EFFECT OF HOUSEHOLD CHARACTERISTICS ON THE DECISION TO CONSUME STAPLE FOODS IN SOUTH AFRICA

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Abstract

Knowledge about the factors influencing household decision to consume staple foods under recent changing economic conditions is essential in evaluating the impact of South African government's trade and domestic policies and marketing firm's strategies. This study estimates a multinomial logistic model using 1993 integrated household survey data to examine the effect of household socio-economic and demographic characteristics on the decision to consume staple foods in South Africa. Results of the analysis indicate that socio-economic and demographic characteristics of households are important factors influencing the decision to consume staple foods. Empirical results indicate that, holding all things constant, the change in the probability of consuming staple foods for a unit change in income and price is very low. The results demonstrate that developing marketing strategies and government policies that target specific market segments is an effective means of promoting the use of staple foods. Findings from this study suggest that the household decision to consume staple foods could decline given increased urbanisation and changing tastes and preferences in South Africa.

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1. INTRODUCTION

South Africa is an upper-middle-income country. Despite its wealth, the experience of the majority of South African households is either one of outright poverty or of continued vulnerability to becoming poor (May, 2000). Over the last two decades, South Africa economy has undergone a dramatic economic, social and political transition. The Government of South Africa's policy on reducing poverty and inequality has led to significant changes in income distribution and urbanisation. The fundamental political changes and recent trade and domestic policy reforms

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are likely to have a significant impact on household food consumption patterns in South Africa. First, the return to democracy in 1994 has induced movement from the rural to urban areas. Second, access to education, health and other basic services for a large number of disadvantaged citizens has increased (Poonyth *et al*, 2001). Third, global trade agreements to which South Africa is signatory have led to reductions in tariffs and non-tariff barriers, spurring growth in trade in agricultural products. The changing consumer demands and policy reforms are challenging policymakers and marketing firms in South Africa.

Over the last two decades the structure and patterns of household food consumption has significantly changed in South Africa (Table 1). Table 1 shows that, during the period 1980 and 1999, per capita consumption of beef and veal and mutton and goat declined quite dramatically, while that for pork had increased slightly. Overall, per capita consumption red meat declined from 29.81 kilograms in 1980 to 21.70 kilograms by 1999, while per capita consumption of white meat rose from 11.9 kilograms in 1980 to 20.4 by 1999. Although per capita wheat consumption appeared to have declined during the period 1980-99, the per capita consumption of maize fluctuated quite dramatically during this period, with major declines in the late 1980s and early 1990s. Per capita consumption of rice rose from 7.9 kilograms in 1990 to 12.1 kilograms by 1999.

Table 1: Per capita food consumption (kg/year) of some selected food items in South Africa, 1980-1999

Year	Beef	Mutton & Goat	Pork	Poultry	Red meat	White meat	Maize	Rice	Wheat
1980	20.88	6.0	2.9	7.8	29.81	11.90	87.9	4.4	55.3
1981	20.97	6.4	3.1	*na*	30.39	13.00	85.1	*na*	51.3
1982	21.43	6.9	3.5	*na*	31.84	14.64	89.5	*na*	48.9
1983	21.04	6.7	3.5	*na*	31.17	15.01	87.0	*na*	61.2
1984	20.24	6.8	3.3	*na*	30.32	15.40	85.0	*na*	53.4
1985	18.59	6.0	3.1	9.8	27.72	14.67	70.5	5.5	50.9
1986	18.73	5.5	2.9	*na*	27.17	15.09	69.5	*na*	53.4
1987	17.19	5.1	3.0	*na*	25.30	15.87	62.1	*na*	62.4
1988	16.79	4.7	3.1	*na*	24.60	16.09	67.4	*na*	53.6
1989	18.00	5.0	3.4	*na*	26.40	16.72	60.2	*na*	49.5
1990	18.68	5.5	3.5	10.8	27.61	15.99	66.8	7.9	44.6
1991	19.19	5.1	3.0	10.8	27.20	15.69	67.4	9.2	44.3
1992	18.49	5.0	3.3	11.0	26.81	15.33	65.0	9.0	40.1
1993	17.09	4.1	3.2	10.5	24.40	16.27	73.4	9.5	41.5
1994	15.23	3.8	3.5	11.7	22.50	17.30	67.4	10.4	43.3
1995	15.31	4.1	3.4	13.0	22.80	18.09	73.2	11.3	51.9
1996	14.31	3.4	3.3	12.5	21.05	20.18	65.3	11.7	51.3
1997	13.11	3.5	3.1	12.8	19.67	20.48	59.4	13.9	40.8
1998	12.96	3.7	3.0	11.9	19.70	20.54	88.0	12.4	54.2
1999	14.90	3.7	3.1	12.7	21.70	20.40	85.2	12.1	48.3

***Note*: *na* denotes data not available.**
***Source of data*: NDA (2002).**

Table 2 shows that, on average, between 1980 and 1999, per capita consumption of beef and mutton and goat had declined by 1.87% and 3.37% per annum, respectively, while that for pork had remained fairly constant over this period. Per capita consumption of poultry rose by 0.38% per annum. During this time, per capita consumption of maize, rice and wheat rose by 0.96%, 3.27% and 0.29% per annum, respectively.

Table 2: Estimated growth rates in per capita food consumption of some major food items in South Africa, 1980-99

Period	Beef	Mutton & Goat	Pork	Poultry	Red Meat	White Meat	Maize	Rice	Wheat
1980-89	-2.63	-5.34	0.89	na	-2.80	1.25	-1.82	na	-1.69
1990-99	-0.11	-0.10	-2.35	1.87	-0.52	3.44	6.75	3.56	4.04
1980-99	-1.79	-3.59	-0.19	-0.44	-2.04	1.98	1.03	2.28	0.22

***Note*: *na* denotes data not available.**
***Source*: Calculated using data from NDA (2002)..**

Knowledge about the effect of household characteristics on the decision to consume staple foods is essential for marketing firms to develop efficient marketing strategies and for policymakers to evaluate the impact of South African government's trade and domestic policy. Household food demand depends on major factors, including but not limited to the socio-economic and demographic characteristics. While a number of studies have examined the impact or potential impact of government policy on agricultural production and productivity, few studies have examined the effect of these reforms on the decision to consume staple foods in South Africa. Some recent studies on demand for food in South Africa include those by Belete *et al* (1990), Nieuwoudt (1998a, 1998b), Poonyth *et al* (2001) and Jooste & Van Schalkwyk (2001). It is therefore imperative that we understand the nature of the causal relationship, if any, between household characteristics and the decision to consume staple foods. This study differs from earlier work on demand analysis by focusing on factors influencing households' decision to consume staple foods in South Africa.

The purpose of this study is to examine the impact of household's socio-economic and demographic characteristics on their decision to consume staple foods in South Africa. To achieve this goal a multinomial logistic model is specified and estimated using the 1993 national household survey conducted in South Africa. While limited to the period before major reforms, the findings of this study will provide a glimpse into nationwide household food consumption patterns in South Africa. The consumption

patterns of this study may well reflect the general consumption behaviour of households in South Africa following the period of major policy reforms. In this study, a staple food is defined as the food consumed mostly by ethnic groups and this includes maize, mealie meal, rice, bread, wheat flour, red meat (beef, pork and mutton) and chicken. This list represents the basic staple foods consumed by South African households.

The rest of this paper is organised as follows. Section 2 describes the method used in the analysis, followed by a description of sources of data employed in Section 3. Section 4 reports and discusses the empirical results from the application of the multinomial logistic model to cross-sectional data of household survey. Section 5 presents the concluding remarks.

2. METHODOLOGY

In this study, a multinomial logistic model relating the likelihood of consuming a staple food as a function of socio-economic and demographic variables - age of household head, level of education in years, race, gender of household head, location of household, family size, income of household head and own-price and cross-price of staple foods - is specified and estimated using estimation procedure in SHAZAM econometric package. A multinomial logistic model is used because it provides a means for capturing the magnitude of the independent variable effects for qualitative dependent variables.

Following the parametisation of Maddala (2000), consider a regression model of the form

$$y^* = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} + u_i \qquad \textbf{(1)}$$

where y* is unobserved and is defined as

$$y^* = \begin{cases} 1 & if\ y^* > 0 \\ 0 & otherwise \end{cases} \qquad \textbf{(2)}$$

From (1) and (2), the likelihood of consuming a staple food can be specified as

$$P_i = Prob\,(y_i = 1) = Prob\left[u_i > -\left(\beta_0 + \sum_{j=1}^{k} \beta_j x_{ij}\right)\right] \qquad \textbf{(3)}$$

$$= 1 - F\left[-\left(\beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} \right) \right] \quad \textbf{(4)}$$

where *F* is the cumulative distribution function of *u*, and β_0 and β_j are parameters to be estimated. If the distribution in (4) is symmetric, then (4) becomes

$$P_i = F\left(\beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} \right) \quad \textbf{(5)}$$

The log-likelihood function is:

$$L = \prod_{y_i=1} P_i \prod_{y_i=0} (1 - P_i) \quad \textbf{(6)}$$

Following from (5), the multinomial logistic function can be written as

$$P_i = F(X_t' \beta) = \frac{1}{1 + \exp(-X_t' \beta)} \quad \textbf{(7)}$$

whereby

$$\log \frac{P_i}{1 - P_i} = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} \quad \textbf{(8)}$$

The expression on the LHS of (8) indicates the logarithm of probability of consuming a staple food to the odds of consuming The coefficients of logistic models do not provide any useful measure of the relationship between dependent and explanatory variables except for the sign and significance of the coefficients of the explanatory variables. Given this, the elasticity of the estimated coefficients of the multinomial logistic model is derived. The elasticity is defined as the changes in the probability of consuming staple foods with respect to a unit change in the explanatory variable. From (5), the elasticity of the multinomial logistic model is:

$$E_k = \left(\frac{\partial P}{\partial X_{kt}} \right) \left(\frac{\overline{X}_k}{F(X_t' \beta} \right) \quad \textbf{(9)}$$

The empirical model is specified as follows:

P(Z) = β_0 **+** β_1 **AGE +** β_2 **AGESQ +** β_3 **RACE +** β_4 **EDU +** β_5 **GEN +** β_6 **URBAN**

+ β_7 **F-SIZE +** β_8 **INC +** β_9 **INCSQ +** β_{10} **LOC +** ε **(10)**

where the dependent variable in the model is a discrete variable 0-1 with 1 if household consumed a staple food and 0 otherwise, and where $Z=X\beta$, and the explanatory variables are as defined in Table 1.

3. DATA SOURCES AND DESCRIPTION

We use data from the 1993 South African Integrated Household Survey data conducted by the Southern Africa Labour Development Research Unit (SALDRU) in the School of Economics, University of Cape Town, South Africa. Funding for this project was provided by the Governments of Denmark, Netherlands and Norway and through the World Bank. The focus of the study was to collect data on living standards in order to provide policymakers with the data for planning strategies to evaluate and implement government policies. The survey collected detailed information on a series of subjects including (but not limited to) household composition, education, health, fertility, employment and household expenditure patterns, including assets, income, expenditure on food and socio-demographic characteristics of households. The survey was conducted in the nine months prior to the country's first democratic election in 1994. A total of 9 000 households were drawn from a carefully selected sample. In this study, however, due to incomplete data in some of the variables, 7 827 observations were used in the analysis.

The explanatory variables were grouped into two classes, namely, the household expenditure and price data on staple foods and household socio-economic and demographic characteristics. Family size is linearly decomposed into the following groups: up to 4 members in household, 5 to 10 members in household and more than 10 members in household. 71% of households were headed by a male and remaining 29.0% by a female. The average family size is 4.47. Additional household characteristics include two continuous variables, namely, age of household head and age of household head squared and income of household head and household head's income squared. Average monthly income of household head was R1 282.60, and average age of household head was 47 years old.

With respect to the educational level of the household head, discrete 1-3 variables were used to model the consumption impacts of education of household head (1 for household head who received no education or primary education; 2 for household head who received secondary (matric) education; 3 for household head with tertiary education and includes first degree, second, third degrees and certificates, diplomas and degrees from polytechnic (Technikon). 23% of household heads never attended school, 44.0% of household heads received primary education, 24.0% received a

secondary education and 9.0% had earned a tertiary education degree. The average number of years of education of household head was 5.33, implying primary level of education.

Another discrete 1-3 variable included in the model is race of household head (1 for household head that is Black, 2 for household head that is Indian/Coloured and 3 for household head that is White). 71% of the households interviewed are Black, 12.0% are Indian/Coloured and 17.0% are White. Despite this variation, this distribution by race is representative of South Africa population. The race categories are hypothesised to reflect quality effects and potential price discrimination impacts on food consumption. Discrete 0-1 variables are used to model the impact of residence on the likelihood of consuming staple foods with 1 if household is in an urban or peri-urban area and 0 otherwise. 68% of households surveyed live in urban or peri-urban areas while 32.0% of respondents live in rural areas. The location effects on consumption of food are modelled by incorporating discrete 0-1 variables for the location where the survey was conducted into the model. A summary of variables used in the analysis is shown in Table 3.

Table 3: Description and means of the dependent and independent variables used in the analysis

Variable	Description	Mean	Std. dev.
Dependent variables			
MEALIE MEAL	Prob. of consuming maize meal; 1 if consumed and 0 otherwise	0.85	0.36
MAIZE	Prob. of consuming maize; 1 if consumed and 0 otherwise	0.40	0.49
RICE	Prob. of consuming rice; 1 if consumed and 0 otherwise	0.62	0.49
BREAD	Prob. of consuming bread; 1 if consumed and 0 otherwise	0.86	0.35
WHEAT	Prob. of consuming wheat; 1 if consumed and 0 otherwise	0.42	0.49
RMEAT	Prob. of consuming red meat; 1 if consumed and 0 otherwise	0.75	0.43
CHICK	Prob. of consuming chicken; 1 if consumed and 0 otherwise	0.81	0.39
Explanatory variables			
AGE	Age of household head in years	47.43	15.23
AGESQ	Age of household head squared in years		
RACE	Race of respondent; 1 if Black, 2 if Coloured, 3 if Indian 4 if White	1.66	1.15
EDUC	Number of years spent in school by household head	5.33	4.50
GEN	Gender of household head; 1 if male and 0 otherwise	0.71	0.45
URBAN	Urbanisation; 1 if urban or peri-urban and 0 if rural	0.68	0.47
F-SIZE	Number of people in household	4.47	0.47
INC	Household income in Rand	1274.94	2052.94
INCSQ	Household income squared in Rand		
LOC	Survey site; 1-14 with the base location of 1 for Pretoria	4.88	3.62
PMAIZE	Own price of maize (in R/kg)	2.10	0.46
PMEALIE MEAL	Own price of mealie meal (in R/kg)	2.02	0.52

PRICE	Own price of rice (in R/kg)	3.19	0.83
PBREAD	Own price of bread (in R/kg)	2.60	0.59
PWHEAT	Own price of wheat (in R/kg)	2.72	0.44
PRMEAT	Own price of red meat (in R/kg)	11.59	1.87
PCHICK	Own price of chicken (in R/kg)	10.12	4.05

4. RESULTS AND DISCUSSION

The empirical results of the application of the linear multinomial logistic model of the likelihood of consuming a staple food on household characteristics are presented in Appendix A. The Maddala R^2-adjusted (goodness of fit measure) is estimated to range between 0.10 for chicken equation and 0.51 for rice equation. The low R^2-adjusted statistics associated with some of the estimated equations do not detract from the usefulness of the model because of the type of data used in the analysis; survey data. The Chi-square statistics of the test of significance of the estimated parameters range from 850.97 for chicken equation to 5 584.04 for rice equation. The results indicate that the socio-demographic characteristics of households and own-price and cross-price of staple foods are important factors influencing household decision to consume staple foods in South Africa.

The effects of household socio-economic and demographic characteristics on the consumption of staple foods in South Africa are reported in Table 4. Table 4 shows that the estimated parameters of the family size variable, F-SIZE, are significant at the 10% level for staple foods. For households with up to four members, family size is positively related to the likelihood of consuming staple foods. Increasing family size by one level for households with less than five members is estimated to increase, on average, the probability of consuming staple foods by 55.0 percentage points. For households with more than four members, family size is negatively related to the likelihood of consuming staple foods. Increasing family size by one level for households with between five and ten members is estimated to decrease, on average, the probability of consuming staple foods by 13.6 percentage points, while those households with more than ten members is estimated to decrease, on average, by 4.7 percentage points. These results suggest that as family size increases beyond four members, staple food consumption per household members decrease.

The education of the household head influences the decision to consume staple foods. Consistent with expectations, household heads with no or formal education up to the secondary education (matriculation) level are more likely to consume staple foods. Increasing education by one level for household heads with less than tertiary education is estimated to increase,

on average, the probability of consuming staple foods by 16.0 percentage points. Household heads with tertiary education are likely to consume less staple foods. Increasing education by one level for household heads with tertiary education is estimated to decrease, on average, the probability of consuming staple foods by 1.9 percentage points. A possible explanation for this behaviour is that highly educated household heads are likely to earn more money and as a result may shift from the consumption of staple foods to value-added products or eat food away from home. It is important to note however that the level of education of household head has no effect on the probability of consuming mealie meal.

Table 4: Effect of household characteristics on staple foods consumption in South Africa

Variable	Maize	Mealie meal	Rice	Bread	Wheat	Red Meat	Chicken
AGE	+	+	+	ns+	+	+	+
AGESQ			-		-		-
INC	ns+	-	+	+	+	+	+
INCSQ	ns+	ns+	-	-	ns-	-	-
RACE							
Black	ns+	ns-	ns-	ns+	+	ns-	ns-
Indian/Coloured	-	-	ns+	ns+	-	ns+	ns+
White	-	ns-	ns+	-	-	ns-	ns-
EDUC							
Up to Year 12	+	ns+	+	+	+	+	+
After year 12	-	ns+	-	-	ns-	-	ns-
GEN	-	ns-	ns+	+	-	+	ns+
URBAN	-	ns+	-	-	ns+	-	-
F-SIZE[A]							
1-4	+	+	+	+	+	+	+
5-10	-	-	-	-	-	-	-
11 and over	-	-	-	-	-	-	-
LOC.DUMMY	yes	yes	yes	yes	yes	yes	yes

Notes: + = significant at the 0.1 level and positive.
- = significant at the 0.1 level and negative.
ns+ = non-significant at the 0.1 level but exhibits a positive trend.
ns- = non-significant at the 0.1 level but exhibits a negative trend.
[a]F-Size denotes family size.

The estimated parameters for the income variable, INC, is significant at the 10% level in staple food equations, except for the maize equation. The coefficient of the income variable is negative and statistically significant in the estimated mealie meal equation. This indicates that the likelihood of consuming mealie meal decreases with an increase in income. The likelihood of consuming rice, bread, wheat, red meat and chicken with

respect to income is positive and less than unity. This implies that an increase in income is associated with a less than proportionate increase in the probability of consuming staple foods.

The income-squared variable, INCSQ, which captures income earned over time, is negative in the estimated rice, bread, red meat and chicken equations, implying that, as income increases, the probability of households consuming these food items would increase to a certain level and then begins to decline. This suggests possible substitution of other food items for these staple foods. As well, there is a possibility of a shift in consumption patterns towards value-added products and/or food away from home.

With the exception of bread, the parameters for the age variable are positive and significant at the 10% level in the estimated equations. This implies that an increase in age is associated with an increase in the likelihood of consuming staple foods. The statistical insignificance of the age variable in the estimated bread equation indicates that the probability of consuming bread is not influenced by age. The estimated parameters of the age-squared variable, AGESQ, are negative in the estimated rice, wheat and chicken equations, suggesting that the probability of consuming rice, wheat and chicken increases with age up to a certain point and then begins to decline.

Overall, the race of household head has very little impact on the probability of consuming staple foods. Indian/Coloured household heads are likely to consume less of maize, mealie meal and wheat. White household heads are likely to consume less of maize, bread and wheat. Although race of household head has no effect on the consumption of rice, it is positive for Indian/Coloured and White household heads but negative for Black-headed households. For meat, although not significant, Indian/Coloured household heads appear to consume more of both red meat and chicken compared with Whites and Black household heads who are likely to consume less of red meat and chicken. Male household heads are likely to consume more bread and red meat and less of maize and wheat. The gender of household head has no statistically significant effect on the consumption of rice, mealie meal and chicken.

The estimated parameters of the urbanisation variable, URBAN, are negative in the maize, rice, bread, red meat and chicken equations, implying that households in urban areas are likely to consume less of these staple foods. Given that South African is experiencing movement of people from rural to urban areas, the results of this study suggest a possible shift in

consumption patterns away from staple foods to more value-added products and perhaps food-away from-home.

Table 5 reports the estimated changes in the probability of consuming staple foods to the own-price and cross-price and income. Table 5 shows that the probability of consuming staple foods is inelastic with respect to own-price, except for mealie meal for which the decision to consume is unresponsive to changes in own-price of product. The probability of consuming maize, wheat and rice declines with an increase in price, estimated to be 0.118, 0.238 and 0.006, respectively, while that for rice, bread and chicken increases with an increase in own-price, estimated to be 0.097, 0.005 and 0.004, respectively. The estimated cross-price elasticities of the probability of consuming staple foods are generally positive, suggesting substitution between staple foods.

Table 5: Estimated changes in probability of consuming staple foods in South Africa

Changes in probability with respect to:								
Staple food	Price of:							Income
	Maize	Mealie meal	Rice	Bread	Wheat	Red meat	Chicken	
Maize	-0.118	0.206	0.019	0.355	-0.052	0.166	-0.277	0.005
Mealie meal	0.002	-0.011	0.017	0.047	-0.010	-0.025	-0.005	-0.004
Rice	-0.116	0.461	0.968	0.590	-0.487	-0.685	-0.189	0.408
Bread	0.005	0.002	-0.021	0.047	0.082	-0.085	0.030	0.042
Wheat	-0.126	0.218	0.015	0.137	-0.238	0.065	-0.166	0.047
Red meat	0.124	-0.015	0.056	0.134	-0.036	-0.065	0.024	0.105
Chicken	0.028	0.010	0.057	0.089	0.037	-0.037	0.040	0.060

The table in the Appendix illustrates regional differences in consumer habits. The location of the household was found to be an important determinant in pattern of consumption of staple foods. The results show that, with the exception of East London, households in other cities generally spend less on rice compared to Pretoria, the base location. The results also indicate that households in other locations are likely to purchase more bread and mealie meal than in the Pretoria area, as expected. Households in Durban and East London are likely to spend more on red meat than in Pretoria area, while households in East London also spend more on chicken than in Pretoria area.

5. CONCLUSION AND IMPLICATIONS

A multinomial logistic model was employed to examine the impact of socio-economic and demographic factors on the probability of consuming seven staple foods (maize, mealie meal, rice, bread, wheat, red meat and chicken) in South Africa. The results indicate some distinctive regional differences in the household decision to consume these foods. These differences may be due to the socio-economic and demographic characteristics of households in those areas. The empirical findings of this study may be useful to policy makers in determining the appropriate policies to implement to encourage increased consumption of staple foods and for marketing firms in determining the appropriate strategies to adopt to target specific market segments. According to the findings, the decision to consume staple foods are influenced by age, income, education, gender, urbanisation, family size and location of household, and to a lesser extent the race of household head. For example, maize and mealie meal may be targeted to heads of households who are Black females. Conversely, rice, bread and red meat may be targeted to head of households who are males and of White or Indian/Coloured origin.

The results indicate that it would be inappropriate to develop marketing strategies and economic policies that ignore the diversity of consumption patterns within society. By developing marketing strategies and economic policies that target specific market segments within the food economy, sellers will be able to encourage increased demand for staple foods and policy makers will be able to eradicate poverty in South Africa.

The finding of this study are important because it suggests that government policy that attempts to raise living standards of households, say through an increase in income, would cause a shift in consumption away from mealie meal and towards other staple foods. An increase in income would have no effect on the consumption of maize. Although not conclusive this result suggests that an increase in income could lead to a decrease in the consumption of staple foods and an increase in the consumption of value-added products. Future research will examine the interrelationship between socio-economic and demographic factors in influencing the decision to consume staple foods in South Africa.

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REFERENCES

BELETE A, IGODAN CO, M'MARETE C & VAN AVERBEKE W. (1999). Analysis of rural household consumption expenditure in South Africa: The case of food plot holders in Tyefu irrigation scheme in the Eastern Cape Province. *Agrekon* 38(2):194-203.

JOOSTE A & VAN SCHALKWYK HD. (2001). The influence of demand and supply shift factors on the South African red meat industry: A spatial partial equilibrium approach. *Agrekon* 40(2):249-258. June.

MADDALA GS. (2000). *Introduction to Econometrics*. Third Edition. West Sussex: Wiley.

MAY J. (2000). Introduction. In: May J (ed), *Poverty and inequality in South Africa: Meeting the challenge*. David Philip Publishers Limited, Johannesburg.

NDA. (2001). *Abstracts of Agricultural Statistics*. National Department of Agriculture, Pretoria.

NIEUWOUDT WL. (1998a). The demand for livestock products in South Africa for 2000, 2010 and 2020, Part I and II. *Agrekon* 37(2):130-161.

NIEUWOUDT WL. (1998b). The demand for livestock products in South Africa for 2000, 2010 and 2020: Part II. *Agrekon* 37(2):143-161.

POONYTH D, HASSAN R & KIRSTEN JF. (2001). Random coefficients analysis of changes in meat consumption preferences in South Africa. *Agrekon* 40(3):426-437.

SALDRU. (1993). *South African Integrated Household Survey data*. Conducted by the Southern Africa Labour Development Research Unit (SALDRU), School of Economics, University of Cape Town, South Africa.

APPENDIX A

Maximum likelihood estimates of the model

Variable	Maize	Mealie meal	Rice	Bread	Wheat	Red Meat	Chicken
AGE	0.007	0.016	0.041	0.001	0.049	0.004	0.034
	(3.45)	(5.77)	(2.92)	(0.22)	(4.64)	(1.68)	(2.85)
AGESQ	-	-	-2.7E-04	-	-3.3E-04	-	-2.1E-04
			(-1.96)		(-3.20)		(-1.85)
INC	6.8E-06	-7.3E-05	3.3E-04	3.7E-04	6.2E-05	4.7E-04	3.2E-04
	(0.28)	(-2.50)	(7.52)	(7.54)	(2.49)	(11.72)	(8.41)
INCSQ	9.8E-10	1.7E-09	-1.1E-08	-1.2E-08	-2.1E-09	-1.5E-08	-9.2E-09
	(0.65)	(1.04)	(-4.96)	(-5.82)	(-1.28)	(-7.09)	(-4.66)
GEN	-0.285	-0.013	0.0429	0.278	-0.156	0.170	0.027
	(-4.86)	(-0.14)	(0.50)	(3.66)	(-2.69)	(2.65)	(0.38)
URBAN	-0.257	0.043	-0.675	-1.150	0.109	-0.890	-0.735
	(-3.63)	(0.51)	(-6.73)	(-10.20)	(1.49)	(-9.43)	(-7.81)
RACE							
Black	0.566	-0.294	-0.806	0.388	5.612	-0.510	0.198
	(1.25)	(-0.62)	(-0.78)	(0.33)	(11.29)	(-0.68)	(0.25)
Indian/Coloured	-0.822	-0.547	0.838	0.0517	-2.965	0.714	0.159
	(-3.06)	(-1.89)	(1.44)	(0.08)	(-10.23)	(1.66)	(0.35)
White	-0.621	-0.067	0.748	-0.148	-4.077	0.591	-0.161
	(-1.82)	(-0.19)	(0.96)	(-0.17)	(-10.89)	(1.05)	(-0.27)
EDUC							
Up to 12 years	0.033	0.002	0.158	0.079	0.024	0.055	0.070
	(3.70)	(0.14)	(12.10)	(6.63)	(2.69)	(5.67)	(6.64)
After 12 years	-0.030	0.004	-0.077	0.044	-0.005	-0.042	-0.009
	(-3.49)	(0.46)	(-5.26)	(-2.64)	(-0.56)	(-3.23)	-0.74
F-SIZE							
1-4	0.204	0.589	0.474	0.361	0.281	0.132	0.248
	(7.19)	(14.14)	(11.30)	(8.96)	(9.82)	(4.00)	(7.07)
5-10	-0.063	-0.162	-0.231	-0.176	-0.1099	-0.073	-0.124
	(-3.21)	(-5.58)	(-7.45)	(-6.02)	(-5.59)	(-3.06)	(-4.86)
11 and over	-0.135	-0.371	-0.342	-0.236	-0.195	-0.089	-0.190
	(-5.39)	(-8.03)	(-8.88)	(-6.39)	(-7.84)	(-3.00)	(-6.00)

APPENDIX A continued

Variable	Maize	Mealie meal	Rice	Bread	Wheat	Red Meat	Chicken
Prices							
PMAIZE	-0.090	0.022	-0.057	0.028	-0.101	0.331	0.091
	(-1.59)	(0.23)	(-0.61)	(0.36)	(-1.75)	(5.09)	(1.31)
PMEALIE MEAL	0.164	-0.138	0.237	0.013	0.183	-0.0433	0.0342
	(3.16)	(-1.63)	(3.33)	(0.18)	(3.52)	(-0.74)	(0.55)
PRICE	0.010	0.137	0.314	-0.075	0.008	0.098	0.122
	(0.28)	(2.61)	(6.05)	(-1.63)	(0.24)	(2.56)	(2.93)
PBREAD	0.219	0.475	0.235	0.205	0.089	0.291	0.231
	(3.40)	(4.31)	(2.47)	(2.36)	(1.37)	(3.96)	(2.88)
PWHEAT	-0.031	-0.099	-0.185	0.339	-0.148	-0.075	0.091
	(-0.52)	(-1.17)	(-1.96)	(4.04)	(-2.44)	(-1.03)	(1.21)
PRMEAT	0.023	-0.057	-0.061	-0.082	0.009	-0.032	-0.021
	(1.58)	(-2.64)	(-3.14)	(-4.46)	(0.66)	(-2.07)	(-1.32)
PCHICK	-0.044	-0.012	-0.019	0.034	-0.028	0.013	0.027
	(-6.44)	(-1.10)	(-1.81)	(3.30)	(-4.15)	(1.66)	(3.03)
Location Dummies							
Durban	-0.125	0.740	0.403	2.210	-2.038	0.354	-0.054
	(-0.91)	(4.38)	(1.73)	(7.99)	(-13.53)	(1.91)	(-0.27)
Cape Town	-0.935	0.847	-0.949	0.906	-1.879	-0.060	-0.587
	(-9.66)	(7.10)	(-6.41)	(6.61)	(-18.58)	(-0.48)	(-4.27)
Port Elizabeth	-1.552	2.169	-1.270	0.998	-1.853	0.021	-0.186
	(-10.85)	(8.65)	(-7.16)	(5.73)	(-13.24)	(0.13)	(-1.08)
East London	0.152	1.926	0.816	2.470	-1.3736	1.880	0.734
	(1.12)	(5.84)	(3.80)	(10.70)	(-10.04)	(9.85)	(3.76)
Bloemfontein	-1.723	1.346	-1.250	1.610	-2.214	0.260	-0.205
	(-7.91)	(2.51)	(-4.95)	(5.21)	(-9.98)	(1.10)	(-0.78)
Kimberley	-3.110	25.421	-1.730	1.150	-1.990	-0.419	-0.118
	(-9.98)	(0.00)	(-7.170)	(4.26)	(-9.39)	(-1.95)	(-0.46)
Pietermaritzburg	-2.854	2.713	-3.90	0.815	-2.051	-0.785	-0.560
	(-14.61)	(4.52)	(-17.30)	(4.21)	(-13.00)	(-4.63)	(-2.973)
Others	-0.256	1.227	-29.600	0.529	-0.775	-0.479	-0.640
	(-2.00)	(5.538)	(-0.002)	(3.070)	(-5.870)	(-3.12)	(-3.78)
Constant	-1.319	-0.870	-0.918	-1.160	-7.128	-0.324	-1.744
	(-2.45)	(-1.29)	(-0.80)	(-0.93)	(-11.39)	(-0.40)	-1.97
Maddala R^2	0.17	0.22	0.51	0.12	0.17	0.18	0.10
Chi-square	1457.77[a]	1914.26[a]	5584.04[b]	1000.03[a]	1472.42[b]	1528.56[a]	850.97[b]

Note: **Values in parentheses are t-ratios.**

[a]Critical value is 16.93 (28 d.f., 95% level of significance).

[b]Critical value is 17.71 (29 d.f., 95% level of significance).