The impact of international trade of commodities on the economic growth of South Africa

Ayanda Priscilla Sikobi

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THE IMPACT OF INTERNATIONAL TRADE OF COMMODITIES ON THE ECONOMIC GROWTH OF SOUTH AFRICA

By

AYANDA PRISCILIA SIKOBI
SOUTH AFRICA

A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE
in
MARITIME AFFAIRS

(SHIPPING MANAGEMENT AND LOGISTICS)

2021
Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature):  
(Date): 21/09/2021

Supervised by: Dr.Satya Sahoo

Supervisor’s affiliation: Professor, Shipping and Port Management, World Maritime University
Acknowledgements

First and foremost, I would like to thank the Almighty. Secondly, I would like to thank my sponsor, the Transport Education and Training Authority of South Africa (TETA) for this prestigious scholarship. A special thank you to my family and fellow countrymen for their continued support throughout this extensive process. Lastly, but certainly not least I’d like to thank my Supervisor Prof Satya Sahoo for your unwavering support and guidance.
Abstract

Title of Dissertation: The Impact of International Trade of Commodities On the Economic Growth of South Africa

Degree: Master of Science

This study provides an empirical analysis of the impact of international trade of commodities on the economic growth of South Africa. This is done by evaluating the impact of the top 10 imported and top 10 exported commodities for the period 2010-2019. The study applies economic theory international trade together with empirical analysis to assess the impact of international commodity trade on GDP. As opposed to forecasting, a now-casting approach is applied to the multiple linear regression model to assess the impact of international trade on economic growth in real-time. Using a now-casting approach instead of forecasting will allow investors, policymakers, and traders to make better investment and policy decisions using real-time data, as quarterly GDP is usually released 8 weeks after a quarter has ended. From the regression analysis, we find that all of the imported commodity groupings have an insignificant impact on quarterly economic growth. When examining the impact of exports, we find the export of vehicles and vehicle parts together with the export of plastic products as the only positive and significant variables. When evaluating the negative export commodities, we find these commodities are exported in large volumes with little to no value addition. Furthermore, the composition of the HS code grouping also plays a role in lowering the impact of some commodities on GDP.

KEYWORDS: International trade, Economic growth, South Africa, Now-casting, Empirical analysis
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<tbody>
<tr>
<td>AIC</td>
<td>Akaike Information Criterion</td>
</tr>
<tr>
<td>ADF</td>
<td>Augmented Dickey-Fuller</td>
</tr>
<tr>
<td>ARMA</td>
<td>Autoregressive Moving Average test</td>
</tr>
<tr>
<td>BIC</td>
<td>Bayesian Information Criterion</td>
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<tr>
<td>CLRM</td>
<td>Classical Linear Regression Model</td>
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<tr>
<td>FDI</td>
<td>Foreign Direct Investment</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Produce</td>
</tr>
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<td>HO</td>
<td>Hicksher-Ohlin</td>
</tr>
<tr>
<td>IPAP</td>
<td>Industrial Policy Action Plan</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>KPSS</td>
<td>Kwiatkowski-Phillips-Schmidt-Shin</td>
</tr>
<tr>
<td>LPI</td>
<td>Logistics Performance Index</td>
</tr>
<tr>
<td>OEC</td>
<td>Observatory of Economic Complexity</td>
</tr>
<tr>
<td>OLS</td>
<td>Ordinary Least Square</td>
</tr>
<tr>
<td>PP</td>
<td>Philips-Perron</td>
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<tr>
<td>REER</td>
<td>Real Effective Exchange Rate</td>
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<tr>
<td>SARB</td>
<td>South African Reserve Bank’s</td>
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<tr>
<td>SSE</td>
<td>Squares Error Term</td>
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<tr>
<td>UNCTAD</td>
<td>UN Comtrade United Nations Comtrade</td>
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<td>WITS</td>
<td>World Integrated Trading Solutions</td>
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Chapter 1: Introduction

With the increasing interconnectedness of nation-states through globalizations economic growth has become a primary focus for policymakers and other economic agents interested in the well-being of the nation’s economy. Like many other African countries, South Africa has experienced transformation in its trade and growth policies. In the case of South Africa, these transformations were enacted through the advent of democracy in 1994 when the economic sanctions against the country were removed, allowing for the country to participate in international trade.

South Africa plays a crucial role in the international trade market as the country is a member of 26 trading blocs having signed 9 international tariff agreements (WITS, 2021). Furthermore, WITS-UNSD Comtrade also stipulates that the country has 223 export partners, and 232 imports partners (WITS,2021). The International Monetary Fund (IMF), also highlights that South Africa has the third-largest economy in Africa (IMF, 2020) and the largest in the Sub-Saharan region in terms of its GDP (Statista,2020), and has long been a significant hub in international trade due to its position which connects the east to the west through maritime trade as well as being situated in one of the major shipping routes, which is the Cape of Good Hope (see figure 01). Additionally, the country has the most extensive transport infrastructure network in the African continent, which includes approximately 750 000 km roads, 30 000 km rail tracks of which 20 900 km are route kilometers, eight commercial ports, and eleven principal airports (Transnet, 2017). The aforementioned heightens the role of liner connectivity and geographical positioning in determining the impact of international trade on country’s economic growth, where the liner connectivity is measured by the Logistics Performance Index (LPI) a benchmark established by the WorldBank strongly associated with trade expansion, export diversification, ability to attract foreign direct investments, and economic growth.
Additionally, UNCTAD’s Maritime Profile for South Africa states that the country accounted for 0.40% of the world’s GDP; where the value of South African imports and exports represented 0.56% and 0.48% of the world’s share, respectively. In monetary terms, the country’s world share of imports was valued at US$ 107,539 (in millions); meanwhile, the exports were valued at US$ 90,016 (in millions) (UNCTAD, 2019). The figures above represent the international trade value ratio to global GDP, which is usually an accurate indicator of overall interdependence in the economy utilized by the IMF (IMF, 2021).

Figure 01: Major Ocean routes for global trade

Source: transportgeography.org

Aims and objectives of the study:

This study aims to investigate the impact of international trade of commodities on the economic growth of South Africa. These will be reached through:

1. Identifying the top 10 imports and exports from South Africa from 2010-2019.
2. Identify which commodities have a positive impact on GDP.
Significance of the study

The importance of the study is to assess which of the commodity groupings has a positive impact on economic growth. Thereby assisting economic agents such as traders; investors; forecasters and policymakers in making more realistic and informed decisions using real-time data.

Structure of the dissertation

This dissertation has been split into seven chapters. The first chapter of the study is the introduction chapter which provides a synopsis of the entire study. The second chapter of the paper is the literature review chapter which explores the literature on the international trade of commodities and how it has impacted economic growth in the past. The literature is reviewed within this chapter focuses mainly on international trade theories and how they impact trade policies; the South African economy and its trade patterns; as well as the type of resources the country is well endowed with. The third chapter of the study is the data whilst the fourth is chapter is the methodology component. In chapter three, a descriptive analysis of the variables and data collection techniques are provided. In chapter fourth chapter we provide a description of the methodology and the various models to be utilized. The fifth chapter of the paper is the empirical findings section, where we analyze and interpret the regression output from our software. The sixth chapter of the study is the discussion chapter, where we focus on the final regression output and apply economic theory in analyzing whether our regression results mimic real-world data as given by OEC, WITS on the types of the commodity that are traded the most by South Africa. The final chapter of the study is the conclusion and recommendation chapter. In essence, this chapter provides recommendations to economic agents on which commodities to focus on to improve trade and output for the country.
Chapter 2: literature review

As a continuation from the previous chapter, the aim of this chapter of the paper is essentially in two folds, firstly to link international trade with international trade theories. This is done by exploring literature that will outline the concept of international trade and its determinants. The second section of the study will explore the components of South African, its role and contribution to the international trade market as well as the country’s resource endowment. In assessing the country’s resource endowment, we look at the trade flows of these commodities, together with the factors that determine international trade.

2.1. History of International Trade?

One of the earliest studies of the relationship between international trade and growth of the economy dates back as far as the classic period in the 18th century when David Ricardo and Adam Smith asserted that trade had a general influence on the positive growth of the economy. Historically, International trade has always been known to take place exclusively through either imports or export. However, the modern landscape of international trade is three-dimensional and inclusive of a concept called entrepot trade. Entrepot trade, which essentially is defined as the act of importing a commodity from country A into country B and later on exporting those goods/services to country C (Yeung,1967). This type of international trade is usually done through commodity arbitrage and free trade zones and is known to be one of the biggest contributors to the growth in the manufacturing industry. For this study, however, we will not look at entrepot trade as this can be seen as double counting.

Nations trade with one another because no one nation is self-sufficient. International trade is essentially the act of importing and exporting goods and services through transferring factors of production. Through international trade, countries can specialize in labor and production to produce/export more at lower unit costs, expand their market size, and engage in mass production. Over the years, the increase in
international trade and investment has reflected deeper exogenous macroeconomic factors such as decreased costs or an increase in the rewards of international economic transactions. For the aforementioned gains in trade to be reached, there are various determinants of international trade that a country needs to consider, particularly when utilizing maritime transport, which is the main channel for the international exchange of commodities (Hoffmann et al., 2019).

2.2. What Is International Trade?

International trade is known to be a composite of goods and services. The trading of goods dates back to 600 BC, where humans used the bartering system to get weapons; food; and spices. The services sector according to United Nations Conference on Trade and Development (UNCTAD), came into existence in the 1980s, where initially the service sector accounted for approximately 61% of the GDP of developed nations and 42% in developing nations. In 2017, UNCTAD later on, reported that the services sector contributed approximately 76% to the GDP in developed countries and approximately 55% in developing countries (UNCTAD, 2017).

Like any other concept, international trade is known to have both advantages as disadvantages. Comparative advantages come into play when assessing the advantages of international trade factors such as job creation, economic growth, competition, technology transfer, and economies of scale. When assessing the disadvantages of international trade, factors such as loss of state sovereignty/dependency, exploitation of natural resources, unfair competition are usually quoted.

2.3. Linking International Trade With International Trade Theories

Studies on the relationship between international trade and the growth of an economy date back as far as the classic period in the 18th century when David Ricardo and Adam Smith asserted that trade had a general influence on the positive growth of the economy. International trade theories are known to provide insights into mechanisms
of international trade as well as the determinants of trade patterns and interactions of trade and economic growth. (Krugman et.al., 2008). Trade theories are important and are often used by managers of large companies as well as policy-makers to identify advantageous strategies that will improve international trade within their firms/countries. Furthermore, these theories can be divided into different schools of thought namely the classical and neoclassical schools of thought. The key difference between the classical and neoclassical schools of thought lies within the assumption, where the classical school of thought was developed under perfect competition and constant returns to scale. Havrylyshyn (1990) goes on to state that by allowing perfect competition the gains from trade essentially translate into improved efficiency. On the other hand, the Neoclassical school of thought was built based on the assumptions that the economy operates under imperfect competition and that there exist economies of scale, which is more evidential to the current setting of international trade. Furthermore, Mogoe (2013) also states that neoclassical trade theories explain trade in terms of technology, technology diffusion/adjustment lags, and continuous innovation processes. In addition, he further elaborates by stating that less developed countries will specialize in the export of old, mature goods where production processes become routine and less skilled labour has to play a greater role (Mogoe, 2013).

2.3.1. Mercantilism Theory

When analyzing the classical school of thought one can simply state that Jean-Baptiste Colbert was one of the founding fathers of international trade theories. Jean-Baptiste Colbert in the 16th century propounded the theory of Mercantilism where the term was derived from the Latin word “mercari”, which means “to run a trade”. (International trade and theory, 2008). According to Landreth and Collander (2002), the mercantilist system was built based on the mercantilism trade theory and advocated for increasing the nation's wealth through instantaneously encouraging production, increasing exports, and holding down domestic consumption. Mercantilism advocated for low wages to give the domestic economy competitive advantages in international trade (International trade and theory, 2008). Essentially, the system's main aim was to ensure
that a country exports more than it imports. To attain the theoretical underpinnings of the mercantilism theory, mercantilists advocated for strict government control of all economic activity and preached economic nationalism as they believed that trade was a zero-sum game and a nation could gain in trade only at the expense of other nations (Georgiou, 2016). From the above, we see that the mercantilism theory of trade was heavily reliant on protectionism in the form of fiscal policy and other governing acts such as the Navigation Acts of 1951 which forbid foreign vessels from trading alongside the British coast. In addition, this required exports to pass through British control before being redistributed all over Europe (Ransom, 1968). Mercantilists believed that the health of a nation’s economy could be assessed through quantifying the number of precious metals the nation owns, a notion that still exists within the 21st century through the “Gold Standard”. The Gold Standard can be defined as a system where the country’s currency is value is directly linked to the reserve of gold, precious metals, and coins. Ownership of precious metals such as Gold which acts as a provider of macroeconomic stability and is often traded in times of economic difficulty to ensure sufficient reserve in a country’s reserve, we see such practices still being evident in economies such as France, Germany, Italy, China, and Switzerland.

2.3.2. Theory of Absolute advantage

The international trade theory of Absolute advantage was the first trade theory advocating for free trade. The theory was coined by Adam Smith in 1776, where he stated “if a foreign country can deliver us goods cheaper than we would produce, it is better to buy them from that country, with a part of the product of our activity, using them in a way which can bring us benefit” (Smith, 1962). Essentially, argued that any given country has an absolute advantage in the production of commodities when it is more efficient than any other country in producing (Smith, 1776). The theory was built on the assumption that the trade was occurring amongst two countries where only two commodities were being trading under free trade agreements with labor being the only cost. From the theory of absolute advantage, we see that free trade leads to specialization in the production of commodities that a country is more efficient in, and
importation of commodities which it cannot produce efficiently thereby leading to international specialization in factors of production which could increase global output. Through international specialization, we find elements of “division of labor” being introduced. When comparing the aforementioned theories, it can be said that Adam Smith’s free trade system was more favorable than Jean-Baptiste Colbert’s mercantilism trade theory for economic growth. Additionally, under mercantilism trade was viewed as being a zero-sum game. Therefore, just like any other theory, the theory of absolute advantage was critiqued mainly because it focused solely on one factor of production and its cost under its assumptions. In contrast, international trade constitutes other costs such as transportations and the cost of capital.

2.3.3. Theory Of Comparative Advantage By David Ricardo

The international trade theory of comparative advantage as propounded by David Ricardo was essentially a continuation of the works of Adam Smith. The theory's underlying assumptions are similar to that of Adam Smith where theory assumes that two countries are trading two goods with only one input factor (labor), which was viewed as being homogenous with an inelastic supply. (Ricardo,1817). A comparative advantage exists when 1 of the trading partners can produce at a lower cost compared to the other. Instead of focusing on a country that can produce the most, the theory of comparative advantage simply bases its production based on the lowest opportunity cost.

2.3.4. Hicksher-Ohlin Theory

The Hicksher-Ohlin (HO) theory differs from the prior mentioned international trade theories. It focuses on differences between countries in their relative factor endowment and differences between their commodities in the intensities with which they use these factors (Shahriar,2019). The theory depicts a more realistic view of production, where a particular article of trade is made through a bundle of factors as opposed to just one factor. The HO essentially maintains that countries tend to export the products for
which they have an abundant supply. “The exchange of commodities internationally is, therefore, indirect factor arbitrage, transferring services of otherwise immobile factors of production from locations where these factors are abundant to locations where they are scarce” (Leamer, 1995).

2.3.5. Gravity Trade Model

The gravity trade model coined by Walter Isard in 1954, estimates the pattern of trade. Essentially the model suggests that trade between two countries is positively related to both their incomes and negatively to the distance between them. This model suggests that closer countries will trade with each other more compared to countries that are further apart, this is due to factors such as transportation cost linked to facilitating trade. The theory further on goes to exam the pattern from the size of the economies of the trading countries, stating that countries with large economies will trade with one another. The distance element of the model has proved to be an empirical success. This could be due to increasing regional trading blocs and the blurring borders caused by the increase in globalization. The income component remains inconclusive firstly because developed nations trade more with developing nations however the rise in South-South trade portrays another image. The inconclusiveness may emanate from the fact that the gravity model lacks structural interpretation in the sense that it tends to ignore the sources of the underlying price and demand of the commodities which usually determine the movement of the commodities (Snudden, 2018).

2.4. International Trade and Economic Growth

Early links between international trade and economic growth were initially discovered by Adam Smith. However, over the years the relationship between international trade and economic growth has been theoretically controversial as the landscape of international trade changes over time. Various arguments supported by empirical
findings have been raised by different scholars on whether or a link between economic growth and international trade exists.

In support of the positive relationship between international trade and economic growth, Azeez et al. (2014) states that the globalized nature of an economy enhances the openness of an economy and its direct participation in the international market leads to market expansion. Additionally, an econometric analysis on the impact of exported natural resources on economic growth conducted by Sachs and Warner (1995a, 1999) found that a contraction in export revenue had a negative effect on economic growth by about 50%. Sachs and Warner (1995a,1999) go on to add that this effect was due to the negative correlation between export concentration and intra-industry trade and a positive correlation between export concentration and volatility of the real effective exchange rate.

In his study on resource abundance and economic development Auty (1998), found that “since the 1960s the resource-rich developing countries have underperformed compared with the resource-deficient economies.” This according to Auty (1998), was based on the differences in capital and income disparities amongst the two economies. Furthermore, the phenomena of resource curse together with Dutch disease can be used in explaining the inverse relationship between the trade of resource and economic growth in the global market.

2.5. The structure of the South African Economy

South Africa’s political transition from Apartheid to democracy in 1994 played a remarkable role in laying the foundations for the country’s current economic structure. Before the attainment of democracy, the country had faced sanctions for political reasons, which had a major impact on the country’s National account. Historically, South Africa’s economy was primarily built on primary and secondary industries, such as mining and manufacturing. However, in recent decades, and in line with global
developments, growth has shifted to the tertiary industries (StatsSA,2021), which is inclusive of trade, finance, transport, and communication. Essentially the South African economy, according to the StatsSA can be divided into industries such as Mining, Finance, Trade, Transport and communication, personal services, manufacturing, government; construction; agriculture; and Electricity, gas, and water. When analysing the different industry’s contribution to the GDP of 2019 in the fourth quarter, we find that only three industries had a positive contribution to GDP (see figure 02 below).

Figure 02 : Sector of GDP and their contribution to GDP in 2019

Source: StatsSA

These finds are justified by Fedderke (2018) who states that’s South Africa’s sectoral structure has close affinities with the characteristics of developed economies, rather than those of an emerging market. Therefore, we see service related industries thriving
and growing more than labor intensive industries. In support of the aforementioned Omilola (2015), states that South Africa tends to export capital-intensive goods produced by highly skilled labourers. By doing so, the country is underutilizing the large pool of low-skilled labor, which in turn adds to the current situation of high unemployment which impacts consumption and savings which in turn impacts GDP.

2.6. Which resources/commodities is South Africa well-endowed with?

South Africa is a country known to have an abundance of natural resources and minerals such as gold, copper, platinum, manganese, iron, silver, and coal. Recently, the country has added natural gas and synthetic fuel to its list of mineral reserves through the exploration of LNG along the South and Northern parts of Kwa-Zulu Natal.

According to the South African Reserve Bank’s (SARB), quarterly bulletin for the first quarter of 2021, SARB asserts that South Africa’s trade surplus with the rest of the world widened slightly in the first quarter of 2021 as the increase in the value of net gold and merchandise exports, which reached a new all-time high, marginally outpaced the increase in the value of imports (SARB,2021). Additionally, exports continued to benefit from the improvement in global economic activity and higher commodity prices, as the value of mining, agricultural, and manufacturing exports all increased in the first quarter of 2021 (SARB,2021). From the aforementioned, we see the importance of commodity prices for South Africa as the country is a major net exporter of minerals and a net importer of oil.

The World Integrated Trading Solutions (WITS) in partnerships with the UNSD Comtrade finds that the top exported goods in South Africa were: Gold; Bituminous coal; Agglomerated iron ores and concentrates; Diesel-powered trucks; Manganese ores and concentrates, with manganese. When assessing the Top 5 imported products Petroleum oils and oils obtained from bituminous was ranked first, followed by Petroleum oils, etc, (excluding crude); preparation, Transmission apparatus, for radiotelegraph incorpo, Other medicaments of mixed or unmixed products, New stamps; stamp-impressed paper; banknotes was ranked fifth (WITS,2021). We see
that the mining industry had a positive quarter, contributing 18.1% to the country’s GDP within the first quarter. The second biggest contributor.

2.7. What are the current trade patterns for South Africa’s international trade?

Commodity trade and geographical trade patterns are known to evolve due to changes in comparative advantages. Over the past couple of years, there has been a rise in South-South trade which has caused exports from developing economies to exceed those of developed nations. Additionally, South-South trade is known to grow substantially higher rate than international trade mainly due to the emergence of developing economies which has increased imports. The increase in imports which represents an increase in demand will led to an increase in the prices for the exporting nations.

According to the WTO, from 2011, developing economies’ exports to other developing economies surpassed its exports to developed economies where “South-South” trade represented an estimated US$ 4.28 trillion or 52% of total developing economies’ exports in 2018. The share of this south-south trade is known to vary by region whereby South Asia and East Asia contributed about 70% while the Latin America region had contributed about 35% to international in 2017 (Afonso, 2017). Another key underpinning factor that dictates’ trade flow is trading blocs and tariff agreements signed amongst developing nations. According to South African Revenue Services (SARS), the top 5 nations South Africa exports to are: United States (12.5%), China (10.9%), Germany (8.6%), Japan (8.6%), and the United Kingdom (7.2%) (SARS, 2021). When analysing the top 5 nations South Africa imports from are: China (20.0%), Germany (8.3%), United States (6.6%), Saudi Arabia (5.7%), India (5.4%) (SARS, 2021).

2.8. Financial factors affecting the trade flows

So far, in this study, we have considered literature that has focused on non-financial determinants of trade flows. It is worth noting that financial factors such as the
The second financial factor to be considered is establishing the trade of commodities is the commodity price. Having information on the commodity prices is crucial for agents such as Governments and Economic authorities. This would assist in formulating policies that are aligned to improving their balance of trade and national accounts, as commodities prices impact the aforementioned. One of the main theories used in determining commodity prices is the ‘theory of storage’, which in essence explains the difference between spot and futures commodity prices in terms of storage costs, stating that commodity price volatility should increase when inventories are low (Carpantier, 2012). The theory of storage can simply be integrated into the economic theory of demand and supply utilized to establish the price of any commodity.
According to Makin and Rohde (2016), broad-based commodity price indices and commodity prices in real terms have boomed since the turn of the century.

Inflation, defined as the steady or persistent rise in prices is said to have an inverse relationship with the trade of commodities. This is purely because inflation is known to devalue currency causing consumers to spend less. The aforementioned argument is further supported by Arango et., al (2008) who argues that a boom in commodity prices is highly associated with an increase in consumption. Therefore, making the inflation rate a key determinant of trade flows.

2.9. The gap in the literature

The impact of international trade on economic growth is an issue of major concern to Policy makers; Central Bank and Investment agents. The first gap in the literature identified in doing the study is based on the fact that the relationship between economic growth and the international trade of commodities has been analyzed mainly from a qualitative perspective focusing mainly on international trade theories and policy reforms. To better understand the movement and trade of commodities which is heavily reliant on macroeconomic factors such as the exchange rate; inflation rates; commodity prices and the cost of the factors of productions a quantitative analysis has to be conducted. Looking at the subject matter from a South African perspective it is worth highlighting that most of the research takes on either a purely qualitative approach or a quantitative approach, and never a combination of both. This creates an incomplete picture of the analysis. Therefore, industry scholars such as Winters (2004), go on to add that inconclusive results may occur because trade liberalization must almost certainly be combined with other appropriate policies, and linear regression models cannot capture such complementary dynamics. Furthermore, scholars such as Mogoe (2013) argue that trade theory provides a little guideline for the effects of international trade on growth and technical progress. Therefore, to attain more accurate results on the relationship of the aforementioned components an econometric analysis ought to be conducted in conjunction with the qualitative
analysis of the theory because in evaluating econometric results, researchers can always find ways of lay bare existing analyses (Lederman, 2002).

The second gap in the literature identified for this study emanates from the fact that there is a shortage of country-specific research analysis, most of the studies that assess the impact of international trade on economic look tend to utilize cross-country data which can be sensitive to data omitted and endogeneity. Furthermore, the literature on the subject matter is inconclusive partly because different analysts and researchers use different proxies for trade openness or international trade and rely on different methodologies. The evidence for growth enhancements through trade liberalization displays mixed-effects because of problems with misspecification and the diversity among the liberalization indices used (Zahonogo, 2016). In addressing this gap, the study will focus solely on South African data to attain precise results and to eliminate any endogeneity caused by using cross-country data.

Like many other countries, the GDP of South Africa as measured by the Central Bank is reported quarterly. However, the report is only made available 8 weeks after the financial quarter has ended. According to Botha, et.al (2021), given lags in the release of data, a central bank must ‘now-cast’ current GDP using data released with a shorter publication lag and/or at a higher frequency than GDP. Through now-casting traders; investors; forecasters and policymakers will be able to have a clear view of the economy in real time. This will enable the economic agents to make better and up-to-date decisions regarding the state of the economy.
Chapter 3: Data

This chapter aims to outline the type of data to be analyzed and the approach/methods utilized to answer the objectives of the study, which is to analyze the impact of international trade of commodities on the economic growth of South Africa. This chapter of the study will be divided into 3 sub-sections where the first section of the chapter will focus on data outlining the data sources, the second subsection will outline data collection techniques, whilst the third section provides us with the variable definitions and the justification for including them into our regression analysis.

3.1. Data Sources

In conducting this study, we collected secondary data from The Observatory of Economic Complexity (OEC), the Federal Reserve Bank of St. Luis, as well as the United Nations Comtrade (UN Comtrade). From, the Federal Bank of St. Luis we abstracted data on the country’s Quarterly GDP and the exchange rate. From the OEC we extracted data on the top 10 imported and exported commodities in South Africa from 2010 Q1 -2019 Q4.

3.2. Data Collecting Techniques

The data collection techniques of extracting data from the prior mentioned websites will differ from the variable in question. From the OEC website, information relating to the Top 10 imported and exported commodities was extracted, where the classification grouping of the commodities in question was the HS Code 2 (see figure below). Using the HS Code of each commodity, we then find the monthly trade value of these commodities on the UN Comtrade website for the period Jan 2010- Dec 2019. The data relating to GDP was extracted from the Federal Reserve Bank of St. Luis, where the quarterly GDP for South Africa is reported in Rands (ZAR). However, the GDP figures have to be converted into US$D which is the internationally acceptable base currency, therefore, information on the exchange rate of ZAR to US$D was abstracted from the same website. Since the exchange rate figures were reported on a
monthly basis, to convert the figures into a quarterly figure, the monthly figures are combined for each quarter, and then divided by 3 to get an estimate of the exchange.

Figure 03: Top 10 exported commodities from South Africa

Source: OEC (2021)
Figure 04: Top 10 imports into South Africa.

Table 01: List of Top 10 Exported and Imported Commodities

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Commodity</th>
<th>HS Code</th>
<th>Trade Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 X1_exp</td>
<td>Precious Metals Gems And Jewellery</td>
<td>71</td>
<td>Export</td>
</tr>
<tr>
<td>2 X2_exp</td>
<td>Ores, Slag And Ash</td>
<td>26</td>
<td>Export</td>
</tr>
<tr>
<td>3 X3_exp</td>
<td>Vehicles And Their Parts</td>
<td>87</td>
<td>Export</td>
</tr>
<tr>
<td>4 X4_exp</td>
<td>Mineral Fuels; Oils And Products Of Their Distillation</td>
<td>27</td>
<td>Export</td>
</tr>
<tr>
<td>5 X5_exp</td>
<td>Machinery And Appliances</td>
<td>84</td>
<td>Export</td>
</tr>
<tr>
<td>6 X6_exp</td>
<td>Iron And Steel</td>
<td>72</td>
<td>Export</td>
</tr>
<tr>
<td>7 X7_exp</td>
<td>Fruits And Nuts; Edibles; Peels Of Citrus Fruits/ Melons</td>
<td>08</td>
<td>Export</td>
</tr>
<tr>
<td>8 X8_exp</td>
<td>Aluminium And Articles Thereof</td>
<td>76</td>
<td>Export</td>
</tr>
</tbody>
</table>
3.3. Variables Definition and Justifications

**GDP**

As mentioned earlier, the economic growth of any nation is measured as the change in the country’s GDP, therefore using GDP as a proxy for economic growth is justifiable. Furthermore, GDP captures the market value of goods and services produced within a country for a particular period, whereby for this study we will be analyzing the market value of goods (imports and exports) into and out of South Africa quarterly.

**Precious Metals Gems and Jewelry export**

According to the OEC (2021), in 2019, South Africa exported a total of $109B, making it the number 36 exporter in the world with Gold leading as the country’s number exported commodity. Precious metals and jewelry commodities under HS 2 code were ranked the 5th most traded commodity products internationally in 2019. Under the HS 2 code classification, Precious Metals Gems and Jewelry export consists of precious metals such as Gold, Platinum, Iridium, and diamonds. The aforementioned commodities according to the OEC were South Africa’s top exported commodities and
accounted for 27.4% of the country’s trade value which is $29.8 billion in nominal terms (OEC, 2021). It is also worth highlighting that South Africa was ranked 7th globally in the trade of precious metals, gems, and jewelry exporting to nations such as the United Kingdom, Switzerland, India, and Hong Kong.

**Ores, Slag, and Ash export**

Ores, Slag and Ash commodity was recorded as the 2nd most exported commodity from South Africa for 3 consecutive years. The HS code classification for Ore, Slag, and ash consists of commodities such as iron, coal, manganese ore, granulated slag, where South Africa is known to be the world’s third-largest exporter of coal. The trade value of the commodity amounted to approximately $1.3 billion in 2019 and $ 1.7 billion in the previous year where 54% of the commodity was exported to China. (Statista, 2021).

**Vehicles and Their Parts export**

South Africa is no stranger in the automotive manufacturing industry as the country produced 6.9% of the global market, and is ranked 22nd globally for its production of vehicles and vehicle parts (International Trade Administration, 2021) with assembling plants for vehicle brands such as Toyota, BMW, and Mercedes Benz. According to the International trade administration (2021), the automotive industry is the largest manufacturing sector in the country, where the industry accounted for 6.4% of the country’s GDP in 2019 which is $14.14 billion in nominal value. According to BBC (2020) cars are made up of approximately 30,000 parts and the South African automobile industry can manufacture these components.

**Mineral Fuels; Oils and Products of Their Distillation export**

Mineral Fuels; Oils and Products of Their Distillation according to the OEC contributed $ 8.18 billion into the country’s GDP, where this classification group consists of commodities such as refined petroleum, petroleum gas. With South Africa being home to the most advanced and largest chemicals sector in Africa with an
abundance of minerals producing over 600 different types of chemicals this has given the country a competitive advantage within the region (InvestSA, 2021). In addition, South Africa comprises around 0.5% of global chemical production capacity with petrochemicals comprising about 55% of all chemicals produced locally (InvestSA, 2021). The top exporting destinations of these commodities were industrious developing countries such India and Pakistan which accounted 30.7% of the export.

**Machinery and Appliances export**

The trade of machinery and appliances accounted for $5.66 billion of the country’s GDP in 2019, as the export of machinery and appliances accounted for 5.21% of exported goods from the country.

**Iron and Steel export**

The export of Iron and steel from South Africa accounted for approximately $ 5.36 billion in 2019 (OEC, 2021). This, however, represented a decline in the value of export in comparison to the preceding year which was roughly $ 6.28 billion (Statista, 2021). This possibly arising from lack of investment into industry. The decline in the export of the commodity could also emanate from the economy’s downgrading by rating agencies, this in exacerbates low the recurrent issues of low investor confidence.

**Fruits and Nuts; Edibles; Peels of Citrus Fruits/ Melons export**

According to the International Trade Administration (2020) citrus, wine, table grapes, corn and wool accounted for the largest exports by value within the Agricultural exports of South Africa. The export trade of Fruits and Nuts; Edibles; Peels of Citrus Fruits/ Melons accounted for 3.38% of the total value of all exports within the country in 2019 (OEC, 2021) with these commodities being exported to countries such as the Netherlands; the UK and the united states of America.

**Aluminum and Articles Thereof export**
According to Statista (2021), “South Africa produced some 717,000 metric tons of refined primary aluminum in 2020, making it the largest aluminum producing country in Africa”. Aluminum is known to be the second most malleable metal and the sixth most ductile and often used as an alloy to construct airplanes, transport automobiles, construction components as well as other cans, foils, and beer kegs.

**Electrical Machinery and Equipment export**

According to the OEC (2021), Electrical Machinery and equipment was the world’s 1st most traded product, with a total trade of $2.53 trillion. South Africa’s export of electrical machinery and equipment contributed to the global production of the commodity. Electrical machinery and equipment contributed approximately $1.77 billion to the country’s GDP, with leading export destinations being neighboring African countries.

**Plastics and Articles Thereof export**

The export of plastic and articles thereof from South Africa amounted to approximately $1.43 billion in 2019, which represented a slight decrease from 1.44 million in 2018 (Statista,2021). The decline in exports of plastics could emanate from the implementation of environmental laws that have banned/limited the use of plastic and articles thereof, where the final top 3 destination of these commodities is Zambia, Nigeria, and Botswana (OEC,2021).

**Mineral Fuels; Oils and Products of Their Distillation Imports**

According to OEC (2021), over the last five years South African imports dropped by $17.9B from $106B in 2014 to $88.5B in 2019, where the top imported commodities were Crude Petroleum Refined Petroleum which is classified as mineral fuels, oils and products of their distillation under HS 2 classification code. The aforementioned commodity countries of origin were Nigeria, Saudi Arabia, United Arab Emirates. The trade trend of importing more from Nigeria could emanate from the fact that South
Africa and Nigeria are part of similar trading blocs. Additionally, this can be justified by the discrepancies in the exchange rate and the gravity trade model.

**Machinery & Appliances imports**

Commodities included under the machinery and appliances classification include Computers, optical readers, Heavy machinery (bulldozers, excavators, road rollers), Printing machinery, Taps, valves, similar appliances transmission shafts, gears, clutches, and similar appliances. The value of machinery and appliances imported into South Africa has shown a decline from its contribution to GDP from $12.3 Billion in 2019 to $ billion in 2020. This could be resultant of the slow-down in industrious activities due to the corona virus pandemic that has global production has slow-down. Furthermore, the economic downgrading has resulted in lower investment confidence and less foreign direct investment (FDI) into the country.

**Vehicles & Their Parts imports**

The import of vehicles and their parts contributed approximately $9.18 billion to the GDP of South Africa in the 2019 financial year, which was marked a decline from the year’s contribution of $ 9.94 billion (OEC,2021). The justification behind the decline of vehicle and vehicle parts imports could emanate from the fact there has been a decline in machinery imports as South Africa is still a developing country dependent on countries such as China, Germany, and Italy. Furthermore, South Africa’s Automotive industry has been developing at a fast pace with huge influx of investments from vehicle OEMs such as BMW, Toyota, and Mercedes Benz.

**Electrical Machinery & Equipment imports**

According to OEC (2021), Electrical machinery and equipment are the world’s first most traded products. Electrical machinery and equipment imports accounted for approximately $ 8.55 billion of the country’s GDP in the year 2019, where under this category we find items such as broadcasting equipment, computers, combustion engines, electrical generating sets, electrical transformers, engine parts as well as
electrical power accessories and office machine parts which are used mainly in production processes of other goods. From the items under the electrical machinery and equipment’s imports, we find that the Broadcasting Equipment has the highest contribution to the country’s GDP, accounting for $2.43 billion.

**Precious Metals, Gems & Jewelry imports**

According to OEC (2021) Precious metals, gems and jewelry was the world’s fifth most traded product in 2019. imports contributed approximately $3.55 billion to the country’s GDP in 2019. The origins of these precious metals, gems, and jewelry according to the OEC (2021) were Ghana, Namibia, and Zimbabwe. The import of Precious Metals, Gems & Jewelry imports essentially represents the import of semi-precious stones and jewelry from the above countries.

**Plastics & Articles Thereof imports**

Being an industrious country that is heavily involved in exporting the inclusion of plastic articles thereof is justified. These goods are used in production processes for wrapping, storing, sealing goods. According to (Babayemi et, al., 2019), approximately 13.7 Mt of plastics were imported into South Africa in the period Between 2000-2017 where the aforementioned accounted for approximately 11.6% of plastics consumption in Africa

Figure 05: top six African countries with the highest import and use of plastics
Instruments & Apparatus imports

Instruments & Apparatus imports accounted for approximately 2.79% of all imports into South Africa in 2019. On the international frontier, instruments and apparatus were ranked as the world’s 6th most traded product where the countries of origin were the United States, Germany, China, and Japan. Under this commodity group classification, we find items such as medical instruments, chromatographic, electrophoresis instruments as well as musical instruments.

Pharmaceuticals Products imports

Although South Africa has pharmaceutical companies such as Johnson & Johnson, Cipla, and Pfizer producing drugs for domestic consumption and export to neighboring countries. The domestic production of pharmaceutical products according to Viviers
et.al, (2014) meets about one-third of the country’s demand for pharmaceuticals, and therefore the remaining two-thirds have to be imported into the country. According to OEC (2021), Pharmaceuticals product imports contributed accounted for 2.73% of all imports into the country in 2019.

Chemical Products N.E.S imports

Chemical products N.E.S according to OEC (2021), were ranked the 17th most traded product in the world in 2019, in addition, the product was also ranked the 73rd lowest tariff using the HS 2 product classification with the top global exporting countries being the United States, Germany, China, and France. From the South African context, chemical product imports accounted for 1.75% of all imports into the country in 2019. Products under the chemical products n.e.s product classification include products such as fertilizers, beauty products, and laboratory reagents

Chemicals, Organic Chemicals imports

Chemical, organic chemical imports according to the OEC (2021) accounted for approximately 1.74% of the country’s imports in 2019 whilst contributing approximately $1.54 billion to the country's GDP in 2019. The products listed under this chemical, organics, and chemical imports include products such as Nitrogen Heterocyclic compounds, Polycarboxylic acids, Industrial fatty acids, oils, and alcohols which are used in industries such as mining, manufacturing, and agriculture which are major exporting industries for the country.
Chapter 4: Methodology

This subsection of the paper outlines the model specification as well as the econometric approach to estimating the relationship between dependent and independent variables using statistical data analysis. The dependent variable will be estimated using Ordinary Least Square (OLS) regression model which is primarily used for predictions and casual inference. In building, we begin the analysis by estimating a simple linear regression

4.1. Model Specification

Simple linear Regression

The model of estimation utilizes a linear regression model which looks at the

$$Y = \alpha + \beta X_t + U_t$$

Where the model simply explains the relationship between the Y and X variable

Where:

- $\alpha$ is the intercept term or constant
- $\beta$ is the coefficient that means the slope of the regression line. When $\beta$ is equal to zero then there’s no relationship between Y and X. If $\beta$ is negative then there exists a negative relationship between Y and X, meaning that if X increases Y will decrease by $-\beta$. If $\beta$ is positive then the relationship between Y and X, meaning that if X increases by then Y will increase $\beta$.
- X represents the regressor / independent / explanatory variable. This is the causal variable in the equation.
- U represents the stochastic error term also known as the random disturbance. The error term measures the difference/ variation between the actual and estimated dependent for each explanatory variable (y- $\hat{y}$)
- t represents the number of observations.

Multiple linear regression model
According to Konansani and Kadre (2015), multiple linear regression is used to predict the dependent variable using more than one explanatory variable. The general equation is given as:

\[ Y_t = \beta_1 X_2 t + \beta_2 X_3 t + \beta_3 X_4 t + \ldots + \beta_k X_k t + U_t, \quad t=1,2,\ldots,T \]

Where:
- \( X_2 t, X_3 t, \ldots, X_k t \) represents the various independent variables,
- \( \beta_1, \beta_2, \ldots, \beta_k \) where \( \beta \) is known as the partial regression coefficient representing the partial effect of each independent variable.

**Ordinary Least Squares (OLS)**

According to Guerard (2013), OLS is the most utilized approach for fitting data into the line where the sum of the squares error term (SSE) is minimized. Since the OLS is employed for analysis we, therefore, have to take Classical Linear Regression Model (CLRM) assumptions into consideration when conducting the various tests to estimate our dependent variable.

Using the generic model structure:

\[ Y = \alpha + \beta X t + U_t \]

The CLRM assumptions are:
1. \( \text{E}(u_t) = 0 \), which means that the mean of the residual should be zero, however, this assumption doesn’t hold in the presence of an intercept term.
2. \( \text{Var}(u_t) = \sigma^2 \) which means the variance of the error should be constant and finite.
3. \( \text{Cov}(U_i, U_j) = 0 \). which means that there is no autocorrelation
4. \( \text{Cov}(x_i, u_j) \), Which means there is no correlation between the individual explanatory variable and the error term.
5. \( u = \text{N}(0, \sigma^2) \) which essentially means that the error term is normally distributed with a mean of zero and a constant variance of sigma squared.
4.2. Econometric Modeling Technique

Under this section of the we provide detailed description of the series of tests will that be conducted to estimate the impact of international trade of commodities on the economic growth of South Africa using Matlab software.

4.2.1. Preliminary Statistics

To begin the econometric analysis of the data, as mentioned before data detailing the top 10 imported and exported commodities, as well as the quarterly GDP for our research period, was organized into an excel spreadsheet. We then arrange the dataset to begin with the date as the column, followed by our dependent variable (GDP), and we group our independent data by first listing all the exported commodities first, and then our independent variables afterward. Upon gathering our sampled data, we analyze the data from a preliminary statistics point of view focusing mainly on the standard deviation and skewness of the dataset. Through analyzing the standard deviation of the dataset we are capturing the volatility of the dataset which is measured by the gap between the variable and the mean. The second most important preliminary statistic is the skewness of the data.

4.2.2. Unit Root Test

Upon completing the preliminary statistics, we log our dataset to eliminate any negative variables within the analysis before conducting the stationarity test. This, according to Gujarati (2003), is done because a regression will generate spurious results if the model is estimated using non-stationary variables and therefore a unit root test has to be conducted to assert whether our variables are stationary or not. The test for stationarity can be conducted using either the Augmented Dickey-Fuller (ADF), Kwiatkowski-Phillips-Schmidt-Shin (KPSS), and Philips-Perron (PP). For our regression results, we examine whether the ADF and PP are moving in the same
direction, if they are moving in the same direction we consider those results. If the
ADF and PP results are different then we utilize the KPSS results.

Using the augmented Dicky-Fuller test (ADF) and the Phillips-Perron (PP), we test the
following hypothesis:

H₀: there is a unit root
H₁: there is no unit root (stationary)

The decision to reject the null hypothesis is when the p-value < 0.05.

4.2.3. Cointegration Test

The cointegration test is conducted to establish whether there exists a long-term
relationship between two or more variables. The test creates residuals of stationary
regression and tests for the presence of unit root. In the presence of a long-term
relationship the Engle-Granger method is applied where we test the following
hypothesis:

H₀: a unit root in Cointegrating regression’s residuals
H₁: residuals from Cointegrating regression are stationary.

Our t-test is conducted using a two-tailed test at a 0.05 level of significance where the
null hypothesis is rejected if the p-value is < 0.05. from running the test.

4.2.4. Multicollinearity / Correlation test

Following the unit root tests, a correlation test is conducted on the given data. The
correlation test is conducted to assess the relationship between two variables. For this
study, the test will be conducted using the Multicollinearity technique where the test
not only detects the relationship amongst the variables but also measures the strength
and direction of the relationship. According to Young (2017), Multicollinearity is
present in a regression model when the variables are not only correlated with the
dependent variable but also to each other. In the case where multicollinearity exists
the model cannot be utilized as the issue of multicollinearity is a violation of the OLS
assumptions. Additionally, multicollinearity is known to increase the variance of the regression coefficients making them unstable, which brings the problem to interpret the coefficients (Shrestha, 2017).

To test for correlation, we utilized the correlation coefficient technique which detects whether or not is a relationship between a variable pair. The correlation variable pair relationship can be captured as being either positive or negative, where a positive correlation essentially means that variables are moving in the same direction, and a negative relationship means that they’re moving in the opposite direction, i.e.: as one increases the other variable decreases. The strength of the relationship amongst the variable is measured by the correlation coefficient which has a maximum value of 1 or 100% indicating perfect correlation. For this analysis variables with a correlation of 80% or correlation coefficient of 0.80 and above will be dropped from the analysis because the presence of multicollinearity increases the standard errors of each coefficient in the model making some of the significant variables statistically insignificant.

4.2.5. t-test

Upon completing the correlation test and removing variable pairs that are highly correlated, a t-test is conducted with the remaining variables to test the statistical significance of the individual variables. \( \beta \) represents the coefficient of the variable, and \( k \) represents the sample number. Where the null and alternative hypotheses are stated as:

\[
H_0: \beta_k = 0 \\
H_1: \beta_k \neq 0.
\]

Our t-test is conducted using a two-tailed test at a 0.05 level of significance where the null hypothesis is rejected if the p-value is < 0.05. from running the test.

4.2.6. ARMA test
An Autoregressive Moving Average test (ARMA), is used to establish whether the previous value of the dependent variable and previous shocks in the system influence the dependent variable today. Where the Autoregressive component (AR) of function is calculated and is defined as:

\[ y_t = \beta_1 y_{t-1} + \beta_2 y_{t-2} + \ldots + \beta_k y_{t-k} \]

The Moving Average (MA) component of the test is used to calculate the impact of the residuals or errors of past time series and calculates the present.

\[ Y_t = \beta_1 \epsilon_{t-1} + \ldots + \beta_k \epsilon_{t-k} \]

This test is done iteratively starting from an ARMA level of order (5,5). If upon adding AR and MA variables and some of our variables that were significant become insignificant we then reduce the level of ARMA starting from a higher order. Once we have selected an ARMA level that is significant we then compare our model with the ARMA to the model without ARMA. The model selection criteria are done by assessing the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) of the model with ARMA and the model without ARMA. According to Burnham and Anderson (2002), the AIC is an information-theoretic indicator based that quantifies the information given in the model and the BIC was designed to maximize the posterior probability of the model. Furthermore, Rossi, et.al (2020), state that; “The basic principle underlying the AIC criterion is the assumption that the less information a model loses, the higher is its quality” and BIC. Essentially, the final model selection is made based on assessing either of the two criteria, where our final model selection is based on the decision of which model has the lowest information criteria.

4.2.7. Normality test

The normality test is conducted to see if the error term is normally distributed with a mean of zero and a constant variance of sigma squared, which is expressed as:
\( u = N (0, \sigma^2) \).

The test is conducted under the null hypothesis residuals are normally distributed. In the case where there’s a violation of the OLS assumption then when insert dummy variables into the regression to replace the variable (s) with high residuals and then we find the error correction term for the variables. we rerun the test, removing all insignificant variables within the regression. For this test we use the hypothesis:

\[
\begin{align*}
H_0 &: \text{Normally distributed error terms} \\
H_1 &: \text{Not Normally distributed error terms}
\end{align*}
\]

Where the test is conducted at a 0.05 level of significance where the null hypothesis is rejected if the \( p \)-value is < 0.05 which implies that the variance of the error term is heteroscedastic.

### 4.2.8. Heteroscedasticity

Heteroscedasticity is a phenomenon that occurs when the variances of the error terms are not constant. The presence of heteroscedasticity in a regression is a violation of the OLS assumption stating: \( \text{Var}(u_t) = \sigma^2 \) variance of the error should be constant.

In addition, the presence of heteroscedasticity indicates that the OLS estimator is no longer best; linear and unbiased estimators (B.L.U.E), and therefore Generalized Least Square (GLS) is used. Using the HAC function, a residual diagnostic test is conducted on a quarterly frequency at a 5 \% level of significance to test whether the variance of the error term is constant using the following hypothesis:

\[
\begin{align*}
H_0 &: \text{homoscedasticity} \\
H_1 &: \text{heteroscedasticity}
\end{align*}
\]

Where the test is conducted at a 0.05 level of significance where the null hypothesis is rejected if the \( p \)-value is < 0.05.

### 4.2.9. Serial Correlation
A CLRM assumes that there is no correlation between amongst the error terms, which is expressed as:
\[ \text{Cov}(U_i, U_j) = 0 \], which means that there is no autocorrelation

Serial correlation exists in a regression model when the error terms are correlated meaning that the error terms are repeated overtime. The presence of serial correlation makes the coefficient estimates to be biased meaning our model is no longer B.L.U.E.

To correct issues related to heteroscedasticity and serial correlation we use various White correction test, Newy West Correction test.

<table>
<thead>
<tr>
<th>Heteroscedasticity</th>
<th>Serial Correlation</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No ARCH effect</td>
<td>No Serial correlation</td>
</tr>
<tr>
<td>2</td>
<td>ARCH effect</td>
<td>No Serial correlation</td>
</tr>
<tr>
<td>3</td>
<td>No ARCH effect</td>
<td>Serial correlation</td>
</tr>
<tr>
<td>4</td>
<td>ARCH effect</td>
<td>Serial correlation</td>
</tr>
</tbody>
</table>

4.2.10. Ramsey reset test

Ramsey Regression Equation Specification Error Test (RESET), is essentially a test conducted to assert the functional form of the regression. For this test, we raise the dependent variable to a higher order of 2 (y_fit_p2). The decision to either reject or not reject the null hypothesis is based on the p-value generated by software which is then compared to the 0.05 level of significance. The RAMSEY RESET test is conducted using the following hypothesis:

\[ H_0: \text{linearity} \]
\[ H_1: \text{non-linear} \]
Chapter 5 Empirical Findings

This section of the study is an analysis of the empirical findings from the statistical software Matlab. The analysis is essentially an interpretation of the output received from the software when conducting the regression analysis. Under the section, we analyze findings from tests such as unit root test, correlation test, t-test, ARMA test, heteroscedasticity test, normality test as well as the Ramsey reset test.

5.1. Unit Root Test Finding

We conducted a unit root test for stationarity using GDP as our dependent variable and the top 10 imported and exported commodities as our independent variables. Upon conducting our unit root test for stationarity, we find that none of the variables stationary level / I (0) process. The dependent variable, GDP is found to be stationary at I (1). As a rule of thumb, our variables should be integrated in the same order. Our 20 explanatory variables were found to be stationary at the I (1) process. We find that all the variables in our regression are not stationary and have to be differenced once before becoming stationary. Therefore, we reject the null hypothesis of a unit root at a 5 % level of significance. According to Mogoe (2013), cointegration is an overriding requirement for any model that has non-stationarity data. The main of conducting the cointegration test is to establish whether there or not there exists a long-run relationship between our dependent variable and the independent variables.

5.2. Correlation Test Finding

Upon conducting our correlation test we find that there are 2 variable pairs with a correlation that is greater than 0.80 which is a violation of the OLS Assumptions stating that no independent variable is a perfect linear function of another explanatory variable, therefore we have to remove one of the variables from variable pair. From
the correlation test, we find machinery and appliances imports ($X_{2\_imp}$) being highly correlated with the import of pharmaceutical products ($X_{8\_imp}$), where the correlation coefficient is 0.81. Secondly, we find a variable pair consisting of the import of pharmaceutical products ($X_{8\_imp}$) and the import of vehicle and vehicle ($X_{3\_imp}$) component where the correlation coefficient is 0.87. Therefore, we remove the import of machinery and appliances ($X_{2\_imp}$) and the import of vehicle parts and vehicle ($X_{3\_imp}$) variable from our regression to eliminate multicollinearity within the regression. The economic justification behind removing the machinery and appliances imports variable instead as opposed to the import of pharmaceutical lies in the fact that pharmaceutical products have an inelastic demand and there exists no substitutes for these products. However, with machinery and appliances, some of the products under this classification can be substituted by human labour in labor primary industries such as Agriculture, and Mining. A switch from capital to labor will result in an increase in employment which can solve the issue of unemployment in the country. In addition, scholars such as Omilola (2015) find that the country is underutilizing the large pool of low-skilled labor, which in turn adds to the current situation of high unemployment thus affecting income earnings within the country which has a ripple effect on the economic growth. The justification behind the removal of vehicle and vehicle parts imports emanates from the fact that South Africa’s automotive industry is highly competitive and has a global presence. Furthermore, the removal of these imports will contribute to an increase in production within the industry. This in turn allow for industry to produce more, thereby improving exports and the overall GDP.
Initially, our regression analysis consisted of an intercept term plus 20 independent variables and the stochastic error term, where our regression model is expressed as:

\[ Y_t = \alpha + \beta_1 X_{1\_exp} + \beta_2 X_{2\_exp} + \beta_3 X_{3\_exp} + \beta_4 X_{4\_exp} + \beta_5 X_{5\_exp} + \beta_6 X_{6\_exp} + \beta_7 X_{7\_exp} + \beta_8 X_{8\_exp} + \beta_9 X_{9\_exp} + \beta_{10} X_{10\_exp} + \beta_{11} X_{1\_imp} + \beta_{12} X_{2\_imp} + \beta_{13} X_{3\_imp} + \beta_{14} X_{4\_imp} + \beta_{15} X_{5\_imp} + \beta_{16} X_{6\_imp} + \beta_{17} X_{7\_imp} + \beta_{18} X_{8\_imp} + \beta_{19} X_{9\_imp} + \beta_{20} X_{10\_imp} + U \]

### Table 02: Multicollinearity Test Findings

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Source: Author’s own

**5.3. t-Test Finding**

Initially, our regression analysis consisted of an intercept term plus 20 independent variables and the stochastic error term, where our regression model is expressed as:
Where, \( Y \) = GDP  
\( \alpha \) = Intercept  
\( \beta_1X_1_{\text{exp}} \) = Precious Metals Gems and Jewellery exports  
\( \beta_2X_2_{\text{exp}} \) = Ores, Slag and Ash exports  
\( \beta_3X_3_{\text{exp}} \) = Vehicles and Their Parts exports  
\( \beta_4X_4_{\text{exp}} \) = Mineral Fuels; Oils and Products of Their Distillation exports  
\( \beta_5X_5_{\text{exp}} \) = Machinery and Appliances exports  
\( \beta_6X_6_{\text{exp}} \) = Iron and Steel exports  
\( \beta_7X_7_{\text{exp}} \) = Fruits and Nuts; Edibles; Peels of Citrus Fruits/ Melons exports  
\( \beta_8X_8_{\text{exp}} \) = Aluminium and Articles Thereof exports  
\( \beta_9X_9_{\text{exp}} \) = Electrical Machinery and Equipment exports  
\( \beta_{10}X_{10_{\text{exp}}} \) = Plastics and Articles Thereof; Rubber and Articles Thereof exports  
\( \beta_{11}X_{1_{\text{imp}}} \) = Mineral Fuels; Oils and Products of Their Distillation imports  
\( \beta_{12}X_{2_{\text{imp}}} \) = Machinery & Appliances imports  
\( \beta_{13}X_{3_{\text{imp}}} \) = Vehicles & Their Parts imports  
\( \beta_{14}X_{4_{\text{imp}}} \) = Electrical Machinery & Equipment imports  
\( \beta_{15}X_{5_{\text{imp}}} \) = Precious Metals, Gems & Jewellery imports  
\( \beta_{16}X_{6_{\text{imp}}} \) = Plastics & Articles Thereof imports  
\( \beta_{17}X_{7_{\text{imp}}} \) = Instruments & Apparatus imports  
\( \beta_{18}X_{8_{\text{imp}}} \) = Pharmaceuticals Products imports  
\( \beta_{19}X_{9_{\text{imp}}} \) = Chemical Products N.E.S imports  
\( \beta_{20}X_{10_{\text{imp}}} \) = Inorganic Chemicals, Organic Chemicals imports  
\( U \) = stochastic error term  

Upon conducting the unit root test for stationarity and the correlation test we conducted a t-test to test the individual significance of the remaining variables within the regression analysis. From the analysis we find our regression to have 4 significant variables commodities namely: vehicle and their parts export(\( X_3_{\text{exp}} \)), mineral fuels; oils and products of their distillation exports(\( X_4_{\text{exp}} \)), Fruits and Nuts; Edibles; Peels
of Citrus Fruits/ Melons (X7_exp), as well as plastic and articles thereof (X10_exp) are left as significant variables. we find our final t-test regression to be as follows:

\[ Y_t = \alpha + \beta_1 X_{1\_exp} + \beta_3 X_{3\_exp} + \beta_4 X_{4\_exp} + \beta_7 X_{7\_exp} + \beta_{10} X_{10\_exp} + U_t \]

From the regression analysis, we find that the export of vehicles and vehicle parts is positive and significant. In addition, we that holding all things constant a 1% increase in the export of vehicles and vehicle parts Vehicle (\( \beta_3 X_{3\_exp} \)) will result in an $0.10 billion increase in the GDP of South Africa per quarter. The positive relationship between the export of vehicles and vehicle parts can be explained by the fact that the country produces 6.9% of the vehicles and vehicle parts for the global market, and is ranked 22\textsuperscript{nd} globally for its production of vehicles and vehicle parts (International Trade Administration, 2021).

With regards to the export of mineral fuels, mineral oils, and products of their distillation (\( \beta_4 X_{4\_exp} \)) we find this commodity to be significant and have a negative impact on economic growth. From the regression analysis, we find that a 1% increase in the export of mineral fuels, oils, and products of their distillation (\( \beta_4 X_{4\_exp} \)) will decrease GDP by $0.23 billion per quarter. Alternately, the regression results can have interpreted as a 1% decrease in the exports of Mineral fuels, mineral oils, and products of their distillation would cause the economy of South Africa to by $0.23 billion per quarter.

From our regression, we find Fruits and Nuts; Edibles; Peels of Citrus Fruits/ Melons (X7_exp) to be significant and negative. From the regression we find that there exists a negative relationship between economic growth and the export of Fruits and Nuts; Edibles; Peels of Citrus Fruits/ Melons (\( \beta_7 X_{7\_exp} \)), where a 1% increase in the export of the Fruits and Nuts; Edibles; Peels of Citrus Fruits/ Melons leads to a decrease of $0.04 billion in the GDP for per quarter. The negative relationship between the export of Fruits and Nuts; Edibles; Peels of Citrus Fruits/ Melons (\( \beta_7 X_{7\_exp} \)) and GDP
quarterly could emanate from the fact that South Africa has been experiencing water shortages which have negatively impact agricultural production. Furthermore, it is important to note that this commodity is seasonal, thus justifying the negative impact of the commodity on economic growth.

When assessing the impact of Plastics and articles thereof ($\beta_{10}X_{10\_exp}$) on t economic growth we find that the commodity is both positive and significant. From our regression we find has a positive relationship between Plastics and articles thereof ($\beta_{10}X_{10\_exp}$) and the economic growth. In addition, we can state that a 1% increase in the export of Plastics and articles thereof ($\beta_{10}X_{10\_exp}$) will cause the economy of South Africa to grow by $0.26 billion per quarter. When assessing the goodness of fit of the regression model by analyzing the adjusted r-squared we find our model has an explanatory of 46.5%.

Table 03: t-Test regression analysis

\[ Y = \alpha + \beta_3 X_3\_exp + \beta_4 X_4\_exp + \beta_7 X_7\_exp + \beta_{10} X_{10\_exp} + U_t \]

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<td>0.06</td>
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Number of observations: 38, Error degrees of freedom: 33
Root Mean Squared Error: 0.058
R-squared: 0.523, Adjusted R-Squared: 0.465
F-statistic vs. constant model: 9.05, p-value = 4.77e-05
5.4. F-test finding

The F-test is similar to the t-test; however, the F-test looks at the overall significance of the model whereas the t-test assesses the significance of each variable. From our F-test we find that the model has an R squared of 52.3%, this reveals that 52.3% of the data fits the regression model, as the R-squared represents the goodness of fit. However, we use the adjusted R-square because our R-squared coefficient tends to increase as we include more variables into the regression. From our regression analysis, we find the adjusted R-square figure to be 0.47 / 47 %. Meaning that our model has predictive power of 47 %. Alternatively, one can state that 47% of the variation of our dependent variable can be explained by the changes in our independent variables.

5.5. ARMA Test Findings

The ARMA test is conducted to establish whether previous values of a variable will have an impact on the future value of the variables. We conduct the ARMA test starting from ARMA order (5,5) where we find that our ARMA coefficients are insignificant as they are greater than the critical level. However, our independent variables within the regression analysis were still significant. We iteratively conduct the test until we reach the level of ARMA where our ARMA independent variables are significant and below the critical value of 5 %. From our regression we find our variables to be significant models to AR (0), and MA (1) (see table 05 below). From the ARMA test, we find that adding a MA variable has improved the model’s predictive power, as adding the MA improved our Adjusted R-squared from 47 % to 63%. Therefore, from the above find that adding one MA variable has improved the regression’s predictive power by 16%.

Table 04: ARMA Test

\[ Y = \alpha + \beta_3 X_{3\_exp} + \beta_4 X_{4\_exp} + \beta_7 X_{7\_exp} + \beta_{10} X_{10\_exp} + MA + U_t \]
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<tr>
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<tr>
<td>MA</td>
<td>-0.69</td>
<td>0.17</td>
<td>-4.02</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Number of observations: 37, Error degrees of freedom: 31
Root Mean Squared Error: 0.0483
R-squared: 0.688, Adjusted R-Squared: 0.637
F-statistic vs. constant model: 13.6, p-value = 4.53e-07

Upon completing the ARMA test we compared our ARMA model to our final t-test results which is the model without the ARMA. We then select the model which is better fitting by assessing the model selection criteria which we do by comparing the AIC and BIC of the models and select a model with the lowest AIC/ BIC. Upon doing this selection we find the model with ARMA to be a better fitting model in comparison to the model without ARMA and we proceed with the model with ARMA. And we proceed to conduct testing for heteroscedasticity.

5.6. Heteroscedasticity Findings

The Normality test computed using the Jarque-bera test shows which shows that residuals are normally distributed. The output from our Jarque-bera test shows that our residuals are normally distributed and follow a chi square distribution. From our heteroscedasticity test we find that there is ARCH effect, as the F-statistic is greater than the critical value, and therefore this has to be corrected using White test.
Table 05: Heteroscedasticity Test Findings

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<td>4.40</td>
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Number of observations: 37, Error degrees of freedom: 34
Root Mean Squared Error: 0.0717
R-squared: 0.246, Adjusted R-Squared: 0.202
F-statistic vs. constant model: 5.56, p-value = 0.00815

5.7. Ramsey Reset Test Findings

The Ramsey RESET test is conducted to test the functional form of the model by essentially detecting whether the model is linear or not by raising the estimated dependent variable to a higher order of 2. Where if the p-value of the is greater than 0.05 then we can conclude that model is nonlinear, and if the p-value is less than 0.05 then we reject the null hypothesis. From the regression we find our model P-value being less than 0.05, and therefore we conclude that the model is non-linear. This could emanate from the fact that our sample size was small. Statistically, as a rule of thumb, a regression is more robust when it has more than 30 variables because the smaller the sample size, the higher the error margin is. To rectify this, we would recommend the usage of a direct model such as the GARCH model, which is an approach to estimating volatility. In addition, a GARCH model is usually preferred by Finance Professionals as it provides more realistic predictions of prices and finance-related instruments.

Table 06: Ramsey RESET Linear regression model:
Y = -0.01 + y_fit_p2

Estimated Coefficients:

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Number of observations: 37, Error degrees of freedom: 35
Root Mean Squared Error: 0.0419
R-squared: 0.152, Adjusted R-Squared: 0.127
F-statistic vs. constant model: 6.25, p-value = 0.0172

Table 07: final regression model
Linear regression model:
Y = α + β_3 X_3_exp + β_4 X_4_exp + β_7 X_7_exp + β_{10} X_{10_exp} + MA + U_t

Estimated Coefficients:

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<tr>
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<th>Estimate</th>
<th>SE</th>
<th>tStat</th>
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<tbody>
<tr>
<td>Intercept</td>
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<td>0.01</td>
<td>-0.53</td>
<td>0.60</td>
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<tr>
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<td>X_{7_exp}</td>
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<td>MA</td>
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</table>

Number of observations: 37, Error degrees of freedom: 31
Root Mean Squared Error: 0.0483
R-squared: 0.688, Adjusted R-Squared: 0.637
F-statistic vs. constant model: 13.6, p-value = 4.53e-07
Chapter 6: Discussion

This chapter of the study aims to discuss the final findings from our regression model. For this section of the study, we analyze the results from regression analysis and apply economic theory and empirical evidence into explaining the outcome from our final regression model.

Upon completing the regression analysis, we find our final model to expressed as:

\[ Y = \alpha + \beta_3 X_{3\_exp} + \beta_4 X_{4\_exp} + \beta_7 X_{7\_exp} + \beta_{10} X_{10\_exp} + MA + U_t \]

Where:  
\( X_{3\_exp} = \text{vehicles and vehicle components} \)  
\( X_{4\_exp} = \text{mineral fuels, oils and products of their distillation} \)  
\( X_{7\_exp} = \text{Fruits and Nuts; Edibles; Peels of Citrus Fruits/Melons} \)  
\( X_{10\_exp} = \text{Plastics and plastic products thereof} \)  
\( MA = \text{moving average} \)  
\( U_t = \text{error correction term} \)

Initially, our regression analysis comprised of the 10 exported and top 10 imported commodities. Based on economic theory, and the Balance of trade equation (Net trade = export – imports), we expect exported commodities to have a positive impact on economic growth and for imported commodities to have a negative impact on economic growth. However, from our regression analysis, we find that all of our imported commodities were insignificant, having no impact on the quarterly economic growth of South Africa. With regards to the exported commodities, we find that only four commodities were significant. However, from the four significant export commodities, we find the export of Mineral Fuels; Oils, and Products of Their Distillation (\( X_{4\_exp} \)) and the export of Fruits and Nuts; Edibles; Peels of Citrus Fruits/Melons (\( X_{7\_exp} \)) as having a negative impact to the quarterly economic growth of South Africa.
6.1. Vehicles and their parts (X3_exp)

The first significant variable in our final regression is the export of Vehicles and Their Parts (X3_exp), where we find that a 1% increase in the export of Vehicles and Their Parts will cause the economy of South Africa to grow by $0.12 billion per quarter. This significant and positive impact of vehicle exports on GDP can be justified by the fact that South Africa’s automotive manufacturing industry is ranked 22nd globally for its production of vehicles and vehicle parts (International Trade Administration, 2021). In addition, the country accounts for 6.9% of the production in the global market. Furthermore, South Africa’s automotive industry remains the largest manufacturing sector in the country has contributed 6.4% of the country’s GDP in 2019. The industry’s ability to having such a great impact on GDP could emanate from the fact that the automotive sector remains one of the most visible sectors receiving foreign direct investments within the manufacturing sector. The industry’s value chain is known driven by seven OEMs namely: BMW, Volkswagen, Mercedes Benz, Ford, Isuzu, Nissan, and Toyota (NAAMSA, 2021), where the total amount of FDI injected into the industry by the aforementioned OEMs was approximately R9.2 billion in 2020 (International Trade Administration, 2021). The continued investment into the industry has allowed for manufacturing and assembly plants to invest in state of the art capital and technology which will result in increased efficiency and productivity as seen in the endogenous growth model where capital formation has been seen as an essential input for economic growth.

A world bank study conducted on “Firm location and determinants of Exports in developing countries” finds that the average share of manufacturing export firms is higher in core regions (Farole, 2011), such is the case in the South African context. In the context of the South African automotive industry, we find the manufacturing and assembling plants strategically located in South Africa’s core manufacturing provinces namely: Gauteng, which is the economic hub of the country; Eastern Cape- the country’s largest Industrial Development Zone and KwaZulu Natal- home to the
busiest port in the sub-Saharan region and the largest port in the African continent. The strategic positioning of these manufacturing and assembling plants can also be seen as an enabling factor that has allowed the country to yield positive returns from the exports of vehicles and vehicle parts.

Figure 06: South Africa Export of Vehicle and Vehicle parts

Source: Tradingeconomics.com

6.2. Mineral Fuels; Oils and Products of Their Distillation (X₄_exp)

The second significant variable from the regression analysis is the export of Mineral Fuels; Oils and Products of Their Distillation (X₄_exp). From our regression, we find that 1% increase in the export of Mineral Fuels; Oils, and Products of Their Distillation (X₄_exp) will cause the GDP to decrease by $0.19 billion per quarter. The reasoning behind the inverse relationship between the export of Mineral Fuels; Oils and Products of Their Distillation (X₄_exp) and economic growth could result from the fact that under this HS Code classification grouping (see Appendix: Table 2) we find commodities which are exported in large volumes but have low values. Furthermore, most of the commodities under the HS code classification are raw materials that have not been processed, there the lack of value addition could also contribute to the low nominal contribution of these commodities to GDP.
From a theoretical perspective, the phenomenon of the Dutch disease, as well as the Resource Curse, can be applied in explaining the inverse relationship between GDP and the export of Mineral Fuels; Oils, and Products of Their Distillation. The Dutch disease is a concept that was coined in 1977 and explains how the discovery and exploitation of natural resources tend to have unexpected repercussions on the overall economy of a nation. The phenomena of the Dutch disease commonly occur in countries whose economic growth is lopsided, relying heavily on the export of natural resources. Furthermore, the OECD (2021) states that “resource abundance does not always bring sustained economic growth and development – it can have the opposite effect, which is sometimes referred to as the “resource curse”. Mikesell (1997) conducted a study “Explaining the resource curse, with special reference to mineral-exporting countries” finds that there exists an inverse correlation between economic growth and natural resource abundance among developing countries. A study conducted by Sachs and Warner (1995) who studied the relationship between “Natural Resource Abundance and Economic Growth in developing countries” finds that “one of the surprising features of modern economic growth is that economies abundant in natural resources have tended to grow slower”. A study on the “Empirical evidence on the resource curse hypothesis in oil abundant economy” conducted by Satti et.al (2014) who focused on Venezuela from the period 1971-2011 finds that natural resource abundance tends to impede economic growth.

From the policy perspective, the inverse relationship can also be explained by the presence of government regulations such as permits and licensing for commodities such as oil, fuel, paraffin, lubricating oils, petroleum gases, petroleum jelly, petroleum bitumen, and paraffin wax. The implementation of these regulations acts as a form of protectionism for local exporting companies.

From a microeconomic perspective, the mineral commodities this inverse relationship can be seen as emanating from the fact that the mining sector’s contribution to GDP
contracted by 1.7% in 2019. This, according to the Mineral Council of South Africa (2019) was due to Logistical constraints (such as rail capacity), Utility disruption (power outages), industrial action, and community unrest. From macroeconomic perspective commodity prices and exchange rate disparities can be seen as underlying forces that impact the trade and movement of these commodities. Given the fact that commodities are traded in US$ and the exchange rate between the US$ and the ZAR continues to widen (see figure 08 below), this causes the commodity prices to drop. For an exporting country like South Africa, depreciation of the ZAR against the US$D translates to lower revenue received for the commodities being sold in the international market even the volume of exports is increasing.

Though South Africa is one of the top mineral exporting countries, the country’s current energy crisis has impacted not only the export of energy resources but also other industries that rely on energy for their operations. The increasing in-house demand for these resources has impacted the revenue received from their exports. To tackle this issue, the country should utilize alternative renewable energy.

Figure 07: South Africa exports of mineral fuels, oils, distillation products

Source: Tradingeconomics.com
6.3. Fruits and Nuts; Edibles; Peels of Citrus Fruits/ Melons ($X_{7,\text{exp}}$)

From the regression analysis, we find that a 1% increase in the export of Fruits and Nuts; Edibles; Peels of Citrus Fruits/ Melons will cause the economy to contract by 0.03 billion dollars per quarter. The inverse impact of these exports can be seen as emanating from factors such as seasonality of the industry, droughts as well as climate change.

The inverse impact of these commodities can also be explained from a policy perspective. Over the years South Africa’s Agriculture sector has always been characterized as a labour-intensive industry. The implementation of minimum wage by the department of Labour can be seen as a price-floor that hinders the market from clearing as this form of intervention causes inefficiencies within the market. Furthermore, the implementation of the minimum wage policy can be viewed as an input cost inflation which has a ripple effect on the revenue earned.

Another policy-related impact that could lead to the negative contribution to economic growth is the land expropriation without compensation passed by the Parliament of South Africa in 2018. The and expropriation without compensation policy allows for the government to pursue land reform via restitution, redistribution and tenure reform.
this in essence allows for the government to claim land that was ceased by the colonists and redistribute the land to its rightful owner without compensation.

Figure 09: South Africa Export of edible fruits, nuts, peel of citrus fruit, melons

Source: Tradingeconomics.com

6.4. Exports of Plastics and Plastic Products Thereof (X\textsubscript{10}\_exp)

From our regression analysis, we find that a 1\% increase in the exports of plastics and plastic products will cause the economy of South Africa to grow by $0.26 billion per quarter. The positive relation between plastic exports and GDP could emanate from the fact that Plastic products are used as inputs by a variety of industries such as motor vehicles, construction, packaging, textiles, and clothing industries, where according to the Industrial Policy Action Plan (IPAP), South Africa’s plastic manufacturing contributed approximately 1.6\% to the country’s GDP and 14.2\% to the manufacturing sector (IPAP, 2020). Furthermore, the introduction of 3D printing, biodegradable plastics as well as plastic recycling has allowed for the industry to produce more plastic products at using fewer inputs further justifying the positive impact of plastics and plastic products on GDP.
6.5. Insignificant variables

The study initially consisted of 20 commodity grouping, upon running our regression we find that sixteen commodity groupings were insignificant within the regression. These commodities were:

- Precious Metals Gems and Jewellery exports \((X_{1\_exp})\);
- Ores, Slag and Ash exports \((X_{2\_exp})\);
- Machinery and Appliances exports \((X_{3\_exp})\);
- Iron and Steel exports \((X_{6\_exp})\);
- Aluminium and Articles Thereof exports \((X_{8\_exp})\);
- Electrical Machinery and Equipment exports \((X_{9\_exp})\);
- Mineral Fuels; Oils and Products of Their Distillation imports \((X_{1\_imp})\);
- Machinery & Appliances imports \((X_{2\_imp})\);
- Vehicles & Their Parts imports \((X_{3\_imp})\);
- Electrical Machinery & Equipment imports \((X_{4\_imp})\);
- Precious Metals, Gems & Jewellery imports \((X_{5\_imp})\);
- Plastics & Articles Thereof imports \((X_{6\_imp})\);
- Instruments & Apparatus imports \((X_{7\_imp})\);
Pharmaceuticals Products imports ($X_8$ _imp); Chemical Products N.E.S imports ($X_9$ _imp); and Inorganic Chemicals, Organic Chemicals imports ($X_{10}$ _imp).

The insignificance of these commodities for the study can be due to the fact that the commodity classification is inclusive of both some high value and low value commodities. Therefore, when we aggregate their contribution to GDP we find it to be the opposite of our expected results. It is no lie that South Africa has vast reserves of resources such as Coal, Gold, Diamonds, Iron ore, Platinum, Manganese, Chromium, and Copper. However, South Africa does not own these mining; quarrying; oil and gas extraction reserves. These reserves are owned by private and foreign companies such as DeBeers; Anglo American; Glencore; BPH, and Rio Tinto. A similar situation exists within the agricultural sector, where land is owned by foreign companies. The privatization of land, mines and can also be seen as a logic reasoning as to why these commodities can be insignificant, as the company’s main earning are directed to head offices which are not likely to be based in South Africa. The revenue generated by these companies operating in South Africa usually covers operational expenses for the company. Furthermore, the investment made by these multinational cooperation’s can be classified as capital flight investment. Capital flight investment does not yield much of a positive impact on GDP as utilizing this investment strategy invest into country to extract resources and leave when the resources have depleted. In addition, the aforementioned commodities are very volatile and are impacted my external macroeconomic factors such economy downgrading and weakening exchange rate.

The insignificance of the imported commodities could emanate from the fact that in our data collection technique we only focused on only on imported and exported commodities and excluded entrepot trade, which is importing a particular good adding value to commodity and re-exporting the commodity. If the study had included entrepot trade, we would see import commodity group classifications such as vehicles and vehicles parts as being positive since the export of vehicles is positive the import of vehicle parts can be used as inputs to support the growing industry.
Conclusion

The study examined the impact of international trade of commodities on the economic growth of South Africa using 2010-2019 as the sample period. The aim of the study was twofold; firstly, it was to identify the top 10 imported and exported commodities within our sample period. Secondly, it was asses which of these commodities have a positive impact on the economic growth. Using the HS 2 commodity code classification, we were able to sample data from the OEC, and UN Comtrade for the regression analysis, where the traded goods represented our independent variables whilst GDP was used as a proxy for economic growth. The impact of trade on economic growth was examined using an OLS regression model. The empirical findings from the regression analysis showed us that all imported commodities have no impact on quarterly economic growth. Though balance trade equation shows us that exports ought to have a positive impact on GDP, in our regression we find that some exported commodities have an inverse impact on the quarterly GDP. Our regression results show that export of Vehicle and vehicle parts (X_{3\_exp}) and Plastics and Plastics products (X_{10\_exp}) have a positive impact of GDP, whilst the export of fruits (X_{7\_exp}) and mineral fuel, mineral and products of their distillation (X_{exp}) have a negative impact on the economic growth.

Based on the findings from our regression analysis one can recommend a review of the policies that promote export-led growth. To attain more revenues from exports South Africa needs to review regulations pertaining to ownership of land, and its reserves. The enforcement of permits and licensing for industries that have potential of improving economy can be seen as a barrier to entry which have created inefficiencies. With south Africa being a country with an abundance of resource, it advisable for the government to focus on boosting its manufacturing industry in order to enable value addition processes into resources as exporting final products as opposed to raw materials will have a greater impact on GDP.
This study may be further investigated through using GARCH model or essentially adding controlled variables such as inflation; and foreign direct investment for more results.
References


Statista, African countries with the highest Gross Domestic Product (GDP) in 2020

Statistics South Africa http://www.statssa.gov.za/?p=14423


Appendices

Appendix 1: Vehicles other than railway or tramway rolling stock, and parts and accessories thereof commodity list

<table>
<thead>
<tr>
<th>Vehicles other than railway or tramway rollingstock, and parts and accessories thereof</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>15</td>
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<td>16</td>
</tr>
</tbody>
</table>
Appendix 2: Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes commodities

<table>
<thead>
<tr>
<th>Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Coal; briquettes, ovoids and similar solid fuels manufactured from coal</td>
</tr>
<tr>
<td>2 Lignite, whether or not agglomerated, excluding jet</td>
</tr>
<tr>
<td>3 Peat (including peat litter), whether or not agglomerated</td>
</tr>
<tr>
<td>4 Coke and semi-coke of coal, of lignite or of peat, whether or not agglomerated; retort carbon</td>
</tr>
<tr>
<td>5 Coal gas, water gas, producer gas and similar gases, other than petroleum gases and other gaseous hydrocarbons</td>
</tr>
<tr>
<td>6 Tar distilled from coal, from lignite or from peat, and other mineral tars, whether or not dehydrated or partially distilled, including reconstituted tars</td>
</tr>
<tr>
<td>7 Oils and other products of the distillation of high temperature coal tar; similar products in which the weight of the aromatic constituents exceeds that of the non-aromatic constituents</td>
</tr>
<tr>
<td>8 Pitch and pitch coke, obtained from coal tar or from other mineral tars</td>
</tr>
<tr>
<td>9 Petroleum oils and oils obtained from bituminous minerals, crude</td>
</tr>
<tr>
<td>10 Petroleum gases and other gaseous hydrocarbons</td>
</tr>
<tr>
<td>11 Petroleum oils and oils obtained from bituminous minerals, other than crude preparations not elsewhere specified or included, containing by weight 70 % or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations waste oils</td>
</tr>
<tr>
<td>12 Petroleum jelly; paraffin wax, microcrystalline petroleum wax, slack wax, ozokerite, lignite wax, peat wax, other mineral waxes, and similar products obtained by synthesis or by other processes, whether or not coloured</td>
</tr>
<tr>
<td>13 Petroleum coke, petroleum bitumen and other residues of petroleum oils or of oils obtained from bituminous minerals</td>
</tr>
<tr>
<td>14 Bitumen and asphalt, natural; bituminous or oil-shale and tar sands; asphaltites and asphalthic rocks</td>
</tr>
<tr>
<td>15 Bituminous mixtures based on natural asphalt, on natural bitumen, on petroleum bitumen, on mineral tar or on mineral tar pitch (for example, bituminous mastics, cut-backs)</td>
</tr>
<tr>
<td>16 Electrical energy</td>
</tr>
</tbody>
</table>
## Appendix 3: Edible fruit and nuts; peel of citrus fruits or melons commodities

<table>
<thead>
<tr>
<th></th>
<th>Edible fruit and nuts; peel of citrus fruits or melons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coconuts, Brazil nuts and cashew nuts, fresh or dried, whether or not shelled or peeled</td>
</tr>
<tr>
<td>2</td>
<td>Other nuts, fresh or dried, whether or not shelled or peeled</td>
</tr>
<tr>
<td>3</td>
<td>Bananas, including plantains, fresh or dried</td>
</tr>
<tr>
<td>4</td>
<td>Dates, figs, pineapples, avocados, guavas, mangoes and mangosteens, fresh or dried</td>
</tr>
<tr>
<td>5</td>
<td>Citrus fruit, fresh or dried</td>
</tr>
<tr>
<td>6</td>
<td>Grapes, fresh or dried</td>
</tr>
<tr>
<td>7</td>
<td>Melons (including watermelons) and papaws (papayas), fresh</td>
</tr>
<tr>
<td>8</td>
<td>Apples, pears and quinces, fresh</td>
</tr>
<tr>
<td>9</td>
<td>Apricots, cherries, peaches (including nectarines), plums and sloes, fresh</td>
</tr>
<tr>
<td>10</td>
<td>Other fruit, fresh</td>
</tr>
<tr>
<td>11</td>
<td>Fruit and nuts, uncooked or cooked by steaming or boiling in water, frozen, whether or not containing added sugar or other sweetening matter</td>
</tr>
<tr>
<td>12</td>
<td>Fruit and nuts, provisionally preserved (for example, by sulphur dioxide gas, in brine, in sulphur water or in other preservative solutions), but unsuitable in that state for immediate consumption</td>
</tr>
<tr>
<td>13</td>
<td>Fruit, dried, other than that of headings 0801 to 0806 mixtures of nuts or dried fruits of this chapter</td>
</tr>
<tr>
<td>14</td>
<td>Peel of citrus fruit or melons (including watermelons), fresh, frozen, dried or provisionally preserved in brine, in sulphur water or in other preservative solutions</td>
</tr>
</tbody>
</table>

Source: findhs.code
Appendix 4: Plastic and articles thereof commodity list

<table>
<thead>
<tr>
<th></th>
<th>Plastics and articles thereof</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Polymers of ethylene, in primary forms</td>
</tr>
<tr>
<td>2</td>
<td>Polymers of propylene or of other olefins, in primary forms</td>
</tr>
<tr>
<td>3</td>
<td>Polymers of styrene, in primary forms</td>
</tr>
<tr>
<td>4</td>
<td>Polymers of vinyl chloride or of other halogenated olefins, in primary forms</td>
</tr>
<tr>
<td>5</td>
<td>Polymers of vinyl acetate or of other vinyl esters, in primary forms; other vinyl polymers in primary forms</td>
</tr>
<tr>
<td>6</td>
<td>Acrylic polymers in primary forms</td>
</tr>
<tr>
<td>7</td>
<td>Polycocetals, other polyethers and epoxide resins, in primary forms; polycarbonates, alkyd resins, polyallyl esters and other polyesters, in primary forms</td>
</tr>
<tr>
<td>8</td>
<td>Polyamides in primary forms</td>
</tr>
<tr>
<td>9</td>
<td>Amino-resins, phenolic resins and polyurethanes, in primary forms</td>
</tr>
<tr>
<td>10</td>
<td>Silocenes in primary forms</td>
</tr>
<tr>
<td>11</td>
<td>Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones and other products specified in note 3 to this chapter, not elsewhere specified or included, in primary form</td>
</tr>
<tr>
<td>12</td>
<td>Cellulose and its chemical derivatives, not elsewhere specified or included, in primary forms</td>
</tr>
<tr>
<td>13</td>
<td>Natural polymers (for example, alginic acid) and modified natural polymers (for example, hardened proteins, chemical derivatives of natural rubber), not elsewhere specified or included, in primary forms</td>
</tr>
<tr>
<td>14</td>
<td>Ion-exchangers based on polymers of headings 3901 to 3913, in primary forms</td>
</tr>
<tr>
<td>15</td>
<td>Waste, parings and scrap, of plastics</td>
</tr>
<tr>
<td>16</td>
<td>Monofilament of which any cross-sectional dimension exceeds 1 mm, rods, sticks and profile shapes, whether or not surface-worked but not otherwise worked, of plastics</td>
</tr>
<tr>
<td>17</td>
<td>Tubes, pipes and hoses, and fittings therefor (for example, joints, elbows, flanges), of plastics</td>
</tr>
<tr>
<td>18</td>
<td>Floor coverings of plastics, whether or not self-adhesive, in rolls or in the form of tiles wall or ceiling coverings of plastics, as defined in note 9 to this chapter</td>
</tr>
<tr>
<td>19</td>
<td>Self-adhesive plates, sheets, film, foil, tape, strip and other flat shapes, of plastics, whether or not in rolls</td>
</tr>
<tr>
<td>20</td>
<td>Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials</td>
</tr>
<tr>
<td>21</td>
<td>Other plates, sheets, film, foil and strip, of plastics</td>
</tr>
<tr>
<td>22</td>
<td>Baths, shower-baths, sinks, washbasins, bidets, lavatory pans, seats and covers, flushing cisterns and similar sanitary ware, of plastics</td>
</tr>
<tr>
<td>23</td>
<td>Articles for the conveyance or packing of goods, of plastics; stoppers, lids, caps and other closures, of plastics</td>
</tr>
<tr>
<td></td>
<td>Description</td>
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<tr>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>24</td>
<td>Tableware, kitchenware, other household articles and hygienic or toilet articles, of plastics</td>
</tr>
<tr>
<td>25</td>
<td>Builders' ware of plastics, not elsewhere specified or included</td>
</tr>
<tr>
<td>26</td>
<td>Other articles of plastics and articles of other materials of headings 3901 to 3914</td>
</tr>
</tbody>
</table>

Source: Findhs.code