IMPACT ANALYSIS OF THE FLOATING EXCHANGE RATE ON THE OUTPUT, EXPORT AND EMPLOYMENT IN THE SOUTH AFRICAN RED MEAT INDUSTRY, 1995-2020

BY

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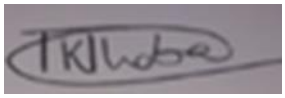
DECLARATION

I declare that the Thesis titled: IMPACT ANALYSIS OF THE FLOATING EXCHANGE RATE ON THE OUTPUT, EXPORT AND EMPLOYMENT IN THE SOUTH AFRICAN RED MEAT INDUSTRY, 1995-2020, hereby submitted to the University of Limpopo for the degree of Doctor of Philosophy in Agriculture (Agricultural Economics), has not previously been submitted by me for a degree at this or any other university; that it is my own work in design and execution, and that all material contained herein has been duly acknowledged.



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Thaba TK (Mr) **Date:**

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I dedicate this thesis to my beloved late mom, Melida Ramaesela Thaba.

ABSTRACT

The rate at which one country's currency is exchanged for another country's currency is known as the exchange rate. The external value of each currency is reflected in the country's economic conditions in general and the purchasing power of the currency relative to that of other currencies in particular. An exchange rate is the main indication signalling the current trends in the economy. The study analysed the impact of a floating exchange rate on production output, exports volume and employment in the red meat industry of South Africa. However, the study prioritised three industries within the red meat industry, which are relevant contributors to agricultural sector in terms of production output, exports volume and employment. The three types of red meat considered for this study are cattle/beef, sheep and goat and pig. The relationship between a floating exchange rate and red meat production is continuously significant, especially with a global increase of red meat consumption and demand. The overarching theoretical framework guiding research on the impact of a floating exchange rate on production output, exports volume and employment is the theory of imperfect competition.

The overall aim of the study was to analyse the impact of a floating exchange rate on production output, exports volume and employment in the South African red meat industry from 1995 until 2020. The study had five objectives for the study and they are broken down as follows: profiling the performance of the South African red meat industry in terms of production output, volume of exports and employment; secondly, to analyse the impact of floating exchange rate on production output, volume of exports and employment in the three selected South African red meat industries; thirdly, to analyse the short-run relation among production output, export volume, employment and exchange rate in the red meat industry of South African, fourthly, to determine the causality relationship or effects amongst production output, volume of exports, exchange rate and employment within the three South African red meat industry; and lastly, to determine the effects of red meat consumption on production output, volume of exports and employment in the South African red meat industry.

The study adopted secondary time series data and employ the following numerous and various analytical techniques to address the objectives: Augmented Dicer Fuller (ADF) test for stationarity test data, descriptive statistics, to profile the three prioritised red meat industries; error correction model of the autoregressive distributed lag (ARDL-ECM), to analyse the impact of floating exchange rate on production output, volume of exports and employment in the selected three South African red meat industries; ARDL bound test was used to analyse the short-run relation among production output, export volume, employment and exchange rate in the red meat industry of South African; granger causality test, to determine the causality relationship or effects amongst production output, volume of exports, exchange rate and employment within the three South African red meat industry; and ordinary least squares (OLS), to determine the effects of red meat consumption on production output, volume of exports and employment in the South African red meat industry.

ADF results showed that for the three selected red meat industries, the variables were integrated at different levels I (0) and I (1). ARDL-ECM estimation measured the long run cointegration among production output, volume of exports, exchange rate and employment through the error correction term adjustment speed. The results showed that in the long run, an exchange rate affects production output, volume of exports and employment in the three South African red meat industries. ARDL bound test confirmed the short run relationship among production output, volume of exports, exchange rate and employment for the three selected South African red meat industries. Granger causality estimation indicates single and bi-directional causality effect among production output, volume of exports, exchange rate and employment for the three selected South African red meat industries. Ordinary least squares (OLS) results show that red meat consumption positively and significantly affects total production output, volume of exports and total employment across the three selected South African red meat industries.

Conclusively, it is recommended that policymakers should not interfere with a floating exchange rate policy. Since the exchange rate volatility positively impacts on production output, exports volume and employment, it implies that the exchange rate volatility can support growth in small open economies by encouraging international capital inflows,

excessive capital inflows into the country. The South African government in collaboration with the red meat industry should undertake more investments aimed at boosting the production of the red meat industry. The recommended investments may include agricultural research and development. Through the adoption of science and technology-based innovations, such as breeding improved livestock that is adaptive to different climatic conditions and improving intensive management methods, the investment on research and development will make the industry to be a sustainable supplier of quality red meat in domestic and various international markets, as South Africa is known to be the leading producer of red meat in the continent of Africa.

Keywords: floating exchange rate, South African red meat industry, total production output, volume of exports, total production.

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LIST OF ACRONYMS

ADF	Augmented Dickey–Fuller
Agri-Seta	Agriculture Sector Education Training Authority
AIC	Akaike Information Criterion
AMIE	Association of Meat Importers and Exporters
ARDL	Autoregressive Distributed Lag
BFAP	Bureau for Food and Agricultural Policy
BLUE	Best Linear Unbiased Estimator
BOP	Balance of Payments
DAFF	Department of Agriculture, Forestry and Fisheries
DALRRD	Department of Agriculture, Land Reform and Rural Development
DOLS	Dynamic Ordinary Least Squares
ECM	Error Correction Model
FAO	Food and Agriculture Organization ARMA
FIAS	Financial Advisory And Intermediary Services
FMD	Foot-and-Mouth Disease
FPM	Food Price Monitoring
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GMTEU	Gauteng Meat Traders Employees Union
IOL	International Labour Organization
IRP	Interest Rate Parity (IRP)
NERPO	National Emergent Red Meat Producers Organisation
NFMT	National Federation of Meat Traders
OIE	International Animal Health Organization
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
RMAA	Red Meat Abattoirs Association
RMD SA	Red Meat Research & Development South Africa
RMIF	Red Meat Industry Forum
RPO	Red Meat Producers Organization
RPO	Red Meat Producers' Organisation

SA	South Africa
SAFA	South African Feedlot Association
SALAA	South African Livestock Agents Association
SAMPA	South African Processing Association
SANCU	South African National Consumers Union
SAPPO	South African Pork Producers Organisation
SARB	South African Reserve Bank
SHALC	Skins, Hides and Leather Council
STATS SA	Statistics South Africa
SVAR	Structural Vector Autoregressive
USA	United States of America
USD	United States dollar
VAR	Vector Autoregressive
VECM	Vector Error Correctional Model
WTO	World Trade Organisation
ZAR	South African Rand
GARCH-M	Generalised Autoregressive Conditionally Heteroscedastic -in-Mean errors
ARCH	Autoregressive Conditionally Heteroscedastic
GARCH	Generalised Autoregressive Conditionally Heteroscedastic
CBN	Central Bank of Nigeria
RMD	Renminbi
RER	Real Exchange Rate
GCT	Granger Causality Test
NAMC	National Agricultural Marketing Council
OCA	Optimum Currency Area
PPP	Purchasing Power Parity
FPE	Final prediction error
AIC	Akaike information criterion
SC	Schwarz information criterion
HQ	Hannan-Quinn information criterion

CHAPTER 1

INTRODUCTION

1.1 Background

The globalisation and integration of world economies into an international market gained momentum and has benefited both developing and developed economies. The South African economy has been integrated into the international market and that has created enormous opportunities for the agricultural sector to zoom into the red meat subsector or industry and other sectors of the economy. Opportunities include participating in the international market by means of exporting and importing investment goods and having access to advance technological innovations that affect the domestic labour market significantly (Mashinini *et al*. 2019). However, such opportunities came with costs attached, which include but are not limited to, the extreme volatility of the South African domestic currency, which affects developing economies more than the developed ones (Sekantsi, 2011).

According to Dahir *et al.* (2018), the volatility of the currency puts immense pressure on the economic policy on the exchange rate regimes selection for the country. The choice of exchange rate regimes and its impact on economic variables is probably one of the most controversial topics in macroeconomic policy. However, while its implications regarding inflation and policy credibility have received considerable attention, the impact of regimes on economic growth has been minimally investigated, probably because nominal variables are typically considered to be unrelated to longer-term growth performance.

Kabundi and Mlachila (2019) proffer that the exchange rate pass-through to consumer inflation has declined considerably in South Africa since the adoption of the inflation targeting framework in February 2000. The South African Reserve Bank (SARB) adopted the use of free-floating exchange rate system in an inflation target, with the sole purpose of trying to combat the negative impact of globalisation on its financial market. Floating exchange rate refers to the value of the currency being determined

by the force of demand and supply in the foreign exchange rate market. Like other subsectors of the South African economy, red meat industry prices are also determined or set by the forces of demand supply, thus making the industry to be very much competitive in the international market and more susceptible to international markets shocks, often by the changes in the exchange rate.

After the collapse of the old system that used the fixed exchange rate, exchange rates across the world have fluctuated widely. Several countries, including South Africa, adopted a flexible exchange rate regime despite its exposure to the exchange rate volatility. This condition is rightly considered to be a risk to the growth of global and macroeconomic stability, because of the existence of heading facilities that would be employed to protect against an exchange rate risk (Sekantsi, 2011). However, the results of this new system of the floating exchange rate have stimulated a boiling and extensive theoretical debate regarding the impact of the exchange rate unpredictability on foreign trade, which is driven by output (Sharma and Pal, 2020). The study by Nyahokwe and Ncwadi (2013) indicates that a greater exchange rate volatility creates insecurity thereby escalating the level of riskiness of trading activity, which will eventually depress trade.

It is argued that a free floating exchange rate can have both favourable and unfavourable consequences because, although it allows an unrestricted foreign exchange and stability in the balance of payment, the negative impact that the exchange rate variability has on exports, output and subsequently employment, negate the little benefits achieved through foreign exchange (Ngondo and Khobai, 2018). The study of the impact of exchange rate on exports, output and employment looking at South African red meat industry thus became of outmost importance.

Overall, the South African agricultural sector consists of 11 sub-sectors or industries with red meat being the leading contributor towards the total agricultural sector. Red meat products contributed 47% to the total gross value of agricultural production in 2019 (Agri-SETA, 2020). The red meat industry is subdivided into various categories such as Meat and Edible Meat Offal, Live Animals (beef, pork, sheep and goat), and Dairy Products. All categories of red meat are marketed in both domestic and international markets.

According to Trade Map (2019), there has been an overall increase in the red meat sub-sector export market since 2012, after the announcement by the International Animal Health Organization (OIE) declaring South Africa free from foot-and-mouth disease (FMD). The declaration has given South Africa access to several export markets like Vietnam, the United Arab Emirates and Jordan onwards (Bureau for Food and Agricultural Policy, 2017). South Africa's global meat imports were valued at R7.2 million, while domestically, South Africa produced approximately 20% of the total meat produced on the continent of Africa and accounted for 1% of global meat production (Red Meat Research & Development South Africa, 2018).

The red meat industry evolved from a highly regulated environment to one that is totally deregulated today. Various policies, such as the distinction between controlled and uncontrolled areas, compulsory levies payable by producers, restrictions on the establishment of abattoirs, the compulsory auctioning of carcasses according to grade and mass in controlled areas, the supply control via permits and quotas, the setting of floor prices, removal scheme, and others, characterised the red meat industry before deregulation commenced. Since the deregulation of the agricultural marketing dispensation in early 2000, the prices in the red meat industry are determined by demand and supply forces.

According to BFAP (2017), in South Africa, meat is regarded as an important product as it provides a source of protein in individual diets as well food security. In South Africa, the most consumed meat is poultry meat, followed by beef, mutton and pork (Agri-SETA, 2020). It has been observed that an increase in the level of income, sustained trends of urbanisation, and improved living standards have an impact on preferences in terms of the consumption of meat products. The consumption of meat products has been increasing over the years, apart from mutton, which has been showing instability. The instability is mainly attributed to the fact that it is expensive in comparison with the other meat products (Vermeulen, 2020).

Regardless of the improvements in red meat consumption in South Africa and producers having responded to the demand, there is still a clear indication of a deficit in the local market, which has then been sustained by imports. According to the Agri-

Seta (2018), besides that there has been an overall increase in the red meat subsector export market since 2014, the South African red meat industry had a production deficit of 444 thousand tons to meet consumer demand in the domestic market. The persisting shortage of red meat for domestic consumption is due the importance of meat products as a source of protein.

The relationship between the exchange rate and export competitiveness has also been analysed for South Africa. Ngondo and Khobai (2018) investigated and assessed the impact of the exchange rate on exports for South Africa. The results obtained indicated that the exchange rate has a significant negative relationship with exports in South Africa. From the results obtained, the overall policy recommendation of study implicated the current free floating exchange rate in an inflation target as adopted by the South African Reserve Bank (SARB) in February 2000. However, the only cost with that is a very volatile domestic currency which could hinder exports. Sekantsi's (2011) recommendations were to the contrary in that, it stated that a stable competitive exchange rate and sound macroeconomic fundamentals that enhance international competitiveness are necessary to ensure greater market penetration of South Africa's exports.

Floating exchange rates allow central banks to change their interest rate to respond to aggregate demand fluctuations. However, such fluctuations create frictions in the labour market in terms of the cost of hiring and firing workers. A regime of flexible exchange rates can be quite volatile and can cause rigidities in labour markets. Exchange rate volatility creates uncertainty about future profits in the traded-goods industries such as red meat, and in turn, it affects the employment within the subsector.

According to Ibekwe and Chukwuemeka (2020), exchange rate movements tend to have an impact on agricultural output and labour demand through two main channels; a depreciation increases the competitiveness of the country's exports and hence, the demand for labour. On the other hand, depreciation increases the cost of intermediate inputs which might offset the first effect. The net effect will then depend on the exposure of local firms to the exchange rate. The sensitivity of employment towards the exchange rate will also be affected by market structure and labour regulations.

Several studies have looked at macroeconomic impacts of the exchange rate on aggregate employment (Frenkel, 2004; Chen and Zoega, 2012; Aloui *et al.* 2018). Others have concentrated on sector responses of employment to the exchange rate (Adedokun, 2012; Dai and Xu, 2017; Alexandre *et al.* 2011). However, most of these studies have tended to use partial equilibrium approaches. The studies have also concentrated on industrialised nations with a few looking at developing countries. The overall conclusion from this body of work echoes reverberates the one presented on the free floating exchange rate. The overall impact of exchange rate movements on employment also tends to be sector specific (Dai and Xu, 2017).

According to Barrientos (2019) on International Labour Organization (IOL), the global value chain of the red meat industry affects employment either positively or negatively, but low skilled employees are often scared of losing their jobs. The increased global competition in goods puts immense pressure on aggregate levels of employment and wages in the importing country (Rodrik, 2018). The main components of the value chain include primary producers, feedlots, abattoirs, wholesalers and retailers. The red meat supply chain has become increasingly vertically integrated. The integration is mainly fuelled by the feedlot industry, where most of the large feedlots own their own abattoirs, or at least have some business interest in certain abattoirs. In addition, according to Food Price Monitoring report, some feedlots have integrated further down the value chain and sell directly to consumers through their own retail outlets (FPM, 2016).

According to Banda (2021), South African red meat exports rose by an average of 12% yearly from 2012 to 2019. This growth was driven by different red meat products. One direct benefit of having a steady increase in exports is job creation and economic growth because these factors push the domestic producers to expand their output and as output grows, more workers are needed. Increasing exports, particularly in the agricultural sector, may be crucial for the low-skilled job creation needed to substantially reduce high overall and youth unemployment. The red meat subsector performance indicates that it is one of the best growing components of the agricultural economy.

Overall, the subsector contributes approximately 40% of the global value of agricultural output and supports livelihoods and ensures the food security of almost a billion people globally (Herrero *et al*. 2013). Furthermore, growing income levels and continued urbanisation in South Africa have increased meat consumption over the past decade. Changing lifestyles and the diets of the emerging middle class have changed to incorporate animal proteins. Therefore, the industry is well placed to grow, and in the process, to contribute to the wider economic development of South Africa, both in the production and provision of employment to the more rural population of the country (RMRD SA, 2016).

Additional factors limiting the red meat subsector are the lack of appropriate infrastructure, poor access to usable technical market information and well-functioning marketing and credit systems for commercialising the emerging red meat subsector. Commercialising the emerging red meat subsector would address these constraints and ensure that farmers produce efficiently (RMRD SA, 2016). Like other agricultural subsectors, the recent drought has significantly affected the red meat industry, including areas involved in cattle, sheep and goat farming. Approximately 590 000 square kilometres has been negatively affected, which has resulted in pockets of livestock mortality in provinces such as the Eastern Cape, while poor livestock conditions were also recorded in the Free State (DAFF, 2016).

The International Animal Health Organization (OIE)'s declaration of South Africa as free from foot-and-mouth disease (FMD) in 2014 also affected the exports onwards (BFAP, 2017). An outbreak of FMD in January 2019 in Limpopo resulted in South Africa losing its OIE FMD free zone status (DAFF, 2019), which has had a devastating effect on trade from South Africa (red meat, hides and skins, wool, mohair and genetic material). Understanding the current exchange rate regime, the relationship between the exchange rate behaviour and production, export and employment is of great significance in promoting better exchange rate style of management and the development of an economy.

1.2 Problem Statement

The collapse of the Bretton Woods System in 1973 paved a way for most countries to adopt floating exchange rate regimes. For a long time, the debate between fixed and

flexible or floating exchange regime and the impact regarding the changes of foreign exchange on output, exports and employment has become another unavoidable topic. The economists who supported a fixed exchange regime have indicated that the adoption of a flexible exchange regime will lead to the contraction of trade volume and the reduction of profits (Ozei *et al.* 2013). The economists who supported fixed exchange regime indicated that for the enhancement and development of export, which will subsequently increase industry's output and employment, a floating exchange regime is better than fixed exchange rates. This is because the floating exchange rate is important for a country to achieve an external equilibrium without some forms of foreign exchange market intervention.

The South African red meat industry is among the best growing industries with the production of approximately 21.4% of the total meat produced on the continent and 1% of global meat production and plays a vital role towards the overall agricultural output, exports and employment, which subsequently contribute to the general economy (Agri-SETA, 2020). Since integration to the global markets, the South African red meat industry has been exposed to floating exchange rates. Moreover, the impact leads to direct and indirect effects on the labour market and output of the red meat industry (Phaleng *et al*. 2018). It is undisputable that one direct benefit of having a steady increase in exports is job creation, and increased production, particularly in the red meat industry (Hatmanu *et al*. 2020).

A floating exchange rate remains a debatable issue where it relates to output growth, exports and employment, and a very little common accord could be developed amid policy (Abdul-Mumuni, 2016). According to National Agricultural Marketing Council (2018), red meat consumption in South Africa expanded rapidly over the past decade and continued growth in red meat consumption is projected in the coming years. This study, therefore, attempted to investigate and analyse the impact (positive/negative) of the floating exchange rate on output, exports and employment in the South African red meat industry for the period between 1995 and 2020.

1.3. Rationale

There are limited studies on the effects of the exchange rate on the agricultural sector's output (Ekholm *et al*. 2012; Obayelu and Salau, 2010; Dlamini, 2014; Adekunle and Ndukwe, 2018; Ogunjimi, 2020). The studies conducted on the effects of exchange rate on employment focused largely on the industries of both developed and developing countries (Frenkel, 2004; Kandil and Mirzaie, 2003; Filiztekin, 2004). Therefore, this study sought to analyse the impact of the floating exchange rate on production output, volume of exports and employment in the South African red meat industry. The study contributes to knowledge and literature at an industry level, which subsequently contribute to the overall production, exports and employment of the South African economy.

According to DAFF (2019), red meat consumption stretched swiftly over the past decade and there is a projected growth in red meat consumption in the coming years. The contribution is mainly on production, international market and provision of employment in more rural population of the country (RMRD SA, 2016). The red meat industry's growth contributes to the wider South African economic development. The analysis of the industry in terms of the effects of exchange rate on output and employment is of importance as it will provide the insights of the industry and contribution to the overall economy. To the best of available knowledge, there are limited studies conducted that analyse the impact of the floating exchange rate at an industry level in developing countries.

The significance of this study is two-fold. Firstly, the study may assist policymakers to implement exchange rate policies that promote output, exports, employment stability and relative stable currency for the South African industries, with red meat being one of them. Secondly, it might put exporters on a vantage ground to address and avoid losses due to exchange rate arrangements.

Thorbecke and Kato (2012) used the Johansen Maximum Likelihood and Dynamic Ordinary Least Squares (DOLS) to investigate how exchange rate changes affect German exports using quarterly data from first quarter of 1980 to the fourth quarter of 2011. Results of estimation indicated that the export elasticity for the unit labour cost-deflated exchange rate equals 0.6. The results also revealed that consumer goods exports are more responsive to changes in exchange rate than capital goods exports.

Aye *et al.* (2015) examined the impact of real effective exchange rate uncertainty on aggregate exports of South Africa from the fourth quarter of 1986 to the second quarter of 2013. Using a bivariate framework where the structural vector auto-regression is modified to accommodate bivariate Generalised Autoregressive Conditionally Heteroscedastic -in-Mean errors (GARCH-M), they found that exchange rate uncertainty has a significant and negative effect on exports in South Africa.

There were several motivations for this study. Firstly, the impact of the exchange rate changes the competitiveness of an industry like South African red meat in the global marketplace. If a currency appreciates, the economy becomes less competitive in the global market and consequently, the demand for local production, exports and labour will decrease, causing wages and possibly employment to decline as well. On the other hand, if a currency depreciates, it will make imports more expensive, demand exported goods will increase, which will result in a higher demand for local labour and higher wages. Secondly, since the trade orientation of industries varies, we are better able to identify the magnitude of production or export responses and employment sensitivity using industry-specific trade weighted exchange rates.

The exchange rate, which is an important variable to the macro economy of a country, has a special important influence on the economic operation in an economy that participates in the international markets or open economy. Hence, to accurately assess and gauge the effect of exchange rate system, there is a need to improve the exchange rate regime and function better. To clearly understand the current exchange rate regime, the relationship between the exchange rate behaviour and export, which will subsequently affect industry's output and employment, is of great significance in promoting trade balance improvements through the real exchange rate style of management and the development of an economy.

1.4. Aim

The aim of the study was to assess the impact of a floating exchange rate on output, export and employment in the South African red meat industry between the period of 1995 and 2020.

1.5 Objectives

The objectives of the study were to:

i. Outline the performance of the South African red meat industry in terms of output, exports and employment.
ii. Determine the impact of the floating exchange rate on output, export and employment in the red meat industry of South Africa;
iii. Analyse the short-run relation among output, export, employment and exchange rate in the red meat industry of South Africa.
iv. Determine the causal relationship among output, export, employment and exchange rate in the South African red meat industry.
v. Determine the effect of red meat consumption on output, export and employment in the South African red meat industry;

1.6 Hypotheses

i. Floating exchange rate does not impact on output, exports and employment in the red meat industry of South African.
ii. There is no short-run relation among output, export, employment and exchange rate in the red meat industry of South Africa.
iii. There is no causal relationship among output, export, employment and exchange rate in the South African red meat industry.
iv. Red meat consumption does not affect output, export and employment in the South African red meat industry.

1.7 Outline of the study

This study focused on the impact analysis of the floating exchange rate on the output, export, and employment in the South African red meat industry, 1995-2020. The study consists of six chapters. The rest of the chapters are structured as follow: Chapter two outlined the theoretical literature review relevant to this study on the impact of the floating exchange rate on the output, export, and employment in the South African red meat industry and reviewed the empirical literature from various developing and developed countries. An overview and performance of the red meat industry of South Africa are provided in Chapter three. Chapter four elucidates the research

methodology of the study, with particular focus on the study area, types of data and collection methods, data management procedures and an overview of the modelling analysis techniques used to achieve each objective. Chapter five presents the results of the empirical analysis and discussion of the findings of the selected meat industry with regards to impact of floating exchange rate on output, exports, and employment. Lastly, chapter six provides the summary and concluding remarks of the study considering the objectives, findings, and recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents the explanations of different concepts used in this study, and as the analysis of various models and methodologies used by previous authors who investigated the effects of a floating exchange rate on output, exports and employment. The chapter also reviews various theories underlying the effects of an exchange rate on exports, output and employment. It further reviews the empirical research that examined the impact of a floating exchange rate on exports, output and employment in developed and developing countries in general and on the red meat industry of South Africa in particular. The floating exchange rate, red meat export, output and employment of South Africa are discussed in detail, with a particular focus on the exchange rate fluctuations for the period 1995-2020 for South Africa and its impact on the agricultural sector pertaining to the red meat industry.

Prior to exploring these exchange rate theories, it is necessary to understand from the onset why there are countries' exports and exchange rate fluctuates. Knowledge on this issue is essential in appreciating the rationale for further exploring the effects of the movements of the exchange rate on exports, output and the employment of different sectors of the economy. The establishments of the General Agreement on Tariffs and Trade (GATT) after the end of World War II and currently the World Trade Organisation (WTO) were intended to administer the effects of the exchange rate on exported goods, create employment opportunities and improve the wages of employees across the world (Sigwele, 2007)

2.3 The South African Exchange Rate Regime

South Africa has maintained a floating currency or exchange rate regime, a holdover from the economic policies of the apartheid era. Policy directions from the South African Reserve Bank, activities of currency speculators, the politics in the country, the unrest and protests on the labour front, public sector debts and the increasingly erratic weather patterns affecting agricultural exports, have all led to a chequered history for the rand against major trading currencies (Aron *et al*, 2014). South Africa moved from

a fixed exchange rate regime to a floating, managed exchange rate, after the abolishment of marketing boards and it was announced in the year 2000, and has avoided problems associated with the transition from a fixed to a floating regime shift.

This chapter takes into cognisance the change of the South African exchange rate regime from a fixed exchange rate to a floating exchange rate that was adopted by the SARB in the year 2000 (Aron *et al*. 2014). Hence, it is critical for one to understand how the red meat industry benefits from integration into the global market and changes in the regime. More than half a century ago, Friedman (1953) argued that a flexible exchange rates helps to insulate the economy against shocks. Subsequent experience has shown that floating exchange rates can be quite volatile. International trade or exports, labour market theories and empirical evidence are necessary to establish how the South African labour market and output within the red meat industry are affected by the floating exchange rate, specifically with its leading trading partners such as Vietnam, United Arab Emirates and Jordan.

When the economy is on the mend, the rand performs well against all major currencies. Unfortunately, the past few years have seen the rapid depreciation of the rand following the persistent threats by international rating agencies to downgrade the country's sovereign rating. The rand thus seems to undergo booms when it strengthens against major currencies and bursts when it experiences sharp falls. Tellingly, therefore, any attempts at capturing the heteroskedastic behaviour of the rand have to incorporate regime switching since the fortunes of the rand closely follow the developments in the underlying ups and downs of the economy.

The external value of each currency is reflected in the country's economic conditions in general and the purchasing power of the currency relative to that of other currencies (Ani *et al*. 2013). Diala *et al.* (2016) observed that the performance and profitability of industries and companies that depend mainly on importation are considerably affected by the exchange rate of the Naira against major currencies of the world. Just like in South African red meat industry, there is an exportation of a large quantity of products from the industry and hence, it is affected by the exchange rate. If there is depreciation of the Rand as the local currency, this makes the agricultural export produce to be

cheaper and thus encourages export and profit. This would stimulate the growth of the economy and consequently increase the returns on Stock.

The reverse is the case when there is an appreciation of the local currency. This therefore implies that the depreciation of the local currency has a positive effect on stock prices. Movements in the exchange rate have ripple effects on other economic variables such as interest rate, inflation rate, import, export, output, etc. These facts underscore the importance of an exchange rate to the economic well-being of every country that opens its doors to international trade in goods and services. The importance of an exchange rate derives from the fact that it connects the price systems of two different countries, thus making it possible for international trade to make a direct comparison of traded goods. In other words, it links domestic prices with international prices through its effects on the volume of imports and exports. An exchange rate exerts a powerful influence on a country's balance of payments position (Adeniran *et al*. 2014).

2.3.1 The Classification of the South African's Exchange Rate Regime

According to Aron *et al.* (2014), from the year 2000, the SARB established the exchange rate system, which refers to the managed floating exchange rate system based on market's supply and demand, and pegs to the US dollar. The pegged exchange rate system incorporates aspects of floating exchange rate systems. Gatawa *et al*. (2017) indicated that smaller economies that are particularly susceptible to currency fluctuations will "peg" their currency to a single major currency or a basket of currencies. These currencies are chosen based on which country's smaller economy experiences a lot of trade activity with or on which currency the nation's debt is denominated in (Gatawa *et al*. 2017).

On monetary policy regime change and exchange rate dynamics in South Africa, Mtonga (2011) avers that economic fundamental indeed anchor the rand's long swing. However, the anchorage is regime dependent; the policy regime's shift to inflation targeting appears to have significantly altered the role and importance of economic fundamentals in pricing the rand on the suitability of exchange rate regimes for middle-income countries with a wide exposure to international capital such as South Africa.

The central thesis of this study is that policy regime change matters significantly for currency pricing.

If a small nation that does a lot of trade with the USA decides to peg its currency to the US dollar, its currency will fluctuate in value in roughly the same manner as the US dollar. The practice eliminates high-magnitude fluctuations and makes the smaller economy's currency a safer investment. Larger economies are less hesitant to set up trade deals with such currencies since its value will likely not fluctuate beyond reasonable levels. When pegged exchange rate agreements are set up, an initial target exchange rate is agreed upon by the participating countries (Özdemir, 2020). A fluctuation range is also set in place to outline acceptable deviations from the target exchange rate. Pegged exchange rate agreements usually must be reviewed several times over their lifetimes to adapt the target rate and fluctuations to the changing economic climate.

The systems of such nature have proven to reduce the volatility of currencies used in developing economies and have placed pressure on governments to be more disciplined with monetary policy choices evidence from South African rands. However, this does open the possibility of investor speculation, which may influence the value of the currency. Pegged rate systems may be abandoned altogether once the weaker currency gains momentum and sees its actual market value jump well ahead of its pegged value.

For countries that have their own currencies like South Africa which uses rands (ZAR), there are, according to Ito and McCauley (2020), six different exchange rate regimes, namely:

1. Board of Currency Arrangements: this refers to the categorical obligation to exchange a locally denominated fund for a particular international currency that is fixed at a predetermined exchange rate.
2. Orthodox fixed peg systems: this system refers to countries that peg their currencies to between -1 or 1 percent margin against the trading partner's currency.
3. Target zone pegged system: a wider permitted fluctuation compared to a conventional fixed peg arrangement.

4. Currency arrangements through a crawling peg system: under this system, the currency is usually adjusted occasionally against the exchange rate of the country of interest.
5. Crawling bands management system: when using this system, the length of the bands that tracks tolerable levels of currency is allowed to increase over the time period.
6. Floating exchange rate regime: this is another currency management method where monetary officials will attempt to affect the exchange rate level.

South Africa opted to go for the floating exchange rate regime or system, which, according to the SARB announcement in 2000, refers to the managed floating exchange rate system based on market's supply and demand, and peg to the US dollar. The pegged exchange rate system incorporates aspects of floating exchange rate systems. Smaller economies that are particularly susceptible to currency fluctuations will "peg" their currency to a single major currency or a basket of currencies. These currencies are chosen based on which country the smaller economy experiences a lot of trade activity with or on which currency the nation's debt is denominated in (Gatawa *et al*, 2017).

A floating exchange rate functions in an open market where speculations, along with demand and supply forces, drive the price with no expectation to south Africa. Floating exchange rate structures mean that changes in long-term currency prices represent comparative economic strength and differences in interest rates across countries, hence the SARB monitors the process very closely. Changes in the short-term floating exchange rate represent disasters, speculations, and the daily supply and demand of the currency. Market sentiment towards the economy of a country affects how strong or weak the floating currency is perceived. For instance, a country's currency is expected to depreciate if the market views the government as unstable. Although the floating exchange rate is not entirely determined by the government, they can intervene when the currency is too low or too high to keep the currency at a favourable price.

Floating exchange rate bears numbers of benefits, which include Stability in the balance of payments (BOP), Foreign exchange is unrestricted, Market efficiency

enhances, large foreign exchange reserves not required and import inflation protected. Every benefit goes with a limitation; hence, the floating exchange rate bears some limitations as well, which include being exposed to the volatility of the exchange rate, restricted economic growth or recovery and existing issues may worsen.

A balance of payments is in the statement of transactions between entities of a country and the entities of the rest of the world over a time period. In theory, any imbalance in that statement automatically changes the exchange rate. For example, if the imbalance is a deficit, it would cause the currency to depreciate. The country's exports would become cheaper, resulting in an increase in demand and eventually attaining equilibrium in the BOP. Floating exchange rate currencies can be traded without any restrictions, unlike currencies with fixed exchange rates. Hence, governments and banks do not need to resort to a continuous management process.

A country's macroeconomic fundamentals affect the floating exchange rate in global markets, influencing the flow of portfolios between countries. Thus, floating exchange rates enhance the efficiency of the market. For a floating exchange rate, central banks are not required to keep large foreign currency reserve amounts for defending the exchange rate. Hence, the reserves can be utilised for promoting economic growth by importing capital goods.

Countries with fixed exchange rates face the problem of importing inflation through surpluses of the balance of payments or higher prices of imports. However, countries with floating exchange rates do not face such a problem. Floating exchange rates are prone to fluctuations and are highly volatile by nature. A currency value against another currency may deteriorate only in one trading day. Furthermore, the short-term volatility in a floating exchange rate cannot be explained through macroeconomic fundamentals.

The lack of control over floating exchange rates can limit economic growth or recovery. The negative currency exchange rate movements may lead to serious issues. For example, if the dollar rises against the euro, it will be more difficult to export to the eurozone from the U.S. If a country is suffering from economic issues, such as unemployment or high inflation, floating exchange rates may intensify the existing

problems. For example, the depreciation of a country's currency already suffering from high inflation will cause inflation to increase further due to an increase in demand for goods. Moreover, expensive imports may worsen the country's current account.

2.3.2 A Basket of Currencies and Exchange Rate Regimes

There are two elements of a basket of a foreign currency, one is the component currency and the other one is the weight of each of component currencies in the basket. In the year 2000, South Africa entered or put in place a managed floating exchange rate regime, based on market supply and demand with reference to a basket of currencies, allowing the exchange rate to float or fluctuate within the range (high and low in two-sided currency) at any particular day by the SARB. Since then, the exchange rate regime in South Africa has shown some resilience from the single currency pegging to a basket currency pegging (De Bruyn *et al*, 2013).

The frequency of weights adjustment of each component currency was not clearly stated (Cui, 2014). Perhaps it will depend on the macroeconomic conditions of the region. Ma and McCauley (2011) investigated the evolving RMB exchange rate regime by using the Renminbi (RMB) real effective exchange rate index from June 1, 2006 to May 30, 2010. The authors through econometric models and graphical analysis found that the RMB has appreciated progressively against the basket of currencies that are major trading partners for China. The main reason of the RMB appreciation is related to the external trade imbalance, in terms of the massive trade surplus.

Applying time series techniques and using a quarterly sample between 1986Q1 to 2005Q4, Raputsoane and Todani (2008) compared different versions of the monetary model of the rand/dollar exchange rate. There is a long-term relationship between the rand/dollar exchange rate, the interest rate, the income, and the money differentials. Rising commodity prices and current account balance as a percentage of the GDP caused the rand to depreciate. A higher inflation differential leads to an appreciation of the rand, which is in contrast with the theory.

Using a monthly data between 1997 and 2008, Grandes *et al* (2010) examined the currency premium for the South African rand vs. the US dollar. They found that the currency premium is determined by the long-term expected inflation differential, risk

aversion, and exchange rate volatility. The results are robust and stable when different sample periods are used.

Mtonga (2011) shows that the trade-weighted rand exchange rate has a positive relationship with the relative money supply, the short-term interest rate differential and a negative relationship with the relative real income and the long-term interest rate differential. The impact of the inflation rate differential or the current account balance may be positive, negative or insignificant depending upon model specifications and sample periods. He concludes that monetary policy regime changes to inflation targeting have a significant impact on the currency value.

Égert (2012) studied the rand exchange rate by adding openness to the stock-flow approach, share prices, and country risk premium to variants of the monetary model. The results improved the fitness of the models during the large rand depreciations in 2002 and 2008. Large depreciations cannot be explained by real commodity prices. While these models do a reasonably good job in-sample, their out-of-sample forecasting properties remain poor.

Using a sample between 1988 and 2007, Gossel and Biekpe (2012) investigated whether the relationship between the rand/dollar exchange rate and several independent variables may have changed due to financial market liberalisation in 1995. Before liberalisation, the interest rate differential, equity and bond purchases by non-residents, the gold dollar price and political risk were statistically significant. After liberalisation, only the interest rate differential and net purchases of stock shares by non-residents were statistically significant.

Based on an annual sample between 1910 and 2010 and applying time series techniques, De Bruyn *et al* (2013) analysed the monetary model of exchange rate determination to ascertain if it may apply to South Africa. According to their findings, evidence supporting the monetary model were mixed, and theoretical restrictions specified by the monetary model could be rejected. Although the monetary model exhibits relatively low predictive and explanatory power over the short run, the monetary model outperforms the random walk model in the out-of-sample forecast.

2.4 Theoretical Foundations of Exchange Rate Determination

The theory of optimum currency areas (OCA), a related economic model, argues that the characteristics of the national economy determine which types of exchange rate policies are optimal (Lane and Milesa-Ferretti, 2017). OCA theory suggests that larger, less trade dependent economies should find the costs of exchange rate adjustments lower in terms of aggregate economic efficiency, while valuing monetary policy autonomy more. In contrast, small open economies prioritise fixed exchange-rate regimes because externally oriented economies will fare better with exchange-rate stability than with control over domestic interest rates. These economic models illuminate the costs and benefits of different exchange-rate policies and provide a necessary starting point for a political analysis of exchange rates.

However, economic theories of exchange rates, by themselves, leave much unexplained. The aggregate economic efficiency effects stressed by traditional OCA analyses are often not the major factor influencing policy. Rather, policymakers are often concerned with many considerations beyond aggregate economic efficiency (Kripfganz and Schneider, 2020). Moreover, an exchange-rate policy has strong redistributive effects. Most authors observe that political considerations are particularly relevant in an exchange rate policy because the trade-offs governments face are between macroeconomic outcomes, which different socio-political actors value differently. Exchange rate policy decisions are therefore not purely a question of economic contingencies, but a question of political priorities as well.

Theories of exchange rates determination have changed since the exchange rate system shifted to the floating rates system (Lu and Wang, 2019). Traditional theories, developed during the period of fixed exchange rates, including the elasticity approach and the absorption approach, focused mainly on the real sector. However, especially in the current period of floating exchange rates, the monetary sector is another important element determining exchange. Exchange rate is a function of many things. Based on these factors, many theories have been formulated to determine the rate of exchange between different currencies (Antwi *et al*, 2013).

According to Riberiro *et al* (2020), the determination of the par values of different currencies which affect different sectors of the economy should be based on the theoretical explanations of the theories of an exchange rate. Some of these important and prominent explanations or theories include: Mint Parity Theory, Purchasing Power Parity Theory, Balance of Payments Theory, Monetary Approach to Foreign Exchange and Portfolio Balance Approach.

2.4.1 The Purchasing Power Parity Theory

The Purchasing Power Parity Theory (PPPT) enunciates the determination of the rate of exchange between two inconvertible paper currencies (Ito and McCauley (2020). Although this theory can be traced back to Wheatley and Ricardo, yet the credit for developing it in a systematic way has gone to the Swedish economist, Gustav Cassel. This theory states that the equilibrium rate of exchange is determined by the equality of the purchasing power of two inconvertible paper currencies. It implies that the rate of exchange between two inconvertible paper currencies is determined by the internal price levels in two countries.

Thus, while the value of the unit of one currency in terms of another currency is determined at any time by the market conditions of demand and supply, in the long run, the exchange rate is determined by the relative values of the two currencies as indicated by their respective purchasing powers over goods and services (Riberiro *et al,* 2020). In other words, the rate of exchange tends to rest at the point which expresses equality between the respective purchasing powers of the two currencies. This point is called the purchasing power parity. Thus, under a system of autonomous paper standards, the external value of a currency is said to depend ultimately on the domestic purchasing power of that currency relative to that of another currency. In other words, exchange rates, under such a system, tend to be determined by the relative purchasing power parities of different currencies in different countries.

The PPPT has been subjected to the following criticisms:

The actual rates of exchange between the two countries very seldom reflect the relative purchasing powers of the two currencies. This may be because governments have either controlled prices or controlled exchange rates or imposed restrictions on import and export of goods. Moreover, the theory is true if we consider the purchasing

power of the respective currencies in terms of goods which enter international trade and not the purchasing power of goods in general. However, we know that all articles produced in a country do not figure in international trade.

The PPPT ignores these influences altogether. Further, the theory, as propounded by Cassel, says that changes in price level bring about changes in exchange rates but changes in exchange rates do not cause any change in prices (Riberiro *et al,* 2020). This latter part is not true, for exchange movements do exercise some influence on internal prices. The PPPT compares the general price levels in two countries without making any provision for distinction being drawn between the price level of domestic goods and that of the internationally traded goods. The prices of internationally traded goods will tend to be the same in all countries (transport costs are, of course omitted). Domestic prices, on the other hand, will be different in the two countries, even between two areas of the same country.

The PPPT assumes that there is a direct link between the purchasing power of currencies and the rate of exchange. However, in fact, there is no direct relation between the two. An exchange rate can be influenced by many other considerations such as tariffs, speculation and capital movements.

2.4.2 The Balance of Payment Theory

The Balance of Payments (BOP) Theory of exchange rate maintains that a rate of exchange of the currency of one country with the other is determined by the factors that are autonomous of the internal price level and money supply (Lane and Milesa-Ferretti, 2017). It emphasises that the rate of exchange is influenced, in a significant way, by the balance of payments position of a country. A deficit in the balance of payments of a country signifies a situation in which the demand for foreign exchange (currency) exceeds the supply of it at a given rate of exchange. The demand for a foreign exchange arises from the demand for foreign goods and services. The supply of foreign exchange, on the contrary, arises from the supply of goods and services by the home country to the foreign country.

In other words, the excess of demand for foreign exchange over the supply of foreign exchange is coincidental to the BOP deficit (Lane and Milesa-Ferretti, 2017). The

demand pressure results in an appreciation in the exchange value of foreign currency. As a consequence, the exchange rate of the home currency to the foreign currency undergoes depreciation. A balance of payments surplus signifies an excess of the supply of foreign currency over the demand for it. In such a situation, there is a depreciation of foreign currency but an appreciation of the currency of the home country. The equilibrium rate of exchange is determined, when there is neither a BOP deficit nor a surplus. In other words, the equilibrium rate of exchange corresponds with the BOP equilibrium of a country. The equality between the demand for and supply of foreign exchange also signifies the BOP equilibrium of the home country.

The excess supply of foreign exchange lowers the exchange value of foreign currency relative to home currency. The appreciation in the exchange rate of home currency reduces exports and raises imports. In this way, the BOP surplus gets reduced, and the system tends towards the BOP equilibrium and also the equilibrium rate of exchange. The depreciation of the exchange value of home currency leads to a rise in exports and a decline in imports. Thus, the BOP deficit gets reduced, and the exchange rate appreciates to approach finally the equilibrium rate of exchange where the BOP is also in a state of equilibrium.

If there are changes in demand or supply or both, the rate of exchange will be accordingly influenced. Apart from the changes in demand and supply, the rate of exchange is affected by the foreign elasticity of demand for exports, the domestic elasticity of demand for imports, the domestic elasticity of supply of exports and the foreign elasticity of supply of imports. The stability of the equilibrium rate of exchange requires that the demand elasticities should be high whereas the supply elasticities should be low.

The BOP Theory has been subjected to the following merits and criticisms:

Merits:

The BOP Theory of rate of exchange has certain significant merits. Firstly, this theory attempts to determine the rate of exchange through the forces of demand and supply and thus brings an exchange rate determination into the purview of the general theory of value. Secondly, this theory relates the rate of exchange to the BOP situation. It

means this theory, unlike PPP theory, does not restrict the determination of rate of exchange only to merchandise trade. It involves all the forces which can have some effect on the demand for and supply of foreign currency or the BOP position.

Thirdly, this theory is superior to both the PPPT and Mint Parity Theory (MPT) from the policy point of view. It suggests that the disequilibrium in the BOP can be adjusted through marginal variations in the exchange rate, viz., devaluation or revaluation (Ito and McCauley (2020). The PPP or mint parity theories, on the contrary, could correct BOP disequilibrium through deliberate policies to cause inflation or deflation. The price variations are likely to have more widespread destabilising effects compared with the variations in exchange rates.

Criticism:

This theory rests upon the assumptions of perfect competition and free international trade. In fact, there are serious imperfections in the market on account of trade and exchange restrictions imposed by the different countries (Ito and McCauley (2020). Therefore, the BOP theory is clearly unrealistic. The BOP theory assumes that no causal connection exists between the exchange rate and the internal price level. Such an assumption is false. The variations in the internal price level can certainly have their impact on the balance of payments situation, which in turn can affect the rate of exchange.

In terms of neglect of the Basic Value of Currency, the gold standard, the metallic content of the standard unit of money indicates the basic or optimum value of the currency. The demand and supply theory applied to the inconvertible paper currency cannot measure the optimum or basic value of the currency. In fact, it neglects this aspect.

This intermediate theory holds that the rate of exchange is a function of the BOP. The variations in the rate of exchange, at the same time, are supposed to bring about adjustment in the BOP deficit or surplus. It implies that the BOP itself is a function of the rate of exchange. From this, it follows that the BOP theory of rate of exchange is indeterminate. It pre-supposes some given rate of exchange and cannot explain how that pre-existing rate of exchange was determined.

2.4.3 The Monetary Approach to the Rate of Exchange

In contrast with the BOP theory of foreign exchange, in which the rate of exchange is determined by the flow of funds in the foreign exchange market, the Monetary Approach postulates that the rates of exchange are determined through the balancing of the total demand and supply of the national currency in each country (Frenkel and Ros, 2006). According to this approach, the demand for money depends upon the level of real income, the general price level and the rate of interest. The demand for money is the direct function of the real income and the level of prices. On the other hand, it is an inverse function of the rate of interest. As regards, the supply of money, it is determined autonomously by the monetary authorities of different countries.

According to Frenkel and Ros (2006), It is assumed that initially, the foreign exchange market is in equilibrium or at interest parity. It is further supposed that the monetary authority in the home country increases the supply of money. This will lead to a proportionate increase in price level in the home country in the long run. It will also cause depreciation in the home currency as explained by the PPP theory.

The monetary approach to rate of exchange has been subjected to the following shortcomings:

Firstly, this approach has generally failed to explain the movements in the exchange rates of major currencies during the period of currency floatation since 1973. Secondly, the Monetary Approach has laid an excessive emphasis on the role of money and has given very little importance to trade as the determinant of foreign exchange rate. Thirdly, this approach holds that domestic and foreign financial assets such as bonds are perfect substitutes. This is not true. Fourthly, the Monetary Approach to the determination of exchange rate has not performed well empirically. The estimated parameters have been found to be either insignificant or had the wrong signs. The monetary exchange rate models have not fared well also in respect of their forecasting ability. The tests on market efficiency have tended to reject this approach.

2.4.4 The Portfolio Balance Approach

In view of the deficiencies in the Monetary Approach, some writers have attempted to explain the determination of exchange rate through the Portfolio Balance Approach

(PBA), which is more realistic than the Monetary Approach (De Bruyn *at al*, 2013). The PBA brings trade explicitly into the analysis for determining the rate of exchange. It considers the domestic and foreign financial assets such as bonds to be imperfect substitutes. The essence of this approach is that the exchange rate is determined in the process of equilibrating or balancing the demand for and supply of financial assets out of which money is only one form of asset.

To start with, this approach postulates that an increase in the supply of money by the home country causes an immediate fall in the rate of interest (De Bruyn *at al*, 2013). It leads to a shift in the asset portfolio from domestic bonds to the home currency and foreign bonds. The substitution of foreign bonds for domestic bonds results in an immediate depreciation of home currency. This depreciation, over time, causes an expansion in exports and reduction in imports.

It leads to the appearance of a trade surplus and consequent appreciation of home currency, which offsets part of the original depreciation. Thus, the PBA also explains exchange over-shooting. This explanation, in contrast to the Monetary Approach, brings in trade explicitly into the adjustment process in the long run.

The portfolio balance approach to rate of exchange has been subjected to the following shortcomings:

There are some shortcomings in the PBA. Firstly, it ignores the real income as a determinant of exchange rate. Secondly, this approach does not deal with trade flows. Thirdly, it assigns no role to expectations. Fourthly, the empirical studies concerning it have yielded only mixed results. Fifthly, in its present form, this approach does not provide a complete and unified theory of exchange rate determination that fully and consistently integrates financial and commodity markets in the short run and long run. No doubt, this approach suffers from some deficiencies, but it has become the focus in the analysis of exchange rate determination.

2.4.5 Interest Rate Parity (IRP)

Interest Rate Parity (IRP) is a theory in which the differential between the interest rates of two countries remains equal to the differential calculated by using the forward exchange rate and the spot exchange rate techniques (Cui, 2014). IRP connects

interest, spot exchange, and foreign exchange rates. It plays a crucial role in Forex markets. IRP theory comes handy in analysing the relationship between the spot rate and a relevant forward (future) rate of currencies. According to this theory, there will be no arbitrage in interest rate differentials between two different currencies and the differential will be reflected in the discount or premium for the forward exchange rate on the foreign exchange. Cui (2014) also indicated that the theory also stresses the fact that the size of the forward premium or discount on a foreign currency is equal to the difference between the spot and forward interest rates of the countries in comparison.

2.5 Empirical Evidence/Review of Past Studies

The existing knowledge/literature is rich with many studies emphasising the existence of the effects of an exchange rate on production output, exports and employment rate in the economy either at national or international level. This study looked at the impact of an exchange rate on the industrial level, which subsequently contributes to the overall performance of the whole economy in the country. Empirical evidence was divided into three aspects: 1) where the exchange rate influences output; 2) where the exchange rate influences the volume of exports, and 3) where it influences employment in the economy either at sectoral, national or international levels.

The general trend of this relationship appears theoretically to be a negative relationship between economic growth and unemployment rate, meaning that a high economic growth must be accompanied by an increase in the employment rate and this means a lower unemployment rate (Omoju and Adesanya, 2012). However, this relationship is not necessarily always true, because economic growth takes place in two directions: firstly, one is due to an increase of the labour productivity, which does not lead to the creation of additional jobs. Secondly, the other direction is associated with an increase in the amount for labour supply, which leads to the creation of additional job opportunities and reduces the rate of unemployment in the economy.

According to Ismaila and Imoughle (2015), the contradiction in the perception of the relationship between growth and unemployment has led many economists to study this relationship. Okun (1962) considered one of the most prominent studies is the study carried out by the United State economist. The study noted the existence of an

inverse relationship between economic growth and unemployment rates in the United States for the period between 1947 and 1957. Okun found that high (or low), GDP by three percent will lead to high (or low) unemployment rates by one percent (Okun, 1962). Some of the studies explaining the relationship between growth and unemployment rates are chronological and orderly presented below.

2.5.1 The Impact of the Exchange Rate Volatility on the Output

The empirical review of the effects of the exchange rate on the agricultural sector output in Nigeria has shown conflicting findings. A number of the findings suggest significant influence from exchange rate, especially the moderating effect of nominal exchange rate (Abdul and Marwan, 2013; Olawale, 2015; Muftaudeen and Hussainatu, 2014; Paul and Akindele, 2016). Despite agreeing that the agricultural sector output responds to the exchange rate, these studies are still at variance with the direction of the effects. For instance, Onwanchukwu (2015) and Ozei *et al* (2013) averred that all the exchange rate variables they employed had a negative effect on the agricultural sector output in both the long and short run, which implies that an exchange rate will rather hamper agricultural sector output in Nigeria. The following studies are against the belief (Onuorah and Osuji, 2014; Olawunmi and Adedayo, 2016) that exchange rate enhances agricultural sector output in Nigeria.

A number of studies outrightly argued that an exchange rate has no effect on the agricultural sector output (Aroriode and Ogunbadejo, 2014; Ojede *et al*, 2013; Pitia and Lado, 2015). These studies indicate that a real exchange rate had an insignificant effect on agricultural sector output. Madito and Khumalo (2014) as well as Holden and Sparman (2013) noted that the nominal and real exchange rate are not statistically significant tools for enhancing agricultural sector output

Wasiu and Ndukwe (2018) investigated the possible asymmetric effect of real exchange rate dynamics on agricultural output performance in Nigeria from 1981 to 2016. The study employed a combination of stationary and non-stationary variables as was found out through the ADF unit root test. Based on the Bounds test for cointegration, a long-run relationship was absent between the real exchange rate and agricultural output, irrespective of specifications. The result of model estimation

showed that the significant drivers of agricultural output are real exchange rate (log-levels), real appreciation and depreciation (after some lags), industrial capacity utilisation rate, and government expenditure on agriculture (Onyanko, 2014).

Gatawa and Mahmud (2019) analysed short and long-run impacts of the exchange rate fluctuations on agricultural exports volume in Nigeria. ARDL was used as the method of analysis; the independent variables included the official exchange rate, agricultural loans and relative prices of agricultural exports while the dependent variable was the agricultural export volume. GARCH was used to estimate the volatility of exchange rates, and other diagnostic tests. Vorlak *et al* (2019) assessed the impact of exchange rates on the economic growth of Cambodia's economic growth. The study used variables such as gross domestic product (GDP) indicating Cambodia's economic growth. They used an ordinary least squares (OLS) regression model for estimation and found that the impact of exchange rate and openness to trade on GDP was 1%. Exchange rate is positively correlated with GDP, while trade openness is negatively correlated with GDP.

The short-run results revealed that the official exchange rate and agricultural loans have a significant positive impact on agricultural export volumes, which has the effect of expanding the dependent variable while relative prices of agricultural exports have a significant negative impact on agricultural exports volume, which also has the effect of contracting the dependent variable. The long-run results revealed similar findings apart from official exchange rate, which has a statistically significant negative impact on agricultural exports volume and is contrary to normal expectations (Adeniyi, 2012).

Dominic (2017) examined the impact of exchange rate on coca export in Nigeria. The Augmented Dickey Fuller Unit root, Johansen co-integration, ordinary least square, and diagnostic tests and error correction mechanism were adopted to analyse the secondary time series data, between 1980 and 2013, generated from Food and Agricultural Organization (FAO), World Bank and the Central Bank of Nigeria (CBN). The ADF unit root test results showed that none of the variables were stationary at level whereas all the variables – cocoa export, agricultural export, exchange rate trade openness and world cocoa price became stationary after first difference or order one. The Johansen co-integration test of the long run relationship revealed that both trace

statistics and maximum eigen value had two cointegrating equations at 5% whereas the trace statistics alone had co-integrating equation at 1%, implying the existence of a long run relationship between coca export, agricultural export, exchange rate, trade openness and world price of cocoa.

The positive sign of the error correction mechanism of 0.07 suggested that deviation from the long run equilibrium is adjusted over the following time period by seven percent. The t-test showed a direct relationship between cocoa export and Exchange rate cum agricultural export, but an inverse relationship with trade openness and world cocoa price. The diagnostic test revealed the non-existence of heteroskedasticity and serial correlation in the error term. The paper concluded that agricultural export, exchange rate, trade openness and world price of cocoa taken together affected cocoa export in Nigeria (Lado, 2015).

Okoro and Charles (2019) examined the effect of exchange rate variation on Nigeria's economy. The objective was to investigate how Naira exchange rate variations against key currencies affected the country's real GDP. The ordinary least square method was used as data analysis techniques. The study used cointegration, unit root, and granger causality test and error correction estimate to study the dynamic effects of commodity currencies on financial market. The study found that naira exchange rate variation with the currencies can explain 65% variation on Nigerian real gross domestic products while the remaining 35% estimation can be traced to external variables not included in the model.

Bussière *et al* (2012) affirmed that the impact of currency collapses (large nominal depreciations or devaluations) on real output remains unsettled in the empirical macroeconomic literature. Least squares analysis, panel data studies, macro model simulations, and VAR models have been used previously to investigate empirically the effects of the real exchange rate on output. The empirical literature on the issue has focused generally on developing countries, but there are some studies investigating developed country cases, such as that of Bussière *et al* (2012).

Bebczuk *et al* (2010) looked at an evaluation of the contractionary devaluation hypothesis, which formed a reduced-form equation for twelve developing countries by

using annual data for 1965–80 in which real output is regressed to money growth surprises, government expenditure, terms of trade, and the real exchange rate. The empirical findings of this analysis suggested that the initial contractionary effects of a real devaluation are reversed after one year and devaluation is neutral in the long run. Bebczuk *et al* (2010) found that devaluations reduce output in developing countries in a pooled time-series/cross-country analysis where the real GDP is explained by the real exchange rate, government spending, terms of trade, and money growth. Glüzmann *et al* (2012) distinguished anticipated and unanticipated devaluations and found that unanticipated devaluations increase the level of output, whereas anticipated de-valuations decrease the level of output.

Alagidede and Ibrahim (2017) focused on the causes and effects of exchange rate volatility on economic growth. The regressed capacity utilisation to the real exchange rate, measures of fiscal and monetary policy, terms of trade, export growth, and import growth in a pooled time series or cross-country analysis and found that real devaluations tended to reduce output and it took at least two years for the full effects to show. In a similar analysis, Seguino (2020), based on engendering macroeconomic theory and policy using nonlinear three-stage least squares, showed that unanticipated devaluations have positive effects on output, but anticipated devaluations do not exert any significant effect on output.

By using a panel data analysis, Ribeiro *et al* (2020) sought to determine if the real exchange rate undervaluation really promotes economic growth and found that after controlling possible external variables having effects on output, real exchange rate devaluations have negative effects on output in the short run but are neutral in the long run. In their study, Kripfganz and Schneider (2020) focused on response surface regressions for critical value bounds and approximate p-values in equilibrium correction models. They found that real exchange rate depreciations had positive effects in Poland, no significant effect in Hungary and the Czech Republic, and negative effects in Slovakia. In a macro model simulation aiming at showing the inflationary effects of real exchange rate targeting, Civcir and Akçağlayan (2010) found real exchange rate appreciations to be contractionary in Turkey.

Mendoza (2012) explored the inflation output volatility trade-off and exchange rate shocks in Mexico by using a VAR model for Mexico with four variables output, government expenditures, inflation, and money growth, and found that most of the output variation is attributable to its own shocks, but the response of output to devaluation is negative. Delgado *et al* (2018) probed the relationship between oil prices, the stock market and the exchange rate in Mexico by using a VAR model with five variables output, the real exchange rate, rate of depreciation of the nominal exchange rate, the real interest rate, and a measure for real money balances showed that declines in output are observed after a devaluation.

Mandelman (2013) examined the monetary and exchange rate policy under remittance fluctuations in Mexico using a VAR model with four endogenous variables and employed the U.S. interest rate, the real exchange rate, inflation, and output on a quarterly basis and found that although the variation of output is explained mostly by its own innovations, the response of output to a permanent depreciation is permanent and negative.

In addition to the direct analysis of the contractionary devaluation hypothesis in the above VAR models, there are VAR models that basically investigate output response in exchange rate-based disinflation programs (L´Opez, 2009). The relationship between output and a reduction in the rate of nominal exchange rate increases. For example, in their study, Sari *et al* (2010) focused on the dynamics of oil price, precious metal prices, and exchange rate showed that by using a two-variable VAR model for Mexico, a reduction in the rate of nominal exchange rate depreciation raised output initially, but the rise was reversed after the twelfth quarter.

Arratibel and Michaelis (2014) estimated time-varying VAR model for Poland by checking the impact of monetary policy and exchange rate shocks and found that a permanent reduction in exchange rate depreciation led to a long-lasting positive effect on output. Most of the studies discussed above found that devaluations are contractionary; however, this is not generally supported as there are studies showing that devaluations are expansionary. Thus, the contractionary devaluations hypothesis is a controversial issue for the world in general and for Turkey in particular.

Mumtaz and Sunder-Plassmann (2010) used the VAR method and structural models, which generally have a theoretical foundation. However, choosing the structural form is often difficult and may lead to arbitrary identifying restrictions. VAR models may not have the strong theoretical foundations that structural models have, but they do provide dynamic interaction among variables of interest and have high predictive power. In addition, Mumtaz and Sunder-Plassmann (2010) provide the theoretical framework of the core model, on which the study based its findings.

The link between growth and exchange rate volatility was examined by Holland *et al* (2011) for a set of 82 advanced and emerging economies using a panel data set ranging from 1970 until 2009. They employed ARMA to derive the monthly volatility measure for Real Exchange Rate. By estimating the dynamic panel data growth model, they found that a more volatile Real Exchange Rate has a significant negative impact on economic growth and the results are more robust for different model specification.

Azeez *et al.* (2012) examined the effects of exchange rate volatility on macroeconomic performance in Nigeria for a period of 25 years ranging from 1986 to 2010. The study employed OLS and Johansen cointegration technique to test for the short and long run effect, respectively. The ADF test reveals that all the variables were stationary. The result found that the Real Exchange Rate volatility contributes positively to GDP in the long run.

2.5.2 The Impact of Exchange Rate Volatility on the Exports

Kohler and Ferjani (2018) evaluated exchange rate effects on the export performance of the Swiss agriculture and food sector. The study used both time series and dynamic panel data models based on data from 1999 until 2012. The study found that in the long run, a 1% appreciation of the Swiss franc leads on average to a decrease in exports of agricultural and food products between 0.8% and 0.9%. The results suggest that on average, producers in the Swiss agriculture and food sector can successfully avoid price competition by differentiating their products, producing high quality products for niche markets.

According to Kargbo (2007), the forecasting agricultural exports and imports in South Africa indicated that the implementation of wide-ranging policy reforms, including trade and exchange rate policies, is improving the efficiency of the South African economy and its reintegration into the global economy with a rapid export expansion. A floating exchange rate policy's conventional view has been that a system of floating or flexible exchange rates would give individual countries more independence on domestic macro stabilisation policies. Furthermore, an important assumption has been that greater stability in the domestic economy would be a logical consequence of such a system, for monetary and fiscal authorities would presumably be able to pursue policy measures more suited to the domestic situation and would not have to impose adjustments on the domestic economy to bring the foreign sector into the equilibrium.

Ngondo and Khobai (2018) carried a study that looked at the impact of exchange rate on exports in South Africa, which emanated from Poonyth and van Zyl's (2000) study, which evaluated the long run and short run effects of real exchange rate changes on South African agricultural exports using an Error Correction Model (ECM) within the cointegrated VAR model. The results suggested that there is a unidirectional causal flow from exchange rate to agricultural exports. The empirical findings establish both short-run and long run relationships between real agricultural exports and the real exchange rate.

Jordaan and Netshitenzhe (2015) analysed the impact of changes in the exchange rate of the rand on South Africa's export sector. The study was conducted using the Johansen Maximum cointegration technique and an Error Correction Model (ECM) to analyse the long run effects and the short-run dynamics of the effects of changes in the exchange rate on South Africa's export volume (total exports, manufacturing exports, mining and agricultural exports) for the period 1988 until 2014.

The results show that while there is a long-run equilibrium relationship between the real effective exchange rate and all the dependent variables (excluding export volumes), a real depreciation of the domestic exchange rate only has a positive long-run effect on manufacturing and mining export performance. In the short run, while the ECM model shows that real effective exchange rate depreciation may increase total exports, mining and manufacturing exports, this is not the case for agricultural exports.

The results also show that manufacturing and mining exports are affected more by their previous values than the exchange rate (Shahriar *et al*, 2019).

Aye *et al* (2015) examined the impact of real effective exchange rate uncertainty on aggregate exports of South Africa for the period from fourth quarter of 1986 until second quarter of 2013. Using a bivariate framework where the structural vector autoregression is modified to accommodate bivariate GARCH-in-Mean errors (GARCH-M), they found that exchange rate uncertainty has a significant and negative effect on exports in South Africa. The findings in this study reveal that real exchange rate has a negative significant long-run relationship with exports. The results obtained are consistent with the view that an exchange rate has contractionary effect on trade. Aye *et al* (2015) applied the Structural Vector Autoregressive (SVAR) and GARCH-in-Mean (GARCH-M) model and came to the same conclusion as in this study.

Thorbecke and Kato (2012) investigated how exchange rate changes affect German exports using quarterly data from first quarter of 1980 until fourth quarter of 2011. Results from the Johansen Maximum Likelihood and Dynamic Ordinary Least Squares (DOLS) estimation indicate that the export elasticity for the unit labour cost-deflated exchange rate equals 0.6. Results from panel DOLS estimation indicate that price elasticities are much higher for consumption goods exports than for capital goods exports and for exports to the eurozone than for exports outside of it. The results obtained suggest that consumer goods exports are more responsive to changes in the exchange rate than capital goods exports.

Dincer and Kindle (2011) examined the effects of exchange rate fluctuations on 21 exporting firms in Turkey from first quarter of 1996 until fourth quarter of 2002. Building on a theoretical model that decomposes movements in the exchange rate into anticipated and unanticipated components, the empirical analysis traced the effects through demand and supply channels. The first component of the study revealed that anticipated exchange rate appreciation, in line with movements in underlying fundamentals, has significant adverse effects on export growth across many firms. The second component revealed that random (unanticipated) currency fluctuations (exchange rate shocks) determine both aggregate demand and supply. Unanticipated

currency appreciation, which is a positive shock to the exchange rate, decreases the cost of buying intermediate goods, subsequently increasing the output supplied.

Nyeadi *et al.* (2014) investigated the impact of exchange rate movement on export growth in Ghana for the period 1990 until 2012. In the study, exchange rate was used as an independent variable while export growth is the dependent variable. Using the OLS estimator, the study found that exchange rate has no impact on the export of goods and services in Ghana. The study, however, found that the GDP, Gross National Saving, Import Growth and Total Investment had a significant impact on export.

Bustaman and Jayanthakumaran (2007) investigated the long-run and short-run impacts of exchange rate volatility on Indonesia's exports of priority commodities to the United States of America over the monthly period 1997 until 2005. Estimates of cointegration relations were obtained using ARDL bounds testing procedure. Estimates of the short-run dynamics were obtained using an error-correction model. The results obtained showed some significant positive and negative coefficients among the range of commodities. However, in the long-run, majority of commodities tend to support the traditional view, as indicated in section 2.

Umaru *et al* (2013) employed the ordinary Least Square, Granger causality test, ARCH and GARCH techniques to investigate the impact of exchange rate volatility on export in Nigeria using annualised data from 1970 until 2009. The study further showed that exchange rate is impacting positively on export, as shown by the regression results. The elasticity results revealed that, the demand for Nigerian products in the world market is elastic.

Nemushungwa *et al.* (2015) empirically investigated the impact of exchange rate volatility on South African exports using the ARDL bounds testing procedure and monthly data for the period 2000 to 2013. Furthermore, it measured real exchange rate volatility and examined the stability of the long run coefficients and the short-run dynamics. The study's results confirmed that exchange rate volatility had an insignificant negative long run impact on South African exports. Moreover, real exchange rate has an insignificant negative long-run effects on South African exports.

The coefficient of error correction term for exports model was positive and statistically insignificant and was therefore not supportive of the validity of the long-run equilibrium relationship between the variables.

Nyahokwe and Ncwadi (2013) investigated the impact of exchange rate volatility on aggregate South African exports flows to the rest of the world for the period 2000 to 2009. The study utilised the Vector Autoregressive (VAR) and Vector Error Correctional Model (VECM) to establish long and short run relationship between exports and exchange rate. The results obtained suggested that there exists no statistically significant relationship and that is there is an ambiguous relationship between South African exports flows and exchange rate.

According to Wondemu and Potts (2016), the debate on the direction of causality between exports and economic growth is contested. However, there is a consensus that exports are of paramount importance to the growth of the country, more especially in developing economies. There are two theoretical frameworks discussed in the paper that explain the interaction between exchange rate and exports. The first framework postulates that a deprecation of domestic currency will have an expansionary effect on trade. This is because a depreciated currency makes home exports relatively cheaper to foreign buyers, resulting in foreign buyers switching expenditure from their own goods and services to the cheaper imports (Appleyard *et al*. 2010).

Contrary to the traditional approach by Appleyard *et al.* (2010), the second theoretical framework presupposes that currency depreciation might have a contractionary effect on output and employment, especially for less economically developed nations. The little gains that might have been achieved through devaluation in the short run, will be wiped away by inflation in the long-run. Increase in output production and export lead economy are doubtless catalysts to the growth of the country. Trade enhances economic growth through job creation.

Umoru and Imimole (2022) studied the impact of currency devaluation on non-oil exports in Africa. The study evaluated studies the effect of trade liberalisation, real exchange rate and trade diversification on selected North Africa countries such as Morocco, Algeria and Tunisia, by decomposing in real exchange rate into fundamental

and monetary determinants, and by using both standard statistical measures of exchange rate fluctuation and the measures of exchange rate risk. The study concluded that exchange rate depreciation has a positive effect on the quantity or manufactured exports while exchange rate misalignment, volatility or fluctuation has a negative effect. According to the authors, the motivating result is that all manufacturing sub-sectors are responsive to exchange rate change, but the degree of responsiveness differs across sectors.

2.5.3 The Impact of Exchange Rate Volatility on the Employment

Several studies have looked at macroeconomic impacts of the exchange rate on aggregate employment (Frenkel and Ros, 2006; Aloui *et al.* 2018). Others have concentrated on sector responses of employment to the exchange rate (Adedokun, 2012; Dai and Xu, 2017; Alexandre *et al.* 2011). However, most of these have tended to use partial equilibrium approaches. These studies have also concentrated on industrialised nations with a few looking at developing countries. One of the overall conclusions from this body of work resonates with the one made above on exchange rate volatility. The overall impact of exchange rate movements on employment also tends to be sector specific.

According to Peláez and Sierra (2016), exchange rate movements tend to have an impact on labour demand through two main channels; a depreciation increases the competitiveness of the country's exports and hence, the demand for labour. On the other hand, a depreciation increases the cost of intermediate inputs, which might offset the first effect. The net effect will depend on the exposure of local firms to the exchange rate. These cost considerations have also been analysed in the literature.

Filiztekin (2004) examined the impact of exchange rate fluctuations on Turkish manufacturing employment and wages using data for a panel of manufacturing industries from 1981 to 1999. He noted different conclusions from most studies that looked at this relationship, the common one being that a depreciation has a net negative effect on both employment and wages, with more pronounced effects on wages. The high dependency of Turkish manufacturing industries on foreign inputs outweighs the positive effect depreciation has on competitiveness. There is, however,

considerable variation across industries. The industry most hurt by devaluations is clothing, the industry that generated the most employment growth throughout the 1980s.

In the case of Hungary on the effects of global economic crisis, Egedy (2012) found that the relative importance of the demand and cost effect tends to be industry specific and that only the Machinery and Food Industry has a significant positive demand side exchange rate elasticity, a 10% real depreciation causes labour demand to rise by three times in Food Industry. The overall effect of the exchange rate on labour demand remains ambiguous. He also found that export share does not affect exchange rate exposure.

Nucci and Pozzolo (2010) use firm level panel data drawn from two sources to examine the relationship between exchange rate fluctuations and labour inputs for Italy. They find that exchange rate fluctuations have a significant effect on employment and hours worked. The effect of the real exchange rate on labour inputs is stronger for firms with low price cost margins than firms with a high mark up. They also found that exchange rate depreciation causes an expansion in the number of hours worked in the subsequent year through the revenue side and a contraction through the cost side.

The sensitivity of employment to the exchange rate will also be affected by market structure and labour regulations. In a perfectly competitive market, one would expect any change that affects the price of the firm to be reflected in changes in the firm's profitability. On the other hand, in an imperfect market setting, this relationship of employment growth and development initiative breaks down and the firm as a price setter now responds by changing mark-ups instead of output. Labour regulation tends to influence the hiring and firing of workers. In tightly regulated labour markets, firms respond to changes in the exchange rates by price adjustment instead of output and employment.

Baggs *et al.* (2016) evaluate firm dynamics in retail trade: The response of Canadian retailers to exchange rate shocks. They argue that both the elasticity of employment to exchange rates and the speed of adjustment to exchange rate shocks is likely to depend on market structure and the regulation of international trade and the labour

market. Using nonlinear least squares, they find that exchange rates do influence industry employment in the expected manner; a real appreciation of a nation's currency leads to a decline in manufacturing employment.

Alexandre *et al.* (2011) focuses on employment and exchange rates by looking at the role of openness and technology. They found that country comparisons show that the UK industry employment is more sensitive to exchange rate changes than United States (US) employment, which in turn is more sensitive than the German or Japanese industry employment. The US and UK labour markets are more responsive to exchange rate induced changes in relative costs than are labour markets in either Germany or Japan. They conclude that this confirms the conventional wisdom that the US and UK are generally viewed as more "laissez faire" than Germany and Japan, both in terms of international trade and labour market regulation (Huang *et al*. 2014).

Several studies have focused on the impact of exchange rate movements on employment on the US (Kandil and Mirzaie, 2003; Agrawal *et al,* 2010; Kafle, 2011). The overall conclusion from these studies is that the impact is sector specific, and it seems to indicate that dollar appreciation seems to have an overall negative impact on employment. Kehoe *et al.* (2018) found that for the US country, movements in the real exchange rate led to the loss of about 1 million manufacturing jobs, which was led by the global imbalances and structural change in the United States.

Mishra and Spilimbergo (2011) proffered that in an integrated world, exchange rates have a statistically significant wage and employment implications in local labour markets, with the importance and size of dollar induced effects varying considerably across industries and being more pronounced in some US regions. Balance dollar appreciations (depreciations) are associated with employment declines (increase) for high and low profit margin industry groups. As industries increased their export orientation, the adverse consequences of appreciations for employment also increased, with some of these adverse effects being counteracted as industries increased their reliance on imported inputs.

Lysenko (2019) indicated that real exchange rate effects on the labour market are dominated by short-run analysis, showing that there is heterogeneity in the responses

of firms or industries to a real exchange rate shock. Analysing data on Canadian manufacturing industries, the study concluded that there is a common long-run equilibrium across all manufacturing industries controlling for their openness to trade after varying adjustments to a real exchange rate shock have taken place. This conclusion is important from the perspective of policymaking because it helps to form expectations about the effects of a real exchange rate movement on the labour market. The results suggest that real appreciation leads to economically significant reductions in employment in manufacturing in the long run. Real wages decrease in industries that are highly engaged in international trade and somewhat increase in industries that are relatively closed to international trade. Both employment and real wages converge quickly to the long-run equilibrium.

2.6 Chapter Summary

The chapter explored both the theoretical and empirical literature on the effects of exchange rate on exports, output, and employment. The arguments raised by the exchange rate theories show that exchange rate fluctuations amongst the developed and developing countries tend to favour the developed countries since developed countries focus mostly on the processing of products, while developing countries concentrate on exporting primary commodities and importing the finished and high-priced products. From the review of empirical literature on exports and exchange rate, the findings of previous studies for both developed and developing countries are conflicting. Therefore, the effect of exchange rate on exports, output and employment is still a debatable issue. This study will contribute to the ongoing debate concerning the impact of exchange rate on exports, output and employment at the industrial level looking specifically at the red meat industry of South Africa. The following chapter presents overview and performance of the south African red meat industry.

CHAPTER 3

OVERVIEW AND PERFORMANCE OF THE SOUTH AFRICAN RED MEAT INDUSTRY

3.1 Introduction

To gain a better understanding of the South African red meat industry and its functions and the roles of the different segments within the industry, it is essential to provide an overview of the red meat industry in South Africa together with the performance of the industry. Numerous authors have reviewed the red meat industry of South Africa in detail (Spies, 2011; Shongwe *et al.* 2007; Jooste and Taljaard, 2004; Meissner *et al*. 2013). However, these studies are either outdated or have not considered the importance of the impact of the exchange rate towards the performance of the industry. Therefore, it is important for this study to provide an updated industry overview, with emphasis on the structure, conduct and performance of the industry with respect to exchange rate without duplicating the previous work already done.

The South African red meat industry plays a significant role in the country's agricultural sector and economy. It encompasses the production, processing, and distribution of beef, lamb, mutton and pork. South Africa has a well-established livestock sector, with a substantial number of cattle, sheep, goats and pigs. Livestock production is spread across various regions of the country, with different breeds adapted to different climatic conditions. Most of the beef production occurs in the central and northern parts of the country, while sheep farming is prevalent in the drier regions.

According to DAFF (2019), the red meat industry is a vital component of South Africa's agricultural sector. Livestock production in South Africa contributes substantially to food security and to the country's GDP, and employs many people, particularly in rural areas. The industry serves both domestic and export markets. South Africa exports red meat products to various countries, including the European Union, Middle Eastern nations, and neighbouring African countries. Beef and lamb

are the primary exported meat products. Export volumes are influenced by factors such as international demand, exchange rates, and trade regulations.

Red meat consumption in South Africa is significant, as it is a popular component of the country's diet; hence, there is a consistent demand for beef, lamb, mutton and pork. Consumption patterns vary across different population groups and regions. However, health and dietary concerns have led to a slight shift towards alternative protein sources in recent years. It is important to note that individual preferences and consumption habits may vary across regions, communities, and socio-economic groups within South Africa. Overall, red meat continues to hold a significant place in the country's culinary landscape, although there is a growing awareness of the need for balanced diets and sustainable food choices (Agri-Seta, 2018).

According to DALRRD (2020), the sector has always been a major employer, but the employment rate has declined steadily since 2000 because of increased minimum wages, fewer commercial farmers and increased property size. Some 245 000 employees with 1.45 million dependants, in addition to dependants on communal land and emerging farms, are employed on 38 500 commercial farms and intensive units with wages amounting to R6.1 Billion (South African rand). Livestock farming is the backbone of the socio-economy and provides the sustenance of most non-metropolitan towns and rural communities.

The South African red meat industry came under pressure during the 1990s due to several factors, including the increase in international competition, especially since 1994. This was brought about by the deregulation process and South Africa's compliance with world trade liberalisation rules. Further pressure resulted because of a decline in the per capita disposable income due to poor economic growth. Adding to this is the fact that consumers are becoming more health conscious and price competition from other sources of protein, especially red meat, are becoming more important (Jooste and Taljaard, 2004).

Since the deregulation of the agricultural marketing dispensation in 1997, the prices in the red meat industry are determined by demand and supply forces. Also, the meat industry experienced dramatic price increases during 2002. In this chapter, the focus was on the beef sub-sector to determine whether these price hikes were due to normal market forces, to exchange rate fluctuations, or to some other forces not characteristic of a totally deregulated industry.

BFAP (2017) indicated that integration of South African red meat into the international market clearly indicates that there is a correlation between the red meat producer price and the exchange rate. Cognisance should be taken of the fact that prices of beef usually peak during the festive season. There has been a decline from November to December and bottom out and reaching a peak again the following season. These peaks coincided largely with the peaks of the exchange rate in 2001 and 2002. This meant that imports were relatively expensive during periods of high seasonal demand because of the low value of the Rand against the US Dollar, and this further supported local beef prices.

3.2 The South Africa Red Meat Industry

The South African agricultural sector consists of 11 sub-sectors or industries with red meat as the leading contributor towards the total agricultural sector. The South African red meat sub-sector is considered dualistic in nature; there is a clear distinction between commercial and smallholder sectors (communal/informal) sector. The smallholder or emerging sector plays a key role in the supply chain of the red meat, but needs to be developed further. According to RPO (2014), household's ownership of livestock plays a major role in food and income security. The South African red meat industry is internationally competitive and can play a major role in growing the GDP and job creation. According to Agri-Seta (2020), the total number of employers registered in the employer database for 2019 are 26 181 and the red meat sub-sector remains the highest on the employer database.

The red meat products contributed 47% to the total gross value of agricultural production in 2019 (Agri-SETA, 2020). The red meat industry is subdivided into various categories such as Meat and Edible Meat Offal, Live Animals (beef, pork, sheep and

goat) and Dairy Products. All the categories of red meat are marketed in both domestic and international markets. In South Africa, stock farming is the only viable agricultural activity in a large part of the country. According to Trade Map (2019), of the 122.3 million hectares of land surface of South Africa, 68.61% is suitable for raising livestock, particularly cattle, sheep and goats, which are the products that constitute the red meat industry of South Africa because most pigs are in an intensive unit.

According to DALRRD, (2020), nine provinces is south Africa account for the total of 43 259 million goats, cattle, pigs and sheep across the country. Overall, the province with the highest share of livestock is the Eastern Cape (28%), followed by the Free State and Northern Cape, both of which account for 16% of the total livestock. The remaining 40% is shared among the remaining six provinces in the country. Zooming in data show that, the Eastern Cape has the highest proportion of goats (38%), followed by the Limpopo Province (18%). The Eastern Cape owns 25% of cattle livestock, followed by KwaZulu-Natal (19%). Likewise, the Eastern Cape owns 29% of sheep and the Northern Cape (35%); Limpopo makes up 24% of pig livestock, followed by 21% of the North-West (DALRRD, 2020).

According to Agri-SETA (2020), consumption patterns of agricultural red meat products is of importance because of its specific relevance towards agricultural products and more specifically livestock and livestock products because of the perishability and post-slaughter care (maintaining quality and freshness of products requires investments in storage facilities, pre-cooling, sorting, transport and handling equipment). Consumption patterns refer to the demand of the product or the pulling effect of the product through the system. Consumption patterns are also included as areas of investigation in terms of domestic supply situation; commodity price relationships; international trade considerations; marketing system infrastructure and government institutions and policies.

The exchange rate is of prime importance to those economic agents who operate in open economies like the South African red meat industry, since it sets the price of goods and capital in terms of foreign currencies within the main components of the South African red meat value chain. In setting these prices, the exchange rate is vital in determining the movement of goods and capital between countries in the international market. The South African agricultural sector is highly dependent on

international transactions for sales of its output and purchases of its inputs, and exchange rate variations cause changes in the price levels at which these transactions occur.

Figure 3.1 depicts the South African red meat value chain. The main components of the value chain include primary producers, feedlots, abattoirs, wholesalers and retailers. The red meat supply chain has become increasingly vertically integrated with the aim of reducing the cost while increasing the output. The integration is mainly fuelled by the feedlot industry, where most of the large feedlots own their own abattoirs, or at least have some business interest in certain abattoirs. In addition, some feedlots have integrated further down the value chain and sell directly to consumers through their own retail outlets (FPM Report, 2016).

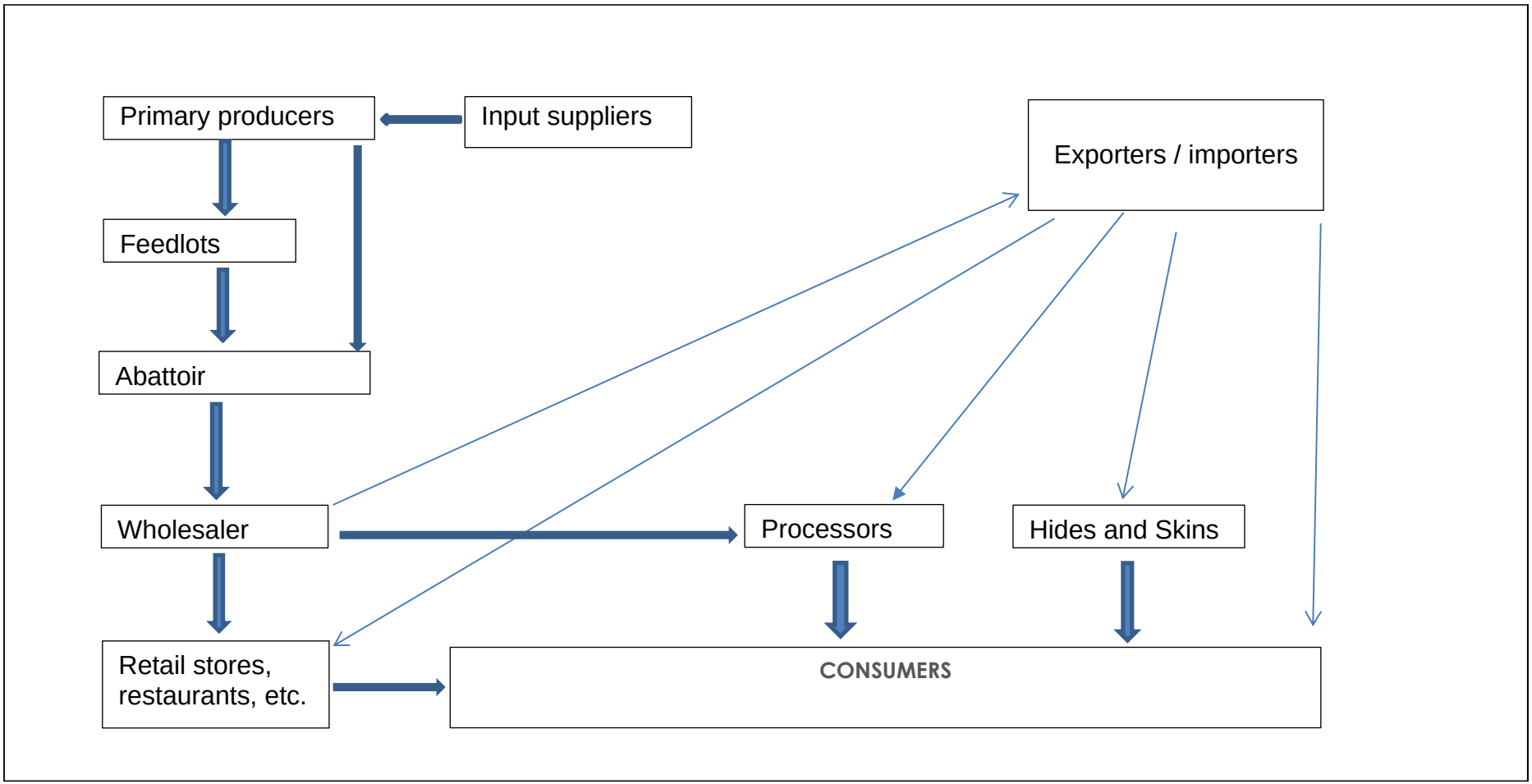

Figure 3.1: General Red Meat Value in South Africa
Source: Spies (2011)

Value Chain Analysis is a method for accounting and presenting the value that is created in a product or service as it is transformed from raw inputs to a final product consumed by customers or end users. Red meat value chain is important as it allows us to stage the level at which role players are affected by the exchange rate. According to Foreign Investment Advisory Service (2007), typically, analysis of the value chain involves identifying and mapping the relationships of the following types of features. The structure of economic agents, such as suppliers, the producer, and the wholesaler. The value of inputs, processing time, outputs and value added. The activities performed during each stage of processing and the spatial relationships, such as distance and logistics of the activities.

The South African red meat value chain includes live animals, meat, processed meat products and by-products from cattle, sheep, pigs and goats that are sold both locally and, in the export, or international market. Primary processed meat and meat products are derived after animals are slaughtered and include carcasses, red offal (liver, lungs, tail, heart and kidneys), hides, skins and other by-products such as blood, bones, horns, hooves, hair, wool, glands, intestines, stomachs and gut contents.

Participants or components in the value chain include input suppliers, primary producers, feedlots, abattoir, traders in animals, in meat and in by-products, processors, wholesalers, retail outlets and consumers. Most actors are not specialised, and their functions relate to various segments of the value chain. Many primary producers, for example, engage in the trading of animals and some upstream actors, such as butchers, trade in animals and meat and undertake primary processing for the production of higher value cuts, minced meat and sausages.

The analysis helps to obtain an overview of the chain, the product flows within the chain, the chain actors as well as the type of interaction between the role players. With respect to the South African red meat industry value chain, the input suppliers segment includes genetic (breeds of meat animals), feed (green, dry fodders, concentrates and pastures) and veterinary services (medicine, vaccination and A. insemination). It deals with the supply of inputs to initiate other stages in the value chain and it is important as the profitability of the industry starts here.

South African red meat is concentrated by primary producers and feedlots where most of them own the abattoir. They deal with production and processing of the red meat products and play a very crucial role in ensuring that the industry keeps its performance towards contributing to the overall gross domestic product of the country. The South African red meat sub-sector's abattoir industry currently comprises approximately 420 abattoirs, down from 470 due to our current economic climate, ranging from rural to high throughput (Lombard, 2020). Wholesaler, Retail stores, further Processors, Hides and Skins and traders are the segments that ensure that red meat products are in the hands of the consumers through different and distinct channels. The identification of activities and the flows between them, starting from the primary agricultural production activity and following the product downstream through the various marketing and processing channels to the final market and upstream to identify the principal input providers and the identification of mediators, is important for a supply chain.

Figure 3.2 provides an example of what a typical red meat value chain could look like and includes the different flows of product flow, information flow and financial flow through and between the different segments of the value chain (Von Cromon-Taubadel, 2017). The physical flow of red meat commodities products along the chain can be seen from the primary producers in response to the growing global and continental needs to enhance value chain efficiency.

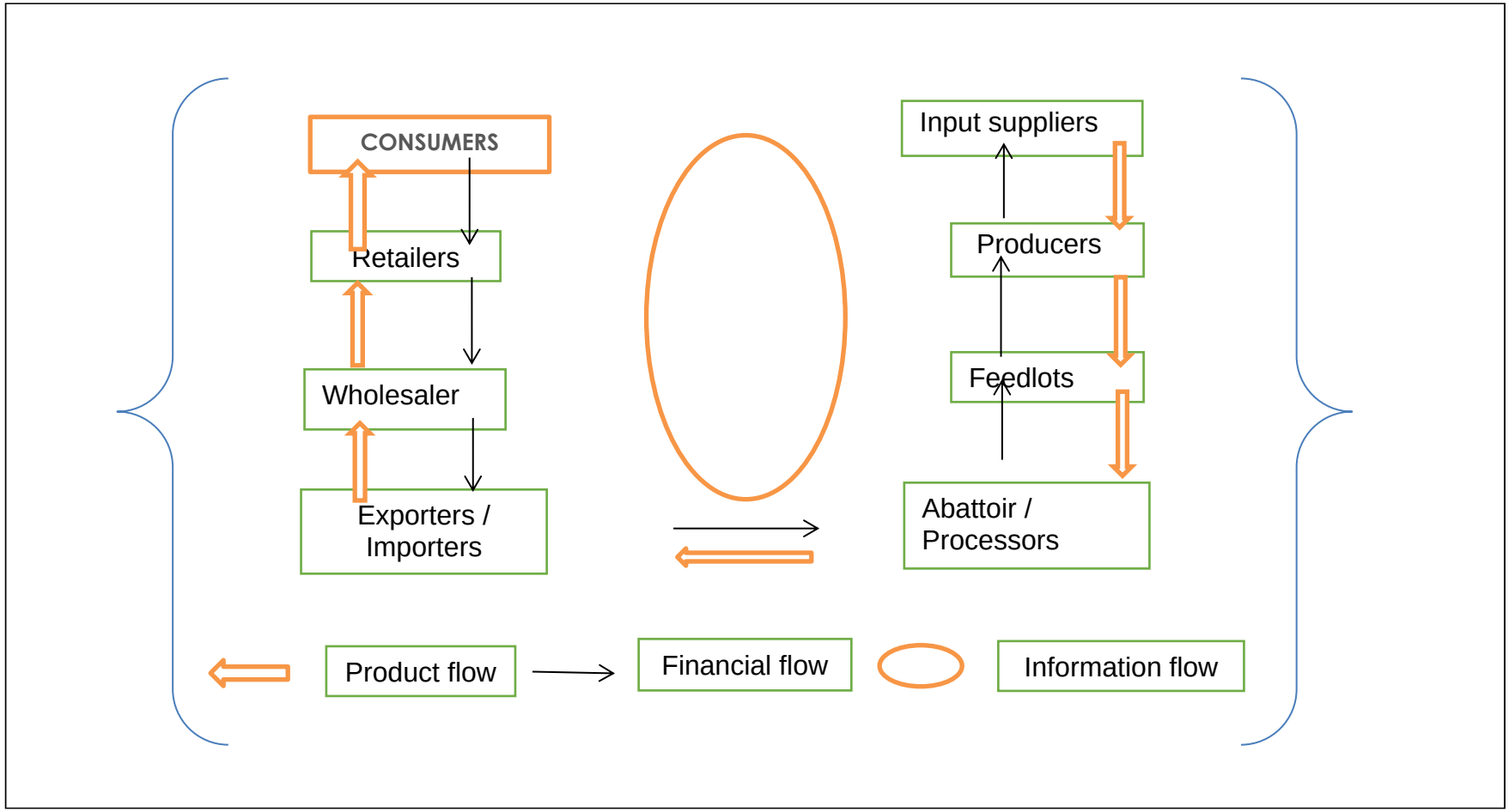

Figure 3.2: Red Meat Value in South Africa
Source: Spies (2011)

The structure component at the sub-sector level is concerned with the number of firms as well as their market power at the different stages of the chain and the different marketing channels present within the chain. Conduct within a sub-sector refers to the specific coordination activities or efforts of the participants of the sub-sector in terms of cooperation or conflict between the different stages and the flow of information across stages.

Conduct also considers how a sub-sector responds to changes in terms of price movements, supply shifts, changes in the world market conditions and emerging competitors or threats. Finally, the analysis of performance at sub-sector level includes: matching of supply and demand between stages; the stability of output, prices and profits; technical and operational efficiency at each stage and linking stages; equity of returns relative to risks; the accuracy, adequacy and equity of information; the level and types of employment; and the adaptability and responsiveness of the subsector (Cantrell and Holzman, 2016).

Lombard (2020) further identifies a number of important aspects when constructing a commodity chain, which includes the agents and institutional sectors that can consist of a physical person in the form of farmers, traders or consumers, or a legal entity in the form of a business, an authority or a development organisation; the classification of agents in terms of their primary activity, which includes firms, financial institutions, households, the government and the rest of the world; the specification and operation of the commodity chain (likely elements and agents), including the input.

Table 3.1 shows the participants and their functions with the south African red meat industry. It is important to understand the role of each player within the values so as to be able to trace the problem that arises with the value chain. South African red meat industry value chain starts with inputs suppliers where input supply for red meat production consists of the supply of animals for fattening, provision of animal health services, feed and the provision of credit services and end with processing red meat involves slaughtering animals, cutting the meat, inspecting it to ensure that it is safe for consumption, packaging and processing it into other products such as sausage or lunch meats, delivering it to stores, and selling it to customers.

Table 3.1 Participants and functions in the South African Red Meat Value Chain

Participants	Functions
Input suppliers	Input supply for red meat production consists of the supply of animals for fattening, provision of animal health services, feed and the provision of credit services. The primary actors in the cattle value chain include the following: a) Calves supplier, b) Beef Cattle feed (grass, legumes, concentrate feed, mineral mixtures) supplier, c) Medicine and veterinary support provider, d) Tools, Technology and other equipment (equipment needed for slaughtering and butchering, ropes, etc.) supplier, e) Support service actors.
Producers	Producers' function is to produce red meat products according to the customers' needs, at a price that is in accordance with the added value provided. As primary stakeholders in the red meat industry, producers are expected to contribute towards statutory and voluntary levies. It creates capacity to deal with and ensure producer interests within the entire value chain of the industry.
Feedlots	Feedlots offer producers the ability to produce a consistent, high-quality product every day of the year. Rations comprise grain, hay, silage as well as other ingredients. Cattle as an example that falls under red meat can be fed for an average of between 50 to 100 days, and sometimes more, depending on their market.
Abattoir	Most slaughtering of goats and sheep is "informal" and is done at the point of production. Cattle are slaughtered at rural slabs, usually small and out of date slaughterhouses at many of the larger villages and towns and at some larger municipal facilities.
Processors	Processing red meat involves slaughtering animals, cutting the meat, inspecting it to ensure that it is safe for consumption, packaging and processing it into other products such as sausage or lunch meats, delivering it to stores, and selling it to customers.

Exporters / Importers	Red meat traders play a pivotal role in the global supply chain by bridging gaps between producers and consumers, and balancing supply and demand. The red meat value chain trading starts at an abattoir going down the stream.
Wholesaler	Wholesalers foresee market conditions. They collect information from retailers about changes in consumer tastes, fashions, and buying habits, which they can pass on to producers of red meat products. They also conduct market surveys by comparing prices, quality, taste, buying power, competitors, etc.
Retailers	Retailers have a large role in promoting sustainable consumption and production, occupying a unique position in the supply chain of red meat products as a 'gatekeeper' between producers and consumers. They can potentially play a big role in furthering the sustainability of consumption and production.
Consumers	The customers are key figures in the supply chain of red meat and their needs, values and opinions will affect the supplier decisions buyers make.

Source: DAFF (2018)

Every link demarcated in the chain relies on goods and services to enable it to fulfil its role(s). At the various stages, goods and services include land, labour, live animals, veterinary supplies, feed supplies, transport, energy, finance and (perhaps above all and what is most lacking) institutional support. Also required are clearly defined and enunciated standards and a regulatory framework. Many of these requirements continue to be weak or non-existent in South Africa red meat industry.

3.3 The South Africa Red Meat Industry Structure

The organisational structure involves various stakeholders within the South African red meat industry. These stakeholders include farmers, meat processors, feed suppliers, veterinary services, government agencies, meat retailers, exporters, and consumers, which they need to be affiliated with the South African red meat industry forum. Understanding the interactions and relationships among these stakeholders is crucial for the performance and dynamics of the industry. The organisational structure of the South African Red Meat Industry Forum (RMIF) is shown below in Figure 3.1. All different organisations mentioned have number of functions within the industry.

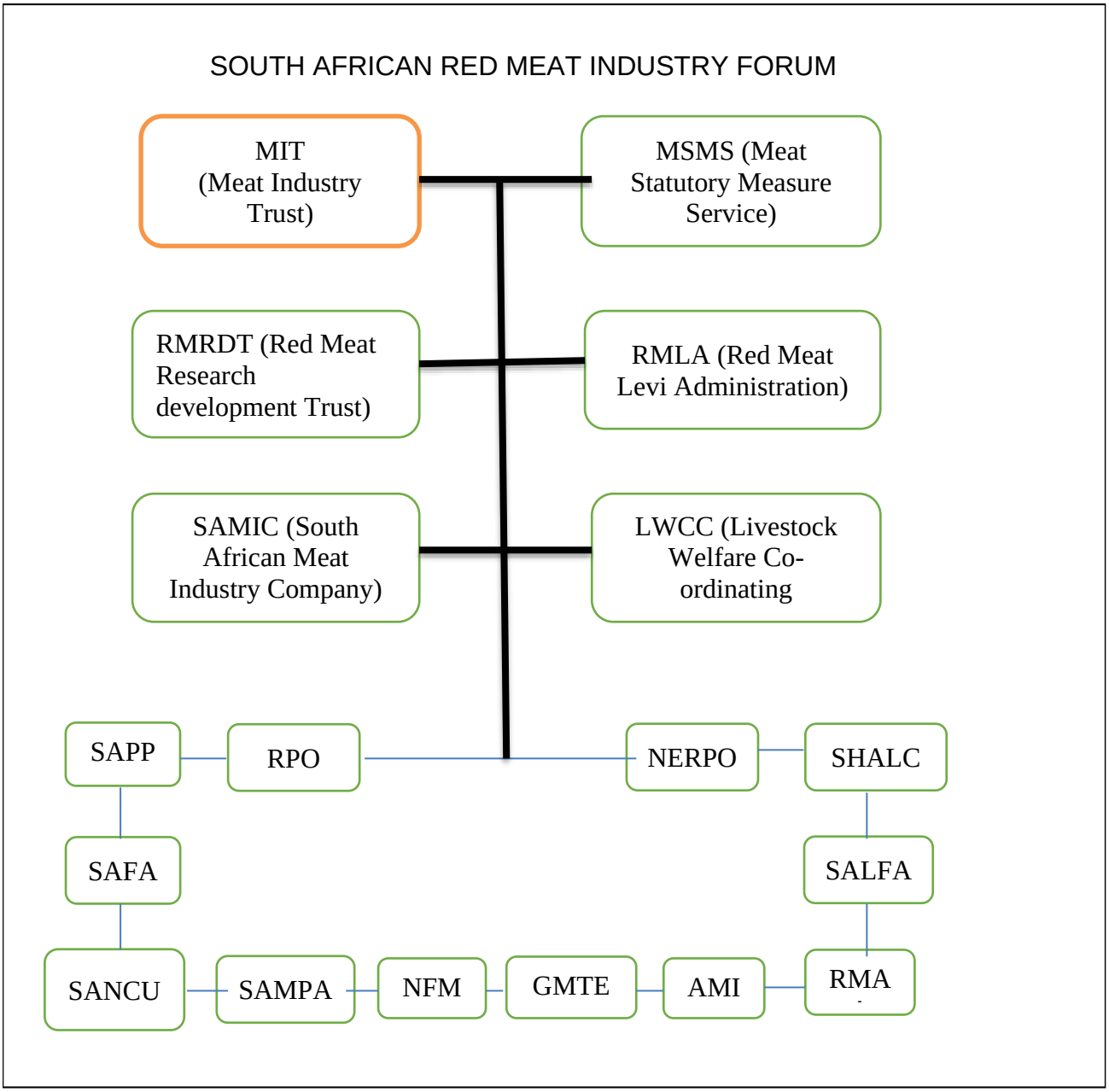

Figure 3.3: The South African Red Meat Industry Structure

Source: RMIF (2019)[1]

[1] **RPO** (RED MEAT PRODUCERS' ORGANISATION), **SAPPO** (SOUTH AFRICAN PORK PRODUCERS ORGANISATION), **SAFA** (SOUTH AFRICAN FEEDLOT ASSOCIATION), **SANCU** (SOUTH AFRICAN NATIONAL CONSUMERS UNION), **SAMPA** (SOUTH AFRICAN PROCESSING ASSOCIATION), **NFMT** (NATIONAL FEDERATION OF MEAT TRADERS), **GMTEU** (GAUTENG MEAT TRADERS EMPLOYEES UNION), **AMIE** (ASSOCIATION OF MEAT IMPORTERS AND EXPORTERS), **RMAA** (RED MEAT ABATTOIRS ASSOCIATION), **SALAA** (SOUTH AFRICAN LIVESTOCK AGENTS ASSOCIATION), **SHALC** (SKINS, HIDES AND LEATHER COUNCIL) and **NERPO** (NATIONAL EMERGENT RED MEAT PRODUCERS ORGANISATION).

The Red Meat Industry Forum (RMIF) of South Africa is an umbrella council consisting of 13 nominated members, each representing the interests of the most nationally representative sector specific organisations within the Red Meat Value Chain from the primary producer to the consumer. The RMIF was established in 1994 when the agricultural control boards were disbanded and it was formally constituted in 1997 in accordance with the provisions of the Marketing of Agricultural Products Act, 1996 (Act No. 47 of 1996), as amended. The purpose of the South African Red Meat Industry Forum (SAMIF) is to serve as a platform for collaboration, dialogue, and decision-making within the red meat industry in South Africa.

SAMIF aims to bring together various stakeholders, including producers, processors, retailers, government agencies, and industry associations, to address common challenges, share knowledge and expertise, and work towards the development and sustainability of the red meat industry. Its key purpose is to represent the Red Meat Industry, to negotiate for an enabling regulatory environment, to formulate industry policy, to facilitate compliance to legislation, to identify, appoint and monitor service providers and assist in sourcing funding to deliver on the mutually agreed essential functions to maintain a viable Red Meat Industry.

The three selected red meat sub-industries are as follows: cattle, sheep and goat and pig. The selection was influenced by the socio-economic contributions of those industries, particularly on output, exports and employment towards the agricultural sector in general and subsequently, the GDP of South Africa. These red meat sub-industries considered under each of the objective differ according to their data set and requirements. The detailed analysis about each considered red meat sub-industry is provided under the specific objective.

3.2.1 The Beef Industry

According to Agri-SETA (2019), beef industry in South Africa is characterised by the dualistic nature of the sector. There is a clear difference between the formal (commercial) sector and informal (non-commercial) beef sector (DALRRD, 2020). Unlike the non-commercial sector, the commercial beef sector is well developed and mature in South Africa. The beef informal (non-commercial) sector may further be

divided into two subsectors, namely, smallholder farmers and subsistence farmers. Smallholder farmers keep their cattle and sell them during Easter and festive seasons, for religious purposes and during their cash strapped seasons. On the other hand, subsistence farmers do not keep their cattle for economic reasons but for household food security purposes.

Typically, these two informal subsectors are not keeping records of their animal stocks; hence, the buyer and seller enter into a verbal agreement, followed by the exchange of money and cattle without recording the transactions (DALRRD, 2020). These informal subsectors are also known to have less knowledge about animal health, disease control and animal development issues and policies regarding animal production in South Africa. Beyond their role in generating food and income, cattle are a valuable asset, serving as a store of wealth, collateral for credit, which is an essential security net during calamitous times for the informal sector (DALRRD, 2020).

Agri-SETA (2019) indicates that beef industry is the second fastest growing commodity in the agricultural sector after the broiler sector. This is driven by income growth and support and technological and structural change. In South Africa, stock farming is the only viable agricultural activity in the large parts of the country. Approximately eighty percent of South African agricultural land is suitable for extensive grazing. Areas for grazing declined owing to expanding human settlements and other activities such as mining, crops, forestry and conservation (DALRRD, (2020). Eighty percent of the total cattle heads are for beef cattle and the remaining twenty percent is for dairy cattle.

The gross production of beef/cattle produced in South Africa from 1995 to 2020 is depicted in Figure 3.4. According to DALRRD (2020), the production of beef from 1995 to 1999 has been rather constant over a period of 4 years with an average of 505 080 tons of beef production. From 2000 to 2007, there was a fluctuation of the beef production, where it rapidly increased from 1999 to 2000, and later decreased production rapidly from 2000 to 2001.

Since 2001, there has been an increase until 2007, reaching the production of 861 400 tons by the year 2007. This was due to the knowledge the farmers had around production in terms of infrastructures such as feedlots and abattoirs. After 2007, there

was a decrease until 2010. This was due to the world shock that occurred but after 2010, there was an increase until it reached its peak point ever in 2016 of 1 090 900 tons. For the year 2020, it showed the signs of an increase and it is projected to increase in the coming decade due to the increasing demand of beef in Africa and the world at large.

3.2.1.1 South African beef production trend

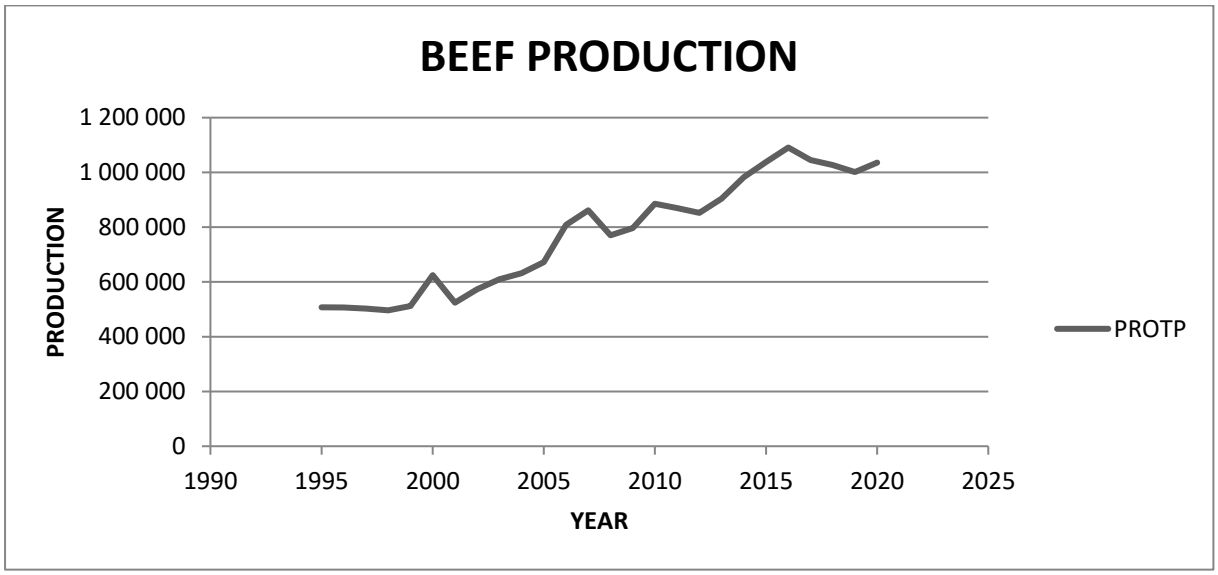

Figure 3.4 Beef production in South Africa
Data source: DALRRD (2020)[2]

The data on figure 3.5 by DALRRD (2020) show that employment in South Africa's beef/cattle industry decreased from 1995 gradually to 2010, that is, from 128 000 people being employed in the industry to 92 000, which is where employment was at its lowest in all the reviewed years. Afterwards, it started to increase year by the year until 2015, where it reached its highest point of 144 000 people being employed by the industry. There are approximately 100 commercial feedlots and 430 abattoirs in South Africa, which contribute to employment numbers. The beef industry is a contributor to livelihoods, thus reflecting that people are dependent on the livestock industry for employment. It contributes to the increase of the labour force's participation and absorption rates in the industry because industries like red meat are considered by the government for promotion as labour absorbing industries.

[2] PROTP = TOTAL PRODUCTION

3.2.1.2 South African beef employment trend

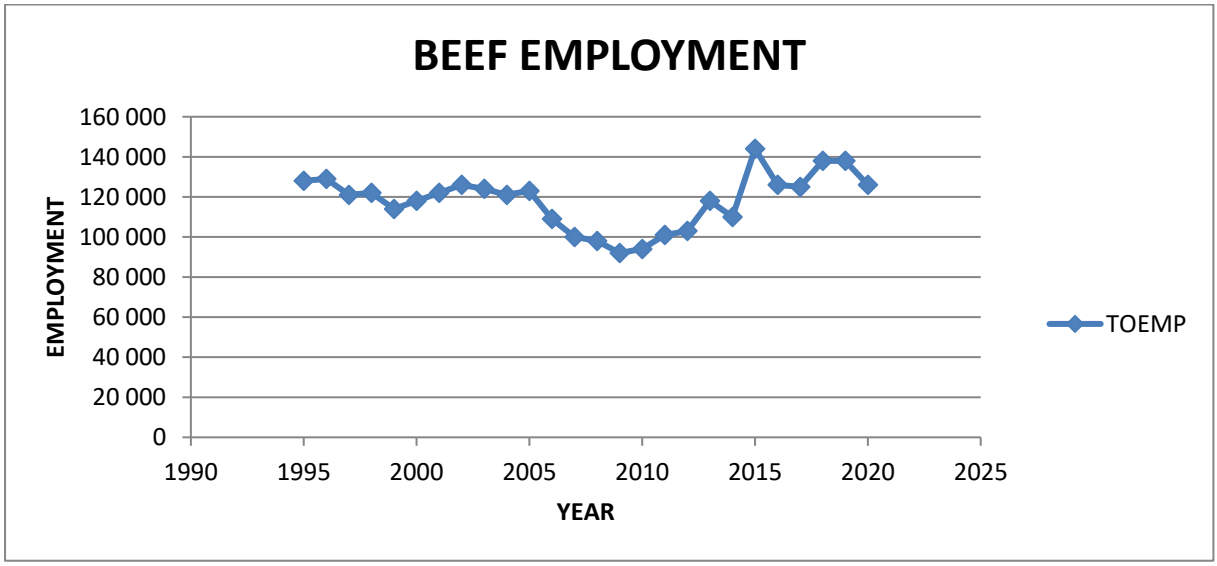

Figure 3.5 Beef Employment in South Africa

Data source: DALRRD (1995-2020)[3]

Figure 3.6: Data on beef exports for South Africa from the year 1995 until 2020 in ZAR were from Quantec easydata. The export value of beef remained less than R200 million, which translates to 220 050 tons, from 1996 to 2010. This was due to the Foot and Mouth (FMD) outbreaks after the South African red meat had been incorporated into the world market and that brought South Africa down to its knees that decade because after the outbreak, it was not allowed to export red meat like beef to certain countries until the FMD outbreak was contained.

After the announcement that South Africa was free from FMD in 2010 by the International Animal Health Organisation, there was a pickup from 2012 to 2016 of exports value, which increased exponentially because there was more international market gain, reaching a staggering 992 282 tons, which is R900 millions of beef being exported. South Africa exported more beef in 2020 as compared to all the years under review and is still increasing.

3.2.1.3 South African Beef Employment Trend

[3] TOEMP = TOTAL EMPLOYMENT

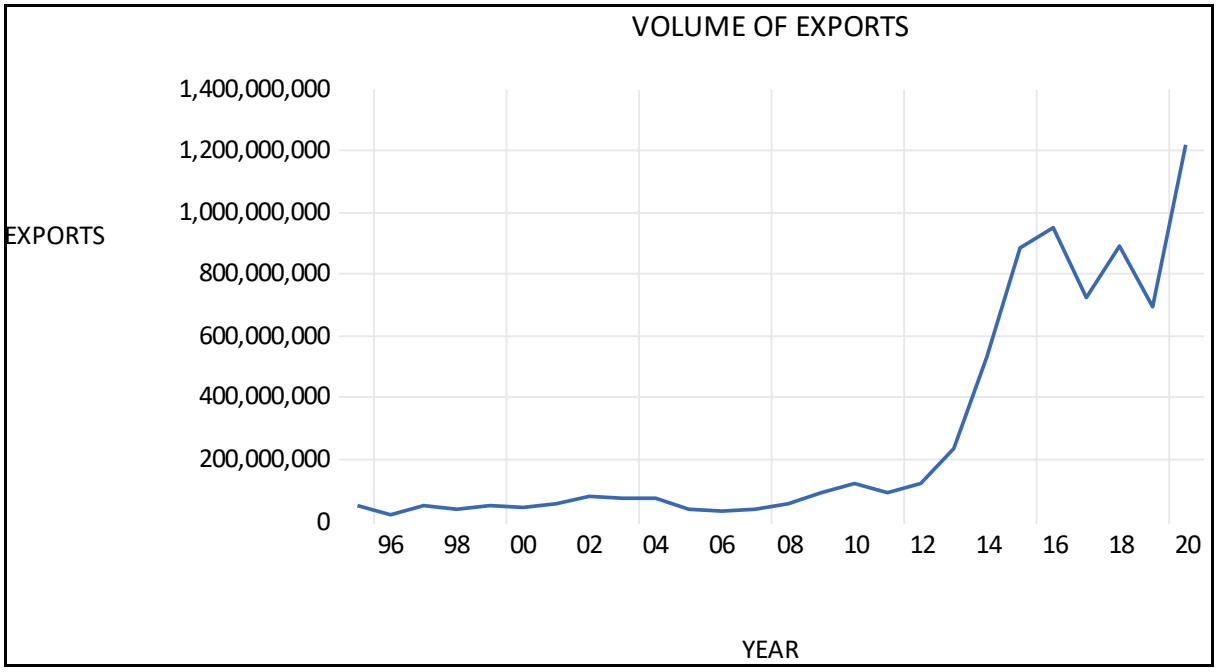

Figure 3.6 Beef Exports in South Africa

Data source: Quantec (1995-2020)

South Africa currently has about 430 abattoirs slaughtering cattle on an annual basis. Figure 3.7 shows the production and consumption of beef, where from 1995 to 2001, the trends were constant but with consumption being above production. From 2002 to 2007, there was a simultaneous increase in production and consumption although consumption was over production until 2007. Both production and consumption followed the same trend. A decline during 2007 to 2009 was experienced and it was due to the global economic meltdown, which led to a decreased disposable income of a large number of consumers. There has been an increase in both production and consumption from 2011 until 2020, where a peak was reached in 2016 amounting to 1079 000 tons.

3.2.1.4 South African beef production vs consumption trend

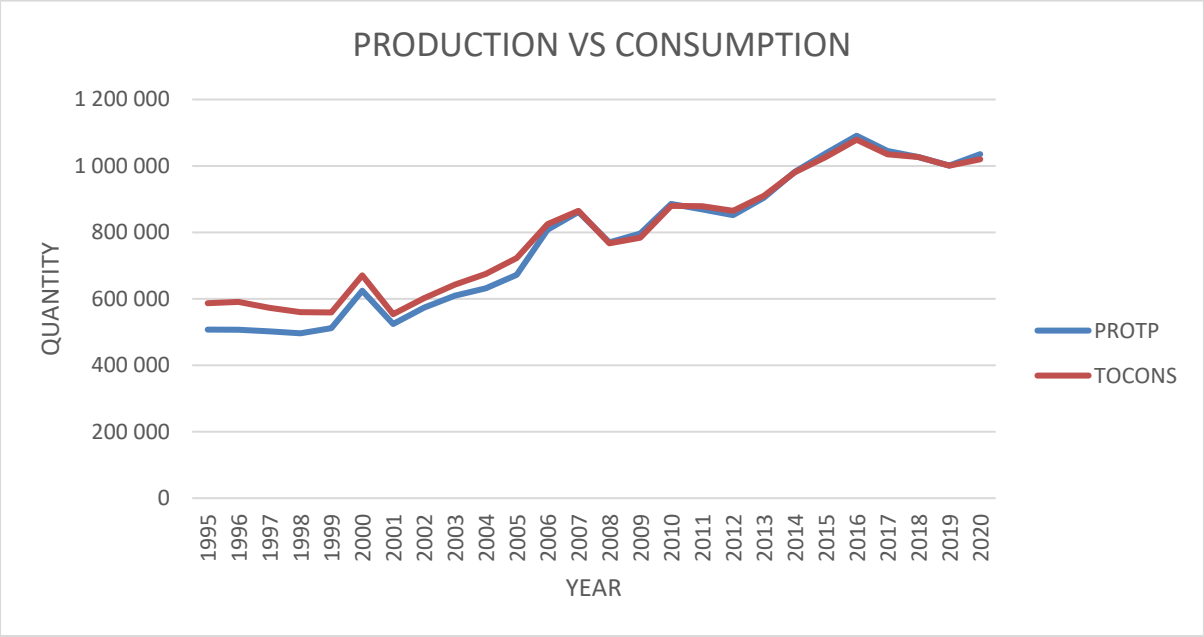

Figure 3.7 Beef employment in South Africa

Data source: DALRRD (1995-2020)[4]

The Figure 3.8 illustrates the beef consumption per capital and exchange rate from 1995 to 2020. The figure shows structural breaks for the exchange rate, which affect the consumption per capita pattern. Real exchange rate indicated structural breaks in 2002, 2008 and 2016, respectively. This was attributed to both internal and external shocks. However, the exchange rate has been on an increase over the year under review and this affected the production of beef and the pricing as well. It could be seen that an increase in exchange rates suppressed the increase rate of consumption per capital. The reason behind this is that an increase in exchange rate devalues the value of rand, which subsequently affects the level of income that consumers receive.

[4] PROTP = TOTAL PRODUCTION
TOCONS = TOTAL CONSUMPTION

3.2.1.5 South African Exchange Rate vs Consumption Per Capital Trend

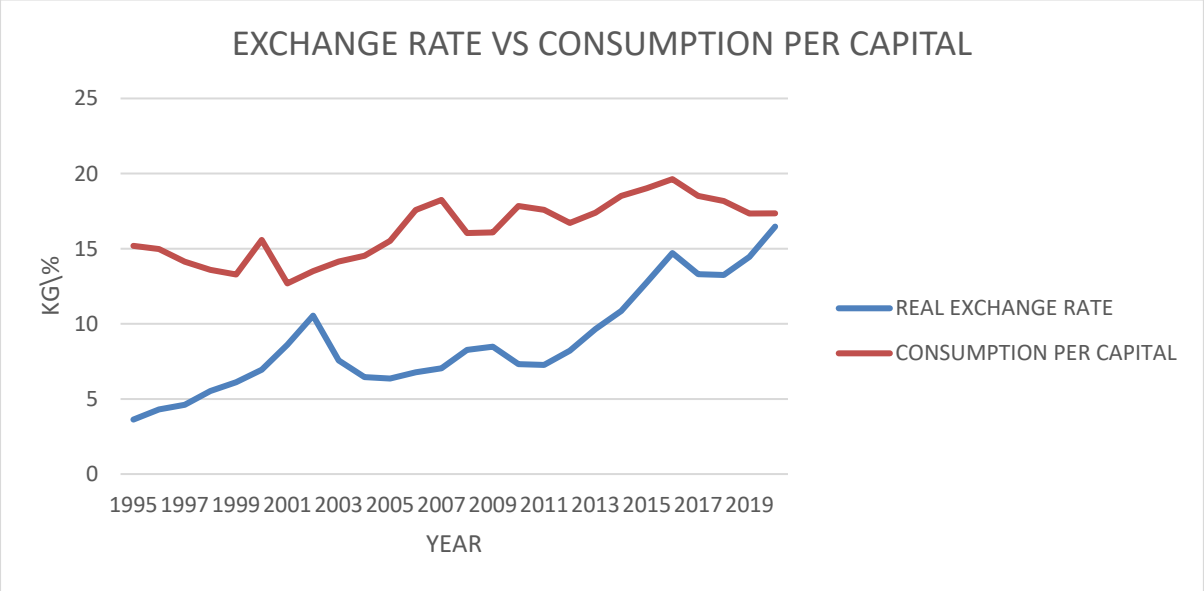

Figure 3.8 Beef Exchange Rate vs Consumption Per Capital in South Africa

Data source: STAT SA, DALRRD (1995-2020)

3.2.2 The Sheep and Goat Industry

DALRRD (2020) indicated that sheep and goat farming is practiced throughout South Africa, with the following provinces as leaders, Northern Cape, Eastern Cape, Western Cape, Free State and Mpumalanga in sheep while the Eastern Cape, Limpopo Province, North-West and KwaZulu Natal Provinces as leading producers for goat. There are over 8 000 commercial sheep and goat farms throughout the country and about 5 800 communal farmers with around 36 thousand workers. The estimated number of sheep and goat in South Africa is 27.8 million in 1995 data by DALRRD (2020). The sheep and goat breed composition in South Africa is made up of Merino, Karakul, other 'wooled' sheep and 'non-wooled' sheep while for goats, the currently recognised commercial breeds for the production of meat are the cashmere and for wool are the Boer goat, Savanna and Kalahari red. Sheep and goats' gross production value depends on the quantity produced and price produced by farmers. This gives a greater chance of fluctuation in production because the forces of demand in the market play a vital role.

Figure 3.9 depicts the sheep and goat production from the year 1995 to 2020. According to DALRRD (2020), the production of sheep and goat increased from its lowest in 1995 of 94 800 tons until it peaked in 2015 at 184 600 tons production. These increases in 20 years show that sheep and goat production started to be given attention. The production of sheep and goat has experienced a little fluctuation from 2011 to 2020. This is due to the drought that occurred in 2013, which affected the red meat industry at large and the availability of the alternative red meat, where consumers had more meat choices at their disposal.

3.2.2.1 South African Sheep and Goat Production Trend

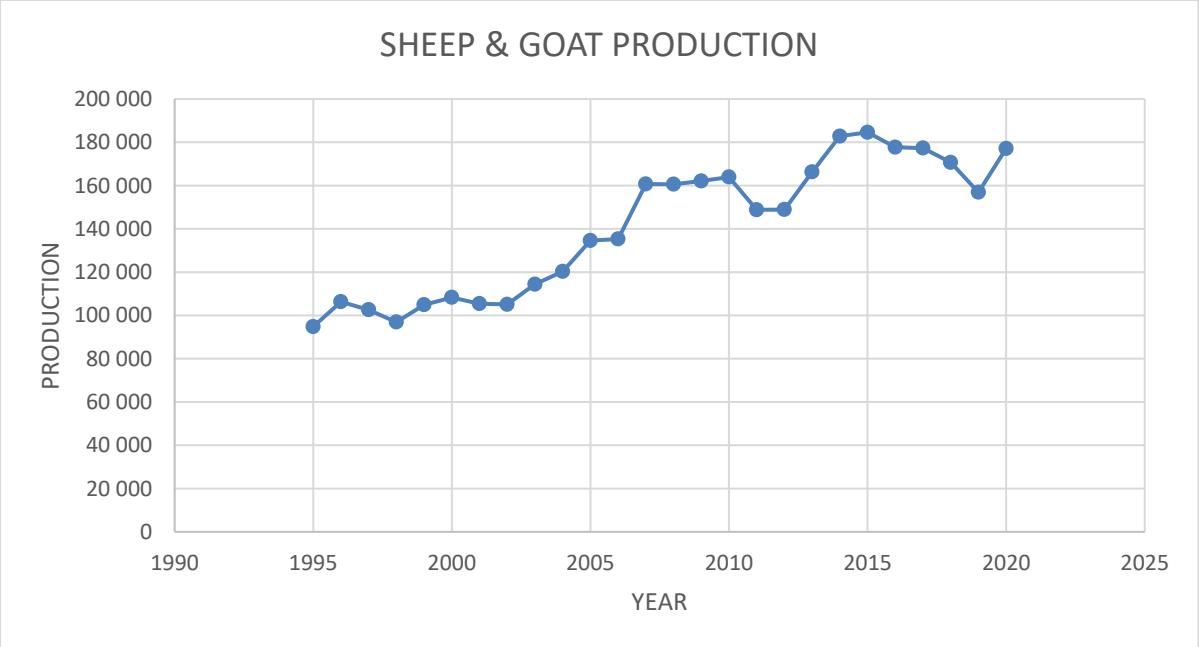

Figure 3.9 Sheep and Goat Production in South Africa

Data source: DALRRD (1995-2020)

Figure 3.10 depicts the sheep and goat volume of exports from 1995 to 2020. According to DALRRD (2020), the exports volume of sheep and goat from South Africa failed to pick up for 14 years from 1995 to 2009. These might be due to its introduction into the international market since South African red meat only started engaging in the international market for red meat in 2000. Since then, the sheep and goat exports started increasing from 2009 onwards and reached the peak of ZAR146 965 454 volume of export in 2020 as compared to the other years reviewed. In 2014, the export value decreased drastically before it increased in 2018. This increase might have been

led by an increased production of sheep and goat in South Africa. There was a skyrocket increase of ZAR49918564 in 2019 to ZAR146965454 in 2020.

3.2.2.2 South African Sheep and Goat Volume of Exports Trend

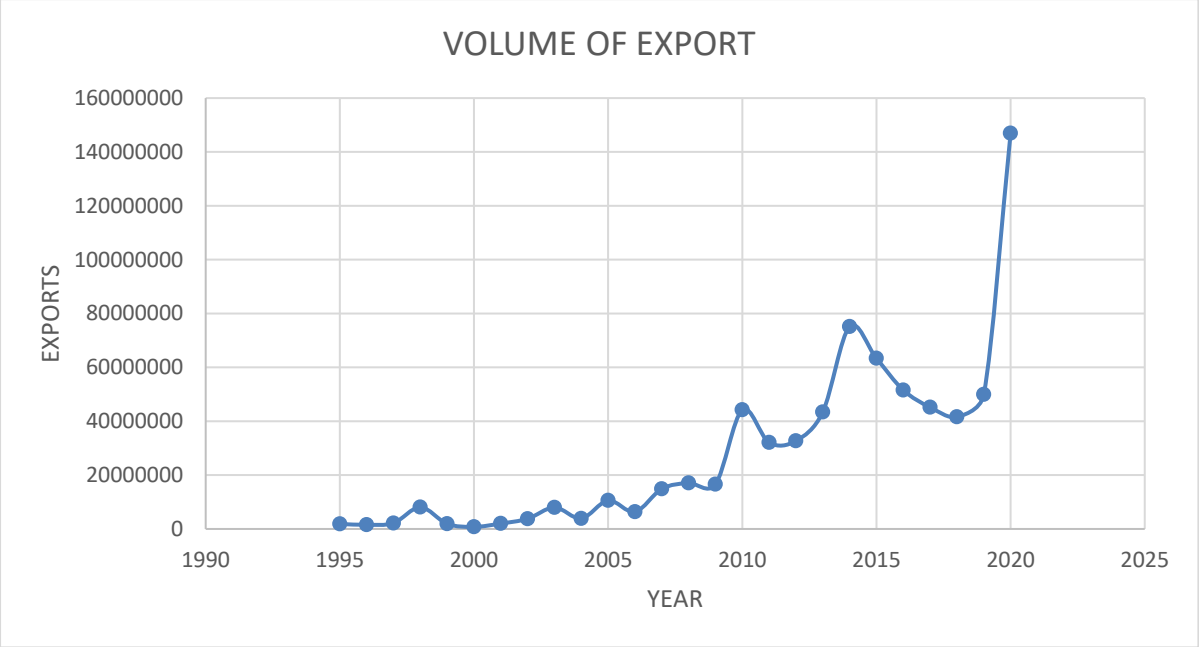

Figure 3.10 Sheep and Goat Volume of Exports in South Africa

Data source: STAT SA, DALRRD (1995-2020)

Figure 3.11 below represents the sheep and goat employment from 1995 to 2020. According to DALRRD (2020), the sheep and goat employment in South Africa decreased from 1995 gradually to 1999. It started to fluctuate from 1999 with 33 576 people employed, until it reached its lowest employment in 2009 with 25 430 people employed. It gradually started to increase by the year 2010 with about 25 926 employed people in that year and then it increased thereafter in a fluctuating way, where employment reached its peak/climax in the year 2015 with 37 090 employments exceeding all the years being reviewed. In general, with fluctuations that occurred over the years, employment numbers in sheep and goat have not really seen difference.

3.2.2.3 South African Sheep and Goat Employment Trend

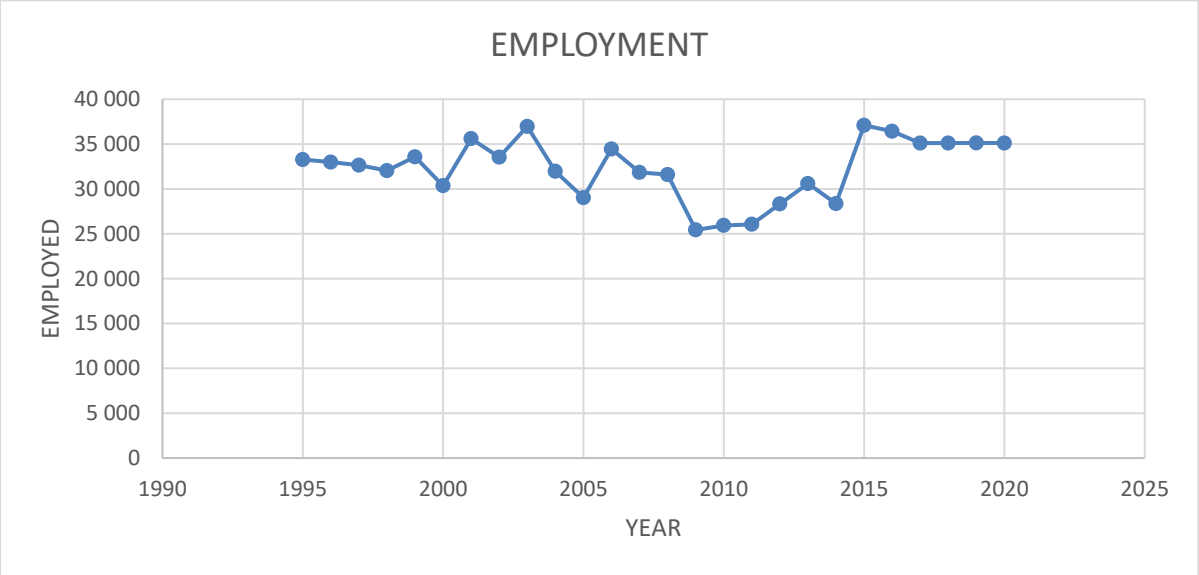

Figure 3.11 Sheep and Goat Employment in South Africa

Data source: STAT SA, DALRRD (1995-2020)

Figure 3.12 demonstrates the sheep and goat production versus consumption from the year 1995 to 2020. According to DALRRD (2020), production and consumption of sheep and goat slowly increased from 1995 to 2007, where consumption reached its peak with 203 000 tons. From 2010, production and consumption of sheep and goat increased simultaneously until they both decreased from 2018 to 2019, then eventually increased until 2020 with 184 000 tons on both consumption and production of sheep and goat. The past two decades' production increased simultaneously with consumption. In general, from the data, the consumption of sheep and goat in South Africa is always greater than the level of production.

3.2.2.4 South African Sheep and Goat Production vs the Consumption Trend

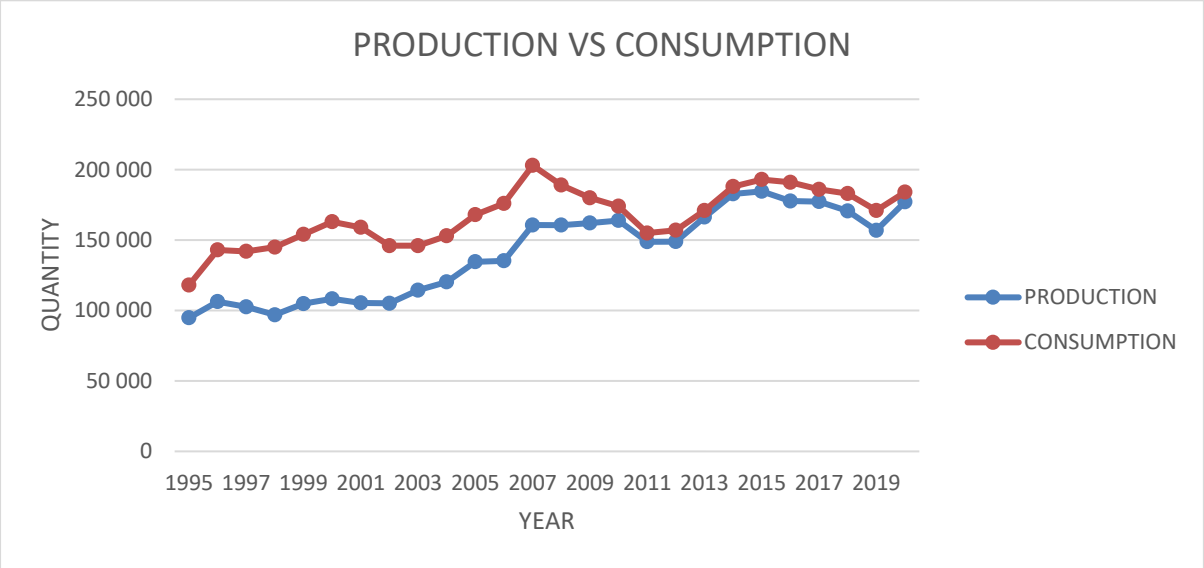

Figure 3.12 Sheep and Goat Production vs Consumption in South Africa

Data source: STAT SA, DALRRD (1995-2020)

3.2.3 Pig Industry

Pork is one of the industries that contribute to the economy of the overall South African agricultural sector. DALRRD (2020) indicated that pork industry contributes around 2.45% to the primary agricultural sector. The gross value of production of pork is dependent on the quantity produced and the price received by farmers. The trend in gross value follows a pattern of prices since the industry is characterised by volatile prices, which means that it is susceptible to the exchange rate and interest rate changes. The average gross value of pigs slaughtered over the past 10 years amounted to R4.2 billion per annum. The contribution of pork to the gross value of agricultural production increased steadily over the years (DAFF, 2018).

There are approximately 4 000 commercial producers and 19 stud breeders in South Africa (DALRRD, 2020), which are expected to cater a larger employment number under this industry. Pig numbers are estimated at 1.389 million for the year 2019; this is a decrease compared to previous years. Notable, however, is the fact that the pig numbers in South Africa have been decreasing for the previous few years. This may be due to an increase in the consumption of pork meat. Pork is produced throughout South Africa. However, the area where pork is produced is not necessarily where the animals are populated. Limpopo and North-West Provinces were the largest producers

accounting for 24% and 21%, respectively. Western Cape and Gauteng followed with a share of 11% each. KwaZulu-Natal accounted for 10% each. The province with lowest pig numbers is Northern Cape with 1% share. During the past decade, approximately 28.5 million pigs were slaughtered yielding more than 2.3 million tons of pork meat. On average, 2.8 million pigs were slaughtered and produced an average of 232 000 tons per year for the period under analysis.

Figure 3.13 depicts pig production from 1995 to 2020. According to DALRRD (2020), the production of pig in South Africa has been increasing drastically / rapidly over the years being reviewed. It reached a peak in 2020 with 298 400 pig production and it is still increasing. The faster grow in pigs' production is because pigs are easily raised. The production increases since farmers know their target market and where to sell and produce.

3.2.3.1 The South African Pig Production Trend

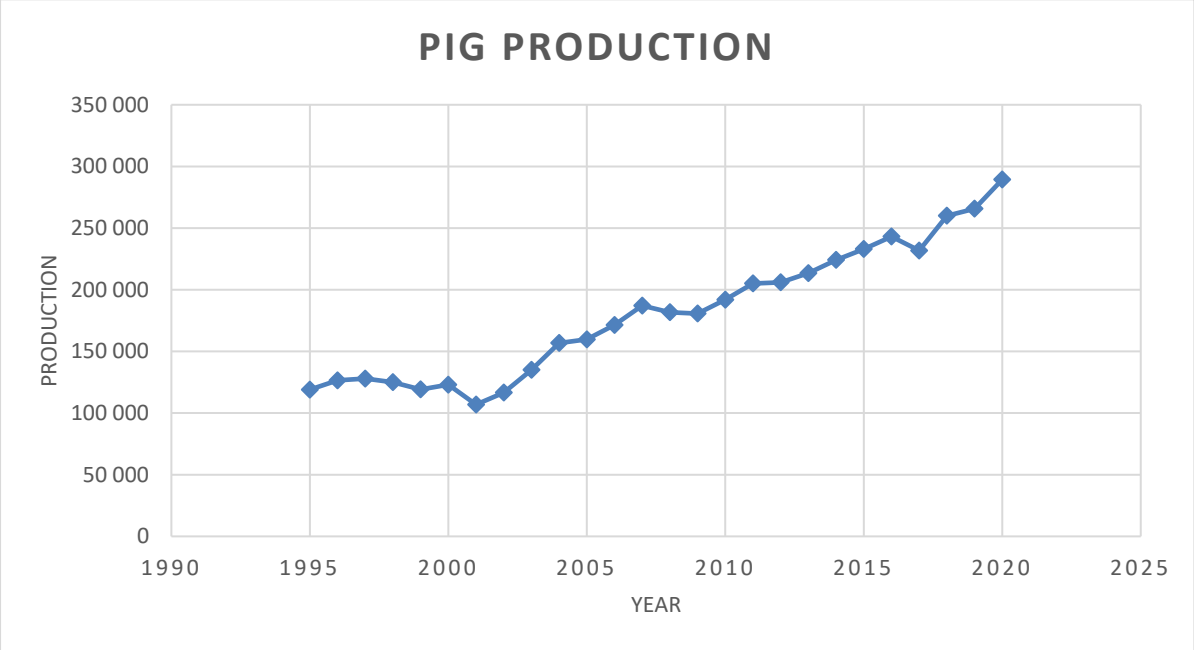

Figure 3.13 Pig Production in South Africa

Data source: STAT SA, DALRRD (1995-2020)

Figure 3.14 represents the pig volume of exports from 1995 to 2020. According to DALRRD (2020), the exports volume of pig in South Africa was very low in 1995 to 2006. Pig exports started increasing from 2007 and reached the peak of 353 690 860

volume of export in 2020 as compared to the other years reviewed. In 2010, the export value decreased drastically before it increased in 2012. This increase might have been led by an increased production of pigs in South Africa. However, it decreased in 2015 to 2016 and increased again until it reached its peak in 2020.

3.2.3.2 The South African Pig Volume of Exports Trend

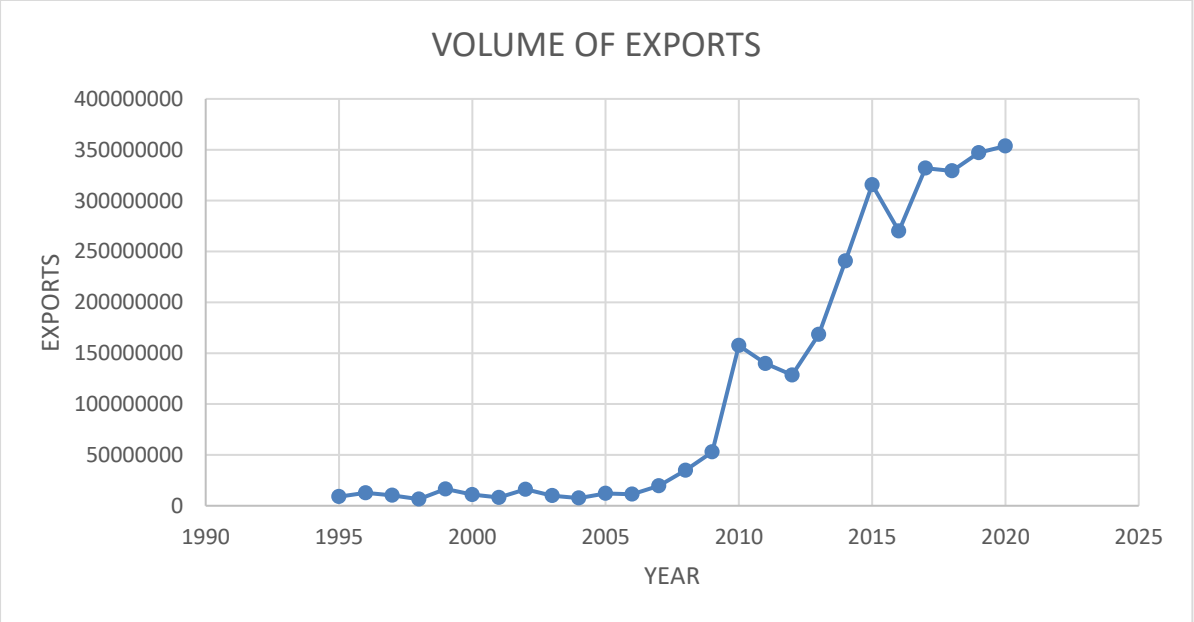

Figure 3.14 Pig Volume of Exports in South Africa

Data source: STAT SA, DALRRD (1995-2020)

Figure 3.15 illustrates the pig employment from 1995 to 2020. According to DALRRD (2020), the pig employment in South Africa increased slowly from 1995 to 2000. It reached its peak 2002 with 3312 people employed. From 2002, it decreased to its lowest in 2008 with 2 613 people being employed. It started to increase from 2009 to 2013. From 2013, it began to fluctuate (increasing and decreasing) until 2020.

3.2.3.3 The South African Pig Employment Trend

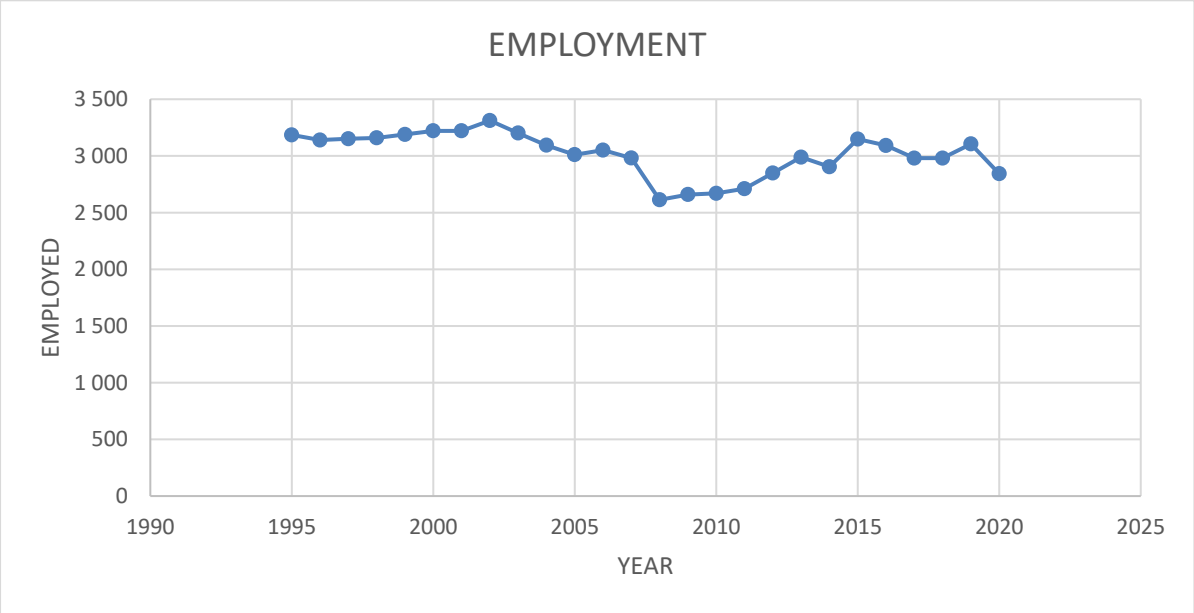

Figure 3.15 Pig Employment in South Africa

Data source: STAT SA, DALRRD (1995-2020)

Figure 3.16 illustrates the pig production vs consumption from 1995 to 2020. Pork is the most consumed products globally whilst South African consumption is lowest compared to poultry and beef consumption. Pork consumption is influenced by the religious and cultural beliefs in the country. Figure 3.16 depicts that the consumption of pork in South Africa increases as production increases. Both the production and consumption of pig experienced a slight decrease in 2016 to 2017. From the Figure 3.16, it is evident that pork consumption is higher as compared to the total production pork in South Africa for the past decade. It is clear that South Africa consumes more than it produces, which makes the country self-insufficient in pork production.

The increased per capita consumption may be due to the increasingly urbanised consumers with the increased per capita income and the well-marketed rib portion consumption. During 2014, South Africa was self-sufficient, producing 236 300 tons, which became more than the consumption of 236 000 tons and consumption had slightly decreased in 2014. This may be due to the high price of pork meat, which made it relatively expensive to its substitutes such as poultry and beef. From 2015 to 2019, the situation returned to its nature were the consumption outstripped the production. This caused South Africa to import pork to meet the local demand.

3.2.3.4 South African Pig Production vs Consumption Trend

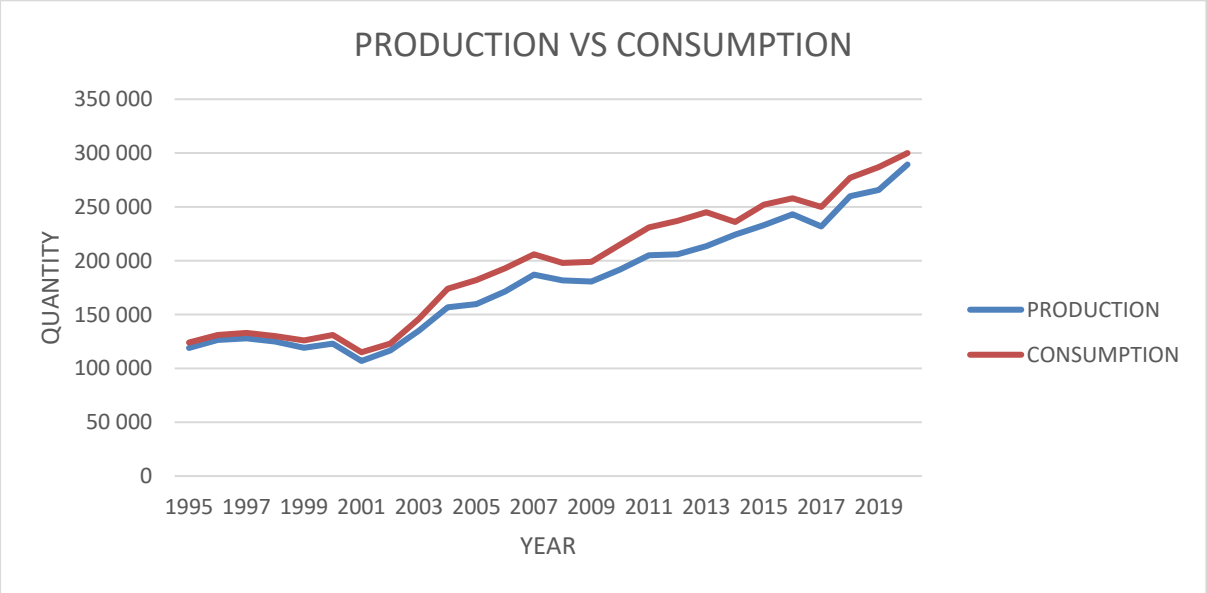

Figure 3.16 Pig Production vs Consumption in South Africa

Data source: STAT SA, DALRRD (1995-2020).

Figure 3.17 represents pig consumption per capital and exchange rate from 1995 until 2020. The figure shows structural breaks for exchange rate, which affect the consumption per capita pattern. Real exchange rate indicated structural breaks in 2002, 2008 and 2016. This was attributed to both internal and external shocks. However, the exchange rate has been on an increase over the years under review and this affected the production of pig and the pricing as well. It could be seen that an increase in exchange rates suppressed the increase rate of consumption per capital. The reason behind this is that an increase in exchange rate devalues the value of rand with subsequently affects the level of income that consumers receive. The increased per capita consumption may be due to the increasingly urbanised consumers with the increased per capita income and the well-marketed rib portion consumption.

3.2.3.5 South African Pig Exchange Rate vs Consumption Per Capital Trend

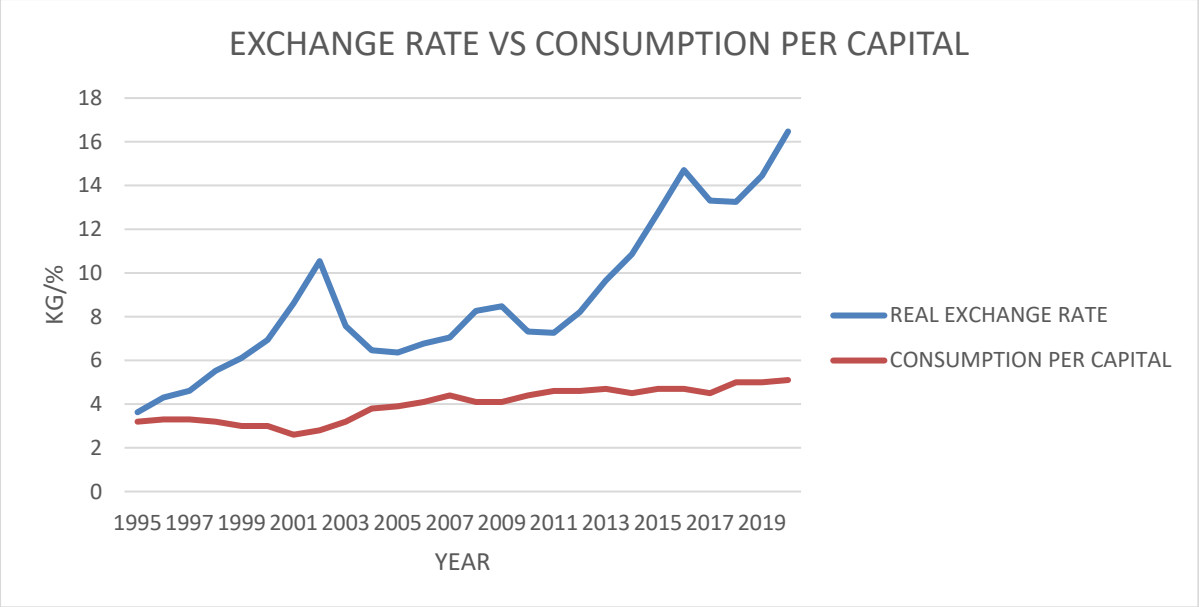

Figure 3.17 Pig Exchange Rate vs Consumption Per Capital in South Africa

Data source: STAT SA, DALRRD (1995-2020)

3.5 Chapter Summary

The chapter provided an overview of the South African red meat industry with particular focus on the three selected sub-industries within the red meat industry. Production, employment, exports and how the exchange rate affect the pricing and demand of the red meat products were also elucidated. This chapter emphasised the complexity of the South African red meat industry's performance. It was noted that there are numerous factors that play a direct role to the profitability of the red meat industry. It was further noted that changes in supply and demand situations, due to economic factors such as the exchange rate and climatic conditions, lead to highly variable industry prices (Agri-SETA, 2019).

This variation in industry prices complicates production decisions at every level of the value chain. The production of beef have doubled, the production of pork has almost tripled and sheep and goat also showed great increase in production withi the period under consideration. The livestock value chain is dominated by big commercial producers that have linked production activities with distribution and processing. Overall, the South African red meat industry plays a vital role in the country's

agricultural sector and economy. While it faces challenges, it continues to meet the domestic demand and exports its products. Adapting to changing consumer preferences, ensuring sustainability, and maintaining high standards will be crucial for the industry's future success. The following chapter presents the methodology and analytical procedure of the study.

CHAPTER 4

METHODOLOGY AND ANALYTICAL PROCEDURES

4.1 Introduction

This chapter describes the study area, outlines the focus of the study, data sources, data requirements, data management procedures and data analytical techniques used to estimate the different methods of achieving the study's objectives. Intuitively, each objective needs a specific data and analytical technique; hence, each has been allocated a detailed methodological approach that addresses data requirements and the estimation techniques. It describes the variables that were considered suitable to analyse the effects of the floating exchange rate on the output, export and employment in the South African red meat industry. The chapter starts by describing the study area, including the selected sub-industries of the general red meat industry for this study, followed by the procedures adapted to measure the effects of exchange rate on the output, exports and employment within the selected red meat industries of South Africa. Furthermore, the chapter presents the procedures used to transform the variables from raw data and to deal with non-stationarity of the data as the study used secondary data.

4.2 Study Area

The study was conducted in South Africa, which is situated on the most southern tip of African continent. The study area includes the entire territory of South Africa, encompassing its nine provinces and diverse climatic regions. South Africa is known for its extensive farming areas, ranging from the fertile grasslands of the Highveld to the semi-arid regions of the Karoo and the coastal areas. The study area covers multiple livestock species raised for meat production. The primary focus is on beef cattle (Bos taurus and Bos indicus breeds), sheep (mainly Dorper and Merino breeds), goats and pigs.

South Africa has nine provinces, namely: Eastern Cape, Limpopo, Northern Cape, Free State, Mpumalanga, KwaZulu-Natal, North-West, Western Cape and Gauteng, which account for the total of 43 259 million goats, cattle, pigs and sheep across the

country (DALRRD, 2020). Overall, the province with the highest share of livestock is the Eastern Cape (28%), followed by the Free State and Northern Cape, both of which account for 16% of the total livestock. The remaining 40% is shared among the remaining six provinces in the country. Zooming in data show that, the Eastern Cape has the highest proportion of goats (38%), followed by the Limpopo Province (18%). The Eastern Cape owns 25% of cattle livestock, followed by KwaZulu-Natal (19%). Likewise, the Eastern Cape owns 29% of sheep and the Northern Cape (35%); Limpopo makes up 24% of pig livestock, followed by 21% of the North-West (DALRRD, 2020).

The Figure 4.1 outlines and indicates the selected red meat or livestock statistics of the across all nine provinces in South Africa. The figure reports the in-depth on total number of cattle, sheep, pigs and goat across each province in the country. Most of the cattle farming takes place in regions with more favourable grazing conditions, such as the Free State, Eastern Cape, and KwaZulu-Natal provinces. Sheep and goats are also significant livestock species in South Africa. Pig farming is another important sub-industry, with South Africa having a sizable pig population.

The South African red meat industry is a significant and dynamic sector that plays a crucial role in the country's economy and culture. The study area encompasses various aspects related to the production, processing, and consumption of red meat in South Africa. the study area of South African red meat encompasses a broad spectrum of factors, including geography, livestock farming practices, breeds, production processes, market dynamics, and cultural significance. Figure 4.1 assist in understanding these aspects is crucial for the sustainable development and management of the red meat industry in South Africa.

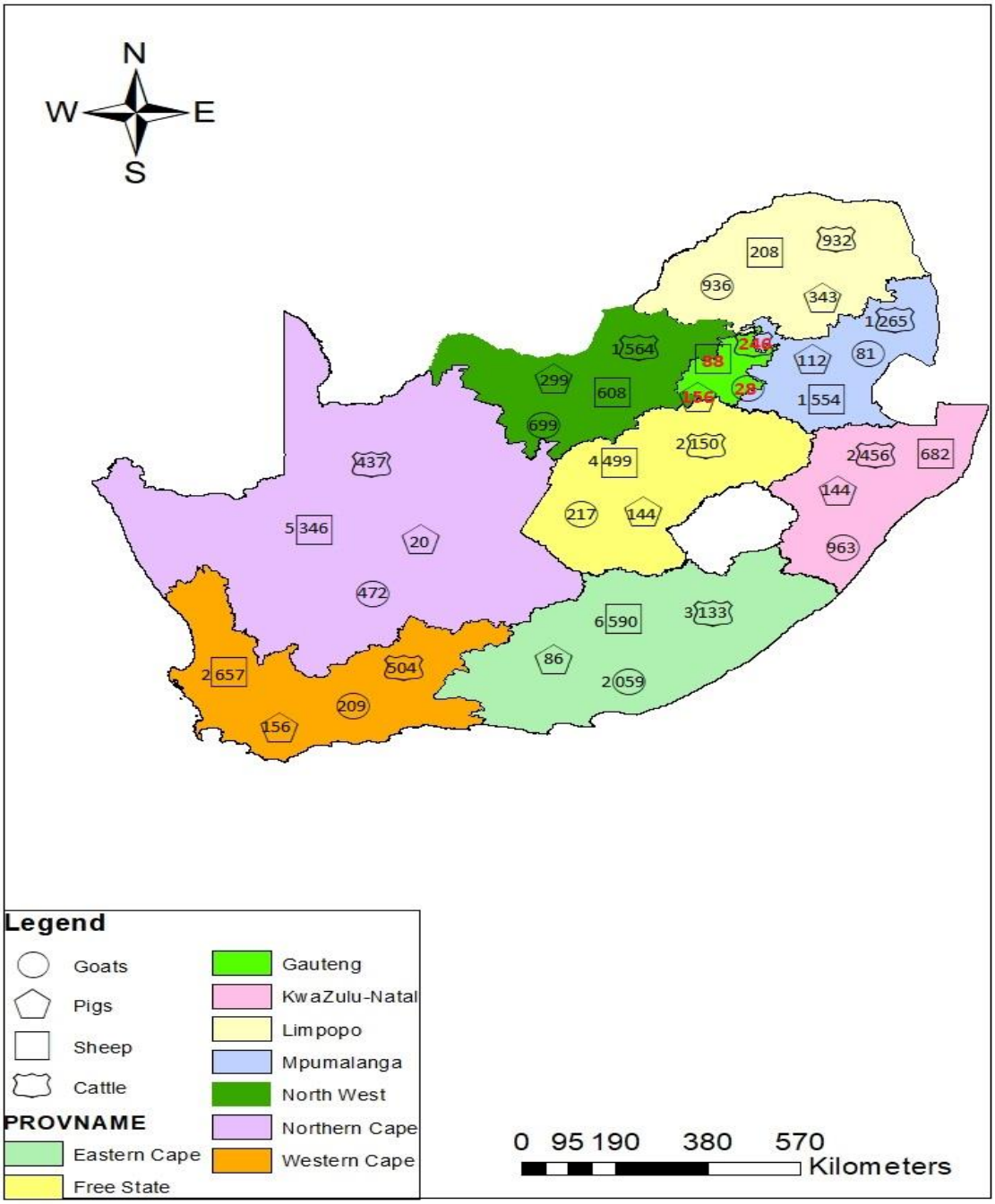

Figure 4.1: South Africa Map on Livestock.

Source: GIS Map

4.3 Focus of the Study

The study focused on the impact of the floating exchange rate on output, exports and employment in the three selected South African red meat sub-industries. The three selected red meat sub-industries are as follows: cattle, sheep and goat, and pig. The selection was influenced by the socio-economic contributions of those industries, particularly on output, exports and employment towards agricultural sector in general and subsequently, the GDP of South Africa. These red meat sub-industries considered under each of the objectives differ according to their data set and requirements. The detailed analysis about each considered red meat sub-industry is provided under the specific objective. The study employed the red meat industry data spanning from the year 1995 until 2020, which is enough to empirically and theoretically test the hypotheses that capture the impact on output, exports and employment of the red meat industry.

4.4 Data Collection

The study was based on secondary time series data, which were attained from government institutions, namely; Department of Trade and Industry (DTI), South African Reserve Bank (SARB), Department of Agriculture, Land Reform and Rural Development (DALRRD), BFAP and Quantec easydata. The data required focused on output, exports, employment and real exchange rate of the South African red meat industry. The study sought to determine the effect of red meat consumption on industry's output, export and employment. The study covered the sample size of 26 years from 1995 until 2020, using annual date from 1995 until 2020, which generated 26 observations (Morse *et al*, 2002). This number of observations became a significant number to analyse the impact of a floating exchange rate on output, exports and employment. In the tables below, the number of variables which can affect production output, volume of exports and total employment in the red meat industry of South Africa, are listed. The selection of the control variables was based on the topic, objectives of the study and the literature suggested significant factors in explaining the impact of the floating exchange rate on output, exports, and employment in the red meat industry of South Africa.

4.5 Data Analysis and General Models

The study employed Autoregressive Distributed Lag (ARDL) techniques proposed by (belke, 2001, shin,2014 and demir, 2010) for cointegration and bounds test long run relationship. The estimation of an error correction model was catered for by the short-run relationship between industry's output, exports and employment based on the changes or movement of the floating exchange rate, which were the variables under investigation. The Engle-Granger test was also performed to verify the causal relationship between the dependent and explanatory variables.

The general model is specified as follows:

$$\Delta lnY_{it} = \beta_0 + \beta_1 \Delta lnX_{1t} + \beta_2 \Delta lnX_{2t} + \beta_3 \Delta lnX_{3t} + \beta_4 \Delta lnX_{4t} + \beta_5 \Delta lnX_{5t} + \beta_6 \Delta lnX_{6t} + \beta_7 \Delta lnX_{7t} + \beta_8 \Delta lnX_{8t} + \beta_9 \Delta lnY_{9t-1} + \pi ECM_{t-1} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots (1)$$

Where Y is dependent variable, while X_1 until X_k represent the independent variables which affect dependent variable. Where t subscript represent a time period or dimension. Where Δ represent the differencing notation, while ln (log) represent the natural logarithm and Y_{t-1} denote the lagged variables, including the dependent variable. The error correction term is denoted by πECM_{t-1}. The disturbance term is represented by ε_t.

The specific equation can be specified as follows for total production output:

$$\Delta lnPROTP_t = \beta_0 + \beta_1 \Delta REXRT_{1t} + \beta_2 \Delta CONSPC + \beta_3 \Delta TOCANU_{3t} + \beta_4 TOSLAU_{4t} + \beta_5 lnVOLEXPT_{5t} + \beta_6 \Delta lnTOEMP_{6t} + \beta_7 \Delta TOCONS_{7t} + \beta_9 \Delta lnPROTP_{t-1} + \pi ECM_{t-1} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where $\Delta lnPROTP_t$ denotes the dependent variable, while X_1 until X_k $(REXRT, CONSPC, TOCANU, TOSLAU, VOLEXPT, TOEMP, TOCONS, and\ PROTP_{t-1})$ represent the explanatory variables, which are the various factors that affect production output as the dependent variable. The t subscript represents a time period or dimension. Where Δ represents the differencing notation, while ln(log) represents

the natural logarithm, πECM_{t-1} represents error correction term and$\Delta lnPROTP_t$ denotes lagged variables, including dependent variable. Disturbance term is represented by ε_t, which captures the effects of variables not included on the regression.

The specific equation can be specified as follows for total employment:

$$\Delta lnTOEMP_t = \beta_0 + \beta_1 \Delta REXRT_{1t} + \beta_2 \Delta CONSPC + \beta_3 \Delta TOCANU_{3t} + \beta_4 TOSLAU_{4t} + \beta_5 lnVOLEXPT_{5t} + \beta_6 \Delta lnTOEMP_{6t} + \beta_7 \Delta TOCONS_{7t} + \beta_9 \Delta lnTOEMP_{t-1} + \pi ECM_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where $\Delta lnTOEMP_t$ represents the dependent variable, while X_1 until X_k $((REXRT, CONSPC, TOCANU, TOSLAU, VOLEXPT, TOEMP, TOCONS, and\ TOEMP_{t-1}))$ represent the independent variables, which are various factors that affect employment (see Table 4.1). The t subscript represents a time dimension. Where Δ represent the differencing notation, while ln(log) represent the natural logarithm, πECM_{t-1} represent the error correction term and $TOEMP_{t-1}$ denote the lagged variables including dependent variable. Error term is represented by ε_t, which captures effects of variables not included on the regression.

The specific equation can be specified as follows for export growth:

$$\Delta lnVOLEXPT_t = \beta_0 + \beta_1 \Delta REXRT_{1t} + \beta_2 \Delta CONSPC + \beta_3 \Delta TOCANU_{3t} + \beta_4 TOSLAU_{4t} + \beta_5 lnPROTP_{5t} + \beta_6 \Delta lnTOEMP_{6t} + \beta_7 \Delta TOCONS_{7t} + \beta_9 \Delta lnVOLEXPT_{t-1} + \pi ECM_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where $\Delta lnVOLEXPT_t$ denotes the dependent variable, while X_1 until X_k $((REXRT, CONSPC, TOCANU, TOSLAU, VOLEXPT, TOEMP, PROTP, TOCONS, and\ VOLEXPT_{t-1})$ represents the explanatory variables, which are various factors that affect volume of export as the dependent variable. The t subscript represents a time period or dimension. Where Δ represents differencing notation, while ln(log) represents natural logarithm, πECM_{t-1} represents error correction term and $VOLEXPT_{t-1}$ denote lagged variables, including the dependent variable. Disturbance term is represented by ε_t, which captures the effects of variables not included on the regression.

4.6 Description of Variable

The description of the variable was important for the analysis as it list all included variables and their interplay, which could help in the estimation of the impact of the exchange rate on output, exports, and employment. The description of the variable also provides valuable insights into the relationship between exchange rate movements and key economic indicators being production, exports and employment for this study. The exchange rate is a crucial variable as it affects the competitiveness of a country's exports, the cost of imports, and overall trade dynamics. The estimation of the impact of the exchange rate on output, the goal was to assess how fluctuations in the exchange rate affect the level of production. The estimation the impact of the exchange rate on employment, the objective was to analyse how fluctuations in the exchange rate affect the labour market. Changes in the exchange rate can influence the competitiveness of industries, which, in turn, can impact employment levels.

Table 4.1 represents the number of variables adopted to analyse the beef/cattle industry throughout the study. There are nine variables in total used in the beef/cattle industry analysis. There are at least three dependent variables, which include the total production output, volume of exports and total employment. The variables are total production output, volume of exports, total employment, total consumption, real exchange rate, consumption per capital, total slaughtered, imports volume, with cattle/beef. Table 4.1 includes the abbreviations of the variables, unit of measurement of response to regressands.

Table 4.1: List of variables for Cattle/Beef industry

Dependent variables description	**Abbreviations**	**Unit of measurement**
Production output in the beef industry	$PROTP_t$	Total annual output in tons
Volume of South African beef industry exports	$VOLEXPT_t$	Value of exports in South African Rand

Total employment in the beef industry	$TOEMP_t$	Total number of people employed in the beef industry
Independent variables description	**Abbreviations**	**Unit of measurement**
Total cattle number in South Africa	$TOCANU_t$	Total number of cattle (count)
Total number of cattle slaughtered	$TOSLAU_t$	Total number of cattle slaughtered (count)
Imports output	$IMPO_t$	Value of imports in South African Rand
Real Exchange Rate	$REXRT_t$	Benchmarking ZAR on USD (a rate which is an indication for international competitiveness)
Total Consumption beef in South Africa	$TOCONS_t$	Total consumption in tons
Consumption per capital	$CONSPC_t$	Consumption in kg per year

Source: Author's compilation

As depicted on Table 4.2, all dependant variables and regressors included in the analysis of the sheep and goat industry are presented. There are three dependant variables included in all analysis of sheep and goats, which are the total production output, volume of exports and total employment. The included regressors for the sheep and goat industry are as follows: real exchange rate, total consumption, total slaughtered, total number of sheep and goats, consumption per capital. The key information included is the description of variable, abbreviations of variables and unit of measurement which align the response of regressors to the dependant variables, which address the set objectives.

Table 4.2: List of variables for the sheep and goat industry

Dependent variables description	**Abbreviations**	**Unit of measurement**

Production Output in the sheep and goat industry	$PROTP_t$	Total annual output in tons
Volume of the South African sheep and goat industry exports	$VOLEXPT_t$	Value of exports in South African Rand
Total employment in the sheep and goat industry	$TOEMP_t$	Total number of people employed
Independent variables description	**Abbreviations**	**Unit of measurement**
Total sheep and goat number in South Africa	$TOSGNU_t$	Total number of sheep and goat (count)
Total number of sheep and goat slaughtered	$TOSLAU_t$	Total number of cattle slaughtered (count)
Imports output	$IMPO_t$	Value of imports in South African Rand
Real Exchange Rate	$REXRT_t$	Benchmarking ZAR on USD (a rate which is an indication for international competitiveness)
Total consumption of sheep and goat in South Africa	$TOCONS_t$	Total consumption in tons
Consumption per capital	$CONSPC_t$	Consumption in kg per year

Source: Author's compilation

As depicted on Table 4.3, there are at least nine variables identified to determine the impact of exchange rate on total production output, volume of exports and total employment in the pig industry. There are three dependent variables, which include the total production output, volume of exports and total employment. The independent variables identified are as follows: real exchange rate, total consumption, total slaughtered, total number of sheep and goats, consumption per capital. The response of regressors to the dependant variables in analysing the impact of exchange rate on total production output, volume of exports and total employment are indicated. Table 4.3 also includes the abbreviations of variables and unit of measurement of independent variables in response to variations in the dependent variables.

Table 4.3: List of Variables for the Pig Industry

Dependent variables description	**Abbreviations**	**Unit of measurement**
Production output in the Pig Industry	$PROTP_t$	Total annual output in tons
Volume of South African Pig Industry exports	$VOLEXPT_t$	Value of exports in South African Rand
Total employment in the Pig Industry	$TOEMP_t$	Total number of people employed
Independent variables description	**Abbreviations**	**Unit of measurement**
Total pig number in South Africa	$TOPINU_t$	Total number of sheep and goat (count)
Total number of pigs slaughtered	$TOSLAU_t$	Total number of cattle slaughtered (count)
Imports output	$IMPO_t$	Value of imports in South African Rand
Real Exchange Rate	$REXRT_t$	Benchmarking ZAR on USD (a rate which is an indication for international competitiveness)
Total consumption of pig in South Africa	$TOCONS_t$	Total consumption in tons
Consumption per capital	$CONSPC_t$	Consumption in kg per year

Source: Author's compilation

Table 4.4 presents all objectives of the study and their techniques or approach to achieve each objective included in the study. Descriptive statistics using the following statistical packages EViews and Microsoft Excel for first objective. This package was summarised data, which included the provision of the measure of central tendency that included the mean, median, mode, minimum, maximum, standard deviation and skewness. Ordinal Least Square model was employed for effect measurements of floating exchange rate of red meat consumer.

Table 4.4: List of objectives and their techniques to achieve.

Objectives to be addressed	**Model/technique**	**Model specification**	**Model description**
1st Objective	Descriptive statistics using the following statistical packages: EViews and Microsoft Excel.	Statistical packages: EViews and Microsoft Excel.	This package was summarised data, which included the provision of the measure of central tendency that included the mean, median, mode, minimum, maximum, standard deviation and skewness.
2nd Objective	ARDL-ECM model Error Correction version of the Autoregressive Distributed Lag	$\Delta lnY_{it} = \beta_0 + \beta_1 \Delta lnX_{1t} + \beta_2 \Delta lnX_{2t} + \beta_3 \Delta lnX_{3t} + \beta_4 \Delta lnX_{4t} + \beta_5 \Delta lnY_{5t-1} + \varepsilon_t$	Where m and n are lagged time period, ε_t is the error term and β_i's represent coefficient and α_1's represent coefficients for long run relationship.
3rd Objective	Bound cointegration test for short-run association estimation	$\Delta lnY_{it} = \beta_0 + \beta_1 \Delta lnX_{1t} + \beta_2 \Delta lnX_{2t} + \beta_3 \Delta lnX_{3t} + \beta_4 \Delta lnX_{4t} + \beta_5 \Delta lnY_{5t-1} + \pi ECMt - 1 + \varepsilon_t$	Where y_t represents the dependent variable, while X_{1t} until X_{kt} denote the explanatory variables. Where $\pi ECMt - 1$ represents error correction parameter and ε_t is an error term.
4th Objective	Granger Causality for causal relationship	$Y_t = \sum_{i=1}^{m} \lambda_i Y_{t-i} + \sum_{j=1}^{m} \delta_j X_{t-j} + \mu_{1t}$	Where it was assumed that the disturbances μ_{1t}. Variable Y is decided by lagged variable Y and

			Y, so does except that its dependent variable is Y instead of X.
5th Objective	Ordinal Least Square model for effect	$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + D_{Tt} + \varepsilon_t$	Where y_t represents the dependent variable, while $X_{1,it}$ until $X_{k,it}$ denote the explanatory variables. Where D_{Tt} represents period dummies and ε_t is an error term.

4.7 Chapter Summary

The chapter presented the data requirements, data management procedures, data analytical techniques and data sources used to estimate the different methods of achieving the study objectives. The chapter commenced with an overview of the study area for the selected groups in the red meat industry, followed by data collection, which outlined how and where the data were collected for the variables included in the estimations. The procedures or approaches adapted to analyse the impact of floating exchange rate on total production output, volume of exports and total employment within the selected South Africa red meat industries were also explained. Furthermore, the chapter outlined the objective-procedures used to achieve each objective. Lastly, the study received institutional ethical clearance as it is attached in the appendices. The following chapter presents the results and discussion of the study.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 Introduction

This chapter presents and discusses the findings on the impact of the floating exchange rate on total production output, volume of exports and total employment within the three selected red meat industries of South Africa. The first results presented are descriptive statistics, which address the first objective that entails outlining the performance of the South African red meat industry in terms of total production output, volume of exports and total employment. Secondly, the chapter presents the error correction model of the autoregressive distribution lag version (ARDL-ECM) analysis of the impact of the floating exchange rate on production output, volume of exports and total employment.

Thirdly, the ARDL Bound test for short run and long run relationship among the variables was applied to check the association among total production output, volume of exports and total employment in the prioritised three South African red meat industries. Fourthly, the granger causality test (GCT) focused on determining the causality relationship or effect amongst total production output, volume of exports, total employment, and exchange rate in six South African red meat industries. Lastly, the ordinary least square (OLS) concentrated on determining the effect and contribution of red meat consumption on total production output, volume of exports and total employment in the South African red meat industry.

5.2 Descriptive Statistics

This section outlines the basic feature of the dataset adopted in the study. The descriptive statistics paints summaries of a sample and guides the selection of inferential techniques. Furthermore, it offers various indicators to clarify the type of data in use. Therefore, when a large set of data is described with a particular indicator, there is always the risk of misrepresenting the original dataset (Gujarati, 2015).

5.2.1 Cattle/Beef

The minimum total cattle/beef number estimation is equivalent to 12.3 million, while its maximum is 13.9 million; the average value is 13.4 million and standard deviation is equivalent to 454532.727. The minimum total production of cattle/beef estimation is equivalent to 496 thousand tonnes, while its maximum value is about 1 million tonnes; the average value is 774 thousand tonnes and standard deviation is equivalent to 206834.814. The minimum total cattle/beef consumption estimation is equivalent to 554 thousand tons, while its maximum value is 1 million tons; the average value is 774 thousand and standard deviation is equivalent to 180127.122.

Table 5.1 shows that the minimum volume of exports (South African Rand) is R 18.1 million, the maximum volume of exports is R 1.2 billion, mean is about R 279 million and standard deviation is equivalent to 366705466.884 . The minimum total slaughter is about 215 thousand, while the maximum total slaughter is equivalent to 3.6 million, the mean is about 2.8 million and the value of standard deviation is equivalent to 447973.174.

Table 5.1 highlights that the minimum real exchange rate is equivalent to R 3.6271, the maximum real exchange rate is about R 16.4719, while mean is about R 8.824742 and standard deviation is equivalent to R 3.4693039. The minimum total employment is estimated to be equivalent to 92 thousands; the maximum total employment is equivalent to 144 thousand, the average total employment is about 118 thousand and the standard deviation is about 13711.085. As illustrated in Table 5.1, the minimum consumption per capital is equivalent to 12.69000 kg/year, the maximum consumption per capital is equivalent to 19.63000 kg/year; the mean is about 16.27577 kg/year and the standard deviation is about the 1.987079.

Table 5.1: Summary Statistics for the Beef/Cattle Industry

Properties /Variable	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
TOCANU	12300000	13900000	13450000.00	454532.727
PROTP	496300	1090900	774196.15	206834.814
TOCONS	554000	1079000	795500.00	180127.122

VOLEXPT	18144666	1216514361	279159634.96	366705466.884
TOSLAU	2159000	3662000	2832269.23	447973.174
REXRT	3.6271	16.4719	8.824742	3.4693039
TOEMP	92000	144000	118076.92	13711.085
CONSPC	12.69000	19.63000	16.27577	1.987079

Source: Author's calculations based on Eviews 12

5.2.2 Pig

As depicted in Table 5.2, the minimum total pig number estimation is equivalent to 1.3 million, while its maximum is 1.7 million; the average value is 1.6 million and standard deviation is equivalent to 102352.212. The minimum total production of pig estimation is equivalent to 106 thousand tonnes, while its maximum value is about 289 thousand tonnes; the average value is 180 thousand tonnes and standard deviation is equivalent to 53452.433. The minimum total consumption of pig estimation is equivalent to 115 thousand tonnes, while its maximum value is 300 thousand tonnes; the average value is 196 thousand and standard deviation is equivalent to 58265.823.

Table 5.2 shows that the minimum volume of exports (South African Rand) is R 6.4 million, the maximum volume of exports is R 353 million, mean is about R 116 million and standard deviation is equivalent to 132479230.351. The minimum total slaughter is about 1.8 million, while the maximum total slaughter is equivalent to 3.5 million, the mean is about 2.4 million and the value of standard deviation is equivalent to 442873.818.

Table 5.2 reveals that the minimum total employment is estimated to be equivalent to 2 thousands; the maximum total employment is equivalent to 3.3 thousand, the average total employment is about 3 thousand and the standard deviation is about 193.321. The minimum real exchange rate is equivalent to R 3.6271, the maximum real exchange rate is about R 16.4719, while the mean is about R 8.824742 and the standard deviation is equivalent to R 3.4693039. As illustrated in Table 5.3, the minimum consumption per capital is equivalent to 2.600000 kg/year, the maximum consumption per capital is equivalent to 5.100000 kg/year; the mean is about 3.992308 kg/year and the standard deviation is about the 0.764159.

Table 5.2: Summary Statistics for the Pig Industry

Properties /Variable	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
TOPINU	1357000	1780000	1601153.85	102352.212
PROTP	106900	289400	180776.92	53452.433
TOCONS	115000	300000	196115.38	58265.823
VOLEXPT	6495322	353690860	116181250.04	132479230.351
TOSLAU	1864000	3504000	2477461.54	442873.818
TOEMP	2613	3312	3017.65	193.321
REXRT	3.6271	16.4719	8.824742	3.4693039
CONSPC	2.600000	5.100000	3.992308	0.764159

Source: Author's calculations based on Eviews 12

5.2.3 Sheep and Goat

As depicted in Table 5.3, the minimum total sheep and goat number estimation is equivalent to 20.6 million, while its maximum is 27.9 million; the average value is 24.2 million and standard deviation is equivalent to 2023188.048. The minimum total production of sheep and goat estimation is equivalent to 94 thousand tonnes, while its maximum value is about 184 thousand tonnes; the average value is 141 thousand tonnes and standard deviation is equivalent to 31081.895. The minimum total consumption of sheep and goat estimation is equivalent to 118 thousand tonnes, while its maximum value is 203 thousand tonnes; the average value is 116 thousand and standard deviation is equivalent to 20364.071.

Table 5.3 shows that the minimum volume of exports (South African Rand) is R 773 thousand, the maximum volume of exports is R 146 million, mean is about R 27 million and standard deviation is equivalent to 32856569.718. The minimum total slaughter is about 5.2 million, while the maximum total slaughter is equivalent to 7.3 million, the mean is about 6.2 million and the value of standard deviation is equivalent to 537794.882.

As illustrated in Table 5.3, the minimum total employment is estimated to be equivalent to 25 thousands; the maximum total employment is equivalent to 37 thousand, the average total employment is about 32 thousand and the standard deviation is about

3405.688. The minimum real exchange rate is equivalent to R 3.6271, the maximum real exchange rate is about R 16.4719, while mean is about R 8.824742 and standard deviation is equivalent to R 3.4693039. As shown in Table 5.3, the minimum consumption per capital is equivalent to 3.000000 kg/year, the maximum consumption per capital is equivalent to 4.300000; the mean is about 3.500000 and the standard deviation is about the 0.309764.

Table 5.3: Summary Statistics for the Sheep and Goat Industry

Properties /Variable	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
TOSGNU	20666000	27972000	24275961.54	2023188.048
PROTP	94800	184600	141050.00	31081.895
TOCONS	118000	203000	166846.15	20364.071
VOLEXPT	773690	146965454	27914094.15	32856569.718
TOSLAU	5203000	7309000	6298153.85	537794.882
TOEMP	25430	37090	32250.12	3405.688
REXRT	3.6271	16.4719	8.824742	3.4693039
CONSPC	3.000000	4.300000	3.500000	0.309764

Source: Author's calculations based on Eviews 12

5.3 Unit root test

Performing several tests on time series data requires that variables be in a stationary mode and cointegrated. Therefore, the estimation was done to know whether a time series is stationary or non-stationary. According to Gujarati (2003), a stationary time series is one whose statistical properties such as mean, variance and standard deviation, remain the same or are all constant over time no matter at what point or level they are measured. If the time series is non-stationary, it implies that the series has a time varying mean or time varying variance or both. Brooks and Rew (2002) came up with the diagnosis for a non-stationary problem to say that, if a series is non-stationary, it must be differenced (d) before it becomes stationary. The series is regarded as integrated of order (where (d) is the order of integration). The order of

integration (d) shows the number of unit roots in the number of differencing operations it takes to make the series stationary.

The study adopted the ADF test to check for stationarity of all variables used in estimating the econometric models. According to Bongsha (2011), secondary data is susceptible to non-stationarity, which results in spurious estimation and misleading findings. The ADF provides three separate equations to test for the stationarity of series. The initial equation has a constant only ($a0$), succeeded by the equation with an intercept term ($a0$) and trend; thirdly, the equation has neither intercept nor a deterministic trend (t). The intuition is that the disturbance term in all the three equations is independent with equally distributed variance (Chamalwa and Bakari, 2016; Gujarati 2003; Wooldridge, 2013). Notably, all the three equations are referred as ADF tests and presented below:

$\Delta Y_t = \beta_1 + ZY_{t-1} + a_i + \varepsilon_t$ (Constant only)……(5.1)

$\Delta Y_t = \beta_1 + \beta_2 + ZY_{t-1} + a_i + \varepsilon_t$ (Constant and trend)……(5.2)

$\Delta Y_t = ZY_{t-1} + a_i + \varepsilon_t$ (No constant, no trend)……(5.3)

Where Yt represents the variable of interest, t denotes a time trend, $\beta 1$ is the constant, $t-1$ shows a lag length while Z is the coefficient of the lagged variable and εt is the disturbance term. The ADF test is used to determine if a variable has a unit root or not. The rule of thumb is that if the t statistic value is greater than the ADF's critical value at 95% confidence interval, then the hypothesis of stationarity was rejected, and the conclusion is that the series has a unit root or is non-stationary. Therefore, for a series to be stationary, it is transformed into first difference or sometimes into the second difference. The stationarity test using the ADF for all identified variables was adopted for the three selected red meat industries. The information displayed in Tables 5.4 until 5.6 are ADF test results of the selected three red meat industries.

5.3.1 Cattle/Beef Industry

Following the procedure of Dickey and Fuller (1979), the study applied the ADF unit root test to statistically determine the stationarity properties of the data. In the test, the study rejected the null hypothesis of unit root, if the p-value of the ADF statistic is equal or less than 5% level of significance. According to Table 5.4, there is a total of eight

variables included in the analysis of the cattle/beef industry, in which one variable was found to be stationary at levels [$I(0)$] and eight variables were stationary after first differencing [$I(1)$]. One variable that was found to be stationary at level was the total slaughtered while seven variables found to be stationary at first difference were the total number of cattle, volume of exports, imports, total consumption; total production output consumption per capital and real exchange rate. The stationarity of variables provides non-spurious estimates and unbiased findings. Furthermore, one of the assumptions underlying the Ordinary Least Square (OLS) is that all variables included in the estimation should be tested for stationarity to predict the Best Linear Unbiased Estimate (BLUE).

Table 5.4: Unit root test for Cattle/Beef variables using ADF test

Variables	Order of integration				$Conclusion$
	Level		1st difference		
	C	C&T	C	C&T	
TOCANU	0.1414	0.1384	0.0013	0.0084	Stationary at $I(1)$
PROTP	0.8310	0.3235	0.0011	0.0065	Stationary at $I(1)$
TOCONS	0.8353	0.3237	0.0002	0.0108	Stationary at $I(1)$
VOLEXPT	0.9982	0.9713	0.0154	0.0066	Stationary at $I(1)$
TOSLAU	0.0474	0.0306	---------	--------	Stationary at $I(0)$
TOEMP	0.2883	0.5749	0.0000	0.0001	Stationary at $I(1)$
REXRT	0.9440	0.8487	0.0145	0.0434	Stationary at $I(1)$
CONSPC	0.5171	0.1827	0.0002	0.0104	Stationary at $I(1)$

Notes: the difference between the calculated t-statistics and critical value at 5% level is used to test a presence of a unit root, *** denotes rejection of hypothesis for unit root at 1% level (p≤0.01) while ** shows rejection of hypothesis for unit root at 5% level (p≤0.05), respectively.

5.3.2 Pig Industry

To statistically determine the stationarity properties of the data, the research applied the ADF unit root test. In the test, the study rejected the null hypothesis of unit root, if the p-value of the ADF statistic is equal or less than 5% level of significance. According to Table 5.5, there is a total of eight variables included in the analysis of the pig

industry, in which one variable was found to be stationary at levels [$I(0)$] and eight variables were stationary after first differencing [$I(1)$]. One variable which was found to be stationary at level was total production output while the seven variables found to be stationary at first difference were the total number of pig, volume of exports, imports, total consumption, total slaughtered, consumption per capital and real exchange rate.

Table 5.5: Unit Root Test for Pig Variables Using ADF Test

Variables	Order of integration				$Conclusion$
	Level		1st difference		
	C	C&T	C	C&T	
TOPINU$_t$	0.9994	0.9998	0.0000	0.0533	Stationary at $I(1)$
PROTP$_t$	0.0443	0.0338	--------	--------	Stationary at $I(0)$
TOCONS$_t$	0.9818	0.4471	0.0029	0.0101	Stationary at $I(1)$
VOLEXPT$_t$	0.9830	0.6935	0.0003	0.0006	Stationary at $I(1)$
TOSLAU$_t$	0.9940	0.8438	0.0001	0.0001	Stationary at $I(1)$
TOEMP$_t$	0.4406	0.6434	0.0009	0.0066	Stationary at $I(1)$
REXRT$_t$	0.9440	0.8487	0.0145	0.0434	Stationary at $I(1)$
CONSPC$_t$	0.8898	0.4856	0.0020	0.0101	Stationary at $I(1)$

Notes: the difference between the calculated t-statistics and critical value at 5% level is used to test a presence of a unit root, *** denotes rejection of hypothesis for unit root at 1% level (p≤0.01) while ** shows rejection of hypothesis for unit root at 5% level (p≤0.05), respectively.

5.3.3 The Sheep and Goat Industry

To statistically determine the stationarity properties of the data, the research applied the ADF unit root test. In the test, the study rejected the null hypothesis of unit root, if the p-value of the ADF statistic was equal or less than 5% level of significance. According to Table 5.6, there is a total of eight variables included in the analysis of the sheep and goat industry, in which one variable was found to be stationary at levels [$I(0)$] and eight variables were stationary after first differencing [$I(1)$]. One variable which was found to be stationary at level was the total consumption while the seven variables found to be stationary at first difference were a total number of sheep and

goat, volume of exports, imports, total production output, total slaughtered, consumption per capital and real exchange rate.

Table 5.6: Unit Root Test for Sheep and Goat Variables Using ADF Test

Variables	Order of integration				$Conclusion$
	Level		1st difference		
	C	C&T	C	C&T	
$TOSGNU_t$	0.9108	0.8299	0.0023	0.0120	Stationary at $I(1)$
$PROTP_t$	0.7073	0.5492	0.0021	0.0146	Stationary at $I(1)$
$IMPO_t$	0.4113	0.9030	0.0013	0.0046	Stationary at $I(1)$
$TOCONS_t$	0.0345	0.0289	--------	------	Stationary at $I(0)$
$VOLEXPT_t$	0.9999	0.8957	0.0225	0.0336	Stationary at $I(1)$
$TOSLAU_t$	0.2065	0.1116	0.0020	0.0043	Stationary at $I(1)$
$TOEMP_t$	0.1225	0.3365	0.0000	0.0000	Stationary at $I(1)$
$REXRT_t$	0.9440	0.8487	0.0145	0.0434	Stationary at $I(1)$
$CONSPC_t$	0.0580	0.1382	0.0047	0.0079	Stationary at $I(1)$

Notes: the difference between the calculated t-statistics and critical value at 5% level is used to test a presence of a unit root, *** denotes rejection of hypothesis for unit root at 1% level ($p \leq 0.01$) while ** shows rejection of hypothesis for unit root at 5% level ($p \leq 0.05$), respectively.

The unit root tests were succeeded by statistical inferences to estimate the impact of the exchange rate on total production output, volume of exports and total employment in the red meat industry of South Africa. The economic theory suggests that when dealing with secondary data, it is always required to perform a stationarity test before running an analytical technique to avoid spurious results (Gujarati & Porter, 2009; Gujarati, 2015; Wooldridge, 2013). The following section provides detailed results and their interpretation from three economic analyses. The economic models involved in the study are: ARDL-ECM model, granger causality test and ordinary least square. The findings are expected to be shared through international publications and also inform policymaking processes.

5.4 Results of the Econometric Analysis

This section presents the estimation results and interpretations from four analytical frameworks, namely: ARDL-ECM model, which tests the impact of the exchange rate on production output, volume of exports and total employment in the selected three South African red meat industries; ARDL bound test for long run relationship or association among included variables; the granger causality test, which concentrates on the causality effect amongst total production output, volume of exports, total employment, and exchange rate in the three South African red meat industries, and lastly, ordinary least square (OLS), which focuses on the effect of consumption on the total production output, volume of exports, total employment, and exchange rate in the South African red meat industry.

Following Nwani and Bassey (2016), the study used the ARDL-ECM approach proposed by Pesaran *et al*. (2001). The ARDL approach provides some desirable advantages over the other traditional cointegration because the ARDL test process provides effective results, whether the variables are integrated at I(0) or integrated at I(1) or mutually co-integrated, which was noted on the stationary test earlier. Another advantage of using the ADRL approach is when the study has a small size of observations and several order of integration of the study variables, which is why the ARDL was the preferred method of this study.

Metsileng *et al* (2018) modelled the BRICS exchange rates using the Vector Autoregressive (VAR) model. Monthly time series data ranging from January 2008 to January 2018 were used. The results revealed that there is a unidirectional relationship amongst the BRICS exchange rates. The VAR model did not satisfy all the diagnostic tests, therefore forecasting future values of the BRICS exchange rates could not be computed. Recommendations for different approaches were formulated; hence, for this study, the ARDM-ECM approach was adopted to capture the impact of the floating exchange rate on production output, volume of exports and employment in the red meat industry of South Africa.

Table 5.7 shows the first stage of ARDL-ECM approach, which is to carry out or determine the number of lag length selection criterion to be utilised throughout the

estimation process for the cattle/beef industry. There are numerous criteria for selecting the lag length when using a time series, namely: Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan Quinn Criterion (HQ) and Schwartz Information Criterion (SC). The study adopted the AIC as the preferred criterion, which takes into cognisance the sample prediction error and specification error (Chamalwa and Bakari, 2016; Kilian and Lutkepohl, 2016; Ratombo, 2019). As depicted in Table 5.7, the optimum lag for the cattle/beef estimation is on level one, which indicates that one lag would be adopted throughout the estimation procedure on cattle/beef industry's regression.

Table 5.7: Lag Selection Criteria Cattle/Beef Industry

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-562.9019	NA	9.45e+09	45.67215	46.06219	45.78033
1	-392.9336	217.5595*	2576252.*	37.19469*	40.70505*	38.16831*

Source: Author own computation based on Eviews 12
*indicate lag order selected by the criterion
LR: sequential modified LR test statistics (each at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The study adopted the bound test of ARDL approach to determine the long run and short run cointegration among the variables or in the estimation. This study followed the work of Nwani and Bassey (2016) who used the ARDL approach proposed by Pesaran *et al*. (2001). The ARDL approach provides some desirable advantages over the other traditional cointegration approaches like Engle-Granger cointegration test (EGCT) and Johansen cointegration test (JJCT). On the other hand, these cointegration approaches require that all variables be integrated into the same order. The ARDL test process provides effective results, whether the variables are integrated at I(0) or integrated at I(1) or mutually co-integrated (Pesaran *et al*. 2001). A small size of observations and several orders of integration of the study variables make ARDL the preferred method of this study.

The study used the AIC to select the lag length for ARDL approach (Narayan, 2005). The findings of the cointegration test based on the ARDL bounds testing approach are detailed in Table 5.8. Results reveal that when the total production output, volume of

exports and total employment are used as dependent variables for the cattle/beef industry, the calculated F-statistics are 319.9608, 6.187654 and 4.058013 respectively, which are greater than the lower bound (2.69) and upper bound (3.83) at 5% significance level. The outcomes of the bounds test conclude that there are three cointegrating vectors that validate the presence of long-run linkage between the total production output, volume of exports and total employment in the cattle/beef industry of the South African red meat industry. Results in Table 5.8 show that there are cointegration vectors among the total production output, volume of exports and total employment, which confirm the robustness of long-run association.

Table 5.8: Long-Run and Bound Test for Cattle/Beef Industry

Variable	F-Statistics value	Significant level	Lower bound 1(0)	Upper bound 1(1)
LNPROTP	319.9608	5%	2.69	3.83
LNVOLEXPT	6.187654	5%	2.69	3.83
LNTOEMP	4.058013	5%	2.69	3.83

Source: Author's own computation based on Eviews 12

5.4.1 ARDL-ECM Estimation Results for Beef/Cattle Industry

Total Production Output

This study confirmed the long run cointegration by using ARDL bound estimation earlier. The short-run elasticities or adjustments for total production output and its determinant when total production output is used as the dependent variable are presented below in Table 5.9. Table 5.9 indicates that the coefficient for ECT is linked to the total production output, which carries an anticipated negative sign, while it shows to be statistically significant at 5% level and its adjustment speed towards equilibrium is 0.93%.

The implication is that in the short run, the total production output is converging by at least 0.93% of last year's deviation from the equilibrium. The smaller value such as 0.93% is associated with slow speed of adjustment to equilibrium. Therefore, the speed of convergence for the total production output to equilibrium is slower. Other

variables included in the total production output estimation include consumption per capital and real exchange rate, which are statistically significant at 5% level while others are not statistically significant.

Table 5.8 results also reveal that the values of the adjusted R^2 were estimated to be 70%, when the total production output is the dependent variable, which confirms that the models are strongly good fitted. Estimated error correction term (ECT_{t-1}) coefficient is negative and significant ensuring that the adjustment process from the short-run deviation for the equilibrium is at a slow speed on the total production output from the previous period's shock, which will converge back to the long-run equilibrium in the current period by the explanatory variables.

Volume of Exports

This study confirmed the long run cointegration by using the ARDL bound estimation earlier. The short-run elasticities or adjustments for volume of exports and its determinant when volume of exports is used as the dependent variable are presented below in Table 5.9. Table 5.9 indicates that the coefficient for ECT is linked to the volume of exports, which carries an anticipated negative sign, while it shows to be statistically significant at 5% level and its adjustment speed towards equilibrium is 1.72%.

The implication is that in the short run, the volume of exports is converging by at least 1.72% of last year's deviation from the equilibrium. The smaller value such as 1.72% is associated with the slow speed of adjustment to equilibrium. Therefore, the speed of convergence for the volume of exports to equilibrium is slower. Other variables included on the volume of exports estimation include consumption per capital and real exchange rate, which are statistically significant at 5% level while others show not to be statistically significant.

Table 5.9 results also reveal that the values of the adjusted R^2 were estimated to be 0.99%, when volume of exports is the dependent variable, which confirms that the models are strongly good fitted. Estimated error correction term (ECT_{t-1}) coefficient is

negative and significant ensuring that the adjustment process from the short-run deviation for the equilibrium is at a slow speed on the volume of exports from the previous period's shock, which will converge back to the long-run equilibrium in the current period by the explanatory variables.

Total Employment

This study confirmed the long run cointegration by using the ARDL bound estimation earlier. The short-run elasticities or adjustments for total employment and its determinant when total employment is used as the dependent variable are presented below in Table 5.9. Table 5.9 indicates that the coefficient for ECT is linked to the total employment, which carries an anticipated negative sign, while it shows to be statistically significant at 5% level and its adjustment speed towards equilibrium is 1.06%.

The implication is that in the short run, the total employment is converging by at least 1.06% of last year's deviation from the equilibrium. The smaller value such as 1.06% is associated with the slow speed of adjustment to equilibrium. Therefore, the speed of convergence for the total employment to equilibrium is slower. Other variables included in the total employment estimation include the total slaughtered, which is statistically significant at 5% level while other shows not to be statistically significant.

Table 5.9 result also reveals that the values of the adjusted R^2 were estimated to be 70%, when total employment is dependent variables, which confirms that the models are strongly good fitted. Estimated error correction term (ECT_{t-1}) coefficient is negative and significant ensuring that the adjustment process from the short-run deviation for the equilibrium is at a slow speed on employment from the previous period's shock, which will converge back to the long-run equilibrium in the current period by the explanatory variables.

Table 5.9: ARDL-ECM Estimation Results for the Beef/Cattle Industry

Error correction	*D(LNPROTP)*	*D(LNTOEMP)*	*D(LNVOLEXPT)*
Error correction term (speed of adjustment)	-0.93* (0.0000)	-1.06 (0.0001)	-1.72 (0.0000)
$CONSPC_t$	0.05 (0.0000)	-0.11 (0.4614)	1.73** (0.0016)
$REXRT_t$	0.0093** (0.018)	0.039 (0.1829)	0.25** (0.0008)
$LNTOCANU_t$	6.64 (0.1409)	3.37 (0.4578)	1.04 (0.2707)
$LNTOSLAU_t$	6.13 (0.1771)	1.13 (0.0287)	1.03 (0.9117)
$LNTOCONS_t$	-1.09 (0.1534)	-51.35 (0.4390)	16.59 (0.9367)
R-squared	0.70	0.70	0.99

Source: Author's own computation based on Eviews 12

The Granger causality test is adopted to test the causal relationship or causality effects amongst variables included in the regression, namely, volume of exports ($LNVOEXPT_t$), real exchange rate ($REXRT_t$), total employment ($LNTOEMP_t$) and total production output ($LNPROTP_t$) in the beef/cattle industry. Table 5.10 below highlights a single directional causality effect between the real exchange rate and volume of exports, as the p-values are less than 0.05 significant level (5%). The statistical hypothesis test for determining whether one time series is useful in forecasting another (Granger, 1969 in Gilmore and McManus, 2002). This is attributed to the fact that the more the real exchange rate fluctuates, it affects or triggers the volume of products exported to other countries by the cattle/beef industry. As the real exchange rate changes, it tends to affect the volume of exports by the industry because it translates into long-term causality effects between the two variables. Under this industry, it is not only real exchange rate and volume of exports that has a long run association, but also the volume of exports and total employment in the cattle/beef industry, which shows that there is a long run effect. This means that the volume of exports has an effect on total employment in the long run. Table 5.10 shows no total of the long run effects of causality for other variables that were also included in the Granger causality test for the cattle/beef industry.

Table 5.10: Granger Causality Test for Beef/Cattle Industry

Null hypothesis	*F-statistics*	*Prob.*
$LNPROTP_t$ does not granger cause ($REXRT_t$	1.39058	0.2509
($REXRT_t$ does not granger cause $LNPROTP_t$	0.35832	0.5556
$LNTOEMP_t$ does not granger cause ($REXRT_t$	0.34648	0.5621
($REXRT_t$ does not granger cause $LNTOEMP_t$	0.96544	0.3365
$LNVOEXPT_t$ does not granger cause ($REXRT_t$	2.73836	0.1122
($REXRT_t$ does not granger cause $LNVOEXPT_t$	3.94305	0.0497
$LNTOEMP_t$ does not granger cause $LNPROTP_t$	0.00388	0.9509
$LNPROTP_t$ does not granger cause $LNTOEMP_t$	0.27620	0.6045
$LNVOEXPT_t$ does not granger cause $LNPROTP_t$	0.29183	0.9509
$LNPROTP_t$ does not granger cause $LNVOEXPT_t$	3.15770	0.6045
$LNVOEXPT_t$ does not granger cause $LNTOEMP_t$	3.64399	0.0494
$LNTOEMP_t$ does not granger cause $LNVOEXPT_t$	1.05757	0.3149

Source: Author's own computation based on Eviews

Note: the relationship with p-values below 0.05 percent signifies the causality effects between the variables, while the relationship with p-value over 0.05 percent denotes no causality between the variables.

PIG Industry Analysis

Table 5.11 shows the firs.t stage of ARDL-ECM approach, which is to carry out or determine the number of lag length selection criterion to be utilised throughout the estimation process for the pig industry. There are numerous criteria for selecting the lag length when using a time series, namely: Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan Quinn Criterion (HQ) and Schwartz Information Criterion (SC). The study adopted the AIC as the preferred criterion because it takes cognisance of the out sample prediction error and specification error (Chamalwa and Bakari, 2016; Kilian and Lutkepohl, 2016; Ratombo, 2019). As depicted in Table 5.6, the optimum lag for the pig estimation is on level one, which indicates that one lag would be adopted throughout the estimation procedure on the pig industry's regression.

5.11: Lag Selection Criteria Pig Industry

Lag	LogL	LR	FPE	AIC	SC	HQ
0	183.7439	NA	1.08e+09	-14.05952	-13.66948	-13.95134
1	329.5109	186.5817*	2.05e-19*	-20.60087*	-17.09051*	-19.62725*

Source: Author's own computation based on Eviews 12
*indicate lag order selected by the criterion
LR: sequential modified LR test statistics (each at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The study adopted the bound test of ARDL approach to determine the long run and short run cointegration among the variables or in the estimation. This study followed the work of Nwani and Bassey (2016) who used the ARDL approach proposed by Pesaran *et al.* (2001). The ARDL approach provides some desirable advantages over the other traditional cointegration approaches like Engle-Granger cointegration test (EG) and the Johansen cointegration test (JJCA). On the other hand, these cointegration approaches require that all variables be integrated into the same order. The ARDL test process provides effective results, whether the variables are integrated at I(0) or integrated at I(1) or mutually co-integrated (Pesaran *et al.* 2001). A small size of observations and several order of integration of the study variables made the ARDL the preferred method of this study.

The study used the AIC to select the lag length for ARDL approach (proposed by Pesaran *et al*. 2001; Narayan, 2005). The findings of the cointegration test based on the ARDL bounds testing approach are detailed in Table 5.12. Results reveal that when the total production output, volume of exports and total employment are used as dependent variables for the pig industry, the calculated F-statistics are 65.63413, 3.904162 and 5.456489, respectively, which are greater than the lower bound (2.69) and upper bound (3.83) at 5% significance level.

The outcomes of the bounds test conclude that there are three cointegrating vectors that validate the presence of long-run linkage between total production output, volume of exports and total employment in the pig industry of the South African red meat industry. Results in Table 5.12 show that there are cointegration vectors among the

total production output, volume of exports and total employment, which confirm the robustness of long-run association.

Table 5.12: Long-Run and Bound Test for Pig Industry

Variable	F-Statistics value	Significant level	Lower bound 1(0)	Upper bound 1(1)
LNPROTP	65.63413	5%	2.69	3.83
LNVOLEXPT	3.904162	5%	2.69	3.83
LNTOEMP	5.456489	5%	2.69	3.83

Source: Author's own computation based on Eviews

5.4.2 ARDL-ECM Estimation Results for Pig Industry

Total Production Output

This study confirmed the long run cointegration by using the ARDL bound estimation earlier. The short-run elasticities or adjustments for the total production output and its determinant when the total production output is used as the dependent variable, are presented below in Table 5.13. Table 5.13 indicates that the coefficient for ECT is linked to the total production output, which carries an anticipated negative sign, while it shows to be statistically significant at 5% level and its adjustment speed towards equilibrium is 0.92%.

The implication is that in the short run, the total production output is converging by at least 0.92% of last year's deviation from the equilibrium. The smaller value such as 0.92% is associated with a slow speed of adjustment to equilibrium. Therefore, the speed of convergence for the total production output to equilibrium is slower. Other variables included on the total production output estimation included the real exchange rate, total number pig, total slaughtered and total consumption, which are statistically significant at 5% level while the others did not show to be statistically significant.

Table 5.13 results also reveal that the values of the adjusted R^2 were estimated to be 97%, when the total production output is the dependent variable, which confirms that

the models are strongly good fitted. Estimated error correction term (ECT_{t-1}) coefficient is negative and significant ensuring that the adjustment process from the short-run deviation for the equilibrium is at a slow speed on total production output from the previous period's shock, which will converge back to the long-run equilibrium in the current period by the explanatory variables.

Volume of Exports

This study confirmed the long run cointegration by using the ARDL bound estimation earlier. The short-run elasticities or adjustments for volume of exports and its determinant when volume of exports is used as the dependent variable are presented below in Table 5.13. Table 5.13 indicates that the coefficient for ECT is linked to the volume of exports, which carries an anticipated negative sign, while it shows to be statistically significant at 5% level and its adjustment speed towards equilibrium is 0.48%.

The implication is that in the short run, the volume of exports is converging by at least 0.48% of last year's deviation from the equilibrium. The smaller value such as 0.48% is associated with slow speed of adjustment to equilibrium. Therefore, the speed of convergence for the volume of exports to equilibrium is slower. Other variables included on the volume of exports estimation include consumption per capital, real exchange rate and total number of pigs which are statistically significant at 5% level while others show not to be statistically significant.

Table 5.13 result also reveals that the values of the adjusted R^2 were estimated to be 70%, when the volume of exports is the dependent variable, which confirms that the models are strongly good fitted. Estimated error correction term (ECT_{t-1}) coefficient is negative and significant ensuring that the adjustment process from the short-run deviation for the equilibrium is at a slow speed on volume of exports from the previous period's shock, which will converge back to the long-run equilibrium in the current period by the explanatory variables.

Total employment

This study confirmed the long run cointegration by using the ARDL bound estimation earlier. The short-run elasticities or adjustments for total employment and its determinant when total employment is used as the dependent variable are presented below in Table 5.13. Table 5.13 indicates that the coefficient for ECT is linked to the total employment, which carries an anticipated negative sign, while it shows to be statistically significant at 5% level and its adjustment speed towards equilibrium is 0.22%.

The implication is that in the short run, the total employment is converging by at least 0.22% of last year's deviation from the equilibrium. The smaller value such as 0.22% is associated with the slow speed of adjustment to equilibrium. Therefore, the speed of convergence for the total employment to equilibrium is slower. Other variables included in the total employment estimation include total consumption, which is statistically significant at 5% level while the other showed not to be statistically significant.

Table 5.13 results also reveal that the values of the adjusted R^2 were estimated to be 54%, when total employment is the dependent variable, which confirms that the models are strongly good fitted. Estimated error correction term (ECT_{t-1}) coefficient is negative and significant ensuring that the adjustment process from the short-run deviation for the equilibrium is at a slow speed on employment from the previous period's shock, which will converge back to the long-run equilibrium in the current period by the explanatory variables.

Table 5.13: ARDL-ECM Estimation Results for Pig Industry

Error correction	*D(LNPROTP)*	*D(LNTOEMP)*	*D(LNVOLEXPT)*
Error correction term (speed of adjustment)	-0.92* (0.0000)	-0.22 (0.0001)	-0.48 (0.0000)
CONSPCt	0.06 (0.3384)	0.91 (0.5680)	0.99 (0.4500)
REXRTt	0.012** (0.0290)	0.08 (0.4126)	-0.15 (0.4747)

LNTOPINUt	0.56* (0.0134)	1.46 (0.5628)	10.87 (0.0122)
LNTOSLAUt	0.49* (0.0021)	0.84 (0.7225)	4.86 (0.6518)
LNTOCONSt	0.56** (0.0134)	0.51 (0.0489)	-5.11 (0.4378)
R-squared	0.97	0.52	0.70

Author's own computation

The Granger causality test was adopted to test the causal relationship or causality effects amongst variables included in the regression, namely, volume of exports ($LNVOEXPT_t$), real exchange rate ($REXRT_t$), total employment ($LNTOEMP_t$) and total production output ($LNPROTP_t$) in the pig industry. Table 5.14 below highlights a directional causality effect between the total production output and volume of exports and volume of exports and total employment as the p-value is less than 0.05 significant level (5%). Statistical hypothesis test for determining whether one time series is useful in forecasting another (Granger, 1969 in Gilmore and McManus, 2002).

This is attributed to the fact that the more the industry produces more output, the greater chance of triggering the volume of industry's products to be exported to other countries. As producers tend to increase the production capacities, it translates into long-term causality effects between the two variables. Under this industry, it is not only the total production output and volume of exports that have a long run association, but also the total employment and volume of exports. The pig industry shows that there is a long run effect, meaning total employment has an effect on the volume of exports in the long run. This affirms the theory that purports to export more, production capacity needs to improve, meaning more people need to be employed so that they will produce more products to be exported. Table 5.14 shows no total of the long run effects of causality for other variables that were also included in the Granger causality test for the sheep and goat industry.

Table 5.14: Granger Causality Test for the pig industry

Null hypothesis	*F-statistics*	*Prob.*
$LNVOEXPT_t$ does not granger cause $LNPROTP_t$	0.54579	0.4678
$LNPROTP_t$ does not granger cause $LNVOEXPT_t$	5.00704	0.0356
$REXRT_t$ does not granger cause $LNPROTP_t$	1.65481	0.2116
$LNPROTP_t$ does not granger cause $REXRT_t$	2.44842	0.1319
$LNTOEMP_t$ does not granger cause $LNPROTP_t$	0.11214	0.7408
$LNPROTP_t$ does not granger cause $LNTOEMP_t$	1.479203	0.2456
$REXRT_t$ does not granger cause $LNVOEXPT_t$	0.01510	0.9032
$LNVOEXPT_t$ does not granger cause $REXRT_t$	2.79203	0.1089
$LNTOEMP_t$ does not granger cause $LNVOEXPT_t$	4.39905	0.0476
$LNVOEXPT_t$ does not granger cause $LNTOEMP_t$	0.00420	0.9489
$LNTOEMP_t$ does not granger cause $REXRT_t$	0.00281	0.9581
$REXRT_t$ does not granger cause $LNTOEMP_t$	0.39366	0.5368

Source: Author's own computation based on Eviews 12

Note: the relationship with p-values below 0.05 percent signifies the causality effects between the variables, while the relationship with p-value over 0.05 percent denotes no causality between the variables.

SHEEP AND GOAT

Table 5.15 shows the first stage of ARDL-ECM approach, which is to carry out or determine the number of lag length selection criterion to be utilised throughout the estimation process for the sheep and goat industry. There are numerous criteria for selecting the lag length when using a time series, namely: Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan Quinn Criterion (HQ) and Schwartz Information Criterion (SC). The study adopted the AIC as the preferred criterion, which take into cognisance the out sample prediction error and specification error (Chamalwa and Bakari, 2016; Kilian and Lutkepohl, 2016; Ratombo, 2019). As depicted in Table 5.14, the optimum lag for the sheep and goat estimation is on level one, which indicates that one lag would be adopted throughout the estimation procedure on the sheep and goat industry's regression.

Table 5.15: Lag Selection Criteria Sheep and Goat Industry

Lag	LogL	LR	FPE	AIC	SC	HQ
0	142.4394	NA	2.95e-09	-10.75515	-10.36511	-10.64697
1	284.2242	181.4846*	7.66e-18*	-16.97794*	-13.46758*	-16.00431*

Source: Author's own computation based on Eviews 12
*indicate lag order selected by the criterion
LR: sequential modified LR test statistics (each at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The study adopted the bound test of the ARDL approach to determine the long run and short run cointegration among the variables or in the estimation. This study followed the work of Nwani and Bassey (2016) who used the ARDL approach proposed by Pesaran *et al,* (2001). The ARDL approach provides some desirable advantages over the other traditional cointegration approaches like Engle-Granger cointegration test (EG) and the Johansen cointegration test (JJCA). On the other hand, these cointegration approaches require that all variables be integrated into the same order. The ARDL test process provides effective results, whether the variables are integrated at I(0) or integrated at I(1) or mutually co-integrated (Pesaran *et al*, 2001). A small size of observations and several order of integration of the study variables made ARDL the preferred method of this study.

The study used the AIC to select the lag length for ARDL approach (proposed by Pesaran *et al*, 2001; Narayan, 2005). The findings of the cointegration test based on the ARDL bounds testing approach are detailed in Table 5.16. Results reveal that when the total production output, volume of exports and total employment are used as dependent variables for the sheep and goat industry, the calculated F-statistics are 65.63413, 3.904162 and 5.456489, respectively, which are greater than the lower bound (2.69) and upper bound (3.83) at 5% significance level.

The outcomes of the bounds test concluded that there are three cointegrating vectors, which validated the presence of long-run linkage between total production output, volume of exports and total employment in the sheep and goat industry of the South

African red meat industry. Results in Table 5.16 show that there are cointegration vectors among the total production output, volume of exports and total employment, which confirm the robustness of long-run association.

Table 5.16: Long-Run and Bound Test for the sheep and goat industry

Variable	F-Statistics value	Significant level	Lower bound 1(0)	Upper bound 1(1)
LNPROTP	6.033167	5%	2.69	3.83
LNVOLEXPT	5.326162	5%	2.69	3.83
LNTOEMP	7.155384	5%	2.69	3.83

Source: Author's own computation based on Eviews 12

5.4.3 ARDL-ECM Estimation Results for the Sheep and Goat Industry

Total Production Output

This study confirmed the long run cointegration by using ARDL bound estimation earlier. The short-run elasticities or adjustments for total production output and its determinant when total production output is used as the dependent variable are presented below in Table 5.17. Table 5.17 indicates that the coefficient for ECT is linked to the total production output, which carries an anticipated negative sign, while it shows to be statistically significant at 5% level and its adjustment speed towards equilibrium is 0.81%.

The implication is that in the short run, the total production output is converging by at least 0.81% of last year's deviation from the equilibrium. The smaller value such as 0.81% is associated with slow speed of adjustment to equilibrium. Therefore, the speed of convergence for the total production output to equilibrium is slower. Other variables included in the total production output estimation include consumption per capital, real exchange rate, total slaughtered and total consumption, which are statistically significant at 5% level while other shows not to be statistically significant.

Table 5.17 results also reveal that the values of the adjusted R^2 were estimated to be 96%, when the total production output is the dependent variable, which confirms that

the models are strongly good fitted. Estimated error correction term (ECT_{t-1}) coefficient is negative and significant ensuring that the adjustment process from the short-run deviation for the equilibrium is at a slow speed on total production output from the previous period's shock, which will converge back to the long-run equilibrium in the current period by the explanatory variables.

Volume of Exports

This study confirmed the long run cointegration by using ARDL bound estimation earlier. The short-run elasticities or adjustments for volume of exports and its determinant when the volume of exports is used as the dependent variable are presented below in Table 5.17. Table 5.17 indicates that the coefficient for ECT is linked to the volume of exports, which carries an anticipated negative sign, while it shows to be statistically significant at 5% level and its adjustment speed towards equilibrium is 1.59%.

The implication is that in the short run, the volume of exports is converging by at least 1.59% of last year's deviation from the equilibrium. The smaller value such as 1.59% is associated with a slow speed of adjustment to equilibrium. Therefore, the speed of convergence for the volume of exports to equilibrium is slower. Other variables included in the volume of exports estimation include the total slaughtered, which is statistically significant at 5% level while the others show not to be statistically significant.

Table 5.17 results also reveal that the values of the adjusted R^2 were estimated to be 67%, when the volume of exports is the dependent variable, which confirms that the models are strongly good fitted. Estimated error correction term (ECT_{t-1}) coefficient is negative and significant ensuring that the adjustment process from the short-run deviation for the equilibrium is at a slow speed on the volume of exports from the previous period's shock, which will converge back to the long-run equilibrium in the current period by the explanatory variables.

Total Employment

This study confirmed the long run cointegration by using the ARDL bound estimation earlier. The short-run elasticities or adjustments for total employment and its determinant when total employment is used as the dependent variable are presented below in Table 5.17. Table 5.17 indicates that the coefficient for ECT is linked to the total employment, which carries an anticipated negative sign, while it shows to be statistically significant at 5% level and its adjustment speed towards equilibrium is 1.08%.

The implication is that in the short run, the total employment is converging by at least 1.08% of last year's deviation from the equilibrium. The smaller value such as 1.08% is associated with slow speed of adjustment to equilibrium. Therefore, the speed of convergence for the total employment to equilibrium is slower. Other variables included on the total employment estimation include consumption per capital, which is statistically significant at 5% level while other shows not to be statistically significant.

Table 5.17 results also reveal that the values of the adjusted R^2 were estimated to be 54%, when the total employment is the dependent variable, which confirms that the models are strongly good fitted. Estimated error correction term (ECT_{t-1}) coefficient is negative and significant ensuring that the adjustment process from the short-run deviation for the equilibrium is at a slow speed on employment from the previous period's shock, which will converge back to the long-run equilibrium in the current period by the explanatory variables.

Table 5.17: ARDL-ECM Estimation Results for the Sheep and Goat Industry

Error correction	*D(LNPROTP)*	*D(LNVOLEXPT)*	*D(LNTOEMP)*
Error correction term (speed of adjustment)	-0.81* (0.0000)	-1.59 (0.0000)	-1.08 (0.0001)
$CONSPC_t$	0.45** (0.0234)	0.91 (0.5680)	0.99** (0.0450)
$REXRT_t$	0.03** (0.0016)	0.08 (0.4126)	-0.15 (0.4747)
$LNTOSGNU_t$	0.75	-1.34	5.01

	(0.1120)	(0.1928)	(0.5217)
$LNTOSLAU_t$	0.95** (0.0001)	0.98** (0.0411)	2.71 (0.5915)
$LNTOCONS_t$	-1.51 (0.0484)	1.83 (0.1681)	-6.53 (0.5979)
R-squared	0.96	0.67	0.54

Source: Author's own computation based on Eviews 12

The Granger causality test was adopted to test the causal relationship or causality effects amongst variables included in the regression, namely, the volume of exports ($LNVOEXPT_t$), real exchange rate ($REXRT_t$), total employment ($LNTOEMP_t$) and total production output ($LNPROTP_t$) in the sheep and goat industry. Table 5.18 below highlights a bi-directional causality effect between the total production output and volume of exports, as both their p-values are less than 0.05 significant level (5%). The statistical hypothesis test is used for determining whether one time series is useful in forecasting another (Gilmore and McManus, 2002 on Granger, 1969). This is attributed to the fact that the more the sheep and goat industry increases production output, the greater chance of triggering the volume of the sheep and goat industry's products to be exported to other countries. As producers tend to increase the production capacities, it translates into long-term causality effects between the two variables. Furthermore, Table 5.18 shows no total of the long run effects of causality for other variables that were also included in the Granger causality test for the sheep and goat industry.

Table 5.18: Granger Causality Test for the Sheep and Goat Industry

Null hypothesis	*F-statistics*	*Prob.*
$LNVOEXPT_t$ does not granger cause $REXRT_t$	0.52745	0.4753
$REXRT_t$ does not granger cause $LNVOEXPT_t$	2.44648	0.1321
$LNTOEMP_t$ does not granger cause $REXRT_t$	0.00899	0.9253
$REXRT_t$ does not granger cause $LNTOEMP_t$	1.42974	0.2445
$LNPROTP_t$ does not granger cause $REXRT_t$	0.93490	0.3441
$REXRT_t$ does not granger cause $LNPROTP_t$	0.10125	0.7533
$LNTOEMP_t$ does not granger cause $LNVOEXPT_t$	0.14793	0.7042
$LNVOEXPT_t$ does not granger cause $LNTOEMP_t$	0.04556	0.8330

$LNPROTP_t$ does not granger cause $LNVOEXPT_t$	5.49651	0.0285
$LNVOEXPT_t$ does not granger cause $LNPROTP_t$	1.66633	0.0212
$LNPROTP_t$ does not granger cause $LNTOEMP_t$	0.00319	0.9555
$LNTOEMP_t$ does not granger cause $LNPROTP_t$	0.12657	0.7254

Source: Author's own computation based on Eviews 12

Note: the relationship with p-values below 0.05% signifies the causality effects between the variables, while the relationship with p-value over 0.05% denotes no causality between the variables.

5.4.4 OLS Estimation Results for Cattle/Beef Industry

Ordinary least squares (OLS) technique was employed to look at the effect of the exchange rate of the three dependent variables, namely, the total production output, volume of exports and total employment by the beef/cattle industry of the South African red meat. OLS is used to estimate coefficients of linear regression equations, which describe the effect between one or more independent quantitative variables and a dependent variable.

Total Production Output

The results for the regression model are shown in Table 5.19, which provides a summary of the robustness or goodness of fit for the model employed. The coefficient of R^2 is 0.93 when total production output is a dependent variable, which implies that 93% of the total variation in cattle/beef production output was attributed to the changes in the explanatory variables (exchange rate, total consumption, total slaughtered, total number of cattle, consumption per capital, total employment and volume of exports). Furthermore, Probability (F-statistics) is highly significant at 1% and also Durbin-Watson at 1.73 closer to 2 indicating that the model is not suffering from serial correlation or multicollinearity problem.

Notably from Table 5.19, there are explanatory variables that are positively and significantly affecting the total production output of the cattle/beef industry. Regression coefficient results of the variable show that total consumption ($LNTOCONS_t$) and total slaughtered ($LNTOSLAU_t$) have the positive relationship with total production output 1.13 and 0.21%, respectively, statistically significant at 5%. This implies that there is

1% increase in the total production output that resulted from 1.13% increase in total consumption and 0.21% increase in total slaughtered. Again, from the results, total employment is seen to have a negative relation with total production output and statistically significant of -0.15 and 5% probability. This might be due to the substitution of workers by machines to carry out the work. The expected signs for the results conform the results from Mahmood *et al* (2013) and Polodoo *et al* (2016). The coefficient of the other variable for the industry cannot be interpreted because it do not significantly affect the total production output.

Volume of Exports

The results for the regression model are shown in Table 5.19 below, which provides a summary of the robustness or goodness of fit for the model employed. The coefficient of R^2 is 0.88 when the volume of exports is a dependent variable implies that 88% of the total variation in cattle/beef volume of exports was attributed to the changes in the explanatory variables (exchange rate, total consumption; total slaughtered, total number of cattle, consumption per capital, total employment and total production output). Furthermore, Probability (F-statistics) is highly significant at 1% and Durbin-Watson at 1.77 closer to 2 indicating that the model is not suffering from serial correlation or multicollinearity problem.

Notably from Table 5.19, there are explanatory variables that are positively and significantly affecting the volume of exports of the cattle/beef industry. The regression coefficient results of the variable shows that total consumption ($LNTOCONS_t$) and real exchange rate ($REXRT_t$) have a positive relationship with total production output 1.93 and 0.30%, respectively, statistically significant at 5%. This implies that there is 1% increase in total production output that resulted from 1.93% increase in total consumption and 0.30% increase in real exchange rate. The expected signs for the results conform the results from Azeez *et al* (2012) who found that the exchange rate volatility positively impacts on economic growth. The coefficient of the other variable for the industry cannot be interpreted because it do not significantly affect the total production output.

Total employment

The results for the regression model are shown in Table 5.19 below, presenting the summary of the robustness or goodness of fit for the model employed. The coefficient of R^2 is 0.66 when total employment is a dependent variable, which implies that 66% of the total variation in cattle/beef employment numbers was attributed to the changes in the explanatory variables (exchange rate, total consumption; total slaughtered, total number of cattle, consumption per capital, total employment and total production output). Furthermore, Probability (F-statistics) is highly significant at 1% and Durbin-Watson at 2.20 slightly greater than 2 indicating that the model is not suffering from serial correlation or multicollinearity problem.

Notably from Table 5.19, there are explanatory variables that are positively and significantly affecting the total employment of the cattle/beef industry. The regression coefficient results of the variable shows that total consumption ($LNTOCONS_t$) has a positive relationship with total employment of 3.57% and is statistically significant at 5%. This implies that there is 1% increase in total production output that resulted from 3.57% increase in total consumption. Again, from the results, the total production output is seen to have a negative relation with total employment and is statistically significant of -2.04 and 5% probability. This might be due to the substitution of workers by machines to carry out the work. The expected signs for the results conform to the results from Schröder (2013). The coefficient of the other variable for the industry cannot be interpreted because it does not significantly affect the total production output.

Table 5.19: Ordinal least square estimation for cattle/beef industry

Dependent variable		*D(LNPROTP)*		*D(LNVOLEXPT)*		*D(LNTOEMP)*	
Independent variable		Coeficient	Prob.(5%)	Coeficient	Prob.(5%)	Coeficient	Prob.(5%)
$CONSPC_t$		-0.0376	0.0153	0.034	0.8908	-0.041	0.2368
$REXRT_t$		0.0056	0.0750	0.301	0.0030	0.021	0.1709
$LNTOCANU_t$		0.1530	0.2101	2.552	0.2158	-0.196	0.7457
$LNTOSLAU_t$		0.2123	0.0433	-2.762	0.8265	0.960	0.0615
$LNTOEMP_t$		-0.1510	0.0002	1.270	0.4529	---	---
$LNTOCONS_t$		1.1358	0.0000	1.939	0.0104	3.572	0.0033
$LNVOLEXPT_t$		-0.0236	0.0675	---	---	0.024	0.4529
$LNPROTP_t$		---	---	-4.279	0.6039	-2.044	0.0016
Goodness of fit	R-squared	0.93		0.88		0.66	
	Prob(f-statistic)	0.00000		0.00000		0.00000	
	Durbin-watson	1.73		1.77		2.20	

Source: Author's own computation based on Eviews 12

Diagnostic Test for the Beef Regression

Various diagnostic assessments were conducted to authenticate the apricot model, specifically including the Breusch-Godfrey Lagrange Multiplier (LM) test to identify serial correlation, the Breusch-Pagan-Godfrey test for Heteroscedasticity, and an evaluation of model stability using the cumulative sum of recursive residuals (CUSUM). The results of the Breusch-Godfrey LM test for serial correlation revealed a p-value of 0.45, leading to the rejection of the null hypothesis related to serial correlation. Consequently, it was concluded that the model is not afflicted by serial correlation (Gujarati, 2015; Wooldridge, 2013).

The results from the Breusch-Pagan-Godfrey test indicate that the beef model is not affected by heteroscedasticity. With a p-value of 0.84, surpassing the 0.05 threshold, it suggests that the error term is evenly distributed across all regressors. These findings affirm the authenticity of the regression, ensuring that the results are reliable and not deceptive. Consequently, the impact of regressors on the South African red meat industry is accurately characterized by the beef regression.

The results of the CUSUM test for stability, as shown in Figure 6.18, indicate that the residuals derived from the beef regression exhibit a normal distribution. Additionally, all necessary variables have been appropriately included in the regression. The use of recursive residuals as a method for testing model stability is evident in Figure 6.18, where these residuals display linearity, given their identical and independently dispersed nature. Consequently, the beef regression is accurately specified, meeting all the diagnostic criteria. In conclusion, the Ordinary Least Squares (OLS) model stands out as the most suitable model for examining the influence of regressors on the South African red meat industry, encompassing aspects such as production, exports, and employment.

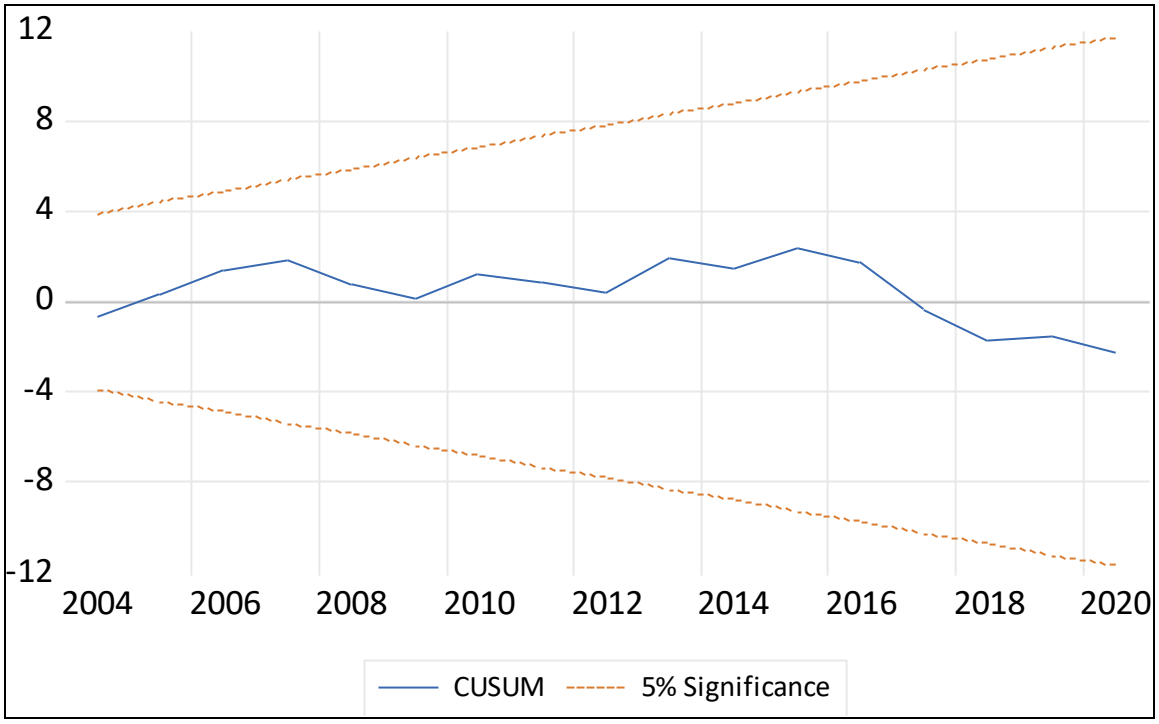

Figure 6. 18: The model stability test for the beef industry

Source: Author's computation based on Eviews

5.4.5 OLS Estimation Results for the Sheep and Goat Industry

Ordinary least squares (OLS) technique was employed to look at the effect of the exchange rate of the three dependent variables, namely, the total production output, volume of exports and total employment by the sheep and goat industry of the South African red meat. OLS is used to estimate the coefficients of linear regression equations, which describe the effect between one or more independent quantitative variables and a dependent variable.

Total Production Output

The results for the regression model are shown in Table 5.20 below, which provides a summary of the robustness or goodness of fit for the model employed. The coefficient of R^2 is 0.95 when the total production output is a dependent variable, which implies that 95% of the total variation in sheep and goat production output was attributed to the changes in the explanatory variables (exchange rate, total consumption, total slaughtered, total number of sheep and goat, consumption per capital, total employment and volume of exports). Furthermore, Probability (F-statistics) is highly

significant at 1% and Durbin-Watson at 1.99 closer to 2 indicating that the model is not suffering from serial correlation or multicollinearity problem.

Notably from Table 5.20, there are explanatory variables that are positively and significantly affecting the total production output of the sheep and goat industry. The regression coefficient results of the variable shows that the volume of exports ($LNVOLEXPT_t$) and total slaughtered ($LNTOSLAU_t$) have a positive relationship with the total production output 0.05 and 0.62%, respectively, and are statistically significant at 5%. This implies that there is 1% increase in total production output that resulted from 0.05% increase in volume of exports and 0.62% increase in the total slaughtered. The expected signs for the results conform to the results from Azeez *et al* (2012). The coefficient of other variable for the industry cannot be interpreted because it do not significantly affect the total production output.

Volume of exports

The results for the regression model are shown in Table 5.20 below, looking at the summary of the robustness or goodness of fit for the model employed. The coefficient of R^2 is 0.86 when Volume of exports is a dependent variable. This implies that 86% of the total variation in the sheep and goat volume of exports was attributed to the changes in the explanatory variables (exchange rate, total consumption, total slaughtered, total number of sheep and goat, consumption per capital, total employment and total production output). Furthermore, Probability (F-statistics) is highly significant at 1% and Durbin-Watson at 1.94 closer to 2 indicating that the model is not suffering from serial correlation or multicollinearity problem.

Notably from Table 5.20, there is an explanatory variable that is positively and significantly affecting the volume of exports of the sheep and goat industry. The regression coefficient results of the variable shows that total production output ($LNPROTP_t$) has a positive relationship with the volume of exports of 5.72 and, is statistically significant at 5%. This implies that there is 1% increase in volume of exports output that resulted from 5.72% increase in total production output. The expected signs for the results conform to the results from Jordaan and Netshitenzhe (2015) who found that exchange rate volatility positively impacts on exports. The

coefficient of the other variable for the industry cannot be interpreted because it do not significantly affect the total production output.

Total employment

The results for the regression model are shown in Table 5.20 below, looking at the summary of the robustness or goodness of fit for the model employed. The coefficient of R^2 is 0.51 when total employment is a dependent variable. This implies that 51% of the total variation in sheep and goat employment numbers was attributed to the changes in the explanatory variables (exchange rate, total consumption, total slaughtered, total number of sheep and goat, consumption per capital, volume of exports and total production output). Furthermore, Probability (F-statistics) is highly significant at 5% and Durbin-Watson at 1.86 closer to 2 indicating that the model is not suffering from serial correlation or multicollinearity problem.

Notably from Table 5.20, there is an explanatory variable that is positively and significantly affecting the total employment of the sheep and goat industry. The regression coefficient results of the variable shows that real exchange rate ($LNREXRT_t$) has a positive relationship with the total employment of 0.03 and is statistically significant at 5%. This implies that there is 1% increase in volume of exports output that resulted from 0.03 percent increase in total production output. The expected signs for the results conform to the results from Filiztekin (2004) who found that the exchange rate volatility positively impacts on employment. The coefficient of the other variable for the industry cannot be interpreted because it do not significantly affect the total production output.

Table 5.20: Ordinal Least Square Estimation for Sheep and Goat Industry

Dependent variable		*D(LNPROTP)*		*D(LNVOLEXPT)*		*D(LNTOEMP)*	
Independent variable		Coeficient	Prob.(5%)	Coeficient	Prob.(5%)	Coeficient	Prob.(5%)
$CONSPC_t$		-0.211	0.1920	-2.051	0.2270	0.125	0.6671
$REXRT_t$		-0.011	0.1987	0.036	0.7085	0.039	0.0076
$LNTOCONS_t$		1.092	0.0716	3.697	0.5752	-0.116	0.9168
$LNTOSGNU_t$		-0.239	0.7060	5.463	0.4060	0.401	0.7195
$LNTOSLAU_t$		0.628	0.0296	-1.440	0.6539	-0.415	0.4406
$LNPROTP_t$		---	---	5.723	0.0123	-0.117	0.7797
$LNVOLEXPT_t$		0.052	0.0123	---	---	-0.011	0.7700
$LNTOEMP_t$		-0.038	0.7797	-0.414	0.7700	---	---
Goodness of fit	R-squared	0.95		0.86		0.51	
	Prob(f-statistic)	0.000000		0.000000		0.040594	
	Durbin-watson	1.99		1.94		1.86	

Source: Author's own computation based on Eviews 12

Diagnostic Test for the Sheep and Goat Regression

Various diagnostic evaluations were undertaken to validate the sheep and goat model, specifically employing the Breusch-Godfrey Lagrange Multiplier (LM) test for identifying serial correlation, the Breusch-Pagan-Godfrey test for Heteroscedasticity, and an assessment of model stability using the cumulative sum of recursive residuals (CUSUM). The outcomes of the Breusch-Godfrey LM test for serial correlation resulted in the rejection of the null hypothesis associated with serial correlation. Consequently, it was deduced that the model is devoid of serial correlation (Gujarati, 2015; Wooldridge, 2013).

Results from the Breusch-Pagan-Godfrey test indicate that the sheep and goat model is unaffected by heteroscedasticity. These results suggest that the error term is uniformly distributed across all regressors. These findings substantiate the credibility of the regression, ensuring that the results are trustworthy and not misleading. Therefore, the influence of regressors on the South African red meat industry is accurately delineated by the sheep and goat regression.

The CUSUM test results for stability, depicted in Figure 6.19, indicate that the residuals derived from the beef regression conform to a normal distribution. Moreover, all requisite variables have been properly incorporated into the regression. The use of recursive residuals as a method for testing model stability is evident in Figure 6.19, where these residuals exhibit linearity due to their identical and independently dispersed nature. Consequently, the sheep and goat regression is appropriately specified, satisfying all diagnostic criteria. In conclusion, the Ordinary Least Squares (OLS) model emerges as the most fitting model for scrutinizing the impact of regressors on the South African red meat industry, covering aspects such as production, exports, and employment.

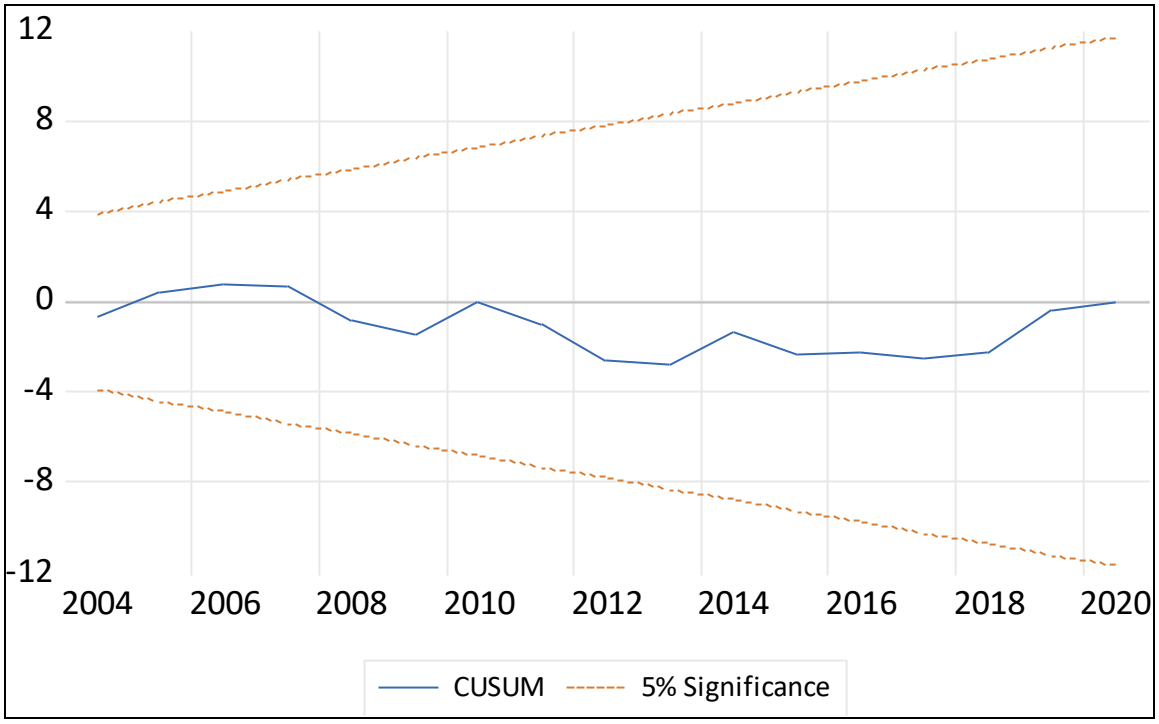

Figure 6. 19: The model stability test for the sheep and goat industry

Source: Author's computation based on Eviews

5.4.6 OLS Estimation Results for the Pig Industry

Ordinary least squares (OLS) technique was employed to look at the effect of the exchange rate of the three dependent variables, namely, the total production output, volume of exports and total employment by the pig industry of the South African red meat. OLS was used to estimate the coefficients of linear regression equations, which describe the effect between one or more independent quantitative variables and a dependent variable.

Total Production Output

The results for the regression model are shown in table 5.21 below, looking at summary of the robustness or goodness of fit for the model employed. The coefficient of R^2 is 0.97 when total production output is a dependent variable which implies that 97% of the total variation in pig production output was attributed to the changes in the explanatory variables (exchange rate, total consumption; total slaughtered, total number of pigs, consumption per capital, total employment and volume of exports). Furthermore, Probability (F-statistics) is highly significant at 1% and Durbin-Watson at

1.61 closer to 2 indicating that the model is not suffering from serial correlation or multicollinearity problem.

Notably from Table 5.21, there are explanatory variables that are positively and significantly affecting the total production output of the cattle/beef industry. The regression coefficient results of the variable shows that total consumption (*LNTOCONS*$_t$) and total slaughtered (*LNTOSLAU*$_t$) have a positive relationship with the total production output of 0.55 and 0.40%, respectively, and is statistically significant at 5%. This implies that there is 1% increase in total production output that resulted from 0.55% increase in total consumption and 0.40% increase in total slaughtered. The expected signs for the results conform to the results from Wasiu and Ndukwe (2018) who looked at the agricultural output and real exchange rate. The coefficient of the other variable for the industry cannot be interpreted because it do not significantly affect the total production output.

Volume of exports

The results for the regression model are shown in Table 5.21 below, looking at the summary of the robustness or goodness of fit for the model employed. The coefficient of R^2 is 0.85 when the volume of exports is a dependent variable, which implies that 85% of the total variation in the pig volume of exports was attributed to the changes in the explanatory variables (exchange rate, total consumption, total slaughtered, total number of pigs, consumption per capital, total employment and total production output). Furthermore, Probability (F-statistics) is highly significant at 1% and Durbin-Watson at 1.56 closer to 2 indicating that the model is not suffering from serial correlation or multicollinearity problem.

Notably from Table 5.21, there is an explanatory variable that is positively and significantly affecting the volume of exports of the pig industry. The regression coefficient results of the variable shows that the total slaughtered (*LNTOSLAU*$_t$) has a positive relationship with the volume of exports of 10.12 and is statistically significant at 5%. This implies that there is 1% increase in volume of exports that resulted from 10.12% increase in total slaughtered. The expected signs for the results conform to the results from Jordaan and Netshitenzhe (2015) who found that the exchange rate

volatility positively impacts on exports. The coefficient of the other variable for the industry cannot be interpreted because it do not significantly affect the total production output.

Total Employment

The results for the regression model are shown in Table 5.21 below, looking at the summary of the robustness or goodness of fit for the model employed. The coefficient of R^2 is 0.59 when total employment is a dependent, which variable implies that 59% of the total variation in pig employment numbers was attributed to the changes in the explanatory variables (exchange rate, total consumption; total slaughtered, total number of pigs, consumption per capital, total employment and total production output). Furthermore, Probability (F-statistics) is highly significant at 1% and also Durbin-Watson at 1.92 closer to 2 indicating that the model is not suffering from serial correlation or multicollinearity problem.

Notably from Table 5.21, there is an explanatory variable that is positively and significantly affecting the total employment of the pig industry. The regression coefficient results of the variable shows that the real exchange rate ($REXRT_t$) has a positive relationship with the total employment of 0.02% and is statistically significant at 5%. This implies that there is 1% increase in the total production output that resulted from 0.02% increase in real exchange rate. The expected signs for the results conform to the results from Filiztekin (2004) who looked at the real exchange rate against employment. The coefficient of the other variable for the industry cannot be interpreted because it did not significantly affect the total production output.

Table 5.21: Ordinal Least Square Estimation for the Pig Industry

Dependent variable		*D(LNPROTP)*		*D(LNVOLEXPT)*		*D(LNTOEMP)*	
Independent variable		Coeficient	Prob.(5%)	Coeficient	Prob.(5%)	Coeficient	Prob.(5%)
$CONSPC_t$		0.062	0.2578	-0.095	0.9646	0.178	0.3133
$REXRT_t$		0.005	0.1501	0.117	0.4139	0.021	0.0495
$LNTOCONS_t$		0.557	0.0004	6.221	0.3738	-0.044	0.9395
$LNTOPINU_t$		-0.040	0.7290	1.624	0.7174	-0.003	0.9917
$LNTOSLAU_t$		0.408	0.0011	10.123	0.0430	0.448	0.3242
$LNPROTP_t$		---	---	-8.350	0.3524	-0.844	0.2581
$LNVOLEXPT_t$		-0.005	0.3524	---	---	-0.025	0.1878
$LNTOEMP_t$		-0.083	0.2581	-3.670	0.1878	---	---
Goodness of fit	R-squared	0.97		0.85		0.59	
	Prob(f-statistic)	0.000000		0.000000		0.011335	
	Durbin-watson	1.61		1.56		1.92	

Source: Author's own computation based on Eviews 12

Diagnostic Test for the Pig Industry Regression

Various diagnostic assessments were conducted to validate the model for the pig industry, specifically utilizing the Breusch-Godfrey Lagrange Multiplier (LM) test for identifying serial correlation, the Breusch-Pagan-Godfrey test for Heteroscedasticity, and an evaluation of model stability through the cumulative sum of recursive residuals (CUSUM). The results of the Breusch-Godfrey LM test for serial correlation led to the rejection of the null hypothesis associated with serial correlation. Consequently, it was inferred that the model lacks serial correlation (Gujarati, 2015; Wooldridge, 2013).

Findings from the Breusch-Pagan-Godfrey test indicate that the pig industry model is not affected by heteroscedasticity. These results imply that the error term is evenly distributed across all regressors. These observations validate the reliability of the regression, ensuring that the results are dependable and not deceptive. Hence, the impact of regressors on the South African red meat industry is accurately depicted by the pig industry regression.

The CUSUM test results for stability, illustrated in Figure 6.20, suggest that the residuals derived from the pig industry regression adhere to a normal distribution. Additionally, all necessary variables have been appropriately integrated into the regression. The utilization of recursive residuals as a method for testing model stability is apparent in Figure 6.20, where these residuals display linearity due to their identical and independently dispersed nature. Consequently, the pig industry regression is suitably specified, meeting all diagnostic criteria. In conclusion, the Ordinary Least Squares (OLS) model emerges as the most suitable model for examining the impact of regressors on the South African red meat industry, encompassing aspects such as production, exports, and employment.

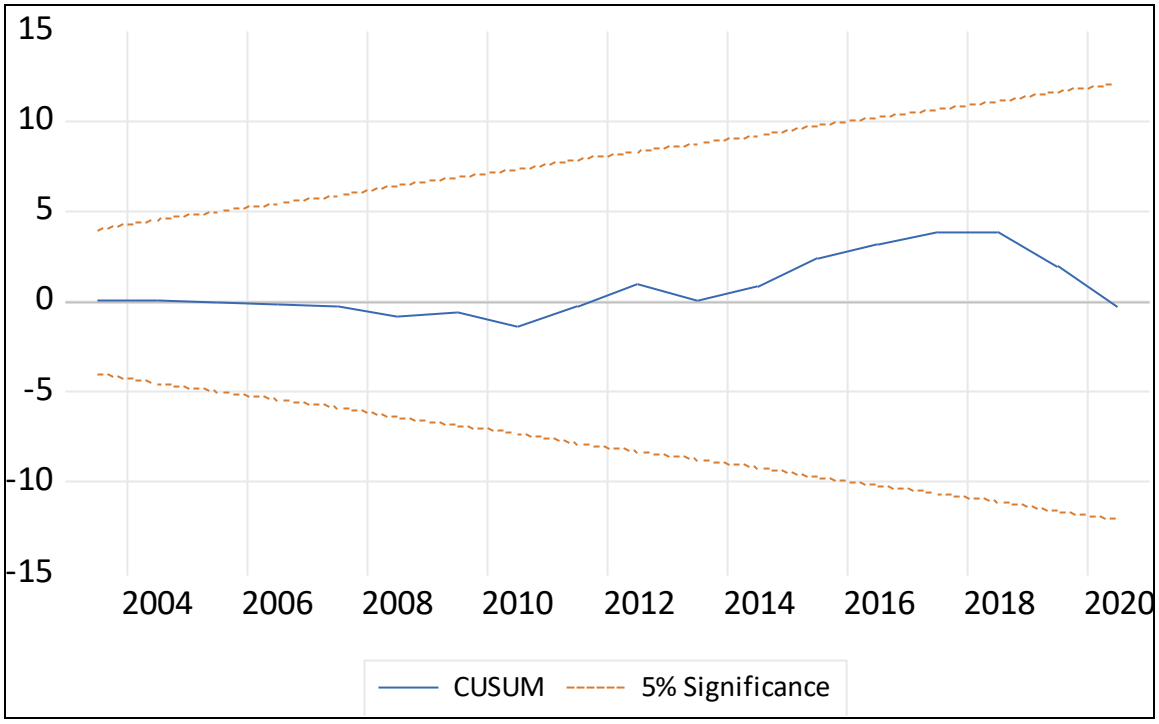

Figure 6. 20: The model stability test for the pig industry

Source: Author's computation based on Eviews

5.5 Chapter Summary

This chapter presented and discussed the findings from the analytical techniques employed such as ARDL-ECM model, granger causality test and ordinary least squares. The findings from the ARDL Bound test show that the variables affect each other in a long run and are able to adjust in the short run as well since the production output affects the volume of exports, total employment affects the volume of exports whereas the volume of exports is affected by the exchange rate in a positive way. The findings emanating from the granger causality confirmed there is a causal relation among the variables, with both single and bi-directional effects. The ordinary least squares for all the estimated red meat industries showed that consumption plays an important role in pushing the demand for the three selected red meat industries. Consumption affects production output, volumes of exports and total employment positively. The following chapter presents the summary, conclusion and recommendation.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter provides the summary, conclusion, and recommendations of the study. The study investigated the impact of the floating exchange rate on the total production output, volume of exports and total employment within the three selected red meat industries of South Africa. The predominant aim of the study was to assess the impact of the floating exchange rate on total production output, volume of exports and total employment in the South African red meat industry between 1995 and 2020. The selection of the red meat industry was informed by the government's declaration that the red meat industry needs to be promoted because it is amongst the top contributors of employment opportunities and increases the South African export base.

Population growth estimates combined with predicted increases in red meat consumption, especially in developing countries, provides the South African red meat industry with a challenge because it is the leading producer of red meat in Africa. Its challenge is to produce red meat in a sustainable manner given the natural resource restrictions and changing market dynamics. The study focused on only three red meat industries, which were prioritised based on their economic and social significance in the entire red meat industry. It also analysed the performance of those three selected red meat industries in terms of total production output, volume of exports, and the floating exchange rate and total employment.

The South African red meat industry shows positive signs of benefiting from the international and local market than other commodities within the agricultural space. The findings show that the cattle/beef industry is the biggest contributor towards production output, volume of exports and employment amongst the other two prioritised red meat industries. The study comprised six chapters, with the first three chapters providing a vivid picture of the red meat industry's background information

and its performance in terms of production, exports and labour markets, all of which talks to the employment numbers.

The second chapter, which is the literature review, explored the theoretical framework and further reviewed the work that was done before and the theories that relate to the study. The ideas highlighted by the theories were that the exchange rate determination amongst developed and developing countries plays a vital role as it can have an impact on production, exports, and employment levels of a country. Furthermore, the findings from literature showed that there are market distortions in developed countries, since production is subsidised and import duties for primary goods are set low to stimulate the beneficiation process. Conversely, developing countries focus mostly on the production of primary goods with minimal government support.

6.2 Summary and Conclusion

This study adopted an in-depth industries analysis for each selected red meat industry, which was complemented by descriptive statistics. The in-depth industries analysis and descriptive statistics were addressing the first objective regarding profiling the performance of the three selected red meat industries. The results from the in-depth industries analysis show that all the three red meat industries are of high economic importance in terms of key dependent variables such as the total production output, volume of exports and total employment. For instance, the South African red meat industry contributes significantly to consumption, direct employment during production, value addition, processing, and marketing. Most indirect employment opportunities are generated at the abattoirs.

The second objective was aimed at analysing the impact of the floating exchange rate on the total production output, volume of exports and total employment in the selected three South African red meat industries. The objective was achieved by adopting the error-correction of the autoregressive distributed lag model (ARDL-ECM) since the variables were endogenous and co-integrated. The ARDL-ECM model measured the long-run relationship amongst the total production, volume of exports, total employment and exchange rate. The model also caters for the short-term variations or dynamics through the ARDL bound test amongst the underlying variables. The error

correction terms (ECT_{t-1}) for the total production output, volume of exports and total employment are negative and statistically significant.

The results for the cattle/beef regression show that in a short-run, the system is stable and the adjustment speed to equilibrium is very slow when all the three are dependent variables (total production output, volume of exports and total employment). The conclusion for the apple regression is that the exchange rate has an effect on the total production, volume of exports and total employment in a long run as they are able to adjust to an equilibrium at that minimal or low speed. Furthermore, the statistical significance of all ECTs' coefficients shows that the selected variables cause one another in the long run.

The short-run findings for the pig estimation highlight that the system for the total production output, volume of exports and total employment is constant and the speed of adjustment towards equilibrium is sluggish. However, the estimation indicates that the system for exports output and imports output are fluctuating while the adjustment speed to an equilibrium is faster. For the pig estimation, the study concludes that a long-run exchange rate and production output results into a surge in the volume of exports in a long-run, while the consumption of pigs also pushes total employment in a positive direction as it is statistically significant. Therefore, the statistical significance of the entire ECTs' coefficients indicates that the selected variables cause one another in the long run.

The results for the sheep and goat analysis show that the steady system for the total production output, volume of exports and total employment is a bit higher in terms of the percentage of disequilibrium associated with each specific period. Ultimately, the findings for the sheep and goat estimation shows that in the long-run, the exchange rate, consumption, number slaughtered and consumption per capital will lead to an increase in production output, exports volume and total employment. Therefore, the statistical significance of the entire ECTs' coefficients indicates that the selected variables cause one another in the long run.

Furthermore, the study endeavoured to determine the causality relation or effects amongst the total production output, volume of exports, total employment and

exchange rate in the three selected South African red meat industries. This objective was successfully realised by using the granger causality test, which focuses on the causality effects amongst underlying variables. The findings from the cattle/beef, sheep and goat and pig regressions show the existence of either a single or bi-directional relationship among the included variables.

The causal relation or effect results for cattle/beef industry show that a single directional causality effect exists between or runs from the volume of exports, total production output, exchange rate to volume of exports and lastly, the causal effect runs from the volume of exports to total employment. Other pairs for cattle/beef estimation do not show a causal relationship or effect because their p-values are greater than the 5% significant level. Causal relation or effect results for the pig industry show a that single directional causality effect exists between or runs the total employment to the volume of exports and lastly, the total production output to volume of exports.

Notably, other pairs in pig estimation do not show a causal relationship or effect because their p-values are greater than a 5% significant level. Causal relation or effect results for the sheep and goat industry show that a bi-directional causality effect exists between, or runs from the total production output to the volume of exports and comes back running from the volume of exports to total production output. Notably, other pairs in sheep and goat estimation do not show a causal relationship or effect because their p-values are greater than 5% significant level.

Lastly, the study aimed at determining the effect of red meat consumption on the total production output, volume of exports and total employment. The objective was successfully realised by applying the Ordinary Least Squares to check the relationship among the underlying variables. The OLS findings from cattle/beef regression show that the total production output is positively affected by consumption and total slaughtered cattle when the dependent variable is total production output, while other variables show no significance of influencing the total production output. When the volume of exports treated as dependent variable real exchange rate and total consumption positively and significantly affect the volume of exports while other variables show no significant influence to the volume of exports. Lastly, when total

employment is a dependent total consumption and production output seems to be positively affecting total employment while other variable shows no significant influence to total employment.

The OLS results from sheep and goat estimation indicate that the total production output is positively affected by consumption, total slaughtered sheep and goat volume of exports, when the dependent variable is total production output, while other variables show no significance of influencing the total production output. When the volume of exports is treated as a dependent variable, the real production output positively and significantly affect the volume of exports while other variables show no significant influence over the volume of exports. Lastly, when the total employment is a dependent variable, the total real exchange rate seems to be positively affecting the total employment while other variables show no significant influence to total employment.

The OLS results drawn from the pig regression show that the total production output is positively affected by consumption and total slaughtered pigs when the dependent variable is the total production output, while other variables show no significance of influencing the total production output. When the volume of exports is treated as a dependent variable, total slaughtered pigs positively and significantly affect the volume of exports while other variables show no significant influence to the volume of exports. Lastly, when the total employment is a dependent, the real exchange rate seems to be positively affecting total employment while other variables show no significant influence to total employment.

The study concludes that for the three selected red meat industries' (cattle/beef, sheep and goat, and pig) estimations, red meat consumption plays a vital role in affecting total production output, volume of exports and total employment across all the selected red meat industries. The OLS findings for the selected red meat industries confirm the positive and statistical significance of red meat consumption affecting the total production output, volume of exports and total employment.

6.3 Recommendations

The following recommendations are based on the critical analysis of the theory, empirical literature review, performance of the red meat industry in South Africa, methodological approach and the empirical findings. The recommendations from this study are put into three categories, which are focused on red meat producers, policy recommendations and recommendations for further research.

6.3.1 Recommendations to producers

Based on empirical results drawn from the analysis for red meat industry performance, producers should hasten the production of the three red meat products. The international trade or exportation of beef and veal, mutton and chevon and pork together with ever increasing consumption show to be important contributors to total employment. Therefore, producers need to deepen and broaden the export base, while working closely with government to diversify the export markets. The diversification of markets coupled with the beneficiation of those products render a great opportunity to assist government in addressing a challenge of red meat products availability and high unemployment.

There is a need for producers to produce more as they gain more profit. The government must ensure the implementation of policies that will encourage local red meat agricultural growth to reduce import, by providing price policy, perfect market and credit facilities to work side by side with farmers or producers of red meat. Government should make effort to invest heavily on agriculture to meet local consumption and export.

6.3.2 Recommendations to policymakers

Policymakers should not interfere with the floating exchange rate policy. Since exchange rate volatility positively impacts on production output, exports volume and employment, it implies that the exchange rate volatility can support growth in small open economies by encouraging international capital inflows, excessive capital inflows into the country. Policymakers should therefore find an equilibrium on the devaluation and appreciation of exchange rate since the devaluation of domestic currency provides

an important opportunity for economic growth. It also promotes exports capacity and reduces the volume of imports and that will translate to price volatility.

The study has established that consumption positively and significantly contributes to production output growth, exports growth and employment growth from the red meat industry of South Africa. Therefore, policymakers need to design policies and come with incentives geared towards encouraging more farmers to produce red meat to enable a rapid growth of the industry. The South African government needs to support the red meat industry through various initiatives, including research and development, extension services, and financial assistance programmes. These measures aim to improve productivity, quality, and market access for red meat producers.

South African government in collaboration with the red meat industry should undertake more investments aimed at boosting the production of the red meat industry. The recommended investments may include agricultural research and development. Through adoption of science and technology-based innovations, like breeding improved livestock that tolerate different climatic conditions and improve intensive management methods. The investment in research and development will make the industry to be a sustainable supplier of quality red meat in domestic and various international markets, as South Africa is known to be the leading producer of red meat in the continent of Africa. This translates into a long run competiveness of the South African red meat industry. Furthermore, the country should also invest in physical and market infrastructure such as water, electricity, harbours, rail and road networks, which indirectly affect the industry.

Policymakers together with government should also reduce the price of agricultural exports as that indirectly impacts on the provision of fiscal incentives examples, tax free on import of agricultural processing equipment and tax holidays for other agriculture related input thereby reducing the cost of production and price of the products. To boost the agricultural export volume, policymakers should take measures in stabilising the exchange rate from the present downward trend since the appreciation of the exchange rate stimulates (increases) agricultural export output.

6.3.3 Recommendations for further research

Further study must be undertaken to establish the effects of the floating exchange rate on output, exports and employment in other industries of the agricultural sector to check whether they react the same or differently toward exchange rate movements. This study can also be extended to other countries on the African continent. Therefore, further research needs to be comparative in nature to create more beneficiaries to exportation, production, and consumption of red meat.

The current study analysed the impact of the floating exchange rate on production output, exports volume and employment focusing on the selected red meat industries. The study used the ARDL-ECM approach, Granger test and OLS for estimation. A similar study could be done using different approaches apart from those used here to capture the effect of the floating exchange rate on other macroeconomic variables.

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APPENDICES

A1: DATA SET FOR BEEF INDUSTRY

YEAR/OBS	*TOCANU*	*PROTP*	*IMPO*	*TOCONS*	*VOLEXPT*	*TOSLAU*	*REXRT*	*TOEMP*	*CONSPC*
1995	12 600 000	507 500	184295487	587 000	50824411	2 182 000	3.6271	128 000	15,19
1996	13 000 000	507 000	154071434	591 000	18144666	2 242 000	4.2993	129 000	14,98
1997	13 400 000	502 400	185672123	573 000	48330612	2 185 000	4.608	121 000	14,13
1998	13 700 000	496 300	62406291	560 000	38743802	2 159 000	5.5283	122 000	13,59
1999	13 800 000	511 700	61677895	559 000	51896071	2 258 000	6.1095	114 000	13,28
2000	13 600 000	624 600	77461156	671 000	44776253	2 726 000	6.9398	118 000	15,58
2001	13 500 000	524 300	35793574	554 000	54414949	2 302 000	8.6092	122 000	12,69
2002	13 500 000	573 400	39150350	602 000	80814467	2 510 000	10.5407	126 000	13,51
2003	13 600 000	609 700	69428215	643 000	73218985	2 535 000	7.5647	124 000	14,15
2004	13 500 000	631 700	126906896	675 000	76387868	2 602 000	6.4597	121 000	14,53
2005	13 500 000	672 300	187405338	723 000	39354377	2 673 000	6.3593	123 000	15,52
2006	13 500 000	808 100	210643441	825 000	30396743	3 026 000	6.7715	109 000	17,58
2007	13 900 000	861 400	175340994	865 000	39542089	3 098 000	7.0454	100 000	18,25
2008	13 900 000	770 200	105339279	767 000	55643165	2 776 000	8.2612	98 000	16,04
2009	13 800 000	796 700	136114807	784 000	89527248	2 869 000	8.4737	92 000	16,09
2010	13 700 000	885 800	455146734	880 000	121232783	2 982 000	7.3212	94 000	17,84
2011	13 700 000	869 500	626230804	879 000	95021788	2 948 000	7.2611	101 000	17,59
2012	13 900 000	852 100	738465339	865 000	119423882	2 895 000	8.2115	103 000	16,71
2013	13 900 000	904 500	659506761	910 000	238289478	3 035 000	9.6551	118 000	17,39
2014	13 900 000	982 600	542988749	981 000	534593960	3 307 000	10.8527	110 000	18,51
2015	13 700 000	1 037 900	482452857	1 027 000	884086491	3 497 000	12.7589	144 000	19,02
2016	13 400 000	1 090 900	581101264	1 079 000	950091061	3 662 000	14.7096	126 000	19,63
2017	13 000 000	1 045 100	532929040	1 035 000	724857897	3 507 000	13.3055	125 000	18,51

2018	12 800 000	1 026 800	483707261	1 027 000	888874275	3 311 000	13.2488	138 000	18,17
2019	12 600 000	1 001 100	453918731	1 001 000	693148827	3 103 000	14.4496	138 000	17,34
2020	12 300 000	1 035 500	97758658	1 020 000	1216514361	3 249 000	16.4719	126 000	17,35

Source: DALRRD, BAFP, QUENTEC, Agri-SETA and Stats SA

A2: DATA SET FOR PIG INDUSTRY

YEAR/OBS	*TOPINU*	*PROTP*	*IMPO*	*TOCONS*	*VOLEXPT*	*TOSLAU*	*CONSPC*	*TOEMP*	*REXRT*
1995	1 585 000	119 000	72487790	124 000	8995154	1 973 000	3,2	3 185	3.6271
1996	1 707 000	126 500	70525062	131 000	12648240	2 194 000	3,3	3 140	4.2993
1997	1 699 000	127 900	53678446	133 000	10237067	2 172 000	3,3	3 151	4.608
1998	1 736 000	125 000	46665895	130 000	6495322	2 061 000	3,2	3 159	5.5283
1999	1 780 000	119 200	69562184	126 000	16420192	2 006 000	3,0	3 189	6.1095
2000	1 647 000	123 000	93172655	131 000	10913564	2 145 000	3,0	3 221	6.9398
2001	1 678 000	106 900	110446204	115 000	8121529	1 864 000	2,6	3 221	8.6092
2002	1 710 000	116 600	103637508	123 000	16130254	2 017 000	2,8	3 312	10.5407
2003	1 663 000	135 000	133176736	146 000	9880095	2 079 000	3,2	3 201	7.5647
2004	1 663 000	156 800	213601684	174 000	7593605	2 131 000	3,8	3 094	6.4597
2005	1 651 000	159 700	301723643	182 000	12085893	2 158 000	3,9	3 011	6.3593
2006	1 622 000	171 400	278593968	193 000	11369624	2 290 000	4,1	3 051	6.7715
2007	1 651 000	187 100	314787224	206 000	19574195	2 497 000	4,4	2 981	7.0454
2008	1 615 000	181 700	287057168	198 000	34859763	2 441 000	4,1	2 613	8.2612
2009	1 613 000	180 700	402562386	199 000	52897482	2 383 000	4,1	2 659	8.4737
2010	1 594 000	191 900	430199324	215 000	157552070	2 474 000	4,4	2 670	7.3212
2011	1 584 000	205 100	595739213	231 000	139861134	2 601 000	4,6	2 711	7.2611
2012	1 579 000	206 000	723007528	237 000	128469048	2 651 000	4,6	2 849	8.2115
2013	1 574 000	213 500	612793367	245 000	168463775	2 734 000	4,7	2 989	9.6551
2014	1 562 000	224 200	570311869	236 000	240611427	2 844 000	4,5	2 904	10.8527

2015	1 523 000	233 000	934323113	252 000	315575784	2 926 000	4,7	3 148	12.7589
2016	1 512 000	243 100	885517516	258 000	270085917	3 011 000	4,7	3 092	14.7096
2017	1 481 000	231 800	964278941	250 000	331895863	2 897 000	4,5	2 980	13.3055
2018	1 454 000	260 000	969950994	277 000	329199800	3 134 000	5,0	2 980	13.2488
2019	1 390 000	265 700	895311958	287 000	347084844	3 227 000	5,0	3 105	14.4496
2020	1 357 000	289 400	724773718	300 000	353690860	3 504 000	5,1	2 843	16.4719

Source: DALRRD, BAFP, QUENTEC, Agri-SETA and Stats SA

A3: DATA SET FOR SHEEP & GOAT INDUSTRY.

YEAR/OBS	*TOSGNU*	*PROTP*	*IMPO*	*TOCONS*	*VOLEXPT*	*TOSLAU*	*CONSPC*	*TOEMP*	*REXRT*
1995	27 850 000	94 800	35803175	118 000	1859292	5 203 000	3,1	33 271	3.6271
1996	27 972 000	106 300	89658607	143 000	1544338	5 904 000	3,6	32 982	4.2993
1997	27 404 000	102 600	109055998	142 000	2185626	5 655 000	3,5	32 651	4.608
1998	27 439 000	96 900	99061777	145 000	8073733	5 536 000	3,5	32 037	5.5283
1999	26 700 000	104 900	103003679	154 000	1900943	5 905 000	3,7	33 576	6.1095
2000	25 941 000	108 300	139583502	163 000	773690	6 115 000	3,8	30 351	6.9398
2001	25 425 000	105 400	102852939	159 000	2009820	5 964 000	3,6	35 602	8.6092
2002	24 830 000	105 100	65154871	146 000	3778430	5 964 000	3,3	33 535	10.5407
2003	24 853 000	114 400	65168382	146 000	7990099	6 012 000	3,2	36 967	7.5647
2004	24 453 000	120 300	88304086	153 000	3902401	6 117 000	3,3	31 964	6.4597
2005	24 372 000	134 600	131795007	168 000	10569031	6 392 000	3,6	29 028	6.3593
2006	24 126 000	135 300	231961008	176 000	6368810	6 427 000	3,8	34 445	6.7715
2007	24 040 000	160 700	232482952	203 000	14900851	6 822 000	4,3	31 840	7.0454
2008	24 109 000	160 600	258340595	189 000	17080989	6 825 000	3,9	31 591	8.2612
2009	23 994 000	162 100	120653743	180 000	16585105	6 838 000	3,7	25 430	8.4737
2010	23 545 000	163 900	474438017	174 000	44211730	6 967 000	3,5	25 926	7.3212
2011	23 358 000	148 800	560833041	155 000	32099039	6 243 000	3,1	26 051	7.2611
2012	23 455 000	148 900	471600575	157 000	32706138	5 993 000	3,0	28 325	8.2115

2013	23 592 000	166 300	405685363	171 000	43421707	6 607 000	3,3	30 599	9.6551
2014	23 188 000	182 800	313481057	188 000	75146992	7 109 000	3,6	28 366	10.8527
2015	22 993 000	184 600	321294210	193 000	63374330	7 309 000	3,6	37 090	12.7589
2016	22 339 000	177 700	285187895	191 000	51557196	7 000 000	3,5	36 429	14.7096
2017	21 785 000	177 300	265168808	186 000	45191512	6 675 000	3,3	35 105	13.3055
2018	21 576 000	170 700	260863735	183 000	41650628	6 145 000	3,2	35 105	13.2488
2019	21 170 000	156 900	154966796	171 000	49918564	5 596 000	3,0	35 125	14.4496
2020	20 666 000	177 100	55808471	184 000	146965454	6 429 000	3,1	35 112	16.4719

Source: DALRRD, BAFP, QUENTEC, Agri-SETA and Stats SA

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TURFLOOP RESEARCH ETHICS COMMITTEE
ETHICS CLEARANCE CERTIFICATE

MEETING: **23 May 2022**

PROJECT NUMBER: TREC/366/2022:PG

PROJECT:

Title:	Impact Analysis of the Floating Exchange Rate on the Output, Export and Employment in the South African Red Meat Industry, 1995-2020
Researcher:	TK Thaba
Supervisor:	Prof JJ Hlongwane
Co-Supervisor/s:	Dr MB Bulagi
	Prof A Belete
School:	Agricultural and Environmental Sciences
Degree:	Doctor of Philosophy in Agriculture (Agricultural Economics)

PROF D MAPOSA

CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.

ii) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

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08 June 2023

TO WHOM IT MAY CONCERN

This letter serves to certify that I have edited a doctoral thesis titled: **IMPACT ANALYSIS OF THE FLOATING EXCHANGE RATE ON THE OUTPUT, EXPORT AND EMPLOYMENT IN THE SOUTH AFRICAN RED MEAT INDUSTRY, 1995-2020** by **TSHEPHI KINGSLEY THABA**. A version of the manuscript with the evidence of my editorial and proofreading interventions has been forwarded to the author(s) and can also be provided by upon your request. I am confident that you will find the editing quality in order.

Best regards

Sebola, M

DR. MOFFAT SEBOLA