The Skill Intensity of Export Growth in South Africa

by

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submitted in accordance with the requirements for

the degree of

MASTER OF COMMERCE

in the subject

ECONOMICS

at the

UNIVERSITY OF SOUTH AFRICA

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July 2022

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I, **Lorrane Mukondi Nesongozhe**, declare that "The skill intensity of export growth in South Africa," is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

Signature of Candidate

12/07/2022

Date

ACKNOWLEDGEMENTS

My gratitude to the Lord Almighty for maintaining my sanity and strength throughout this dissertation. It has been a pleasure working with Professor Njabulo Innocent Mkhize, who guided and pushed me throughout this journey. My sincere appreciation goes to his valuable input and method for supervising, which allowed me to simultaneously be under his wing while also being independent in my thinking. To my colleagues in the field of academia, Professor Syden Mishi, Professor Renee Van Eyden**,** Professor Busani Moyo, Professor Robinson Zurika and Mr Thabang Malatji, I am grateful for their contributions. Additionally, this dissertation would not have been possible without the support and encouragement of my family and friends.

ABSTRACT

South Africa has consistently attempted to increase its export base to increase its market share and increase its trading partners in other parts of the world. This is done in an effort to grow the economy and with the hope to increase employment in the face of job shedding in the local economy. What is not clear is the implication of export intensity on labour skills. Skills are in different categories, low-skilled, semiskilled and skilled; which interplay in the market intensity continuum. There is need to take all three into account, simultaneously to get a better understanding of the skills intensity of export growth. Given the simultaneous nature of the model, this study uses the three-stage least squares (3SLS) method to estimate the demand for skills using a linear specification when examining the correlation between export performance in the four biggest exporting industries and the skills structure of South Africa. Resulting from the study is that South Africa is skill intensive in all the main exporting industries. In the manufacturing sector, semiskilled workers are employed alongside skilled workers. This study suggests that skills development should be a continuous and active process.

KEY TERMS:

Skilled labour; Semiskilled labour; Low skilled labour; Exports; Three-Stage Least Squares (3SLS); Skills policy; Skills-only Heckscher-Ohlin-Samuelson (HOS); Simultaneous equations; Employment; Demand

Abbreviations and Acronyms

ANC	African National Congress
AsgiSA	Accelerated and Shared Growth Initiative – South Africa
CEPD	Center for Education and Professional Development
DTIC	Department of Trade Industry, & Competition
EPMD	Export Promotion and Market Development
GATT	General Agreement on tariffs and trade
GEAR	Growth, Employment and Redistribution
GEIS	General Export Incentive Scheme
GDP	Gross Domestic Products
H-O	Heckscher-Ohlin
LACEX	Labour Content of Exports
MAP	Marketing of Agricultural Products
NSDS	National Skills Development Strategy
NQF	National Qualifications Framework
RDP	Reconstruction and Development Programme
SAQA	South African Qualifications Act
SETA	Sector Education and Training Authorities
SURE	Seemingly Unrelated Regression
3SLS	Three-stage Least Squares
2SLS	Two-stage Least Squares

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

International trade is important to any economy, to access goods and services that a country does not produce, and to also gain a market for its own products (Perla, Tonetti and Waugh ,2021). Countries can seek growth by accessing the international market and growing exports (injection into the circular flow of income) and reducing imports (a leakage to the system). It is imperative, however, to understand the key drivers of export growth (nondomestic outputs) to inform domestic policies as well as international arrangements. The relationship between inputs and outputs, known as the production function (Ackerberg, DA., Caves, K. and Frazer, G., 2015), (including export goods) considers capital and labour. The factor intensity of each country's production depends on Rodrick's (2003) framework of proximate factors which are a country's relative access to inputs (capital, labour and natural resources). Thus, the effect of each structure on exports is worth investigating to explore the country's plausible specialization area.

The importance of international trade is not confined to economic growth, and the impacts flow into the labour market. The skill-enhancing trade hypothesis suggests that the expansion of markets through trade liberalisation enhances research and development (R&D), which boosts the stock of technological expertise and creates skill-intensive employment (Araujo, Vivarelli and Bogliacino, 2009). In addition, Meschi, Taymaz and Vivarelli (2009) find that technology transfer through importation produces knowledge and skill, which is known as skill upgrading (Robbins and Gindling, 1999; Stokey, 1996). Additionally, the quality-upgrading hypothesis, posits that trade increases the average product quality in exporting industries, which generates a demand for more qualified labourers (Verhoogen, 2007).

Several studies indicate that China has a surplus of cheap labour, and empirical evidence also suggests that labour-intensive industries are China's export comparative advantage (Marshall, 2011; Harrigan and Deng, 2010; Zheng, 2004; Zhu, 1991). For a resource-rich country such as Indonesia, evidence indicates that the largest contributors to exports are non-renewable resources. Indonesia, as a low-skill labour intensive country, relies on low-skill production (Li and Coxhead, 2008). The United States, on the other hand, is regarded as capital intensive. However, an earlier study by Leontief and Trefler (1993), (Hufbauer, 1970), and (Leamer, 1980) concluded that exports from the United States are not capital intensive. Wörz's (2004) study of skill intensity in foreign trade and economic growth found that for industrialised countries, trade increases the demand for skilled workers, and for less industrialized countries,

trade increases the demand for medium-skilled workers, since trade patterns depend on industrial development. Therefore, highly industrialised countries are bound to export skill-intensive goods. Less industrialized countries are bound to export semi to low-skill intensive goods. Considering that South Africa is slightly lagging in industrialization, this study predicts that South Africa's exports are bound to be driven by low to semiskilled labour.

1.1.1 THE SITUATION IN SOUTH AFRICA

South Africa is very capital intensive even though it is characterised by an abundant supply of low-skilled labour and relatively few high-skilled workers (Lewis, 2002; Black, Craig and Dunne, 2017). Since the dawn of South Africa's democracy, several sectors have shed formal sector low-skill jobs, while the demand for scarce skilled labour and capital has increased (Thurlow, 2007; Trendle, 2008; Bhorat, Goga and Stanwix, 2014).

During the mid-1990s, South Africa embarked on a vigorous trade liberalisation reform path by lowering its tariffs and other quantitative controls. (Vickers, 2014; Edwards and Lawrence, 2006). These reforms were intensified further through the implementation of comprehensive tariff cuts and the phasing out of General Export Incentive Scheme (GElS), (which was aimed at subsidizing selected manufacturing exporters) as agreed upon in the Uruguay Round of the General agreements on tariffs and trade (GATT) negotiations (Nattrass, 1998).

It was hoped that incentives aimed at export production would stimulate output, employment and productivity growth. However, given the extent to which trade liberalisation implied structural adjustments, the economy suffered significant job losses mainly due to poor coordination with other important policies such as labour market policy (Lewis, 2001; Banerjee, Galiani, Levinsohn, McLaren and Woolard, 2008; Black and Gerwel, 2014). Given that South Africa is a skill-scarce country with an abundant supply of low-skilled labour, a number of these job losses were incurred in labour-intensive industries (Lewis, 2002; Erten, Leight and Tregenna, 2019). It became apparent therefore that export production incentives have been of high skill labour (quality) intensity, moving from general labour (quantity) intensity.

Hence, it is against this backdrop that this study seeks to explore the export side of the comparative advantage in the South African economy to explain the level of skill set that is instrumental to export growth. The objective of this study is to ascertain the changing patterns of skill intensity of export growth in South Africa. The study will make use of the Three least

squares methodology to investigate how the skill intensity of export growth has evolved in South Africa by examining whether trade openness has been skill intensive.

1.1.2 REVIEW OF SKILLS DEVELOPMENT AND EXPORT PROMOTION POLICIES IN SOUTH AFRICA

There has been a significant outcry that begs for the re-evaluation of labour policy, especially pertaining to skills development (Mukwawaya, Emwanu and Mdakane, 2018; Tshilongamulenzhe, 2011). Erten, Leight and Tregenna (2019) find that South Africa's labour market is marked by unique qualities of low levels of employment, lack of development in the informal sector, lack of growth in the manufacturing sector and a lack of flexibility of wages. It has been well recorded that South Africa has one of the highest unemployment rates. Moreover, unemployment is more visible among low-skilled labour. The abundance of low skills in South Africa was largely formulated during the apartheid era in the presence of racial discrimination in education and training and labour market racial segmentation (Ashton, DN 2004) emphasised/imposed by law. A large influx of low-skilled labour was witnessed during the 1990s, when black women entered the labour force after the acts of racial discrimination were abolished (Banerjee et al., 2008). The formal sector has equally experienced job shedding as the South African economy moved from labour-intensive to capital-intensive production (DoL, 2005). To correct skill deficiencies, the Reconstruction and Development Programme (RDP), which was implemented after independence in 1994, invited amongst other factors a national ministry that will focus on education and training. This ministry will also be responsible for providing uniform standards, norms and policies. Further education and training were invited from the industry level. This was followed by the revival of the National Qualifications Framework (NQF) under the South African Qualifications Act 58 of 1995 (SAQA), which was formulated by the Department of Education and Labour. The NQF attached qualifications to its levels and standards within South Africa's education and training. This policy certifies acquired skills and knowledge. Other policies aligned to the RDP included the ANC (African National Congress) Policy Framework for Education and Training (1994), the Discussion Document on a National Training Strategy Initiative (1994), the CEPD (Centre for Education and Professional Development), Implementation Plan for Education and Training and the White Paper on Education and Training No 196 of 1995, which guides education and training within the national mandate.

In relation to economic growth, the RDP promoted trade and industrial policy. Recognising international pressures and domestic deficiencies, the RDP advocated for and adopted tariff adjustments, thus complimenting the General Agreement on Tariffs and Trade (GATT) adjustments. Although the RDP advocates for trade policy to promote the large domestic manufacturing sector for export production, on the flip side, the GATT could not coexist with the General Export Incentive Scheme (GEIS), which was aimed at promoting exports by making payments to manufacturers for exporting manufactured products (Hirsch, 1994). Export subsidies were thus phased out in 1995 (Cassim, 2004). The RDP has critical objectives that are aligned to South Africa's imperative needs; however, the RDP ignores trade-offs, and its economic objectives are bound to clash. In addition, the RDP is built on a rocky foundation with minimal statistical forecast and an unclear economic model (Nattrass, 1994; Blumenfeld, 1996; Blumenfeld, 1997).

Giving a clearer stance on South African foreign policy was the introduction of a new policy that was introduced to work in conjecture with the RDP policy (Naidoo and Marè, 2015) two years after independence. Thus, for the period 1996–2000, South Africa inaugurated the Growth, Employment and Redistribution (GEAR) policy, a macroeconomic policy that included microeconomic focal points such as trade. The GEAR, which adheres to the outward-oriented framework aimed at reducing tariffs, adopting trade and investment laissez-faire measures that aim to reduce production costs, thereby improving competitiveness and encouraging investment (Streak, 2004). In its approach, the GEAR policy was fuelled by the 'export-led hypothesis'. As noted by Vickers (2014), the GEAR was not implemented in isolation but compliments the GATT, which was implemented by the World Trade Organisation. During this period, trade liberalisation was successfully intensified under the New Tariff Rationalisation Process of 1996 (Erten, Leight and Tregenna, 2019). Following trade liberalisation in the 1990s, Edwards and Lawrence (2006) found that imports increased, input prices decreased (as aimed for by the GEAR), and additionally, the profits on domestic sales boosted exports. In addition, the Marketing of Agricultural Products (MAP) Act No 47 of 1996 (amended in 1997 and 2001) was enacted. This Act contained a levy clause aimed at funding export promotion and market development (EPMD) (Marketing of Agricultural Products, 2005). This levy was dedicated to promoting agricultural exports such as potatoes, wine, winter cereal, deciduous fruits and citrus. Lubinga (2017), conclude that the levy expenditures on EPMD were successful in increasing exports.

As part of the GEAR policy, skills need to be developed both in the formal and informal sectors. This was realised when The Green Paper on Skills Development Strategy for Economic and Employment Growth in South Africa found expression legally in the Skills Development Act 97 of 1998. The Skills Development Act, as the GEAR proposed, is aimed at growing labour skills. This was achieved through the formulation of Sector Education and Training Authorities (SETA), which makes part of the National Skills Development Strategy (NSDS) and is also integrated into the NQF. These cover skills in accountancy and financial services, agriculture, banks, chemical industries, construction, food beverages manufacturing, forest industries, education, energy, engineering, electronics and telecommunication; health and welfare; information systems, local government, water manufacturing and public services. This act also includes learnerships and learning programmes.

Following the GEAR was the Accelerated and Shared Growth Initiative – South Africa (AsgiSA), which was implemented in 2004 with the main mandate of achieving economic growth. AsgiSA ignored trade policy; however, as part of the impediments affecting economic growth, AsgiSA recorded, amongst other factors, the exchange rate volatility affecting tradable goods and services and thus economic growth. Naidoo and Marè (2015) note that the strength of the rand currency affected exporters by making exports more expensive. In contrast, Boshoff (2008) argues that the attempts to influence the currency have previously failed. In addition, this clashes with the objective of the South African Reserve Bank (SARB) to keep the currency weak. More important policy variables influencing exports are bureaucratic certainty and costs that threaten growth. The AsgiSA identifies the shortage of skilled labour, particularly skills such as engineering, artisans, IT technicians, and managers (financial, project, and personnel), as one of the main challenges to economic progress. As part of the solutions, the NSDS was moved to phase 2, and internships aimed at skill transfer from experts to graduates were implemented. To ensure that the objective was to upskill the labour force, the Joint Initiative on Priority Skills (JIPSA) was also introduced. The JIPSA was also mandated to find scarce skills and initiate training.

The New Growth Path (NGP) is both a macroeconomic and microeconomic policy that was established in 2010. Among the microeconomic elements is the trade policy. The NGP asserts that trade policy should be concentrated and must be able to establish opportunities for exports in external markets. This policy calls for the promotion of agriculture, light industry and services. Trade agreements and facilitation are emphasised to achieve these objectives. This is realised when the European Union (EU) reached an agreement to liberalize 95% of South

African products by 2010. The NGP identifies skill shortages in artisans and technical skills that are addressed by the Human Resource Development Strategy (HRDS). Notable objectives of the HRDS include improving the supply of quality skills through identification of scarce skills and training opportunities in the private sector, as well as providing training funds/bursaries. A second goal of HRDS is to encourage lifelong learning at work through the introduction of skills plans at work and learnership opportunities. This is also highlighted by the amended Skills Development Act 37 of 2008, which also proposes the implementation of apprenticeship and any other learning programme that entails work experience.

The National Development Plan (NDP) was first released in 2011 and envisions an inclusive economy by 2030. To obtain more than a five percent growth level annually, the policy proposes that there should be a concentrated focus on increasing exports in areas where South Africa already has endowments and comparative advantages. These include mining, construction, mid-skill manufacturing, agriculture and agro-processing, higher education and tourism and business services. The policy reform in South Africa, therefore, has been anchored around trade liberalisation.

The NDP highlights the challenges that are currently faced by SETAs, which include the disadvantage that courses do not match labour market needs. Furthermore, skill shortages are prevalent in the economy.

More importantly, it is crucial to note that the development of skills and export promotion complement each other. This can be seen in the National Exporters Development Programme (NEDP) established by the Department of Trade and Industry, now called the Department of Trade, Industry, & Competition (DTIC). Aside from increasing exports, this programme provides export skill training to potential exporters and is registered with SAQA. The NEDP aims to promote and broaden the export base by capacitating local producers. This is accomplished by providing training and information, as well as by providing mentoring services. Export villages that are joint firms also promote exports by increasing international market presence. This is especially beneficial for small firms that do not have access to the international market (DTI, NEDP 2013).

1.2 PROBLEM STATEMENT

Many authors have accepted that economic globalisation leads to positive economic growth (Bhagwati, 2004; Winters, 2004; Potrafke, 2015). This is also explained by the later authors of the growth-led hypothesis. Their view is that GDP (Gross Domestic Product) growth will result to an increase in exports (trade), which will lead to a rise in consumer demand, thereby increasing employment. Accordingly export growth in South Africa has been stable over the years (Cali and Hollweg, 2017). However, the economy has witnessed job shedding of low-skilled labour from various sectors in recent years (Banerjee, Galiani, Levinsohn, McLaren and Woolard, 2008; Davies and Thurlow, 2010). This raises the question as to which skills set contributes the most to export growth in South Africa. A problem arises: exports are growing; however, this appears to affect the most abundant factor (labour). It is therefore likely that South Africa will experience non-inclusive, jobless export-led growth as unemployment remains high in an upwards trajectory. Against this background, this paper seeks to understand the long-run relationship between export growth and the skills demand in the South African economy.

1.3 OBJECTIVES OF THE STUDY

The main objectives of this study are as follows:

a) To examine the skill intensity of export growth in South Africa and its changing pattern from 2008 to 2020.

b) To deduce how the different skill levels, contribute export growth.

1.4 RESEARCH QUESTIONS

The dissertation seeks to get answers to the following question.

a) What is the skill intensity of export growth in South Africa?

b) How do the different levels of skills demanded contribute to export growth?

1.5 EXPECTED CONTRIBUTION OF THE STUDY

It is of interest to the researcher since the study on skills will strongly contribute to aiding in finding solutions to the high unemployment rate in South Africa, especially where demand is concerned.

a) Providing data on labour activity in exporting industries, this study provides policy makers with a comprehensive view of labour conditions in these sectors.
b) This study provides researchers (and policy makers) with additional evidence for ascertaining changes in skill patterns in South Africa, providing a helpful tool for future studies and policy making.
c) This study provides empirical evidence on the skill intensity of export growth compared to other former descriptive studies.

1.6 CHAPTER LAYOUT

A total of five chapters are included in this study. Continuing from the introductory chapter, which contains a summary of the study, chapter two explores the theoretical literature.
A variety of trade theories are discussed in this chapter, including their origins and evolution. The third chapter will review literature regarding the link between skill and exports. In chapter four, we present the methodology and empirical evidence that were derived from the econometric model implemented in this study. The final chapter ends with overall policy recommendations, while emphasizing the study's limitations and suggesting future research areas.

CHAPTER 2: THEORETICAL LITERATURE REVIEW

2.1. Introduction

In the previous chapter, this study alluded to South Africa's trade pattern status quo. A major focus of the chapter is the structural economic changes that have taken place in South Africa since 1994, as well as the policies adopted by government aimed at addressing past inequalities, injustices, and other impediments to further economic emancipation and growth. A review of related trade theories will be presented in this chapter. In some theories, trade patterns are described, while in others, trade relationships are prescribed. As part of this chapter, this chapter will explore the arguments presented by the theory of absolute advantage, and then moves down to the sister theory of comparative advantage. In addition to focusing on Ricardo's concept of Comparative Advantage, this discussion discusses the origins, evolution, and hypothesis posed by Heckscher-Ohlin (H-O). The chapter also discusses Stolper-Samuelson and Rybczynski's factor-price equalization and the skill-only Heckscher's theory.

2.1.1 The Classical School of Thought

2.1.1.1 Absolute Advantage

The theory of absolute advantage was pioneered by Adam Smith in his book entitled "Wealth of all Nations" (1776). Interestingly, over the years there has been development to the theory of absolute advantage as a result of debates as acknowledged by Schumacher (2020). According to Schumacher – the theory of absolute advantage has the following misinterpretations or interpretations: (i) absolute advantage as postulated by the neoclassical theory (ii) absolute advantage built on increasing returns and (iii) absolute advantage based on uneven development. These interpretations are unfortunately misleading.

Significant contribution pertaining to 'quality labour' were identified in the works of Adam Smith. Moreover, the ability of labour to acquire wealth informed Smith's distinction between unproductive (serving under justice and war) and productive labour (Walter, 2011). Education is therefore regarded as a necessity for productive work. As an advocate for free education for the poor, Adam Smith argued that this provision would be critical to the systems' long-term sustainability and therefore should be an investment. The country's quality of labour determines its fertility because in an economy that is growing rapidly, qualified workers become more in demand.

The cornerstone of the theory of absolute advantage is the division of labour, which involves increasing the quantity of work with the same amount of labour, increasing output. The increase in output – necessitates technological advancement, skills and therefore productivity is improved. This process enhances economic growth and therefore wealth. The production of the commodity will eventually result in the specialization which improves productivity. Smith also maintains that the gains from the division of labour are realized further when a trade relationship is established. The increase in the division of labour benefits the country through exportation process. The division of labour also benefits a nation, as it carries qualitative and quantitative production benefits. (Shumacher,2012).

The theory of absolute advantage acknowledges that trade should be mutually beneficial to trading partners; otherwise, countries will not engage in trade. For trade to exist, each country must be efficient in producing of a commodity that it will exchange for a commodity that it is inefficient in producing (Zhang, 2008). It is possible to achieve absolute efficiency through habit or application. Thus, a country sells and eventually specializes in the goods that it produces cheaply relative to other countries and buys goods that are produced by other countries at a competitive price - a price lower than the local country. This exchange is beneficial as the local country consumes more goods at a price lower than the local price, and the same is true for the foreign country. Production efficiency is determined by the labour productivity of each country. Hence, a country is said to have an absolute advantage if its relative unit cost expressed in labour terms is lower than that of the other country.

Smith contends that countries' natural differences are not the basis for international trade (before trade) but rather specialization distinguishes a country from another which induces the country to trade. Smith postulates that, with the introduction of international trade, specialization increases, and productivity gains are made possible by technical and organizational improvements. Thus, more goods can be produced with the same amount of labour. This also enhances economic development. This is also true for neoclassical interpretation of the theory of absolute advantage which holds that trade is advantageous for nations that can take advantage of differences. There will be specialization among countries in certain goods that can be traded internationally and that are devoted to increasing territorial division of labour (Schumacher, 2020)

In many cases the theory of absolute advantage has been reconstructed numerically to capture the idea of specialization. If we assume that South Africa's unit cost is R6 for producing 3 units

of commodity X relative to Nigeria with a unit cost of R8 for producing the same number of units, then it follows that South Africa has an absolute advantage over the production of commodity X. In the production of commodity Y, however, Nigeria has an absolute advantage over South Africa with a unit cost of R3 for 1 unit while South Africa's unit cost for 1 unit of Y is R7. This is implies that, it is best for South Africa to export commodity X and import commodity Y from Nigeria. In Nigeria, commodity Y is produced at a cheaper price. Schumacher (2020) has criticized this numerical example for misinterpreting Adam Smith's theory. It is usually argued that one country should specialize in agricultural products, while the other should specialize in manufactured goods. This is erroneous since Adam Smith himself did not advocate specialization in agricultural commodities, but rather acknowledged that poorer economies would eventually develop manufacturing industries once they accumulated the necessary capital.

Other advantages of international trade as postulated by Adam Smith include the arguments that, trade makes monopolies less likely. Nations also transfer knowledge and technology across borders through international trade (Schumacher, 2012).

A free trade policy based on interdependence between countries was advocated by Adam Smith (Walter, 2011). It should be achieved moderately and gradually with consideration of industries that move away from protectionist policies that aim to protect fragile industries from competition.

Even though Adam Smith's theory of absolute advantage was highly critiqued for its limitations. A few of them include the argument that Smith did not account for international specialization and territorial division of labour (Schumacher, 2020). Adam Smith was also referred to by Ricardo as a "poor trade theorist" (Mehmet, 2002). As a result, we will explore the theory of comparative advantage by David Ricardo.

2.1.1.2 Comparative Advantage

Another preposition from the classical school of thought is Ricardian's (1817) theory of comparative advantage. This theory explains the pattern of international trade and was initially introduced in 1817 by David Ricardo in his book entitled "On The Principles of Political Economy and Taxation. While Adam Smith considers only one factor of production in the theory of absolute advantage, Ricardian theory assumes that technology is a rationale for

countries to trade (Zhang, 2008). In the formulation of the theory of comparative advantage, Ricardo makes the following assumptions:

i. Labour is the only factor of production and in this case includes low, semi, and highly skilled labour.
ii. Technology is fixed and heterogeneous between countries.
iii. There is mobility of factor of production between sectors, which means that labour can move from one sector to another. The process of upskilling labour contributes to this process as well. When unskilled labour becomes semiskilled or highly skilled, it can move into sectors where semi to high skills are required. There is no restriction on mobility in the domestic country. However, factors of production are immobile between countries.
iv. Countries have a fixed amount of resources and these are homogenous.
v. No barriers to trade which implies that there are no import duties and transportation costs.

Although the theory of absolute and comparative advantage coherently emphasizes the importance of labour; it is important to note that the two authors have contrasting views on labour. Smith's theory of absolute advantage explicitly argues that the productivity of labour is determined by the division of labour (Schumacher, 2012) while on the contrary Ricardo argues that to fully exhaust the benefits of the division of labour, technology is a necessary condition that could also improve the productivity of labour.

According to the law of absolute advantage, if a country is efficient in producing both goods, it has no reason to trade with another country. For Ricardo on the other hand, low opportunity costs of producing certain goods relative to other countries should be the basis for international trade.

In the example given by Ricardo in his theory of classical labour, the economy consists of two producers (countries), two commodities and one factor of production (labour) (Ruffin, 2002; Gandolfo, 2014). The theory of comparative advantage contends that even though one country is not efficient in the production of both commodities; countries can gain from trade if they fulfil the following conditions:

1. Countries must have different comparative costs.
2. The terms of trade ratio between the two countries must be between the comparative costs. (Gandolfo,1994)

The Ricardian theory of trade is emphatical on free trade (Yap and Selvaratnam, 2018). The very essence of free trade calls for laisses-faire policies and hence trade liberalization. According to Ricardo – free trade induces countries to specialize in the products they have a comparative advantage or relatively least opportunity costs. This implies that countries will consequently specialize in products they have maximum productivity and cost-effectiveness. The results of free trade, as stated in the Ricardian model are economic growth and an efficient reallocation of resources thus less waste.

Schumacher (2013) notes that Ricardo defines the advantages of trade as including the increase in profit (through nominal income), the increases in quality and the quantity (and variety) of production which contribute to their nations' wealth and only adds to their natural expansion by providing workers with more lucrative employment. This also leads to an increase in savings and capital accumulation. A nation's consumption exceeds the nation's production possibility frontier as a result of trade, resulting in an increase in welfare and a rise in social indifference curve. Moreover, these benefits can only be realized in the presence of a free international trade system. In the event of equal opportunity costs however, trade cannot exist which is problematic.

H-O theory is mainly criticized for its assumptions. Murdock (2020) criticizes Ricardo's assumption of capital loyalty to the home country. Ricardo argues that capitalists are loyal to their country of birth – and on that basis, they will not move their capital to other countries with foreign laws. This view contradicts business logic. Murdock argues on behalf of American bankers that have moved their capital to low-wage countries. The very essence of capital mobility implies that capital will move to the most beneficial investments characterized by high returns and low cost. In addition, the second criticism refers to trade deficit/surplus. The economic model of silver and gold is no longer applicable to the current world of freely floating exchange rates that balance trade. As opposed to the 'gold' era, the country experiencing a trade surplus would be expected to manipulate its currency to achieve a trade balance. The assumption that factors of production can move easily between industries is disputable; empirically this assumption has been illustrated by the unemployment rate from structural changes. For example, low skills cannot instantly move to skill-intensive industries, and thus, they are pushed home (Fletcher, 2011).

2.1.2 The Neoclassical School of Thought

2.1.2.1 The Heckscher-Ohlin Theory

The Heckscher-Ohlin theory makes use of the following assumptions:

i. Two countries, two factors of production [Labour (denoted by L) and capital (denoted by C)] and two goods (Labour intensive good X and Capital-intensive good Y) - 2 x 2 x 2 model.
ii. The reversal of factor-intensities is not included. This assumption, given only two factors of production, and only two goods, implies that the capital-intensive good makes use of more capital than labour, while the labour-intensive good makes use of more labour than capital. Therefore, the capital to labour ratio (K/L) is higher for the capital intensive good compared to the labour intensive good (Sawyer and Sprinkle, 2020).
iii. There is a free movement of capital and labour in the domestic economy. Capital and labour cannot, however, move freely between countries.
iv. The production function is characterized by decreasing and constant returns to scale. This implies that, the production function for good X is the same for the two countries, whereas it differs for good Y (Good Y has an identical production function in both countries) (Gandolfo, 2014).
v. No transportation and trade costs which allows products to move at no costs between the two countries.

The Heckscher-Ohlin (H-O) was named after Eli Heckscher and Bertil Ohlin. The Heckscher-Ohlin theory was formulated to delineate a country's pattern of trade relative to its endowment of factors of production (particularly labour and capital). This theory helps us predict a country's trade patterns. H-O theory is based on Ricardo's notion of Comparative advantage of 1817. Unlike Ricardo's claim that comparative advantage arises from technology differences, the H-O theory maintains that such differences are due to factor endowments rather than technology. The Heckscher-Ohlin theory assumes that countries have identical or homogenous tastes and technology. The basis for trade is informed by different factor endowments. Furthermore, barriers to trade should be minimized; exceptional cases include goods that a country has comparative disadvantages (Robbins, 2003). H-O

theory argues that a country specializes in the production and exportation of goods that use its abundant/ factor (Zhang, 2008). In other words, a country will export goods that are intensive in its relatively abundant factor and will import goods that are intensive in its relatively scarce factor.

A comprehensive interpretation of the H-O model is the Heckscher-Ohlin-Vanek model by Vanek (HOV) (1968) and includes the work of Helpman (1981) and Krugman (1985). The cornerstone of the HOV is factor contents of trade. The assumptions of the model include identical technologies, tastes and preferences and factor price equalization (Srivastava and Mathur, 2013). There is consensus that the theory has, however, failed empirically due to unrealistic assumptions (Leontief, 1953; Leamer, 1984; Baldwin, 2008; Fisher, 2011). The HOV can be illustrated as follows:

$F_i = AT_i = V_i = s_i V_w$……..……Eq 2.1

Where:

$F_i - factor\ content\ of\ trade\ of\ country\ A$

$V_i - factor\ abundance\ or\ scarcity\ of\ country\ A$

$V_w - world\ factor\ abundance\ of\ country\ A$

$s_i - country\ A\ Gross\ Domestic\ Product\ (GDP)\ share$

Baldwin (2008) summarizes the contribution of Vanek as follows: the quantity of factor contents in production (directly and indirectly) in a country's net trade, equates to its factor endowment less the international endowment multiplied by the country's share in the world GDP. Second, Baldwin acknowledges Vanek's inclusion of more goods, more factors, and more countries.

The Heckscher-Ohlin theory of trade hypothesizes that international trade increases productivity and therefore increases income and this is dependent on the supply of the factor, labour and capital (Beaudreau, 2015). This theorem also argues that when trade takes place, it is not only goods that are traded but the skills (unskilled and skilled) embedded in the goods that are exchanged. Countries gain from trade where they have the most abundant skill endowment and experience losses where they have the scarcest skill.

Opening to international trade may lead to a rise in the prices of labour-intensive goods in developing countries whose comparative advantage depends on the availability of unskilled

workers. Increased imports may, however, lead to a decline in the price of skilled labour-intensive products. As a result of such price changes, skilled and unskilled workers' relative demand might change. Consequently, the wage gap between skilled and unskilled workers is expected to contract, with international trade as a corollary generating a positive effect on income equality. (Kohpaiboon and Jongwanich, 2014)

For Heckscher and Ohlin, production for the international market induces specialization and thereby increases the level of skills in the export sector (Heckscher and Ohlin, 1991). This is substantiated by Verdoorn's law, which postulates that the expansion of the export sector leads to the specialization of export products, which consequently increases productivity and the level of skills. This law, however, differs from the neoclassical hypothesis postulated by economists such as Irwin (1996), who argues that through the importation of technology, knowledge and ideas are transferred and thus skill transfer. Despite the differences, these authors believe that international trade induces skill upgrading.

The Heckscher-Ohlin can also be explained by the following hypothetical scenario:

Table 2.1: H-O Hypothetical example

Country names	Country A	Country B
Types of Goods	Goods X	Goods Y
Factors of Production	Capital (K)	Labour ln

If $\frac{K_A}{L_A} > \frac{K_B}{L_B}$ ……..……..Eq 2.2.

K refers to Capital.

L refers to Labour.

According to the equation above, country A is the abundant capital country.

If $\frac{L_A}{K_A} < \frac{L_B}{K_B}$ ……..……..Eq 2.3.

According to the equation above, country B is a labour-abundant country.

If $\frac{K_{cars}}{L_{cars}} > \frac{K_{textiles}}{L_{textiles}}$ ……..Eq 2.4.

The fraction reveals that good X is capital intensive - This means that more capital is needed to produce good X.

If equation 2.4 is true, it also stands to be correct that:

$\frac{L_{cars}}{K_{cars}} < \frac{L_{textiles}}{K_{textiles}}$……..Eq 2.5.

This implies that good Y is labour intensive, which means that more labour is needed to produce good Y.

The H-O theorem argues that, since Country A is capital abundant, it will therefore export capital intensive good X and will import labour intensive good Y. Considering that Country B is labour abundant, it will thus export labour intensive good Y and will import capital intensive good X (Sawyer and Sprinkle, 2020).

Trade in natural resources (diamonds and coffee etc.) is not included in this theory. In addition, there is criticism that the countries do trade similar products (intra-industry trade), and the Heckscher-Ohlin theory does not give explanation to this (Sawyer and Sprinkle, 2020).

Beyond the H-O model other interpretations include the Stolper Samuelson theory by Stolper-Samuelson (1941) and Samuelson (1948, 1949). The Rybczynksi theory by Rybczynski (1955) and the factor-price equalization posited by Leamer (1980). These are explained briefly:

2.1.2.2 Rybczynksi theory

Rybczynski (1955) focuses on the impact of a change in a factor input on output growth. This theorem shows how production allocates the abundant factors towards industries that use the factor. This theorem argues that countries that trade in goods with high labour content are characterised by low savings and investment in capital. This implies that the more capital stock a country possesses – that country will trade capital-intensive goods. Alternatively, an increase in immigration increase labour-intensive production and a decrease in capital-intensive production.

2.1.2.3 Factor Price Equalization Theory & The Stolper-Samuelson

2.1.2.3.1 The Factor Theorem

Factor price equalization and the Stolper-Samuelson are an extension of the basic Hecksher-Ohlin theorem. This theorem is explained by Samuelson (1948/9) and Leamer (1987). Factor price equalization describes the effect of international trade on factor prices. This theory demonstrates that when countries trade freely amongst each other, the prices of factors of production (*wages and rate of capital return*) are eventually equalized. (Feenstra, 2004, 23). This can be explained by the following hypothetical example:

Table 2.2:Factor price Equalization

Country names	Country A	Country B
Types of Goods	Goods X	Goods Y
Factors of Production	Capital (K)	Labour ln

We assume that Country A is capital abundant, and it produces capital-intensive good X. The opposite is true for country B. The factor price equalization says that since country A produces capital-intensive good X, the demand for capital will rise and therefore increase the price of capital. The flipside shows that the demand for labour will decrease and therefore decrease wage prices. The opposite is true for country B. This finding actively demonstrates that since country B produces labour intensive good Y, the demand for capital will decrease and therefore decrease the price of capital. The flipside shows that the demand for labour will increase and therefore increase the wage prices. Before trade, wage prices were low and for country B, wages were high. Thus, prices will eventually equalize, and this is made possible by the mobility of factors of production.

Factor equalization and Stolper Samuelson's theory are somewhat intertwined. Samuelson argues that the elimination of trade barriers will lead to an increase in the real income of the relatively used factor while reducing the return on the factor that is not used intensively. For Samuelson, unskilled labour stands to benefit in poor countries. Hypothetically, this implies that trade results in distributional effects that create winners and losers. After trade, capital owners in a capital-intensive country, A, are winners from trade and therefore, labour loses. For labour-intensive country B, unskilled labour is the winner of trade, and capital owners are the losers. (Gandolfo, 2014)

Authors such as Leamer (1980) find that the H-O theorem is unrealistic. The reason for this circumstance is that in the real world, countries produce more than two goods and have more than two factors of production. Leamer and authors such as Leontief and Trefler (1993) and Davis and Weinston (2001) learned that the H-O theorem is empirically invalid. In other words, countries that are capital-abundant were not exporting capital-intensive products. Robbins (2003) highlights that the Heckscher-Ohlin has the tendency to disregard the distribution of human capital which varies steadily. Findlay and (1983) find that this is not the exercise of identifying skilled labour from unskilled labour – as this process should be resolved endogenously considering that upskilling results from wage differentials – labourers' resort to

acquiring skills to obtain higher income. Thus, H-O theory also ignores the changes in skill supply on wages. For authors such as Wood (1994) this version is classified as “weak” and is “qualitative” in approach. Wood thus calls for the skill-only H-O model as presented by Samuelson and Vanek.

2.1.2.4 Skill-Only Heckscher-Ohlin- Samuelson (HOS)

The H-O model can also be explained without other variables such as capital and hence the skills-based hypothesis, which focuses on labour – skilled and unskilled labour. This theoretical perspective is modelled by Kenen (1965) and includes the work of authors such as Mincer (1958), Schultz (1961) and Becker (1962) (Keesing, 1956, 1966); other authors include Minford(1989), Findlay and Kierzkowski (1983), (Gaisford,1993) and (Woods,1994). The theory was significant in explaining the trade between the labour-intensive South and capital-intensive North wherein the Ethier-Svensson-Gaisford (ESG) theory by Gaisford (1993) and Woods (1994) argues that trade patterns are explained by immobile factor endowments such as labour and land. Other influencers include Branson and Junz (1971) who find that capital and labour influence trade differently. The authors find that, in the United States, the manufacturing sector shows a positive relationship between human capital and exports and a negative relationship between physical capital and exports. A further study by Baldwin (1971) suggests that trade in the United States is less influenced by capital but is influenced by human capital on skills.

This model assumes a fixed supply of labour, capital, and skills. Land and labour are understood as factors that are modifiable (Keesing, 1966). As cited by Findlay and Kierkowski (1983), skill has the potential to be trained, and technology induces a change in the requirement of skills; land has the potential of fertility, while capital can be allocated with both. (Jones, 1971). Other suppositions of this theory include, free trade, no transport costs, homogenous tastes, homogenous production function and minimized trade barriers to trade.

In this model, the factor of production of interest is skill. That is, skilled, unskilled, and other types such as semiskilled labour. According to pioneers of the skill-only Heckscher-Ohlin, labourers should not be treated in their raw nature as they can acquire skill. Skills can be regained and changed or transferred. These authors refer to the following case scenarios:"

1. If attaining skills is without cost and is instant, wages will be the same for all skills.

2. If attaining skills is without cost but takes a longer period and does not affect production and consumption, initially wages would differ for scarce skills (which will demand a high wage) and trade patterns would follow this trend. However, following a substantial period after upskilling has taken place, wages would be the same.
3. If attaining skills involves cost and involves that such workers remain out of the labour market and as a motivating factor, workers will be rewarded with interest for the income forgone during the training period – initially wages would differ as the wages of skilled labour will be higher. Consequently, trade patterns would be determined by demand and supply. However, in the long run the wages of unskilled labour would be the same through trade. The cost involved in acquiring skills will determine an international homogenous wage and thereby diminish locational advantages.

These scenarios contend that the removal of the initial skill distribution disadvantages if two countries have the same technology – trade would not exist. That is, factor upskilling could possibly abolish the need for trade. The Skill-only H-O model argues that trade takes places owing to skill differences caused by historical skill composition which prolongs to the present and a clear example would be the Apartheid regime/administration in South Africa which denied black people access to skill acquisition. (ii) cultural differences that inform decisions to acquire skills (iii) Income inequality (iv) selective migration and (v) labour division caused by trade (Keesing,1966).

The apologists of this theory exclude capital in the trade of goods based on international capital mobility. Capital in this context refers to finances, which is noted as the difference between net cash outflows and inflows when deriving the trade balance (Woods, 1994). This is clarified by the theory of capital as posited by Smith (1984). Capital theory emphasizes the importance of interest rates, which are the of cost of capital (also known as dated labour), as a key determinate of trade flows of capital-intensive noncapital-intensive products. This theory argues that for a country to have a comparative advantage in capital-intensive goods, its average interest rate should be lower than the interest rate in the world. In the case of the North and the South – Woods reveal that empirical evidence suggests that the interest rate was similar Pasinetti (1981).

Findlay and Kierzkowski (et. al) deliberate on a simple general equilibrium model that incorporates human capital. This model makes the following assumptions:

i. Perfect competition in the goods and factor market.

ii. Homogenous taste and preferences.
iii. Unskilled workers are potentially skilled workers and thus are in a long-run competitive equilibrium.
iv. Fixed supplies of capital, labour and land.

2.1.2.4.1 Constant returns to scale

This equilibrium model is built on a stationary economy where new-borns are denoted by N, and T represents their lifetime. The number of births makes up for the number of deaths. This is expressed as follows:

$UT + E\theta + E(T - \theta) = NT$NT ……..…....Eq 2.6.

refers to the total number of individuals and includes skilled workers (denoted by E), unskilled workers (denoted by UT), and students from different levels of education (denoted by EϴK – the process of students upskilling is denoted K and includes other factors such as teachers).The output of skilled labour is expressed as follows:

$Q = F(K, E; \theta)$……...Eq 2.7.

where Q refers to output

E refers to students spending θ time with K units of educational input.

The labour market consists of skilled labour denoted by L1 which embodies skill expressed by efficiency units; and unskilled (or low skilled labour) denoted by L2 (also referred to as UT). The reward for unskilled labour is denoted by W2. In the case of skilled labour – the wage of skilled labour is expressed as follows:

$= W_{1q} = W_1 f(k)$……Eq 2.8.

Which includes efficiency units (q=f(k))

The economy produces two goods, denoted by G1 and G2. The price of the goods is determined by the world market (this is altered later in the model). According this model as with the standard Heckscher-Ohlin, there is no factor intensity reversal which means G1 may be relatively skill-intensive but relatively low-skill intensive in comparison to G2.

Thus, the HOS model is expressed as follows:

$pG + G_2 = w_1 L_1 + W_2 L_2 = y_1 E(T - \theta)$……..…….... Eq 2.9.

Expresses the production value of the two goods at the given world prices

$+w_1 f'(k) kE(T - \theta) + w_2 UT$……..…….……..Eq2.10.

$Expresses\ the\ sum\ of\ the\ two\ factor\ payments\ to\ unskilled\ and\ skilled\ labour$

$= w_2E\ (T-\theta) + w_1f'(k)kE(T-\theta) + w_2UT$ ..... Eq 2.11.

$expresses\ a\ breakdown\ of\ the\ gross\ income\ of\ L_1\ into\ net\ income\ and\ the\ cost\ associated\ with\ attaining\ education$

$+w_2E\theta + [y_1E(T-\theta) - w_2T]E$ ..... Eq 2.12.

Expresses the sum of consumption by skilled workers, owners of K (i.e., international bank that deducts the interest rate from the national income), unskilled labour, students and interest earners of rentiers.

This model captures the Rybczynski effect and Stolper-Samuelson effect. When L_1 and L_2, prices of factors and goods simultaneously increase the production of G_1 and reduce the production of G_2 – the Rybczynski effect emerges. The Stolper-Samuelson effect results when the price increases of G_1 raise w_1 and reduce w_2.

2.3 Chapter summary

This chapter has provided a review on the theoretical background that focuses on trade theories. The chapter initially introduces the classicalist view on trade. The argument that is centralized around absolute and comparative advantage that countries have over others. Classical economists focus mainly on technological disparity between countries. They demonstrate that differences in technology between countries is a necessary condition for trade to take place. On the contrary, neo-classical economists focus on factor endowments. Based on the H-O theorem, countries trade goods that are produced by their abundant factor, which has distributional effects. This chapter also investigates further to other prepositions of the H-O theorem namely, the factor-price equalization (1953), the Stolper-Samuelson theorem (1948/9) and the Rybczynski effect (1955). The factor equalization theorem postulates that as country A produces capital intensive goods, the demand for capital will increase in place of that good, and thus the price of capital will rise. This is interweaved with the Stolper-Samuelson theorem which argues that a decrease in trade barriers will also increase the real income of the commonly used factor, while a reduction in the return on the less frequently used factor will occur. Last, the Rybczynski effect argues that a country with a large stock of capital will be able to trade goods that are capital-intensive. Another wing of the H-O theory is the Skill-Only

Heckscher-Ohlin- Samuelson (HOS) theory. According to this viewpoint, labour and land endowments are cited as explanations for trade patterns. The factor of production of interest is therefore labour (unskilled, semiskilled and skilled labour). The next chapter will assess the empirical literature.

CHAPTER 3: EMPRICAL LITERATURE REVIEW

3.1 Introduction

In the previous chapter, the focus was on trade theories that explain trade patterns. This chapter begins with an overview of the export-led growth theory as a basis for assessing the practicality of exports as a microeconomic growth engine in South Africa. This is followed by the empirical literature review explaining the skill content of exports. The empirical literature is demarcated by the level of industrialization and location in which the study was conducted (Global to local). This chapter is articulated to provide pragmatic understanding of this research.

3.2 Literature on Export-led Growth

3.2.1 The Standard Export-led Theory

After the establishment of the positive relationship between exports and economic growth by economists (Balassa,1978), the export-led hypothesis emerged as a neoliberal explanation of such interconnection. According to Gershon (1982) By exporting, resources leave the inefficient non-trade sector and enter the trade sector. The export-led growth hypothesis regards at least two channels of benefits that result in economic growth. According to this hypothesis:

i. A direct increase in exports will boost domestic output, which is processed by endogenous factors and externalities. The transmission of new management techniques and technological spill overs are two examples of these externalities. Export-led growth entails a need to import to accommodate externalities. Furthermore, technological spill overs have the potential to enhance existing products and, in some cases, to produce new products. This provides for more efficient utilization of capacity.

ii. Economies of scale, industrialization, and the import of capital goods are increasing their effects.

An alternative channel, includes analysing the total factor productivity (TFP) rate, which measures the efficiency of factor inputs (Gershon, 1982)

The impact of the export-led growth model has however been denied in developing economies (Sharma and Dhakal, 1994). Ghatak, Milner, and Utkulu (2010) provide the view that the

relationship between exports and economic growth is driven by manufactured goods and not primary commodities; which thereby poses a challenge for most developing countries in Africa that export primary commodities. The question of trade of primary commodities is thus answered by the Staple theory of growth.

3.2.2 The Staple Theory of Growth

While it is true that the link between exports and economic growth may not exist in developing countries, there are other empirical studies that support the export-led growth hypothesis, including the staple theory of growth which offers an explanation for the link between exports and economic growth in countries with abundant resources, particularly those with natural resources (Altman, 2003). Studies have established that the staple theory of growth was first proposed during the 1920s and 1940s by two Canadian economists - H. A Innis and W.A Mackintosh. For economies that come from colonial backgrounds, the staple theory is particularly relevant (Weintraub, 1978**).** According to Kravis, ideal conditions for applying staple growth theory are an economy with an abundance of land (natural resources), a large population, and a social and economic system that is geared towards growth (Kravis, 1970).

As a supply-side theory of growth, the staple theory stresses the importance of abundance of natural resources in producing staple goods for external consumption (Altman, 2003), (Choy and Sugimoto, 2013). As a result of the discovery of a primary product in which the country has a comparative advantage, previously idle or undiscovered resources come to use; thus, they earn a return through international trade. In the staple theory of growth, which was discovered and studied from the Canadian economy, it was hypothesized that the discovery of a primary commodity and its expansion therefore required considerable primary inputs and relatively little local processing to drive higher rates of aggregate and per capita income through a greater rate of capital formation, and an inflow of capital and labour to the region.
It has been argued that the export-led growth hypothesis leads to a fallacy of composition, despite widespread support for it. It has been argued that the export-led growth hypothesis leads to a fallacy of composition, despite widespread support for it.

Under any given set of global demand conditions, if too many countries are attempting to rely on export-led growth policies at the same time, the market for exports from developing countries will be limited by the capacity of industrialized economies (Blecker, 2002).

Several studies have confirmed the existence of the export-led growth in South Africa. Among the studies include the study by Biyase and Zwane (2014) conducted for African countries concludes that there is positive relationship between export and growth. This was also confirmed by Malefane (2021) when she analyzed SACU (South African Customs Union) countries. Based on this study, the export-led growth hypothesis seems to be applicable to South Africa and Botswana (excluding eSwatini, Botswana, and Lesotho). Similar findings have been reported by Rani and Kumar (2018) for BRICS (Brazil, Russia, India, China, and South Africa). These results indicate that the export-led growth hypothesis is applicable to these countries. In South Africa, Moroke and Manoto (2016) establish a long-run equilibrium relationship between exports and economic growth. Export growth is argued to lead to economic growth by export-led growth theorists. As demand grows for goods and services, local production increases, leading to an increase in the demand for labour (low skilled, semiskilled, and skilled).

3.3 Literature linking exports and skills

Empirical literature linking exports and skills have been conducted in several countries. Using a dynamic panel estimation, Wörz (2005) analyzes the performance of 45 Asian and Latin American, as well as OECD (Organisation for Economic Co-operation and Development) member countries over the period 1981-1997 in her study. According to Wörz (2005), trade benefits skilled labour in industrialized countries, while trade benefits medium-skilled workers in less industrialized countries, because trade patterns are dependent on industrialization levels. This finding was not initially supported by Welsch (2004) whose study was focused on West Germany which forms part of the industrialized OECD members. This study makes use of cross-section regression over the period 1986 to 1990. The study of Welsch (2004) suggests that high-skilled labour faces import competition that is induced by trade openness in the manufacturing sector. According to the author, export growth is low skill-intensive, which results in greater employment opportunities for low-skilled workers.

Accetturo, Bugamelli and Lamorgese (2013) provide evidence that an increment in exports significantly affects the labour market. The authors make use of the Instrumental variables' specifications (IV-FE) to estimate casual relationships. This investigation mainly focused on specific Italian provinces that experienced increases in exports from 2000 to 2006. The authors find that the increase in exports was skill intensive, in other words- international demand was more favourable towards skilled labour. Conti, Turco and Maggioni (2010) ascertain these

findings. According to these authors, Italy's exports to industrial countries outside Europe are more likely to be produced by companies with higher levels of productivity and skilled labour. In contrast, these authors argue that having the status of a 'service exporter' does not seem to benefit innovation. Innovation in distant industrial countries, however, can positively impact export intensity (which suggests the quality upgrading hypothesis). In other words, the increase in skill-intensive goods is the result of the demand from other industrialized countries. An earlier regression analysis by Manasse, Stanca and Turrini (2004) however, find that export-driven demand changes reduce the relative demand for skilled labour. There has been a shift from firms requiring skill-intensive labour to firms hiring low-skilled workers, offsetting the effects of technology on factor proportions and wage shares. Despite the shift in demand towards unskilled-intensive work, these exporting firms have invested in upgrading their skills most intensively.

Interestingly, Amiti and Freund (2008) observe a distinguished pattern in their study that investigates the anatomy of China's export growth. This study also aimed to investigate industrialised China's export structure. In conducting this study, Amiti and Freund (2008) extracted the data from the China Customs Beijing containing 8900 codes. By using an intensive margin, the results of this study indicated that although the export structure has become highly sophisticated (exporting electrical machinery, telecoms and office machines), the skill content of export growth remained the same especially when processing trade is excluded.

Further research was conducted by Meschi, Taymaz, and Vivarelli (2009) who examined the demand for skills and openness to trade in the newly industrialized country of Turkey. This study extracted evidence from the Turkish Microdata from 1980 to 2001. Dynamic panel data estimations are used in this investigation. The authors conclude that technology and trade openness has witnessed labour shifting towards skilled labour. Studies in industrialized countries tend to conclude that most industrialized economies are skill-intensive, though there are also studies arguing against this conclusion.

For emerging economies, Edwards (2001) uses input-output demand analysis to investigate globalization and skill bias in occupational employment in South Africa. Edwards (2001) claims that export-led growth does not significantly affect trade. For South Africa, Edwards argues that it is not vivid that trade is responsible for shifting the economy from labour to capital-intensive sectors. This author acknowledges that South Africa's manufacturing sector

is moving towards skill-intensive production to enhance its ability to compete in international markets. In this regard, Edwards invites authors to investigate whether the shifts result from wage shifts as presented by Samuelson (1948/9). Based on the year of the study, this investigation is possibly answered by the study of Birdi, Dunne and Watson (2002) who investigates labour demand in relation to trade in South Africa. This study makes use of the dynamic panel data method based on the Cobb-Douglas production function over the period 1972-1993. The empirical evidence reveals that the effects of trade are nonbiased between skills; in other words, trade effects have been evenly distributed between skills. The latter studies differ from these findings as shown by Stern and Flatters (2007) who conducted a qualitative study that was focused on trade and trade policy in South Africa. The research findings conclude that exports are capital intensive thus resulting to the shedding of labour-intensive jobs.

Other authors such as Edwards and Behar (2006) also investigated trade liberalization and labour demand within South African manufacturing firms. The manufacturing sector, being one of the largest contributing sectors in South Africa has shown to react to the existence of trade liberalization. Thus, the employment structure has changed. The authors make use of two approaches. First, the author estimates the relative labour demand functions using surveys which allow for the identification of the relationships between the skill intensity of production and a range of technology and trade factors. The second approach relies on the mandated wage framework developed by Leamer (1996). To estimate changes in factor prices between 1994 and 2003, this approach uses the production characteristics of the firm. This study finds that export-oriented firms, firms importing large shares of their raw materials and firms facing low tariff levels tend to be biased towards skilled labour. Furthermore, the study finds that trade opening tends to favour capital returns relative to labour returns. While semiskilled workers suffer the most from the negative impact on labour, a real increase in factor returns is mandated for unskilled workers.

Bhorat (2010) points out through descriptive analysis and the demand trends from 1970 to 1995 and 1995 to 2005. The research findings reveal that during 1970- 1995 labour demand due to trade positively impacted all skill levels for sectors excluding farming, fishing and forestry. The structural changes that occurred during 1995-2005 resulted in a shift towards semiskilled and skilled workers. This change excludes an insignificant number of unskilled elementary workers. Among other factors, the change in output composition and technological advancements have contributed to this.

In an investigation of South African export diversification, Matthee, Idsardi, and Krugell (2015) employed the intensive margin calculation to determine the skills (and technological) intensity of exports. To analyze the structural transformation of South Africa's export patterns from 1994 to 2012, its intensive margins are decomposed according to the classification presented below (Table 3.1). Decomposition reflects the value share of each product grouping in total increases, decreases, and extinctions. The intensive margin method adopts Basu's (2011) proposed export database which divides commodities into 6 groups, which are presented below:

Export Database Table 3.1

	Commodities	**Examples**
HS-6 UNCTAD Skill and Technology Intensity	Nonfuel primary commodities	Maize, lead ores
	Resources-intensive manufactures	Leather handbags, wallpaper
	Low-skill- and technology-intensive manufactures	Window frames, motorboats
	Medium-skill-and technology manufactures	Hydraulic turbines, hairdryers
	High-skill-and technology-intensive manufactures	Mobile phone, aircraft
	Unclassified products	Petroleum, monetary gold

This study finds that, for the period, 1994-2012, South Africa's growth in exports was stimulated by the Chinese demand for nonfuel primary commodities which is sustainable only in the short run. The second greatest contributor to export growth has been the production of medium- and high-skill- technology products, which stimulates demand for semi- to high-skilled labour.

Cali and Hollweg's (2017) examination of South Africa's factor content of exports is enabled by the Labour Content of Exports (LACEX) database which is a newly developed database by the World Bank. The LACEX database consists of labours' contribution to local and export production on an aggregate and sectoral level. The study makes a distinction between the export

contribution by skilled and unskilled labour; however, it creates a missing middle of semiskilled labour. This study finds that the shift from direct manufacturing to indirect services sector export growth is skill-intensive which implies that export growth is biased towards skilled labour. This study also finds that the importation of technology also increases the demand for skilled labour.

There are different conclusions drawn from studies conducted in South Africa. Some of these studies based in South Africa found that the early effects of trade on the labour market were neutral, meaning that trade positively affected all skills. Several authors find that export growth remains skill intensive, while others conclude that export growth is semiskilled to skilled labour intensive. Thus, this study aims to ascertain the changing skills pattern in South Africa. As an alternative to general overviews or one centred around the manufacturing sector, this study examines the changing skill patterns of other exporting industries as well.

Even though these studies have laid the groundwork for understanding the skill intensity of export growth, most of them have been descriptive and, as such, have not been based on an appropriate econometric model. This call, therefore, for a quantitative study that aims to deepen the understanding of the export side of comparative advantage in the South African economy to explain structural adjustment that displaces low-skilled jobs in favour of skilled jobs and capital. In this study, we intend to gain insight into the most exporting industries in South Africa and their interactions with skills.

3.4 Chapter Summary

In this chapter, a brief background is provided about the export-led growth theory, which attempts to explain how exports are related to economic growth. The discussion revolves around the standard export-led growth theory and the staple growth theory. Additionally, the chapter provides an empirical review of the research linking skills and export growth. The analysis includes studies conducted in industrialized countries around the world. In accordance with the findings of the literature review, many of these studies conclude that export growth is skill intensive. Several studies based in South Africa also conclude that export growth is skill-intensive, however these findings are slightly inconsistent as other studies tend to include semiskilled labour. It is possible that the observed differences are caused by the method of estimation and the variables selected in each study. Thus, the next chapter focus on the proposed research methodology.

CHAPTER 4: EMPIRICAL ANALYSIS OF THE SKILL INTENSITY OF EXPORT GROWTH IN SOUTH AFRICA

4.1. Introduction

In the previous chapter, we explored the literature review of the skill intensity of export growth in South Africa and other countries. The focus of this chapter is to investigate the skill intensity of export growth in South Africa using the three-stage least squares technique. The discussion will include a review of the estimation method and technique, model specification, definition and measurement of the key variables, data sources and the interpretation of results.

4.2 Model Specification

The model specification is as follows:

$$InSkill_t = \beta_0 + \beta_1 InE_t + \beta_2 InC_t + \beta_3 lnW_t + \beta_4 In\epsilon_t + \beta_5 ln\mathcal{R}_t + \mu_t \ldots\ldots\ldots\ldots \text{ Eq 4.1.}$$

Where,

$Skill_t$ = skills divided into three categories (Unskilled, Semiskilled and Skilled)

E_t = Export growth

C_t = Gross Fixed Capital Formation

W_t= Average wage rate

ϵ_t = Exchange rate

$\mathcal{R}_t$ = Repo rate

NB: ***In*** indicates that the variables are in log format.

4.3 Definition & Measurement of Variables

4.3.1 Skills

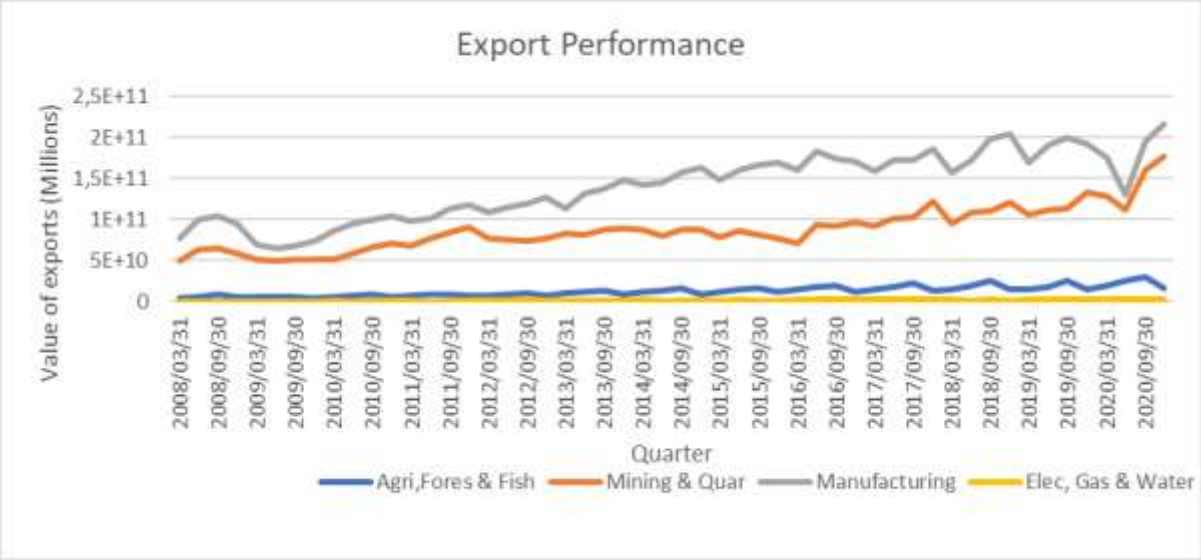
Specifically, skill levels are divided into low-skilled, semiskilled and skilled. These subcategories will be formed by assigning different occupations to the three skill levels according to the description provided by statistics South Africa (Statssa). Unskilled labour includes domestic and elementary workers. Semiskilled labour is made up of sales & services; clerks, craft & related occupations; plant and machine operators. Lastly, Skilled labour includes

skilled agriculture, mangers, professionals and technicians. This summarizes the contribution of various industries to employment and is expressed by the number of people employed in thousands.

4.3.2 Export growth (E)

Exports are concentrated in four economic sectors which are: Manufacturing; mining and quarrying; Agriculture, forestry and fishing; and Electricity, gas and water. In this study, we have only focused on four key sectors contributing to South Africa's export growth. The Export growth series is expressed in constant prices and calculated in millions (ZAR). The export-led growth theorists argue that export growth leads to economic growth. The additional demand for goods and services increases local production, which increases the need for labour (unskilled, semiskilled, and skilled).

The four main contributing sectors to export growth in South Africa are illustrated as follows:
Figure 4.1: Export Performance



Source: Author

Over the past decade, both mining and manufacturing sectors have experienced decreases in their contributions to GDP, however the two sectors remain the contributing industries to export growth in South Africa for the period 2008-2020. As observed by other authors, a small and stable proportion of the GDP is contributed by agricultural sector (Bhorat, Rooney and Steenkamp, 2016). On the other hand, the electricity, gas and water sector has shown poor performance for the period 2008-2020.

4.3.3 Wages (W)

Wages or remunerations are defined as the income that labour receives from producing. Wages are expressed as the average wage rate across all skills. Classical economists argue that the increase in wages decreases the demand for labour- thus an anticipated decrease in the demand for labour and vice versa. (Snowdon and Vane, 2013). Empirically, this is ascertained in the case of South Africa, and this is caused by the influence of collective bargaining councils (Fintel, 2015) (Fedderke, 2012). Wages are also affected by employment contracts. As a consequence of the Labour Relations Act, dismissals and retrenchments are much more difficult and expensive. Bhorat's findings (2013) suggest that the domestic labour market is characterized by lagged adjustments caused by sticky contracts. Additionally, the high levels of disputes and inefficiency of the dispute-handling offices result in high unemployment rates. This is due to the variable being a function of supply and demand on the labour market but is not a dependent variable on any equation in the system.

4.3.4 Gross Fixed Capital Formation - GFCF (Investment)

Gross fixed capital formation (or investment) contains land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings (well classified under community, social and personal service) (World Bank). This variable sums up the industry contribution to gross fixed capital investment and is expressed in millions.

According to the Harrod Domar model (Snowdon and Vane, 2013), investment positively affects economic growth. This implies that an increase in investment induces a positive reaction on production, exports and on all skill types and vice versa.

4.3.5 Exchange rate

An official exchange rate can be either the one set by national authorities or the one determined by the legally regulated exchange market. The annual average is derived from the monthly average (local currency units relative to a basket of currencies). This is referred to as real effective exchange rate (REER). The exchange rate series trade between South Africa and its (20) largest trading partners determines the weighted average exchange rate of the rand. (Index 2015/2005=100). This is known as the effective exchange rate. This study makes use of the effective exchange rate.

In a competitive global market, depreciation of the national currency against the foreign currency reduces the price of local goods, thus boosting exports. The appreciation of the local currency against the foreign currency on the other hand, induces a negative reaction as the increase in the exchange rate reduces the demand for local goods. Following South Africa's flexible exchange rate system, empirical evidence reveals that there is an inverse relationship between exchange rates and export growth in South Africa (Mashilana and Hlalefang, 2018). Faulkner and Loewald (2008) note that exports seem to rise when their relative profitability to domestic sales increases, such as when a currency depreciates.

This study assumes that the demand for all skill types is expected to increase (following an increase in exports) in the case of a depreciation of the rand. On the other hand, the demand for all skill types is expected to decrease (following a decrease in exports) if rand appreciates.

4.3.6 Repo rate

Rate at which private banks borrow Rands from the Reserve Bank of South Africa. Increasing repo rates affect banks' ability to borrow. In conjunction with an increase in the repo rate, banks also increase their borrowing rate (interest rates). The high interest rate makes it difficult for businesses to borrow money, which lowers productivity and as a result, employment and exports are stagnant. A study conducted in India concluded that exports show a negative correlation with the repo rate. (Kotishwar, 2020).

This study predicts that as the repo rate increases, firms will borrow less and produce less, which will result in a decrease in unskilled, semiskilled and high-skilled labour.

4.4 Data & Sources

The data used in this study for the econometrics model are quarterly secondary data that were extracted from the period 2008 quarter 1 to 2020 quarter 4. The data were obtained freely from Easy data by Quantec (Quantec, 2021).

Below is a summary of the data variables and sources:

Variable	Description	Source
$\boldsymbol{E}$	Export growth	Quantec
Skill	Skills (Unskilled, semiskilled and skilled labour)	Quantec
$\boldsymbol{\mathcal{R}}$	Repo rate	Quantec
C	Gross Fixed Capital Formation	Quantec
W	Average Wage Rate	Quantec
$\boldsymbol{\epsilon}$	Exchange rate	Quantec

4.5 Simultaneous Equation Model

The objective of this study includes examining the skill intensity of export growth in South Africa and its changing pattern from 2008 to 2020 and to deduce how the different levels of skills demanded contribute to export growth. Simultaneous equations were introduced during the period 1940s and 1950s and pioneered by authors such as Haavelmo (1944); Koopmans and Marschak (1950) and Koopman and Hood (1953). Literature shows that there are three ways to estimate simultaneous equations – seemingly unrelated regression (SUR), two-stage least squares (2SLS) and three-stage least squares (3SLS) (Lehrer and Godwin, 1986). Simultaneous equations are preferred as a caution against simultaneity bias, which occurs when two variables influence each other simultaneously. As an example, skilled labour may be correlated to unskilled labour, but we could presuppose that they are uncorrelated; and that everything else in the study is exogenous - the results are unlikely to be accurate (Min, 2019).

The first type of simultaneous equation is known as the two-stage least algorithm which was formulated to calculate a single equation at a time. To estimate the two equations together, it is possible to use the seemingly unrelated regression technique. However, each regression consists of the same number of lag endogenous variables, so using OLS for each equation separately produces effective estimates. Although the individual equations may appear to be unrelated, they are related, despite their apparent absence from each other (Zellner, 1962). This caters for additional information when compared to the separate equations.

The three-stage least squares algorithm estimates all the coefficients of the entire system at once for each structural disturbance (Zellner and Theil, 1962). This technique has the advantage of efficiency following the former 2SLS. Due to potential endogeneity related issues as result of simultaneity bias, this study has thus chosen to make use of the 3SLS which was initially introduced by Zellner and Theil in 1962. This method has been spotted from great research by authors such as Lee and Weng (2013); Vo and Nguyen (2014); Ghosh (2014); Kao and Lin (2016); Bakhsh *et al*, (2017); and Urbano *et al*, (2020) who have used this very method in their work. By using this technique, an analysis of a system of structural equations can be performed, in which some equations contain endogenous variables as part of the explanatory variables. There is an explicit assumption that all dependent variables are endogenous to the system, and that disturbances within the equations of the system can be correlated with them, respectively. To estimate 3SLS we regard system estimators over a single equation. The difference is that system estimators include the zero restrictions in each equation, in addition, the variance-covariance matrix of the disturbances of the system.

For this study; a system of structural equations is estimated, as some equations contain endogenous variables among the explanatory variables. Endogenous variables are described as variables that are jointly and interdependently determined random variables (Seddighi, 2013). The disturbance is correlated with the endogenous variables—violating the assumptions of OLS. Further, because some of the explanatory variables are the dependent variables of other equations in the system, the error terms among the equations are expected to be correlated.

In this study, the estimation was done through three-stage least squares (3SLS). The other categories of employment enter the system as explanatory variables to the other equations. All dependent variables are explicitly taken to be endogenous to the system and are treated as correlated with the disturbances in the system's equations. Unless specified, all other variables in the system are treated as exogenous to the system and uncorrelated with the disturbances. Exogenous variables on the other hand are variables determined independently from endogenous variables and outside the model (Seddighi, 2013). In this study the following macroeconomic variables have been taken as exogenous - exchange rate, gross fixed capital formation and repo rate. The macroeconomic variables above are likely to have a stronger relationship with exports within each of the main exporting sectors than with employment levels within different skill categories, thus making them good instruments.

The specification further overridden the endogeneity of one of the categories of employment, unskilled labour employment; this was done by specifying the variable as exogenous. This can be argued on the basis that every other individual within the labour market can enter this category of employment- it is determined exogenously. However, the other categories may be considered endogenously determined.

The wage rate is regarded as an endogenous variable in this study. As a variable of interest, the wage rate, is a function of demand and supply in the labour market; but is not a dependent variable in any of the equation in the system. This variable has been defined as endogenous for these reasons.

The structural version of the simultaneous equation model is illustrated as follows:

$Y_{11}Y_{1t} + Y_{12}Y_{2t} + \ldots + Y_{1G}Y_{Gt} + \beta_{11}X_{1t} + \beta_{12}X_{2t} + \ldots + \beta_{1K}X_{kt} = \varepsilon_{1t}$ ……Eq 4.2(a).

$Y_{21}Y_{1t} + Y_{22}Y_{2t} + \ldots + Y_{2G}Y_{Gt} + \beta_{21}X_{1t} + \beta_{22}X_{2t} + \ldots + \beta_{2K}X_{kt} = \varepsilon_{2t}$: ……Eq 4.2 (b).

$Y_{G1}Y_{1t} + Y_{G2}Y_{2t} + \ldots + Y_{GG}Y_{Gt} + \beta_{G1}X_{1t} + \beta_{G2}X_{2t} + \ldots + \beta_{GK}X_{kt} = \varepsilon_{Gt}$……...Eq 4.2 (c).

Where:

All the endogenous variables that belong to *G* are represented by *Y*

The *X*'s represent *K*s' predetermined variables (lagged dependent variables and exogenous variables).

ε refers to disturbances

structural parameters are shown by *Y*'s and β's and t = 1,2,...,n.

With this model, we regard system estimators over a single equation. The difference is that system estimators include the zero restrictions in each equation, in addition, the variance-covariance matrix of the disturbances of the system as a whole. The 3SLS estimate can be shown in matrix form as follows: This is illustrated below

$$\begin{bmatrix} Y_{11} & Y_{12} & \ldots & Y_{1G} \\ Y_{21} & Y_{22} & \ldots & Y_{2G} \\ \vdots & \vdots & \cdots & \vdots \\ Y_{G1} & Y_{G2} & \cdots & G_{GG} \end{bmatrix} \begin{bmatrix} Y_{1G} \\ Y_{2G} \\ \vdots \\ Y_{Gt} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \beta_{12} & \cdots & \beta_{1K} \\ \beta_{21} & \beta_{22} & \cdots & \beta_{2K} \\ \vdots & \vdots & \vdots & \vdots \\ \beta_{G1} & \beta_{G2} & \cdots & \beta_{Gk} \end{bmatrix} \begin{bmatrix} X_{1t} \\ X_{2t} \\ \vdots \\ X_{Kt} \end{bmatrix} = \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \vdots \\ \varepsilon_{Gt} \end{bmatrix} \ldots\ldots\ldots\ldots\ldots\ldots\text{Eq 4.3.}$$

Or

$\Gamma Y_t + BX_t = \varepsilon_t, t = 1,2,\ldots,n$ ……Eq 4.4.

Γ represents GxG matrix of the coefficients of Y

B represents GxK matrix of the β coefficients

$\Gamma Y_t = -\beta X_t + \theta\varepsilon_t$

$\Gamma^{-1}\Gamma Y = \Gamma^{-1}\beta X_t + \Gamma^{-1}\theta\varepsilon_t$

$Y = \Gamma^{-1}\beta X_t + \Gamma^{-1}\theta^T\varepsilon_t$

$Y_t = \Sigma X_t + \Lambda\varepsilon_t$

Where,

Σ represents GxG matrix of the structural coefficients of X

Λ represents Gx1 vector of the structural disturbances for time t

Y_t refers to endogenous variables for time t

X_t refers to the K pre-determined variables for time t

ε_t refers to the structural disturbances for time t

The equation will be used to conduct the analysis of the study, whereby the system will include three simultaneous equations and 8 independent variables. Consequently, the identification criteria for the simultaneous equation, necessitates that the number of equations must not be greater than the number of regrresors. *G-K = -5 (degree of overidentification)* which implies that the equation is overidentified. This means that it satisfies the identification requirement.

4.6 Estimation Technique/Method

This study seeks to estimate a model for the demand for labour using a double-log linear specification by assessing the linkage between export performance and the demand for different skills levels in the South African economy. To determine the skill intensity of export growth, this study employs a three-stage least squares (3SLS) estimation technique applied to a set of three simultaneous equations, differentiating between the demand for skilled, semiskilled and unskilled labour.

4.6.1 Testing Stages

In the case of an equation with endogenous variables on the left and exogenous endogenous variables on the right, the right-hand endogenous variables are correlated with the error term, which results in the OLS (Ordinary least squares) being distorted and inconsistent. As a result, the right-hand side endogenous variables in this equation need to be replaced by variables that are highly correlated with the one they are replacing, but not correlated with the error term (Baltagi, 2011).

Stage 1

In the first stage, correlations between endogenous regressors and disturbances are eliminated. This is achieved by regressing the endogenous regressors on a set of instrumental variables. These are the ones that are correlated with the endogenous regressor but not related to the disturbance. The objective is to regress the endogenous regressor on the set of instrumental variables.

Stage 2

Following the first stage, to generate estimates of structural parameters that appeared in the system, we replace actual values with estimated values of dependent variables and apply

ordinary least squares to generate estimates in this stage. During stage 2, by using the residuals of each equation, we estimate the cross-equation covariances and variances. This is illustrated by the formula below:

Stage 3

3SLS includes the third stage that is not included in the latter 2SLS. By using the variance-covariance matrix estimated in the final stage, the estimation efficiency is improved by leveraging the variance-covariance matrix. It is important to note that in the simultaneous estimation, misspecification from one equation can contaminate the estimates for the other equations. Step three combines the results from step one and two and the application of generalized least squares - GLS estimator.

4.6.2 Diagnostic Test

A diagnostic test ensures that the classical normal linear regression assumptions are not violated. The assumptions that must be adhered to must ensure normality on the distribution of residuals with zero mean and variance, and homoscedasticity. These are explained as follows:

4.6.2.1 Normality

The possibility of nonnormality is prominent in regression analysis thus, the normality test assesses if there is a normal distribution of residuals, with a zero mean and variance. Other causes include misspecification, multicollinearity and the lack of stationarity from the dependent variable. The test of normality is vital for hypothesis testing and prediction. (Gujarati,2009). Nonviolence of normality implies that the estimator is BLUE (best linear unbiased estimator). To test normality, we use Jacque-Bera (1980).

4.6.2.2. Heteroscedasticity

In a situation whereby the variance is the same as the error term despite the change in value taken by the independent variable (Pedace,2013), heteroscedasticity exists. Heteroscedasticity violates one of the assumptions of the classical linear regression model and is caused by various reasons. A misspecified model can produce heteroscedasticity. Other causes include a case when the variance of the residual is not persistent over different values (unequal variance). Outliers can also lead to heteroscedasticity. The existence of heteroscedasticity results in unbiased, consistent yet inefficient OLS estimates or incorrect inferences (Neeraj, 2010). To test for heterodasticity, we use the Breusch-Pagan test.

4.7 Results and Discussion

Estimating employment levels within different categories (three in particular) involves simultaneity since the total number of employed people is not entirely determined by the same factors, for example, productivity in sectors, macroeconomic environment; and secondary variables themselves compete with each other - they explain each other somewhat.

Descriptive statistics are presented below- both the original data and then the logged values. Descriptive analysis provides an overview of the data and how it has been distributed. The original descriptive data are presented in Table 4.1, with sectorial exports denoted in millions of Rands.

4.7.1.1 Descriptive Statistics

Descriptive statistics provide the mean, standard deviation, minimum and maximum number from the 52 observations.

Table 4.1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Skilled Labour	52	3713.581	141.684	3372.701	3929.517
Semiskilled Labour	52	7019.022	507.424	6336.629	7857.876
Unskilled Labour	52	4387.995	327.867	3903.525	4870.967
Agricultural, Forestry & Fishing	52	12546.876	6146.098	3890.129	30255.58
Mining & Quarrying	52	87710.463	26659.025	49153.195	176367.97
Manufacturing	52	140381.42	40814.676	64812.172	216290.95
Electricity Gas & Water	52	1496.848	910.617	163.677	3245.938
Average Wage Rate	52	125949.54	29129.938	73451.262	188747.4
Real Effective Exchange Rate	52	82.06	5.29	71.848	90.602
Gross Fixed Capital Formation	52	959819.1	71873.537	745529	1050491
Repo Rate	52	6.516	1.861	3.5	12

The summary of the natural log of each of the variable statistics is presented below. To ensure linearity (to ensure that data do not exhibit a normal distribution) and reduce the wide variation among the data points, we log the variables. Most importantly we also log the variables to assess elasticity (responsiveness or growth rate).

4.7.1.2 Descriptive Statistics (logged variables)

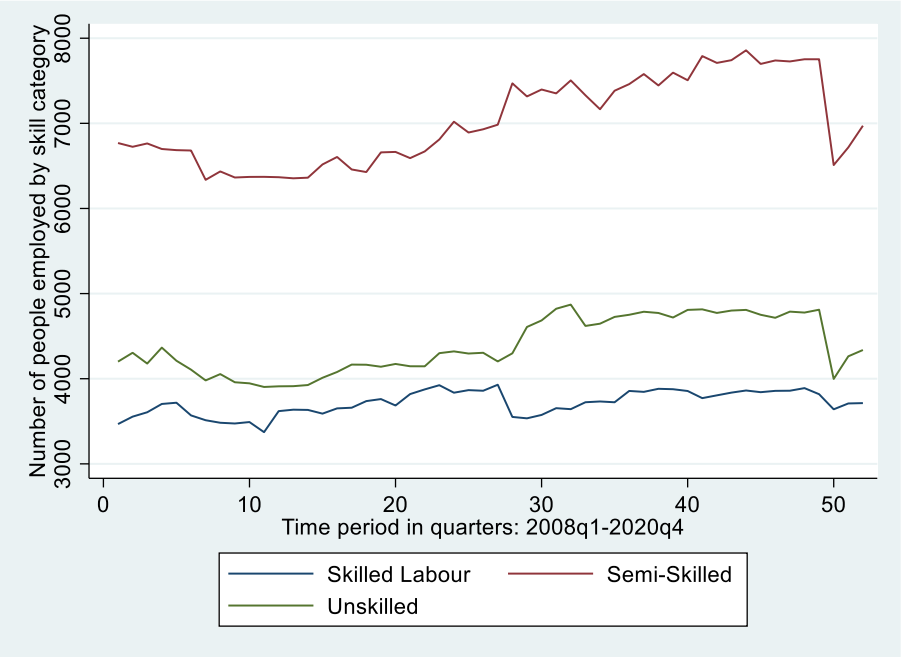
Table 4.2: Descriptive Statistics (Logged Variables)

Variable	Obs	Mean	Std. Dev.	Min	Max
lnSkilled Labour	52	8.219	0.038	8.123	8.276
lnSemiskilled Labour	52	8.854	0.072	8.754	8.969
lnUnskilled Labour	52	8.384	0.075	8.27	8.491
lnAgricultural, Forestry & Fishing	52	23.134	0.5	22.082	24.133
lnMining & Quarrying	52	25.155	0.293	24.618	25.896
lnManufacturing	52	25.621	0.32	24.895	26.1
lnElectricity, Gas & Water	52	20.839	0.875	18.913	21.901
lnAverage Wage Rate	52	11.716	0.244	11.204	12.148
lnReal Effective Exchange rate	52	4.405	0.065	4.275	4.506
lnGross Fixed Capital Formation	52	13.772	0.078	13.522	13.865
lnRepo Rate	52	6.516	1.861	3.5	12

In Table 4.2, descriptive statistics are presented in log format. Repo rates are already reported in log format, however.

As part of the descriptive analysis, trends of the key variables are presented in Figures 1 and 2.

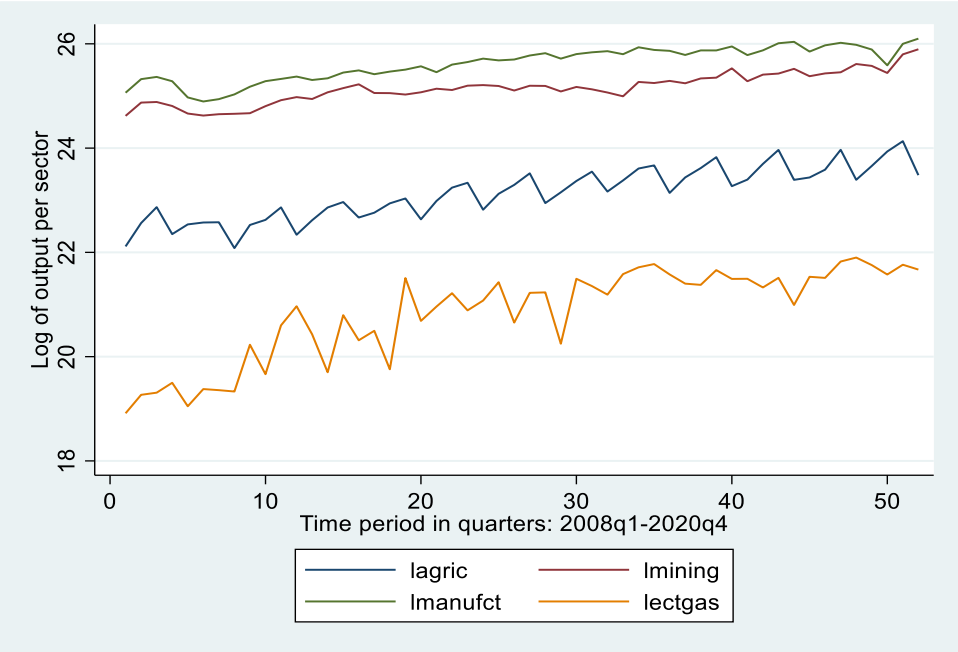
Figure 4.2: Skills



Source: STATA

These skills data start in 2008q1 and end in 2020q4. The dominant skill category in the South African labour market is semiskilled labour, followed by low-skilled labour and then skilled labour.

Figure 4.3 : Export Performance



The export data range is from 2008q1 to 2020q4. In 2008, during the first quarter, the performance of exports was relatively low. As a result of the 2008/09 global financial crisis, Mohammed (2009) notes a decline in global demand for mining and mineral products from South Africa. This in turn led to further declines in exports for those commodities. During the same period the electricity, water and gas industry experienced a decline in exports in South Africa because their generation plant was out of service for reconditioning (Statssa, 2008). Within the last two decades, South Africa's manufacturing sector has exhibited relatively poor performance (Bhorat and Rooney, 2017) (Kreuser and Newman, 2018).

To illustrate the strength and direction of the relationship between the variables we present correlation coefficients among the variables, as shown in Table 2.

4.7.1.3 Pairwise correlations

In addition to illustrating the relationship between variables the pairwise correlation reviews the possibility of multicollinearity. The pairwise illustration shows a strong association between the average wage and export growth in the four sectors. Interestingly, we also observe

a weak connection between export growth in different sectors and exchange and repo rate. However, the effect of the exchange rate cannot be ignored in the face of the findings from a study by Chamuorwa and Choga (2015) suggest that the exchange rate volatility negatively affects export performance in South Africa.

Table 4.3: Pairwise Correlation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Skilled Labour	1.000										
(2) Semiskilled labour	0.563*	1.000									
(3) Unskilled labour	0.553*	0.952*	1.000								
(4) Agriculture, forestry and fishery	0.523*	0.591*	0.578*	1.000							
(5) Mining & quarrying	0.546*	0.550*	0.503*	0.748*	1.000						
(6) Manufacturing	0.632*	0.816*	0.789*	0.783*	0.854*	1.000					
(7) Electricity, Gas and Water	0.585*	0.682*	0.656*	0.797*	0.770*	0.852*	1.000				
(8) Average wage rate	0.589*	0.703*	0.665*	0.845*	0.904*	0.921*	0.881*	1.000			
(9) Real Effective Exchange rates	-0.122	0.432*	0.406*	0.221	0.133	0.188	0.203	0.206	1.000		
(10) Gross Fixed Capital Formation	0.555*	0.632*	0.643*	0.111	0.036	0.428*	0.244	0.175	-0.050	1.000	
(11) Repo rate	-0.225	0.019	0.072	-0.357*	-0.482*	-0.374*	-0.420*	-0.543*	0.364*	0.113	1.000

** p<0.1*

The next step to is conduct the unit root test.

4.7.1.4 Unit Root Test

Using augmented Dickey-Fuller testing, this study will ensure that the results are reliable and avoid autocorrelation Nkoro and Uko (2016). The purpose of unit root testing is to test whether the variable in question is stationary or nonstationary. This is illustrated by the following equations:

If $|\rho| < 1$: y_t will be stationary

If $|\rho| = 1$: y_t will be nonstationary

If $|\rho| > 1$: y_t will be nonstationary and explosive

In the case of nonstationarity, the unit root test also demonstrates how many times a variable is differenced for it to be stationary.

Table 4.4: Unit Root Test

Variable			T-statistics	Prob.	Inference
lnUnskilled Labour	Level 1	Interceot	-1.702290	0.4241	Nonstationary
		Trend & Intercept	-2.150090	0.5062	Nonstationary
		None	-0.113882	0.7143	Nonstationary
	1st Difference	Intercept	-8.537113***	0.0000	Stationary
		Trend & Intercept	-8.455403***	0.0000	Stationary
		None	-8.625358***	0.0000	Stationary
lnSemi_skilled Labour	Level	Intercept	-7.237399***	0.0000	Stationary
		Trend & Intercept	-7.247681***	0.0000	Stationary
		None	-0.418811	0.5272	Nonstationary
lnSkilled_Labour	Level	Intercept	-2.743172**	0.0739	Stationary
		Trend & Intercept	-2.964759	0.1520	Nonstationary
		None	0.379304	0.7901	Nonstationary
lnAgricultural, forestry & Fishing	Level	Intercept	-2.837357**	0.0617	Stationary
		Trend & Intercept	-0.909762	0.9453	Nonstationary
		None	-2.434961**	0.9958	Stationary
lnElectricity, Gas & Water	Level	Intercept	-1.874968	0.3411	Nonstationary
		Trend & Intercept	-5.441616***	0.0002	Stationary
		None	1.708821	0.9774	Nonstationary
lnManufacturing	Level	Intercept	-0.749045	0.8241	Nonstationary
		Trend & Intercept	-1.975997	0.5992	Nonstationary
		None	1.722075	0.9780	Nonstationary
	1st Difference	Intercept	-6.440767***	0.0000	Stationary
		Trend & Intercept	-6.350525***	0.0000	Stationary
		None	-3.544713***	0.0007	Stationary
lnMining & Quarrying	Level	Intercept	0.115205	0.9638	Nonstationary
		Trend & Intercept	-3.320911*	0.0744	Stationary
		None	1.640520	0.9740	Nonstationary
lnRepo rate	Level	Intercept	-3.570057	0.0100	Nonstationary
		Trend & Intercept	-3.439767*	0.0576	Stationary
		None	-2.148605**	0.0317	Stationary
lnAverage Wage Rate	Level	Intercept	-1.434104	0.5584	Nonstationary
		Trend & Intercept	-2.610817	0.2775	Nonstationary
		None	6.531887	1.0000	Nonstationary
	1st Difference	Intercept	-5.976762***	0.0000	Stationary
		Trend & Intercept	-5.978384***	0.0000	Stationary
		None	-0.387682	0.5391	Nonstationary
	Level	Intercept	-1.5523368	0.4993	Nonstationary

lnGross Fixed Capital Formation		Trend &Intercept	-1.230364	0.8933	Nonstationary
		None	-0.341310	0.5573	Nonstationary
	1st Difference	Intercept	-6.389715***	0.0000	Stationary
		Trend & Intercept	-4.192651***	0.0093	Stationary
		None	-6.432910	0.0000	Stationary

* p<0.10 ** p<0.05 *** p<0.01

Notes: *** implies rejection of the null hypothesis at the 1 percent level. **at the 5 percent level and * at the 10 percent level.

Semiskilled and skilled labour is stationary at the 5% level, and unskilled labour is stationary at the first difference level. The unit root tests found that export industries such as agriculture, forestry, fisheries, electricity, gas, and water; and mining and quarrying are stationary at 5%. However, the manufacturing variable is stationary at the first difference. In addition, the repo rate is stationary at the 5% level and the average wage rate and gross fixed capital formation are stationary at the first difference level. Next, we will test for endogeneity among the variables.

4.7.1.5 Endogeneity results

The following results contain a test for endogeneity for each variable. For this test, the Durbin-Wu-Hausman test is used. This technique took its name from the seminal works of James Durbin, De-Min Wu, and Jerry Hausman (Durbin 1954; Wu 1973; Hausman 1978). The Durbin-Wu-Hausman test can be used to see whether there is any significant impact on the coefficient estimates due to possible endogeneity of the right-hand side variables. In the table below, if the p-value is significant (>0.10), then OLS is not consistent, therefore, 3SLS is valid (as an endogenous technique).

Table 4.5: Endogeneity results

Variable	Chi-square: (df)value	P-Value	Outcome
lnSemiskilled labour	(1) 3.34	0.0677	Endogeneity
lnUnskilled labour	(1)0.71	0.4009	No Endogeneity
lnManufacturing	(3) 28.61	<0.001	Endogeneity
lnMining & Quarrying	(3) 8.36	0.0391	Endogeneity
lnAgricultural, Forestry & Fishery	(3) 9.40	0.0244	Endogeneity
lnElectricity, Gas & Water	(2) 7.06	0.0292	Endogeneity

lnReal Effective Exchange Rate	(1) 0.05	0.8251	No endogeneity
lnAverage Wage Rate	(3) 13.62	0.0035	Endogeneity
lnRepo rate	(1) 3.27	0.0707	Endogeneity
lnGross Fixed Capital Formation	(1)3.00	0.0832	Endogeneity

Table 4.5 shows that unskilled labour and the real effective exchange rate are exogenous variables. All exports, semiskilled, low-skilled, the average wage rate, the repo rate, and gross fixed capital formation are endogenous. Skilled labour is then considered the reference skill.

4.7.1.6 Regression results

Within the framework of the 3SLS technique, Table 4.6 displays the regression results. The dependent variables are skilled labour, semiskilled labour and low skilled labour. The independent variables include exports (in the manufacturing, mining, agricultural and water, electricity and gas industry), average wages and repo rate.

It is important to note that the model was estimated in a parsimonious manner which also decreases interrelation between variables (Marsh, Nagayasu and Wandrin, 2009) and increase rigour (Cheng, 2001). Additionally, the presence of all variables broke the estimation process - we had singular matrices, and therefore the estimation was not convergent. The intent in building the parsimonious model was to ensure that we had a model that was the best fit; as a result, there were some slight differences in the explanatory variables included.

Table 4.6: Regression results

	Coef.	Sig	St.Err.	t-value	p-value
Regression (1)					
lnSkilled labour – Dependent Variable					
lnSemiskilled Labour	-0.19		0.153	-1.24	0.214
lnMining & Quarrying	0.117	**	0.05	2.36	0.018
lnAgricultural, Forestry & Fishing	0.061	**	0.024	2.56	0.01
lnManufacturing	0.129	**	0.065	2.01	0.045
lnElectricity, Gas & Water	0.037	**	0.015	2.44	0.015
lnAverage Wage Rate	-0.406	***	0.12	-3.37	0.001
Constant	6.214	***	0.883	7.04	0.000
Regression (2)					
lnSemiskilled Labour- Dependent Variable					
lnAgricultural, Forestry & Fishing	0.049		0.031	1.59	0.112
lnMining & Quarrying	-0.046		0.068	-0.68	0.496

lnManufacturing	0.321	***	0.058	5.53	0.000
lnElectricity, Gas & Water	0.005		0.021	0.23	0.815
lnAverage Wage Rate	-0.26	*	0.158	-1.65	0.098
Constant	3.605	***	0.955	3.77	0.000
Regression (3)					
lnUnskilled Labour- Dependent Variable					
lnAgricultural, Forestry & Fishing	0.024		0.043	0.55	0.583
lnMining & Quarrying	-0.053		0.055	-0.97	0.334
lnManufacturing	0.175		0.114	1.54	0.123
lnExchange Rate	0.105		0.184	0.57	0.569
lnGross Fixed Capital Formation	0.203	***	0.069	2.96	0.003
lnRepo Rate	0.012		0.012	0.93	0.35
lnAverage Wage Rate	0.026		0.326	0.08	0.936
Constant	1.034		1.521	0.68	0.497
Mean dependent var	8.384	SD dependent var		0.075	
Number of obs	52.000	Akaike crit. (AIC)		.	

* p<0.10 ** p<0.05 *** p<0.01

We assessed South Africa's export growth skill intensity using the 3SLS data analysis technique. The research findings show that exports in the focused sectors increase the employment of skilled individuals. The manufacturing sector has the greatest impact, with a p-value of 0.045. The coefficient for the change in manufacturing exports on skilled labour is 0.129, which means that a 1 percent increase in manufacturing exports increases skilled labour demand by 12 percent. The results of this study are consistent with those of Cali and Hollweg (2017), who have reported that the manufacturing sector favours skilled workers.

This was followed by the mining and quarrying industry with the p-value of 0.018. For an increase in mining and quarrying exports, the coefficient is 0.117, which means that skilled labour demand increases by 11 percent for every 1 percent increase in mining and quarrying exports. The agricultural sector is the third-highest contributor to the demand for skilled workers with the p-value of 0.01. The coefficient for the change in agricultural exports is 0.061, which means that a 1 percent increase in agricultural exports increases the demand for skilled labour by 6 percent. Finally, the electricity, water and gas sector is the fourth highest contributor to the demand for skilled labour with the p-value of 0.015. This is represented by a coefficient of 0.037, which implies that for every 1 percent increase in electricity, water, and gas exports, there is a 3 percent increase in the demand for skilled labour.

This study shows that more exports in the manufacturing sector increase employment of semiskilled individuals. According to our results, the coefficient for manufacturing exports is 0.321, meaning that the demand for semiskilled labour increases by 32 percent for every 1 percent increase in manufacturing exports. This is shown by the p-value is 0.000. This conclusion is consistent with Matthee, Idsardi, and Krugell (2015), who concluded that manufacturing industries may demand semi- and high-skilled workers when they produce medium- and high-skilled technologies.

The classical economic theory argues that the increase in higher wages reduces the demand for labour – and this is consistent with the findings of this study, which show that higher wages reduce the employment of skilled and semiskilled individuals [they are more costly and therefore less hired when wage increases]. For skilled labour, this is shown by the coefficient of - 0.406, and the p-value is 0.001. For semiskilled labour, this is shown by the coefficient of -0.26 and the p-value is 0.098. The role of trade unions is substantial in South Africa, and several studies have investigated their impact on the labour market. According to Fintel (2017) wages have a decisive impact on whether a firm chooses to expand employment. According to the various estimates performed in the study, unemployment increases in response to workers' wages, especially for those paid moderate-to-high wages. These changes are also believed to result from high concentrations of unionized workers and employment in large companies (that typically do collectively bargain). An earlier study by Magruder (2012) also concludes that a centralized collective bargaining agreement lowers employment in an industry by 8–13 percent, with losses disproportionately concentrated among small companies.

The increase in the gross fixed capital formation increases employment for the low-skilled individuals. This is shown by the p-value of 0.003. The coefficient for gross fixed capital formation is 0.203, meaning that the demand for low-skilled labour increases by 20 percent for every 1 percent increase in gross fixed capital formation. The increase in demand could be embedded in the work required for investment-related projects that require low skills. According to the Word Bank (2021), investment contains land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, etc., including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings (well classified under community, social and personal service). Furthermore, the findings of Vargas, Nayyer and Vèzina (2018) demonstrate that foreign direct investment (FDI) is associated with a higher probability of employment and

higher wages for unskilled workers than for skilled workers in emerging economies (i.e. Brazil, Colombia, Ethiopia, Mexico, the Philippines, South Africa, and Vietnam).

In relation to table 4.7 below and out of interest, one of the employment categories was treated as exogenous`- unskilled employment and the comparable results are presented below.

4.7.1.7 Regression results with unskilled labour employment as exogenous

Table 4.7 consists of regression results with unskilled labour treated as an exogenous variable.

Table 4.7: Regression Results

	Coef.	Sig	St.Err.	t-value	p-value
Regression (1)					
lnSkilled Labour – Dependent Variable					
lnSemiskilled Labour	-0.058		0.162	-0.36	0.72
lnMining & Quarrying	0.123	**	0.05	2.48	0.013
lnAgricultural, Forestry & Fishing	0.054	**	0.024	2.27	0.023
lnManufacturing	0.087		0.067	1.31	0.191
lnElectricity, Gas & Water	0.037	**	0.015	2.40	0.016
lnAverage Wage Rate	-.372	***	0.121	-3.07	0.002
Constant	5.738	***	0.903	6.36	0.000
Regression (2)					
lnSemiskilled Labour – Dependent Variable					
lnSkilled Labour	0.062		0.415	0.15	0.882
lnAgricultural, Forestry & Fishing	0.046		0.036	1.29	0.197
lnMining & Quarrying	-0.054		0.082	-0.66	0.509
lnManufacturing	0.317	***	0.061	5.20	0.000
lnElectricity, Gas & Water	0.003		0.025	0.11	0.913
lnAverage Wage Rate	-0.238		0.208	-1.15	0.252
Constant	3.264		2.458	1.33	0.184
Regression (3)					
lnUnskilled – Dependent Variable					
lnAgricultural, Forestry & Fishing	0.022		0.043	0.50	0.616
lnMining & Quarrying	-0.059		0.056	-1.05	0.292
lnManufacturing	0.179		0.114	1.57	0.116
lnExchange Rate	0.095		0.185	0.51	0.608
lnGross Fixed Capital Formation	0.186	**	0.075	2.48	0.013
lnRepo Rate	0.012		0.013	0.99	0.323
lnAverage Wage Rate	0.038		0.327	0.12	0.908
Constant	1.283		1.582	0.81	0.417
Mean dependent var		8.384	SD dependent var	0.075	
Number of obs		52.000	Akaike crit.	.	

			(AIC)	

* p<0.10 ** p<0.05 *** p<0.01

Based on the estimation, export growth in the mining, agricultural, and electricity sectors does benefit skilled labour. Other studies conducted by Edwards and Behar (2006), Foster (2006) generally conclude that exports benefit skilled labour. The mining and quarrying industry is the most significant contributor with a p-value of 0.013 and a coefficient of 0.123. As a result, the demand for skilled workers increases by 12 percent for every 1 percent increase in mining and quarrying exports. This is followed by the agricultural, forestry and fishing sector with a p-value of 0.023. The coefficient is 0.054 which implies that for every 1 percent increase in the growth of agricultural, forestry and fishing exports, there will be a 5 percent increase in the demand for skilled labour. The electricity, water, and gas sector is the third largest contributor with a p-value of 0.016, and the coefficient is 0.037. This estimation shows that a 1 percent increase in the exports of electricity, water and gas will lead to a 3 percent increase in the demand for skilled labour.

The results from Table 4.7 (as with Table 4.6) demonstrate that semiskilled jobs benefit from manufacturing export growth. This is shown by the p-value of 0.000, and the coefficient slightly decreases to 0.317. This suggests that a 1 percent increase in manufacturing exports results to a 31 percent increase in the demand for semiskilled labour.

We observe that unskilled labour is positively correlated with gross fixed capital formation. In comparison to Table 4.6 the coefficient for gross fixed capital formation, has decreased to 0.186, which signifies that for every 1 percent increase in gross fixed capital formation, the demand for low-skilled labour increases by 18 percent.

4.8 Chapter Summary

This chapter summarizes the econometric estimations undertaken and discusses the study's empirical findings. The estimated results were obtained by using the three-stage least squares approach which estimates all the coefficients of the entire system at once for each structural disturbance. In order to test stationarity in all variables, the augmented Dickey-fuller test was utilized. Of the exporting industries tested, agriculture, electricity, and mining were stationary at first level, whereas manufacturing is stationary at first difference. In addition, semi-skilled and skilled labour were stationary at first level, and unskilled labour was stationary at first

difference. The average wage rate and gross fixed capital formation were also stationary at first difference. The repo rate on the other hand was stationary at first level. This was followed by a test of endogeneity which propelled a further regression analysis which was conducted using labour as an exogenous variable. Taking the analysis further, the next chapter draws conclusions, recommends economic policies, and highlights areas for further study.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter provides the main conclusions, as it summarises the motivation for the study, the main findings in relation to the objectives, and its value and significance. The study was motivated by the fact that South Africa has been experiencing job losses despite attempts to increase export production, which is intended to boost output and create jobs. This situation is further complicated by the fact that most job losses are being experienced by unskilled labour, which is in abundant supply. The study reviewed the theoretical background, which focuses on trade theories as literature on the relationship between skills intensity and export growth. A review of classicalist and neoclassical theoretical perspectives was conducted to understand the pattern of trade. Trade theorists present these arguments as a framework for evaluating spill-overs or the consequences of trade. Earlier authors from the classical school argued that a country's pattern of trade is influenced by its specialisation, which induces it to exchange goods. Latter authors, as presented by the Ricardian school of thought, further argued that for trade to exist, it is necessary for countries to specialise in goods over which they have a competitive advantage. In other words, countries should exchange goods with low opportunity costs for goods with higher opportunity costs. Based on this school of thought, trade patterns are not influenced by natural differences (low-skilled, semiskilled and/or highly skilled), which shifts the focus from factor endowments (or capabilities) to production capabilities. This study does not apply this theory since the genesis of trade is based on specialisation rather than proximate factors.

Several contributions to trade theory have been made by neoclassical economists, one of which is the Heckscher-Ohlin theory. A country exports goods that use its most abundant factor and imports goods that are made up of its scarcest factor. The Heckscher-Ohlin theory offers a different perspective than this study. Consequently, it is not South Africa's abundant factor skill that informs its comparative advantage. Based on this study, Skills-only Heckscher-Ohlin theory can be attributed; thus, trade patterns are determined by demand and supply. Nevertheless, upskilling may potentially result in wages being equalised and trade being abolished.

It conducted an econometric analysis to assess the changing patterns of the skill intensity of export growth in the main South African industries (i.e., manufacturing, agriculture, mining and utilities). That is, it investigated the skill intensity of export growth in the main industries to identify those industries that are skill intensive. According to the literature, skills are in different categories, namely, low-skilled, semiskilled and skilled, all which interplay in the market intensity continuum. The study uses the three-stage least squares (3SLS) method to estimate the demand for skills using a linear specification when examining the correlation between export performance in the four largest exporting industries and the skills structure of South Africa. Some of the likely reasons for the changing patterns of the skill intensity of export growth were explored. Additionally, this chapter provides some policy recommendations and study limitations that offer opportunities for future research.

5.2 Summary of key Findings

Essentially, the objective of this study was to develop a model of labour demand using a double-log linear specification by assessing the relationship between export performance and the demand for skills at different levels in the South African economy. According to the results of the model, the objectives outlined in Chapter 1 have been achieved. This study was designed to identify the changing patterns of the skill intensity of export growth in South Africa from 2008 to 2020, along with the different levels of skills needed to determine export growth.

The three-least-squares method was used to achieve the study's objectives. Among the variables incorporated into the model were skills (unskilled, semiskilled, and skilled), export growth, wages, gross fixed capital formation, and the exchange rate. Our findings are consistent with earlier studies by Bhorat (2010) and Birdi, Dunne and Watson (2002). Based on the results of the three-least squares analysis (Chapter 4) in this study:

(a) The top four industries contributing to export growth are all skill intensive (manufacturing, mining & quarrying, agriculture, and electricity, gas & water). As a result, skilled workers are in greater demand due to an increase in exports.
(b) The manufacturing sector also employs semiskilled workers. Accordingly, when exports in the manufacturing sectors increase, semiskilled labour is in demand.
(c) Unskilled labour employment is further influenced by factors such as gross fixed capital formation. Emerging economies are particularly prone to this trend. A large percentage

of the investment in gross fixed capital formation consists of work that requires unskilled labour.

(d) The increase in the wage of semiskilled and skilled labour reduces the demand.

5.3 Contribution of the Study

Having demonstrated which skill contributes to export growth in the four main export industries, this study has unpacked the skill intensity of export growth in South Africa in detail. This study contributes to the increasing body of literature showing the changes in skill patterns in South African industries. As such, export industries are skill intensive in South Africa. Lack of demand for unskilled (and some semiskilled workers) labour may explain why job losses affect unskilled workers.

Academics, scholars, and policymakers can therefore benefit from the contribution this study makes to understanding unemployment in relation to the external environment. To better formulate skills and macroeconomic policy, we need to understand the skill pattern in South Africa and the world more broadly, as well as demand trends. The skill resource can also be utilised more effectively as a result. The supply of labour should be able to meet the demand for labour.

As a recommendation, the existing skills policy should be supplemented with a proactive and regular approach to skills development. A rethinking of labour reform policies should take place at the level of NEDLAC (National Economic, Development and Labour Council), including structural reforms. It is also imperative that industries participate actively in the training of the workforce. In light of the rapid pace of technological change, it should be less likely for unskilled workers to lose their jobs because of constant upskilling.

Considering the impact of globalisation, it is important that policies in South Africa also align with global patterns. South Africa should increase research to ensure that the skills policy aligns with labour market demands. For the labour force that is outside the market, it is important

5.4 Limitation of Research

This study was limited to data that were available only from 2008. Thus, a few years were not included because there was a lack of data.

Moreover, it would be beneficial to continuously study the skill intensity of export growth, which opens opportunities for further research. In the context of changing global trends, it is essential to understand how those trends impact the local economy. Furthermore, this will contribute to the continuous shaping of macroeconomic, industrial, and skills policies.

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Appendix

Diagnostic techniques were carried out and results are presented below.

Joint test that the coefficients are equal to 0 in all equations

Table A1: Joint Test

Test	chi2	Prob > chi2	Conclusion
Joint test of the pair = 0			
lnSkilled Labour lnSemiskilled Labour	(2) =3.96	0.1378	Fail to reject
lnManufacturing lnMining, & Quarrying	(6) =42.28	0.0000	Reject
lnManufacturing lnAgricultural, Forestry & Fishing	(6) =36.10	0.0000	Reject
lnManufacturing lnElectricity, Gas & Water	(5) =39.02	0.0000	Reject
lnAgricultural, lnForestry & Fishing L Electricity, Gas & Water	(5) =13.51	0.0191	Reject
lnMining & lnQuarrying L Electricity, Gas & Water	(5) =10.39	0.0650	Reject
lnMining & lnQuarrying L Agricultural, Forestry & Fishing	(6) =16.38	0.0119	Reject
Single test- variable =0			
lnSemiskilled Labour	(1) =3.34	0.0677	Reject
lnManufacturing	(3) =28.61	0.0000	Reject
lnMining & Quarrying	(3) =8.36	0.0391	Reject
lnAgricultural, Forestry & Fishing	(3) =9.40	0.0244	Reject
lnElectricity, Gas & Water	(2) =7.06	0.0292	Reject
lnReal Effective Exchange Rate	(1) =0.05	0.8251	Fail to reject
lnAverage Wage Rate	(3) =13.62	0.0035	Reject
lnRepo rate	(1) =3.27	0.0707	Reject
lnGross Fixed Capital Formation	(1) =3.00	0.0832	Reject

Three-stage least-squares regression

Table A2: Three-stage least squares regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lnSkilled Labour	52	6	.0482973	0.6071	36.28	0.0000
lnSemiskilled Labour	52	6	.0589217	0.3169	88.61	0.0000
lnUnskilled Labour	52	7	.0281801	0.8548	354.47	0.0000

Overall System Heteroscedasticity Tests after (3SLS-SURE) Regressions

In Table A3, we present the Hall-Pagan LM and Engles' Arch LM tests for heteroscedasticity.

Table A3: Heteroscedasticity Test

System Heteroscedasticity Tests (3sls)			
Single Equation Heteroscedasticity Tests: Ho: Homoscedasticity - Ha: Heteroscedasticity			
Eq. lnSkilled Labour:	Engle LM ARCH Test:	E2 = E2_1 = 0.4365	P-Value > Chi2(1) 0.5088
Eq. lnSkilled Labour:	Hall-Pagan LM Test:	E2 = Yh = 1.0788	P-Value > Chi2(1) 0.2990
Eq. lnSkilled Labour:	Hall-Pagan LM Test:	E2 = Yh2 = 1.0870	P-Value > Chi2(1) 0.2971
Eq. lnSkilled Labour:	Hall-Pagan LM Test:	E2 = LYh2 = 1.0706	P-Value > Chi2(1) 0.3008
Eq. lnSemiskilled Labour:	Engle LM ARCH Test:	E2 = E2_1 = 0.0000	P-Value > Chi2(1) 0.9955
Eq. lnSemiskilled Labour:	Hall-Pagan LM Test:	E2 = Yh = 1.0639	P-Value > Chi2(1) 0.3023
Eq. lnSemiskilled Labour:	Hall-Pagan LM Test:	E2 = Yh2 = 1.0584	P-Value > Chi2(1) 0.3036
Eq. lnSemiskilled Labour:	Hall-Pagan LM Test:	E2 = LYh2 = 0.0695	P-Value > Chi2(1) 0.3011
Eq. lnUnskilled Labour:	Engle LM ARCH Test:	E2 = E2_1 = 0.2140	P-Value > Chi2(1) 0.6436
Eq. lnUnskilled Labour:	Hall-Pagan LM Test:	E2 = Yh = 0.8853	P-Value > Chi2(1) 0.3468
Eq. lnUnskilled Labour:	Hall-Pagan LM Test:	E2 = Yh2 = 0.8825	P-Value > Chi2(1) 0.3475
Eq. lnUnskilled Labour:	Hall-Pagan LM Test:	E2 = LYh2 = 0.8881	P-Value > Chi2(1) 0.3460

Table A4: Heteroscedasticity Test

Overall System Heteroscedasticity Tests: **Ho: No Overall System Heteroscedasticity**			
Breusch-Pagan LM Test	= 17.1406	P-Value > Chi2(3)	0.0007
Likelihood Ratio LR Test	= 18.0429	P-Value > Chi2(3)	0.0004
Wald Test	= 1.82e+09	P-Value > Chi2(3)	0.0000

The results show how the null of homoscedasticity cannot be rejected, concluding that the single equations have a variance of the residual is constant and no anticipated bias.

Normality has been confirmed for the single equations as well, based on the results presented in the table below. As for the overall system, normality is refuted as we fail to reject 'no overall system nonnormality' for all tests, except only the Jarque-Bera LM test.

Table A5: Non-Normality Test

System Non-Normality Tests (3sls) **Single Equation Non-Normality Tests:** Ho: Normality - **Ha: Non-Normality**			
Eq. lnSkilled Labour:	Jarque-Bera LM Test	= 3.6974	P-Value > Chi2(2) 0.1574
Eq. lnSemiskilled Labour:	Jarque-Bera LM Test	= 1.1106	P-Value > Chi2(2) 0.5739
Eq. lnUnskilled Labour:	Jarque-Bera LM Test	= 0.4276	P-Value > Chi2(2) 0.8075

Table A6: Non-normality Test

Overall System Non-Normality Tests: **Ho: No Overall System Non-Normality**			
Non-Normality Tests			
Jarque-Bera LM Test	= 3.13e+08	P-Value > Chi2(2)	0.0000
Geary LM Test	= -4.0162	P-Value > Chi2(2)	0.1342
Anderson-Darling Z Test	= -0.7522	P-Value>Z (0.680)	0.7517
D'Agostino-Pearson LM Test	= 1.5689	P-Value > Chi2(2)	0.4564

Table A7: Skewness Test

Skewness Tests:			
Srivastava LM Skewness Test	= 1.0508	P-Value > Chi2(1)	0.3053
Small LM Skewness Test	= 1.1243	P-Value > Chi2(1)	0.2890
Skewness Z Test	= -1.0603	P-Value > Chi2(1)	0.2890

Kurtosis Tests:			
Srivastava Z Kurtosis Test	= 0.4044	P-Value > Z (0,1)	0.6859
Small LM Kurtosis Z Test	= 0.4446	P-Value > Chi2(1)	0.5049
Kurtosis Test	= 0.6668	P-Value > Chi2(1)	0.2524
Skewness Coefficient	= 0	Standard Deviation	= 0.1943
Kurtosis Coefficient	= 3.1586	Standard Deviation	= 0.3862
Runs Test: (54) Runs - (78) Positives - (78) Negatives **Standard Deviation Runs Sig(k) = 6.2248 , Mean Runs E(k) = 79.0000** **95% Conf. Interval [E(k)+/- 1.96* Sig(k)] = (66.7994, 91.2006)**			

Diagnostic techniques were carried out and results are presented below:

Table A8: Three-stage least squares regression

Equation	**Obs**	**Parms**	**RMSE**	**"R-sq"**	**chi2**	**P**
lnSkilled Labour	52	6	.032174	0.2868	78.25	0.0000
lnSemiskilled Labour	52	6	.0516318	0.4755	126.70	0.0000
lnUnskilled Labour	52	7	.0336266	0.7933	250.44	0.0000

A9: Heteroscedasticity Test

Overall System Heteroscedasticity Tests: **Ho: No Overall System Heteroscedasticity**			
Breusch-Pagan LM Test	= 38.5422	P-Value > Chi2(3)	0.0000
Likelihood Ratio LR Test	= 47.8959	P-Value > Chi2(3)	0.0000
Wald Test	= 1.58e+09	P-Value > Chi2(3)	0.0000

A10: Non-normality Test

Single Equation Non-Normality Tests: **Ho: Normality - Ha: Non-Normality**				
Eq. lnSkilled Labour:	Jarque-Bera LM Test	= 0.3830	P-Value > Chi2(2)	0.8257
Eq. lnSemiskilled Labour:	Jarque-Bera LM Test	= 0.3514	P-Value > Chi2(2)	0.8389
Eq. lnUnskilled Labour:	Jarque-Bera LM Test	= 5.2672	P-Value > Chi2(2)	0.0718

A11:Non-Normality Test

Overall System Non-Normality Tests: **Ho: No Overall System Non-Normality**			
Non-Normality Tests:			
Jarque-Bera LM Test	= 3.13e+08	P-Value > Chi2(2)	0.0000
Geary LM Test	= -2.7310	P-Value > Chi2(2)	0.2553
Anderson-Darling Z Test	= -0.2047	P-Value>Z (1.816)	0.9653
D'Agostino-Pearson LM Test	= 1.5461	P-Value > Chi2(2)	0.4616
Skewness Tests:			
Srivastava LM Skewness Test	= 0.0819	P-Value > Chi2(1)	0.7748
Small LM Skewness Test	= 0.0890	P-Value > Chi2(1)	0.7654
Skewness Z Test	= 0.2984	P-Value > Chi2(1)	0.7654
Kurtosis Tests:			
Srivastava Z Kurtosis Test	= 1.0456	P-Value > Z (0,1)	0.2958
Small LM Kurtosis Test	= 1.4570	P-Value > Chi2(1)	0.2274
- Kurtosis Z Test	= 1.2071	P-Value > Chi2(1)	0.1137
Skewness Coefficient = 0	**Standard Deviation = 0.1943**		
Kurtosis Coefficient = 3.4101	**Standard Deviation = 0.3862**		
Runs Test: (62) Runs - (78) Positives - (78) Negatives **Standard Deviation Runs Sig(k) = 6.2248, Mean Runs E(k) = 79.0000** **95% Conf. Interval [E(k)+/- 1.96* Sig(k)] = (66.7994, 91.2006)**			