ELSEVIER

Agricultural Economics 14 (1996) 11–19

AGRICULTURAL ECONOMICS

The dynamics of household beef consumption in Cameroon

N. Emmanuel Tambi

Institute of Animal and Veterinary Research, Mankon P.O. Box 125, Bamenda, Cameroon

Accepted 11 December 1995

Abstract

Recent changes in economic conditions have introduced notable changes in household beef consumption patterns in Cameroon. While consumers are concerned about the short- and long-run effects of these factors on beef consumption habits, policy makers are more worried about the appropriate period necessary for households to make complete adjustments in consumption since this information is vital for planning production. Static and dynamic demand frameworks involving the Nerlovian partial adjustment (PA) model are used to capture the dynamic nature of beef consumption parameters. Maximum likelihood estimates of the PA model reveal that the conditioning variables explain 79% of the variation in beef consumption. Income, previous consumption, own-price and prices of fish and pork are jointly important in explaining beef consumption habits. Beef is a normal good with pork and fish as substitutes and chicken as a complement. Long-run price and income elasticities are greater than but not significantly different from their short-run values, suggesting that adjustment in consumption is fast with about 80% of the difference between actual and 'desired' consumption being completed in about 2 years. Projections show that demand for beef will reach 109 620 t by the year 2000, giving an incremental total and per capita demand of 31 730 tons and 1.84 kg, respectively.

1. Introduction

The Republic of Cameroon enjoyed yearly economic growth (GDP) of 8% in real terms between 1980/81 and 1985/86, spurred-on by export earnings from petroleum and agricultural products. Real per capita income rose at 4.5% year^{-1} from 186 700 Francs CFA in 1980/81 to 233 000 Francs CFA in 1985/86. The decline in world oil prices experienced in 1986 and the precipitous reduction in world market prices of agricultural products in 1987 brought an end to growth in GDP and real per capita income. Between 1985/86 and 1990/91 real per capita income dropped at 7.4% year^{-1}, reaching 158 400 Francs CFA in 1990/91. During this period, the Cameroon government maintained a trade policy dominated by quantitative restrictions and price controls on major food items. In January 1988 a tax was imposed on meat imports, ostensibly to raise government revenues and stimulate domestic meat production. The abrupt drop in meat imports, coupled with inadequate domestic supply pushed up the price of meat and thus depressed domestic demand. For example, per capita meat consumption which had risen from 12.05 kg in 1981 to 13.8 kg in 1986 dropped to 11.6 kg in 1992.

Beef accounts for about 55% of the meat consumed in Cameroon. The purpose of this paper is to present empirical evidence on the dynamics of beef consumption in Cameroon. Static and dynamic demand equations involving the partial adjustment (PA) framework are estimated from annual time series data for the period 1976 to 1992 using the SHAZAM package (White et al., 1990). This application of a dynamic model to beef demand in Cameroon is particularly attractive because there is no empirical

SSDI 0169-5150(95)01175-7

evidence available about short- and long-run adjustments in household beef consumption patterns in Cameroon. What is lacking most is information on the length of time necessary for these adjustments and for planning within the livestock sector.

2. Model specification

Most economic analyses of household consumption behavior have applied the now standard neoclassical model. Following this framework, two demand functions, derived from a utility maximizing framework were chosen to model household demand for beef in Cameroon: the more theoretically appealing static model and a more pragmatic, but simpler dynamic model.

The double-log static demand equation for beef takes the form:

$$\log X_t^k = \alpha + \beta_1 \log Y_t^k + \beta_2 \log PB_t^k + \beta_3 \log PK_t^k + \beta_4 \log PC_t^k + \beta_5 \log PF_t^k + \mu t \qquad (1)$$

where $\log X_t^k$ is per capita consumption of beef in the kth province at time t; $\log Y_t^k$ is real per capita income (deflated by Consumer Price Index (CPI) for food less durables 1979/80 = 100); $\log PB_t^k$, $\log PK_t^k$, $\log PC_t^k$ and $\log PFk_t^k$ are deflated (1978–80 = 100) retail prices of beef, pork, chicken and fish in the kth province at time t in Cameroon francs per kg, respectively; μ_t is a random disturbance term; and α and β are parameters to be estimated. In accordance with economic theory, hypothesized signs of the coefficients in Eq. (1) are $\beta_2 < 0$ and β_1, β_3, β_4 and $\beta_5 > 0$.

The rapid growth in real per capita income experienced in the 1970s and early 1980s and its sudden drop in 1985/86, coupled with fluctuations in market prices of meat appeared to have altered beef consumption patterns in Cameroon (Atouga, 1990; Tambi and Vabi, 1991). Modeling the effects of such changes renders use of Eq. (1) inappropriate because of its inability to approximate the short-run dynamic adjustments. To model these dynamics, a double log form of the partial adjustment (PA) model originally proposed by Nerlove (1958) was used. The model assumes that the equilibrium value of the dependent variable depends only on the current value of the regressors. However, and as shown by Koyck (1954), Bessler and Brandt (1982) and Arize and Walker (1992), many economic time series tend to exhibit highly autocorrelated properties. Thus, specification of the 'desired' long-run optimal demand becomes difficult because of the implication of the disturbance term. By incorporating the lagged dependent variable as a regressor, the PA model requires that the distributed lag pattern be identical for each regressor and that there be no serial correlation between the errors and the lagged dependent regressor.

Since a priori knowledge of the appropriate lag length that ensures empirical white noise is scanty, the general form of the distributed lag model was specified as follows:

$$X_t^k = \alpha_o + \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{m} \beta_j Z_{t-j} + \epsilon_t \qquad (2)$$

where X_{t-i} are lagged regressors of the dependent variable, Z_{t-j} are regressors of other explanatory variables identified above, ϵ_t is a white noise residual, α_o and α_i are parameters to be estimated. Because of its ability to exhaust all available degrees of freedom, a restricted form of the PA model is specified as follows:

$$\log X_t^k = \delta \log \alpha + \delta\beta_1 \log Y_{t-1}^k + \delta\beta_2 \log PB_{t-1}^k + \delta\beta_3 \log PK_{t-1}^k + \delta\beta_4 \log PC_{t-1}^k + \delta\beta_5 \log PF_{t-1}^k + (1-\delta)\log X_{t-1}^k + \delta\mu_t \qquad (3)$$

where δ is a constant defined as $(0 < \delta < 1)$.

Direct application of ordinary least squares (OLS) to Eq. (3) provides estimates that are consistent, but biased because of the possible correlation of X_{t-1} with the error term. To obtain consistent and asymptotically efficient estimators of Eq. (3), it is important to determine whether it follows an autoregressive scheme. We do this by applying maximum likelihood estimation (ML) to Eq. (3) and testing the null hypothesis of no first-order serial correlation, i.e. $\rho = 0$. Failure to reject the null hypothesis implies the absence of first-order serial correlation and direct OLS estimators become consistent and asymptotically efficient. However, rejection of the null hypothesis lends confidence to ML estimators which are obtained by a search procedure which applies

Table 1
Ordinary least squares (OLS) and maximum likelihood estimates of demand for beef in Cameroon

Explanatory variables	Static demand		Dynamic demand	
	OLS estimates	t-values	ML estimates	t-values
Intercept	3.612	2.063	3.809	24.130
$\log Y_t$	0.166	2.208		
$\log PB_t$	−0.489	−2.708		
$\log PK_t$	0.691	3.340		
$\log PC_t$	−0.129	−1.439		
$\log PF_t$	0.315	2.382		
$\log Y_{t-1}$			0.596	10.129
$\log PB_{t-1}$			−1.464	−3.432
$\log PK_{t-1}$			1.025	8.176
$\log PC_{t-1}$			−0.061	−1.618
$\log PF_{t-1}$			0.855	4.434
$\log X_{t-1}$			0.213	4.434
δ			0.787	
R^2	0.740	0.794		
Durbin–Watson	1.916			
Durbin-h			0.651	
ρ			0.246	
LM			2.686	
SEE [a]			0.073	
Number of iterations			11	

[a] Standard error of estimate.

OLS to Eq. (3) for values of δ that yield minimum residual sums of squares (RSS) (Doran, 1988). The Lagrange multiplier (LM) test which is $X2$ distributed and appropriate when OLS (restricted ML) is applied on the PA model is used. Durbin h statistics, though applicable for large samples are also calculated. These diagnostics are reported at the bottom of Table 1 with values of ρ and LM. Clearly, these tests reveal that the disturbance term is not a moving average, suggesting that the PA model is not dynamically misspecified in terms of functional form, omitted variables and regressor-disturbance term independence.

3. Data

Very few demand estimates have been obtained for Cameroon, the earliest dating back to 1966. One reason is the absence of an adequate data base both in terms of quality and period covered. The official source of data on meat in Cameroon is the Statistics Division of the Ministry of Livestock, Fisheries and Animal Industries (MINEPIA) which publishes information on herd inventories and number of animals slaughtered. Herd inventories and number of animals slaughtered are reported for each of the geographical divisions of the country. Divisional data are aggregated into provincial and then national data. Reported numbers of animals slaughtered include only those officially inspected by MINEPIA officials and do not include illegal slaughters. [1] Total quantity of beef consumed was obtained by multiplying the number of cattle slaughtered in each province by a carcass yield of 150 kg (FAO, 1985). Per capita

[1] According to data provided in MINEPIA Livestock Statistics Year Book, illegal slaughters of cattle are calculated to be 16% of total beef consumed in rural areas with limited veterinary coverage and 10% of total consumption in urban and peri-urban areas where veterinary control posts are available. Illegal slaughters of sheep and goats are as high as 42% and 25% in rural and urban areas, respectively. Since unrecorded quantities of beef consumed are reasonably small, particularly in urban areas where 70% of beef is consumed in Cameroon, the data on quantities consumed are not expected to bias the estimates obtained.

consumption was then obtained by dividing total consumption by the human population of each province.

Retail beef, pork, chicken and fish prices were obtained from Annuaire Statistique du Cameroun (ASC), Direction de la Statistique et de la Comptabililite Nationale, a statistical yearbook published by the Ministry of Plan and Territorial Administration (MINPAT). Retail prices are reported in current market value for each provincial capital city. However, price indices are not available for all capital cities. To account for price changes due to inflation and regional differences, retail prices were brought to constant 1979–80 prices by deflating them by the consumer price index (CPI) for food less durables. Because of geographical proximity, price data for the Center and East Provinces were deflated by the CPI for Yaounde; data for Littoral and South-west Provinces by the CPI for Douala; and data for the North, North-west and West Provinces by the CPI for Bamenda.

ASC contains data on total and per capita income. At current market prices per capita income exhibits considerable variation (CV = 31%) from year to year. However, when measured in real terms, there is less variation despite the fact that real per capita income almost doubled over the period from 1976 to 1990. Between 1980/81 and 1985/86, real per capita income increased at 4.5% $year^{-1}$ but recorded a negative growth of 7.4% $year^{-1}$ between 1985/86 and 1991/1992. It is important to note that changes in real per capita income followed changes in market prices of beef. Measured at constant 1979/80 prices, the price index of beef rose from 0.74 in 1976 to 168.1 in 1985 but dropped to 138.8 in 1991/92. Although growth in per capita beef consumption appeared moderate, the trend in demand seemed to be dictated by income and price changes. Per capita beef consumption increased marginally from 1976 (5.71 kg) to 1980 (5.82 kg). It decreased thereafter to 5.49 kg in 1983 before picking up significantly to 6.72 kg in 1986. After 1986, there has been a constant decline in per capita beef consumption, reaching 5.79 kg in 1992. The analysis presented in this paper takes into account these changes and the model chosen for analysis attempts to capture the dynamic nature of the variables affecting beef consumption in Cameroon.

4. Results and discussions

This section presents static and dynamic demand estimates for beef in Cameroon. Results of both models are presented and discussed followed by estimates obtained for each province. Projected beef consumption from estimates of the dynamic model are also provided along with conclusions and policy implications.

4.1. Static demand for beef

OLS estimates from the static model (Eq. (1)) are presented in Table 1. The conditioning variables explain 74% of the variation in beef consumption. Income, own-price and cross-price elasticities are below unity, suggesting that demand for beef is less sensitive to income and price changes. Real per capita income has a significant ($P < 0.05$) effect on demand for beef. However, the increase in demand associated with a 1% increase in real per capita income is quite small. Thus, growth in real per capita income will influence demand for beef only to a limited extent. Except chicken, changes in prices of beef, pork and fish significantly ($P < 0.05$) influence demand for beef. Fish and pork appear as substitutes to beef whereas chicken is complementary.

As a static demand model, these estimates assume an instantaneous new equilibrium with changes in conditioning variables. Thus, a change in real per capita income and own-price of beef for example, would alter demand by 0.17 and 0.49%, respectively, to assume a new equilibrium level of consumption.

4.2. Dynamic demand for beef

In the dynamic demand equation, the conditioning variables explain 79% of the variation in beef consumption. Except the price of chicken, all other variables are statistically significant ($P < 0.01$). Beef is relatively more sensitive to changes in own-price and the price of pork than is the case with other cross-prices. Accordingly, beef it classified as a relative luxury (> 0). Own-price elasticity for beef is greater than values reported by Rogers and Lowdermilk (1991) for beef in Mali and Ingco (1990) for Korea.

Beef is classified as a normal good with an income elasticity value inferior to that reported by Atouga (1990) for urban areas of Cameroon and Adegeye (1988) for Nigeria. However, it is close to values reported by Holtzman (1988) and Tambi and Vabi (1991) for urban and rural areas of Cameroon, and Savadogo and Brandt (1988) for Burkina Faso (Table 2).

Except pork, all cross-price elasticities are below unity in absolute value. The low value between beef and chicken (0.061) indicates that purchases of beef are relatively independent of chicken. This is consistent with the fact that chicken plays an important role in meat consumption patterns in Cameroon. In most rural areas, chickens serve important social functions. They are offered for consumption as gifts to friends and relatives and are consumed following sacrifices made during death celebrations.

Lagged beef consumption is of the hypothesized positive sign and is statistically significant ($P < 0.01$). This supports the null hypothesis about the adequacy of the static model. The estimated value of δ, obtained as one minus the coefficient of X_{t-1} is 0.79. δ is not significantly different from unity, suggesting that about four fifths of the discrepancy between the actual and 'desired' consumption balance is eliminated in 1 year. The fact that δ is not significantly different from unity lends credibility to the estimates of the static model which assumes that $\delta = 1$. The time period necessary to achieve a 95% adjustment in beef consumption in Cameroon is approximately 2 years (Table 3). Thus, as changes occur in price, income and other economic variables, households will require 2 years to achieve the 'desired' long-run equilibrium level of beef consumption.

Long-run price and income elasticities calculated from the coefficient of the lagged dependent variable are reported in Table 3. Although generally larger than short-run elasticities, the long-run price elasticity is below the value reported by Rodriguez (1985) in Zimbabwe from an Almon lag model but above that obtained from a geometric lag model. The bias of δ towards unity reveals two things. First, long-run price and income elasticities are higher than but closer to their short-run values; implying an immediate and speedy response of beef demand to changing price and income. Second, higher long-run elasticities are indicative of greater adjustment in beef consumption habits due to the presence of beef

Table 2
Comparison of price and income elasticities of demand for meat by various authors

Author	Country	Product	Model type	Elasticities	
				Price	Income
Present study	Cameroon	Beef	Static	−0.489	0.166
			Partial adjustment	−1.464	0.596
Tambi and Vabi (1991)	Cameroon	Beef	Log–log		0.235
Atouga (1990)	Cameroon	Meat	3SLS [a]	−1.83	1.43
Holtzman (1988)	Cameroon				
	Urban	Beef	Linear		0.60
	Rural	Beef	Linear		0.20
Adegeye (1988)	Nigeria	Beef	Linear	−2.367	1.370
			Log-linear	−2.675	1.357
Savadogo and Brandt (1988)	Burkina Faso	Meat	AIDS [b]		0.79 [c]
					0.81 [d]
					0.81 [e]
Ingco (1990)	Korea	Beef	AIDS	0.0072	

[a] Three-stage least squares.
[b] Almost ideal demand system.
[c] Low income group.
[d] Medium income group.
[e] High income group.

Table 3
Estimated short- and long-run price and income elasticities and period of adjustment in demand for beef in Cameroon

Country and provinces	Own-price elasticity		Income elasticity		Coefficient of adjustment (δ)	Period of adjustment (years) [c]
	Short-run	Long-run [a]	Short-run	Long-run [b]		
Cameroon	−1.464	−1.860	0.596	0.756	0.787	1.94
Center	−0.774	−0.827	0.115	0.123	0.963	1.09
East	−2.674	−3.135	0.737	0.864	0.853	1.56
Littoral	−0.621	−0.703	0.384	0.435	0.883	1.39
North	−0.904	−1.162	0.404	0.519	0.775	1.98
North-west	−0.866	−1.312	0.356	0.539	0.660	2.78
South-west	−0.013	−0.014	0.101	0.110	0.915	1.22
West	−0.714	−1.562	−0.132	−0.289	0.457	3.81

[a] Obtained as $\beta_1/1-\delta$.
[b] Obtained as $\beta_2/1-\delta$.
[c] Based on a 95% period of adjustment and calculated using the following formula: $N = \log(1-A)/\log(1-\delta)$, where N is the number of years required to obtain a specific adjustment, A is percent of total adjustment toward long-run equilibrium, and δ is coefficient of adjustment.

substitutes in Cameroon. 'Bush' meat is one of such substitutes for which data unfortunately are absent. According to Ngwa (1986), inhabitants of forest regions of Cameroon hunt and consume large quantities of 'bush' meat. Survey data by Tambi (1993) report monthly urban household consumption of 'bush' meat of 2.2 kg in forest areas of Bertoua in the East Province compared with 0.18 in Douala in the Littoral Province and 0.38 kg in Yaounde in the Center Province.

5. Beef consumption by province

Eq. (3) was also estimated for each province. The diagnostic tests reported at the bottom of Table 4 reveal the absence of first-order serial correlation in the provincial data. The explanatory power of the equation is good, and varies from 52% in the East Province to 88% in the North Province. Excluding the intercept, 15 of the 41 coefficients are statistically significant at $P < 0.05$ and 14 at $P < 0.01$. Real per capita income has a significant effect on beef consumption in all except the East and West Provinces. In all provinces, income elasticities are below unity. However, beef remains a normal good in all except the West Province where it is an inferior good. The direct price-induced income effect, coupled with the hypothesized negative own-price elasticity suggests that consumers in the West Province are motivated to decrease consumption of beef in response to increased real per capita income. This behavior appears to be in line with the rightward shifts in consumption of pork and fish. Historically, the West Province is the major consumer of pork, taking up 24.8% of total national consumption. Recent estimates by Tambi (1993) show monthly consumption of pork and fish in the West Province to be 0.72 and 1.70 kg per head compared with a national average of 0.35 and 1.36 kg, respectively. From these results, attempts to increase real per capita income in Cameroon will have only a small positive effect on beef consumption in the provinces.

Changes in own-price of beef have no significant ($P > 0.05$) effect on demand in the Littoral and South-west Provinces. The reduction in demand for beef in these provinces is quite small. In the East Province on the contrary, demand is quite sensitive to own-price changes. Cross-price elasticities lead us to classify fish as a close substitute to beef in all provinces. Pork substitutes beef in the Center, East, Littoral, North-west and West Provinces while chicken substitutes beef in the Center, Littoral, North-west and South-west Provinces but complements it in the East, North and West Provinces (Table 4).

Current consumption of beef is significantly ($P < 0.05$) influenced by previous consumption in all except the Center and South-west Provinces. All coefficients of adjustments are less than unity and

Table 4
Maximum likelihood estimates of beef demand in the provinces of Cameroon

Explanatory variable	Province						
	Center	East	Littoral	North	North-west	South-west	West
Intercept	3.872	−2.539	3.505	4.908	1.475	1.219	−3.499
	(3.300)	(−6.738)	(7.960)	(15.030)	(7.090)	(5.830)	(−4.847)
$\log Y_{t-1}$	0.115	0.738	0.384	0.404	0.356	0.101	−0.132
	(1.890)	(1.209)	(2.485)	(4.457)	(5.653)	(1.831)	(-1.280)
$\log PB_{t-1}$	−0.774	−2.763	−0.621	−0.904	−0.866	0.013	−0.714
	(−2.156)	(−2.044)	(−1.535)	(−2.623)	(-4.735)	(0.063)	(−4.434)
$\log PK_{t-1}$	0.415	1.394	0.657	na	0.512	−0.472	1.112
	(2.527)	(2.677)	(5.162)		(3.203)	(−1.701)	(6.640)
$\log PC_{t-1}$	0.766	−0.945	0.434	−0.187	0.088	0.990	−1.024
	(4.503)	(−1.963)	(2.002)	(−1.745)	(1.578)	(6.787)	(-1.096)
$\log PF_{t-1}$	0.034	0.611	0.411	0.102	0.686	0.244	0.361
	(0.218)	(1.586)	(2.601)	(4.457)	(3.969)	(5.550)	(1.942)
$\log X_{t-1}$	0.064	0.147	0.117	0.222	0.340	0.085	0.543
	(1.549)	(2.737)	(2.086)	(3.276)	(4.873)	(1.664)	(1.944)
R^2	0.828	0.518	0.816	0.878	0.783	0.795	0.855
ρ	−0.115	0.113	0.235	0.106	0.218	−0.020	−0.156
Durbin-h	0.052	0.063	0.108	0.047	0.047	0.006	0.080
LM	3.168	0.426	3.107	3.905	6.072	0.003	2.933
SEE	0.055	0.173	0.095	0.061	0.058	0.054	0.087
No. of iterations	9	8	14	11	8	19	7

Figures in parenthesis are t-statistics.
na, not available (predominantly muslim area with limited consumption of pork).
Values in parentheses are t statistics.

vary from 0.46 in the West Province to 0.94 in the Center Province. δ is not significantly different from unity in the Center, East, Littoral and South-west Provinces. This is indicative of a faster rate of adjustment in beef consumption which is accomplished in less than 2 years. In the rest of the provinces where δ is significantly different from unity, the time period necessary for a 95% adjustment in consumption varies from 2 years in the North Province to 3.8 years in the West Province (Table 3). Adjustment in consumption is slow in the West and North-west Provinces but speedy in the rest of the provinces.

All long-run price and income elasticities are greater than their short-run values but remain below unity in all except the East, North, North-west and West Provinces. Long-run price-consumption adjustment is quite high in the East (3.14%) Province. The high speed of adjustment coupled with the relatively high price and income elasticities is revealing of the presence of beef substitutes in that province. Close substitutes to beef in the east province are pork, fish and 'bush' meat. Census data (MINAGRI, 1986) classify the east province as least producer of beef cattle with less than 1% of national production and the third major producer of pigs with 14.4% of national production.

6. Consumption projections

Household demand for beef in Cameroon is projected for the year 2000 using base year 1990 consumption figures. Growth in population and per capita income, and income elasticities are used to make projections following the method described by Holtzman (1988) as follows: $Dbc = Pop + (E_i \times Y_i)$, where Dbc, Pop and Y_i are percent changes in beef consumption, population and real per capita income, respectively, and E_i is income elasticity of demand for beef. Population and real per capita income are assumed to grow at rates of 3.57. and 2.0%, respectively (MINPAT, 1986).

Given a long-run income elasticity of demand of

Table 5
Projected demand for beef in Cameroon (2000)

Country and provinces	Income elasticity of demand [a]	Base year (1990) demand	Rate of population growth (%)	Projected demand [b]		Incremental demands	
				Total (t)	Per capita (kg)	Total (t)	Per capita (kg)
Cameroon	0.757	76890	3.5	108620	6.30	31730	1.84
Center	0.123	17006	4.5	26410	6.47	9404	2.30
East	0.864	2238	2.5	2869	4.23	631	0.93
Littoral	0.396	16373	6.5	30740	10.43	14367	4.88
North	0.478	21089	2.3	26500	6.94	5411	1.42
North-west	0.539	7496	2.4	9512	5.56	2016	1.18
South-west	0.196	6301	3.1	8548	6.69	2247	1.76
West	−0.216	6367	3.7	8336	4.12	1949	0.96

[a] Long-run income elasticity of demand is obtained from the dynamic demand model. Values show how much beef consumption will increase over the long-run when income rises.
[b] Assumes a 2% annual growth rate of income.

0.80 and assuming constant relative prices, projected demand for beef in Cameroon will reach 108 620 t (6.30 kg per head) by the year 2000. This represents an additional 31 730 t of beef over the base period 1990. If this incremental demand were to be satisfied, per capita demand for beef in Cameroon would rise by 1.94 kg per head (Table 5).

With differential population growth rates and income elasticities, demand for beef is projected for each province. In the Littoral and Center Provinces with high population growth rates, demand for beef is projected at 30 740 (10.43 kg per head) and 26 410 t (6.4 kg per head), respectively. Total incremental demand is estimated at 14 367 and 9404 t, giving a per capita incremental demand of 4.88 and 2.30 kg, respectively. In the East and West Provinces with low population growth rates, incremental per capita demand by the year 2000 is quite small (Table 5).

7. Conclusion and implications

Static and dynamic demand analyses of beef reveal that income, own-price, prices of fish and pork, and previous consumption are important determinants of household beef consumption patterns in Cameroon. The increase in demand attributable to changes in real per capita income is quite small. Thus, a policy designed to raise household incomes would increase demand for beef but to a limited extent. Projected demand for beef using historical growth rates of population and real per capita income reveal that per capita demand will increase by 1.84 kg by the year 2000. Given the decline in real per capita income experienced since 1986/87, coupled with the January 1994 devaluation of the Franc CFA and the recent salary cuts, it is unlikely that this demand will be fulfilled. Thus, attempts to adjust wages upwards would be necessary to permit households achieve the 'desired' optimal level.

Pork and fish are close substitutes to beef whereas chicken is a complement. This finding is in line with recent improvements in the marketing and distribution of fresh fish which have resulted in a reduction in the price of fresh fish. Also, technological improvements from research conducted at the Institute of Animal and Veterinary Research have led to increased weight gains in pigs, increased dissemination of cross-bred pigs to small-holders and the control of the African swine fever epidemic. These developments have resulted in lower production costs and price of pork. Although technological developments increased productivity gains in the poultry industry, rising production costs due to shortages of major ingredients (maize, imported minerals, premix) led to higher prices and a depressed demand for poultry meat. If these developments continue unchecked, a continued shift towards pork and fish will be observed at the expense of beef and poultry meat.

The analysis presented in this paper elicits beef as a normal good with substantial substitution possibilities between beef, pork and fish. This indicates that income and relative prices may serve as effective

policy instruments in the management of demand for beef for the nutritional welfare of Cameroonians.

An important measure towards this direction would be to abolish the present beef price-control system and move towards a liberal beef-pricing system.

Current consumption is significantly influenced by previous consumption. Adjustment in beef consumption habits is fast with about 80% of the difference between actual and 'desired' consumption being completed in about 2 years. The overall implication of this is that a policy designed to raise the price of beef, ostensibly to protect producers, would immediately encourage households to shift from beef to the consumption of fish and pork. Thus, only complementary policy measures that take into account objectives of producers and consumers would be beneficial. In the absence of policies leading to the production of high quality beef at affordable prices to households, lags in habit formation would continue to give the wrong signals to producers.

This article projects an increase in total and per capita demand for beef in Cameroon by the year 2000. If this demand level is to be met, Cameroon's livestock development objective to increase national production of beef must be addressed more seriously. Two areas of concern are improved productivity of local herds and increased off-take within the traditional sector. Intensification through improved grazing methods, eradication of tse-tse flies and use of improved management techniques are of prime necessity.

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