

URBAN CONSUMPTION OF BEEF

IN THE IVORY COAST

by

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## ABSTRACT

This paper examines several factors influencing beef consumption in Abidjan. The Ivorian capital constitutes one of the principal markets for livestock from the West African Sahelian countries, notably Mali and Burkina Faso (Upper Volta). Since 1975, moreover, Ivory Coast has supplemented beef supplies with imports of frozen beef from South America, Argentina in particular. The paper analyses consumer preferences for meats in order to assess the effects of frozen beef imports on the market for Sahelian cattle. A more detailed discussion of these preferences are found in the author's 1983 doctoral dissertation (School of Business Administration, The University of Michigan).

## RESUME

Ce rapport examine plusieurs facteurs qui agissent sur la consommation de viande à Abidjan. La capitale ivoirienne constitue l'un des marchés principaux où se vendent des animaux en provenance des pays sahéliens en Afrique occidentale; en particulier, du Mali et de Burkina Faso. En outre, la Côte d'Ivoire complète ses approvisionnements depuis 1975 en important de la viande congelée de l'Amérique du sud, surtout de l'Argentine. Le rapport analyse les préférences des consommateurs pour déterminer les effets des importations sur la commercialisation de bovins venant des pays sahéliens. La thèse doctorale qui fut soutenue par l'auteur en 1983 (School of Business Administration, University of Michigan) offre un traitement approfondi de ces préférences.



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## 1. INTRODUCTION\*

Located in tropical areas where tsetse flies make cattle raising extremely difficult, the Ivory Coast has to a great extent depended on its Sahelian northern neighbors for its beef supply. As a result of the drought which destroyed a large part of the Sahelian livestock, limiting the availability of fresh beef in the market in the 1970s, the Ivorians had to find other supplementary sources of animal protein. Import of frozen beef from Argentina, and increased domestic livestock and fish production were the alternatives considered. The Argentinian frozen beef made an easy penetration into the Ivorian market, achieving a market share exceeding 25 percent in the second year and keeping the annual availability per capita of beef at 6.35 kg, just slightly below the predrought level.<sup>1</sup>

Much consideration has been given to the increase of domestic livestock production. In fact, this could reduce the dependence of the country on foreign meat supplies, subsequently bringing about foreign exchange savings. The Ivory Coast government has already initiated important cattle development programs in the northern regions which offer the most favorable climate. Meanwhile, the Sahel cattle suppliers have been rebuilding their herds, hoping to recapture their market that was lost during the drought.

One may then wonder if the Ivorian beef market would grow enough to absorb the potential supply offered by the domestic producers, by the northern neighboring countries and the Argentinians.

The purpose of this research was to provide some light toward the response to that question, attempting to achieve the following objectives:

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\*Funding for the consumer survey was contributed in part by the Center for Research on Economic Development, under the Livestock and Meat Marketing in West Africa project, sponsored by the Agency for International Development, Regional Economic Development Services Office for West Africa (Contract No. REDSO/WA-77-105). Cooperation from the Centre Ivoirien des Recherches Economiques et Sociales (CIRES) at the University of Abidjan, and the School of Business Administration at The University of Michigan were also essential in carrying out this study.

<sup>1</sup>Christopher Delgado and John Staatz, Livestock and Meat Marketing in West Africa, Volume III: Ivory Coast and Mali (Ann Arbor: CRED, The University of Michigan, 1980), p. 50.

- (1) identify the principal factors that influence consumption levels of beef among urban residents of the Ivory Coast;
- (2) evaluate the marginal influence of those factors in determining the consumption levels;
- (3) estimate the income and price elasticities of the demand for beef.

## 2. RESEARCH DESIGN

### 2.1. MODEL

The following variables were thought to affect consumption levels of beef among Ivory Coast urban dwellers. In agreement with standard economic theory, it was hypothesized that the beef consumption level of the household is negatively related to its price and positively related to the price of competing meats and fish, and to the family income. It was also hypothesized that the beef consumption levels are positively related to the family size and the food purchaser's education and length of urban residency. The relevance of family size stems from the assumption that the Ivorian households set a minimum requirement of beef consumption per person. The role of education is the information processing power it confers on the decision maker.<sup>2</sup> Literate consumers can learn about the nutritional value of food items and subsequently purchase substitutes more easily than those who are not literate. Urban residency length was thought useful in this study under the assumption that consumers who have been living a long time in urban areas have limited access to meats from game animals, and will have developed a relatively strong preference for beef. Acceptance of this hypothesis means that there is a lag in adjusting meat preferences among consumers who recently moved from the rural areas. Ethnic and religious affiliations were thought to affect consumption levels of the household. It was hypothesized that consumers from the northern part of the country, and the Moslems, consume more beef than others.

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<sup>2</sup>Bernard Kouassi, "Determinants of New Food Product Adoption Decision in A Developing Nation " (Ph.D. dissertation, The University of Michigan, 1983), Chapter IV.

Although there may be seasonal variations in the consumption levels, they are disregarded in this study because the effect of seasonal variation would be reflected in the price according to the law of scarcity. Occupation was not considered in this study because it is known to be highly correlated with income. Its contribution to the knowledge of the Ivorian meat market was considered too small for the cost of collecting and analyzing of related data.

In summary, the general form of the beef consumption model to be estimated can be written as follows:

$$Q_b = B_0 + \sum_i B_i X_i$$

where,

$Q_b$	=	the weekly consumption of beef per household member
$B_0$	=	intercept
$B_i$	=	the coefficient of the i-th variable
$X_i$	=	the value of the i-th variable

## 2.2. DATA COLLECTION

Information used in this study originated from the following sources: (1) surveys of family consumption and budget conducted by the Ivory Coast Ministry of Economics, Finance and Planning between January 1978 and September 1979; (2) the Family Meat Consumption Survey; and (3) a beef price survey conducted simultaneously by the author from June 1979 to June 1980.

The government survey provided the data regarding the income, size and composition of families. Data regarding the income, size and composition of the family were extracted from the government study on the city of Abidjan.

The government study was aimed at determining household budget and consumption. The sampling method used consisted of selecting clusters of households around randomly selected points in the city. The city was divided into seven sections with housing types classified into five categories.

The "dwelling" was used as the household sample unit. Each cluster point consisted of 25 dwelling units. On this basis, two surveys were conducted. In the first, demographic data such as family size, composition and income were collected for approximately 2400 households. In the second survey, which was conducted on a smaller scale, data on food consumption and expenditures and allocation of remaining income among nonfood items were obtained for approximately 540 household units.

The meat consumption survey, based on a subset of households participating in the government study, provided additional information regarding the beef consumption levels and the demographic background.

The sample of the meat consumption survey was randomly selected from the worksheets of interviewers in the second government survey. In fact, each interviewer of the budget-consumption study was assigned 12 households per quarter. Once found, the unit location was reported on a worksheet. From the personnel of the Statistical Division, 22 worksheets were collected, yielding a sample of 264 dwelling units out of 360 contacted between April 1979 and September 1979. Due to the mobility factor, the lack of precise addresses in some areas and the time and cost constraint, only 210 dwelling units were located and 162 households contacted. The questionnaire was administered in the following way: a trained enumerator visited the family eight to twelve times after obtaining permission from the head of household and scheduling an interview with the food purchase decision maker. Information regarding the demographic data and meat preference of the family was thereafter collected in two to three visits.

Generally, the consumption levels were obtained during the morning while the demographic and preference data were collected in the afternoon or evening.

The interviewers were instructed to keep the visits short, lasting less than 20 minutes in the morning and 30 minutes in the afternoon, and to stop interviewing between 11:00 a.m. and 3:00 p.m. This would give the household enough time to prepare their lunch and taken their afternoon nap (siesta). The principal investigator (the present author) met daily with the interviewers to discuss the work (including review of data obtained the previous day and in the morning session, and difficulties encountered). Proper course of action was then taken.

Each interviewer worked continuously for 18 to 21 days. At the end of that period, he was allowed 3 or 4 days vacation, depending on his performance. On the average, he visited 5 or 6 families a day.

In order to ensure the reliability of the data and to encourage the respondents, the coordinator of the survey, who was also the principal investigator of the project, made personal visits to most of the households surveyed. Furthermore, the enumerators had to carry pictured identification cards with the seal of the National University of the Ivory Coast. To further encourage willing participation in the survey, respondents were occasionally offered small gifts such as glasses, cups, pens and pencils.

The consistency and reliability of data were checked in two ways: by comparing figures obtained from the Department of Statistics (Ivory Coast Government) with this study's data (e.g., family size) and by comparing related pieces of information within this survey (e.g., length of residency versus age, and readership level versus education).<sup>3</sup>

Contradictory responses were corrected, based on all statements made by the respondents and on the government consumption survey data if possible. On a few occasions, respondents were reinterviewed to achieve more clarity. In general, however, the responses obtained were consistent and found to be reliable.

The achieved reliability and consistency of the data can most likely be attributed to the cooperation of the respondents. This cooperation stemmed partly from the survey's official backing by the Ivory Coast Government and partly from the survey method itself. Interviewers were instructed to approach respondents for a brief period at a convenient time -- ordinarily no more than fifteen to twenty minutes. Moreover, the study questionnaire was administered in a period long enough to allow the interviewer to become acquainted with the respondent through many visits. In all, of the 210 households asked to participate in the consumption study, only 12 refused to participate. Data from 26 households, however, were rejected because their interviewer was found unreliable. In summary, consumption levels of 172 households and demographic data from 144 households were considered for statistical analyses.

As far as the price survey is concerned, once or twice a week, the investigator and a woman who was familiar with food purchases purchased meat and fish. Each purchase was weighed as bought. Thereafter, the edible parts were recorded. Due to logistics problems, the price was not regularly compiled during the first three months of the survey.

### 3. PROFILE OF THE IVORY COAST CONSUMER

The focus of this chapter is to describe the sample data including the consumers' demographic background and their sources of awareness.

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<sup>3</sup>Readership levels are measured by the number of papers and magazines read daily.

Food purchase decision makers are predominantly primary women of the household. Primary women, defined as the leaders of women, the female heads of the household, or the wives of the heads of the household, represent 87.4 percent of all food purchase decision makers. Primary men of the household make food purchase decisions only 5.6 percent of the time. Seven percent of purchases are decided by relatives or domestics in charge of cooking. The demographic background of the Ivory Coast consumer is exhibited in Table 3.1.

### 3.1. RELIGION

Fifty-five percent of the respondents were Christian, 28.5 percent Moslem, and 16 percent of other religious affiliations. Generally, Ivory Coast Christians are concentrated in urban areas. People of traditional African faiths, so-called Animists, are found predominantly in rural areas of savannah and forest zones. Moslems typically reside in urban areas and northern rural regions.

Ivorians of traditional faiths have taboos that vary among families and across regions. Christians have mixed beliefs; though their faith may reflect contemporary trends, Christians have a tendency to respect and keep their parents' taboos, regardless of how obsolete and unrelated to modern Christian faith they may be. As pork is a taboo for the Moslem, goat meat is taboo for some Christians. There may be many explanations for these Christian attitudes, including simply that they never developed a taste for goat meat. In this case, habits determine product choice. Such exclusive attitudes may change when normal substitutes are lacking in the market, such as during the Sahel droughts in the 1970's when the Sahelian beef was often unavailable in the market. Another reason may be that although some people claim to be Christian, they still have superstitions regarding their ancestors' taboos. Traditionally, consumers in this category would not violate their parents' beliefs.

Similar incongruities exist within the Ivory Coast Moslem communities. However, it must be considered that Islam developed its traditional roots from the traditional African religions and, therefore, it might be expected that these Moslem beliefs are firmly held. Moslems have had a tendency to maintain the traditional values of the areas where the religion has been established.

### 3.2. ETHNICITY

Respondents are divided into five categories representing the major ethnic group origins of the Ivorians: Akan, Krou, Voltaic, Malinke, and Mixed



(Pluriethny). These ethnic groups form cultural entities which share common beliefs, typically concerned with the types of food eaten and how it is obtained, prepared, and eaten. As shown in Table 3.1., over 53 percent of respondents are from the Akan group. Eighteen percent form the Krou group, 12.6 percent make up the Malinke group, approximately 5 percent are in the Volta-Senoufo group, and 11 percent comprise other ethnic groups. A recent publication of the Ivory Coast government's Office of Statistics revealed data similar to ours.

For the Akans -- originating in the East, Southeast, and Central areas of the country -- fish and meat from wild animals used to be the main protein sources of their diet. Since forests are rapidly being converted into farmlands, meat from wild animals is now scarce and considered a gourmet item. Beef has become its substitute. In addition to beef and fish, lamb, pork, poultry, and eggs, once only consumed occasionally, have now entered into the Akan's daily market basket in the urban areas.

Although the Krous -- originating in the South and Southwest areas -- differ from the Akans in many cultural aspects, both groups have a preference for the same products in their protein source basket. A major reason for this similarity is geographical. Both groups originated in areas bordered by the Atlantic Ocean which contain many rivers with a plentiful fish supply. Much forestland complete with wild game was available to them. Climate also played a dominant role in shaping their meat consumption patterns, since the humid conditions which exist in these areas make cattle farming almost impossible.

The Voltaics and Malinke -- originating in the Northern sector of the country where the climate is dry, making fish widely unavailable -- include meat from both farm and wild animals as the most common source of protein intake. Meat is supplemented largely by grains such as the soybean, peanut, and cashew nut.

### 3.3. READERSHIP

Table 3.1. indicates that 68.5 percent of the buyers do not read newspapers (or magazines), 2.8 percent read only one newspaper, and 28.7 percent read more than two newspapers. These percentages imply that a well-designed advertisement in the local newspapers will reach at most 31 percent of the households. Because television advertising is uncommon, billboards and movies remain the major advertising media for focusing on the visual appeal and

TABLE 3.1

## CHARACTERISTICS OF THE IVORY COAST CONSUMERS

Characteristics	Number of Respondents	Percentage
<b>DECISION MAKER</b>		
Primary Women	125	87.4
Primary Men	8	5.6
Others	10	7.0
Total	143	100.0
<b>RELIGION</b>		
Moslems	41	28.5
Christians	80	55.5
Others	23	16.0
Total	144	100.0
<b>ETHNICITY</b>		
Akan	76	53.1
Krou	26	18.2
Malinke	18	12.6
Volta-Senoufo	7	4.9
Others	16	11.2
Total	143	100.0
<b>NUMBER OF NEWSPAPERS OR MAGAZINES READ</b>		
None	98	68.5
One	4	2.8
Two or more	41	28.7
Total	143	100.0
<b>EMPLOYMENT STATUS</b>		
No outside employment	103	71.5
Outside employment	41	28.5
Total	144	100.0
<b>NUMBER OF MALE WAGE EARNERS</b>		
0	7	4.9
1	86	60.6
2	28	19.7
3 or above	21	14.8
Total	142	100.0

TABLE 3.1 (con't.)

## CHARACTERISTICS OF THE IVORY COAST CONSUMERS

Characteristics	Number of Respondents	Percentage
<b>NUMBER OF FEMALE WAGE EARNERS</b>		
0	86	60.6
1	43	30.3
2	7	4.9
3 or above	6	4.2
Total	142	100.0
<b>DURATION OF URBAN RESIDENCE</b>		
0- 4 years	25	19.0
5- 9 years	50	37.9
10-14 years	23	17.4
15-19 years	16	12.1
20 years or more	18	13.6
Total	132	100.0
<b>AGE</b>		
13-19	21	14.9
20-29	65	46.1
30-39	38	27.0
40 or above	17	12.0
Total	141	100.0
<b>EDUCATION COMPLETED</b>		
None	83	57.6
1st-5th grade	15	10.4
6th grade	21	14.6
7th grade	25	17.4
Total	144	100.0
<b>MONTHLY HOUSEHOLD INCOME IN 1000 CFA</b>		
1- 49	26	18.7
50- 99	46	33.1
100-149	34	24.5
150-199	18	12.9
200 or above	15	10.8
Total	139	100.0
<b>MONTHLY HOUSEHOLD INCOME PER CAPITA IN 1000 CFA</b>		
1- 9	54	39.4
10-19	47	34.3
20-29	20	14.6
30 or above	16	11.7
Total	137	100.0

attractiveness of the product advertised. In such a society, word-of-mouth and radio broadcasting must also be included in promotional program design.

#### 3.4. EMPLOYMENT STATUS

Table 3.1. shows that 71.5 percent of the respondents did not have outside employment. Food choices are considered to be part of the daily activities of housekeepers, implying a well-developed skill in the practice of selecting meats. There were no women working outside the home in 60.6 percent of households, while in 30.3 percent, only one woman worked outside the home. With regard to male employment outside the home, only 4.9 percent of households indicated that no man worked outside the home, with 60.6 and 19.7 percent of the households having one and two men working outside the home, respectively.

#### 3.5. DURATION OF URBAN RESIDENCE

As reported in Table 3.1., in less than one-fifth of the households surveyed, the decision maker resided less than five years in the city of Abidjan. Nearly two-fifths of the persons sampled have lived in Abidjan for ten years or longer. The average length of stay is eight years. These figures reflect that those people who decide on the type of meat to buy generally know their way about the city and, therefore, would likely know where the bargains or best buys are to be found. One cultural element which favors such a situation is the cultural extensiveness of the family which helps make it easy for nuclear families to share living quarters. In addition to this, the unavailability of accommodations in the city forces newcomers to live temporarily with residents who have been in the city for many years. Clearly, these hosts would be the decision makers.

#### 3.6. AGE

Respondents ranged from 13 to 60 years of age, with an average age of nearly 29 years (see Table 3.1.). Fully three-quarters of the sample were less than 35 years old. Although these figures are consistent with published demographic data, one must be careful in interpreting them. This is not to imply that the ultimate consumers of food products are the young, but the purchase decision makers are young. It is important to note, however, that urbanization itself is a very recent phenomenon in the Ivory Coast; thus it is not surprising to find a young urban population.

### 3.7. EDUCATION

Table 3.1. shows that 57.6 percent of food decision makers have never attended school. Of the remaining population, 68.0 percent have less than a sixth grade education level and 82.6 percent have less than the seventh grade level. These relatively low levels of education of the food purchase decision makers could imply difficulty in communication between them and the sellers. However, given the multitude of local languages (which approximates sixty), the urban consumers seek a way to communicate with nonmembers of their own ethnic group (i.e., tribe). As a result, *linguae francae* have been developed. Among these, an Ivorian French has been in common usage in urban areas, especially in the city of Abidjan. In addition to these *linguae francae*, the educational system inherited from the French colonials makes it possible for a person with a third-grade education to read and write elementary French. In other words, without much difficulty, a third-grade educated person could read newspapers and perform minor clerical work. Consequently, those people with near completion of elementary school very often seek employment outside the household, leaving the grocery purchases, a daily activity, to those with no formal educational attainment.

### 3.8. INCOME

Monthly earnings of the households surveyed vary between 10,000 and 680,000 CFA, with a mean of 112,490 CFA and a standard deviation of 87,303 CFA (see Table 3.2.). In terms of dollars, the average household earns approximately \$US 511 per month.<sup>4</sup> Table 3.1. reveals that 48 percent of households earn at least 100,000 CFA, i.e., nearly \$US 450 per month. Households earning more than 200,000 CFA (about \$US 910) account for 10.8 percent of the sample.

At first glance, these figures may indicate that the Ivory Coast urban residents have ample purchasing power. Such an inference may be erroneous for several reasons. Firstly, the income data available represent the earnings for the entire household which may be an extended family. In fact, the average number of persons living in the same household varies between one and 25, with an average of eight. Secondly, the average number of wage earners per household is two. Taking this information into consideration, household

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<sup>4</sup>During the survey the average exchange rate of the CFA Franc was 220 CFA per American dollar.

TABLE 3.2.  
DESCRIPTIVE MEASURES OF CONSUMER PROFILE

Variable	N	Minimum	Maximum	Mean	STD Dev.
Stay (years)	133	1.0000	54.000	11.030	8.6803
Age (years)	141	13.000	60.000	28.660	9.1697
Rent (1000 CFA)	117	2.0000	92.000	13.097	11.726
Total Income (1000 CFA)	140	10.000	680.00	112.49	87.303
Number of Persons	142	1.0000	25.000	8.5563	4.3508
Income per Capita (1000 CFA)	137	1.6667	165.00	17.036	19.943
Workers	142	0.	6.0000	2.0493	1.2955
Income per Worker (1000 CFA)	140	5.0000	185.00	60.214	38.786
Education (years)	144	0.	13.000	2.8958	3.8480

earnings per capita and income per wage earner were computed with regard to number of wage earners per household. The income per capita per household is distributed as shown in Table 3.1. It appears that 39.4 percent of the residents have less than 10,000 CFA (\$US 45) per month. Households with less than 30,000 CFA (\$US 135) per capita represent 88.3 percent of the sample. When considering the number of wage earners, it is estimated that the average income per employee is about 60,214 CFA (\$US 274).

### 3.9. SOURCES OF PRODUCT AWARENESS

Of the 157 people interviewed on the newly introduced Argentinian frozen beef, 151 respondents asserted that they were aware of it. Those who learned about it through the mass media represented only two percent. Display and salespersons, however, accounted for 62.3 percent of the awareness sources, with friends, relatives and other consumers as the communicators in 30.5 percent of the cases. Only 4.6 percent of the respondents were unable to recall how they first learned about the product.

One reason for this imbalance in sources of product awareness is that noncanned food products are predominantly sold in the open-air market which is organized by product categories. That is, there is a place reserved for butchers, a place for fresh and frozen fish, a place for smoked fish, and so on. As competition among salespersons is high, it is not uncommon to hear a salesperson loudly inviting potential buyers. With the "posted" price of Argentinian beef being lower than that of the local product, it would not be surprising to find Argentinian beef salespersons calling out the "price advantage" of their products. Another factor which contributes to the high incidence of awareness at the salesplace is the frequency of grocery shopping of the Ivory Coast consumers. From the study of meat consumption, it was learned that most of the households do their grocery shopping on a daily basis.

Obviously, a product destined for sale in the open-air market need not utilize mass media advertising to heighten product awareness. An appropriate objective for advertising such a product may be to lure the consumer toward the trial, the adoption, and frequent usage stages. Display, salespersons, and consumers' word-of-mouth (CWOM) will diffuse the product across the nation.

## 4. ANALYSIS

This section is concerned with determining models that would explain and predict the consumption of beef per household member. Two measures of consumption can be considered. The first refers to the weight in kilograms consumed per week. The second considers the Franc CFA amount spent on beef for each household member. The weight measures provide information that can be most useful in diet studies. The expenditures however, show the shares of beef in the family budget. In this study only the weight measure will be analysed. The least squares regression technique is used in the multivariate analysis. Linear and logarithmic models are considered. To detect severe multicollinearity and avoid overspecification of the models, correlation matrices are first computed.

### 4.1. CORRELATIONAL ANALYSIS

The correlational analysis gives the following results:

#### 4.1.1. Prices

a. There is no severe collinearity between prices of different products. It is important to note however that the price of the edible part of fresh beef sold with bone is positively correlated to the prices of the edible part of whole fresh fish. It is also negatively correlated to the price of fresh fish sold without the head and to the price of frozen beef sold with bone, for significance level  $\alpha = 0.01$ . The positive covariation of prices of beef and fish suggest that these may be substitutable. It also could be due to the effect of supply seasonality.

b. Only the price of the edible part of fresh beef sold with bone and the price of frozen beef sold with bone are correlated to the per capita beef consumption. The per capita consumption varies negatively with the former price for  $\alpha = 0.01$  and positively with the latter for  $\alpha = 0.1$ . Although the price of fresh beef and the price of frozen beef are not correlated, only the price of fresh beef will be considered in the multivariate analysis. In fact, as observed during the survey very often, butchers mix both meats and sell that mix as fresh meat.

#### 4.1.2. Demographic Variables

a. There is no severe collinearity between demographic variables.



b. For  $\alpha = 0.05$ , the per capita beef consumption is correlated only to the size of the household, the income per person, and the Moslem status of the decision maker. Moslems show a tendency to consume more beef than others. The per capita consumption decreases with the family size and increases with income per capita.

#### 4.1.3. Seasonal Variations

a. Only the price of frozen beef sold with bone follows very strong seasonal variations with correlation coefficients of  $-0.81$  for long dry season and  $0.73$  for long rainy season dummy variables. The correlation between long rainy season and the price of fresh beef sold without bone, although significant at  $\alpha = 0.01$ , was relatively small ( $r = 0.28$ ). These results suggest that frozen beef which was abundant in long dry season was getting scarce in long rainy season. This situation is explained by the financial problems the distributor of frozen beef was facing during the survey and which led to its closing. The price of fresh beef without bone which competed with the frozen beef for the "shishkebab" market also increased in the long rainy season but only slightly.

b. For  $\alpha = 0.05$ , only long rainy season shows a significant correlation with the per capita consumption of the urban household.

#### 4.1.4. Logarithmic Analysis

The correlational analysis of the natural logarithms shows similar results to those above. Interestingly, the price of fresh fish becomes positively correlated with the consumption of beef. It also remains correlated to the price of beef.

#### 4.1.5. Significant Variables

In summary the variables which are correlated with the consumption levels for  $\alpha = 0.1$  are the following:

1. Price of fresh beef sold with bone
2. Price of fresh fish
3. Family size
4. Moslem status
5. Long rainy season season
6. Income per capita

The correlational analysis reveals no severe collinearity case between those independent variables.

## 4.2. THE MULTIVARIATE MODELS

### 4.2.1. Full Models

The results of the full linear model [M1] as presented in Table 4.1. are as follows:

a. The household consumption of beef per person is negatively related to the beef price and to the family size. It is, however, positively related to the spring season, and to per capita income.

b. The price of fish, the length of decision maker's urban residency, his or her religious affiliation and his or her completed educational level do not affect the household consumption of beef per person. Furthermore, there is no other seasonal variation which was statistically significant at a level of  $\alpha = 0.10$ .

As shown in Table 4.1., the analysis of the logarithmic full model [M2] of beef consumption per capita reveals that:

a. The beef consumption per urban dweller increases with the household per capita income and with the price of fresh fish. It decreases, however, with its own price.

b. The length of the decision maker's urban residency, his or her educational level, his or her religious affiliation, the family size and the seasonal variations have no significant impact on the beef consumption for a significance level of  $\alpha = 0.10$ .

### 4.2.2. Reduced Models

The regression analysis shows that the best linear model contains per capita income, the price of fresh beef, and the spring season as follows:

$$Q = 0.6113 - 0.00033 BP + 0.0105 Y + 0.30 SP \quad [M3]$$

$$(3.51) \quad (-2.35) \quad (3.34) \quad (3.19)$$

where Q = kilograms (kg) of beef consumed weekly by the average family member

Y = monthly income (1000 CFA) per family member

BP = the price of edible fresh beef in CFA per kg

SP = the long rainy season.

The number between parentheses represents the Student t-statistics. The regression is significant for  $\alpha = 0.001$  ( $F = 11.56$ ,  $n = 110$ ). The coefficient of determination is estimated as  $R^2 \cong .25$  which implies a multiple correlation coefficient  $R = 0.5$ .

TABLE 4.1.

## MULTIVARIATE MODELS OF HOUSEHOLD BEEF CONSUMPTION PER CAPITA

Independent Variables	Linear Model [M1] (Q in kg)				Logarithmic Model [M2]			
	Coefficients	T-Statistics	Significance	Elasticities	Coefficients	T-Statistics	Significance	Elasticities
Constant	.6428	2.81	.006		-1.98	-0.26	.793	
Beef Price (CFA/kg)	-.0004	-2.48	.015	-1.09	-1.91	-1.76	.081	-1.91
Fish Price (CFA/kg)	.0002	1.42	.160	0.42	1.79	2.75	.007	1.79
Income per Capita (1000 CFA)	.0077	2.13	.039	0.27	0.71	2.90	.005	0.71
Household Size (persons)	-.0136	-1.83	.071		0.03	0.08	.933	
Residency Length (years)	.0007	0.19	.851		0.10	0.44	.663	
Education (years)	.0092	1.11	.268		-0.15	-0.86	.392	
Moslem (dummy)	.0803	1.18	.267		0.45	1.16	.250	
Long Rainy Season (dummy)	.2417	2.09	.040		0.66	1.05	.296	
Long Dry Season (dummy)	-.0711	-0.97	.336		0.02	0.04	.966	
R <sup>2</sup>	.30				.24			
F	3.98				2.97			
N	93				93			

The notation for the reduced logarithmic models is as follows:

- $Q^*$  = the natural logarithm of weekly consumption of beef per individual  
 $BP^*$  = the natural log of the price of edible fresh beef  
 $Y^*$  = the natural log of the monthly income per person  
 $FP^*$  = the natural log of fish price

The best fitted model is expressed as follows:

$$Q^* = -0.299 - 2.17 BP^* + 1.88 FP^* + 0.69 Y^* \quad [M4]$$

(-0.05) (-2.51) (3.37) (3.42)

where  $R^2 = .20$ ,  $F = 8.74$ , and  $n = 110$ .

Omitting the intercept, which is not significant, gives a slightly different model:

$$Q^* = -2.20 BP^* + 1.87 FP^* + 0.68 Y^* \quad [M5]$$

(-4.31) (3.49) (3.60)

where  $R^2 = .20$ ,  $F = 44.60$ , and  $n = 110$ .

The models M2, M4 and M5 imply a multiplicative function of the consumption levels, i.e.

$$Q = aX_1^{b_1} \cdot X_2^{b_2} \cdot \dots \cdot X_n^{b_n}$$

It can be shown that in this case the coefficients  $b_1$ ,  $b_2$ , ...,  $b_n$  represent also the elasticities of the corresponding variables. We may thus infer the following elasticities:

a. The per capita beef consumption of the Ivorian urban dweller is positively associated with reported monthly revenue, but with a relatively low elasticity ( $e_Y = 0.68$ ).

b. The per capita beef consumption of the Ivorian urban dweller is highly elastic with respect to the price of fresh beef ( $e_{BP} = -2.20$ ) and to the price of fresh fish ( $e_{FP} = 1.87$ ).

#### 4.3. SUMMARY OF FINDINGS FROM THE MULTIVARIATE ANALYSIS

The multivariate results presented above can be summarized as follows:

a. There is a negative relationship between price of beef and consumption of beef according to all five models.

b. There is a positive relationship between price of fresh fish and beef consumption in the logarithmic models.

c. There is a positive relationship between income per capita and beef consumption according to all five models.

d. Seasonal variations and family size appear significant only in the linear model.

e. No religious affiliation affects the per capita beef consumption.

f. In no case does the length of the decision maker's urban residency affect beef consumption, neither does his or her education level.

g. The income elasticity is about 0.7.

h. The demand for beef is elastic with respect to its own price and to the price of fish. The demand elasticity with respect to beef price is about -2, while the one with respect to fish price is about +2.

#### 4.4. INTERPRETATION OF THE RESULTS

a. Family size is not significant in either the linear or the logarithmic model, perhaps because it is correlated with income. As a result it becomes redundant once income, which is most highly related to the per capita consumption, is in the model.

b. Seasonal variations are significant in the linear models but not in the logarithmic models. It should be noted that there is no correlation between prices and any season. Apparently, the availability of the frozen Argentinian beef, when supply of Sahelian beef is limited, prevented systematical changes of prices, with respect to season, from occurring.

c. According to the multivariate results, Moslem decision makers are not different from others. Their households consume beef as much as Christians and others do. The following reasons can be given. First, note that most Ivorian Moslems believe in eating only meat from animals blessed before slaughtering. Meats from game animals do not meet this requirement. Second, note also meats from game animals, which make the difference between Moslems and the others, are scarce. It appears that, regardless of their religious affiliations, urban consumers use the same product line of animal protein sources. Furthermore, as shown below, consumption habits acquired from their areas of origin change quickly with the cultural milieu. It is relevant to note that most of the Ivorian Moslems originated from the north and Christians from the south.

d. The length of the decision maker's urban residency does not have any influence on beef consumption per person for one main reason. Because of the strong ties in the extended family system, newcomers learn quickly about products sold and consumed in the city. This situation is enhanced by the lack of accommodations in urban areas, which forces newcomers to be hosted by relatives and friends for months. Subsequently, newcomers acquire eating habits from those who have been residing in the city for many years. The newcomers become somewhat "acculturated". They become urban consumers before being food decision makers in the city. Even if illiterate consumers know very little of the nutritive value of beef, they customarily have it in their diet.

e. The low income-elasticity figure is consistent with an estimate of 0.55 reported in a previous study.<sup>5</sup> An increase of household income per capita apparently has only a modest effect on beef consumption. As some decision makers stated during the interview, the additional income may be allocated to another food item or another household need. Clearly, the Ivorian household sticks with a food budget in which the purchases vary with prices. The determinants of that food budget may include more variables than income, such as plans for purchase of durable goods (car, television, etc...).

f. The high level of beef demand elasticity with respect to its own price and to the price of fish implies that decision makers on the average are very sensitive to price variations. Some of them admittedly were less sensitive. During the survey it was observed that several food decision makers spent about the same amount of money on beef regardless of its price. In other words, ceteris paribus, the beef budget was fixed, and the price-elasticity of demand was unitary.

## 5. CONCLUSIONS

### 5.1. POLICY RECOMMENDATIONS

In the aim of providing beef for Ivory Coast consumption, policymakers should keep in mind the following:

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<sup>5</sup>Kenneth H. Shapiro, "The Livestock Economies of Central West Africa: An Overview" in Livestock Production and Marketing in the Entente States of West Africa: Summary Report (Ann Arbor: CRED, 1979), p. 56.

a. The urban consumers of the Ivory Coast are very responsive to the prices of beef and fish. This implies that policies which would result in increasing prices of beef and fish may bring about a worsened diet. As this survey reveals, beef is among the primary sources of animal protein in the Ivory Coast, hence a decrease in its consumption may create more malnutrition problems. The Ivory Coast cattle raising program should be competitive instead of seeking trade protection or price controls. The gain from local noncompetitive beef production may be more than offset by the nutritional loss.

b. As a result of the high rate of urban growth and the likely decreasing supply of meat from game animals, demand for beef will remain high in the next few years. It is relevant to note, however, that lower prices of mutton or fish may alter, to a great extent, the role of beef in the Ivorian diet. In fact, this study has shown that consumption of beef is highly sensitive to the price of fish. With regard to mutton, although available data on its price were not sufficient for analysis, its first rank in the Ivory consumers' preferences for meat is unquestionable.<sup>6</sup>

c. The prospect for Sahelian beef in the Ivorian market will depend on its relative prices. Although urbanization increases the market potential, in the absence of important economic improvement, prices are the most important factors determining per capita beef consumption. The recent increases in transportation cost between the Ivory Coast and its neighboring supplier countries may significantly affect consumption of Sahelian beef.<sup>7</sup> Very often, when the Sahelian beef, which is most preferred by the average consumer, is only available in limited supply, butchers have a tendency to mix it with frozen beef. As the frozen beef, a second class beef from Argentina, is the cheapest one, this strategy allows those butchers to maintain an acceptable or even high profit margin. In other words, unless the Sahelian beef becomes competitive with respect to the frozen beef, it is likely that it will lose important parts of its Ivorian market.

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<sup>6</sup>D. Bollinger, Les Marchés des Volailles, des Porcs et de la Charcuterie, Tome I (Paris: IDET-CEGOS, 1975), p. 42.

<sup>7</sup>Television interviews with a Voltaic participant to a seminar organized by CEAO on livestock marketing among its member countries (Abidjan, Ivory Coast, April 1984).

d. Responsiveness of beef consumption to income change, measured by its elasticity, is not as high as the ones with respect to fish and beef prices. Thus, income increases will not generate large boosts in beef consumption.

## 5.2. LIMITATIONS

The results and recommendations of this study are limited in several ways:

a. The measured consumption of beef does not take into account what is consumed outside the household (e.g., school boarding house, army, restaurant). In Abidjan, for example, a large number of low-income employees, working far from their residence, have their lunch in "restaurants". In this study, no information was gathered on those restaurants, which are becoming very important as more institutions adopt the "short lunch break" regime.

b. Substitution between beef and other meats has not been considered because of the lack of reliable information on their prices. As more poultry are raised, one may expect a high substitution between beef and chicken, which is the third choice of Ivorian consumers after mutton and beef.<sup>8</sup>

c. Household income levels may have been underreported. Although the income-elasticity found here is consistent with a previous study, it is advised that other methods of income evaluation be developed. It is the author's hope to investigate a proxy for income which will be easier to collect than earnings. For example, food budget, rent and utilities bills have been thought of. These items of income allocation will be considered in a further study.

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<sup>8</sup>D. Bollinger, op. cit., p. 42.



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