"AN ESTIMATE OF COMMERCIAL BEEF DEMAND IN ZAMBIA"

A Thesis Presented to the Department of Agricultural Economics and Extension Education of the University of Zambia

by

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In partial fulfilment of the requirements for the Degree of Bachelor of Agricultural Sciences.

ABSTRACT

AN ESTIMATE OF COMMERCIAL BEEF DEMAND IN ZAMBIA

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This study was an attempt to get an understanding of the pattern of consumption of beef meat in Zambia over a seventeen-year (17) period from 1985 to2001. It also went on to explain the individual's demand for beef meat with reference to changes in the demand for substitute meats (pork and chicken), changes in real beef prices and real per capital income. Further, a forecast was made of the quantity of beef that would be consumed for the five (5) years from the year 2003 to 2007.

Data collected mainly being quantitative, computer did analysis and the software used was statistical package for social sciences (SPSS).

Research findings were that all things being equal, a one Kwacha increase (decrease) in the real consumer price of beef decreased (increased) the quantity of beef consumed by 9 746 heads of cattle and a one Kwacha increase (decrease) in the real per capital income increased (decreased) the quantity of beef consumed by 66 heads of cattle. Further, it was found out that a one Kwacha increase (decrease) in the real retail price of pork increased (reduced) the quantity of beef consumed by 663 heads of cattle while, ceteris paribus, a one Kwacha rise (decrease) in the real retail price of chicken caused the quantity of beef demanded to increase (fall) by 871 heads of cattle.

However, only real per capital income and real price of beef were the main factors affecting beef consumption. From trend analysis it was found out that 17 062, 14 497, 11 932 , 9 367 and 6802 in the years 2003, 2004, 2005 , 2006 and 2007 respectively.
From these findings, the following recommendations were made: 1. Social change – need to implement policy that will encourage or persuade small scale farmers to go commercial and keep cattle for the markets 2. Establishment of livestock markets and

slaughter houses at strategic points to encourage continuous cattle trades according to the actual price on the market 3. Support for beef processors in the Form of provision of credit facilities at preferential rates to those that would want to venture into beef processing or expand their plants and 4. Strict monetary policy so as to reduce inflation because it has a negative effect on prices and in turn, incomes 5.Employment creation 6. Integrating the market.

ACKNOWLEDGEMENTS

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Also my special thanks go to my classmates Particularly James Mulolo, Stephen Kabwe (The Mayor), Hilgard Sakeni and my dearest friend Mutengo Sindano for being so wonderful to me during my stay on campus.

DEDICATION

This work is dedicated to members of my family for their inspiration and encouragement during my school life. These are named as follows:

My Dad and Mum – Mr. and Mrs. A. Tembo

My Sisters: Scholastica, Thandiwe, and Mutunduwata

My Brothers: Hamlet, Pontino and Little Luwo.

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LIST OF ABBREVIATIONS

CSO	-	Central Statistical Office
FAO	-	Food and Agriculture Organization of the United Nations
LDCs	-	Least Developed Countries
MACO	-	Ministry of Agriculture and Cooperatives
MoFEP	-	Ministry of Finance and Economic Planning
ZAMBEEF	-	Zambia Beef Company
ZNFU	-	Zambia National Farmers Union

CHAPTER 1

INTRODUCTION

1.0 Introduction

Prior to 1991, agricultural policy in Zambia was characterised by the government controls through parastatals and other government supported institutions to deliver agricultural services. In 1992, the government embarked on agricultural policy reforms, which were part of the structural adjustment programme (SAP). The main thrust of the policy reforms was to liberalise the agricultural sector and to promote private sector development and participation in the delivery of agricultural services. This would be achieved through the creation of an enabling environment for private sector participation through measures such as withdrawal of government from production, marketing, and distribution of inputs; privatisation of parastatals, elimination of price controls and elimination of direct subsidies.

It was anticipated that this policy of liberalisation would foster higher productivity, efficiency, and competitiveness in the agricultural sector in general and in the beef commodity industry in particular. Thus the beef commodity as well as other livestock products was expected to increase agriculture's contribution to; national income generation as well as creation of employment opportunities; national food security through increased beef production and sustainable industrial development through provision of such raw materials as cattle hides.

However the liberalisation policy has not helped much in the revitalisation of the beef industry in that beef production and markets have continued to dwindle. Between 1996 and 1997, total cattle population decreased from approximately 5.5 million to 2.7 million animals due to disease outbreaks. During this period, the small-scale sub-sector suffered massive losses due to frequent outbreaks of contagious diseases. The prevalence of diseases has restricted Zambian beef from entering some lucrative external markets.

On the demand side, the quantity of beef demanded in 2001 was only 26.94 percent what it was in 1985. This was a drastic decline in the size of the beef market and is acting to slow down performance of this sub-sector.

Thus, this study examined the demand side of the beef sub-sector so as to get an understanding of the factors affecting it and formulate policies specific to this sub-sector in addressing the bottlenecks identified.

1.1 Problem Statement

Lately insufficient food and an ill-balanced diet have become common features of the way of life of most of the Zambian people. The diets of more than 50 per cent of Zambians are barely balanced mainly due to an inadequate, in certain cases absent, intake of sufficient amounts of proteins, particularly animal proteins which furnish essential amino acids necessary for the proper body development of humans (Masiye et al, 1998). According to FAO (1994), it is desirable that in

order to guarantee a well-balanced protein provision for an adult, at least 7.30 kilogrammes of animal protein should be consumed per person annually.

In Zambia beef is the most acceptable animal meat relish (Zulu, 2001) across different cultures and religious groupings. However, beef consumption in the country has been on the decline. By the year 2001, the consumption level had drastically reduced to only 26.94 per cent that of 1985. During the same period the human population had experienced a fast annual growth rate of 3.1 Per cent (CSO, 2000). Besides, the country had undergone a high rate of urbanization in the same period (1985 to 2001).

This means that there has been a progressive decline in the number of people in Zambia that have access to commercial beef and it also indicates that decreasing quantities have been consumed per person between the two years (1985 to 2001). This was confirmed by the CSO statistical figures (CSO, 2001) that have indicated a decline in the per capital beef consumption to less than 2 kilogrammes per person per year by 2001. Besides, during the same period the rate of adult malnutrition has been on the increase.

This study, therefore, examined and analysed the economic factors influencing beef consumption. In doing this a demand model for beef was simulated.

1.2 Rationale of the study

Past agricultural policies in Zambia have indeed proved inadequate in addressing the several difficulties that the livestock sub sector has been experiencing. As a result of this, there has been a need for formulation of not only sector, but also commodity specific objectives and policies. By examining each of the variables assumed to influence beef demand, this study was able to reveal the major ones and thus equipped planners as well as policy makers with the knowledge necessary for making long range policies specific to this commodity. Besides, this study was also beneficial to firms engaged in beef production as the information generated there from would make them more responsive to changes in the major factors affecting demand for this commodity.

1.3 Research Objectives

The general objective of this study was to carry out an analysis of the commercial beef demand in Zambia.

The specific objectives that were employed in achieving the general objective were:

1. To estimate the demand function for beef in Zambia for the period between 1985 and 2001
2. To examine the effect of each factor assumed to influence demand for beef
3. To forecast the demand for beef in Zambia from the year 2003 to 2007.

CHAPTER 2

LITERATURE REVIEW

2.1 Literature Review

There are indeed many studies that have been carried out on the performance of the beef industry not only in Zambia but also in the rest of the world. These studies have mainly focussed on animal husbandry, that is, management practices. However, a few of the studies have been on beef marketing.

Lucas Zulu (2001) carried out a research on the beef consumer behaviour with regards to price differential for beef grades. His findings were that most beef consumers are unaware about beef grade characteristics and existence of beef grading. Further, he stated that incomes coupled with level of formal education are the main factors that affect consumer choice for beef grades. Mvula (1992) also conducted a study, much attention was accorded to the existence as well as the awareness on the part of consumers and retailers of beef grading.

The development research Centre Zambia Limited (May, 1988) in a study on emergent beef farmers concluded that there was a need to have marketing agents to bring beef buyers and sellers together because above all else, emergent beef farmers require an efficient and reliable cattle market so that they can sell any cattle as and when they want to. This is the only way their commercial instincts, already well developed in relation to crops, can be developed in relation to cattle. Bekure S. and McDonald I. (1985) in a paper entitled "Livestock marketing efficiency" said that the livestock marketing system plays an important role in

enabling livestock to move from areas of surplus to those of deficit. Its efficiency determines a) the income of livestock producers and hence the level of offtake, and b) the consumer price of meat and hence the level of consumption. The more efficient the marketing system is in minimising the costs of moving animals from the areas of surplus to those of deficit, the better it can stimulate both consumption and production.

In a study on the response of subsistence cattle producers to beef price adjustments, Doran et al (1989) and Rodriguez (1985) showed that cattle herds in communal areas in Swaziland and Zimbabwe respectively would increase further as a result of beef price increases. They stated that the reason for the rise in herd inventories is that the increase in the price of beef results in a higher cash-value per animal unit. Hence the subsistence oriented livestock producers will sell fewer animals to meet their minimum money transaction demand.

Morgan T. H. (1997), President of Morgan Consulting Group of USA in an article entitled, "World Beef Trade Expected to expand by 20 fold by 2050." Wrote that beef is being challenged by less expensive competitive meats. The decline in the cost of producing pork and poultry worldwide is causing beef to lose market share in Canada, USA, and globally. This loss of market is tied directly to more rapid advances in the production of feed grains than forages. Corn yields have increased five fold from the early 1900s whereas alfalfa hay yields have increased by only sixty (60) per cent. Since beef cattle are efficient at converting forages to

meat while pork and poultry are not, beef has lost its comparative advantage. For the global beef industry to regain lost market share these trends in the relative efficiency of forage production/utilization versus feed grains will need to be reversed.

Abbot J. C. (1984) in a paper presented to the International Association of Agricultural Economists stated that in developing countries the income elasticity of demand for beef, in particular, is positive. As real per capita income rises in LDCs the demand for the principal livestock products, meats, milk and eggs also rises. An example is in Iran where when the production was growing at just under three (3) per cent and real disposable income at five per cent (5%) meat demand in the same period rose at around nine per cent (9%) per annum.

In all the above researches and papers only the marketing aspects were considered. Apart from that percentage increases in beef consumption were given when income increased. However, there seems to have been no studies carried out on the quantitative relationships between the quantity of beef consumed and the variables that affect it. This is the gap that was identified and which this study tried to fill.

CHAPTER 3

METHODOLOGY AND THEORETICAL FRAMEWORK

3.1 Research Methodology

This study was based mostly on secondary data but a little primary data was used. In order to attain the objectives outlined in this study, both quantitative and qualitative data was collected. Quantitative data was collected as time series data. Time series data consists of observations on a variable over several periods using a certain time interval for example quarterly, yearly and so on. In this study a yearly interval was used. Time series data was collected on the following variables; quantity of beef consumed (beef demanded), consumer price of beef, per capital income and consumer prices of beef substitutes (pork and chicken). The range of time series data collected was from 1985 to 2001 representing a time period of 17 years. This data was obtained from the following sources (organizations and institutions); CSO, FAO, MACO, MOFEP, ZAMBEEF, ZNFU, UNZA Main Library, Luscold Zambia Limited and Kembe Meat Corporation.

Qualitative data was obtained through unstructured interviews with key personnel or managers of the organisations mentioned above.

3.2 Data Analysis

In analysing the data that was gathered in this study both descriptive and quantitative statistics were employed through the utilization of computer software called statistical package for social sciences (SPSS). Microsoft excel was used to

produce the line graphs showing the trends in beef consumption, income, and the prices of beef, pork and chicken.

The ordinary least squares (OLS) regression technique was used to regress the various independent variables on the quantity demanded. Thus a linear demand model was obtained and objective number one achieved. The coefficients of the independent variables obtained in the derived demand model were used in the analysis of the effects of these independent variables on demand. To achieve the third specific objective a forecasting model was employed. The exact steps followed in order to arrive at the forecasting model are explained in the theoretical framework.

By and large, all the running, processing and analysis of the data were based on the ordinary least squares (OLS) technique. This technique was chosen because of it's simplicity as an estimation procedure and it applies to the model that was developed in this study.

The time series data were collected in nominal values and therefore had to be converted into real values as at 1985. Thus, 1985 was the base year. The following formula was used to convert the nominal data collected. The prices of beef, pork and chicken were averages obtained from the organisations mentioned above.

Real consumer price in year t = Nominal price in year t x $\frac{\text{CPI in 1985}}{\text{CPI in year}}$

3.3. Theoretical Framework

3.3.1 Demand Model

From microeconomic theory, the individual demand for any food product, that is the quantity consumed, depends on a constellation of economic and social factors associated with the product and its use. While estimates vary widely, most research includes the following factors as determining meat demand: own price of commodity, prices of related commodities, that is, substitutes and compliments, changes in the disposable incomes of the consumers and consumers' tastes and preferences.

However, due to non availability of relevant data concerning some of the demand determinants, it was not possible to prepare a model incorporating all the above variables. Thus, this study was only based on a model that included the following economic variables; real disposable income of consumers, and the real prices of beef, chicken as well as pork. This was based on the assumption that chicken and pork are close substitutes of beef.

The demand model was expressed mathematically as:

$$Y = B_0 + B_1 X_1 + B_2 X_2 + B_3 X_3 + B_4 X_4 + e_i$$

Where: Y = quantity of beef consumed (Quantity demanded)

X_1 = consumer price of beef

X_2 = the real per capital income

X_3 = the consumer price of pork

X_4 = the consumer price of chicken

B_0 = is intercept of the regression line or the constant

B_1, B_2, B_3 and B_4 are regression coefficients

e_t is the random error term (includes the impact of demand influences not Included in the model).

In the model above, the dependent variable is Y (the quantity of beef consumed) and X_1, X_2, X_3 and X_4 are the independent variables. From microeconomic theory, the quantity of a commodity demanded is expected to have a negative relationship with its own price, that is, for a normal commodity. In addition, the relationship between the quantity of a normal commodity consumed and the disposable income of consumers is expected to be positive. Also the relationship between the quantity of a commodity consumed and the prices of its substitutes is expected to be positive.

Thus, it was expected that the quantity of beef consumed would be positively related to the real per capita income and prices of pork and chicken while being expected to be negatively related to its own retail price.

3.3.2 Forecasting Model

The forecasting method involved the use of trend analysis. Because trend analysis is concerned with the long-term direction in the time series, such analysis is performed using annual data.

The method of least squares is the most frequently used method for determining the trend component of time series. When the long term increases or decreases appear to follow a linear trend, the equation for the trend line values is:

$Y_t = B_o + B_1X$

Yt = quantity of beef meat demanded in year t

X = number of years from base year

B_0 = intercept of the trend line

B_1 = slope of the trend line

The above equation was used as beginning point for forecasting. The slope of this linear equation indicates that as long as the long term trend during the 17-year period is maintained there has been an average increase of about B_1 unit consumption per year.

3.3.3 Assumptions of the Linear Regression Model

The linear regression model is based on certain assumptions, some of which refer to the distribution of the random variable e_i, some to the relationship between the

explanatory variables; some refer to the relationship between the explanatory variables themselves. According to Koutsoyiannis (1977) the assumptions are;

1. e_i is a random real variable

   The value which e_i may assume in any one period depends on chance; it may be positive, negative or zero.

2. The mean value of e_i in any particular period is zero

   This means that for each particular value of X, e may assume various values, some greater than zero and some smaller than zero , but if we considered all the possible values of e ,for any given value of X, they would have an average value equal to zero.

3. The variance of e_i is constant in each period

   The variance of e_i about its mean is constant at all values of X. In other words for values of X, the es will show the same dispersion round their mean.

4. The variable e_i has a normal distribution

The values of e_i have a bell-shaped symmetrical distribution about their zero mean.

5. The random terms of different observations (e_i , e_j) are independent

   This means that the covariances of any e_i with any other e_j are equal to zero .The value which the random assumed in one period does not depend on the value which it assumed in any other period.

6. e is independent of the explanatory variable(s)

   The disturbance term is not correlated with the explanatory variables.

3.3.4 Problems Associated with the Model

1. The parameter estimates obtained in a regression model are only as good as the data used. In least developed countries like Zambia many years of poor quality national aggregate data is rarely sufficient to generate meaningful estimates of the parameters of the model.
2. Multicollinearity

   The term Multicollinearity is used to denote the presence of linear relationships among explanatory variables. This means that there is a lack of independence among explanatory variables in a data set. It is a sample problem that results in relatively large standard errors for estimated regression coefficients.

The best cure for Multicollinearity is to obtain more data which, in turn , might lead to exhibition of more independent movement of the independent variables and allow better estimates to be obtained. However, this is not always possible if , for example , a survey has been completed or if published statistics do not contain more observations. An alternative to overcome the constraint of multicollinearity is to drop one of the collinear variables , though the choice of which one to drop is somewhat arbitrary.

3.Autocorrelation

This is a special case of correlation. Autocorrelation refers to the relationship, not between two (or more) different variables but between the successive values of the variable. The most common sources of autocorreletion include mis-specification of the error term, omission of some important explanatory variables and mis–specification of the mathematical form of the model.

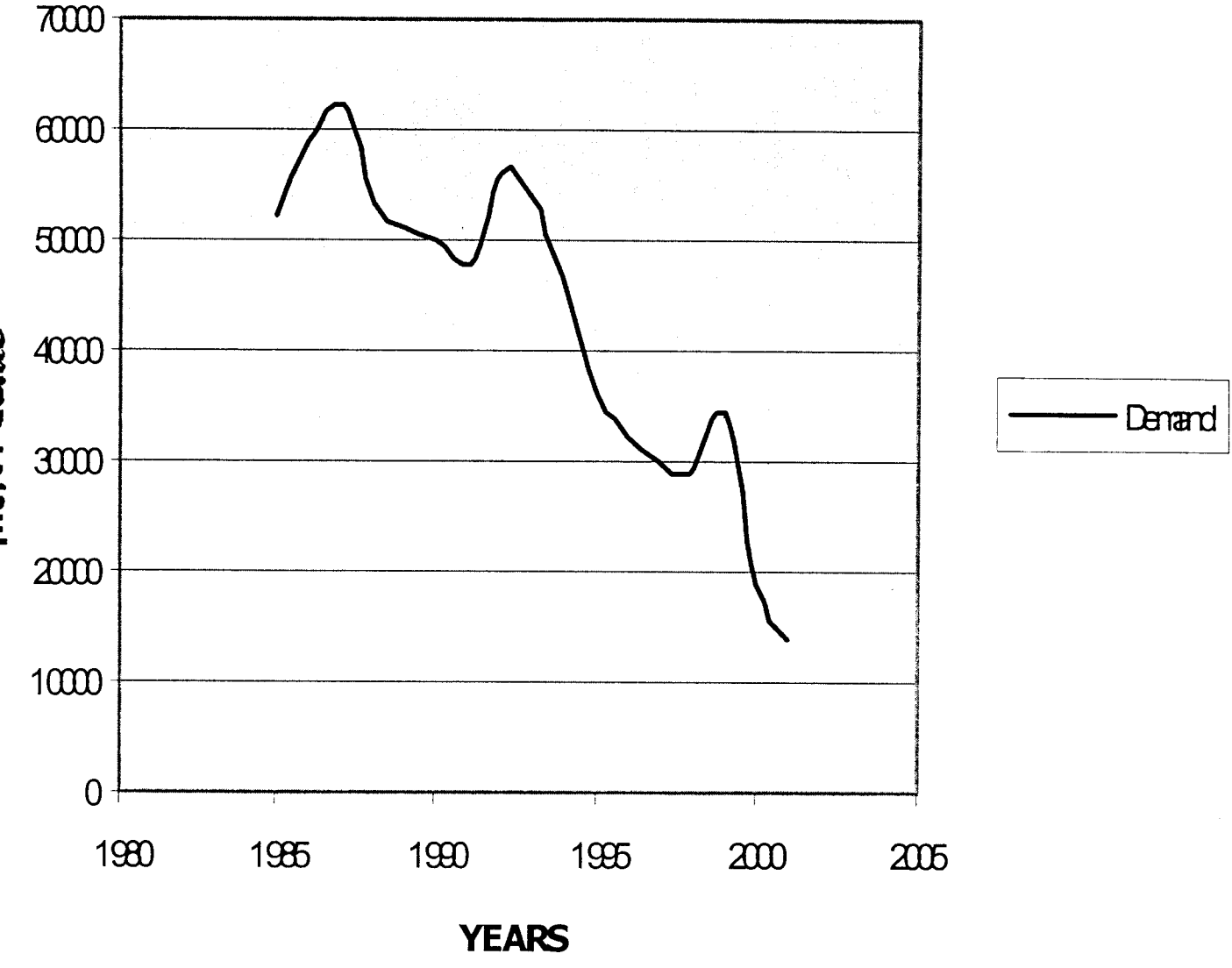
CHAPTER 4

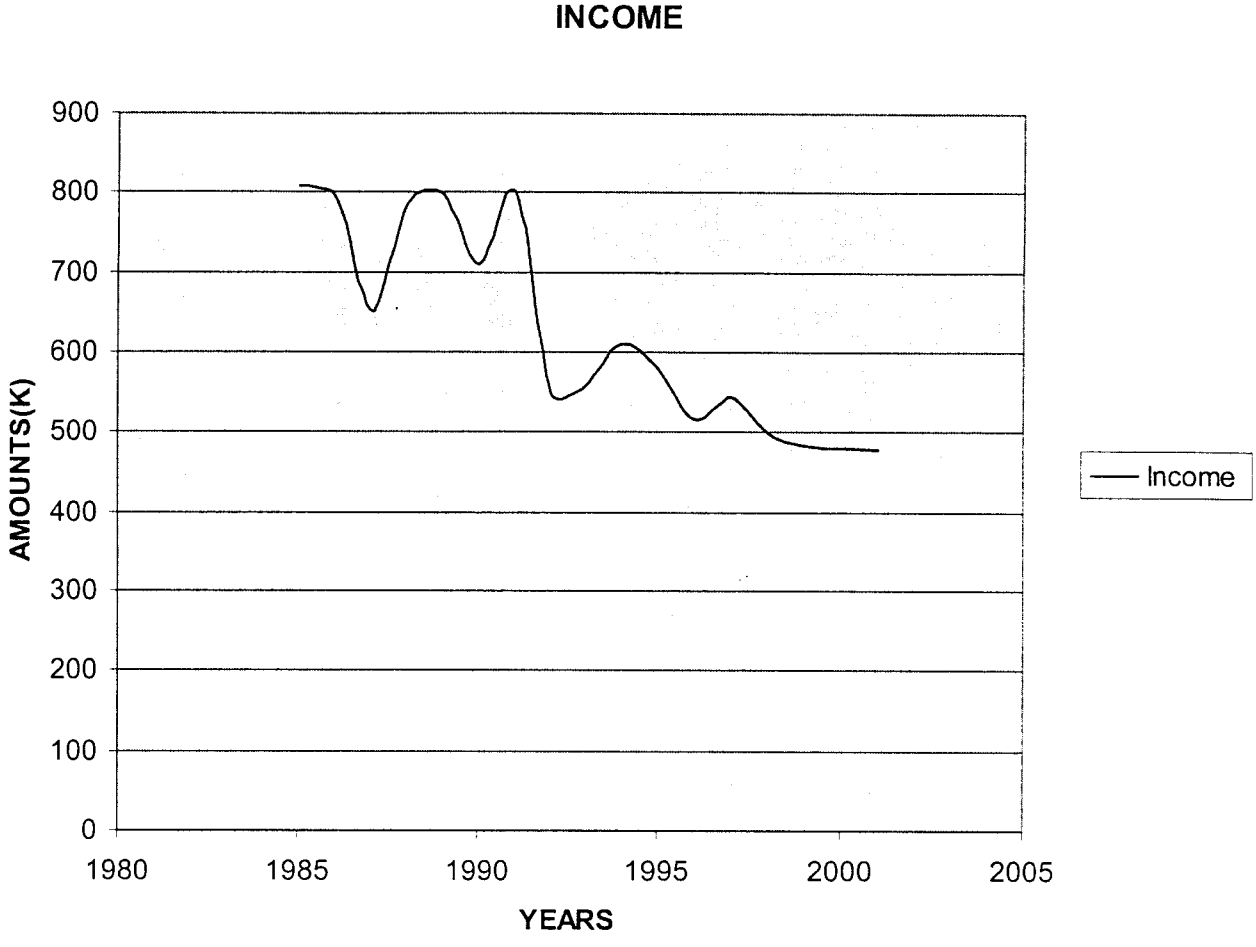
FINDINGS AND INTERPRETATION

4.1 TRENDS IN THE VARIABLES INFLUENCING BEEF DEMAND

This study found it necessary to explain the trends in the independent variables affecting the demand of beef in order to get an understanding of the beef market. The data in table 1 indicated that the quantities of beef demanded were steadily falling over the 17-year period although there were fluctuations in some years. The real consumer prices of beef fairly fluctuated and were relatively high comparative to those of chicken. This caused consumers to substitute chicken for beef in providing meat protein. The per capita income was seriously falling in the 17-year period and thus, reducing the purchasing power of consumers.

TRENDS IN DEMAND




INCOME
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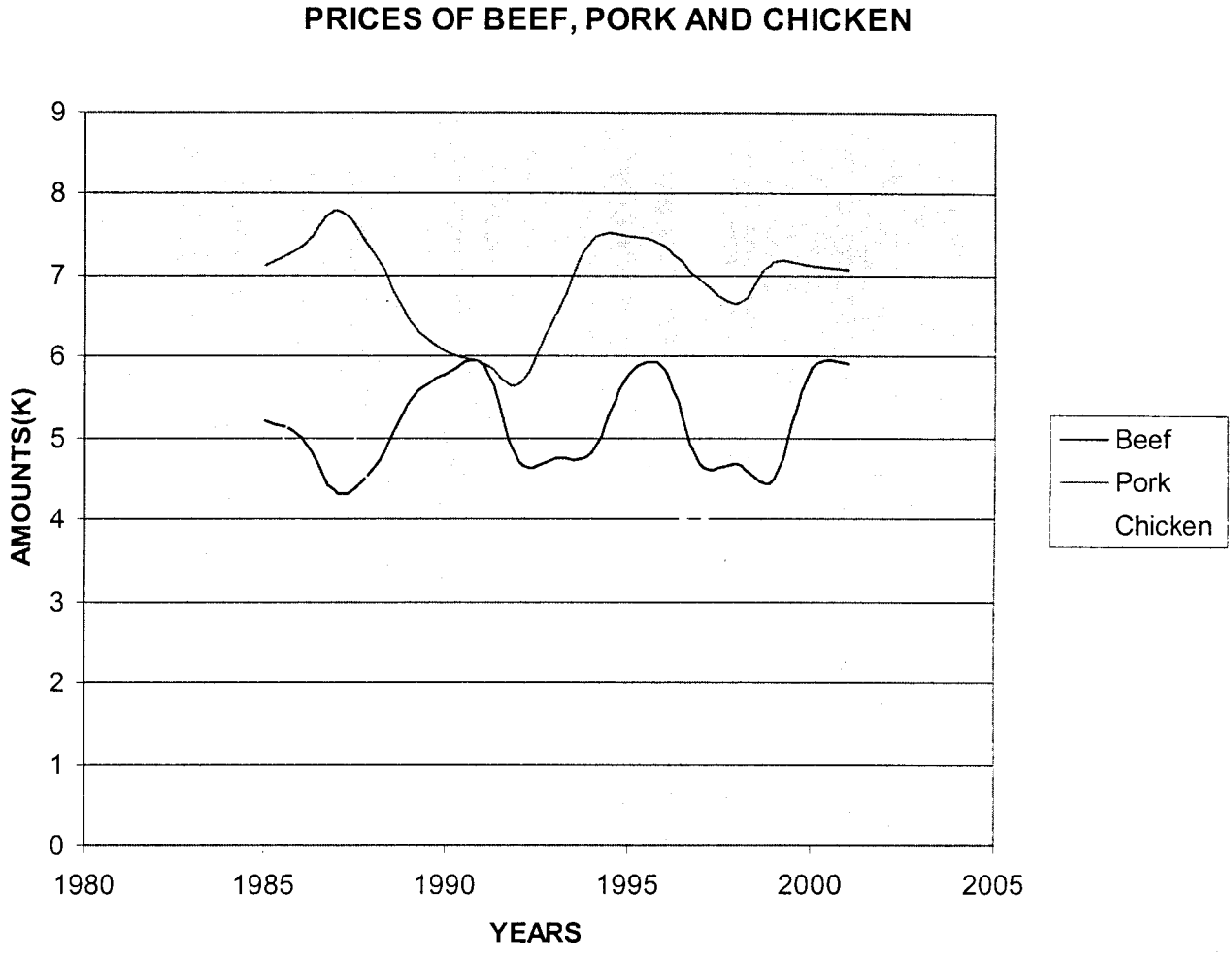

4.2 DEMAND ANALYSIS

TABLE 1 : OUTPUT OF THE DEMAND ANALYSIS

VARIABLE	VARIABLE IDENTITY	COEFFICIENT	T-VALUE	SIGT	AVERAGE ELASTICITY
Consumer price of beef (K/Kg)	X_1	-9745.76	-2.64	0.022	-1.18
Per capita income (K)	X_2	65.56	3.81	0.022	0.96
Consumer price of pork (K/Kg)	X_3	662.71	1.75	0.105	0.11
Consumer price of chicken (K/Kg)	X_4	871.48	1.65	0.125	0.09

(Constant)		59371.38	1.68	0.119
Model	F-value		10.86	
Tabulated (critical)	F value		3.26	

R^2 = 0.784

DW = 1.141

From the demand output above the estimated equation for commercial beef demand was as follows:

$$Y = 59\,371.38 - 9\,745.76X_1 + 65.56X_2 + 662.71X_3 + 871.48X4$$

4.3 SIGNIFICANCE OF THE DEMAND ESTIMATE MODEL

To test the significance of the demand estimate model the F – statistic was used. The F – statistic tests the model for whether any of the independent variables really influences the dependent variable. The decision rule used was that if the computed F – value was greater than the tabulated (critical) F value, then the demand estimate model was significant. If this rule was not satisfied, then the estimate was insignificant. Using this decision rule the demand response model employed in the simulation of this study was significant because the computed F – value of 10.86 was greater than the tabulated value of 3.36. Thus, the regression parameters were not all equal to zero.

Further the coefficient of determination, which measures the goodness of fit of a regression line, indicated that the model explained 78.4 percent of the variation in the quantity of beef demanded. The remaining 21.6 percent of the variation in the quantity of

beef demanded was explained by other independent variables not included in the model such as price of fish and beans as well as other social factors.

4.4 SIGNIFICANCE OF THE PARAMETER ESTIMATES

To find out whether or not a particular independent variable had an influence on the dependent variable the t – statistic was employed. The decision rule that was used to test the significance of the particular estimates at 95% confidence level was that if the **SIGT** of a certain independent variable was less than (0.05), then the estimate was significant. Conversely, if the **SIGT** was greater than (0.05), then the estimate was insignificant.

Employing the above decision rule, only b_1 and b_2 the parameter estimates of the consumer price of beef and the per capita income respectively, were considered significant. It was going to be suitable to drop the other two variables, that is, the consumer price of Pork and the consumer price of chicken from the model but this was not done because their exclusion from the model, distorted the expected relationships between the independent variables and the dependent variable in the theoretical framework. Thus these insignificant variables were retained.

4.5 AUTOCORRELATION IN THE INDEPENDENT VARIABLES

In regression analysis it is assumed that the values of the individual error terms (ei) are independent. However it may happen that the error terms (the values of ei) are not independent; instead, they are serially correlated or auto correlated. To see whether autocorrelation was present in the error terms in the demand for beef regression model,

use was made of the Durbin – Watson test. The Durbin-Watson statistic for the model was found to be 1.141. This value fell within the acceptable range of 0.780 (Lower Limit) to 1.90 (Upper Limit) for the four independent variables and the time series data ranging from 1985 to 2001. Thus the degree of serial (auto) correlation was not high at all considering that the Durbin-Watson statistic obtained (1.141) is neither very close to the lower limit (0.780) nor to the upper limit (I.90).

4.6 AVERAGE ELASTICITIES

The average elasticities that are found in the table were computed using the following formula:

$$\text{Average elasticity} = \frac{b\bar{X}}{\bar{Y}}$$

Where : b was the coefficient of the specified independent variable.

$\bar{X}$ was the average value of the particular independent variable and;

$\bar{Y}$ was the average value of the dependent variable (Quantity of beef demanded):

$\bar{Y} =$ **42716**

$$\text{Average price elasticity of beef demand} = -b_1 . \frac{\bar{X}_1}{\bar{Y}}$$

$$= -9\,745.76 \times \frac{5.17}{42716}$$

$$= -1.18$$

$$\text{Income elasticity of beef demand} = b_2 . \frac{\bar{X}_2}{\bar{Y}} = 65.56 \times \frac{626.56}{42716}$$

$$= 0.96$$

Average cross-price elasticity of pork for beef $= -b3 \cdot \frac{\overline{X_3}}{\overline{Y}}$

$= 662.71 \times \frac{6.90}{42716}$

$= -0.11$

Average cross-price elasticity of chicken for beef $= -b_4 \cdot \frac{\overline{X_4}}{\overline{Y}}$

$= 871.48 \times \frac{4.40}{42716}$

$= 0.09$

4.7 INTERPRETATION OF COEFFICIENTS AND AVERAGE ELASTICITIES

4.7.1 THE CONSTANT

The parameter estimate of the constant was 59 371.38. This value was also the intercept of the demand response multiple regression function. The implication of this intercept was that when the quantity of beef demanded was not influenced by all the independent variables in the demand response model, 59 371 heads of cattle would be consumed. In other words, 59 371 heads of cattle would be demanded if the values of all the explanatory variables was zero.

4.7.2 THE PRICE OF BEEF

In this study it was found out that when all other independent variables specified in the demand model were equal to zero and therefore not influencing the quantity of beef demanded, a one Kwacha increase in the real consumer price of beef reduced the quantity demanded by 9 746 heads of cattle. Conversely, a one Kwacha decrease in the real consumer price of beef increased the quantity demanded by 9 746 heads of cattle. Thus,

the relationship between the quantity demanded and the own price of beef was found to be negative which confirmed the assertion in the theoretical framework and the Law of demand for a normal good.

The absolute value of the average elasticity of the own price of beef was 1.18 and this meant that the demand for beef was elastic. This coefficient of elasticity implied that a one per cent increase in the real consumer price of beef caused a 1.18 per cent reduction in the quantity of beef demanded. In the same vain, a one per cent decrease in the real consumer price of beef caused a 1.18 per cent increase in the quantity of beef demanded. This change in quantity demanded of beef was proportionately greater than the corresponding change in the own price of beef. This result was inconsistent with the expected usually inelastic demand for agricultural products.

4.7.3 PER CAPITA INCOME

The coefficient of Per capita income was found to be 65.56. This coefficient implied that all other independent variables being equal, a one Kwacha increase in the real per capita income of beef consumers increased the quantity of beef demanded by 66 heads of cattle and vice-versa. This result, thus, fulfilled the expected relationship stated in the theoretical framework.

The average elasticity coefficient of the real per capita income was 0.96. What this meant was that a one per cent increase in the real per capita income of beef consumers increased the quantity demanded of beef by 0.96 per cent, and vice-versa. Therefore, per capita income was discovered to be positively related to the quantity of beef demanded.

Since the elasticity coefficient was found to be between zero and one it was concluded that beef is a normal good. This is as it should be, most especially in developing countries where it is expected that as incomes rise the consumption of beef also rise.

4.7.4 BEEF SUBSITUTTES

The commodities that were considered close substitutes for beef were pork and chicken. In this study it was discovered that when all other independent variables were held constant, a one Kwacha increase in the real retail price of pork increased the quantity of beef demanded by 663 heads of cattle.. Thus, in this study a positive relationship was observed between the price of pork and the quantity of beef demanded. This relationship is consistent with what the theoretical framework purported.

On the other hand it was found that when all the other independent variables are held constant, a one Kwacha increase in the real consumer price of chicken increased the quantity demanded of beef by 871 heads of cattle. This result satisfied the expected relationship in the theoretical framework.

The average cross-price elasticity of pork for beef indicated that all the other independent variables being equal, a one per cent increase in the real consumer price of pork increased the quantity of beef demanded by **0.11 percent.** However, the average cross-price elasticity of chicken for beef implied that all other independent variables being equal, a one per cent increase in the real consumer price of chicken increased the quantity demanded of beef by 0.09 per cent.

4.8 Prioritising the variables affecting demand for beef

The average elasticities were useful in comparing the independent variables in terms of their influence on the quantity of beef demanded. This was because the obtained average elasticities were pure numbers in which, the effect of differences in units were eliminated.

On the basis of average elasticities in the table, the independent variables with respect to their order of importance in affecting the quantity of beef demanded were own price of beef, per capita income, price of pork and price of chicken. The price of chicken was found not to significantly affect the quantity of beef demanded; however, the positive coefficient indicated that it was a substitute though only to a very small extent.

This study was cognizant of the fact that while own price of beef was the most influential independent variable it only effected changes along the demand curve. The other factors shifted the demand curve of beef to the right for increases in quantities demanded and to the left for decreases in quantities demanded.

It was also recognized that even if it were the t – value that was used to compare the impact of each independent variable on the quantity of beef demanded, the results would still be own price of beef and the per capita income. These, as earlier stated, were found to contribute significantly to the amount of beef demanded.

4.9 TREND ANALYSIS

TABLE 2: OUTPUT OF THE TREND ANALYSIS

Variable	Variable identity	Coefficient	T-value	Sig T
Constant		63 232	21.58	0.000
Number of years from base year	X	-2 565	-8.21	0.000

R^2 = 0.818 Model F – Value = 67.42 F – Critical = 4.54

Using the results from the table above, the equation for the trend line reduces to:

$$Y_t = 63\,232 - 2\,565\,X$$

Where:

Y_t = quantity of beef meat demanded in year t

X = number of years from base year.

TABLE 3: FORECAST FOR THE NEXT FIVE YEARS

Year	Coded year (period)	Forecast (number of cattle)
2003	18	17062
2004	19	14497
2005	20	11932
2006	21	9367
2007	22	6802

4.10 SIGNIFICANCE OF THE TREND RESPONSE MODEL

The trend response model used in the simulation of the study was significant because the model F – value of 67.42 was greater than the tabulated (F – critical) value of 4.54. Therefore, the trend parameter estimates were not at all equal to zero.

The coefficient of multiple determination (R^2) indicated that the trend model explained 81.8 per cent of the variation in the trend of beef consumption. This is a rather high value of R^2 implying that the trend analysis model had a good goodness of fit.

4.11 INTERPRETATION OF THE COEFFICIENTS

4.11.1 THE CONSTANT

The coefficient of the constant of the trend model was found to be 63 232. This implied that when the number of years from the base year was not influencing the trend the number of beef cattle consumed was 63 232. In other words, the quantity of beef consumed in the base year was 63 232.

4.11.2 THE NUMBER OF YEARS FROM THE BASE YEAR

The coefficient of the number of years from the base year variable was –2 565 implying that in each year the number of cattle consumed would go down by 2 565 that of the previous year.

Thus, the forecasted number of cattle to be consumed will be 19 627, 17 062, 14 497, 11 932 and 9 367 in the years 2002, 2003, 2004, 2005 and 2006 respectively. This confirms

what the trend line postulates that each year the number of cattle consumed goes down by 2 565 that of the previous year.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The beef market has been in a slump. The major factor responsible for this is the weak Zambian economy. Rapid economic decline over the past decade, families with disposable income and low employment rates all contributed to a negative economic environment for the beef industry.

From the study it was concluded the future of the beef industry was apparently inauspicious. This was because from the trend line obtained the quantities of beef demanded would decline by 2 565 heads of cattle per year and will be 17 062, 14 497, 11 932 , 9 367 and 6802 in 2003, 2004, 2005, 2006 and 2007 respectively. This implied that the extent of the market would be decreasing, in turn, becoming smaller and smaller. Smaller markets usually breed high costs as there would be no utilization of economies of scale by producers. Subsequently, high producer costs would be passed on to the consumers in form of high beef prices, which would further constrain the development of the beef industry.

Besides, the declining real per capita incomes of consumers as well as would-be consumers have reduced their purchasing power. As a result beef consumers would be expected to switch to chicken as it has comparatively lower real prices.

5.2 Recommendations

As has already been stated the future of the beef industry in Zambia is very inauspicious. Thus there is a need for policies that will reverse this trend and give the industry some hope. The following recommendations were given:

5.2.1 Social Change

Zambia's cattle population is currently estimated at about 3 million of which about 80 per cent are under traditional management (GART, 2001). However, traditional farmers have beliefs or superstitions such as keeping cattle for prestige or as a means of saving and so have a reluctance to sell cattle except where there is special need of cash. Thus there is a serious need to implement a deliberate policy of social change among the traditional cattle keepers that will persuade them to go commercial and keep cattle for the market. This would, in turn, see a steady supply of cattle on the market thus stabilizing prices.

5.2.2 Establishment of Livestock Markets and Slaughter Houses

Urban and Rural cattle markets or old cattle sale yards should be opened at strategic points to encourage continuous cattle trades according to the actual price on the market. Also there should be establishment of legal cattle slaughter houses that will enable those that want to slaughter their animals for the market to do so.

5.2.3 Support for Beef Processors

Government should offer credit facilities at preferential rates to those that would want to venture into processing and those that want to expand their plants. This would expand the market for beef in the country as more cattle get to be demanded for.

5.2.4 Strict Monetary Policy

In this study it was discovered that the two main factors influencing demand for beef were the per capita income and the price of beef. Both the price of beef and the per capita income are affected by inflation. Thus, government is urged to work towards lowering annual inflation by 13 per cent by the end of the year as stated in the 2002 budget and further in the years to come. This would stimulate demand by lowering consumer prices. Lower consumer prices would then maintain or increase the consumer's purchasing power for beef depending on the resulting reduction in these prices because real per capita incomes would be maintained.

5.2.5 Employment Creation

Beef consumption in Zambia has been on the wane mainly because there has been a progressive decrease in the number of people in paid employment in the country. Thus there is a serious need to institute policies that will create employment and increase incomes of the poor. Beef being a normal good, as the number of the poor in employment increase and , in turn, their incomes go up , there will be a significant increase in it's consumption.

5.2.6 Integrating the Market

Investing in fully integrated systems will allow access to markets and opportunities for enhanced profitability. Alliances or business structures that allow the production, marketing, and distribution of beef products within the structure will have lower transaction costs than multiple entities trying to piecemeal the movement and processing of beef products from the farm gate to plate. Lower transaction costs mean lower prices for consumers and increased quantity demanded.

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APPENDIX

Table 1: Data for the Demand Response Simulation

	Year	Demand	Beef	Income	Pork	Chicken
1	1985.00	52415.00	5.20	808.10	7.12	4.31
2	1986.00	58695.00	5.00	793.35	7.36	5.60
3	1987.00	61982.00	4.31	652.00	7.80	5.72
4	1988.00	53231.00	4.66	786.40	7.25	4.24
5	1989.00	51230.00	5.47	798.70	6.43	4.48
6	1990.00	49982.00	5.78	708.94	6.05	4.20
7	1991.00	47894.00	5.88	801.20	5.90	4.17
8	1992.00	56123.00	4.71	549.42	5.68	4.11
9	1993.00	53914.00	4.75	557.60	6.55	4.33
10	1994.00	46638.00	4.83	611.14	7.43	4.51
11	1995.00	35962.00	5.80	579.75	7.49	4.14
12	1996.00	32162.00	5.83	516.70	7.36	4.08
13	1997.00	30011.00	4.69	543.61	6.95	3.99
14	1998.00	28937.00	4.67	501.62	6.65	4.25
15	1999.00	34210.00	4.50	484.23	7.16	4.30
16	2000.00	18669.00	5.86	481.00	7.11	4.23
17	2001.00	14120.00	5.90	477.13	7.08	4.21

SOURCES: Ministry of Agriculture Bulletin of Statistics (2000/2001)

Central Statistical Office Digest (1998)

Zambeef sales records (1990-2000)

Zambia Pork Products price records (1988-1996)

Tamba Farms sales records (1992-2000)