3.7476*	*2.1326*	*0.5234*
7	*0.0185*	*90.0732*	*1.6282*	*4.2950*	*2.5474*	*1.4562*

8	*0.0206*	*86.9566*	*2.3541*	*4.7356*	*2.8487*	*3.1049*
9	*0.0226*	*83.1736*	*3.1391*	*5.0976*	*3.0380*	*5.5518*
10	*0.0248*	*78.7574*	*3.9408*	*5.3983*	*3.1272*	*8.7764*

Source: Author's computations

The variance decomposition evaluates the movements in the shocks of itself and another variable. Table 5.7 highlights that in the third quarter, the variance contribution of economic growth was 98.14% of its own shocks, whereas, in the long run, the last quarter's economic growth accounted for 78.76% of its own shocks showing lower results than in the short run. The variance contribution rate of government capital stock, private capital stock, total employment, and research and development to economic growth in the short term is 1.27%, 0.03%, 0.55%, and 0.01% respectively. In the short run, the variance contribution of government capital stock is the highest followed by total employment. This suggests that the shocks in government capital stock in the short run to economic growth are greater relative to the other components. However, over a period of 10 quarters, research and development has a greater effect on economic growth as its variance contribution rate is the highest at 8.78%. Total employment has the lowest effect on economic growth in the long-run than in the short-run; with shocks to economic growth at 3.13%.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

This chapter concludes the findings deduced in chapter four and outlines the recommendations and limitations of the study. Section 6.2 prepares the synopsis and conclusions of the research paper. Finally, section 6.3 provides policy recommendations followed by the limitations posed by the study.

6.2. Summary and conclusions

The level of government capital stock in South Africa indicates the ability to increase future economic growth. Herewith, the study indicates that government capital stock presents as one of the most crucial economic growth indicators. This is an indication that high levels of government capital stock could result in the increase of economic growth.

The study intended to analyse the effects of public expenditure on economic growth in South Africa. Subsequently, this study attempted to provide insight into the influence of public expenditure on economic growth in the country, employing quarterly secondary time series data and techniques of analysis including unit root tests, VAR test to co-integration, and the VECM.

The variables of interest used in the study included GDP, KP, KG, L, and A. The Johansen Cointegration test established the variables to have a long-run association. The VECM analysis indicated a significant long-run relationship between the variables KG and L to GDP. The error correction term indicated that the economy may reach full equilibrium restating the significant long run association. Moreover, the short run VECM analysis indicated evidence of a positive short run association between the variables KG, KP, and A to GDP. Findings indicated that public expenditure has a positive effect on economic growth in the short run.

The Granger causality test depicted a unidirectional relationship between LNKP and LNGD, as LNGDP Granger causes LNKP. A dependent relationship was illustrated between LNGDP and LNKG, indicating that there is no causal relationship between the variables. LNL and LNGDP, as well as LNA and LNGDP, indicated an independent relationship between the variables.

In addition, to establish the response of economic growth to the variable shocks. The impulse response functions indicated an overall negative response between GDP and KG, as well as GDP and KP. Therefore, suggesting that an increase in public spending and private spending prevents economic growth. In contrast, the impulse responses indicated a positive association between GDP and L. The nature of the relationship indicates that L is efficient to support economic growth. Moreover, the impulse response also indicated a positive association between GDP and A, suggesting that research and development encourage technological growth and stimulate economic growth.

The study concluded a significant long-run relationship between the variables and a unidirectional relationship of causality running from public investment to economic growth. Therefore, the study empirically suggests that public spending is a key driver of economic growth.

6.3. Recommendations and limitations

The implementation of trade facilitation, investment, improved transport infrastructure, and access to finance policies is necessary for economic growth. Expansion in expenditure should be avoided, as it leads to huge debt accumulation in the economy. Due to its immediate inflationary impact, government spending should not be used as a policy stabilizing instrument.

South African should implement policies that will support and foster long-term economic growth without jeopardizing the consumption of the future generation. As a result, the long-term advantages are sustainable and just what South Africa requires. The world is shifting to a more service-oriented industrial model, and technology is undeniably taking control. It is critical that South Africa invests more in the use of technology. This will enhance productivity, resulting in increased growth and jobs.

South Africa's biggest concern is that it is lagging, thus it is always attempting to catch up with global market innovation. This reduces productivity and results in slower growth. From this research, it is possible to conclude that capital, technology, and skills are essential factors in predicting and explaining economic growth.

The market economy is extremely competitive, and it is always evolving as new technology is introduced. South Africa will benefit from high growth rates and lower unemployment rates if it invests in the usage of cutting-edge technology.

South Africa's high rate of unskilled labour compared to skilled labour is unfortunate. This is the primary cause of the high unemployment rate, as the labour market is unable to utilise the current available labour due to a shortage of skills. If research and development became a priority, South Africa would be able to provide training and internships to people in less fortunate communities. The implementation of government programmes would allow these communities to benefit from the opportunities and skills that these programmes could offer. Government consumption should therefore be well coordinated in various sectors especially during a financial crisis.

6.3.1. Limitations

As a result of a limitation of literature in the South African context, among other constraints, the limitation of data and time impeded the influence of public expenditure on economic growth within the study.

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APPENDIX A

Figure A.1: Jarque-Bera Normality Test

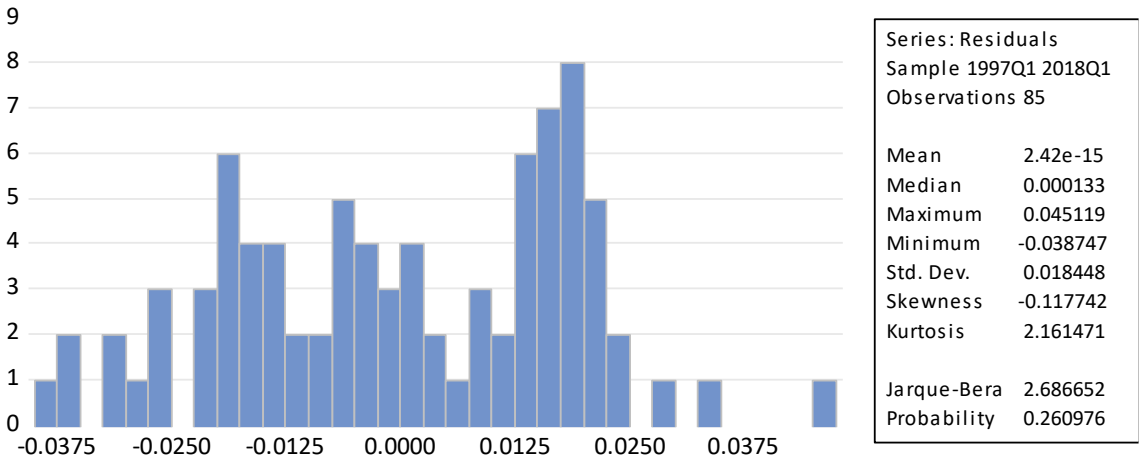

Table A.1: Serial Correlation LM Test

Null hypothesis: No serial correlation						
lag	LRE*stat	df	Prob	Rao F-stat	df	Prob
1	23.961	25	0.523	0.960	(25,213.2)	0.523
2	21.485	25	0.665	0.856	(25,213.2)	0.666
3	9.168	25	0.998	0.355	(25,213.2)	0.998

Table A.2: Heteroscedasticity Test

F-statistic	3.994	Prob. F(4,80)	0.005
Obs*R-squared	14.148	Prob. Chi-Square(4)	0.007
Scaled explained SS	7.278	Prob Chi-Square(4)	0.122