The econometric estimation of the domestic demand for broiler meat in South Africa (1971 - 2012)

by

Mmapake Florence Masha

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SUPERVISOR: PROF A. BELETE

CO-SUPERVISOR: Ms M.H LEFOPHANE

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ABSTRACT

The aim of the study was to estimate the future demand for broiler meat in South Africa. The first objective of the study was to identify factors that affect the demand of broiler meat. The second objective of the study was to determine whether the variation in specific economic factors have a significant effect on the quantity of broiler meat demanded in South Africa. The third objective of the study was to determine whether the variation in joint economic factors have a significant effect on the quantity of broiler meat demanded in South Africa. The data used in the study were obtained from Department of Agriculture, Forestry and Fisheries under Directorate Agricultural Statistics and Economic Analysis. Log-log model was used on historical time series data starting from 1971 to 2012 to estimate the demand of broiler meat in South Africa. Data were further categorized into two periods; that is; 1971 to 1995 and 1996 to 2012, to check the effect of policy changes on the demand for broiler meat which is the deregulation of agricultural markets.

The results of the study revealed that the main determinants of broiler meat demand include price of broiler meat, price of beef, price of pork, price of mutton and the level of income. The regression results for the period 1971 to 1995 reveals that broiler meat demand was inelastic with respect to price of broiler meat. The results of the study further revealed that beef, mutton and pork are the substitutes of broiler meat and they have significant effect on the demand for broiler meat. The regression results for the period 1996 to 2012 indicated that all the factors have significant effect on the demand for broiler meat with the exception of mutton price.

The results further indicated that short-run price elasticity of demand ranged from 0.531 to 0.932 and long-run demand elasticities ranged from 0.695 to 1.73 for the period between 1971 and 1995. This implied that broiler consumers were more responsive to price changes in the long-run. In addition, price elasticity of demand ranged from 0.152 to 0.190 in the short-run for the period between 1996 and 2012, while in the long-run the elasticities ranged from 0.530 to 1.05 signifying that behavioral adaptation plays a

significant role on the changes of price. Income elasticity in both short and long-run stood at 8.631 and 8.394 respectively for the period between 1971 and 1995.

On the other hand, for the period between 1996 and 2012 it stood at 1.787 in the short-run and 2.755 in the long-run. This signifies that income had a greater effect on the demand for broiler meat for both periods. However, the effect was even greater for the period between (1971 and 1995) implying that the effect of income on broiler meat demand is fading away today in South Africa. This may further imply that in the future broiler meat in South Africa will be considered as an inferior good.

It is on the basis of these results that the study recommends that more research be undertaken in order to understand the nature of broiler meat industry in South Africa before any policy development is made. The study for the time being, also recommends that the Department of Agriculture provide a policy instrument such as subsidies on animal feeds, purposefully to encourage more farmers in broiler production. This recommendation will increase production in pursue to respond to the high demand for broiler meat in the country.

Keywords: Broiler meat demand, short-run and long-run elasticities, log-log model

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DECLARATION

I declare that the mini-dissertation hereby submitted to the University of Limpopo, for the degree of Master of Science in Agriculture (Agricultural Economics) has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

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Surname, Initials (title)   **Date**

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LIST OF ACRONYMS AND ABBREVIATIONS

AMIE   Association of Meat Importer and Exporter

BFAP   Bureau for Food Agricultural Policy

BMI   Business Monitor International

CPI   Consumer Price Index

DAFF   Department of Agriculture, Forestry and Fisheries

FAO   Food and Agriculture Organisation

GAIN   Global Agricultural Information Network

NDA   National Department of Agriculture

SACU   Southern African Custom Union

SADC   Southern African Development Community

SAGI   South African Government Information

SAPA   South African Poultry Association

STATSSA   Statistics South Africa

CHAPTER ONE: INTRODUCTION

1.1 Background to the study

Broiler meat production and consumption in South Africa increased by 63.9% and 73.6% respectively from 2000 to 2010 (NDA, 2011). Poultry meat is an important source of protein and it is consumed by majority of people in the country. Studies reveal that broiler meat demand is the highest in South Africa as compared to other meat types such as pork, beef, mutton and goat. The broiler industry is the leading sector in meat industry of South Africa and it sustains many livelihoods. The Department of Agriculture indicates that income of broiler meat industry at producer level was R22 940 billion in 2010 and the per capita demand of broiler meat has increased from 19.7 kg in 2000 to 32.96 kg in 2010 (DAFF, 2011a). The broiler industry in South Africa accounted for 58% of the market share as compared to other enterprises in agricultural meat industry in 2006. Furthermore, broiler meat is the cheapest meat that most South Africans can afford. Its demand in South Africa is high and outstrips supply (SAPA, 2006).

In the year 2010, there was an increase of 3% in broiler production compared to 2009 as South Africa's economy recovered from recession. The rand exchange rate primarily drives broiler meat imports into South Africa. Broiler meat imports increased in 2009 by 7.8% to reach 205,827 tons due to a stronger Rand. Brazil is the most important trading partner for South Africa in terms of poultry meat imports, having 74.6% of the South African market. Although South Africa produces less than 1.5% of the world's broiler meat, it is a major poultry producer, with almost 80% of total broiler production in the Southern African Development Community (SADC) region. In addition, the production capacity expansion programmes that were introduced a few years back, increased imports due to a stronger rand exchange rate and this created an over-supply. However, as the South African economy has recovered from the recession, domestic demand for broiler products has increased (DAFF, 2011b).

The South African per-capita demand for broiler meat in 2012 was 35.79 kg whereas only 3.2 kg for mutton, 4.7 kg for pork and 16.60 kg for beef were consumed on an annual basis (DAFF, 2013a). Regardless of the price, the rise in broiler meat demand in the past few years was as a result of the fact that the industry responded to the needs of consumers and food services through value-added, brand name and convenience products. The broiler industry is not only producing commodity volume products, it increases the choices of consumers. Growth in the economy is responsible for the increased demand for broiler meat as improvement in standards of living can make many consumers to move towards protein filled diets, health awareness and convenience. The growing trend towards processed chicken meat and more sophisticated value-added products will create further market opportunities (FAO, 2011).

1.2 Problem statement

It is observed that agricultural products experience instability such as price fluctuation due to the shift in supply and demand. Most agricultural products are seasonal in nature, since they have a degree of perishability and the quantity supplied is uncertain as a result of external forces such as high input cost, inflation and climatic conditions. The change in consumer buying patterns is uncertain as a result of economic factors such as inflation and unemployment. The producers are not certain about the quantity demanded by consumers and consumers are also not certain about the quantity that will be supplied in the market. This leads to uncertainty with regard to producers and consumers' decisions since they both are always not sure what the price will be, hence they can either overestimate (or remain with surplus) or underestimate (and remain with deficit) the demand and supply for broiler meat.

The problem the study is trying to address firstly, is the fact that there is a gap between production and consumption. The domestic production of broiler meat in South Africa is not sufficient to cater for the entire population. Annual average growth in production of broiler meat is 2.4% and this is outpaced by the growth in demand which is 3.4% (BFAP, 2012). Secondly, price fluctuation is also one of the obstacles facing the industry as well as unfavourable policy environment. In South Africa, there is a high

demand for broiler meat due to an ever increasing population growth which grew from 52.89 million in 2013 to 54 million in 2014 (STATS SA, 2014) and this pushes up the price, which impact negatively on consumers who are in the low income bracket. The price for broiler meat is generally lower when compared to other types of meat which makes it to be consumed by all income groups. The prices of meat in South Africa, on the average, were R13.88/kg for broiler meat, R 16.74/kg for pork, R29.56/kg for beef and R42.91/kg for mutton in 2012 at producer level (DAFF, 2013b). Per capita demand of broiler meat in South Africa has increased over the past ten years from 14.53 kg in 2002 to 16.60 kg in 2012 (DAFF, 2013a).

Per capita demand of broiler meat is estimated to increase in the future due to positive economic growth, population growth and improved standard of living, since demand of broiler meat is closely related with disposable income (SAPA, 2006). Previous studies have focused on the development of models through which demand variation can be estimated and they also focused on quantifying the non-economic factors. Other studies have focused on all meat types in general and as a result there is limited literature on the broiler meat demand as an individual enterprise. In addition, most of these studies used Almost Ideal Demand System model (AIDS model) to address the problem and this study used log-log model. As such, this study focused specifically on the broiler meat enterprise. Furthermore it identified the specific factors that affect broiler meat industry and it goes on to determine whether the variation in economic factors has significant effect on the demand of broiler meat in South Africa. Therefore, it was found necessary to study the estimates of demand for broiler meat.

1.3 Motivation of the study

It is perceived that broiler meat is the most consumed meat as compared to other meat types in South Africa. As a result the study will help in the understanding of broiler meat status in terms of production, consumption and prices. This knowledge is also important on the sustainability and growth of the industry. In addition, the identification of the factors will help in understanding the implications of these factors on the broiler meat industry. The information generated from this study will specifically create awareness among the producers, policy makers and investors. The study may prompt the

producers to increase production in order to close the gap between production and consumption and therefore demonstrate the need for investors to increase the broiler meat production. This study will further encourage the policy makers to review the standard requirement of broiler meat and also to relook at the policy environment around the import of broiler meat as this leads to price instability on South African markets. Therefore, it is important to investigate the situational analysis of broiler meat industry in South Africa and evaluate the effect of policy change since market deregulation occurred in South Africa. Broiler meat in South Africa is the cheapest source of protein which makes it important for all stakeholders in the industry to be kept informed about what is happening in the industry from time to time and also to know about what may happen in the future.

1.4 Aim and objectives of the study

1.4.1 Aim

The aim of this study was to estimate the domestic demand for broiler meat in South Africa.

1.4.2 Specific objectives

i.   To identify variables that affects the demand for broiler meat in South Africa.
ii. To determine whether the variation in specific economic factors has significant effect on the quantity of broiler meat demanded in South Africa.
iii. To determine whether the joint economic factors have a significant effect on the quantity of broiler meat demanded in South Africa.

1.5 Research hypotheses

i.   There are no variables that affect demand for broiler in South Africa.
ii. The variations in specific economic factors have no significant effect on the quantity of broiler meat demanded in South Africa.

iii.   The joint economic factors have no significant effect on the quantity of broiler meat demanded in South Africa.

1.6 Organisational structure of the dissertation

This study is organised into 5 chapters. Chapter 1 provides general introduction and background information to the study, problem statement and motivation, aim, objectives and hypotheses of the study. Chapter 2 provides literature review which highlights the review of previous studies. Chapter 3 provides the methodology of the study which includes the study area, data set and analytical technique. Chapter 4 presents the results of the study and interpretation of the results. The last chapter of the study is chapter 5 which includes the summary, conclusion and policy recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of South African poultry industry. The chapter also highlights the demand and supply of broiler meat in South Africa. The effect of policy changes on broiler meat industry is also reviewed. Factors affecting the demand for broiler meat in South Africa are later discussed in this chapter.

2.2 Review of previous studies

2.2.1 Overview of South African poultry meat industry

According to Terry (2013), demand of poultry meat has increased rapidly in two continents, namely, Oceania and Africa as compared to other continents. The report indicates that the global average uptake per person for poultry meat has increased from 11.1kg to 13.6kg during the 10 years period (2001 to 2010). The report further indicates that poultry meat consumed globally increased from 68.9 million tons to 95.1 million tons during the passed 10 years period.

The study also indicated that in South Africa per capita demand of poultry meat was estimated at a record 36.8kg in 2012. It also indicated that the recent change in policy on increment of tariffs on imported poultry has increased the price. Even though poultry meat is consumed at greater quantities in Africa, reports indicated that Africa lags behind compared to the world at large. This mainly indicates that there are economic challenges that exist in this region (Terry, 2013).

According to the report by South African Poultry Association (SAPA), demand of broiler meat in South Africa prevailed at 1.851 million tons in 2012 whereas on the other hand the production prevailed at 1.448 million tons, imports and exports stood at 370 901 and 7422 tons respectively. The report further indicated that the per capita demand of broiler meat is 36.26kg per annum (SAPA, 2013a).

2.2.2 Demand and supply for broiler meat in South Africa

The poultry meat industry in South Africa is expanding to larger quantities however the demand still outstrips supply. South Africa slaughters about 979 million broilers per annum which is equivalent to 1.37 million tons of broiler meat during the year 2011(SAPA, 2013a). The industry expanded from 1.37 million tons of broiler meat to 1.4 million tons in 2012. It continued to increase gradually in 2013 to 1.42 million tons of broiler meat. The population of South Africa consumed 1.8 million tons of broiler meat in 2013. This clearly indicates that South Africa is not producing enough broiler meat since the production of broiler was 1.42 million tons during the same year. Boiler meat remains the dominant meat type consumed in South Africa. The imports of broiler meat in South Africa continue to increase as the demand increase rigorously. Basically, South Africa supplements the local demand by importing 28% of the total local production of broiler meat (GAIN, 2013).

2.2.3 Effect of policy changes on broiler meat industry

It is perceived that poultry meat was not under the control board of the Marketing Act of 1968 but the substitutes of broiler meat were regulated by this Act. South African poultry industry has recently experienced a change in policy. There was initiation of anti-dumping policy against Brazil since they were deemed to dump their poultry meat in South Africa at very low prices which disadvantages the income of local producers. Recently, there was change in tariffs applied on imported poultry meat in South Africa. The tariffs increased from 27% to 82% (SAPA, 2013b).

The increment of tariffs on poultry meat leads to increase in food prices, limited access and this poses a serious threat on food security in South Africa. The tariffs increment was implemented to protect local producers but on the other hand the poor consumers of South Africa are now faced with higher prices of broiler meat in local markets. The tariffs increase was implemented in order to make imported and local produce of poultry meat to be on the same price level. Currently, South Africa imports more poultry meat from the European Union and this tariff increment does not apply to European Union

countries. As a result, the implication of this policy may not be much effective in the long run (AMIE, 2013).

Anti-dumping policy is the protectionist tariffs that a domestic government imposes on foreign imports that are normally priced below the market price. Dumping is the act of charging lower prices for the good in a foreign market than one charge for the same good in a domestic market for demand in the place of the exporter. Anti-dumping actually protects the interest of the domestic industries. In 2012 South Africa introduced anti-dumping duty on the imported poultry meat from Brazil and there was no success with regard to this matter, hence it introduced tariffs increment on imported poultry meat (SAPA, 2013b).

2.2.4 Factors affecting demand for broiler meat in South Africa

Radder and Le Roux (2005) maintain that meat is a product that is consumed mostly in the world. The most consumed meat types in South Africa include poultry, beef, mutton and pork. Poultry meat is the most consumed meat type in South Africa due to prices and healthy issues associated with this meat type. Poultry meat is commonly valued as a cheap source of protein. It is perceived as healthy meat type as compared to other meat types such as red meat since it has saturated fats. The study maintains that non-economic factors such as health, sensory variable, social interaction familiarity and habit, psychographics and demographics influence the demand for poultry. While on the other hand the economic factors include prices, promotion and distribution of poultry meat.

In spite of the affordable price of broiler meat, the poultry meat industry is perceived as an industry that responds to the needs of consumers and food service operators for value-added, brand and convenience product. Economic growth is also derived as one of the factors that influence the demand of broiler in South Africa. Economic growth improves the living standard of the consumers as a result they move towards more diet-filled protein, health awareness and convenience. Marketing in the poultry industry is improving and this attracts the consumers to the poultry industry (GAIN, 2012).

Magdelaine *et al.* (2008) noted the main factors that affect demand for poultry meat. The study revealed that low pricing and competitive pricing of poultry are among the factors contributing to higher demand of poultry. It was further revealed that the absences of cultural or religious obstacles, dietary and nutritional value are the core factors influencing demand of poultry meat. It was also revealed that preparation time and diversification of places of demand also contributes to the higher demand of broiler meat. South Africa changed towards diets containing high level of proteins. Poultry meat is perceived as convenient, healthy and affordable source of protein (BMI, 2013).

2.2.5 Meat demand studies done in South Africa

Taljaard (2003) conducted a study on econometric estimation of the demand for meat in South Africa. The objectives of the study included the development of a model through which the demand relations could be estimated and easily updated for future use. The methodology used included demand model specifications, namely the Rotterdam and Linearized Almost Ideal Demand System (LA/AIDS). These models were first tested to see which one among them could best fit the data for meat demand in South Africa. The uncompensated own price elasticity for beef (-0.7504) was the largest in absolute terms, followed by mutton (-0.4678), pork (-0.36972) and chicken (-0.3502). In terms of the compensated own price elasticities, which contain only the pure price effect, pork was the most elastic, followed by mutton, chicken and beef.

Poonyth *et al.* (2001) conducted a study in South Africa and indicated that per capita demand of red meats, particularly of beef decreased whereas demand of poultry meat has increased over the past years. The empirical results indicated a long run growth prospect for poultry meat demand. The results further indicated that red meat has a price elasticity of -0.41, and poultry meat is a significant substitute for red meat, with a cross price elasticity of 0.8762.

Taljaard *et al.* (2006) conducted a study about a broader understanding of South African consumer spending on meat. Generally, the study analysed meat demand trends and meat demands in order to quantify the effect of non-economic factors on the demand for meat in South Africa. Ordinary Least Squares (OLS) was applied and also the

Johansen co-integration approach to identify the significant changes in the contributions of economic and non-economic factors towards meat demand. The results of the study indicated that non-economic factors such as health, safety, preference and taste play a greater role in determining meat demand in South Africa.

Oyewumi *et al.* (2010) conducted a study on "Tariff and Tariff Rate Quota Liberalisation in the South African Livestock Industry: Approaches to Welfare Measurement". The study used a partial equilibrium comparative static model. The model was used to measure the welfare effects of further liberalisation in the livestock industry of South Africa, particularly in meat products using four policy scenarios. The impact of trade liberalisation on consumers and producers of livestock products were compared in the study. The results showed that income change is necessary to attain the welfare level resulting from trade liberalisation given the current prices.

Vink and Van Rooyen (2009) studied perspectives on the performance of agriculture in South Africa since 1994 and implications for its role in achieving sustainable food security. The study indicated that poultry meat was not under any statutory control board but substitute of poultry were under control board. It was further noted that demand for poultry continues to increase throughout the years. In addition, the study indicated that the decline in the real price of animal feeds since deregulation has resulted in relatively low red meat prices.

2.2.6 Meat demand studies done in Africa

Alboghdady and Alashry (2010) discovered that own-price elasticity was highest for fish, followed by chicken, beef and duck. On the other hand, the cross-price elasticity of beef showed a complementary relationship with the other meat types, except for fish, which is substitutive. Chicken and fish showed a substitutive relationship with all other meat types. Compensated own-price elasticity estimates showed similar trends but smaller values than uncompensated ones, which is theoretically consistent.

Yadeta *et al.* (2002) conducted research on poultry marketing focusing on structure, spatial variations and determinants of prices in Eastern Shewa Zone, Ethiopia. The objectives of the study were to assess chicken marketing structure, constraints and

examine determinants of chicken prices. Descriptive statistics and correlation methods were used to analyse the data. Results showed that chicken marketing system is characterised by many producers and buyers. The marketing channels are relatively short and transactions between producers and consumers are dominant in most markets. The results also showed that access to large urban consumer centres; weight, breed type, colour and seasonal demand have a significant impact on the prices of chickens.

2.2.7 Meat demand studies done across the world

According to Hupkova and Bielik (2009), the main determinants of meat demand in Slovakia were income, prices, convenience and health issues. The aim of the study was to obtain estimates of demand elasticities on income and prices. The fixed effect specification was used to analyse the study. The study indicated that beef demand by pensioner was income elastic whereas demand for pork and poultry were income inelastic. The study also indicated that demand for poultry meat in Slovakia is continuously increasing. The main finding of the study was that the declining beef demand in Slovakia was influenced by the decreasing purchasing power and the occurrence of diseases.

Maradoli *et al.* (2001) conducted a study in Indonesia on the Demand for Beef: Implications for Australian Agribusiness. The main purpose of the study was to report the results concerned with producing more reliable demand parameter estimates of meat in Indonesia. The methodology used was the Linear Approximation of the Almost Ideal Demand System (LA/AIDS) model. The estimated own-price elasticity of the beef group and chicken group was negative. The cross-price elasticities indicated that all the meat groups are substitute goods, as expected. Furthermore, consumers seemed more likely to adapt their chicken demand patterns to price changes than they did for beef.

Bhati (1987) did a study in Australia which mainly focused on changes of poultry meat sector since 1970. Log linear model was used to analyse the data. The results revealed that own price elasticity of supply was 0.90 for chicken meat and 1.19 for poultry meat. Own price elasticity of demand for chicken meat -0.35 and – 0.36 for poultry meat. The

cross price demand elasticity was 0.23 for poultry meat and 0.21 for chicken meat with respect to substitute meat (beef and veal, mutton and pork) as a whole. The review forms a basis for the formulation, estimation and interpretation of an econometric model of poultry meat supply and demand.

A study by Taha and Hahn (2012) indicated that poultry meat was a close substitute for pork, sheep and offal. The study also indicated that coefficient for beef was positive and negative for other meat types.

Capps (1989) utilised scanner data to estimate retail demand function for meat products which includes steak, ground beef, roast beef, chicken, pork chops, ham and pork lion. The results of the study indicated that own price elasticity were negative and statistically significant, exception was only for roast beef which was in the inelastic range. The results of the study further revealed that cross-price elasticities were positive and statistically significant.

Goodwin (1992) conducted a study on short and long-run elasticities on demand. In this study the researcher discovered that short-run and long-run elasticities are defined by the parameter of the model while in the cross section results short and long-run elasticities are based on the original author's own judgment on the nature of behavioral changes and variables allowed in the model. It was also discovered that short term elasticities were usually lower than the long term elasticity mainly due to behavioral adaptation that occur over a period of time. The response of consumers on demand is more visible in the longer-run than in the short-run. The study revealed that pricing has a powerful cumulative effect on the pattern of demand.

Jonathan *et al*. (2006) discovered that in the short run, consumers appear to be less responsive to increases in prices of gasoline. The study compared the prices and income elasticity of gasoline demand in two periods using log-linear model. It revealed that short run elasticities differ considerably and that elasticities ranged from -0.034 to -0.077 during 2001 to 2006 and -0.21 to -0.34 for the period between 1975 and 1980. The income elasticities of gasoline ranged from 0.47 to 0.49 (1995 to 1980) and from

0.53 to 0.54 (2001 to 2006). On the other hand, the price elasticity of gasoline demand ranged from -0.31 to – 0.34 (1975 to 1980) and -0.041 to -0.043 (2001 to 2006).

Hassan (2013) applied a multistage almost ideal demand system on beef demand in Colombia and discovered that price elasticity of demand for beef (-0.24), chicken (0.16) and pork (-0.02) in the short-run, while in the long-run price elasticity for demand for beef (-1.95), pork (-0.09) and chicken (-0.03). The study further indicated that the total expenditure of elasticity demand for beef was 1.78 in the long-run and 0.03 in the short-run.

2.2.8 Chapter summary

The main purpose of the chapter was to provide an overview on previous studies regarding meat demand and also provide the methodologies they used to analyse their data. The studies have indicated that most of the researchers used almost ideal demand system to estimate the demand for meat. This study focused on determining whether the variation in economic factors has significant effect on the demand of broiler meat in South Africa using log-linear model.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides an overview of the method used in analysing variables which were considered in estimating demand for broiler meat. The chapter further shows the study area, data set and analytical technique/model used to analyse the data. The chapter goes on to describe model used to address the objectives. In addition the chapter shows the properties of the model to emphasize the rationale behind using the model in this study.

3.2 Study area

The study is done on the entire South Africa and South Africa is a country located at the southern tip of Africa. It is divided into nine provinces. South Africa is a multi-ethnic nation and has diverse cultures and languages. Eleven official languages are recognised in the South African constitution. South Africa is ranked as an upper-middle income economy by the World Bank. It has the largest economy in Africa and the 28th-largest in the world (SAGI, 2011).

Poultry meat in South Africa is consumed throughout the nine provinces. The broiler meat is produced across South Africa. However the major producers of broiler meat in South Africa include North West, Western Cape, Mpumalanga and Kwa-Zulu Natal. The four provinces are the sources with 81% of broiler meat produced in South Africa (DAFF, 2011b).

The broiler meat industry contributes a lot to the economy of South Africa. It is projected that broiler meat industry contributed a gross value of about R15. 989 billion on an average of ten years (2002-2011). The poultry meat industry employs about 26 306 people in South Africa (DAFF, 2012).

Figure 1: South African map

Source: SAGI, 2011.

3.3 Data set

The study used secondary data obtained from Department of Agriculture, Forestry and Fisheries (DAFF). The data was produced under the Directorate of Economic Analysis and Agricultural Statistics. The data showed consumption of broiler meat, prices of other meat types, price of broiler meat, production, income levels, exports and imports from 1971-2012 in South Africa.

3.4 Analytical technique/model

The data were analysed using both descriptive statistics and demand equation. The demand equation measures the comparative effect of each factor upon the quantity demanded for broiler meat in South Africa. The nature of the study requires a non-linear empirical demand specification and the log- log model was employed in this study as this form of specification provides better estimates of demand for broiler meat (Rosenfeld, 2002).

3.4.1 The log- log model

A log-log model is a mathematical formula that takes the form of a function whose logarithm is a first-degree polynomial function of the parameters of the model, which makes it possible to apply linear regression (Rosenfeld, 2002).

The general model can be written as:

$$\ln Y_t = \beta_0 \ (P^{b1}_{\ C}) \ (P^{b2}_{\ B}) \ (P^{b3}_{\ P}) \ (P^{b4}_{\ M}) \ (I^{b5})$$

In order to obtain the estimates from the log-log demand function, the function must be converted into linear form using natural logarithms and as the result the function is estimated as follows in logarithms (ln):

$$\ln Y_t \ = \beta_o + \beta_1 \ \text{lnprC} + \beta_2 \text{lnprB} + \beta_3 \text{lnprP} + \beta_4 \text{lnprM} + \beta_5 \ln I \ + U_t$$

Where Y_t = demand of broiler meat (000' kg)

    lnprC = Real price of broiler (R/kg)

    lnprB = Real price of beef (R/kg)

    lnprP = Real price of pork (R/kg)

    lnprM = Real price of mutton (R/kg)

    ln I = Real income (R)

    U_t = Disturbance term

    $\beta_{o.....} \ \beta_6$ = Estimated parameters

3.4.1.1 The properties of log- log model

The most important property about the log transformed function is the fact that the estimated parameters are actually the elasticity for corresponding variables. This approach provides precise measure of the responsiveness of the quantity demanded in broiler meat. The log-linear model indicates the effect of a one-unit change in any independent variables (own price, price of broiler meat substitutes and also the income)

on the dependent variable which is consumption and will tend to vary while the elasticities of demand are assumed to be constant. A log-linear model provides more control over the interaction of the variables (Rosenfeld, 2002).

The following table shows variables description and prior expectation of the results (coefficients of variables).

Table 3.1: Description of variables and units of measurement

Variables	Description and units	Prior expectation of the result
Y_i	demand for broiler meat (kg)	Dependent variable
B_o	Intercepts	+
p_rC	Real price of broiler meat (R/kg)	-
P_rB	Real price of beef (R/kg)	+
p_rP	Real price of pork (R/kg)	+
p_rM	Real price of mutton (R/kg)	+
I	Real income per capita (R)	+
T	trend	
U_t	Disturbance term	

3.5 Mathematical formula for converting nominal price into real price

The nominal price of broiler, pork, mutton and beef were converted to real price by using the price index (CPI) in order to capture the real changes in prices. In other words, to avoid problems of estimates bias that originates from inflation, the nominal

price of broiler, pork, mutton and beef were converted into real prices by using the CPI. The prices were converted using the following formula:

$$\frac{\text{Nominal price}}{\text{Price Index}} = \text{Real price}$$

3.6 Data analysis

The study used spss and excel to analyse the data. The data analysis includes qualitative and quantitative. The log- log model was used to answer the all the objectives. The objectives of the study firstly to identify the factors that affect the demand of broiler meat and this objective was answered using log-log model (looking at t-ratio, level of significance and coefficients). The second objective was also addressed using log-log model (coefficients and t-ratio). The third objective was also addressed using the log-log model looking at coefficient and f-ratio.

3.7 Chapter summary

This chapter has provided an overview of the study area, data set and also the method used to analyse the data. The study used log-log model to address the objectives of the study. The study intended to identify factors affecting broiler meat demand in South Africa and also to determine whether the variations in economic factors have significant effect on the quantity of broiler meat demanded in South Africa. This study used log-log model to analyse the data.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter discusses the results of the study. As highlighted in chapter three of the study, prior expectations of the results were that the price of broiler meat would be negative whereas the price of substitutes would be positive as supported by economic theory. The signs of the coefficient in this study play a vital role in the interpretation of the results. The results of this study are categorised into two periods in order to show the effect of policy change during the time when South African markets were regulated and after the deregulation occurred. The study results cover the period between 1971 and 1995, and the period between 1996 and 2012 and this was done by running regression analysis for the two periods separately.

4.2 The descriptive results of the study

Table 4.1: Descriptive statistics of the variables between 1971 and 1995

	Mean	Standard deviation	Minimum	Maximum
Demand for broiler (000' kg per year)	5.925	0.451	4.777	6.495
Price of broiler meat (R/kg)	2.352	0.156	2.139	2.637
Price of beef (R/kg)	5.499	0.822	4.071	6.713
Price of mutton (R/kg)	7.376	0.913	5.970	8.776
Price of pork (R/kg)	5.302	0.763	3.942	6.435

Table 4.2: Descriptive statistics of the variables between 1996 and 2012

	Mean	Standard deviation	Minimum	Maximum
Demand (000' kg per year)	7.059	0.296	6.601	7.524
Price of broiler meat (R/kg)	2.684	0.371	2.037	3.471
Price of beef (R/kg)	7.125	0.595	6.023	3.952
Price of mutton (R/kg)	7.570	0.521	6.716	8.439
Price of pork (R/kg)	6.938	0.354	6.259	7.489

Tables 4.1 and 4.2 above show that the standard deviations are smaller implying that the values in the statistical data set are close to the mean value on average. Standard deviation measures the level of data concentration around the mean. Since the Tables 4.1 and 4.2 indicate that standard deviations are smaller it means that the data were more concentrated and it also indicates that variability between the minimum and maximum is lower. For instance, Table 4.1 indicates that demand for broiler meat had a minimum of 4.777kg and maximum of 6.495kg. The same scenarios were observed for minimums and maximums of beef price, broiler price and pork price for the period between 1971 and 1995. Table 4.2 also indicates that the standard deviations are smaller implying that the data were also concentrated around the mean during the period between 1996 and 2012. It is also observable from the Table 4.2 that during 1996 and 2012 demand for broiler meat had a minimum of 6.601kg and maximum of 7.524kg and this basically suggest that the variation of the data set was low in this period. The same observation applies to the price of broiler, pork, mutton and beef in this period.

The following figures were generated (by the researcher) on the basis of the secondary data compiled to show the historical trends on the following aspects. The aspects

considered are: consumption of broiler meat; real prices of various types of meat; production and consumption of broiler meat; income level and consumption of broiler meat; and volumes of imports and exports of broiler meat in South Africa over the two periods- 1971 to 1995 and 1996 to 2012.
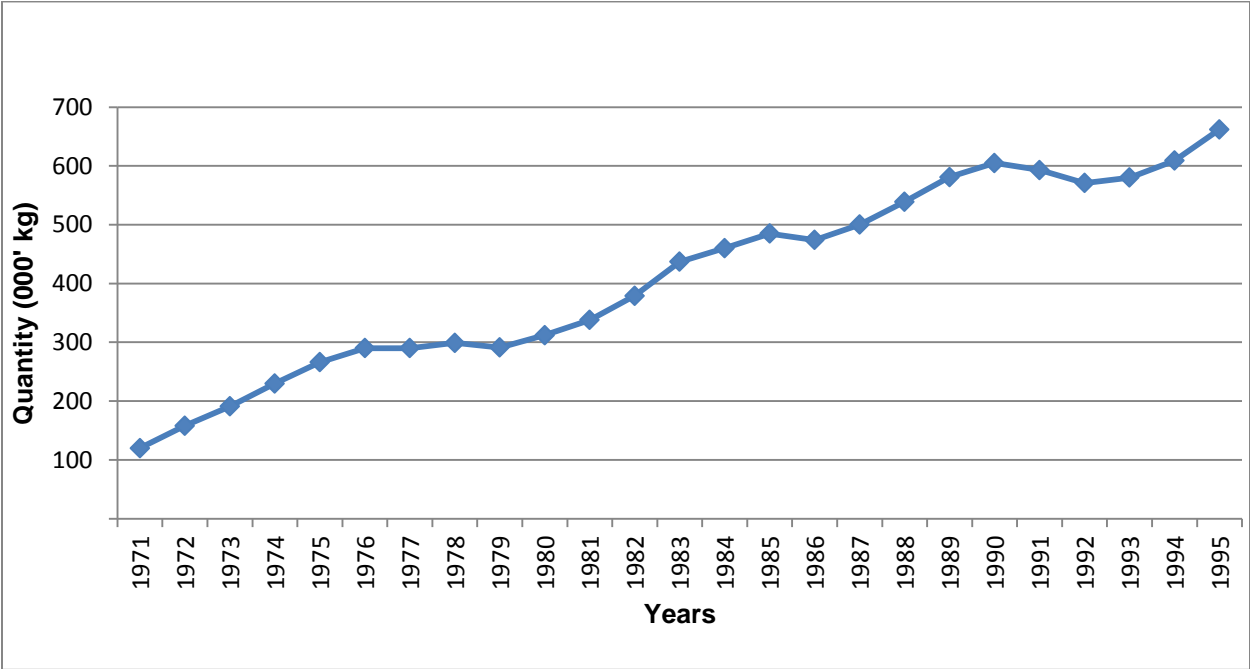
Figure 2: Consumption of broiler meat from 1971 to 1995.

Source of data : DAFF, 2013a

Figure 2 above indicates consumption of broiler meat during the period 1971 to 1995. Generally, the figure indicates that the consumption of broiler meat showed an increasing trend throughout the years. The figure also indicates that the consumption of broiler meat was fluctuating during the years between 1985 and 1994 and this may be attributed to the fact that during the late 80s and early 90s there, was drought in South Africa which led to low production in maize used for stock feed such as broilers. The drought led to fluctuation in the production of broiler meat. Figure 2 indicates that consumption of broiler meat was very high during the year 1995 and this may be due to the improvement in the livelihood of many South Africans as the country became a democratic state. In other words, most disadvantaged communities had access to the

resources of the country and this might have prompted high consumption of broiler meat.
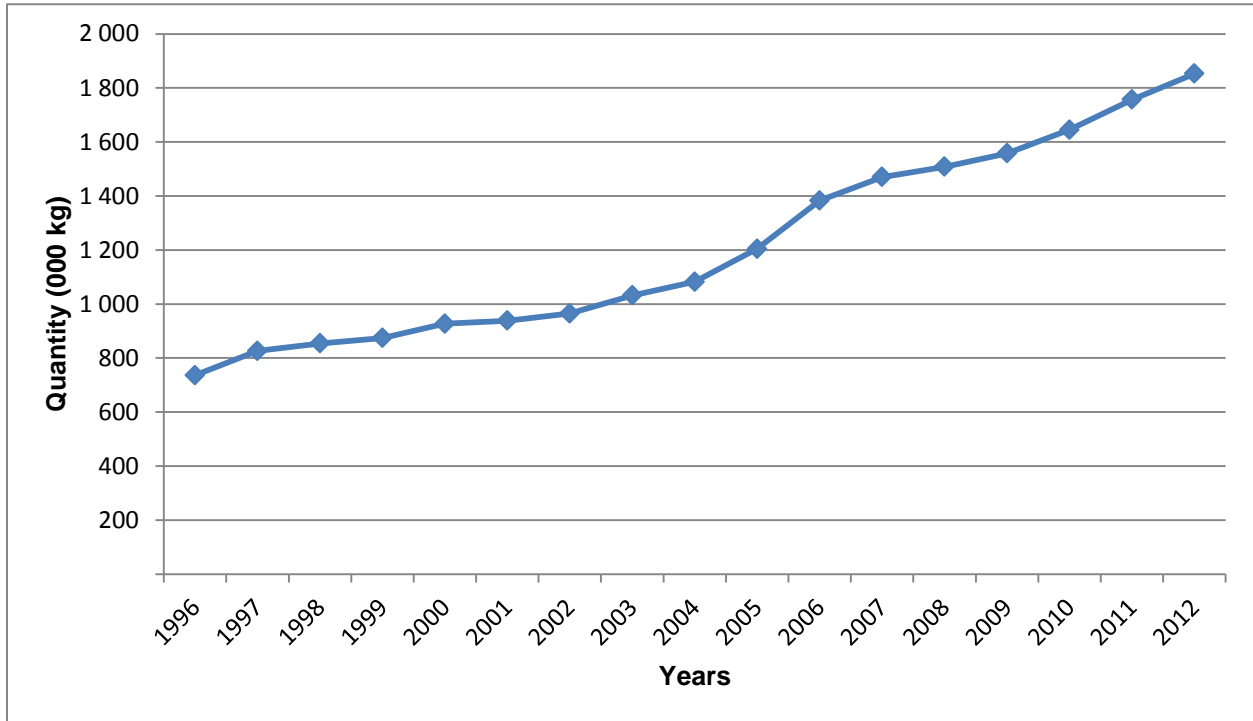
Figure 3: Consumption of broiler meat from 1996 to 2012.

Source of data: DAFF, 2013a

Figure 3 indicates the consumption of broiler meat from 1996 to 2012. The figure indicates that the consumption for broiler meat was lower during the period between 1995 and 2002. This was followed by a significant increase in 2003 which was attributed to the fact that economic growth in South Africa started to show significant economic growth. The employment rate increased significantly and many South Africans were able to afford broiler meat and the industry was also competitive.
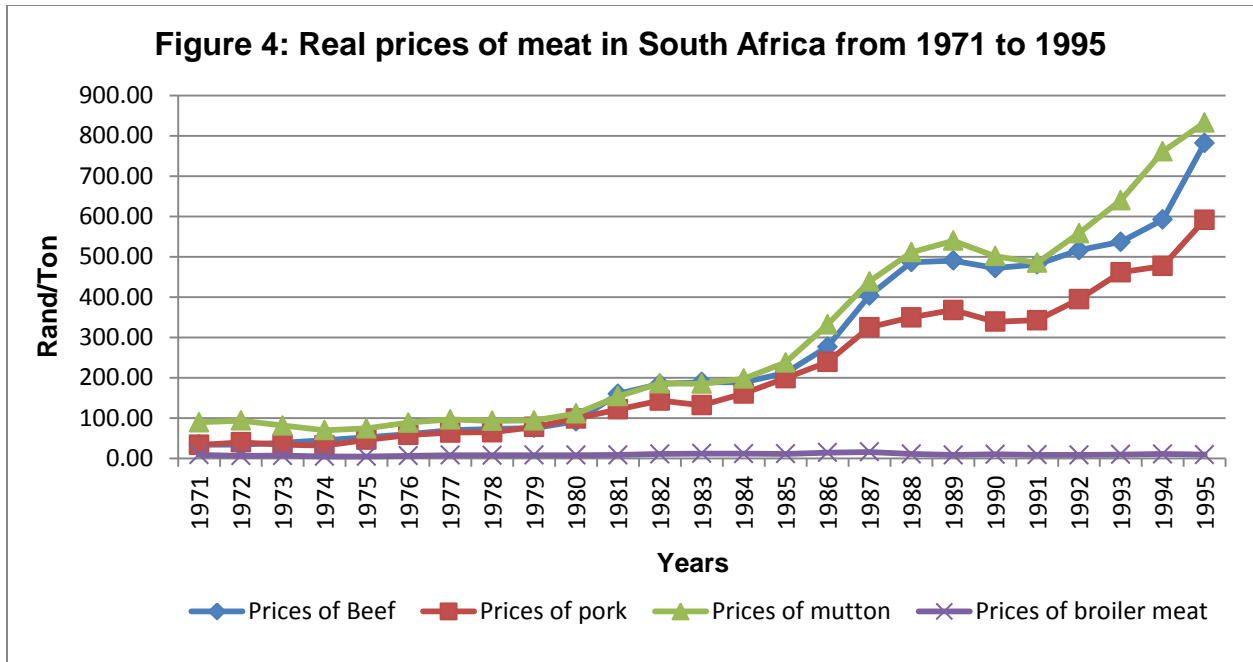
Figure 4: Real prices of meat in South Africa from 1971 to 1995.

Source of data : DAFF, 2013a

Prices for meat are determined by supply and demand forces. The law of demand state that the lower the price of a commodity the higher the demand. Microeconomic theory highlights that demand patterns depend on economic factors such as income levels, prices of substitutes and own price and it also depends on non-economic factors such as population growth, consumer preferences, health issues, quality, convenience or taste characteristics. The level of advertisement also may play a vital role to the increase in demand for meat (BMI, 2013).

The prices of the four meat types varied significantly as indicated on the figure above. The figure shows that broiler meat remained lowest throughout the period under analysis and this may be attributed to the fact that the production stages of broiler rearing are much shorter as compared to other livestock. The figure further indicates that the price of mutton was the highest throughout the period under analysis, followed by beef and pork due to high feed cost.
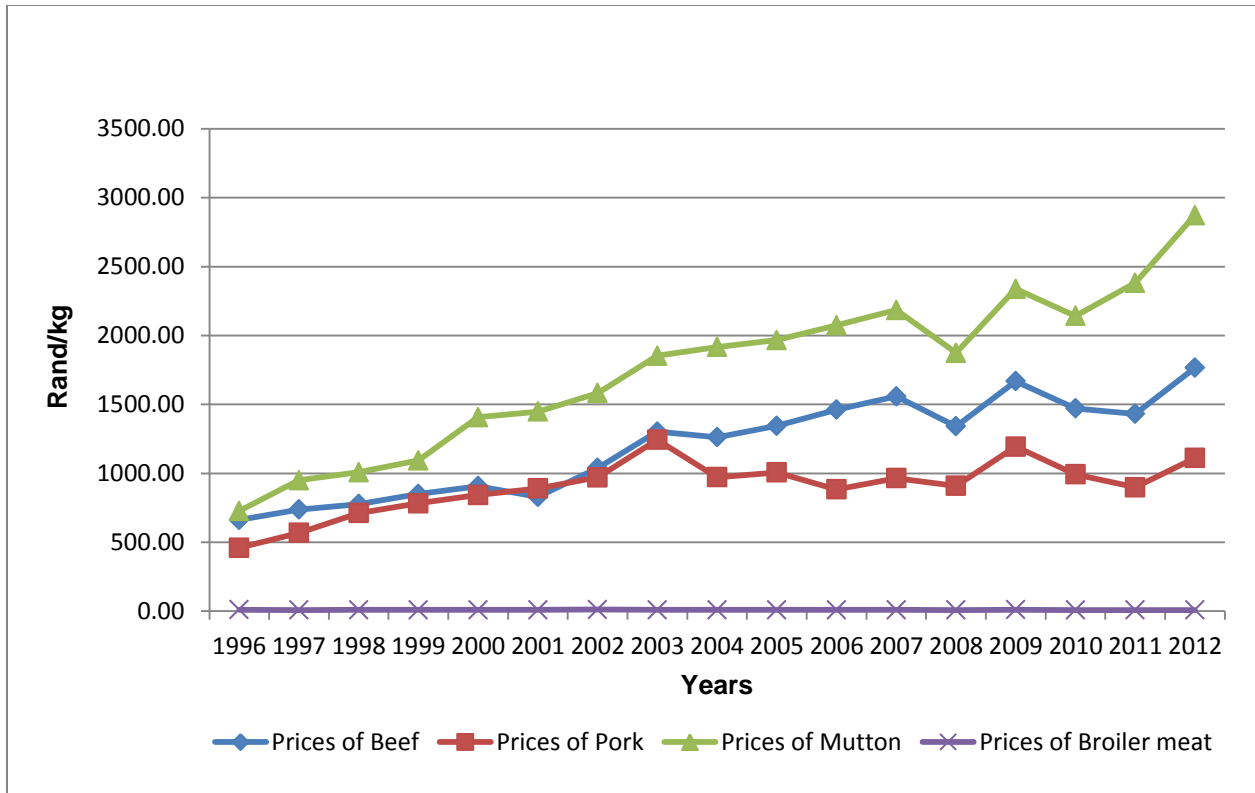
Figure 5: Real prices of meat in South Africa from 1996 to 2012.

Source of data : DAFF, 2013a

Figure 5 above indicates the prices of the four meat types from 1996 to 2012. Generally, the figure indicates that the prices of meat were fluctuating throughout the period under analysis mainly due to inflation rate during this period. Furthermore, meat prices were adversely affected by the dramatic increase in stock feed. In terms of local prices, all three meat types which include pork, mutton and beef had higher prices with mutton prices being dominant throughout the period under review. The price of broiler meat remained stable throughout the period of analysis; hence broiler meat had a high level of demand.
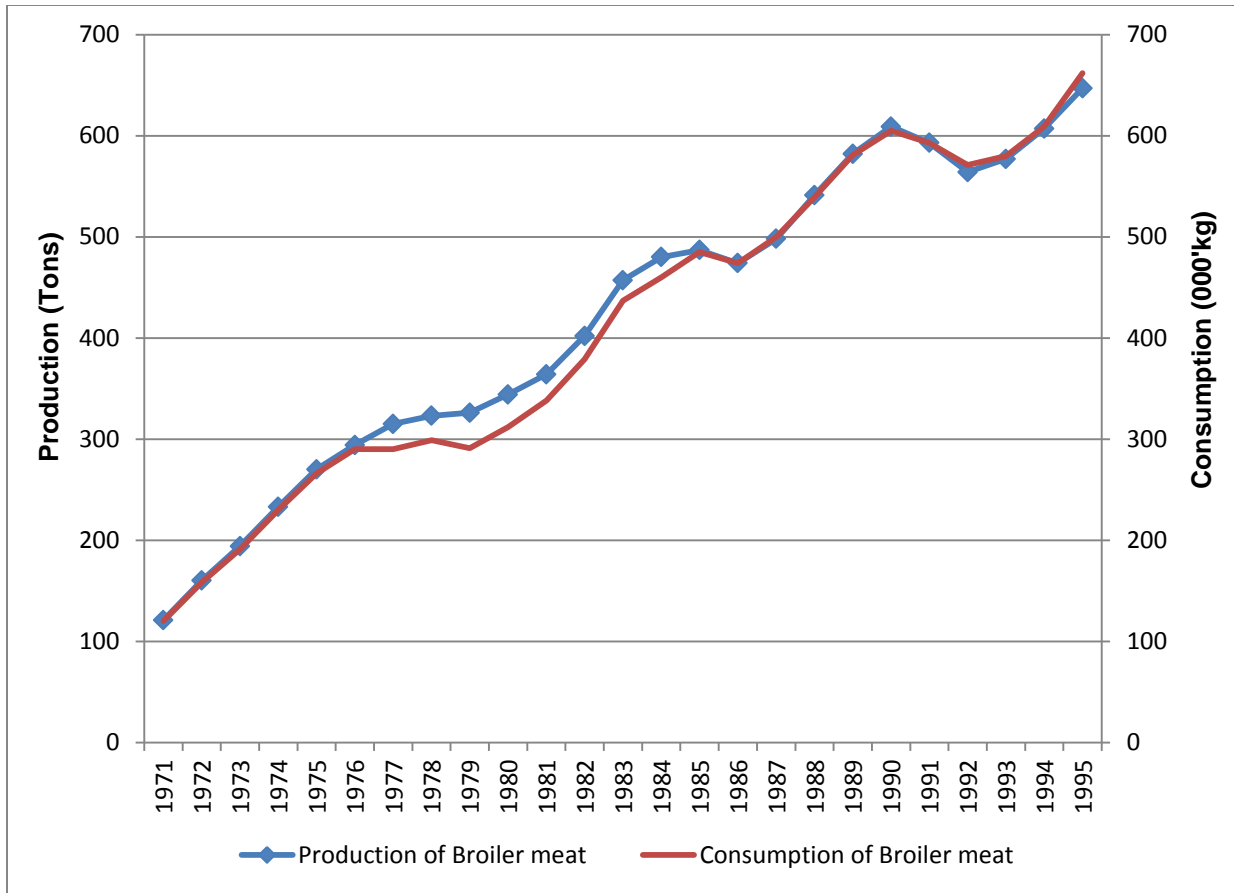
Figure 6: Production and consumption of broiler meat in South Africa from 1971 to 1995.

Source of data: DAFF, 2013a

Figure 6 above indicates consumption and production of broiler meat in South Africa from 1971 to 1995. Generally, the figure indicates that consumption and production in the previous years was more or less the same. It is observable from the figure that consumption of broiler meat outstripped the production between the period of 1985 and 1995. This may be attributed to rising purchasing power and changing of food habits. This was also the period when the economic situation of South Africa was starting to show significant improvement. The population of South Africa was increasing at an alarming rate; hence the consumption for broiler meat was increasing dramatically.
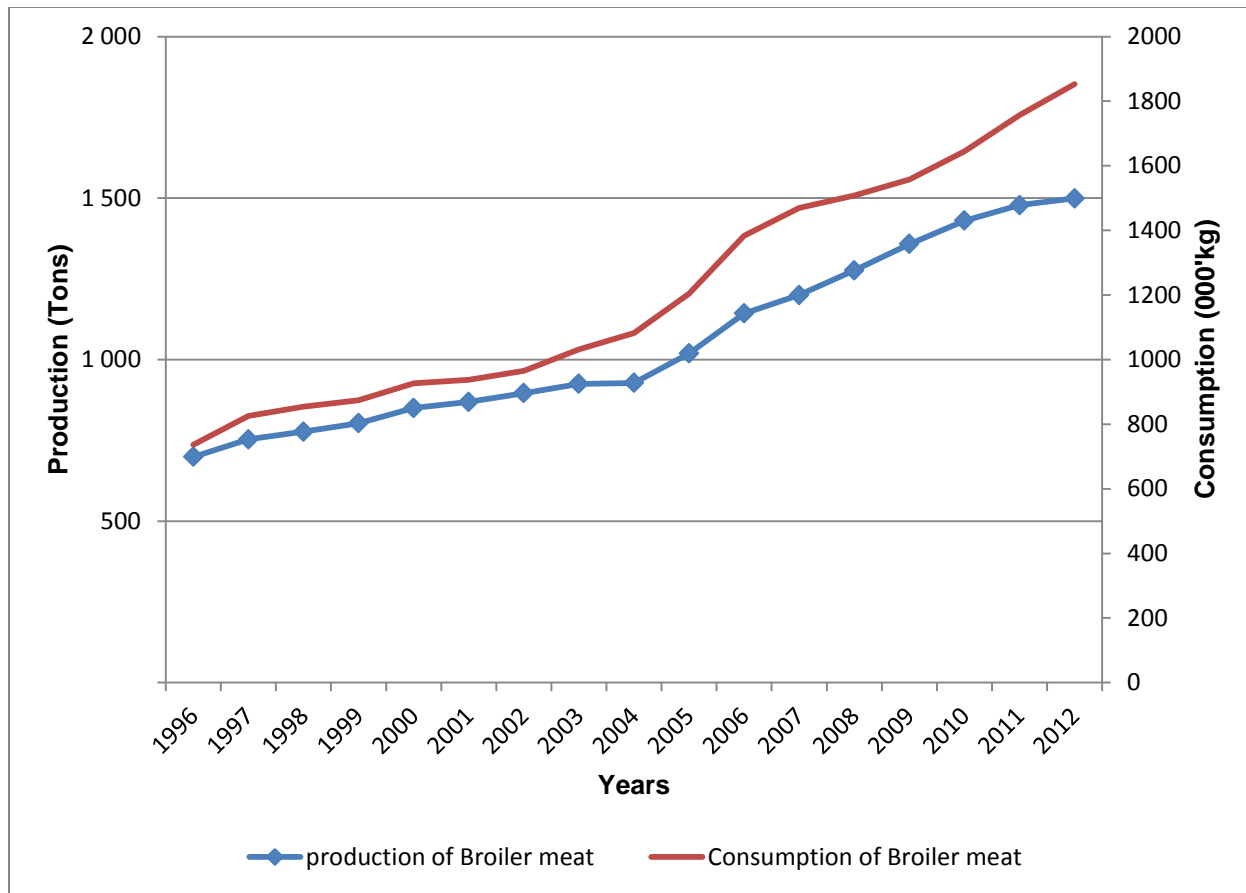
Figure 7: Production and consumption of broiler meat in South Africa from 1996 to 2012.

Source of data: DAFF, 2013a

Figure 7 above indicates production and consumption of broiler meat after the apartheid era and also during the period when the market of agricultural products was deregulated. Even though poultry meat industry was not under regulation, it was affected indirectly by the evolutions of the Marketing Act no 47 of 1996 due to the fact that the price of substitutes had an effect on the consumption of broiler meat. It is observable from the figure above that consumption of broiler meat continued to increase dramatically throughout the period under analysis and this was influenced by the fact that the price of broiler meat was affordable as compared to other meat types such as pork, mutton and beef as illustrated in Figure 4 and 5. In addition, this may be attributed

to favourable economic factors such as increasing urbanisation which made people to move towards healthy diets.
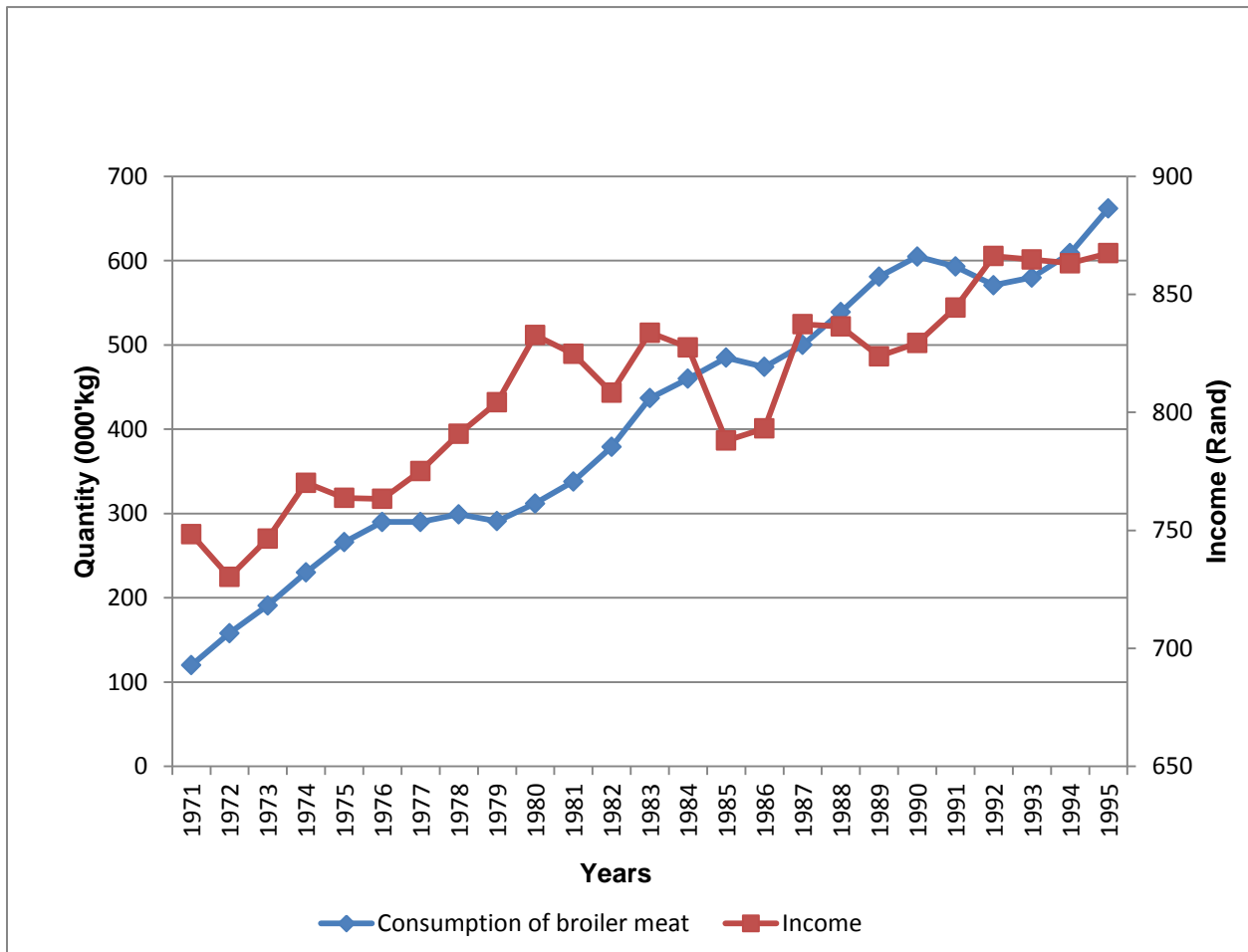
Figure 8: Income levels and consumption of broiler meat in South Africa from 1971 to 1995.

Source of data: DAFF, 2013a

Figure 8 above shows the local consumption of broiler meat and income levels for the period between 1971 and 1995. Generally, the figure indicates that the consumption of broiler meat and income level are not consistent to each other which implies that the income levels was less essential to the demand of broiler meat during this period under analysis (1971 to 1995). In the period between 1971 and 1974, income and consumption showed an increasing trend, meaning that an increase in income may

have led to increase in the demand for broiler meat. It is also evident from the figure that, for the period between 1986 and 1987 the level of income dropped while the demand of broiler meat continued to increase and this may also stipulate the fact that sometimes increase in consumption of broiler meat does not completely depend on income increment (autonomous consumption).
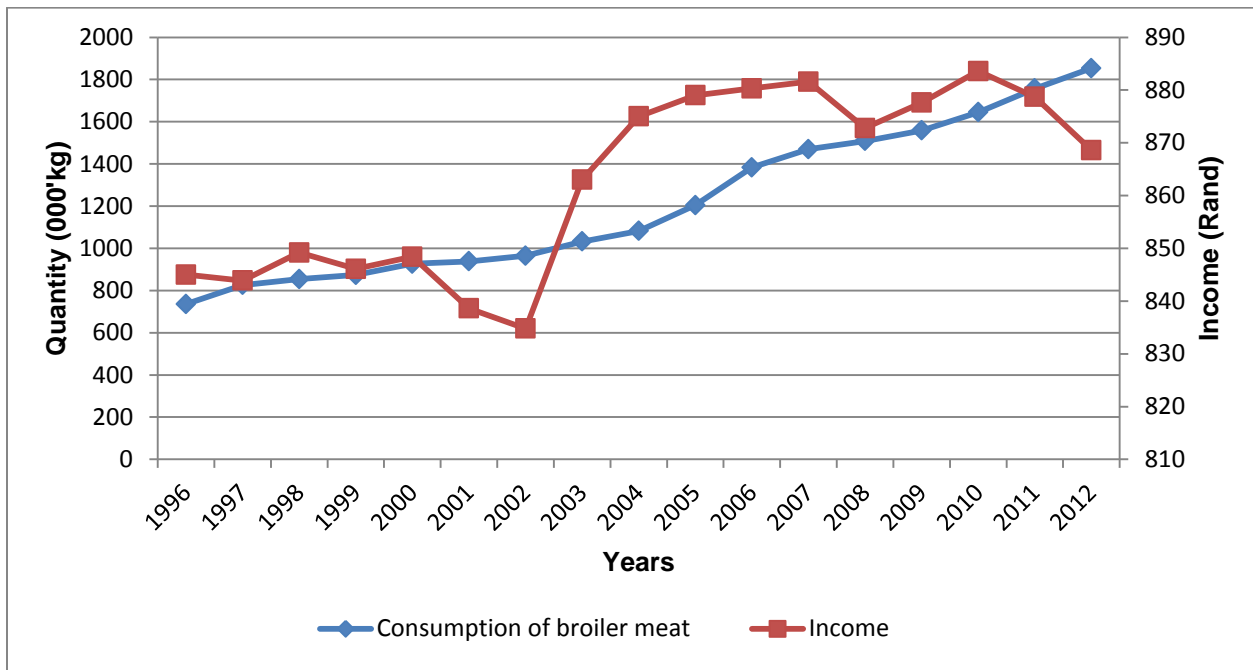
Figure 9: Income levels and consumption of broiler meat in South Africa from 1996 to 2012.

Source of data: DAFF, 2013a

Figure 9 above shows the consumption of broiler meat and incomes after the deregulation of market occurred in South Africa from 1996 to 2012. The substitutes of broiler meat were highly regulated before 1994 which affected the performance of the markets in South Africa. Today South African markets are relieved from the regulation and the broiler meat industry has started to be more competitive. It is evident from the figure that the demand of broiler showed a significant increase since market deregulation occurred and also the income levels of many South Africans have improved. Furthermore, the figure indicates that there was a significant increase of income levels for the period between 2003 and 2007 due to significant growth in the

economy of South Africa. This clearly indicates that the process of deregulating markets in South Africa has brought more improvements in the economy of the country.
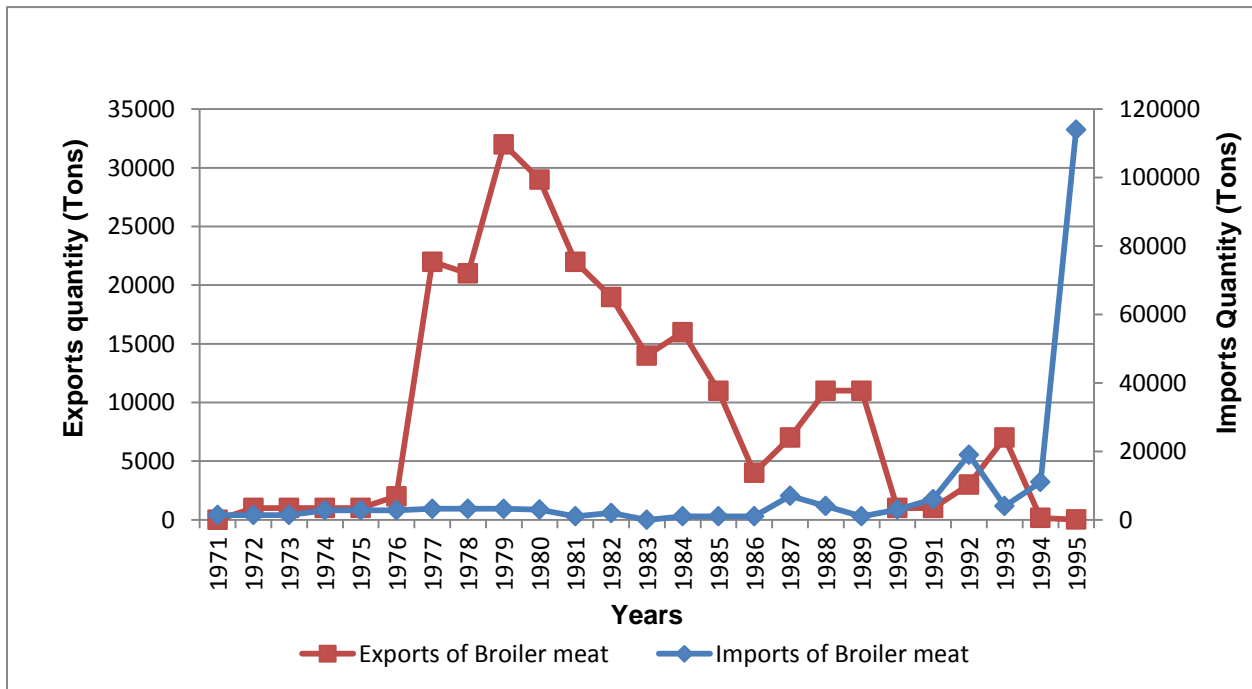
Figure 10: Volumes of import and exports of broiler meat in South Africa from 1971 to 1995.

Source of data: DAFF, 2013a

Figure 10 above indicates volumes of exports and imports of broiler meat in South Africa from 1971 to 1995. It can be observed from the figure that both exports and imports of broiler meat were lower during 1971 up to 1976. This may have been due to unfavourable conditions of exchange rates and trade sanctions. It further indicates that both imports and exports started to increase during the year 1977. It is also evident from the figure that from 1977 to 1989, exports of broiler meat in South Africa were more than the imports and this may be attributed to the fact that South Africa produced enough of broiler meat during this era. From 1990 South Africa started to import more broiler meat than exports, a trend that may have been triggered by high demand of broiler meat during the century from South African markets. The import of broiler meat increased to more than went 100 thousand tons in 1995. The import of broiler meat

grew at a rate of 92% annually for the period between 1971 and 1995. On the other hand exports declined at a rate of 3.9% annually for the period between 1971 and 1995.
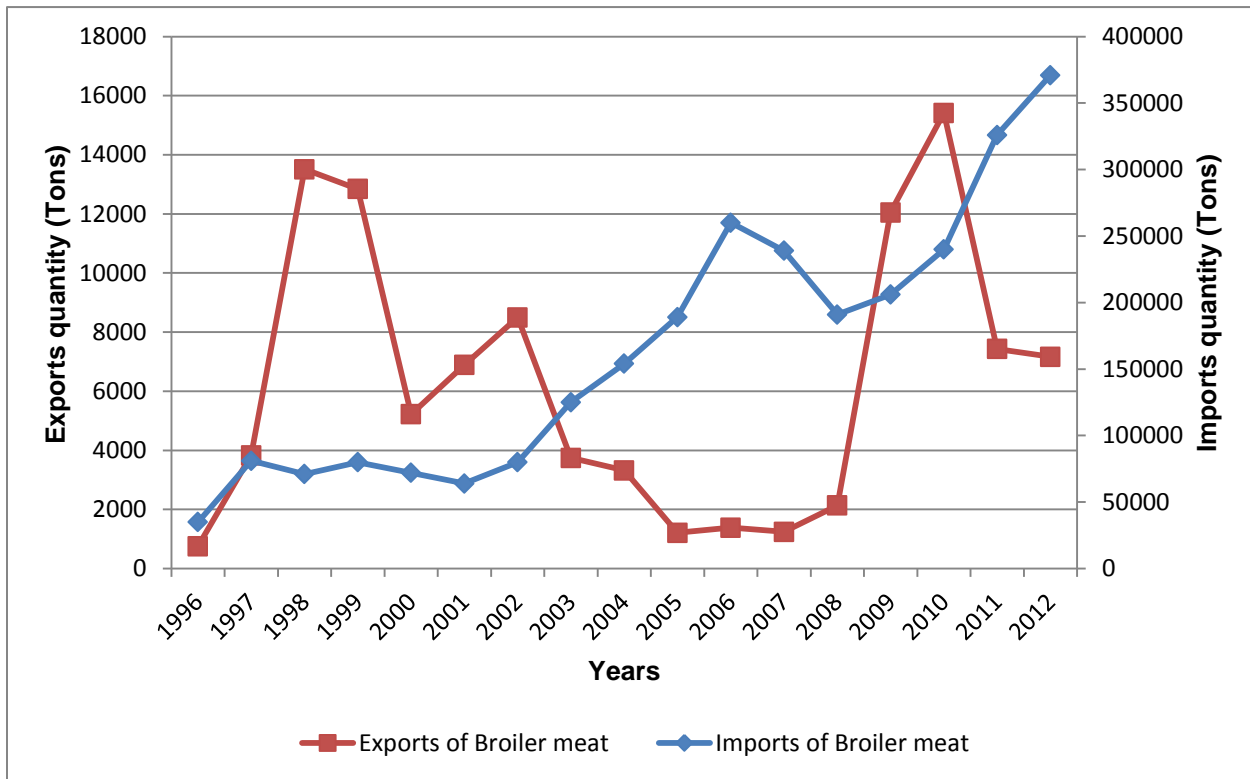
Figure 11: Volumes of import and export of broiler meat in South Africa from 1996 to 2012.

Source of data: DAFF, 2013a

The deregulation of agricultural markets in South Africa brought a massive change in the broiler meat industry. The effect of this market deregulation has brought a negative effect on the imports and exports market as it is observable from the figure above that from 1996 to 2012 there was a massive increase in the quantity of broiler meat import due to production and consumption trends. Production of broiler meat in South Africa is low hence low exports. However, the low production is not the only factor that leads to low exports but may be due to the quality of South African meat which does not meet the market requirement at international level. Due to the transformation that occurred in the meat industry since 1996, the number of commercial farmers has increased

significantly. The import of broiler meat grew at a rate of 21% annually for the period between 1996 and 2012. On the other hand, exports grew at a rate of 5% annually.

4.3 Empirical results of the study

The log-log regression model was used to test the significant level of variables. The model has the dependent variable which is the demand for broiler meat and this dependent variable is explained by independent variables which are the factors affecting broiler meat demand and these factors includes price of broiler meat , price of substitutes and income levels. The adjusted R square is used to describe the weakness and strength of the model. Moreover, the R square explains the importance of effects of independent variables on the dependent variable which is broiler meat demand. Results of the regression analysis are presented below in Table 4.3.

Table 4.3: Regression results for the period between 1971 and 1995.

Variable	Coefficient	Std. Error (SE)	t-statistic	Sig
Constant	48.708	22.970	2.119	0.047
Price of broiler meat	-0.881	0.513	-1.71	0.102
Price of beef	0.537**	0.201	2.670	0.015
Price of mutton	0.965**	0.375	2.484	0.022
Price of pork	0.932**	0.451	2.137	0.045
Income	8.631**	3.490	2.472	0.023

Dependent variable: Demand of Broiler

***, **,*: Significance at 1%, 5% and 10% respectively.

R- Squared: = 0.627 F-ratio: 6.407 at 0.0012

Table 4.3 shows the parameters, standard error of estimates, t-ratios and significant level. These elements can be used to test the significance level of each variable. As can be seen from Table 4.3, the price of broiler meat was not significant, while on the other hand the price of beef, mutton, pork and income level were significant variables at 5%. The table indicates that the t-ratio for all the independent variables were greater than 2

and exception was only for the price of broiler meat and this may be attributed to the missing data in some years. This was addressed by calculating the average of the data points and filling the missing data points. The results indicate that the model can best fit the data as it can explain 62.7% of the variation in the dependent variable whereas 37.3% was not explained by the model. This signifies that the independent variables included in this demand equation are important in explaining the variation or effect of the independent variables on broiler meat demand. The F-ratio is 6.407 at the significance level of 1% which implies that the joint economic factors have significant effect on the demand of broiler meat.

 It was also noted from the literature that there are other factors such as safety, health, preference and taste that affect demand but they were not considered in this study due to lack of quantification on these variables. Subsequently, the R square found in these results could have been much better if such variables were considered while the inclusion of the level of, advertisement also played a vital role on the demand of broiler meat.

The model indicates that the price of broiler meat affects the broiler demand negatively and this is expected since this implies that if the price of broiler meat increases demand will decrease by 0.881. These two variables are inversely proportional to each other, that is to say, a 1% increase in the price of the broiler meat would cause a decrease by 0.881% in the demand of broiler meat. This high coefficient of broiler meat price suggests that the price of broiler meat is the key determinant of the quantity of broiler meat demanded in South Africa. This finding is inconsistent with that of Poonyth et al (2010) who discovered that broiler meat is significant on the demand for broiler meat with a coefficient of 0.8762.

The model shows that the price of beef has a positive effect on the demand for broiler meat at a significant level of 5%. If the price of beef increases by 1%, the demand of broiler meat increases by 0.537% in the sense that the consumers will tend to prefer a meat type which is much cheaper. This is expected as the microeconomic theory states that in the estimation of demand equation the price of substitutes will affect the dependent variable positively as this is a close substitute. These findings is consistent

with that of Maradoli et al (2001) who discovered that consumers were more likely to adapt to chicken price than beef.

The log-log results indicate that the price of mutton has a positive relationship to the demand for broiler meat at the significant level of 5%. This implies that if the price of mutton increases by 1%, the demand for broiler meat will increase by 0.965%. Also, the economic theory supports the relationship between the two variables. The magnitude of this coefficient suggests that the price of mutton is regarded as one of the key determinants in the amount of broiler meat consumed in South Africa. And it was also notable that mutton is a close substitute of broiler meat. This finding is consistent with that of Taha and Hahn (2012) who noted that mutton is a close substitute for broiler meat.

The model indicates that the price of pork has a positive relationship with demand for broiler meat, which implies that if the price of pork increases by 1%, the demand for broiler meat increase by 0.932% at a significant level of 5%. However, such inference cannot hold in cases where pork meat is not consumed due to religious reason and not necessarily due to price increase. These findings are in line with those of Taljaard (2003) who noted that pork was more responsive to the demand of meat.

The results of the model indicate that the level of income has a positive effect on the demand of broiler meat at a significant level of 5%. This implies that if the income increases by 1%, the demand for broiler meat will increase by 8.631%. This finding is consistent with that of Hupkova and Bielik (2009) who discovered that income is the main determinant of broiler meat demand.

Table 4.4: Regression results for the period between 1996 and 2012.

Variable	Coefficient	Std. Error (SE)	t-statistic	Sig
Constant	14.233	3.789	3.756	0.003
Price of broiler	-0.152*	0.074	-2.054	0.065
Price of beef	0.185**	0.078	2.368	0.037
Price of mutton	0.190	0.113	1.688	0.119
Price of pork	0.368**	0.135	2.723	0.020
Income	-1.787***	0.541	-3.301	0.007

Dependent variable: Demand of Broiler meat

***, **,*: Significance at 1%, 5% and 10% respectively.

R- Squared: = 0.989 F-ratio: 293,430 at 0.0002

Table 4.4 shows the model summary and the variation that can be explained by the model. Table 4.4 shows that the model can explain 98.9% of the variation between the independent variable and dependent variable (demand for broiler meat). Only 1.1% cannot be accounted by the model. The R square after the apartheid era was higher compared to the previous table, that is; Table 4.3 and this may be as a result of the market being competitive after the deregulation of the agricultural market. The record keeping of data became more profound as compared to previous years. It can be observed from the table that the estimated standard errors are small in the exception of only the intercept. Hence, a conclusion can be drawn from the Table 4.3 that the values of the slope are stable. The F-ratio is 293.430 at the significance level of 1% which implies that the joint economic factors have significant effect on the demand of broiler meat.

The model indicates that the price of broiler meat affects the broiler meat demand negatively at significant level of 10% and this is expected since this implies that if the price of broiler meat increases, demand will decrease with that coefficient. This implies

that if the price of broiler meat increases by 1%, the demand for broiler meat will decrease by 0.152%. Looking at the magnitude of this coefficient, it simply signifies that an increase in the price of broiler meat will not essentially reduce the quantity of broiler meat demanded. This finding is consistent with that of Bhati (1987) who noted that own price elasticity for demand was negative (-0.35).

The model results show that the price of beef has a positive effect on demand for broiler meat at the significant level of 5%. This implies that if the price of beef increases by 1%, the demand for broiler meat will increase by 0.185%. Beef meat is the second consumed meat type after broiler meat in South Africa. This low coefficient suggests that if the price of beef increases the effect on quantity of broiler meat consumed will be lower. This finding is consistent with that of Maradoli et al (2001) who learned that consumers are more likely to adapt to chicken price than for beef. Beef meat is more expensive compared to broiler meat.

The results indicate that the price of mutton has a positive relationship with demand for broiler meat. This implies that if the price of mutton increases by 1%, the demand for broiler meat will increase by 0.190% as this is a close substitute for broiler meat and statistical results indicate that mutton is not significant. In addition, the model indicates that the price of pork has a positive relationship with the demand for broiler meat, which implies that if the price of pork increases by 1%, the demand for broiler meat will increase by 0.368% at the significant level of 5%. This finding is consistent with that of Capps (1989) who noted that cross-price elasticity is positive and statistically significant.

The results of the model indicate that level of income has a negative effect on demand of broiler meat at the significant level of 1%. This implies that if the price of broiler meat increases by 1%, the demand for broiler meat will decrease by 1.787%. This is not expected but it implies that broiler meat is an inferior good as consumers tend to buy other meat types since their standard of living has improved as a result of income increment. This finding is inconsistent with that of Taljaard (2003) who discovered that broiler meat is a necessity. This may be attributed by the use of different methods in data analysis.

4.3.1 Demand elasticities

Demand elasticities refer to the sensitivity or responsiveness the demand for a particular product is to a change in economic factors such as price and income in particular. Demand elasticities of different products play a vital role in defining the level of sensitivity of price changes. It also helps in identifying the core market factors that affect the demand of a good and improves the competitiveness in a firm. In that light, demand elasticity that is greater than one (Ep>1), is said to be elastic while elasticities that are greater than one are said to be inelastic (Ep<1), and demand elasticities that are equal to one are said to be unit elastic (Ep=1). The price elasticity of demand for broiler meat is elastic in the long-run and inelastic in the short-run for both periods. This signifies that consumers are likely to respond to price changes in the long-run than in short-run and these results are consistent with those of Goodwin (1992). The formula used for calculating long-run price elasticities can be written as $\beta_i = \beta_i/1- \beta_o$.

Table 4.5 Demand elasticities (1971-1995)

Variable	Short run elasticities	Long run elasticities
Price of broiler meat	-0.881	-1.739
Price of beef	0.537	0.774
Price of mutton	0.965	1.202
Price of pork	0.932	0.695
Income	8.631	8.394

Source: own analysis.

Table 4.6 Demand elasticities (1996-2012)

Variable	Short run elasticities	Long run elasticities
Price of broiler meat	-0.152	-1.05
Price of beef	0.185	0.711
Price of mutton	0.190	0.712
Price of pork	0.368	0.530
Income	-1.787	-2.755

Source: own analysis.

Table 4.5 and 4.6 indicate demand elasticities on the two periods, that is; 1971 to 1995 and 1996 to 2012. Looking on the analysis in Table 4.7, price elasticity of demand in the short-run is low at -0.881 and this means that 1% increase in the price of broiler meat would lead to 0.881% decreases in the demand for broiler meat when all other independent variables are held constant. As the value of the coefficient is less than 1, it could be said that in the short-run demand for broiler meat is inelastic to variations in the prices and this is due to the fact that consumers are used to buying broiler meat as a result when price of broiler meat goes up, consumers will tend to consume out of habit. However, as time goes by they will start to realise that the price rise in broiler meat is permanent, and therefore would start to look for alternatives. The long-run elasticity is high at 1.73 which implies that when all or most factors that affect the demand have changed, the broiler consumers in South Africa become more sensitive to the prices due to the fact that they become aware of the price increase. These findings are in line with those of Jonathan et al (2006) who noted that demand elasticities are more responsive in the long-run than in the short-run.

The results in Table 4.5 further indicate that in South Africa, broiler meat demand seems to be insensitive to variation in the following factors, that is; the price of beef (0.537), mutton (0.965) and pork (0.932). These results are consistent with those of Hassan (2013) who also noted that beef (-0.24), poultry (0.16) and pork (-0.02) were inelastic in the short-run, however sensitive to the income level in the short-run. It is also observable from the table that in the long-run demand for broiler meat will be sensitive

to utmost all factors exception for beef and pork as their elasticities were 0.77 and 0.69 respectively. However, these values were not very far from unity. This is attributed to the existence of multicollinearity problem in the data points as their correlation coefficient exceeds 0.8 which is the benchmark for testing multicollinearity.

Table 4.6 indicates that after the market deregulation (policy change) occurred in South Africa, the demand for broiler meat was still inelastic (0.152) in the short-run due to inability to increase the quantity of broiler meat demanded and also due to the dependency on substitutes. The Table further indicates that, in the long-run, the price elasticity of demand for broiler meat was somewhat elastic at 1.05 which implies that the consumers of broiler meat were responsive to the price when most factors changed. The price demand elasticity of pork, beef and mutton were 0.530, 0.712 and 0.711 respectively which implies that they are inelastic. Subsequently these factors are moving towards unity than in the long-run and this is attributed to the fact that there are some years in the data set where inflation was very high in South Africa, for instance the global financial crisis that occurred in late 2007. These types of instances make the data points to contain extremely large and extremely low value. This may lead to problems in the regression results as it is normally expected that price demand elasticity would be more elastic in the long-run and inelastic in the short-run since most factors are fixed in the short-run. The income elasticity of demand has significant effect on the demand of broiler meat in South Africa as the elasticity stands at 2.755 which is greater than unity and this is supported by economic theory which states that income increment leads to increase in demand. This finding is consistent with that of Goodwin (1992) which noted that short term elasticities were usually lower than the long term elasticity mainly due to behavioral adaptation that occur over a period of time.

The results further indicate that after the market deregulation occurred, South Africans have shown preference for mutton meat. The income elasticity coefficient shows that broiler meat is an inferior good to households in South Africa. The demand of broiler meat was affected by economic and non-economic factors. However, the study focused on the economic factors which include own broiler meat price, beef meat price, pork meat price, mutton meat price and income.

The results indicate that broiler meat demand is inelastic with respect to price of broiler meat in the short-run and elastic in the long-run as supported by economic theory. The result further indicates that pork and beef are the substitutes of broiler meat. In addition, the results indicate that the price of mutton has no significant effect on the demand of broiler meat. It is also observable from the model results that broiler meat is an inferior good for South African households as income affected the demand for broiler meat negatively and these results are contrary to those of Taljaard (2003) who noted that chicken (0.53) can be considered as a necessity good in South Africans diets. This may be as a result of the data used and the methodology used to address the problem. The specification of the model can also lead to difference in the results. As such, it can be concluded that the variation of economic factors has significant effect on the quantity of broiler meat demanded by South Africans.

4.3.1 Unit root test

Table 4.7: Results of unit root tests at levels.

Series	ADF test statistic	Critical value	Lag-length	Probability	Conclusion
Demand of broiler meat	0.115928	2.936942	0	0.9407	Non-stationary
Price of broiler meat	0.007958	2.935001	0	0.9523	Non-stationary
Price of beef	0.876698	2.935001	0	0.7856	Non-stationary
Price of mutton	1.895311	2.935001	0	0.3312	Non-stationary
Price of pork	2.591872	2.938987	0	0.1032	Non-stationary
Income	2.486961	2.935001	0	0.1259	Non-stationary

Table 4.8: Results of unit root tests at first differences.

Series	ADF test statistic	Critical value	Lag-length	Probability	Conclusion
Demand of broiler meat	13.70598	2.936942	1	0.0000	Stationary
Price of broiler meat	6.375534	2.936942	1	0.0000	Stationary
Price of beef	7.083980	2.936942	1	0.0000	Stationary
Price of mutton	6.416336	2.936942	1	0.0000	Stationary
Price of pork	8.158614	2.938987	1	0.0000	Stationary
Income	7.141351	2.936942	1	0.0000	Stationary

Tables 4.7 and 4.8 show unit roots results at levels and first difference. The results of the unit root tests showed that all the variables were non-stationary at levels as shown in Table 4.7 above. Therefore, the null hypothesis of unit root is accepted at all levels since all series of the ADF test statistics were less than the relevant critical values. It is also observable from Table 4.8 that unit root test show that all the series were stationary after the first difference. As a result, the null hypothesis of unit root in all series was rejected at (5%) level of significance for all series since the ADF test statistics were greater than the respective critical values as shown in Table 4.8.

4.3.2 Diagnostic test

Diagnostic tests were conducted to validate the model used and the tests included Breusch-Godfrey test for serial correlation, Jarque test for normality and Breusch-Godfrey test for Heteroskadacity.

Table 4.9: **Diagnostic tests results: 1971-1995**

Test	Method	Result	P-value	Conclusion
Serial correlation	Breusch-Godfrey test	0.311	0.201	No serial autocorrelation
Normality	Jarque test	0.333	0.513	Residuals are normally distributed
Heteroskedasticity	Breusch-Godfrey test	0.0734	0.0830	No sign of heteroskedasticity

Table 4.10: **Diagnostic tests results: 1996-2012**

Test	Method	Result	P-value	Conclusion
Serial correlation	Breusch-Godfrey test	0.788	0.8804	No serial autocorrelation
Normality	Jarque test	0.552	0.759	Residuals are normally distributed
Heteroskedasticity	Breusch-Godfrey test	0.214	0.247	No sign of heteroskedasticity

Time series data is normally associated with problems such as heteroskadacity, serial correlation and many other problems. The study tested for heteroskadacity using white test. Table 4.9 indicate that for the period between 1971 and 1995, the result showed that the p-value of 0.0830 which is great than the chi-square (0.0734) was obtained implying that there was no sign of heteroskadacity. Furthermore the Breusch-Pagan Godfrey LM test was performed and LM result of 0.201 and the P- value of 0.311

confirming that the residuals were not autocorrelated. Table 4.10 shows that during the period between 1996 and 2012 the p-value of 0.247 and the chi-square of 0.214 was obtained implying that there was no sign of heteroskadacity. Furthermore, the Breusch-Pagan Godfrey LM test was performed and LM result of 0.788 and the P- value of 0.880 were obtained confirming that the residuals were not autocorrelated.

4.4 Chapter summary

This chapter outlined the findings of the model results and explained the implications of the results. Looking at the prior expectations as outlined in chapter 3 in Table 3.1, it can be concluded that for the period between 1971 and 1995 the results were as expected, while the results for the period between 1996 and 2012 were not as expected particularly looking at the sign of the income variable. It was expected that income would affect the demand for broiler meat positively. However, the results indicate that income affects demand for broiler meat negatively implying that broiler meat in South Africa may be considered as an inferior good.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarises the main findings of the study and draws the conclusions from the empirical results. It also makes recommendations based on the findings of the study.

5.2 Summary

The aim of the study was to estimate the domestic demand for broiler meat in South Africa. The first objective of the study was to identify economic factors that affect broiler meat demand and the hypothesis stated that there are no variables that affect demand for broiler meat in South Africa. The hypothesis was rejected because the study results confirmed that there are factors that affect the demand for broiler meat. The second objective of the study was to determine whether the variation in specific economic factors have a significant effect on the quantity of broiler meat demanded in South Africa and the hypothesis stated that the variations in specific economic factors have no significant effect on the quantity of broiler meat demanded in South Africa.

The hypothesis was rejected because the economic factors have significant effect on the variation on the quantity of broiler meat demanded in South Africa. The third objective of the study was to determine whether the variation in joint economic factors have a significant effect on the quantity of broiler meat demanded in South Africa and the hypothesis stated that the joint economic factors have no significant effect on the quantity of broiler meat demanded in South Africa. The hypothesis was rejected because the study results confirmed that the joint economic factors have a significant effect on the quantity of broiler meat demanded in South Africa.

The study showed that the South African broiler industry does not adequately cater for the population of South Africa. The price of broiler meat, substitutes and level of income are the main determinants of broiler meat demand. These economic factors have a significant effect in determining the variation on the quantity of broiler meat demanded by South Africans. It is also observable from the results that consumers of broiler meat

were more responsive to price change in the long-run than in the short-run in both periods. It is also observed from the results that income had greater effect on the demand for broiler in the period between 1971 and 1995 than in the period between 1996 and 2012. This was mostly influenced by the structural change that occurred in the industry due to the market deregulation that occurred in 1996. It is also learned that prior to this policy implementation, imports of broiler meat had increased by 21% while exports grew by 5% annually.

The results show that the price of broiler meat, beef, mutton, pork and income are important determinants for broiler meat demand. The Price of broiler meat affects the demand of broiler meat negatively and the result indicates that the price of broiler meat is of paramount importance in explaining the variation. The price of pork, beef and mutton affects the demand for broiler meat positively. Furthermore, the study revealed that income level affected the demand for broiler meat negatively for the period between 1996 and 2012. This implies that broiler meat was found to be an inferior good and also that South African consumers would consume other types of meat as their income increases.

The study also revealed factors that influence the demand of broiler meat in South Africa. These factors include the price of broiler meat, prices of substitutes and income levels. These factors were found to be significant in explaining the variation in broiler meat demand. Broiler meat continued to be the most consumed type of meat in South Africa. The domestically produced broiler meat does not cater for the whole population of South Africa and is therefore supplemented by imports from various countries in the world. Studies have revealed that there are two types of factors that affect demand for broiler meat, that is; economic and non-economic factors. The economic factors include broiler price, price of substitutes and also level of income whereas the non-economic factors, although not considered in this study, are health, sensory variable, social interaction, familiarity and habit, psychographics and demographics.

The results further indicated that short-run price elasticity of demand ranged from 0.531 to 0.932 and long run demand elasticities ranged from 0.695 to 1.73 for the period between 1971 and 1995. This implies that broiler consumers are more responsive to

price changes in the long-run. For the period between 1996 to 2012 price elasticities ranged from 0.152 to 0.190 in the short-run, while in the long-run the elasticities ranged from 0.530 to 1.05 signifying that behavioral adaptation serve a significant role on the changes of prices. Income elasticity in both short and long-run stood at 8.631 and 8.394 respectively for the period between 1971 and 1995. On the other hand, for the period between 1996 and 2012 it stood at 1.787 in the short-run and 2.755 in the long-run. This signifies that income had a greater effect on the demand for broiler meat for both periods. However, the effect is even greater for the period between (1971 and 1995) implying that, nowadays the effect of income on broiler meat demand is fading away in South Africa. This may further imply that in the future broiler meat in South Africa may be considered as an inferior good, because income affects broiler meat negatively during this period.

5.3 Conclusion

Based on the findings of the study the following conclusions were drawn:

The demand for broiler meat in South Africa for the period between 1971 and 1995 does respond too well to the price of beef meat (a substitute to broiler) as the coefficient was small signifying that the price increase of beef meat was not essentially increase broiler meat demand in South Africa. This is attributed to the fact that beef meat is considered as unhealthy meat as compared to broiler meat, as it is perceived to contain saturated fats. Subsequently consumers of South Africa move toward healthy and convenient products. And also this is attributed to the fact that beef meat is more expensive as compared to broiler meat in South Africa (FAO, 2011). While on the other hand for the period between 1995 and 2012 the coefficient of beef meat price became much smaller emphasizing that even nowadays the price of beef meat is still not responding too well to the demand for broiler meat.

It was also noted that for the period between 1971 and 1995, the price of broiler meat affects the demand for broiler meat negatively and it also indicates that an increase in the price of broiler meat will decrease the demand for broiler meat significantly. This is attributed to the fact that broiler meat is mostly consumed by low income households in

South Africa. The coefficient of broiler meat price basically suggests that consumers are very sensitive to price increase. Whereas for the period between 1996 and 2012 the coefficient of broiler meat price was too low signifying that an increase in the price of broiler nowadays will not essentially reduce the demand for broiler meat.

Furthermore it was observed that price of mutton and pork responds too well to the demand for broiler meat in South Africa. Because their coefficient are high signifying that price increase in pork and mutton will increase the demand for broiler meat significantly during the period between 1971 and 1995 while for the period between 1996 and 2012 the price of pork and mutton did not respond too well to the demand for broiler meat as their coefficient were low signifying that nowadays an increase in the price of pork and mutton will not essentially reduce the demand for broiler.

In addition it was also noted that the income responded too well to the demand for broiler meat in South Africa for the period between 1971 and 1995 as their coefficient are very high. This finding signifies that an increase income will significantly increase the demand for broiler meat implying that broiler meat was a necessity during this period. While on the other hand, for the period between 1996 and 2012 the income did responded well to the demand for broiler meat. However during this period the income affected the demand for broiler meat negatively implying that nowadays broiler meat is considered as an inferior good and also that the effect of income on broiler meat is fading away as the coefficient are lower compared to the previous period.

Based on the demand elasticities it was noted that for both period (1971 to 1995 and 1996 t0 2012) consumers of broiler meat responds too well to price changes in the long-run as compared to the short-run. Basically demand elasticities were less than 1 in the short-run and greater than 1 in the long-run. This finding basically signifies that behavioral adaptations plays a significant role on the changes of prices and also that as time goes by consumer starts to become aware of price increase. In the short-run consumers are less sensitive to price changes because most of them consume out of habit.

5.4 Recommendations

The study has noted that demand for broiler meat does not respond to the price of beef and beef is a close substitute for broiler meat in both periods. This clearly indicates that the meat industry in South Africa is not competitive. Therefore the study recommends that government should pay more attention to the industry by providing necessary support services such as capital investment, research and development and provision of subsidies on broiler feed as it is the major cost drive in the industry.

The study has also found that the adjusted R-square for the period between 1971 and 1995 was moderate compared to the adjusted R-square for the period between 1996 and 2012. This is attributed by the fact that there were data missing in some years and also that there are other factors which affects demand for broiler meat in South Africa which were not considered in the study due to the lack of quantification on this variables. Therefore the study recommends that a continuous and complete record keeping in the broiler industry in South Africa can be much helpful in future research. The study has failed to identify and quantify non-economic factors. Hence, the study recommends that development of methods on the quantification of the non-economics factors such as health, taste preference, health, sensory variable, social interaction, familiarity and habit, psychographics and demographics will be of great importance.

It was also noted from the descriptive results that demand for broiler meat is greater than the production and also that imports are far much higher than exports. This signifies that domestically South Africa is not producing enough broiler meat. Therefore the study recommends that the government should provide policy instrument that can attract many farmers to engage in poultry farming in order to increase production and also that more research should be undertaken on policy design around the industry in order to understand the nature of broiler meat industry in South Africa. The policy environment of the South African broiler meat industry needs to be reviewed in order to make the industry more competitive.

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