AN ANALYSIS OF THE RELATIONSHIP BETWEEN EXPORTS AND ECONOMIC GROWTH IN SOUTH AFRICA, 2000-2020

BY

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ABSTRACT

Since 1994, the South African government has prioritised rapid economic growth. Despite theorists' contradicting views, the country considered the global market as one of the gateways to accelerated economic growth. In the early 1990s, South Africa opened to foreign markets by removing trade barriers. However, the results of such actions were not entirely what was expected. This study analysed the relationship between exports and economic growth in South Africa from the year 2000 to 2020.

The study aimed to investigate how exports affect the overall growth of the economy in South Africa. Quarterly time series data from StatsSA and the South African Reserve Bank covering the period 2000 to 2021 was used in the study's empirical analysis and tests. The study utilized numerous econometric approaches and or tests such as; the unit root test, Johansen's cointegration procedure, the Vector Error Correction Model (VECM), as well as Granger causality model to gain a clear perception of the relationship between exports and the rate of South Africa's economic growth.

The Johansen cointegration test was conducted to examine the contribution of exports to economic growth in South Africa. The test confirmed the presence of a long-term equilibrium relationship between the dataset. The results of the unit root test indicated that both variables became stationary at the first difference, as evidenced by passing both the ADF and PP tests. The correlation between exports and the growth of the economy is positive in the short term and long term. The outcomes of the Granger causality tests indicated that GDP Granger causes exports, signifying that economic growth in South Africa has an effect on exports. Additionally, the VECM outcomes demonstrated that there exists both a short-term and long-term relationship between economic growth and exports in South Africa.

The research suggests, among other things, that the government should develop policies to promote increased exports from South Africa, as this will lead to the creation of more jobs in the long run.

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DECLARATION

I, Ramakgasha Molobe Joyce, declare that this dissertation hereby submitted to the University of Limpopo for the degree Master of Agricultural Management (Agricultural Economics) has not been previously submitted by me for a degree at this or any other University, that it is my work in conception and execution, and that all the sources herein have duly acknowledged.

…….. ……

Signature Date

DEDICATION

I would like to dedicate my work to my late great grandmother, Johanna Mogale, my grandmother, Modjadji Joyce Ramakgasha, and my mother, Maite Ramakgasha. It is unfortunate that you are all no longer here to see my achievements and the young woman I have become. You somehow motivate me to do better in life and to never give up until I reach my goals.

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LIST OF ACRONYMS

ADF: Augmented Dickey-Fuller

DAFF: Department of Agriculture, Forestry and Fisheries

DRI: Department of research and Information

ECT: Error Correction Term

ELG: Export-led Growth

ELGH: Export-Led Growth Hypothesis

EU: European Union

FAO: Food and Agriculture Organization

FTA: Free Trade Areas

GDEH: Growth-Driven Export Hypothesis

GDP: Gross Domestic Product

GLE: Growth-Led export

IDC: Industrial Development Corporation

IFR: Impulse Response Function

LDC: Less Developing Countries

NDP: National Development Plan

NGP: New Growth Path

NIPF: National Industry Policy Framework

OLS: Ordinary Least Square

PP: Philips Peron

REER: Real Effective Exchange Rate

RC: Real Consumption

RG: Real Government Expenditure

RGDP: Real Gross Domestic Product

RI: Real Investment

RM: Real Imports

RX: Real Exports

RSA: Republic of South Africa

SADC: Southern Africa Development Corporation

SARB: South African Reserve Bank

Stats: Statistics South Africa

UN: United Nations

US: United States

VAR: Vector Auto-Regression

VECM: Vector Error Correction Model

WDI: World Development Indictors

CHAPTER 1:

INTRODUCTION

1.1. Background of the study

Most economists describe economic growth as the rise in the number of goods and services manufactured by a nation in the course of its progress duration (Broughel and Thierer, 2019). Some countries are very rich while others are very poor. The economic sizes of different countries across the world vary greatly, with some countries being very rich while others are very poor. While some countries experience rapid economic growth, others either grow slowly or not at all (Soylu, 2017). Numerous studies have been carried out globally to investigate whether a nation should concentrate on boosting exports to drive economic growth or prioritize local trade to promote export expansion (Mehrara & Firouzjaee, 2011).

Economic welfare is significantly impacted by economic growth, making it one of the most critical determinants. The link between economic growth and exports is a common subject of discussion, as evidenced by economists' efforts to explain the variations in economic growth levels among different countries. Exports of goods and services are a significant source of foreign exchange income, which helps to alleviate the burden on the balance of payments and generate job opportunities (Shihab *et al.,* 2014).

In recent years, export performance has played a crucial role in the economic advancement of many developing nations. It has led to accelerated growth and a reduction in poverty levels (Tibebu (2018). Exporting goods has yielded economic advantages stemming from efficiency gains linked to leveraging comparative advantages and the better allocation of limited resources (Arsawan *et al.,* 2022). Furthermore, there are dynamic gains in the export industry propelled by amplified competition, increased economies of scale, improved utilization of capacity, knowledge and know-how dissemination, and technological advancements (Shafarddin (2011).

Whenever economists attempt to describe the varying degrees of economic growth across different nations, they often examine the link among exports and economic growth, which is a frequently discussed subject (Yanikkaya (2003). The reason exports are viewed as a driving force for economic and social development is that they have the potential to increase technological innovation, meet foreign demand, and generate more foreign exchange inflows (Ramos, 2001). Exports are considered to be a driver of economic and social development because they have the potential to reduce poverty and influence economic growth (Bakari & Mabrouki, 2016).

The argument concerning the role of exports as one of the main deterministic factors of economic growth is not new. It goes back to the classical economic theories of Smith and Ricardo, who argued that international trade plays an important role in economic growth. The neoclassical approach emphasises the importance of competitive advantages in international trade (Shihab, *et al*., 2014). Each country maximises its welfare by engaging in activities that are the most efficient in terms of the scarcity of resources and production factors in the economy. In this case, the benefits of trade are static and trade liberation and openness cannot lead to an increase in the long-run growth rate, but they influence income level (Fosu, 1990).

Economic growth is the primary goal of policymakers across the world. Strategies such as export-led growth have varied across and within countries over time to achieve the objective (Tibebu, 2018). Researchers and policymakers have shown a great interest in the possible relationship between exports and economic growth in a country. The main question is whether or not a country should promote exports to keep up economic growth, which in turn generates exports remains. There are propositions, according to the export-led growth hypothesis, that export activity leads to economic growth. Trade theory provides several plausible clarifications in favour of this idea. Besides others, the positive impact of an outward-oriented trade policy on technological change, labour productivity, capital efficiency and, eventually, production, can be mentioned (Habanabakize, 2020).

However, the growth-driven exports hypothesis postulates a reverse relationship. It is based on the idea that economic growth induces trade flows. It can create comparative advantages in certain areas leading to specialisation and facilitating exports (Sawaneh, 2019). These two approaches certainly do not exclude each other;

therefore, the third notion is a feedback relationship between exports and economic growth. There is a potential for simple contemporaneous relationship between these two variables (Razmi and Hernandez, 2011).

Prior to South Africa's transition to a democratic government, the country encountered a range of challenges, including harsh trade barriers, financial sanctions, and inner political encounters (Du Plessis, 2006). These barriers were underpinned by a trade policy that prioritized domestic interests, as highlighted (Thurlow, 2006). However, after the transition to democracy, there was a major shift in national fiscal and monetary policies (Thirlwall, 2011). For instance, in 1990, African governments started adopting trade liberalization policies and even endorsed the General Agreement on Tariffs and Trade's Uruguay Round (Ramos & Chitiga, 2007).

There was widespread anticipation that lifting these restrictions would improve South Africa's economic behaviour (Thurlow (2006). South Africa opened its trade with other nations, with the probability that promoting trade with other countries would boost economic growth in the year 1996 (Du Plessis, 2006). Aside from those steps, South Africa had implemented two Free Trade Areas (FTAs), with the initial one being the South African FTA, which was ratified in 199 but was not enforced until 2000. Another FTA is the Southern African Development Corporation (SADC), consisting of fourteen (14) African countries, which was established in 1996 and came into effect the same year.

With the domestic drivers of growth currently under strain, the South African economy will most likely have to rely on exports for a positive performance. Consumer and business confidence are at low levels, thus providing little hope (IDC, 2017). In 2020, exports of goods and services claimed a 30.5% share of GDP, illustrating the importance of external markets for the economy at large and sectors in particular. As an increasing portion of economic activity has been derived from global demand, so has the demand for labour. The importance of exports and their role in employment creation can be derived through direct as well as indirect exports (Ajmi *et al.,* 2015)

The South African economy expansion in the first quarter of 2021 was a surprise on the upside. The GDP increased by 1.1% in real terms compared to the fourth quarter of 2020. Relative to the first quarter of 2020, however, the real GDP was 3.2% lower. Exports-oriented businesses across a wide range of segments of the broad agriculture

and manufacturing sectors are generating higher revenues as trading conditions improve in their respective global markets (DRI, 2021).

Although exports of goods and services declined marginally (-0.9%) in the first quarter of 2021, the outlook for exports looks solid considering a stronger than anticipated global economic recovery and generally favourable conditions in commodity markets. Exports not only make a considerable contribution to the national GDP, but also sustain a substantial portion of overall employment in the South African economy. It is estimated that over 2,6 million jobs or 22.1% of all sector employment in 2020 may be directly and/or indirectly associated with exports (DRI, 2021).

1.2. Problem statement

South Africa has suffered severe trade liberalisation and subsequently adopted an outward-bound trade orientation since democratic development. Supporting the enormous trade liberalisation of the 1990s was undergirded by the understanding that exports and trade openness enhance economic growth. The adoption of the National Industry Policy Framework (NIPF) was highlighted to support an explicit export-oriented policy framework (Thirlwall, 2011).

South African exports needed to be more distinctive to export uncertainty. In response to that, the government came up with measures to protect, support and promote small exporting businesses to continue to be competitive in the international markets, mostly in the form of export subsidies. South African exports and economic growth grew tremendously due to the government's trade liberalisation and export-boosting framework. Between 1970 and 1990, growth in exports and GDP was approximately 24 and 62%, respectively, which increased 10 years later by 89 and 69%, respectively (Cipamba, 2013).

Economic policy has constantly played a significant role in export production in the total growth process in South Africa (Feddersen, *et al*., 2017). The question of what this purpose is and how exports can promote economic growth in the country remains unresolved. Understanding how exports are linked to other macroeconomic variables like economic growth can help answer the question of whether export-led growth is a viable option in South Africa and whether increased exports can make a notable

contribution to meeting the National Development Plan (NGP) and New Growth Path (NDP) and employment targets (Hussain, 2006).

As a result, there is a gap in research in terms of determining the economic linkages that underlie the growth process of developing economies, with a particular focus on South Africa's specific situations and assessing whether greater exports in South Africa can be linked directly to productivity growth and technological advancement. This study, therefore, attempts, to analyse the role played by exports in the overall economic growth in South Africa for the period 2000 to 2020.

1.3. Rationale of the study

Economic growth has always been a key concern and an important aim for underdeveloped and developing countries and economists (Matezo, *et al*., 2021). South African policy has always achieved faster economic growth as its main focus. Significant focus has been placed on trade policy and regulation during the last vicennial (Andrei, *et al*., 2020). Although food security remains a major development task in the country, the relationship between exports and economic growth may provide policymakers with enough information about trade policy to promote exports (Chang, *et al*., 2013). Presently, most developing countries rely on exports for foreign exchange to improve their economic status. Exports remain the main supplier of foreign currency, regardless of these countries' access to foreign currency, which is in the form of private loans and foreign aid (FAO, 2000).

Countries such as South Africa, focus their economic policies on increasing exports, in line with trade between countries advancing exports. This is because exports are perceived as an engine for economic growth (Ukama, 2012). Over the past vicennial, great focus has been put on trade policy and regulation to bring about rapid economic growth. Thus, understanding the relationship between exports and economic growth helps in designing better management and public policies. Increased exports from South Africa result in expanded markets, internal and external economies, increased export earnings, and increased employment levels (Soylu, 2017).

1.4. Scope of the study

1.4.1. Aim

The study aims to analyse the role played by exports in the overall economic growth in South Africa for the period 2000 to 2020.

1.4.2. Objectives

The objectives of the study are:

i. To examine the contribution of exports to economic growth in South Africa.

ii. To determine both the short-run and long-run relationship between exports and economic growth.

iii. To examine the direction of the causal relationship between exports and economic growth.

1.4.3. Research hypotheses

i. Exports do not contribute to economic growth in South Africa.

ii. There is no short-run and long-run relationship between exports and economic growth.

iii. There is no causal relationship between exports and economic growth.

1.5. Organisational structure of the study

Chapter one includes the background of the study, the gap of knowledge that was identified, aim, objectives, hypothesis as well as the contribution of the study. The rest of this dissertation comprises the following chapters: Chapter two (2) is a review of the literature related to this study; it discusses the concepts and provides reviews of what other authors have stated about the relationship between exports and economic growth in South Africa. Chapter three (3) explains the methodology applied to the study, which includes the study area, data source, data analysis techniques and models. Chapter four (4) presents the results of the study as well as their analysis. Chapter five (5) provides a summary of the conclusions and recommendations of the study's findings, which could be used by policy makers, among other stakeholders.

CHAPTER 2:

LITERATURE REVIEW

2.1. Introduction

This chapter offers a comprehensive description of terminologies, and a review of previous studies conducted locally and internationally on the relationship between export and economic growth. It also provides an overview of exports and economic growth in South Africa, and further reviews the contribution of exports to economic growth.

2.2. Definition of the key concepts

2.2.1. Exports

The term ‘exports’ refers to the value of goods and services produced by a country’s firms at a given time and purchased by the residents of another country (Amadeo, 2020). An export is anything that is produced domestically and sent to or sold in a foreign country, regardless of what it might be and how it gets there, it could be sent by email or shipped (Amadeo, 2020). Exports form one component of international trade. They have remained impressive with more markets being liberalised or opened. In South Africa, agricultural exports are important due to their positive influence on economic development. The expansion of products to international markets creates an opportunity to generate or earn more foreign currency, which will in turn enable domestic industries to create employment and generate income (DAFF, 2016). It is known that exports are seen as an engine of economic and social development because of their ability to influence economic growth and poverty reduction.

2.2.2. Economic growth

In this study, gross domestic product (GDP) was used as a proxy for economic growth. Most economists define economic growth as an increase in the number of goods and services produced by a country during its progress period. According to Krugman (2000), GDP is the value of all the finished goods and services produced within the

borders of a given country over a given period. Some countries are very rich while others are very poor. Hence, many countries have different economic sizes all over the world. Some countries are economically growing very fast while others are either growing too slow or not growing at all (Soylu, 2017).

Economic growth is the primary goal of policymakers worldwide. To achieve the goal, strategies such as export-led growth have been implemented across and within countries over time (Tibebu, 2018). Real and nominal GDP can be used to calculate economic growth. Real GDP is referred to as the value of economic output produced in a given period and are adjusted for changes in the general price level. The nominal GDP is the total market value of the economic output produced in a year within the borders of a country (Swan, 1956).

South African economic growth is measured or estimated on a regular basis by the national accounting section of Stats SA and the South African Reserve Bank (SARB). It is traditionally measured as the percentage rate of increase in real GDP. Data on economic growth are estimated by sectors, industries, provinces, and at the national level.

2.3. Export-led growth hypothesis (Export–led model of growth)

The ‘ELG hypothesis’ is used to describe the causality from exports to real output, in the international trade and development literature, whereas the ‘GEE hypothesis’ is used to describe the reverse causal flow from the real output to exports. The ELG hypothesis reveals that exports-oriented strategies assist in encouraging economic growth (Chenery and Strout, 1966). Export expansion can promote output growth both directly, as a component of aggregate output and as well as indirectly through efficient resource allocation, better capacity utilisation, exploitation of economies of scale and encouragement of technological advancement due to foreign market competition.

According to Medina-Smith (2001), many economists have been conducting several studies on the relationship between international trade and output growth since Adam Smith in the second half of the eighteenth century. With the fast-growing literature, there are two main competing hypotheses, namely, the “export-led growth’ (ELG) hypothesis and the “growth-led-exports” (GLE) hypothesis. It is suggested that exports

as a part of GDP would have a direct causal impact on GDP (Balassa, 1978). According to Balcilar and Özdemir (2013), there are other channels through which exports might contribute indirectly to economic growth. The first one is that there is a chance to gain efficiency from economies of scale via the export markets for those countries with limited local-based markets (Helpman and Krugman, 1985). Secondly, by decreasing foreign exchange restrictions, exports opened the way for increased imports, including productivity-improving capital goods constraints (McKinnon, 1964). Thirdly, the exposure to international competition creates pressure for more efficient production in the home economy too (Balassa, 1978). Lastly, international trade is an important transport for the transfer of know-how, by way of communications with foreign businesses (Grossman and Helpman, 1991).

The role of exports in economic growth is one of the important matters that have dominated the growth of international literature on the subject. It has been argued by most economists that, the fast growth of exports can lead to higher economic growth. Because exports are a component of GDP via the national income identity (expenditure side), an increase in GDP in response to increased exports may appear trivially obvious. As Greenaway and Sapsford (1994) point out, the proper reference here is to non-export GDP (or domestic demand), which is expected to rise as exports rise. This is known as the export-led growth hypothesis (ELGH).

ELG refers to the advantages that a country may gain if it pursues a strategy of raising demand from foreign countries (Awokuse, 2008). The willingness of a country to explore export-oriented growth strategies is not new, as there may be direct or indirect gains from doing so (Awokuse, 2008). Direct benefits include increased output, which can lead to an increase in employment or income. Indirect effects include increased economies of scale in non-export industries and related technological advancements (Awokuse, 2008).

In the literature, the basic concept of ELG is generally expressed in the same way, with similar definitions provided by many researchers (Chan and Dang, 2010). In terms of the empirical tests used to demonstrate the ELG in practice, there are different opinions in the literature. Methods for conducting such empirical investigations are constantly improved and modified, and they include different techniques such as bi-variate causality techniques, which include vector auto-correction mechanisms

(VECM) and Granger causality empirical techniques (Chan and Dang, 2010). Kindleberger proposed the export-led growth (ELG) hypothesis in 1962. ELG is regarded as an important pillar of the free- trade school of thought that began in the 1980s. The other significant school of thought is the Prehisch (1950) protectionism school, which supports import substitution policies rather than export promotion to stimulate economic growth. There has been little agreement among economists about the nature of the relationship between exports and economic growth. The debate has centred on whether strong economic performance is export-led or growth-driven.

The export-led growth (ELG) strategy is a type of economic development strategy that highlights the importance of exports and foreign trade to a country's economic growth and development. Due to the real and desired benefits of foreign trade for both developing and developed countries, there has been a noticeable shift toward this strategy. Furthermore, encouraged by the debate over whether exports have a positive effect on economic growth, development economists have focused on the relationship between exports and economic growth. (D.Dutt and Ghosh, 1996). According to Adam Smith, international trade enables a country to redistribute given resources to provide new, effective demand for output from surplus resources, assuming that a previously isolated country has surplus production above the requirements of domestic consumption. As a result, domestic surplus productive capacity appropriate for export produces a costless means of attaining imports and advancing domestic economic activity (Tadesse, 2012).

This export-based growth theory suggests that a country's exploration of a primary commodity with a comparative advantage, or an increase in demand for such a primary commodity, leads to an increase in the export-based commodities, which leads to higher growth in both aggregates and per capita income (Ghosh and D.Dutt, 1996). According to Meier (1995), exporting primary products reduces both unemployment and underemployment, draws attention to an inflow of production factors in the export sector, increases the rate of investment and savings in the economy, and creates a link with other sectors of the economy. Furthermore, D.Dutt and Ghosh (1996) provided three explanations of why export growth increases real GDP. Firstly, increases in export growth may indicate an increased demand for domestic output. Second, loosening foreign exchange restrictions permits the import of productive intermediate goods that are used in manufacturing. Lastly, increased

exports enable firms to achieve economies of scale by expanding their domestic market and, as a result, reducing unit costs.

Several studies have been undertaken in the theoretical and empirical literature to find the relationship between export and economic growth. However, the discussion about export being the main factor for economic growth has been going on for centuries. The origins of the export-led growth hypothesis (ELGH) and the growth-driven export hypothesis (GDEH) can be traced back to classical economic theorists. Both Smith and Ricardo state that trade is important for economic growth and that specialisation results in economic gains. They aver that a country will gain an advantage if it exports the goods that it produces in large quantities to a country that does not produce or produces those goods in small quantities. Many economists, both past and present, have presented their theories, claiming that the foreign trade hypothesis as a growth engine can be detrimental to poor developing countries. The neoclassical school of thought, for example, emphasised the concept of comparative advantage and how positive externalities promote economic growth (Ngumi, 2009).

The export-led growth hypothesis has been one of the most heavily debated hypotheses in recent years, with little agreement. The discussion, which dates back to classical and neoclassical economic theories, focuses on the importance of exports as a key factor of economic growth (Ngumi, 2009). The authors, such as Adam Smith, James Mill, and David Ricardo, argued that partaking in international trade could be a powerful positive force in the economies of countries and that there are economic gains from specialisation. Some of the related reasons examined to support this argument are that encouraging exports promotes the production of goods, which provides the economy with foreign exchange, and permits the importation of capital inputs that cannot be made locally (Tivatyi *et al*., 2022).

According to Cypher and Dietz (1997), export production and international trade, in general, facilitate effective knowledge dissemination and improve input efficiency. Regardless, the issue of export-led growth is best understood within a standard Keynesian framework. According to Palley (2002), while Keynesian economics highlights demand-determined equilibrium and that the level of economic activity adapts to equal the level of aggregate demand, export-led policies struggle with an inherent compositional misjudgement. Palley (2002) argues by using the logic of a

two-country macroeconomic model explored (Palley,1999), that when one country attempts to improve the local aggregate demand by raising exports, the importing country's domestic aggregate demand significantly reduces (the second country's). The logic of a static Keynesian theory implemented in a Keynesian growth theory, on the other hand, suggests that the rate of economic growth is impacted by the rate of demand growth. Simply put, it contends that because export growth increases demand, it, therefore, eventually increases economic growth.

In theory, the ELG hypothesis holds that exports stimulate economic growth. This could be true for several reasons (Shafarddin, 2011). First, increased exports may lead to an expansion in the demand for the country's output, thereby expanding real GDP (GNP). Second, increased exports may cease a binding foreign exchange restriction, permitting gains in productive intermediate imports and, as a result, output growth (Shafarddin, 2011). Third, increased exports may result in increased efficiency and thus increased output. This is because exporting contacts with foreign competitors may result in faster technological change, the development of indigenous entrepreneurship, and the exploitation of scale economies.

Furthermore, competitive pressure may lead to greater efficiency and product quality. Exchange control liberalisation and the resulting export growth are likely to decrease the allocative inefficiencies associated with exchange controls (Jung and Marshall, 1985). All of these strategies for the export promotion that contribute to growth have one thing in common, that is, they all contend that increased exports lead to increased output. As a result, the export-led growth hypothesis should be regarded as not only a claim of correlation, but also a claim of causation (Jung and Marshall, 1985).

2.4. A review of previous studies on the relationship between the exports and economic growth

Academics and policymakers have conducted various studies and research on exports, imports, and economic growth. A number of studies show varying findings regarding the relationship between these three variables. Recently, the majority of studies have focused on VAR and VEC models, as well as the cointegration approach.

Hassan (2007) assessed the relationship between exports and economic growth in Saudi Arabia using a VAR Model Analysis. Modern econometric techniques such as

Vector Auto-Regression (VAR), Impulse Response Function (IFR) and the Granger-causality test were applied to determine the long-term relationship between exports and domestic economic growth from 1970 to 2005. The results showed that Saudi Arabia's export sector had a significant impact on economic growth and had a positive impact on other economic activities in the long run. A long-term equilibrium also existed among the macroeconomic variables studied, including RGDP, RC, RG, RI, RX, and RM.

Ngumi (2009) assessed the relationship between exports and economic growth in Kenya. The results showed that manufactured exports did not have a significant impact on economic growth. Therefore, Kenya's manufactured exports did not Granger-cause economic growth for the study. However, there was a bi-directional causality between imports and manufactured exports.

Jordaan and Eita (2009) investigated the cause-and-effect connection between the expansion of the economy and exports in Botswana during the period spanning from 1996 to 2007. The findings showed a bidirectional causal relationship between exports and economic growth, suggesting support for the export-led growth hypothesis and inverse causality. The research outcomes suggested that to accomplish significant economic growth, it is advisable to support measures that facilitate the increase of exports.

Kim and Lin (2009) examined the impact of export composition on economic growth and indicated that not all exports contribute equally to economic growth. Many developing countries, in particular, rely on primary product exports, which are susceptible to extreme price fluctuations. This category of exports had a negligible impact on economic growth in most cases, whereas manufactured exports had a positive and significant impact on economic growth.

Rangasamy (2009) explored the relationship between Exports and economic growth in the context of South Africa. The study aimed to determine the validity of focusing on export production. By employing contemporary econometric methods in a multifaceted analytical framework, the findings revealed a one-way causal link from exports to economic growth in South Africa, as indicated by Granger causality. Moreover, the conventional gross domestic product (GDP) calculation tends to underestimate the actual impact of exports on economic growth. This underscores the importance of

intentional policy interventions aimed at fostering export production, which holds substantial potential for enhancing the South African economy's prospects for growth. The research results also highlight the necessity of prioritizing the advancement of non-primary exports.

Muhammad (2012) contribution of Agricultural Exports to Economic Growth in Pakistan. The primary goal of this analysis was to investigate and quantify the contribution of agricultural exports to Pakistan's economic growth. The Johansen cointegration method was used to estimate the relationship between Pakistan's GDP and agricultural and non-agricultural exports from 1972 to 2008. The study's results indicate that agricultural exports have a negative and significant effect on economic growth, with an elasticity of 0.58. Furthermore, agricultural exports and real GDP have bidirectional causality. It is suggested that non-agricultural exports be encouraged.

Kalaitzi (2013) examined the relationship between exports and economic growth in the United Arab Emirates over the period 1980-2010. The two-step Engle-Granger cointegration test and the Johansen cointegration technique were used in the study to confirm whether or not there was a long-run relationship between the variables. Furthermore, this study used a Vector Auto Regression Model to establish the Impulse Response Function and the Granger causality test to investigate the relationship between exports and economic growth. The results of the study confirmed the long-run relationship between manufactured exports, primary exports, and economic growth. Furthermore, the Granger causality test revealed that there was a unidirectional causality between manufactured exports and economic growth. As a result, increasing the degree of export diversification away from oil could accelerate economic growth in the UAE.

Ajmi, Aye, Balcilar and Gupta (2013) investigated the dynamic causal link between exports and economic growth using both linear and nonlinear Granger causality tests. The study used annual South African data on real exports and real GDP from 1911-2011. The linear Granger causality result showed no evidence of significant causality between exports and GDP. Accordingly, the study turned to the nonlinear methods to evaluate Granger causality between exports and GDP. It used both Hiemstra and Jones (1994) and Diks and Panchenko (2005) nonlinear Granger causality tests. For the Hiemstra and Jones (1994) test, it found a unidirectional causality from GDP to

exports. However, using the Diks and Panchenko's (2005) test, the study found evidence of significant bidirectional causality.

Shihab, Soufan and Abdul-Khaliq (2014) examined the causal relationship between exports and economic growth in Jordan. The aim of the study was to examine the causal relationship between economic growth and exports in Jordan using the Granger causality method to determine the direction of the relationship between exports and economic growth during the period 2000-2012. The findings of the study showed that there is a causal relationship going from the economic growth to export, and not from exports to economic growth. According to the findings of causality tests, changes in economic growth help explain changes in export.

Shamshad and Abul (2014) investigated the effect of exports on economic growth in Bangladesh, based on a two-sector growth model. Using yearly data for the period 1961-1992, the results suggest that an increase in the share of investment in GDP significantly increases the growth rate of GDP in normal years, but negligibly increases GDP growth in abnormal years.

Agrawal (2014) analysed the role of exports in India's economic growth. The researcher analysed the significance of exports in India's economic growth and whether the export-led growth hypothesis (ELGH) applies to India. The causality analysis supports the validity of the ELGH for India during the trade liberalisation phase. Error variance decomposition and other analyses were also conducted; these corroborated the results of the causality analysis and suggested that the rapid growth of exports has played a significant role in increasing the growth rate in India following the economic reforms of 1991.

Ajmi, Aye, Balcilar and Gupta (2015) used both linear and nonlinear Granger causality tests to explore the dynamic causal relationship between exports and economic growth. Annual South African data were used on real exports and real GDP from 1911 to 2011. There is no evidence of significant causality between exports and GDP, according to the linear Granger causality result. As a result, we employ nonlinear methods to assess Granant VAR is unstable, which calls into question the causality result identified by the linear causality between exports and GDP. First, we employ Hiemstra and Jones' (1994) nonlinear Granger causality test to discover a unidirectional causality between GDP and exports. Moreover, evidence of significant

bi-directional causality was found using a more powerful and less biased nonlinear test, the Diks and Panchenko (2006) test. These findings highlight the dangers of drawing incorrect conclusions based on standard linear Granger causality tests, which do not account for structural breaks or reveal nonlinearities in the dynamic relationship between exports and GDP.

Bonga, Shenje and Sithole (2015) analysed export sector contribution to economic growth in Zimbabwe, which was a causality analysis. The study used unit root tests, cointegration analysis, Granger causality tests, vector auto regression (VAR), Vector Error Correction (VEC) and impulse response function (IRF) in the analysis. The study aimed at determining whether GDP, exports and imports are cointegrated, whether exports Granger cause growth and whether exports Granger cause investment. Using STATA, the results from the study showed that the variables were not stationary in levels; hence, differencing them to attain stationarity. There was no cointegration found among the variables, and the Granger causality tests indicated a one-way causality between GDP and exports. There is no strong evidence for short-run causality running from export growth to economic growth. However, the use of VEC model and IRFs revealed that a long-run relationship exists between exports and non-export GDP, thereby supporting export-led growth hypothesis.

Habanabakize (2020) Explored was the impact of economic growth and exchange rate fluctuations on imports and exports within the context of post-2008 financial crisis South Africa. The primary objective of this study was to ascertain how both exchange rates and economic growth influence the dynamics of imports and exports in the South African economy. To achieve this goal, a cointegration test was conducted employing the autoregressive distributed lag (ARDL) model. This model was applied to quarterly time series data spanning from 2008 to 2018. Additionally, the research utilized the error correction model and Granger Causality tests to discern the short-term relationships and causal links among the variables. The regression analyses uncovered the presence of a durable relationship among the analyzed variables. Aligning with established economic literature, the study's results revealed a positive correlation between economic growth and both imports and exports. However, the investigation also highlighted that over the long term, a stronger value of the South African Rand leads to increased imports and reduced exports. Moreover, the Granger Causality analysis indicated a mutual causal connection between the exchange rate

and imports, economic growth and imports, as well as the exchange rate and economic growth. To sum up, the study demonstrated a causal interplay among the examined variables.

Alattabi, AlBadri and AlBadawi (2020) used a modified version of the Granger causality test developed by Toda and Yamamoto in 1995, to assess the causal relationship between agricultural exports and agricultural growth in Iraq. The tests revealed that the variables are non-stationary at their levels, but stationary at the first differences. The findings revealed that there is no causal relationship between agricultural exports and agricultural growth in Iraq, indicating that the country is still struggling from economic disruption caused by UN sanctions that began in August 1990 and lasted until the invasion of Iraq in 2003, with the economics being particularly troubled in the agriculture sector.

Tivatyi, Shou and N'Souvi (2022) did a Study on Import and Export-Led Economic Growth: Cases of Botswana, Namibia, South Africa, and Zimbabwe in Southern Africa. This study aims to investigate the relationship between exports, imports and economic growth of a sample of four countries in Southern Africa for the period 1980-2019. In doing so, we check whether the Export-Led growth (ELG), Import-Led Growth (ILG), Growth-Led Export (GLE) and growth-led import (GLI) propositions hold in four Southern African economies, namely Botswana, Namibia, South Africa and Zimbabwe. Specifically, the present study tries to 1) understand to which extent imports, exports and economic growth are correlated in the short and long run in Botswana, Namibia, South Africa and Zimbabwe; 2) assess the effects of imports and exports on the economic growth in each of these countries. To this end, we used time series data, covering the period 1980 to 2019. In doing so, the co-integration tests, Vector Autoregressive "VAR" model (for South Africa) and vector error correction models "VECM" model (for Botswana, Namibia and Zimbabwe) then Granger causality tests are applied to investigate the relationship between the variables. The results show that both short run and long run relationships exist among these variables. On the one hand, our findings failed to validate the export-led growth hypothesis for South Africa in the long-run but provided support for the exports-led growth hypothesis in the short-run. The analysis finds prominent evidence of bidirectional causality between exports and growth for Botswana, Namibia, and Zimbabwe in the long run. On the other hand, suggestive evidence of unidirectional causality running from growth to

imports was found in the case of Botswana, Namibia and South Africa. In addition, bidirectional causality between exports and imports was validated by Zimbabwe case study.

2.5. Overview of exports and GDP in South Africa

2.5.1. Exports in South Africa

In the fourth quarter of 2020, net exports negatively contributed to growth in expenditure on GDP. The increased trade in motor vehicles and other transport equipment; metals and stones; and base metals and articles of base metals largely influenced the increase in exports of goods and services by 26.6 percent.

Despite a significant depreciation of the South African Rand (ZAR) following the global financial crisis, South Africa's export performance has been very poor. South Africa's real effective exchange rate (REER) encountered one of the longest and largest exchange rate depreciation spells in recent years, with its REER weakening by around 25% between January 2011 and July 2014. Despite a drop in relative prices, South African exports increased at a very slow (4 percent) rate during this period. South Africa's export growth averaged about 82 percent of its trading partners' import growth during 2011–14, one of the lowest proportions among peers, with its share of global exports falling by nearly 15 percent. Sluggish exports combined with relatively inelastic imports, attributable in part to large infrastructure projects, have contributed to a current account deficit approaching 6 percent of GDP (from about 2 percent of GDP at the beginning of the aforementioned period).

Several explanations have been proposed to explain South African exports' insensitivity to real exchange rate depreciation. According to Edwards and Garlick (2008), infrastructure deficiencies limit South African exports. According to the South African Reserve Bank (SARB)(2022), weaker external demand, lower commodity prices, extended industrial action, and logistical and energy constraints have all played a significant role in this issue. Other possible explanations include "survival of the least expensive" major capital inflows and concomitant real exchange rate appreciation until 2010, which may have diminished the competitiveness of South African exporting firms, even pressuring some out of business. High product market

margins and labour market wages have resulted in uncompetitive domestic production costs, eroding external competitiveness (Saint-Paul, 1997; Cuñat and Melitz, 2012).

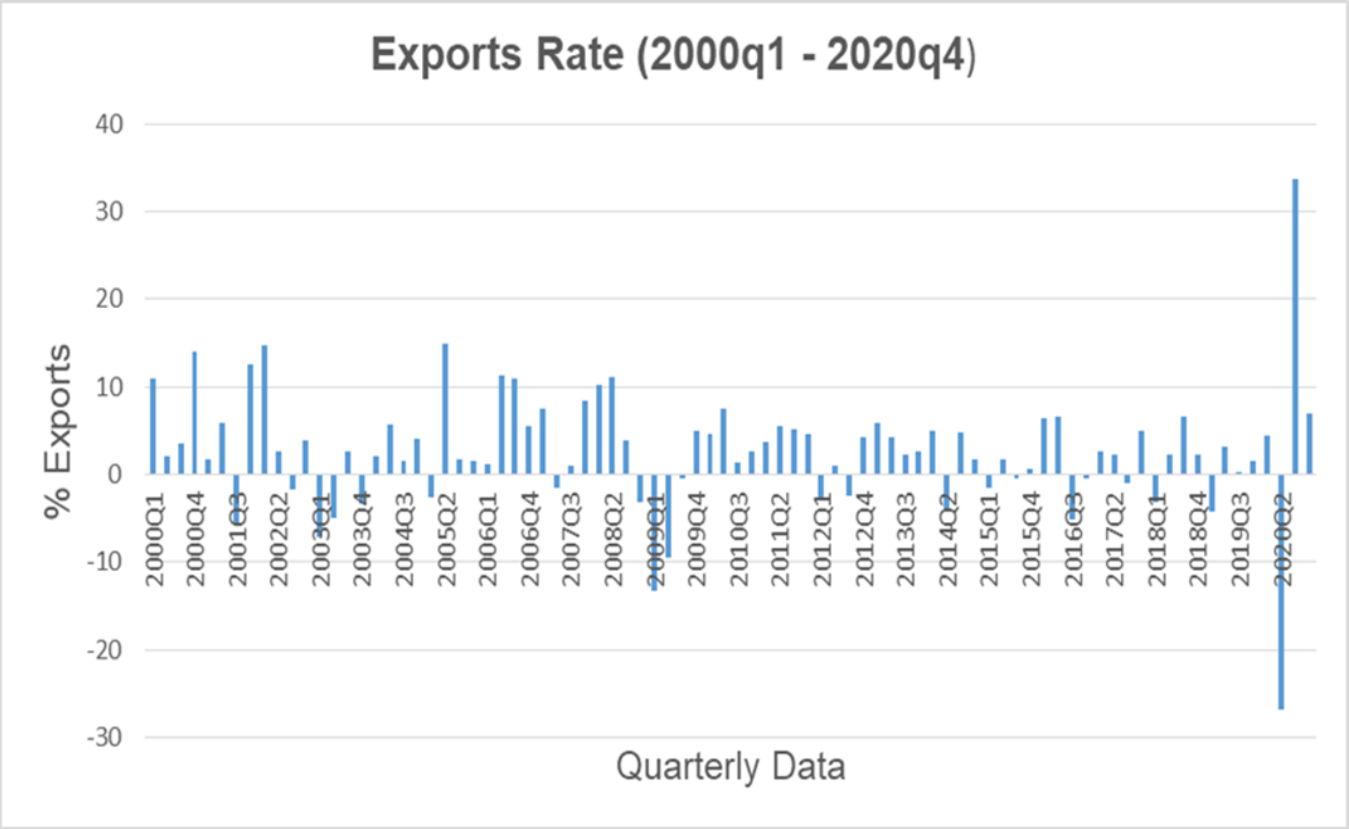

FIGURE 2.1: EXPORTS TRENDS OF SOUTH AFRICA (2000Q1 – 2020Q4).

Source: Own computation using Excel

Evidently, by looking at the graph in Figure 2.1 above, the export growth in the first quarter of 2000 was 10.88 percent and dropped in the second and third quarter by 2.07 and 3.46 percent, respectively. Following the lifting of sanctions in the early 1990s. The exports expanded rapidly, but by the mid1990s, the pace of growth had begun to slow down. This slow economic growth continued quickly in the first half of the 2000s, and more quickly after 2005, with real export growth falling to just 0.6 percent annually between 2005 and 2011, compared with the middle-income country average of 6.4 percent. The result is that South Africa's share in global export markets stagnated at a time when other emerging markets like China, India, and the Russian Federation were seeing major gains. A stronger export sector also drives job creation. Increasing exports, particularly in manufacturing, may be crucial for the low-skilled job creation needed to substantially reduce high overall and youth unemployment. And exports are especially critical amid South Africa's widening current account deficit and

the external vulnerability arising from its reliance on volatile capital flows to fund the deficit (WDI, 2014).

During the second quarter of 2020, the exports dropped drastically by 26.76 percent. This major decline was because of the Covid-19 outbreak and a complete national lockdown. For the past decade, the South African economy has experienced stagnation, which has put a strain in the effort to tackle the historical structural inequalities, unemployment and poverty. There is a consensus amongst the social partners that there should be substantial structural change in the economy that would unlock growth and allow for development. The challenges in the South African economy have overtime been worsened by sustained low levels of investment and growth. These challenges, coupled with an increasing budget deficit and a rising stock of debt has constrained the fiscal space.

The outbreak of the Covid-19 pandemic in March 2020, found a vulnerable South African economy. In fact, when the pandemic reached our shores, the South African economy had experienced two consecutive quarters of a recession. As a result, the Covid-19 pandemic deepened the economic crisis. Many people lost their jobs, many have gone without income for extended periods, and many are going hungry every day. Inequality is expected to widen and poverty to deepen (The South African Economic Reconstruction and Recovery Plan, 2020).

2.5.2. Economic growth in South Africa

The South African economy is one of the largest in Africa, constituting 15.46 percent of Africa's GDP (Stephan, 2020). South Africa's GDP has nearly tripled to $400 billion since 1996 when international sanctions were lifted after more than a decade. The country is rich in natural resources and is a leading producer of platinum, gold, chromium and iron. South Africa grew at a 4.5 percent annual rate from 2002 to 2008 (StatsSA, 2009). Although, in recent years, successive governments have failed to address the country's structural problems, such as the growing wealth disparity, a low-skilled labour force, high unemployment, food insecurity, high corruption, and crime rates. As a result, since the recession in 2009, the country's growth has been sluggish and below the continent's average (StatsSA, 2012).

According to StatsSA (2017), the South African economy unexpectedly contracted by 0.7 percent on an annualised basis in the first quarter of 2017, following a 0.3 percent decline in the previous period and falling short of market expectations of 0.9 percent growth. The growth rate of the South African economy is lagging many of the developing countries in Sub-Saharan countries that have stable governments in place. To the north, Nigeria and Egypt are the second and third largest economies in Africa, respectively, both of which are politically unstable. All of the Sub-Saharan countries are substantially smaller than South Africa and are growing off a much lower base. South Africa is the largest member of the SADC and plays a leading economic role among the 15 member nations (SADC, 2012).

The South African economy is classified as upper-middle income by the World Bank, making it one of five African countries (the others being Mauritius, Botswana, and Gabon) (World Bank, 2018). However, the official unemployment rate remains at 25 percent, and one-quarter of the population lives on R21.66 per day. Nonetheless, since the end of apartheid in 1994, the black middle class has grown significantly, and the GDP has increased from $136 billion to $408.6 billion. The wealth gap between the rich and the poor has grown to unacceptable proportions as per capita GDP has not increased proportionately. As a result, labour unrest has increased, stifling new investment and raising the unemployment rate.

Eight industries recorded positive growth between the third and fourth quarters of 2020 (StatsSA, 2020). Real GDP (measured by production) increased at an annualised rate of 6.3 percent in the fourth quarter of 2020, largely as a result of further easing of COVID-19 lockdown restrictions. Eight industries recorded positive growth between the third and fourth quarters of 2020. The largest positive contributors to growth in GDP in South Africa in the fourth quarter were the manufacturing, trade, and transport industries. The manufacturing industry grew at a 21.1 percent annual rate and contributed 2.4 percent to economic growth. The trade, catering, and lodging industries grew at a 9.8 percent annual rate and contributed 1.3 percent points. The transportation, storage, and communication industries grew at a 6.7 percent annual rate and contributed 0.5 percentage points (StatsSA, 2020). Expenditure on real GDP increased at an annualised rate of 6.5 percent in the fourth quarter of 2020; all expenditure components increased.

Household final consumption expenditure increased at a 7.5 percent annual rate in the fourth quarter of 2020, accounting for 4.7 percent of total growth. Government final consumption expenditure increased by 1.1 percent, accounting for 0.2 percentage points (StatsSA, 2020). Gross fixed capital formation increased at a 12.1 percent annual rate, contributing 1.9 percentage points. Changes in inventories in the fourth quarter contributed 4.0 percent to the total growth. Net exports contributed -4.5 percentage points to total growth, owing primarily to a significant increase in imports (StatsSA, 2020).

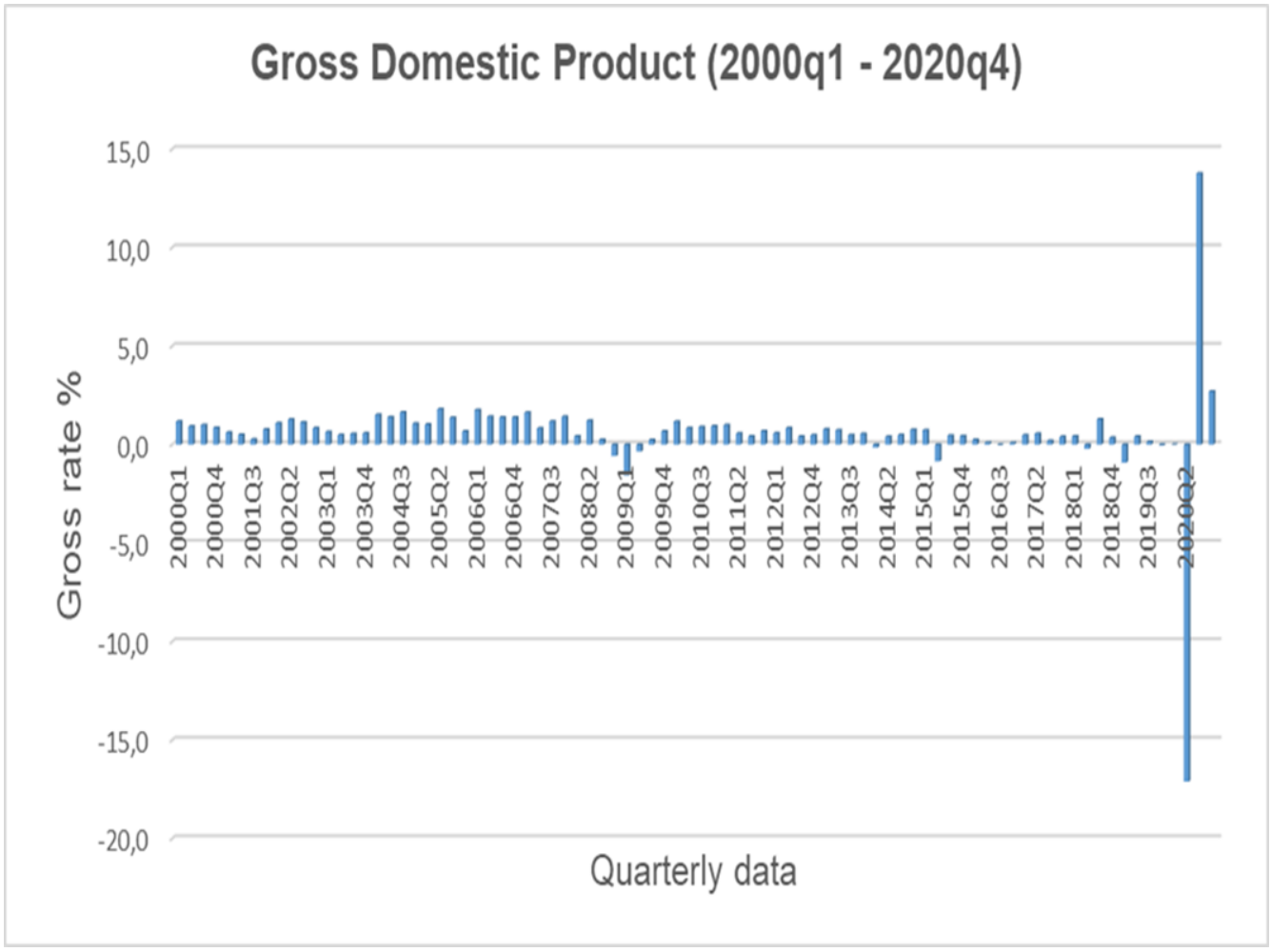

FIGURE 2.2: GROSS DOMESTIC PRODUCT TRENDS OF SOUTH AFRICA (2000Q1 – 2020Q4).

Source: Own computation using Excel

South African economic growth slowed to an estimated 2.2 percent in 2001 against the backdrop of a marked slowdown in the global economy and was expected to moderately strengthen in 2002, buoyed by both international recovery and rising domestic demand. Government policies continue to be focused on sustainable

development and creating a strong and stable economic base through tariff liberalisation, prudent fiscal policy, investment in infrastructure, education, land reform and lower inflation. Deficit reduction and strong revenue performance had created the fiscal room for the government to respond to the present slowdown (Budget Review, 2002).

After eight years of strong gains in productivity, market restructuring, and trade expansion, the South African economy is fundamentally more competitive in international product markets, laying the groundwork for rising exports, improved income and employment, and deeper financial integration (Budget Review, 2005).

South Africa's economy is undergoing one of the longest periods of growth since World War II. Following a challenging period of corporate restructuring, formal sector employment has been increasing for about two years; inflation has moderated, and interest rates have fallen to historic lows. Investment in both the public and private sectors has increased, resulting in a steady increase in productive capacity. In 2004, the economy grew by 3.7 percent, and by 5 percent in 2005 (Budget Review, 2005).

The graph in Figure 2.2 depicts the gross rate fluctuating over time, especially during the last quarter of 2008 and the first two quarters of 2009, when there was a significant economic downturn. Following a decade of uninterrupted growth, this resulted in the first recession in 17 years, with the economy contracting by 2% in 2009q1. A wide range of negative domestic developments contributed to the severity of this downturn. These included a debt-fuelled consumption boom, followed by a spike in inflation in 2008 and 2009, which reduced competitiveness and pushed interest rates higher. Prior to this time, the GDP was volatile. Then, in 2020, there was the greatest drop in GDP as a result of the Covid-19 outbreak.

2.6. Export rate vs GDP

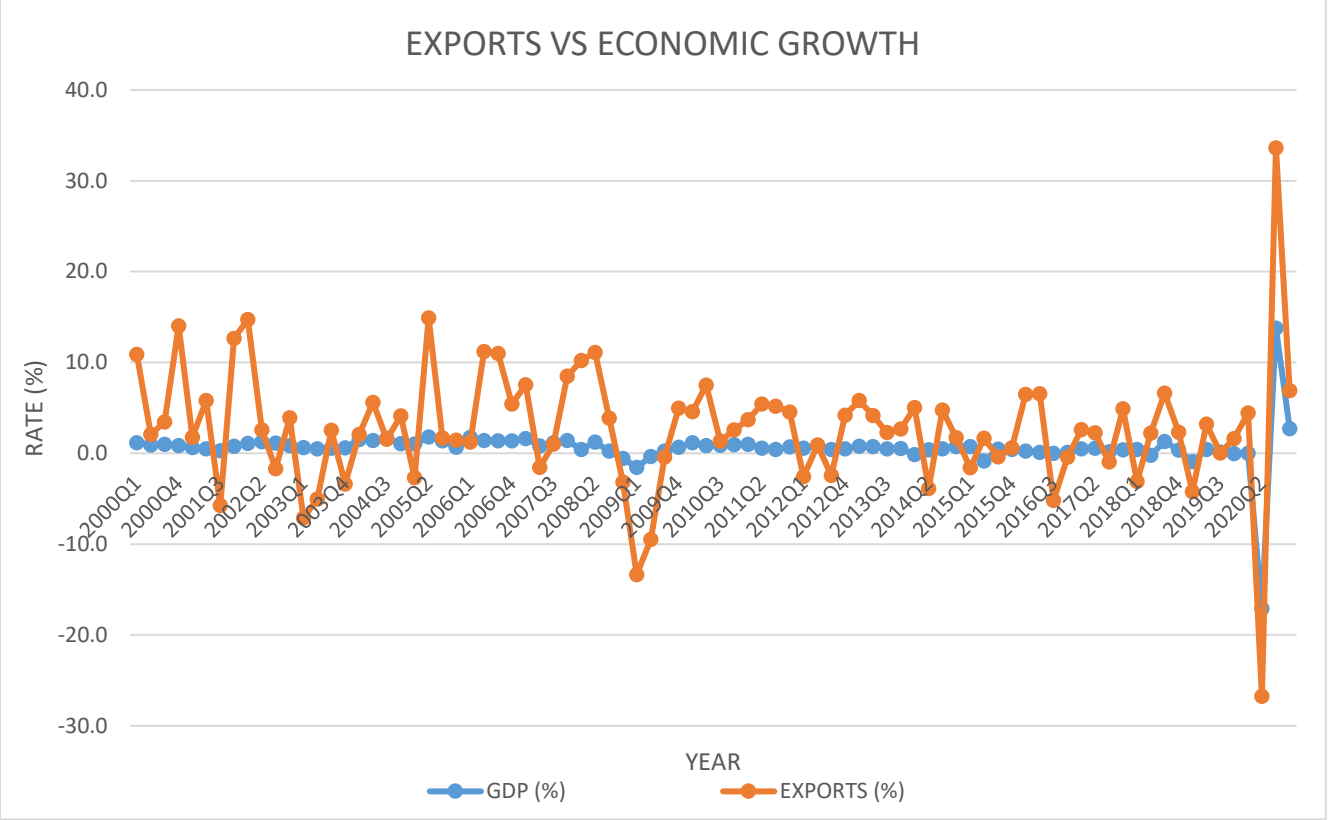

FIGURE 2.3: RELATION BETWEEN EXPORTS AND GDP

Source: Own computation using Excel

Figure 2.3 above shows the behaviour of the GDP at current prices and exports in South Africa over the period 2000 to 2020. The South African economy has registered an average annual rate of economic growth of 3.3 percent since 1994. This compares with an average of 3.6 percent for the world economy at large. For the period 1994 to 2000, the economy grew on average by 2.9 percent; for the period 2001 to 2007, the economy grew on average by 4.3 percent and, since the Global Financial Crisis (GFC), it has grown by 2.2 percent.

South Africa experienced the longest economic boom during the period 2003 to 2008 in history. Employment increased, unemployment fell, investment rose and inflation and real interest rates declined rapidly. As a result, the rand gained value, which caused exports growth to increase. However, the global economic recession that followed reversed many of the gains in employment creation, and investment levels decreased (DTI, 2013). This has been seen by the 1.6 and 13.36 decline in GDP and exports, respectively, in the first quarter of 2009.

Real GDP (measured by production) increased at an annualised rate of 6,3 percent in the fourth quarter of 2020, largely as a result of further easing of COVID-19 lockdown restrictions. Exports contributed negatively to growth in expenditure on the GDP in the fourth quarter. Exports of goods and services increased at a rate of 26, 6 percent.

2.7. The study's contribution to knowledge

The research will make a substantial and valuable addition to the current body of knowledge concerning the correlation between exports and economic growth. This contribution is pivotal in enhancing the development of more effective management strategies and public policies. In terms of private investments, the study's findings have provided specific recommendations aimed at fostering a constructive synergy between investments and a nation's economic growth trajectory. Consequently, for the South African government to bolster economic expansion, a considerable allocation of resources is advisable to stimulate the growth of domestic markets, reduce governmental spending, and attract investments to the country. These steps collectively hold the potential to drive South Africa's economic growth forward.

2.8. Chapter Summary

The study reviewed previous studies on the relationship between exports and economic growth among different countries. The reviewed literature indicated that most of the studies used the Vector Error Correction Model to determine the long run and short run relationship between exports and economic growth among different countries. This chapter also highlighted exports and economic growth in South Africa. This chapter also highlighted the exports-led growth hypothesis.

CHAPTER 3:

METHODOLOGY AND ANALYTICALPROCEDURES

3.1. Introduction

This chapter provides a brief description of the study area, data collection and data analysis (unit root test, Johnsen cointegration test, and Vector Error Correction Model and Granger Causality Model). It describes the variables that were considered to estimate the relationship between exports and economic growth in South Africa.

3.2. Study area

The study on the estimation of the relationship between exports and economic growth was based in South Africa. Exports of goods and services in South Africa were reported to be 30.47% of the GDP in 2020, according to the World Bank's collection of development indicators (World Bank, 2020). The South African economy increased by 1.1% in the q1 of 2021, rendering into a yearly growth rate of 4.6% increase in the real GDP in the q4 of the previous year (STATSSA, 2021).

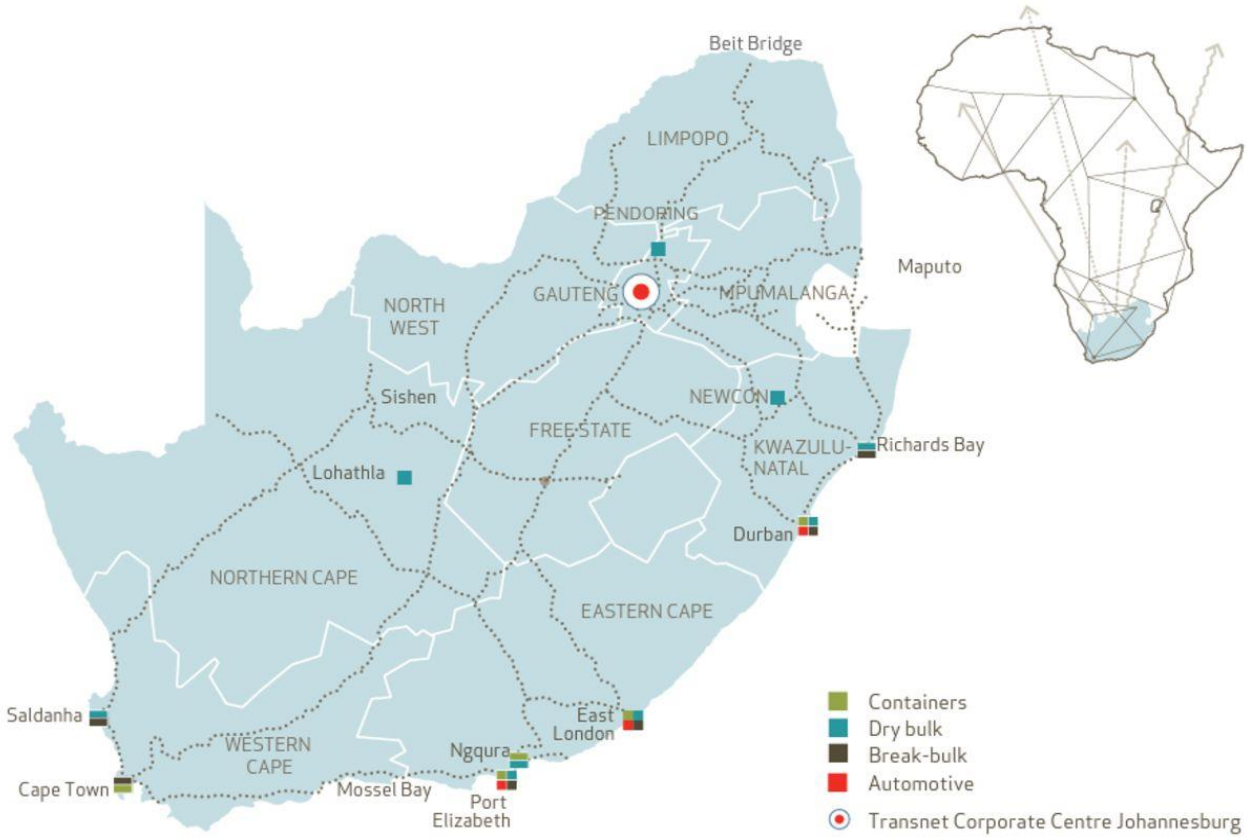

FIGURE: 3.1. MAP OF SOUTH AFRICA

Source: Bloomberg

3.3. Data source

The study used the secondary time series data, which were analysed using the Econometrics Views software package 7.0.0.1 (Eviews 7.0.0.1). Secondary time series data on South African exports and economic growth, which were obtained from STATS SA and South African Reserve Bank were used. The studied data covered a sample size of 21 years from the period 2000 until 2020 using quarterly data of 2000q1 to 2020q4 and 84 observations, which were from four quarters per year for 21 years.

The study focused on the period 2000- 2020 primarily because this timeframe allows for a broad analysis of economic trends capturing both short-term and long-term patterns in exports and economic growth in South Africa. Moreover, this period covers an important timeframe of two decades, potentially offering insights into how various global, regional, and domestic factors have impacted South Africa's export dynamics and overall economic performance.

3.4. Data Analysis

The unit root test for this study was conducted using the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) procedures. The first objective, which was to examine the contribution of exports on economic growth in South Africa, was addressed using the Johansen Cointegration Test. In this case the model was examining whether or not there is long run association between exports and economic growth. The application of the cointegration approach requires a prior amination of the time series properties. This is necessary because macroeconomic time-series may exhibit time trends, which can lead to flawed results. For the second objective, which was to determine the short-run and long-run relationship between exports and economic growth, the Vector Error Correction Model (VECM) was used. Lastly, for the third objective, which was to examine the direction causal relation between exports and economic growth, the Granger Causality Test was used.

Economists often use the econometric technique of unit roots to check for the presence of a time trend in the series. Unit root testing is the first step in the Johansen

analysis of cointegration; other steps include, cointegration tests, and Granger causality tests. Each of these steps is explained below.

3.4.1. Unit root test

In economic modelling, it is important that both variables being studied, dependent and independent variables, exhibit stationarity. Stationarity refers to a statistical property of a process where the average and standard deviation of the procedure remain constant with time (Challis and Kitney, 1991). According to Brooks (2008), the stationarity or otherwise of a series can have a significant impact on its behaviour and properties. Using non-stationary series can as well lead to false/wrong regression. In the occurrence that the data are non-stationary at level [I (0)], the data require to be differenced until stationarity is reached (Brooks, 2008). This study employed the Augmented Dickey fuller (ADF) and Phillip Peron test to test for unit root.

- Augmented Dickey fuller (ADF) test

Non-stationary variables often exhibit multiple trends, where the average value does not revert to its previous level over time. The ADF test was developed to build on the work of Dickey and Fuller in 1979 and 1976, respectively. These researchers refined their model with the primary goal of testing their hypothesis, which suggested that the parameter φ equals 1 in the equation $Yt = \varphi Yt-1 + Ut$.

Therefore, their hypotheses are:

H_0: Series contains a unit root ($\varphi = 1$).

H_1: Series is stationary ($\varphi < 1$).

If the time series data does not have a unit root issue, then it is acceptable to reject the null hypothesis. This means that the hypothesis put forward for testing can be rejected with confidence (Gujarati & Porter, 2009).

- Phillips–Perron (PP) tests

The PP tests are a more elaborate version of tests for non-stationarity due to unit root. Brooks (2008) argues that the PP tests are similar to ADF tests, but they correct for autocorrelated residuals in an automated way. Despite this difference, both the PP and ADF tests have the same underlying asymptotic distribution. Brooks (2008) notes

that the PP tests often produce results similar to those ADF tests and share many of the same limitations.

- Criticisms of Dickey–Fuller- and Phillips–Perron-type tests

The unit root tests have been widely criticised for their limited power when the process is stationary, but has a root close to the non-stationary boundary. For example, consider an AR data generation process with a coefficient of 0.95. If the true data generation process is Y_t = 0.95Yt1 + U_t, the unit root null hypothesis should be rejected. It has thus been argued that the tests are ineffective at determining, for example, whether = 1 or = 0.95, especially with sample sizes (Brooks, 2008).

Brooks (2008) further claims that the source of this problem is that the null hypothesis is always rejected under the classical hypothesis testing framework; it is simply stated that it is either rejected or accepted. This means that a failure to reject the null hypothesis could occur due to either the null being correct or insufficient information in the sample to allow rejection.

3.4.2. Johansen Cointegration Test

In this study, the Johansen multivariate framework was utilized to investigate the correlation among exports and growth South African economy (Johansen in 1988). The framework was employed to investigate the extent to which exports impact the country's economic growth. The Johansen Cointegration test, which comprises the Trace statistic and Max-Eigen statistic, was employed to accomplish this. The cointegration also assists in discovering if there is an existence of disequilibrium in different variables (Pesaran and Shin, 2001). Furthermore, this method allows the specification of dynamic modification amongst the cointegrated variables in a study (Johansen, 1991). After the data are cointegrated, they have a positive or equilibrium relation between them. Due to the existence of such relation, there must be some association during short term. There may be disequilibrium in the short term and we can refer to the error term as an equilibrium error.

3.4.3. Vector Error Correction Model (VECM)

In this study, the aim was to explore the connection among economic growth and exports in both the short-term and long-term. To achieve this, the Vector Error Correction Model was utilized. The VECM helped to analyse the dynamics in the short run and the equilibrium relationship in the long run, between the variables in the dataset (Eze, *et al*., 2016).

The model can be illustrated as:

$$\Delta LGDP_t = \beta_0 + \beta_1 \Delta X_{t-1} + \beta_2 IM_{t-1} + \beta_3 XGDP_{t-1} + \varepsilon_t \quad (1)$$

In the above equation, ∆L represents the variation in the natural logarithm of GDP, while β0 is a fixed value. The parameters β1, β2 and β3 correspond to the independent variables, and εt represents the error term. This model estimated the dynamic behaviour of the appropriate variables in this study, resulting in confirmation of the long-run relationship. It overcomes the difficulties of spurious regression using the suitable differenced variables to determine the short-term adjustment in the model (Mah, 2005).

The relation between exports and imports within a country's economy gives insights into trade balances, market competitiveness, and overall economic performance. Imports represent the inflow of goods and services from foreign markets, which can balance domestic production and contribute to satisfying local demand. Understanding how exports and imports interrelate is important for a comprehensive assessment of a country's trade dynamics and their implications for economic development.

3.4.4. Granger Causality Test

Hurlin & Venet's, (2001) a causality test is a method commonly utilized by researchers to evaluate the correlation between economic growth and exports. The test is employed to ascertain if one variable's previous values can be used to project another variable's upcoming values. As per this test, if variable X is said to be beneficial in projecting the values of variable Y, then it Granger-cause variable Y. The estimation of regression of the dependent variable (Y) and the independent variables on all the applicable variable, including the present and past values of X and Y, as well as testing the hypotheses may be identified by the patterns of causality in a simple bivariate

model. The Granger causality test was used in this study to determine the causal relation between exports and economic growth.

The causality between X and Y variables may be determined using the model below:

$$Y_t = b_0 + a_0X_t + \sum^{m}_{j=1} a_jX_{t-j} + \sum^{n}_{i=1} b_iY_{t-i} + u_t \quad (2)$$

$$X_t = c_0 + d_0Y_t + \sum^{n}_{i=1} c_iY_{t-i} + \sum^{m}_{j=1} d_jY_{t-j} + v_t \quad (3)$$

Where:

The error terms of the model are represented by ut and vt. Testing the null hypothesis that aj=dj=o for all j (j=o,1...m), as contrasting to the alternative hypothesis that aj ≠0 and dj ¹ 0 for some js, the direction of the relationship between X and Y can be determined.

3.4.5. Description of the variables used in the model

This study estimated the relationship between two main macroeconomic variables, exports and economic growth. The models used in the study adopted export rate as proxy for exports and GDP as a proxy for economic growth. Quarterly data on both the variables (exports and economic growth) were obtained from the Stat SA and Federal Reserve Bank of St. Louis.

TABLE: 3.1 DESCRIPTION OF VARIABLES

Variables	Description	Expected sign
Exports (X)	Export rate in South Africa from 2000Q1 to 2020Q4	(+ / -)
GDP	GDP in South Africa from 2000Q1 to 2020Q4	(+ / -)

CHAPTER 4:

RESULTS AND DISCUSSION

4.1. Introduction

This chapter presents and discusses the results as per the methodology outlined in chapter 3. The analysis was based on 84 observations of exports and economic growth in South Africa. The data were extracted from StatsSA and the Federal Reserve Bank of St. Louis. The first section outlines and discusses the descriptive statistics of the variables. The succeeding sections present the results in lieu of objectives 2 and 3. Firstly, the stationarity of the time-series data is presented as obtained from the Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests. The second step is the presentation of the cointegration test using the trace statistics and Max-Eigen statistics. The last section demonstrates the results of the Granger Causality Test, showing the direction of causality and the results from the VEC Model.

4.2. Descriptive statistics results

TABLE 4.1: DESCRIPTIVE STATISTICS OF THE EXPORTS AND GDP MEASURED IN PERCENTAGE

Properties	GDP (Y)	Exports (X)
Mean	0.60	2.73
Median	0.62	2.56
Maximum	13.76	33.63
Minimum	17.09	-26.762
Standard deviation	2.50	6.96

Source: Own Computation, 2022

Table 4.1 above illustrates the mean, median, standard deviation, maximum and minimum of the exports and GDP data series. GDP has a minimum value of -17.09 and a maximum value of 13.76 whereas exports have a minimum value of -26.76 and maximum value of 33.63. The average real GDP growth rate was 0.60% with a standard deviation of 2.50. Exports had an average of 2.73% with a standard deviation of 6.96. Observably, the extreme values of all the variables do not come close to the mean, thus displaying a major variation. The relatively low standard deviations confirm

this as well. Thus, it can be concluded that no high magnitude variations in the macroeconomic variable, exports and GDP growth data examined are present.

4.2.1.

4.3. **Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Unit Root Test**

TABLE 4.2: AUGMENTED DICKEY-FULLER (ADF) TEST RESULTS

	Exports(Y)		
	Augmented Dickey-Fuller		
	Levels		
	Intercept	Intercept &Trend	None
ADF statistics	-9.910580	-9.927039	-8.690619
Critical values at 5% Level	-2.896779	-3.464865	-1.944762
	Output/GDP(X)		
	Augmented Dickey-Fuller		
	Levels		
	Intercept	Intercept &Trend	None
ADF statistics	-2.393269	-3.361575	-2.186902
5% Level	-2.897678	-3.465548	-1.944862

	Exports(Y)		
	Augmented Dickey-Fuller		
	First Difference		
	Intercept	Intercept &Trend	None
ADF statistics	-9.433006	-9.386502	-9.500942
Critical values at 5% Level	-2.897678	-3.466248	-1.944862
	Output/GDP(X)		
	Augmented Dickey-Fuller		

	First Difference		
	Intercept	Intercept &Trend	None
ADF statistics	-12.76092	-12.64379	-12.82490
Critical values at 5% Level	-2.897678	-3.466248	-1.944862

Source: Own Computation, 2022

To statistically determine the data's stationarity properties, the ADF unit root test was applied. As part of it, the null hypothesis of unit root is rejected at the 5% significance level if the absolute value of the ADF statistic is greater than the associated critical value. Table 4.2 depicts the results of the three ADF test series conducted as part of the study. The results are not stationary at levels because the ADF statistics for GDP is 3.36, which is lower than the critical value of 3.47, although the results for exports are stationary as the ADF statistics of 9.93 is greater than the critical value of 3.46. As a result, we fail to reject the null hypothesis of non-stationarity unit root at 5% level of significance. The ADF tests were done for all the quarterly exports and GDP series covering the period 2000 to 2020.

The results for both exports and GDP pass the levels and become stationary at the first difference. This is given by the ADF statistics that is 9.38, which is greater than the critical value of 3.47 for exports and ADF statistics of 12.64, which is higher than the critical value of 3.47. Thus, the null hypothesis of non-stationarity unit root test is rejected at 5% level of significance. This means that the Johansen cointegration test can be employed.

Usman (2012) asserts that is it generally a good thing to start the general ADF model that contains the constant and a trend. If a unit root is not rejected based on the general test form, then one should proceed with the tests without time trend and a drift. This usually improves the efficiency and the power of the test. Looking at the results of the exports, it is confirmed that the variables are statistically significant at 5% significance level. However, when observing the results of the GDP, it is evident that the intercept at levels is statistically insignificant based on the ADF absolute statistics at the 5% significance level. Hence, the ADF test continued to be performed with both the time trend and drift, and also without them.

According to Vavra and Goodwin (2005), there is a need for the transformation of non-stationary economic time series data done through differencing or de-trending, otherwise the results will be spurious. The term “spurious regression” was first used by Granger and Newbold (1974) to describe the regression results involving time series data, which look good, that is, the t-values suggest that there is a significant relationship among the tested variables. Spurious regression refers to the regression that tends to accept a false relation or reject a true relation by flawed regression schemes. There are two types of errors that may occur in statistical inference. Type I error refers to the rejection of the true hypothesis, and the type II error refers to the acceptance of a false hypothesis (Chiarella and Gao, 2002). Spurious regressions occur when the mean, variance and covariance of a time series vary with time. The classic results of a usual regression cannot be legitimate, if the non-stationary series of the data is used for analysis (Nazir and Qayyum, 2014).

4.3.1. The table below indicates the results for Phillips Perron test

TABLE 4.3: PHILLIPS PERRON (PP) TEST RESULTS

	Exports(Y)		
	Phillips Peron		
	Levels		
	Intercept	Intercept &Trend	None
PP statistics	-9.943220	-10.04986	-8.718024
Critical values at 5% Level	-2.896779	-3.464865	-1.944762
	Output/GDP(X)		
	Phillips Peron		
	Levels		
	Intercept	Intercept &Trend	None
	-13.83823	-19.06682	-12.12252
Critical values at 5% Level	-2.896779	-3.464865	-1.944762

	Exports(Y)
	Phillips Peron
	First difference

	Intercept	Intercept &Trend	None
PP statistics	-32.83414	-33.67380	-33.20630
Critical values at 5% Level	-2.897223	-3.465548	-1.944811
	Output/GDP(X)		
	First difference		
	Levels		
	Intercept	Intercept &Trend	None
PP statistics	-33.09515	-31.87053	-33.57023
Critical values at 5% Level	-2.585861	-3.465548	-1.944811

Own computation, 2022

Table 4.3 above presents the results for the Phillips-Perron unit root tests of the variables. These tests were performed to check the robustness of the results concerning exports and the GDP growth at levels and first difference.

Phillips-Perron tests revealed the high PP statistics value, both at the levels and first difference for all the variables. Exports had 9.94 PP statistics greater than the critical value of 2.90 at levels and 32.83 PP statistics greater than the critical value of 2.90 at the first difference. The GDP growth had 13.84 PP statistics greater than the critical value of 2.90 at levels and 33.10 PP statistics greater than the critical value of 2.59 at the first difference. This implies that the null hypothesis of the non-stationarity can be rejected at any conventional critical values. Exports and GDP growth results are stationary at the levels and at first, differenced as the PP statistics is greater than the critical value at 5%.

The Phillips Perron (1988) test determines whether a variable has a unit root. The null hypothesis is that the variable contains a unit root, and the alternative is that the variable is generated by a stationary process. A great advantage of the Phillips Perron test is that it is non-parametric, that is, it does not require selecting the level of serial correction as in ADF. It rather takes the same estimation scheme as in ADF test, but corrects the statistic to conduct auto corrections and heteroscedasticity. Phillips Perron is used to test for the null hypothesis of a unit root of a univariate time series (Perron, 1988).

4.4. Johansen Cointegration Tests

Johansen cointegration test was used to provide the number of co-integrating equations and enabled the researcher to impose theory-based restrictions. When there is cointegration, it means variables share the same trend and the long run equilibrium as suggested theoretically. The cointegration results are analysed by the trace test and the maximum eigenvalue test in tables 4.4 and 4.5 below.

4.4.1.

TABLE 4.4: RESULT OF THE COINTEGRATION TEST USING TRACE STATISTICS

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 critical value	Prob.**
None *	0.285626	39.40114	29.79707	0.0029
At most 1	0.136230	12.15694	15.49471	0.0094

Own computation, 2022

This study went further to find the existence of a long run relationship between the variables using the Johansen Cointegration test. Table 4.4 above presents the results of the cointegration test using trace statistics of the variables and depicts that the trace test shows that the co-integrated equation exists at 5% level of significance. The decision rule states that the null hypothesis is rejected where there is no cointegration between the variables. The Johansen cointegration test results provide evidence that the two variables are cointegrated. The trace test indicates that there is one cointegration relationship between the two variables at 5% level of significance. In the test, when testing the null hypothesis that the rank is 0, the p-value for the trace statistic is less than 5%. As such, we reject that null hypothesis and assume the existence of at least one cointegration relationship in the system.

Cointegration is a method used to establish whether there exists a linear long-run economic relationship among the variables (Johansen, 1991). Cointegration also helps in pointing out whether there exists disequilibrium in various variables (Pesaran and Shin, 2001). Further, cointegration allows us to specify a process of dynamic adjustment among the co-integrated variables (Johansen, 1991). The cointegration test using trace statistics was conducted to establish the number of possible cointegrating equations.

4.4.2. The table below indicates the results for the Cointegration test using Max-Eigen statistics

TABLE 4.5: RESULT OF THE COINTEGRATION TEST USING MAX-EIGEN STATISTICS

Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen statistics	0.05 critical value	Prob.**
None *	0.285626	27.24419	21.13162	0.0061
At most 1	0.136230	11.86234	14.26460	0.0091

Own computation, 2022

Table 4.5 presents the results of the cointegration test using maximum Eigen value statistics of the variables and depicts that the maximum Eigen value test reflects that a cointegrated equation exists at a 5% level of significance. The Johansen cointegration test results provide evidence that the two variables are cointegrated. The Max-Eigen statistics test indicates that there is one cointegration relationship among the two variables at 5% level of significance. In the test, when testing the null hypothesis, the rank is 0, the p-value for the trace statistic is less than 5%, meaning that the null hypothesis is rejected. There is a long-run relationship between the variables based on the results of cointegration using the trace and eigenvalues. The results imply that the Vector Error Correction Model (VECM) can now be used.

Using the maximum likelihood technique, this method estimates the number of co-integrating relations between non-stationary variables integrated of the same order. Because there is a co-integrating equation at 5% significance levels, the series can be merged linearly, and there is a long-run and short-run relationship between exports and economic growth. The existence of a co-integrating equation implies that, even if there are short-run shocks that affect the movement of the individual series, they will converge with time in the long run.

As supported by the literature, the results above agree with a study done by Kalaitzi (2013) who examined the validity of the export-led growth (ELG) hypothesis in the United Arab Emirates (UAE) over the period 1975–2013, using a neoclassical production function augmented with merchandise exports and imports of goods and services. The study applies the Johansen cointegration technique regression to confirm the existence of a long-run relationship between exports and economic

growth. The Johansen test results confirmed the existence of a long-run relationship between exports and economic growth.

4.5. The VECM results

Once the existence of the cointegration between variables is confirmed, the third step is to develop the error correction mechanism to model the dynamic relationship. This model's purpose is to indicate the rate of adjustment from the short run equilibrium state to the long run equilibrium state.

TABLE 4.6: RESULTS OF VECTOR ERROR CORRECTION MODEL

Error Correction:	D(LGDP)	D(X)
CointEq1	0.148984	1.975552
	(0.15675)	(0.44731)
	[0.95047]	[4.41655]
D (GDP(-1))	-1.786487	-3.690879
	(0.19536)	(0.55750)
	[-9.14452]	[-6.62044]
D(X(-1))	0.114044	0.350965
	(0.07531)	(0.21490)
	[1.51441]	[1.63316]
	(45.4177)	(129.607)
	[1.51512]	[1.08568]
R-squared	0.715669	0.624601
Adj. R-squared	0.688404	0.588604

Own computation, 2022

The table above displays the error correction term (ECT), which has a positive coefficient and is not statistically significant at 5% level. The value of the ECT is 0.148984, which indicates that the link among the variables is in line with research's

prior expectations and that the stability condition is met. This suggests that in the long run, the system will return to equilibrium rather than the short run, and any short-run imbalances will be corrected in the long run. The current period adjusts for the previous period's deviation from short-run equilibrium at a speed of 14.9%. The positive sign and the value of the ECT, along with its t-statistical value of 0.95047, suggest a significant impact of economic growth on exports in South Africa. The value of the R-squared (R2) is 0.715669, demonstrating that 71.6% of the difference in real GDP is denoted by the explanatory variables, while the remaining 28.4% is attributable to the effects of other variables not included in the model. However, in the short run, a 1% change in LGDP leads to a 0.1140% rise in the change in X, holding other factors constant.

The p-values for GDP and exports of 0.17 and 0.45, respectively, which are in the parentheses, are insignificant at 5% significance level. High adjusted R^2 which range from 62.46 to 71.56% in all the models indicates a good prediction power of the models as the explanatory variables account for a larger proportion of the variation of economic growth. The short run dynamics of the models were then analysed using the VECM, which gave the following results:

The results agree with a paper written by Bonga, Shenje and Sithole (2015) which empirically examined the export-led growth paradigm for Zimbabwe using historical data from 1975 to 2013. The study used unit root tests, cointegration analysis, Granger causality tests, vector auto regression (VAR), Vector Error Correction Model (VECM). There is no strong evidence for short-run causality running from export growth to economic growth. However, the use of VEC model reveals that a long-run relationship exists between exports and non-export GDP, thereby supporting an export-led growth.

4.6. Granger causality test

Identifying the nature of the relationship between the model's variables necessitates the identification of any potential causal links between them. To determine this, the Granger causality test was used in the study. It allows for the statistical detection of cause-and-effect interactions between system variables. The results are shown in Table 4.7 below.

Having found a unique co-integrating relation among the variables, Granger causality can be conducted to establish the direction of causality. Following Engle and Granger (1987), an ECM representation was used for this purpose.

TABLE 4.7: RESULTS OF THE GRANGER CAUSALITY TEST

Null hypothesis	Obs	Lags	F-Statistic	Prob.
X does not Granger Cause GDP	82	2	0.43265	0.6504
GDP does not Granger Cause X			5.50066	0.0058

Own computation, 2022

Table 4.7 above indicates that the null hypothesis proposing that exports do not granger cause GDP is accepted at 5% significance level; however, the null hypothesis proposing that GDP does not granger cause export is rejected at 5% significance level. This implies that GDP predicts exports in South Africa. These results provide the evidence of uni-directional causality between export and GDP. This implies that export growth may cause the growth of economy in the country. This also denotes that over the long run, changes in exports align with changes in GDP.

The Granger Causality test is in contradiction with a study done by Jordaan and Eita (2009) which examined the cause-and-effect relationship between the expansion of the economy and exports in Botswana during the period covering from 1996 to 2007. The results showed a bidirectional causal relationship between exports and economic growth, wherein the results from this study revealed a uni-directional causality between exports and GDP.

4.7. CHAPTER SUMMARY

In this chapter, the researcher used Eviews 9.0 to perform and present the estimated results in both tabular form and used Microsoft excel for the graphical results. The study used quarterly time series data from 2000 to 2020 to estimate the Johansen Cointegration test, the Granger Causality Model and Coefficient of the Error Correction Model.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. INTRODUCTION

This chapter summarises the study's findings as well as the extent to which the objectives and hypotheses outlined in the first chapter have been addressed, and it concludes with the recommendations based on the findings.

5.2. SUMMARY

The aim of the study was to analyse the relationship between exports and economic growth in South Africa from 2000 to 2021. The first objective was to examine the contribution of exports to economic growth in South Africa. The second objective was to determine both the short-run and long-run relationship between exports and economic growth. The last objective was to examine the direction of the causal relation between exports and economic growth. The hypotheses of the study were that (i) exports do not contribute to economic growth in South Africa; (ii) There is no short-run and long-run relationship between exports and economic growth; and lastly, (iii) There is no causal relation between exports and economic growth. The study period was 21 years.

In chapter two, the theoretical and empirical literature was reviewed, and key terms were defined, described, and discussed in the second section of the chapter. In the final section of the chapter, findings from related studies were presented along with a thorough explanation of the studies.

Secondary time series data from StatsSA and the South African Reserve Bank were utilised to achieve the objectives of the study. The data were quarterly, with 84 observations from 2000 to 2020. The Augmented Dickey Fuller and Phillips Perron tests of the unit root test were used to check the stationarity of the results. The studied data were applied to the Johansen Cointegration Test to examine the contribution of exports to economic growth in South Africa. The studied data were also applied to the Vector Error Correction Model (VECM) to determine both the short-run and long-run relationships between. The Granger causality test was used to examine the direction of the causal relationship between exports and economic growth.

By examining the relationship between exports and economic growth, the study results attempted to fill a gap by determining the economic linkages that underpin the growth process of developing economies, with a particular focus on South Africa's specific situation. The following are the study's key findings:

The ADF results at levels were not stationary and failed to reject the null hypothesis, because GDP results were not stationary while results for exports were found to be stationary at 5 % significance level. The results are not stationary at levels because the ADF statistics for GDP is 3.36, which is lower than the critical value of 3.47, although the results for exports are stationary, as the ADF statistics of 9.93 is greater than the critical value of 3.46. As a result, we fail to reject the null hypothesis of non-stationarity unit root at 5% level of significance. The results for both exports and GDP pass the levels and become stationary at the first difference. Therefore, the null hypothesis of the non-stationarity unit root test is rejected at 5% level of significance.

Phillips-Perron tests revealed the high PP statistics value both at the levels and first difference for all the variables. This implies that the null hypothesis of the non-stationarity can be rejected at any conventional critical values. Exports and GDP growth results are stationary at the levels and at first differenced, as the PP statistics is greater than the critical value at 5%.

The cointegration test results using trace statistics and Max-Eigen for both exports and GDP found that the null hypothesis is rejected at these two co-integrating variables at 5% level of significance. The Johansen cointegration test results provide evidence that the two variables are cointegrated. In both the tests, when testing the null hypothesis, the rank is 0, the p-value for the trace statistic is less than 5%, meaning that the null hypothesis is rejected.

The VECM results found 0.148984 as its value which implies that there is a long run and short run relationship between the exports and economic growth. The results also showed the value of R-squared (R^2) as 0.715669. This indicates that 71.6% of the real GDP entails explanatory variables, while the remaining 28.4% of the variations is attributed to the effects of other variables not included in the model.

The Granger causality test results found that the null hypothesis proposing that exports do not granger cause GDP is accepted at a 5% significance level; however, the null hypothesis proposing that GDP does not granger cause exports is rejected at a 5%

significance level. This means that a change in the export rate does not cause a change in GDP growth. However, a change in GDP growth does cause a change in the export rate. Therefore, it can be concluded that a change in the export rates can be a predictive variable of the change in the actual GDP growth.

5.3. CONCLUSION

The main aim of the study was to investigate the connection among economic growth and exports in South Africa, with GDP serving as a substitute for economic growth and exports denoted by X.

The study utilized empirical methods to explore the characteristics of time series variables, using ADF and PP unit root stationarity tests due to the nature of the variables analysed. The initial analysis showed that both variables had unit roots and were non-stationary. However, after applying the first differencing, both series became stationary, enabling the use of cointegration approaches. The Johansen cointegration procedure was employed with the goal of examining the long-term links among the variables, and the results demonstrated that the variables have some sort of relationship.

The study presented three hypotheses. The first one stated that exports do not contribute to the development of the South African economy, which was refuted based on the cointegration test using both the trace and Max-Eigen statistics. The second hypothesis was that there is no short-run and long-run relationship between exports and economic growth, which was rejected as evidence that a long-run relationship exists among variables, but no short-run relationship. The last hypothesis stated that there is no causal relationship between exports and economic growth, which was accepted based on the F-statistics of 0.43 being greater than the critical value of 0.05.

5.4. RECOMMENDATIONS

The study’s findings have generated the following recommendations. The South African government needs to restructure its spending to align it with its macroeconomic growth objectives.

1. The government's proposed export promotion policy seems to be on the right track. These initiatives should aim to increase South Africa's exports and competitiveness. As a result, strategic trade agreements with various partners need to focus on ensuring that South Africa increases its export share in various markets while preserving the ability to use tariff policy. To export high-tech manufactured goods, South Africa should move up the 65 ladder of traditional comparative advantage. This requires government intervention to support the industrial sector through measures such as encouraging the provision of information and communication technology, education, and skill development, among other things.
2. The government intends to use trade policies to stimulate economic growth by expanding export production, creating jobs, and reducing poverty. Considering this goal, it is preferable to broaden liberalisation in the service sector and other manufactured sectors, where nominal and effective rates of protection remain high. In other words, there is room for further trade liberalisation; this could include implementing a broad tariff reform strategy in which the government commits to further simplification and tariff rate reductions. This is due to the fact that tariff liberalisation can benefit the economy through dynamic gains such as productivity, export performance, and diversification.
3. In terms of private investments, the findings of this study suggest ways to promote a positive relationship between investments and a country's economic growth. As a result, the South African government needs to devote significant resources to stimulating local markets to widen South African exports, cutting government spending, and attracting investment into the country to boost economic growth. The findings of this study will help the government and policymakers steer their focus toward policies that are more directed toward encouraging exports and promoting economic growth. The study will also be useful to the government, policymakers, economists, researchers, and academics in general.
4. Other government policy approaches that could assist in improving exports include the provision of adequate infrastructure (both physical and institutional), education (investment in technical education and training), a competitive

exchange rate, a tax credit for R&D investment, a reduction in anti-export bias, and the implementation of international trade shows.

5. The policy implications of the positive relationship between exports and economic growth show that economic reform policies and the transition to a free market have assisted the economy in redistributing its resources to productive uses. However, a number of issues must be addressed, including further trade liberalisation, tariff revisions, non-tariff barriers, exchange rate policies, and the development of an efficient service infrastructure.

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APPENDICES

APPENDIX A: DATA COLLECTED FOR THE STUDY

	GDP	EXPORTS
2000Q1	1,2	10,8841
2000Q2	0,9	2,07158
2000Q3	1,0	3,46306
2000Q4	0,9	14,00565
2001Q1	0,6	1,74552
2001Q2	0,5	5,79529
2001Q3	0,3	-5,74227
2001Q4	0,8	12,63311
2002Q1	1,1	14,71408
2002Q1	1,3	2,58018
2002Q3	1,1	-1,68122
2002Q4	0,8	3,92009
2003Q1	0,6	-7,12231
2003Q2	0,5	-5,04827
2003Q3	0,5	2,54973
2003Q4	0,6	-3,3859
2004Q1	1,5	2,0722
2004Q2	1,4	5,61313
2004Q3	1,6	1,54864
2004Q4	1,1	4,13426
2005Q1	1,0	-2,67396
2005Q2	1,8	14,89235
2005Q3	1,4	1,70155
2005Q4	0,7	1,44353
2006Q1	1,8	1,23833
2006Q2	1,4	11,21807
2006Q3	1,4	10,97624
2006Q4	1,4	5,43267
2007Q1	1,6	7,53565

2007Q2	0,8	-1,54331
2007Q3	1,2	1,015
2007Q4	1,4	8,47328
2008Q1	0,4	10,21569
2008Q2	1,2	11,08692
2008Q3	0,2	3,8688
2008Q4	-0,6	-3,19229
2009Q1	-1,6	-13,35987
2009Q2	-0,3	-9,50053
2009Q3	0,2	-0,41989
2009Q4	0,7	4,95379
2010Q1	1,2	4,56385
2010Q2	0,8	7,4915
2010Q3	0,9	1,33535
2010Q4	0,9	2,58258
2011Q1	1,0	3,68488
2011Q2	0,6	5,42267
2011Q3	0,4	5,19205
2011Q4	0,7	4,55461
2012Q1	0,6	-2,57858
2012Q2	0,8	0,90291
2012Q3	0,4	-2,43216
2012Q4	0,5	4,19545
2013Q1	0,8	5,80598
2013Q2	0,7	4,16023
2013Q3	0,5	2,27199
2013Q4	0,5	2,67622
2014Q1	-0,1	5,04325
2014Q2	0,4	-3,88062
2014Q3	0,5	4,75452
2014Q4	0,7	1,72186
2015Q1	0,7	-1,60113

2015Q2	-0,8	1,66728
2015Q3	0,5	-0,37957
2015Q4	0,4	0,58654
2016Q1	0,2	6,49536
2016Q2	0,1	6,5366
2016Q3	0,0	-5,17677
2016Q4	0,1	-0,43321
2017Q1	0,5	2,61218
2017Q2	0,5	2,23662
2017Q3	0,2	-0,95921
2017Q4	0,4	4,87904
2018Q1	0,4	-3,09099
2018Q2	-0,2	2,20863
2018Q3	1,3	6,62993
2018Q4	0,4	2,31486
2019Q1	-0,9	-4,21908
2019Q2	0,4	3,21853
2019Q3	0,1	0,03743
2019Q4	0,0	1,60751
2020Q1	0,0	4,44888
2020Q2	-17,1	-26,7626
2020Q3	13,8	33,62903
2020Q4	2,7	6,91571

APPENDIX B: RESULTS OF THE DESCRIPTIVE STATISTICS

Sample: 2000Q1 2020Q4

	GDP	X	T
Mean	0.603876	2.725985	733908.1
Median	0.624645	2.564955	733907.5
Maximum	13.76497	33.62903	737698.0
Minimum	-17.09418	-26.76260	730119.0
Std. Dev.	2.502913	6.955909	2227.320
Skewness	-2.523684	0.098096	2.73E-05
Kurtosis	39.82406	9.822567	1.799611
Jarque-Bera	4835.206	163.0507	5.043267

Probability	0.000000	0.000000	0.080328
Sum	50.72562	228.9828	61648278
Sum Sq. Dev.	519.9596	4015.927	4.12E+08
Observations	84	84	84

APPENDIX C: RESULTS OF AUGMENTED DICKEY FULLER TEST FOR GDP

LEVEL INTERCEPT

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.393269	0.1468
Test critical values:	1% level	-3.513344	
	5% level	-2.897678	
	10% level	-2.586103	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/06/22 Time: 16:15
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-1.016210	0.424612	-2.393269	0.0191
D(GDP(-1))	-0.566218	0.423372	-1.337402	0.1850
D(GDP(-2))	-1.076275	0.458744	-2.346134	0.0215
C	0.444545	0.367078	1.211037	0.2296

R-squared	0.716880	Mean dependent var	0.021069
Adjusted R-squared	0.705849	S.D. dependent var	4.171293
S.E. of regression	2.262330	Akaike info criterion	4.518789
Sum squared resid	394.0965	Schwarz criterion	4.637034
Log likelihood	-179.0110	Hannan-Quinn criter.	4.566230
F-statistic	64.98969	Durbin-Watson stat	2.006653
Prob(F-statistic)	0.000000		

1 DIFFERENCE INTERCEPT

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.76092	0.0001
Test critical values:	1% level	-3.513344	
	5% level	-2.897678	

	10% level	-2.586103

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 09/06/22 Time: 16:17
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-4.550970	0.356633	-12.76092	0.0000
D(GDP(-1),2)	2.012446	0.246808	8.153884	0.0000
C	-0.188697	0.262031	-0.720132	0.4736

R-squared	0.904090	Mean dependent var	-0.137511
Adjusted R-squared	0.901630	S.D. dependent var	7.428542
S.E. of regression	2.329883	Akaike info criterion	4.565847
Sum squared resid	423.4118	Schwarz criterion	4.654531
Log likelihood	-181.9168	Hannan-Quinn criter.	4.601428
F-statistic	367.6294	Durbin-Watson stat	2.125345
Prob(F-statistic)	0.000000		

LEVEL INTECENT AND TREND
Null Hypothesis: GDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.361575	0.0000
Test critical values:	1% level	-4.073859	
	5% level	-3.465548	
	10% level	-3.159372	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/06/22 Time: 16:20
Sample (adjusted): 2000Q3 2020Q4
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-2.251698	0.240526	-9.361575	0.0000
D(GDP(-1))	0.607439	0.152162	3.992060	0.0001
C	2.903609	0.601925	4.823869	0.0000
@TREND("2000Q1")	-0.039729	0.011496	-3.455946	0.0009

R-squared	0.736472	Mean dependent var	0.021670
Adjusted R-squared	0.726337	S.D. dependent var	4.145468
S.E. of regression	2.168613	Akaike info criterion	4.433603
Sum squared resid	366.8247	Schwarz criterion	4.551004

Log likelihood	-177.7777	Hannan-Quinn criter.	4.480738
F-statistic	72.66132	Durbin-Watson stat	1.952328
Prob(F-statistic)	0.000000		

1ST DIFFERENCE INTECENT AND TREND

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.64379	0.0000
Test critical values:	1% level	-4.075340	
	5% level	-3.466248	
	10% level	-3.159780	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 09/06/22 Time: 16:21
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-4.620371	0.365426	-12.64379	0.0000
D(GDP(-1),2)	2.064454	0.253875	8.131762	0.0000
C	0.241534	0.547953	0.440793	0.6606
@TREND("2000Q1")	-0.010214	0.011421	-0.894347	0.3739

R-squared	0.905076	Mean dependent var	-0.137511
Adjusted R-squared	0.901377	S.D. dependent var	7.428542
S.E. of regression	2.332878	Akaike info criterion	4.580204
Sum squared resid	419.0588	Schwarz criterion	4.698449
Log likelihood	-181.4983	Hannan-Quinn criter.	4.627646
F-statistic	244.7240	Durbin-Watson stat	2.134974
Prob(F-statistic)	0.000000		

NONE LEVEL

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.186902	0.0285
Test critical values:	1% level	-2.593824	
	5% level	-1.944862	
	10% level	-1.614145	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/06/22 Time: 16:23
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.645555	0.295192	-2.186902	0.0317
D(GDP(-1))	-0.931397	0.298067	-3.124789	0.0025
D(GDP(-2))	-1.447824	0.342073	-4.232504	0.0001

R-squared	0.711487	Mean dependent var	0.021069
Adjusted R-squared	0.704089	S.D. dependent var	4.171293
S.E. of regression	2.269087	Akaike info criterion	4.512966
Sum squared resid	401.6028	Schwarz criterion	4.601649
Log likelihood	-179.7751	Hannan-Quinn criter.	4.548546
Durbin-Watson stat	2.044042		

1ST DIFFERENCE NONE

Null Hypothesis: D(GDP) has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.82490	0.0000
Test critical values:	1% level	-2.593824	
	5% level	-1.944862	
	10% level	-1.614145	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 09/06/22 Time: 16:23
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-4.515076	0.352056	-12.82490	0.0000
D(GDP(-1),2)	1.985862	0.243287	8.162622	0.0000

R-squared	0.903452	Mean dependent var	-0.137511
Adjusted R-squared	0.902230	S.D. dependent var	7.428542
S.E. of regression	2.322774	Akaike info criterion	4.547783
Sum squared resid	426.2269	Schwarz criterion	4.606905
Log likelihood	-182.1852	Hannan-Quinn criter.	4.571503
Durbin-Watson stat	2.119039		

RESULTS OF ADF FOR EXPORTS

LEVEL INTERCEPT

Null Hypothesis: X has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.910580	0.0000
Test critical values:	1% level	-3.511262	
	5% level	-2.896779	
	10% level	-2.585626	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(X)
Method: Least Squares
Date: 09/06/22 Time: 16:33
Sample (adjusted): 2000Q2 2020Q4
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X(-1)	-1.089844	0.109968	-9.910580	0.0000
C	2.868073	0.817978	3.506297	0.0007

R-squared	0.548041	Mean dependent var	-0.047812
Adjusted R-squared	0.542461	S.D. dependent var	10.27972
S.E. of regression	6.953370	Akaike info criterion	6.740131
Sum squared resid	3916.298	Schwarz criterion	6.798417
Log likelihood	-277.7154	Hannan-Quinn criter.	6.763547
F-statistic	98.21960	Durbin-Watson stat	1.991400
Prob(F-statistic)	0.000000		

1ST DIFFERENCE INTERCEPT

Null Hypothesis: D(X) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.433006	0.0000
Test critical values:	1% level	-3.513344	
	5% level	-2.897678	
	10% level	-2.586103	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(X,2)
Method: Least Squares
Date: 09/06/22 Time: 16:38
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(X(-1))	-2.146983	0.227603	-9.433006	0.0000
D(X(-1),2)	0.389899	0.148829	2.619788	0.0106
C	0.156369	0.915099	0.170876	0.8648

R-squared	0.796714	Mean dependent var	-0.346973
Adjusted R-squared	0.791502	S.D. dependent var	17.99975
S.E. of regression	8.218979	Akaike info criterion	7.087103
Sum squared resid	5269.026	Schwarz criterion	7.175786
Log likelihood	-284.0277	Hannan-Quinn criter.	7.122684
F-statistic	152.8481	Durbin-Watson stat	2.064344
Prob(F-statistic)	0.000000		

LEVEL INTERCEPT AND TREND

Null Hypothesis: X has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.927039	0.0000
Test critical values:	1% level	-4.072415	
	5% level	-3.464865	
	10% level	-3.158974	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(X)
Method: Least Squares
Date: 09/06/22 Time: 16:41
Sample (adjusted): 2000Q2 2020Q4
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X(-1)	-1.101481	0.110958	-9.927039	0.0000
C	4.066972	1.610039	2.526009	0.0135
@TREND("2000Q1")	-0.027804	0.032143	-0.864994	0.3896

R-squared	0.552228	Mean dependent var	-0.047812
Adjusted R-squared	0.541034	S.D. dependent var	10.27972
S.E. of regression	6.964202	Akaike info criterion	6.754918
Sum squared resid	3880.009	Schwarz criterion	6.842346
Log likelihood	-277.3291	Hannan-Quinn criter.	6.790042
F-statistic	49.33125	Durbin-Watson stat	1.986232
Prob(F-statistic)	0.000000		

1ST DIFFERENCE TREND AND INTERCEPT

Null Hypothesis: D(X) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.386502	0.0000
Test critical values:	1% level	-4.075340	

	5% level	-3.466248
	10% level	-3.159780

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(X,2)
Method: Least Squares
Date: 09/06/22 Time: 16:41
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(X(-1))	-2.147029	0.228736	-9.386502	0.0000
D(X(-1),2)	0.387781	0.149634	2.591525	0.0114
C	-0.652634	1.922799	-0.339419	0.7352
@TREND("2000Q1")	0.018857	0.039359	0.479094	0.6332

R-squared	0.797318	Mean dependent var	-0.346973
Adjusted R-squared	0.789422	S.D. dependent var	17.99975
S.E. of regression	8.259875	Akaike info criterion	7.108818
Sum squared resid	5253.366	Schwarz criterion	7.227062
Log likelihood	-283.9071	Hannan-Quinn criter.	7.156259
F-statistic	100.9687	Durbin-Watson stat	2.064560
Prob(F-statistic)	0.000000		

LEVEL NONE

Null Hypothesis: X has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.690619	0.0000
Test critical values:	1% level	-2.593121	
	5% level	-1.944762	
	10% level	-1.614204	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(X)
Method: Least Squares
Date: 09/06/22 Time: 16:42
Sample (adjusted): 2000Q2 2020Q4
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X(-1)	-0.951154	0.109446	-8.690619	0.0000

R-squared	0.479442	Mean dependent var	-0.047812
Adjusted R-squared	0.479442	S.D. dependent var	10.27972
S.E. of regression	7.416783	Akaike info criterion	6.857343
Sum squared resid	4510.711	Schwarz criterion	6.886485
Log likelihood	-283.5797	Hannan-Quinn criter.	6.869051
Durbin-Watson stat	2.010855		

1ST DIFFERENCE

Null Hypothesis: D(X) has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.500942	0.0000
Test critical values:	1% level	-2.593824	
	5% level	-1.944862	
	10% level	-1.614145	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(X,2)
Method: Least Squares
Date: 09/06/22 Time: 16:43
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(X(-1))	-2.148150	0.226099	-9.500942	0.0000
D(X(-1),2)	0.391182	0.147723	2.648081	0.0098

R-squared	0.796638	Mean dependent var	-0.346973
Adjusted R-squared	0.794064	S.D. dependent var	17.99975
S.E. of regression	8.168323	Akaike info criterion	7.062786
Sum squared resid	5270.998	Schwarz criterion	7.121908
Log likelihood	-284.0428	Hannan-Quinn criter.	7.086506
Durbin-Watson stat	2.064502		

APPENDIX C: RESULTS OF PHILLIPS PERRON FOR GDP

LEVEL INTERECEPT

Null Hypothesis: GDP has a unit root
Exogenous: Constant
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-13.83823	0.0001
Test critical values:	1% level	-3.511262	
	5% level	-2.896779	
	10% level	-2.585626	

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

Residual variance (no correction)	5.516510
HAC corrected variance (Bartlett kernel)	3.847216

Phillips-Perron Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/06/22 Time: 16:25
Sample (adjusted): 2000Q2 2020Q4
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-1.346139	0.104714	-12.85542	0.0000
C	0.797366	0.267912	2.976227	0.0038

R-squared	0.671082	Mean dependent var	0.018411
Adjusted R-squared	0.667021	S.D. dependent var	4.120220
S.E. of regression	2.377545	Akaike info criterion	4.593815
Sum squared resid	457.8704	Schwarz criterion	4.652101
Log likelihood	-188.6433	Hannan-Quinn criter.	4.617231
F-statistic	165.2619	Durbin-Watson stat	2.045898
Prob(F-statistic)	0.000000		

1ST DIFFERENCE

Exogenous: Constant
Bandwidth: 19 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-33.09515	0.0001
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

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

Residual variance (no correction)	9.565538
HAC corrected variance (Bartlett kernel)	2.399151

Phillips-Perron Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 09/06/22 Time: 16:26
Sample (adjusted): 2000Q3 2020Q4
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.692328	0.087946	-19.24270	0.0000
C	0.128020	0.346052	0.369943	0.7124

R-squared	0.822333	Mean dependent var	-0.131941
Adjusted R-squared	0.820113	S.D. dependent var	7.382717
S.E. of regression	3.131242	Akaike info criterion	5.144824
Sum squared resid	784.3741	Schwarz criterion	5.203525
Log likelihood	-208.9378	Hannan-Quinn criter.	5.168392
F-statistic	370.2816	Durbin-Watson stat	2.184936
Prob(F-statistic)	0.000000		

LEVEL TREND AND INTERCEPT

Null Hypothesis: GDP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-19.06682	0.0000
Test critical values:	1% level	-4.072415	
	5% level	-3.464865	
	10% level	-3.158974	

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

Residual variance (no correction)	5.323160
HAC corrected variance (Bartlett kernel)	1.473771

Phillips-Perron Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/06/22 Time: 16:30
Sample (adjusted): 2000Q2 2020Q4
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-1.372249	0.104630	-13.11521	0.0000
C	1.591713	0.535979	2.969728	0.0039
@TREND("2000Q1")	-0.018553	0.010884	-1.704642	0.0921

R-squared	0.682610	Mean dependent var	0.018411
Adjusted R-squared	0.674676	S.D. dependent var	4.120220
S.E. of regression	2.350059	Akaike info criterion	4.582233
Sum squared resid	441.8222	Schwarz criterion	4.669661
Log likelihood	-187.1627	Hannan-Quinn criter.	4.617357
F-statistic	86.02801	Durbin-Watson stat	2.071021
Prob(F-statistic)	0.000000		

1ST DIFFERENCE TREND AND INTERCEPT

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-31.87053	0.0001
Test critical values:	1% level	-4.073859	
	5% level	-3.465548	
	10% level	-3.159372	

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

Residual variance (no correction)	9.499766
HAC corrected variance (Bartlett kernel)	2.575785

Phillips-Perron Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 09/06/22 Time: 16:31
Sample (adjusted): 2000Q3 2020Q4
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.697228	0.088445	-19.18962	0.0000
C	-0.333013	0.713470	-0.466751	0.6420
@TREND("2000Q1")	0.010866	0.014692	0.739566	0.4618

R-squared	0.823555	Mean dependent var	-0.131941
Adjusted R-squared	0.819088	S.D. dependent var	7.382717
S.E. of regression	3.140146	Akaike info criterion	5.162315
Sum squared resid	778.9808	Schwarz criterion	5.250366
Log likelihood	-208.6549	Hannan-Quinn criter.	5.197666
F-statistic	184.3658	Durbin-Watson stat	2.186886
Prob(F-statistic)	0.000000		

APPENDIX D: RESULTS OF THE JOHANSEN COINTEGRATION TEST USING BOTH THE TRACE AND MAX-EIGEN STATISTICS

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.285626	39.40114	29.79707	0.0029
At most 1	0.136230	12.15694	15.49471	0.0094

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.285626	27.24419	21.13162	0.0061
At most 1	0.136230	11.86234	14.26460	0.0091

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

APPENDIX E: RESULTS OF THE VECTOR ERROR CORRECTION MODEL (VECM)

Vector Error Correction Estimates
Date: 08/29/22 Time: 16:30
Sample (adjusted): 2000Q4 2020Q4
Included observations: 81 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
GDP(-1)	1.000000
X(-1)	-0.574951 (0.09315) [-6.17222]
T(-1)	-7.54E-05 (0.00015) [-0.49138]
C	56.26572

Error Correction:	D(GDP)	D(X)	D(T)
CointEq1	0.148984 (0.15675) [0.95047]	1.975552 (0.44731) [4.41655]	-0.047467 (0.02956) [-1.60582]
D(GDP(-1))	-1.786487 (0.19536) [-9.14452]	-3.690879 (0.55750) [-6.62044]	0.001793 (0.03684) [0.04866]
D(GDP(-2))	-2.250908 (0.28752) [-7.82872]	-4.649595 (0.82049) [-5.66689]	0.035780 (0.05422) [0.65991]
D(X(-1))	0.114044 (0.07531) [1.51441]	0.350965 (0.21490) [1.63316]	-0.003388 (0.01420) [-0.23859]
D(X(-2))	0.084941 (0.05707) [1.48849]	0.262317 (0.16285) [1.61083]	-0.025268 (0.01076) [-2.34802]
D(T(-1))	-0.441576 (0.34296) [-1.28756]	-0.552358 (0.97869) [-0.56439]	-0.083908 (0.06467) [-1.29740]
D(T(-2))	-0.314335 (0.34335) [-0.91551]	-0.993469 (0.97980) [-1.01395]	-0.825265 (0.06475) [-12.7460]
C	68.81315 (45.4177) [1.51512]	140.7121 (129.607) [1.08568]	174.3337 (8.56473) [20.3548]
R-squared	0.715669	0.624601	0.704654
Adj. R-squared	0.688404	0.588604	0.676333
Sum sq. resids	395.7816	3223.023	14.07452
S.E. equation	2.328447	6.644622	0.439092
F-statistic	26.24900	17.35141	24.88109
Log likelihood	-179.1838	-264.1209	-44.05565
Akaike AIC	4.621821	6.719034	1.285325
Schwarz SC	4.858310	6.955523	1.521814
Mean dependent	0.021069	0.042625	91.32099

S.D. dependent	4.171293	10.35954	0.771802

Determinant resid covariance (dof adj.)	24.12089
Determinant resid covariance	17.65659
Log likelihood	-461.0820
Akaike information criterion	12.05141
Schwarz criterion	12.84956

APPENDIX F: RESULTS OF THE GRANGER CAUSALITY TEST

Pairwise Granger Causality Tests
Date: 08/29/22 Time: 16:28
Sample: 2000Q1 2020Q4
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
X does not Granger Cause GDP	80	0.74651	0.5636
GDP does not Granger Cause X		4.23047	0.0040
T does not Granger Cause GDP	80	NA	NA
GDP does not Granger Cause T		NA	NA
T does not Granger Cause X	80	NA	NA
X does not Granger Cause T		NA	NA