

Patterns of change in beef production and consumption in Africa

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Summary

This paper analyses the patterns of change in the production and consumption of beef in Africa over the last two decades. A 'decomposition' method of analysis is used to examine the change in total beef production during this period, attributable to changes in herd size, in the proportion of cattle slaughtered and in productivity per head of cattle. Sub-regional aggregations are complemented with similar analyses for individual countries to demonstrate the diverse patterns of change in beef production and consumption. The results reveal an overall increase in total beef production (due mainly to an increase in cattle numbers and in the percentage of slaughtered cattle, rather than to productivity gains), a stagnation in per capita production, and an overall increase in the total consumption of beef and a decline in per capita consumption (due mainly to faster population growth and urbanisation, and a decline in per capita income, respectively).

Keywords

Africa – Beef production and consumption – Decomposition analysis – Herd size effect – Interaction effect – Off-take effect – Yield effect.

Introduction

The total production of beef in Africa increased from 2.8 million tonnes (t) in 1978 to 3.71 million t in 1998. This increase of 38% (1.91% per year) is higher than in the developed world where, on average, production increased by only 1%. Changes in the quantity of the beef produced are caused by the following:

- changes in the total number of cattle
- changes in the proportion of animals in the herd which are slaughtered
- changes in the productivity of each animal.

Of course, other biological, environmental and economic factors also influence these sources of change. In Africa as a whole, the total cattle population and the number of cattle slaughtered grew by about 2% per year during the years from 1978 to 1998. The largest percentage increase occurred in Central Africa. Beef yield per animal grew by less than 1% during the same period. The total consumption of beef in Africa increased faster than production. Approximately 2.6 million t of beef were consumed in 1978 and, by 1998, total consumption had grown to 3.9 million t. This rapid growth in

consumption, which is equivalent to 49% (2.43% per year), is an indication of what Delgado *et al.* (4) refer to as the 'livestock revolution'. The growth in human population, increased urbanisation, rising income levels and, above all, changes in consumption habits explain this demand-led revolution.

This paper analyses the patterns of change in the production and consumption of beef in Africa over the last two decades. A 'decomposition' method is used to analyse the percentage change in total beef production, attributable to changes in herd size, the proportion of cattle slaughtered and productivity per head of cattle. Sub-regional aggregations are complemented with similar analyses for individual countries to demonstrate the diverse patterns of change in beef production and consumption in Africa. Such an analysis should not only document elements of the 'livestock revolution', but also identify production and consumption problems that need to be addressed.

Changes in herd size, percentage of slaughtered animals and yield per animal

The continent of Africa contains approximately 216 million cattle. The cattle population increased by 34% (1.69% per year)

between the years 1978 and 1998 (Table I). The largest absolute increase in cattle numbers occurred between 1988 and 1998. Approximately half of these cattle are found in East Africa, where Ethiopia and Sudan together account for two-thirds of the total number of cattle in this sub-region. West and southern Africa each have 20% and the remaining 10% are found in Central and North Africa. Nigeria alone accounts for 44% of the West African cattle population, while Madagascar and the Republic of South Africa jointly account for 55% in the southern Africa sub-region.

East Africa had the largest absolute increase of 33.3 million cattle, followed by West Africa with 14.5 million. In both sub-regions, approximately 80% of the growth occurred during the decade from 1988 to 1998. The growth in cattle numbers in North and South Africa was minimal, averaging less than 1% per year.

A total of approximately 25 million cattle were slaughtered in Africa in 1998. This number had increased by 31% (1.56% per year) from approximately 19 million in 1978 (Table I). As a result of its large cattle population, East Africa accounted for 40% of the total number of cattle slaughtered. More than half of the increase in the number of cattle slaughtered also occurred in this sub-region, due mainly to a significant increase in the numbers of cattle slaughtered in Sudan and Ethiopia. Southern and West Africa followed, with 5.7 and 4.7 million cattle

slaughtered in these sub-regions, respectively. The Republic of South Africa and Nigeria accounted for 45% and 39% of the regional slaughter yield, respectively. The largest annual percentage growth in slaughtered cattle, of 2.78%, occurred in Central Africa, followed by West Africa with 2.58%. In southern Africa, the number of cattle slaughtered declined between the years 1978 and 1998.

The beef yield from each cattle beast slaughtered in Africa averaged approximately 154 kilograms (kg) in 1998, having increased from approximately 150 kg in 1988 (Table I). The largest cattle are found in southern Africa, with an average carcass weight of 179 kg per head. The carcass yield varies from 127 kg in Madagascar to 221 kg in Namibia and 236 kg in Reunion. North Africa follows, with cattle weighing an average of 159 kg per head. In West Africa, the average carcass weight is 121 kg, with a range from 90 kg in Sierra Leone to 163 kg in Nigeria.

There are significant differences in productivity gains for regional cattle in Africa. The overall reduction in beef yield for the period between 1978 and 1998 was due mainly to productivity losses experienced in West and East Africa. North Africa experienced the highest gains in the productivity of beef cattle, with an overall gain of 57 kg per head between 1978 and 1998. The sub-regions of southern and Central Africa experienced a gain of 15 kg and 9 kg, respectively.

Table I
The total cattle herd size, number of cattle slaughtered and yield per head of cattle in Africa, between 1978 and 1998, categorised by region

Herd size (million head)	Total number of cattle			1978-1988	Change 1988-1998	1978-1998	Annual percentage change		
	1978	1988	1998				1978-1988	1988-1998	1978-1998
West Africa	30.1	33.1	44.6	3.0	11.5	14.5	1.0	3.47	2.41
Central Africa	9.6	12.4	15.4	2.8	3.0	5.8	2.92	2.42	3.02
Southern Africa	42.9	42.7	43.3	-0.2	0.6	0.4	-0.05	0.14	0.05
East Africa	71.2	79.1	104.5	7.9	25.4	33.3	1.11	3.21	2.34
North Africa	7.5	7.9	7.9	0.4	0.0	0.4	0.53	0.00	0.27
Africa total	161.3	175.2	215.7	13.9	40.5	54.4	0.86	2.31	1.69
Number slaughtered (million head)									
West Africa	3.1	4.1	4.7	0.9	0.7	1.6	2.90	1.75	2.58
Central Africa	0.9	1.2	1.4	0.3	0.2	0.5	3.33	1.67	2.78
Southern Africa	5.9	5.7	5.7	-0.2	0.0	-0.2	-0.34	0.00	-0.17
East Africa	6.8	7.7	9.8	0.9	2.1	3.0	1.32	2.73	2.21
North Africa	2.2	2.6	3.2	0.4	0.6	1.0	1.82	2.31	2.27
Africa total	18.9	21.2	24.8	2.3	3.6	5.9	1.22	1.70	1.56
Beef yield (kilogram/head of cattle)									
West Africa	123.0	119.4	120.3	-3.6	0.9	-2.7	-0.29	0.08	-0.11
Central Africa	138.4	147.0	147.7	8.6	0.7	9.3	0.62	0.05	0.34
Southern Africa	168.2	185.3	183.3	17.1	-2.0	15.1	1.02	-0.11	0.45
East Africa	134.1	132.7	133.7	-1.4	1.0	-0.4	-0.10	0.08	-0.01
North Africa	127.7	164.2	184.3	36.5	20.1	56.6	2.86	1.22	2.22
Average for Africa	138.3	149.7	153.9	11.4	-4.1	15.6	0.83	0.28	0.56

The percentage of cattle slaughtered, also known as the 'off-take rate', is estimated at 15.5% for the entire continent, varying from an average of 9% in Central Africa and 9.3% in East Africa to 40.5% in North Africa (Table II). These differences reflect the relative importance of cattle for alternative uses in each sub-region, such as pulling machinery (traction) and milk production, as well as the type of production system being employed. In Central, East and West Africa, where the majority of the cattle are raised extensively, off-take rates are quite low, compared to those in the southern and North African sub-regions, where semi-intensive and intensive farming systems are more evident. In North Africa, where the off-take rate averages 34.5%, as many as 52% of these cattle are slaughtered in Egypt. Cattle off-take rates in Africa increased slowly between 1988 and 1998. North Africa is the only sub-region where there has been a significant growth in cattle off-take rates. Between 1978 and 1998, the average off-take rate increased by 1.4% per year. Most of the increase (2.3% per year) occurred between 1988 and 1998.

Table II
Off-take rates (percentage of cattle slaughtered) and change in off-take rates in Africa, between 1978 and 1998, categorised by region

Region	Off-take (percentage)			Change (percentage)		
	1978	1988	1998	1978-1988	1988-1998	1978-1998
West Africa	10.3	12.2	10.5	1.84	-1.39	0.10
Central Africa	9.0	9.7	9.0	0.78	-0.72	0.00
Southern Africa	13.8	13.3	13.2	-0.36	-0.08	-0.32
East Africa	9.5	9.7	9.3	0.21	-0.41	-0.11
North Africa	29.2	32.9	40.5	1.27	2.31	1.40
Africa total	14.36	15.56	16.50	0.84	-0.60	0.65

West and Central Africa, Liberia, Côte d'Ivoire and the Democratic Republic of Congo all experienced a significant decline in cattle off-take rates between 1978 and 1998. However, in Togo, the off-take rate doubled from 13% to 26% and in Gabon it increased from 7% to 24%. In southern Africa, the Republic of South Africa, Zimbabwe and Reunion each experienced a decline in cattle off-take rates, whereas, in Mozambique and Lesotho, off-take rates actually increased. Burundi, Mauritius and Rwanda were the countries with significant increases in off-take rates in East Africa. The countries in this sub-region which experienced major declines in their off-take rates were Djibouti and the Seychelles. Apart from Tunisia, where the off-take rate remained the same at 34%, all the other North African countries experienced an increase in their cattle off-take rates.

Method of assessment

The authors divided or 'decomposed' changes in beef production from 1978 to 1998 into four categories or 'effects',

three primary effects and one interaction effect. The derivation of these effects is based on the following equation for beef production:

Total beef production = total herd size × proportion of animals slaughtered in herd × beef yield per slaughtered animal

Total beef production is a function of the total number of cattle, the percentage of those animals which are slaughtered (the off-take rate) and the yield per slaughtered animal. Following Tambi *et al.* (14), the total differential divides the total change in beef production during the time period 1978 to 1998 into its component elements, as follows:

- the herd effect
 $\Delta HS \times PC^{78} \times BY^{78}$ for the time periods 1978 to 1988 and 1978 to 1998
 $\Delta HS \times PC^{88} \times BY^{88}$ for the time period 1988 to 1998
- the off-take effect
 $HS^{78} \times \Delta PC \times BY^{78}$ for the time periods 1978 to 1988 and 1978 to 1998
 $HS^{88} \times \Delta PC \times BY^{88}$ for the time period 1988 to 1998
- the beef yield effect
 $HS^{78} \times PC^{78} \times \Delta BY$ for the time periods 1978 to 1988 and 1978 to 1998
 $HS^{88} \times PC^{88} \times \Delta BY$ for the time period 1988 to 1998
- the interaction effect
 $(\Delta HS \times \Delta PC \times BY^{78}) + (\Delta HS \times PC^{78} \times \Delta BY) + (HS^{78} \times \Delta PC \times \Delta BY) + (\Delta HS \times \Delta PC \times \Delta BY)$ for the time periods 1978 to 1988 and 1978 to 1998
 $(\Delta HS \times \Delta PC \times BY^{88}) + (\Delta HS \times PC^{88} \times \Delta BY) + (HS^{88} \times \Delta PC \times \Delta BY) + (\Delta HS \times \Delta PC \times \Delta BY)$ for the time period 1988 to 1998

where HS is the total number of cattle in the national or regional herd, PC is the proportion of cattle slaughtered and BY is the beef yield per slaughtered animal.

The superscript numbers (78, 88) indicate that the value of the variable is for 1978 or 1988. The Δ indicates change in the variable from 1978 to 1988, 1978 to 1998 or 1988 to 1998 (e.g., ΔHS equals the change in the total number of cattle in the herd from 1978 to 1998, or $HS^{98} - HS^{78}$).

The herd effect is the change in beef production due to a change in the total number of cattle from 1978 (1988) to 1998, assuming that the proportion of animals slaughtered and the yield per slaughtered animal remain constant at the 1978 (1988) level. The 'proportion of cattle slaughtered' effect is the change in beef production resulting from a change in the proportion of animals slaughtered from 1978 (1988) to 1998, assuming that the number of animals and the yield per animal remain constant at the 1978 (1988) level. The yield effect is the change in beef production attributed to changes in yield per animal from 1978 (1988) to 1998, assuming that the total number of animals and the proportion of animals slaughtered

remain the same as in 1978 (1988). The interaction effect accounts for changes in the three components of beef production which occur simultaneously. Interpretation of these interaction effects is rather difficult, because they represent the change in beef production that cannot be apportioned to only one of the three effects. In fact, the interaction effect describes the change in beef production resulting from simultaneous changes in the herd size, the proportion of the herd being slaughtered, and the beef yield per slaughtered animal. The interaction term may be positive or negative, depending on changes in the underlying variables during the period 1978 (1988) to 1998.

The total change in beef production is a combination of these four effects. By calculating the relative and absolute shares of each effect in the total change, it is possible to compare across countries or sub-regions, the impact, and therefore the contribution, of each factor to changes in beef production in Africa.

The authors illustrate this decomposition analysis for two sub-regions, West Africa and East Africa, through an example using Nigeria and Tanzania (Table III). In Nigeria, the cattle herd increased by 8.155 million between 1978 and 1998. The number of cattle slaughtered increased by 0.683 million but the percentage of cattle slaughtered and the yield per slaughtered animal both declined. Total beef production increased by 49,000 t. This increase is decomposed into the following effects:

– the herd effect

$$\Delta HS \times PC^{78} \times BY^{78} = (8,155) \times (0.098) \times (218/1,000) = 174$$

– the percentage slaughter effect

$$HS^{78} \times \Delta PC \times BY^{78} = (11,558) \times (-0.006) \times (218/1,000) = -15$$

– the beef yield effect

$$HS^{78} \times PC^{78} \times \Delta BY = (11,558) \times (0.098) \times (-55/1,000) = -62$$

– the interaction effect

$$49 - 174 - (-15) - (-62) = -48.$$

The herd size effect is positive because the number of cattle increased. However, the proportion of animals slaughtered, as well as the yield per animal, declined. The interaction effect is also negative, suggesting that most of the gains accruing from an increase in herd size were somewhat offset by the negative effects of the other three components.

Tanzania in East Africa presents a totally different production pattern from that of Nigeria. The total number of cattle in the herd, the number and proportion of animals slaughtered and the yield per animal all increased during the years 1978 to 1998. The total number of cattle and the number of animals slaughtered increased by 2.155 million and 0.768 million, respectively, while beef yield per animal increased by 3 kg. Total

Table III
Decomposition analysis, using the examples of Nigeria and Tanzania

Indicator	West Africa (Nigeria)	East Africa (Tanzania)
Total cattle herd (thousands)		
1978	11,558	12,117
1998	19,713	14,272
Change, 1978-1998	8,155	2,155
Slaughtered animals (thousands)		
1978	1,130	1,299
1998	1,813	2,067
Change, 1978-1998	683	768
Proportion of cattle slaughtered (percentage)		
1978	9.8	10.7
1998	9.2	14.5
Change, 1978-1998	-0.6	3.8
Beef yield per animal (kg)		
1978	218	100
1998	163	103
Change, 1978-1998	-55	3
Total beef production (thousands t)		
1978	247	130
1998	296	213
Change, 1978-1998	49	83
Decomposition of beef production		
Herd effect (thousands t)	174	23
Percentage slaughter effect (thousands t)	-15	46
Beef yield effect (thousands t)	-62	4
Interaction effect (thousands t)	-48	10
Percentage contribution of effects		
Herd effect	355	28
Percentage slaughter effect	-31	55
Beef yield effect	-126	5
Interaction effect	-98	12

t: tonnes

beef production thus increased by 83,000 t as a result of the following effects:

– the herd effect

$$\Delta HS \times PC^{78} \times BY^{78} = (2,155) \times (0.107) \times (100/1,000) = 23$$

– the percentage slaughter effect

$$HS^{78} \times \Delta PC \times BY^{78} = (12,117) \times (0.038) \times (100/1,000) = 46$$

– the beef yield effect

$$HS^{78} \times PC^{78} \times \Delta BY = (12,117) \times (0.107) \times (3/1,000) = 4$$

– the interaction effect

$$83 - 23 - 46 - 4 = 10.$$

More than half of the increase in beef production was due to the increase in the percentage of animals slaughtered, followed by the herd effect. The beef yield effect accounted for the smallest portion of the total increase, while the interaction effect accounted for 12% of the increase (Table III).

Data sources

The data used in the analyses of beef production and consumption in Africa were obtained from the Food and Agriculture Organization (FAO) World Agriculture Information Centre (WAICENT) database (6). This is the most comprehensive source which provides time series data on the following elements:

- the total number of cattle
- the number of cattle slaughtered
- domestic beef production
- beef imports and exports.

These types of data are required for the decomposition analysis of a country, as well as for regional comparisons. To compensate for changes in national administrative boundaries, the analyses combined data for some countries (e.g., Ethiopia and Eritrea) so that a consistent historical data series could be maintained. The analysis is performed by country, after which regional aggregations are obtained, as shown in Table IV. These analyses use changes between the mean figures for the three-year periods between 1977 and 1979 (referred to as 1978), 1987 and 1989 (referred to as 1988) and 1997 and 1999 (referred to as 1998). This minimises the influence of year-to-year variations on estimates of the effects. To isolate periods of real impact, the twenty-year period between 1978 and 1998 is divided into two ten-year periods: 1978 to 1988 and 1988 to 1998.

Table IV
Regional aggregations used in this analysis of beef production and consumption

Region	Countries included in this region
West Africa	Benin, Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo
Central Africa	Cameroon, Central African Republic, Chad, Congo (Democratic Republic of), Congo (Republic of), Gabon, Sao Tome and Principe
Southern Africa	Angola, Botswana, Lesotho, Madagascar, Mozambique, Namibia, Reunion, South Africa, Swaziland, Zambia, Zimbabwe
East Africa	Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Mauritius, Rwanda, Seychelles, Sudan, Tanzania, Uganda
North Africa	Algeria, Egypt, Morocco, Tunisia

Results

Patterns of change in beef production

Total production

Total beef production increased in all the sub-regions of Africa during 1978 to 1998. The overall increase was 1.023 million t,

which is equivalent to an annual growth rate of 1.9% (Table V). Delgado *et al.* (4) reported a similar growth rate of 2.1% for the period from 1982 to 1994. For the developing world as a whole, growth in total meat production occurred at an average rate of 5.4% between 1982 and 1994. In Africa, one-third of the increase occurred in East Africa and 26% in North Africa. North Africa had the highest annual increase of 5.5%, due mainly to an 18% increase in Egypt. The larger part of the increase in East Africa occurred during 1978 to 1988, whereas, in North Africa, most of the increase occurred during 1988 to 1998. Growth in Central and West Africa averaged 3.5% and 2.3%, respectively. Cameroon accounted for most of the increase in Central Africa, whereas, in the Democratic Republic of Congo, beef production declined by 11% per year. In West Africa, most of the increase occurred in Benin and Togo. In Nigeria, Mauritania and Côte d'Ivoire, beef production actually declined. Southern Africa had the smallest increase in production, of only 59,000 t. The gains in beef production achieved in southern Africa during the period from 1978 to 1988 were somewhat offset by a negative growth rate from 1988 to 1998.

Per capita production

Whereas the total production of beef increased between 1978 and 1998, per capita production stagnated at 5.5 kg per person between 1978 and 1988 and declined to 5.2 kg per person during the ten-year period from 1988 to 1998 (Table V). Beef production per capita decreased over all by approximately 1% per year, meaning that the human population increased faster than the increase in total beef production. The only sub-region where the per capita production of beef increased was North Africa, where production rose from 3.1 kg per person in 1978 to 4.4 kg per person in 1998, representing a 2.1% annual increase. In the rest of the sub-regions, per capita production dropped. Although southern Africa produced more beef per capita than any other region in Africa, this region also experienced the greatest drop, from 12.3 kg per person in 1978 to 8.5 kg per person in 1998. This is equivalent to a 1.5% decline per year. Production of beef per capita declined in all other countries of southern Africa, except Angola and Malawi. In East Africa, per capita production declined from 7.6 kg per person in 1978 to 6.9 kg per person in 1988. Thereafter, production stagnated until 1998.

Magnitude of effects

As indicated above, the total production of beef in Africa increased by 1.023 million t between 1978 and 1998 (Table VI). Approximately 5.4% of this increase occurred between 1988 and 1998, while the rest occurred between 1978 and 1988. In their 2020 vision study of livestock production and consumption, Delgado *et al.* (4) alluded to the fact that rapidly increasing meat and milk production in the developing world coincided with rapidly increasing numbers of animals, increases in the productivity of animals and in the number of

Table V
Total and per capita beef production in Africa, between 1978 and 1998, categorised by region

Region	Beef production			Change (1,000 t)			Annual percentage change		
	1978	1988	1998	1978-1988	1988-1998	1978-1998	1978-1988	1988-1998	1978-1998
Total (1,000 t)									
West Africa	382	482	561	100	79	179	2.62	1.64	2.34
Central Africa	120	177	205	57	28	85	4.75	1.58	3.54
Southern Africa	995	1,054	1,048	59	-6	53	0.59	-0.06	0.27
East Africa	907	1,017	1,305	110	288	398	1.21	2.83	2.19
North Africa	280	426	588	146	162	308	5.21	3.80	5.50
Africa total	2,684	3,171	3,707	472	551	1,023	1.76	1.75	1.91
Per capita (kg)									
West Africa	2.9	3.0	2.7	0.1	-0.3	-0.2	0.34	-1.00	-0.34
Central Africa	2.6	3.0	2.6	0.4	-0.4	0.0	1.54	-1.33	0.00
Southern Africa	12.3	10.9	8.5	-1.4	-2.4	-3.8	-1.14	-2.20	-1.54
East Africa	7.6	6.9	6.9	-0.7	0.0	-0.7	-0.92	0.00	-0.46
North Africa	3.1	3.9	4.4	0.8	0.5	1.3	2.58	1.28	2.10
Africa total	5.5	5.6	5.2	0.1	-0.4	-0.3	0.18	-0.71	-0.27

t: tonnes

animals which were slaughtered or milked. The increase in production of beef in Africa originated from four major sources, as follows:

- changes in the size of the cattle herd
- changes in the number of cattle slaughtered
- changes in the productivity of individual cattle
- the interaction of these three effects.

Table VI
Sources of changes in beef production in Africa, between 1978 and 1998, categorised by region

Region	Effect (1,000 t)				Total change
	Herd	Off-take	Productivity	Interaction	
Period 1978 to 1988					
West Africa	38	70	-11	4	101
Central Africa	35	10	7	6	58
Southern Africa	-5	-34	101	-4	58
East Africa	100	18	-10	1	109
North Africa	14	35	80	17	146
Africa total	182	99	167	24	472
Period 1988 to 1998					
West Africa	167	-68	4	-23	80
Central Africa	42	-13	1	-3	27
Southern Africa	15	-10	-11	0	-6
East Africa	328	-37	8	-10	289
North Africa	0	98	52	12	162
Africa total	552	-30	54	-24	552
Period 1978 to 1998					
West Africa	183	6	-8	-8	173
Central Africa	71	0	8	8	87
Southern Africa	9	-42	89	89	145
East Africa	425	-16	-3	-3	403
North Africa	15	108	124	62	309
Africa total	703	56	210	148	1,117

t: tonnes

For the period 1978 to 1998, herd size, productivity, off-take and interaction effects were positive. This was also true for the period between 1978 and 1988. However, the off-take and interaction effects were negative for the period between 1988 and 1998. This indicates that the gains achieved in beef production during the years 1978 to 1998 were somewhat offset by a negative growth rate in the number of cattle slaughtered during 1988 to 1998, as well as in the interaction among the three effects (Table VII).

Table VII
Sources of changes in beef production in Africa, as a percentage of the total, between 1978 and 1998, categorised by region

Region	Effect (percentages of the total)			
	Herd	Off-take	Productivity	Interaction
Period 1978 to 1988				
West Africa	37.62	69.31	-10.89	3.96
Central Africa	60.34	17.24	12.07	10.34
Southern Africa	-8.62	-58.62	174.14	-6.90
East Africa	91.74	16.51	-9.17	0.92
North Africa	9.59	23.97	54.79	11.64
Africa total	38.56	20.97	35.38	5.08
Period 1988 to 1998				
West Africa	208.75	-85.00	5.00	-28.75
Central Africa	155.56	-48.15	3.70	-11.11
Southern Africa	-250.00	166.67	183.33	0.00
East Africa	113.49	-12.80	2.77	-3.46
North Africa	0.00	60.49	32.10	7.41
Africa total	100.00	-5.43	9.78	-4.35
Period 1978 to 1998				
West Africa	105.78	3.47	-4.62	-4.60
Central Africa	81.61	0.00	9.20	9.20
Southern Africa	6.21	-28.97	61.38	61.38
East Africa	105.46	-3.97	-0.74	-0.74
North Africa	4.85	34.95	40.13	20.06
Africa total	62.94	5.01	18.80	13.25

East Africa was responsible for 36% of the increase in beef production from 1978 to 1998. All of this increase came from an expansion of the cattle herd. Sudan contributed 55% of this expansion. However, the productivity, the off-take and the interaction effects were negative for East Africa. Approximately one third of the gains achieved in the off-take rate from 1978 to 1988 were eroded during the period from 1988 to 1998. In spite of this, however, the sub-region of East Africa more than doubled its 1978 to 1988 level of contribution to the total increase in beef production during the following decade from 1988 to 1998.

North Africa accounted for 28% of the total increase in beef production. All four effects were positive throughout the period from 1978 to 1998. Most of this increase came from improvements in productivity and an increase in the number of cattle slaughtered. Morocco was the only country in this sub-region where the herd effect was negative.

As the third major contributor to beef production, most of the increase experienced in West Africa came from an expansion in the cattle herd. This occurred particularly during the ten-year period from 1988 to 1998. The evolution of changes in the off-take and productivity effects presents a contrasting pattern. The off-take rate was positive between 1978 and 1988 but became negative between 1988 and 1998, eroding the gains achieved earlier. On the other hand, the negative effect of productivity achieved during the years 1978 to 1988 became positive during 1988 to 1998. All the negative interaction effects occurred between 1988 and 1998.

The Central and southern African sub-regions each accounted for a small part of the increase in beef production. The contribution to total production from these two sub-regions declined. This means that, over time, the countries of Central and southern Africa have been experiencing a negative growth rate in beef production. This decrease has been due to a drop in the number of cattle slaughtered and in the productivity per animal in these two sub-regions.

Perhaps a more intuitive insight into the patterns of change in beef production in Africa is obtained when one considers the effects as percentages rather than absolute amounts of beef. For Africa as a whole, and for the entire period from 1978 to 1998, about three fifths of the increase in production came from an expansion in cattle numbers while about 19% came from an increase in productivity (Table VII). The off-take effect played a limited role, complemented by the interaction effect. In regard to the gains achieved during 1988 to 1998, declining off-take rates helped to reduce these gains by about 5.4%. This, to an extent, influenced the interaction effect to reduce production by about 4.4%. This analysis supports the study of Delgado *et al.* (4), which showed that 'the rapid expansion of livestock food production in developing countries resulted primarily from increased numbers of animals rather than higher carcass weight per animal'.

The sources of change as a percentage of total beef production differ from sub-region to sub-region. In East Africa, for example, 100% of the increase in production was due to an increase in the size of the cattle herd. The other three effects reduced the total increase in production by about 5%. West Africa presents a similar pattern, except that minor gains in the number of cattle slaughtered helped to cancel out the negative effects of productivity and interaction. In southern Africa, the situation was dominated by the positive productivity and interaction effects. In Central Africa, where most of the effects are positive, the cattle herd is the major source of change, accounting for 82% of the increase in Central Africa. In North Africa, where all the effects are equally positive, the off-take and productivity effects account for 35% and 40.1%, respectively, of the total increase in beef production.

The preceding analyses suggest that in East and West Africa, where 50% of African beef is produced, most of the increase in production came from growing cattle numbers rather than gains in the productivity of these animals. Among the challenges facing food production on this continent, Badiane and Delgado (1) identified the following factors which impeded livestock production in Africa:

- severe disease problems, such as trypanosomiasis
- poor genetic potential
- lack of feed and poor-quality feed
- marketing 'bottlenecks' (i.e., points at which the flow is impeded).

These constraints arise from a stagnation in technological innovation. Progress in generating and transforming modern livestock production technologies has been slow in most parts of the continent and absent in other parts. Insufficient livestock research and extension systems, poor livestock marketing infrastructures, inappropriate domestic production, trade and exchange rate policies, and unfavourable climatic conditions have contributed in no small way to the decline in the productivity of livestock in Africa (2, 9, 15).

Patterns of change in beef consumption

A proper analysis of changing patterns in beef production in Africa requires a better understanding of consumption patterns. This is because the aim of domestic production is to increase the availability of meat for consumption by the growing population in Africa. It is also important to consider consumption because many of the countries in Africa are not self-sufficient in beef, despite the large numbers of cattle available in these countries. Africa as a whole is even considered to be a net importer of beef. Changes in beef consumption in Africa will therefore be sensitive to developments in the world beef markets. These developments may include such factors as prices and the availability of concessional (subsidised) imports from developed countries. In this analysis, beef consumption or availability is considered as domestic production plus net imports.

Total consumption

In 1998, Africa had a total of approximately 3.8 million t of beef available for consumption (Table VIII). In all, 97% of this total came from domestic production while about 3% was imported. Net imports averaged 100,700 t in 1998, having decreased from 134,400 t in 1988 (Table IX). In 1978, Africa was a net exporter of beef with exports averaging approximately 125,000 t, but this situation quickly changed and the continent became a net importer ten years later.

Total beef consumption increased by about 1.25 million t from 2.56 million t in 1978 to 3.80 million t in 1998. Some 62% of this increase was available during 1978 to 1988 and the rest during the following decade, from 1988 to 1998. The availability of beef in Africa increased at an overall rate of 2.43% per year, which was equivalent to the average increase in human population (8). In 1998, East Africa accounted for 32% of the total beef available for consumption and contributed the largest share to the increase. Together, Ethiopia, Kenya, Sudan and Tanzania accounted for 80% of the total meat available in this sub-region.

Southern Africa was the second most productive sub-region, contributing 2.7% of the available beef. However, its contribution to the growth in consumption was only 12%. The Republic of South Africa alone accounted for 53% of the available meat, followed by Madagascar with 14%.

North Africa contributed about 20% to the total amount of meat available in Africa in 1998. Consumption increased at an annual growth rate of 6%, with Egypt accounting for 54% of the available meat in this sub-region. The annual rate of increase in beef availability was smallest in southern and West Africa. In West Africa, Nigeria and Mali together provided two thirds of the available meat in this sub-region.

Per capita consumption

The per capita consumption of beef in Africa, on average, was 5.56 kg between 1978 and 1998. Consumption increased from 1978 to 1988 but declined to 5.2 kg by 1998 (Table VIII). The International Livestock Research Institute (8) reported a similar estimate of 5.8 kg per person per year and a negative growth rate of 1.6% for the period from 1983 to 1992.

From a regional standpoint, per capita consumption declined in all sub-regions of Africa except North Africa. In East Africa, where per capita consumption stagnated at 6.4 kg per person, Kenya had the highest per capita consumption of 10 kg per person, followed by the Seychelles and Mauritius. Burundi had the smallest per capita consumption. Southern Africa reported the highest per capita consumption of beef of 10.2 kg per person per year, due mainly to the high consumption rates reported in Swaziland (21 kg), the Republic of South Africa (18 kg) and Madagascar (12 kg). In Central and West Africa, the Republic of Central Africa and Mali were the two countries with the highest per capita consumption of 12 kg and 7 kg, respectively.

A number of empirical studies have quantified the factors which have led to changes in the consumption of animal products in developing countries. These include the following:

- changes in per capita income
- changes in the prices of meat and milk products
- growth in urban populations
- changing cultural habits.

Using a sample of 64 developing countries, Delgado and Courbois (3) derived expenditure, price and urbanisation elasticities for different meat and milk products. For beef, these authors showed that the relative share of beef in the total

Table VIII
Availability of beef in Africa, by total and per capita, between 1978 and 1998, categorised by region

Region	Beef availability			Change			Annual percentage change		
	1978	1988	1998	1978-1988	1988-1998	1978-1998	1978-1988	1988-1998	1978-1998
Total (1,000 t)									
West Africa	422	521	574	99	53	152	2.35	1.02	1.80
Central Africa	136	212	238	76	26	102	5.59	1.23	3.75
Southern Africa	888	1,082	1,034	194	-48	146	2.18	-0.44	0.82
East Africa	771	933	1,215	162	282	444	2.10	3.02	2.88
North Africa	343	592	745	249	153	402	7.26	2.58	5.86
Africa total	2,560	3,340	3,806	780	466	1,246	3.05	1.40	2.43
Per capita (kg)									
West Africa	3.2	3.2	2.7	0.0	-0.5	-0.5	0.00	-1.56	-0.78
Central Africa	2.9	3.7	3.0	0.8	-0.7	0.1	2.76	-1.89	0.17
Southern Africa	11.0	11.2	8.4	0.2	-2.8	-2.6	0.18	-2.50	-1.18
East Africa	6.4	6.4	6.4	0.0	0.0	0.0	0.00	0.00	0.00
North Africa	3.8	5.5	5.6	1.7	0.2	1.8	4.47	0.18	2.37
Average for Africa	5.46	6.00	5.22	0.54	-0.78	-0.24	0.99	-1.30	-0.22

t: tonnes

Table IX
Net imports of beef into Africa between 1978 and 1998, categorised by region

Region	Net imports (1,000 t)			Change (1,000 t)			Net imports as percentage of total availability		
	1978	1988	1998	1978-1988	1988-1998	1978-1998	1978	1988	1998
West Africa	40.0	39.3	13.3	-0.7	-26.0	-26.7	9.48	7.54	2.32
Central Africa	16.0	34.7	33.1	18.7	-1.6	17.1	11.76	16.37	13.91
Southern Africa	-107.0	27.7	-13.4	134.7	-41.1	93.6	-12.05	2.56	-1.30
East Africa	-136.7	-83.5	-89.6	53.2	-6.1	47.1	-17.73	-8.95	-7.37
North Africa	63.0	116.2	157.3	53.2	41.1	94.3	19.63	19.63	21.11
Africa total	-124.7	134.4	100.7	259.1	-33.7	255.3	-4.87	4.02	2.65

t: tonnes

consumption of animal products increased by 0.65% as real expenditure on animal food products increased. Increasing the price and the rate of urban growth in these countries would reduce the relative share of beef in the total consumption of animal food products by 0.14% and 0.2%, respectively.

In a similar study in the Central African state of Cameroon, Tambi (13) used an Almost Ideal Demand System model which incorporated habit formation with and without homogeneity imposed on the system to derive expenditure and uncompensated price elasticities for meat, milk and dairy products. For a 1% increase in per capita income, budget shares for meat and milk increased by 0.27% and 0.36%, respectively. The expenditure elasticities led to meat, milk and dairy products being classified as relative luxuries. Higher urban growth was also found to increase budget shares for meat significantly; a finding that was corroborated by Ingco (7), who also reported a positive association between urbanisation and expenditures on meat in Korea. In Nigeria, Nweke *et al.* (11) also fitted a Working-Lesser demand function, and found that

expenditure elasticities for meat varied from 1.62% for low-income households to 0.84% for high-income households.

The significance of these analyses to the present study is that the stagnation or decline in per capita consumption of beef corresponds to a continuous drop in per capita gross national product (GNP) in Africa. The annual growth rate of per capita GNP in Africa declined from 3.7% from 1975 to 1984 to 2.2% from 1990 to 1998 (Table X). Annual growth in per capita consumption also declined by about 1% between 1988 and 1998. Although differences exist in per capita GNP across the sub-regions, GNP growth slowed down in all of them. In southern Africa, per capita GNP declined between 1990 and 1998 and consumption also decreased. Central and North Africa showed a different pattern of change. In both these sub-regions, per capita GNP fell significantly but per capita consumption increased, suggesting that factors other than income might have fuelled the growth in consumption. In West Africa, growth stagnated in both per capita GNP and per capita consumption.

Table X
Growth rates for the human population, urban population and gross national product (GNP) per capita in Africa between 1975 and 1998

Region*	Average annual percentage growth rate						Gross national product per capita		
	Total population			Urban population			1975-1984	1985-1989	1990-1998
	1975-1984	1985-1989	1990-1998	1975-1984	1985-1989	1990-1998			
West Africa	2.8	3.0	2.8	6.2	5.5	5.1	2.0	3.3	2.6
Central Africa	2.6	2.9	2.7	5.2	4.7	4.3	2.7	1.0	0.5
Southern Africa	2.7	2.8	2.5	5.0	4.6	4.2	3.6	4.9	2.7
East Africa	3.4	3.3	2.5	6.9	6.0	5.1	4.5	3.2	2.1
North Africa	2.6	2.5	1.9	3.6	3.8	3.1	5.8	3.0	3.1
Total average for Africa**	2.8	2.9	2.5	5.4	4.9	4.4	3.7	3.1	2.2

* Sub-regional aggregations are as defined in Table IV. The sub-region of East Africa does not include the Seychelles and Mauritius in its GNP computations
Source: African development indicators 2001: drawn from World Bank Africa Database (16)

** Total averages have been rounded up to one decimal place

As was the case with per capita GNP, the slow growth in the urban population in Africa depressed the increase in the per capita rate of consumption. Africa has had the highest rate of population and urban population growth in the developing world. In the last two decades, the annual population growth rate averaged 2.7% while the urban population grew at 5% per year. Between 1985 and 1998 the growth rate in the urban population declined from 4.9% to 4.4% (Table X), which was consistent with the decline in per capita consumption.

Although meat prices in the developing world have declined between 23% and 35% over the past two decades (4), inadequate national data on beef prices in African countries make it difficult to establish the relationship between aggregate regional per capita consumption and price. For some African countries, however, the evidence on the impact of declining meat prices on increased consumption is mixed. In Uganda, for example, when the retail price of meat decreased in dollar terms by 8% between 1990 (725 Ugandan shillings (Ushs)/kg or US\$1.69) and 1994 (1,526 Ushs/kg or US\$1.56), total meat consumption increased by 37% from 97,000 t in 1990 (5). However, in Cameroon, when the retail price index (1978-1980 = 100) of beef dropped from 168 in 1985 to 139 in 1992, per capita consumption of beef also fell from 6.7 kg in 1986 to 5.8 kg in 1992 (12). Nevertheless, national data from Kenya also support the inverse relationship between beef consumption and price. Between 1988 and 1998, per capita beef consumption dropped from 10.4 kg to 8.8 kg as the real retail price of beef increased from US\$1.61 to US\$2.08 (10).

Conclusion

This study documents the patterns of change in beef production and consumption in Africa over the last twenty years (from 1978 to 1998). The authors used a 'decomposition' method to explain the effects caused by changes in herd size and off-take and productivity rates. The data used in the analyses were obtained from the FAO WAICENT database. The evidence suggests that there has been an overall increase in the

total beef production in Africa, even though total and per capita consumption have increased at a faster rate than production. The increase is largely explained by the overall increase in the total cattle numbers and cattle off-take rates, rather than by gains in productivity. However, other factors, such as environmental, political and other social effects (although these were not captured in the methodology used for analysis), could also have had an impact, either positive or negative, upon the observed patterns.

There were sub-regional differences in production and consumption patterns. For example, in West and East Africa, where more than 50% of the increase in beef production occurred, most of this was due to an expansion in cattle numbers rather than productivity gains. Most of the productivity gains occurred in North Africa, while Central and southern Africa experienced a decline in both productivity and off-take rates.

On the consumption side, the analysis indicates that Africa has evolved from being a net exporter to a net importer of beef, especially over the last ten years. The rate of beef consumption per capita has declined over the years, due principally to the faster rates in population growth, compared to the rate of beef production. Other factors, such as the consistent decline in per capita income and in the urban population, could also explain the observed trend. Although meat prices have decreased by 23% to 35% over the last two decades, it is difficult to establish the relationship between aggregate meat consumption and price, due to inadequate national data on beef prices in most African countries.

The preceding factors present a challenge to the growth and development of the livestock sub-sector. It will be crucial to observe how this sector responds to the needs of the vast majority of the rural African population, especially in the provision of food security.

Évolution de la production et de la consommation de viande bovine en Afrique

N.E. Tambi & O.W. Maina

Résumé

Les auteurs analysent les grands changements qui sont intervenus dans la production et la consommation de viande bovine en Afrique au cours des vingt dernières années. Ils ont recours à une méthode d'analyse de « décomposition » pour apprécier la part de la taille des troupeaux, de la proportion d'animaux abattus et de la productivité par animal dans l'évolution de la production totale de viande bovine durant cette période. Des agrégations sous-régionales sont complétées par des analyses similaires au niveau de chaque pays pour mettre en évidence la diversité des facteurs impliqués dans l'évolution de la production et de la consommation de viande bovine. Il ressort de cette analyse que :

- a) la production totale de viande bovine a enregistré une augmentation généralisée, qu'il convient d'attribuer principalement à un accroissement du nombre de bovins et du pourcentage d'animaux abattus plutôt qu'à des gains de productivité ;
- b) la production par habitant est en stagnation ;
- c) la consommation totale de viande bovine est en progression, sous la poussée de la croissance démographique et de l'urbanisation, alors que la consommation par habitant est en recul suite à la baisse des revenus par habitant.

Mots-clés

Afrique – Analyse de décomposition – Consommation de viande bovine – Effet de la taille des troupeaux – Effet des interactions – Effet des prélèvements – Effet des rendements – Production de viande bovine.



Modalidades de evolución de la producción y el consumo de carne de ganado vacuno en África

N.E. Tambi & O.W. Maina

Resumen

Los autores analizan los rasgos principales de la evolución que han sufrido en las dos últimas décadas los modos de producción y consumo de carne bovina en África. Utilizando un método analítico de 'descomposición', estudian las variaciones habidas en el volumen total de producción de carne bovina durante dicho periodo, atribuibles a su vez a los cambios en el tamaño de los rebaños, en la proporción de ejemplares sacrificados y en la productividad por cabeza de ganado. Los totales subregionales se complementan con análisis similares de varios países por separado, lo que pone de relieve las diversas modalidades con que han evolucionado la producción y el consumo de carne vacuna. Los resultados obtenidos ponen de manifiesto:

- a) un incremento general de la producción de carne vacuna (debido principalmente al crecimiento de la cabaña ganadera) y del porcentaje de ejemplares sacrificados, en lugar de un aumento de la productividad;

b) un estancamiento de la producción per capita;
c) un aumento general del consumo total de carne bovina y una caída del consumo per capita, que en esencia se explican, respectivamente, por la mayor tasa de crecimiento demográfico y de urbanización y por la caída de los ingresos per capita.

Palabras clave

África – Análisis de descomposición – Consumo de carne vacuna – Efecto de la extracción – Efecto de las interacciones – Efecto del rendimiento – Efecto del tamaño del rebaño – Producción de carne vacuna.



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