DAIRY MARKETING AND PRICING IN KENYA: ARE MILK SHORTAGES THE CONSEQUENCE OF DROUGHT OR PRICING POLICIES?

by

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ABSTRACT

In this paper, production, consumption, marketing and pricing of dairy products in Kenya are examined and discussed. It is argued that there are severe irrationalities in the pricing of dairy products and that these have become an important constraint on the industry. At a uniform price between locations, transport costs are hidden and there is excessive stimulation to production far from the consuming areas. At a uniform price between seasons, the far greater production costs in the dry season are not incurred so that dry season milk shortages (annually blamed on the drought) are now regular features. Wet season surpluses are in the meantime enormous, involving the necessity for substantial processing capacity that remains idle for a good part of each year. Large financial losses are incurred by the Kenya Cooperative Creamery (K.C.C.) in the flush season when twice as much milk must be purchased at the same uniform price. A large percentage of this milk is then used for manufacturing and sold at a net loss. An excessive consumer price for liquid milk is meanwhile maintained which severely inhibits the growth of milk consumption, especially among the poor who would derive the greatest nutritional benefit from increasing their consumption.

A large part of the additional supplies in the smallholder areas are going into local consumption. Only when local demand is met at the supply price to K.C.C. can the surpluses from these areas be expected in the formal market. At a seasonally uniform producer price the supply fluctuations between seasons are particularly severe from these areas.

An alternative milk pricing system is proposed that would recognise that neither the production costs nor the financial or social value of additional milk is uniform between seasons and locations. In this system a floor price would be paid for all seasons with an ex post additional payout depending on the proportion of milk intake that is sold as fluid milk.

DAIRY MARKETING AND PRICING IN KENYA

INTRODUCTION

Livestock accounts for some 30 per cent of Kenya's gross national product and about 8 per cent of the country's total export earnings. Of the livestock exports, dairy products constitute 24 per cent. In 1972, formally marketed milk amounted to 270 million litres valued at K£10.4m. Dairy exports earned K£3.8 million from exports of milk and milk products. As milk sold in the formal market was only an estimated 26 per cent of all milk produced in the country, dairying is undoubtedly an important agricultural industry.

Commercial milk production is dependent largely on grade[1] and exotic cattle (Bos taurus breeds) of which there were an estimated 416,000 mature cows in 1972, 485,000 in 1974, and are expected to be 625,000 in 1978. Ninety per cent of adult female cattle consist of the indigenous zebu, Bos indicus breed, that yield very little milk. They are principally important for subsistence in the pastoral and marginal areas, where they provide meat, milk and blood, hides and skins. Table 1 shows the estimated cow population by breed.

Table 1. Grade cow population by breed, 1974 mature cows.

Breed	'000	Per cent of total
Ayrshire	134	27.6
Guernsey	117	24.1
Friesian	105	21.7
Jersey	64	13.2
Zebu crosses	65	13.4
Total	485	100

Source: 9.

Of the mature grade cows 84.6 per cent are found in 12 districts: Meru, Murang'a, Kiambu, Nyandarua, Nyeri, Nakuru, Kericho, Trans Nzoia, Uasin Ghisu, Laikipia, Nandi and Kakamega. Table 2 shows the distribution of the dairy herd according to the type of producer. Although grade cattle population on smallholdingshas been increasing, the large-scale farm sector still accounts for about 60 per cent of all commercial milk production. The percentage of mature cows in the dairy herd is 58, 44 and 50 for large-scale, small-scale and settlement farms respectively, which gives a weighted average of 49 per cent for the national herd. Eighty per cent of the grade cattle population is located

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1. The term 'grade' refers to any bovine animal with distinct dairy characteristics, but at least of F2 characteristics or higher.

in the high potential areas. In the smallholder areas, improved cattle are steadily replacing unimproved types. At present 32 per cent of the cows in smallholder areas are cross-breeds.

Table 2. Kenya grade cattle by type of farmer.

Type of Farmer	Thousands head	Per cent share
Large-scale	164	33.8
Small-scale: grade	140	28.9
zebu crosses	65	13.4
Settlement schemes	116	23.9
Total	485	100

Source: 9.

Most of the milk produced in Kenya is consumed by the farmer or sold in the local markets, with only perhaps 50 per cent of the milk produced by grade cattle and 2 per cent of the milk produced by the zebu herd reaching the formal (commercial) marketing system. In 1970, an estimated 75 per cent of all milk produced in Kenya was consumed on the farms on which it was produced.

ESTIMATION OF MILK PRODUCTION

To reach some milk production figure, most authors use estimates of the number of dairy cows and multiply by some average presumed production per year. In most Districts, reports stating numbers of dairy cows are not based on survey results, but are instead guesses, hopes or projections from some known or estimated baseline. Projections, furthermore, frequently show steady increases in the number of grade and zebu animals from year to year despite the fact that the area may be maximally stocked or even overstocked to begin with (at least given current management levels); i.e. carrying capacities are not taken adequately into account. Estimates of numbers of dairy animals may also take into account A.I. figures, calving intervals and mortality estimates but these too may be quite inaccurate. There undoubtedly is an increase in the number of grade dairy animals - almost a population explosion in some areas, but even here, most figures are estimates on which little reliance should be placed. An example of the dearth of information is the 1972 I.B.R.D. sponsored study of the availability of dairy breeding stock. It projected that dairy heifers for sale to smallholders would be in excess by 1973, while in fact the opposite was the case.

The estimation of production per animal is equally problematic. There is a wide range of possibilities in terms of milk yield, depending only partially on genetic endowment, and equally or even more so on management and feeding practises. In any case, the actual production per cow is certainly far lower than the potential and, especially amongst less experienced farmers, also much lower than the economically optimal production level. There are many reasons for this: the main reason relates to feeding practises - poor or inadequate grazing with little or no supplement, no steaming up so that animals start their lactations in poor condition, and no provision for dry season feeding. (Reference will shortly be made to the dry season fall in production. It should be noted here that it is perfectly possible to maintain production levels in the dry season, but that the costs of doing so are enormously higher than in the rainy season.) Other reasons include late first pregnancies, long calving intervals, random calving not timed to take advantage of the rains, inadequate culling, i.e. keeping cows to advanced age and failing to select out unproductive ones, and the failure to upgrade the stock by using the best genetic material available. Low grade bulls are used in some 60 per cent of the grade herd that is not covered by artificial insemination. In some cases, production may be consciously limited for lack of a market for the surplus, especially in the more remote areas.

Estimates of total production from various sources vary quite markedly. In computing Table 3, the Ministry of Agriculture makes the following assumptions: the number of mature grade dairy cows was 320,000 in 1968, and increased, with some fluctuations, to 449,000 in 1973. The yield per cow per year was 1,340 litres in 1968, steadily increasing to 1,491 litres by 1973. (The actual yield per cow may instead be decreasing according to other sources with the rapid upgrading of zebu stock and the higher proportion of grade animals on farms that are relatively poorly managed. See Kenya Development Plan, p. 248.) The number of zebu cows was 3.383 million in 1968, increasing to 3.707 million in 1973, with each animal producing an estimated 120 litres per year over and above that taken by the calf.

Then assuming a grade dairy herd increase of 5.3 per cent a year and a per cow yield increase of 32 litres per year, the total milk production would increase from 739.6 million litres in 1974 to 1,133.6 million litres in 1980.

De Jong (Economic Planning Division, Ministry of Agriculture) assumes much lower production figures. His estimates are given, for comparison,

in Table 4. He assumes that the average cow on a small-scale farm produces 516 litres per annum; on a settlement farm a grade cow is assumed to produce 730 litres and on a large-scale farm 1,133 litres, giving an overall average production of 855 litres per year. This gives an estimated production of 376 million litres by the grade cow herd in 1973/74 in contrast to 669.5 million litres using the other assumptions. Obviously, the paucity of data on Kenya cattle populations and their productivity is a significant problem in the planning process.

The current total milk production estimates of the Kenya Ministry of Agriculture are those given in Table 3. They are broken down by grade and zebu animals and among large-scale, small-scale and settlement farms in Table 4.

Table 3. Total milk production in Kenya (million litres).

	1968	1969	1970	1971	1972	1973
Total grade cow milk produced	428.8	455.9	499.4	550.8	606.9	669.5
Total zebu cow milk produced	406.0	414.4	422.9	430.0	437.4	444.9
TOTAL	834.8	870.3	922.3	980.8	1044.3	1114.3
Grade cow milk as % of total	51.4	52.4	54.1	56.2	58.1	60.1

Source: Ministry of Agriculture.

CONSUMPTION AND MARKETING

The predominant marketing agency, with a virtual monopoly on the formal dairy products market, is the Kenya Co-operative Creameries (K.C.C.). It normally handles an estimated 25 per cent of total milk production and 96 per cent of all milk passing through known commercial channels. The K.C.C. is a commercial company, and it is also a producer co-operative. In 1968 it had 1,469 supplying members (1,254 individuals and 215 cooperatives). This has grown to a current (1975) total of about 5,500 suppliers (3,096 individual member suppliers, 294 cooperatives and 2,000 to 2,500 'temporary member' suppliers). The only other milk processors are the Mariakani Milk Scheme at the Coast and various other small producers who are licensed to sell milk in isolated rural areas.

Table 4. Estimated distribution of grade cattle and milk production.

	LARGE-SCALE		SMALL-SCALE		SETTLEMENT		NOT ALLOCATED		TOTAL
	No.	%	No.	%	No.	%	No.	%	
Number of grade cows	177,000	39.2	159,000	35.3	114,000	25.3	950	0.2	450,950
Amount of milk produced (million litres)	207	55.1	82	21.8	83	22.0	4	1.1	376
Rural supplies (million litres)	31	27.7	41	36.6	38	33.9	2	1.8	112
Factory supplies (million litres)	176	66.7	41	15.5	45	17.0	2	0.8	264

Source: 1, p. 3.

The retail prices from this marketing system and the prices that it pays to farmers are controlled by Government. These prices are analysed later.

There have been a number of efforts to control the monopoly powers of the K.C.C. but a powerful lobby has been built up and these efforts have not been successful. In 1965 the Kibaki Commission Report recommended, inter alia, that the K.C.C. be nationalised into a Dairy Commission with powers to organise and control the whole industry, with consumer interests also represented, but this proposal was defeated in Parliament. In 1970-71, an official Dairy Working Party was set up to examine, among other things, the pricing policy and competitiveness of the dairy industry. The members of the Dairy Working Party saw their duty as being to "formulate a pricing and marketing policy for the dairy industry that would encourage the growth of the industry in the 1970s in the national interest". Interesting debate took place among academics, producer interests and the K.C.C. While the working party was sitting, the K.C.C. announced the abolition of independent dairying on F.A.O. (Tentoni) recommendations. This was justified on the grounds of improved hygiene, as the milk supplied by the K.C.C. would be pasturised, and lower distribution costs. The former system of distributing milk to the consumers through dairies was replaced by a new rationalised system of distribution direct to retailers, and the monopoly position of the K.C.C. was further entrenched. The middlemen were eliminated, but so was the competition, so that marketing costs were not necessarily reduced nor efficiency increased. The economists on the working party eventually resigned on the grounds that economic issues and consumer interests were being ignored in considering structural and pricing policies for the industry.

The statutory authority set up to govern the industry, the Kenya Dairy Board, has similarly made a number of efforts to rationalise the pricing system and exert some control over the K.C.C. Thus far these efforts have not been successful. The Dairy Board initially came into being at the instigation of the K.C.C., principally for the purpose of controlling non-K.C.C. distributors of dairy produce. With the virtual abolition of the non-K.C.C. distributors, the role of the Dairy Board has been little more than that of an observer. The only authority it has had are licensing and other powers over the diminutive private retailers outside of the main urban centres. (Even here, the Board encounters considerable difficulty so that the control of unlicenced retailers is virtually non-existent.) Political considerations, particularly among producers, and the requirement that the K.C.C. maintain financial viability in the face of the given producer price, have thus been the principal bases for pricing in the industry.

The net effect of the structural and pricing policies that currently exist is that there are enormous inefficiencies in the processing and marketing system which eventually raise the fluid milk price to the consumer. The effect of this is to reduce consumption of fluid milk to a lower level than it would be otherwise, particularly among poorer consumers. (The dietary implications of this are obvious.) More milk thus has to go into manufacturing where the realised price per litre of milk is a very great deal lower. The losses involved in manufacturing milk, and in maintaining a very substantial capacity to do so (a capacity that is only utilised at the peak of the flush season) must again be re-couped from sales of fluid milk. (The pricing issue will be discussed in more detail in a later section of this paper.)

Table 5 gives a quantitative picture of milk intake and utilisation by the K.C.C. in recent years. Total milk intake has seen a steady increase in recent years with some dropping off in intake in 1974. (Preliminary estimates for 1975 are that intake is unlikely to grow substantially from the 1974 figure.) It is possible that besides factors such as the changing composition of farms in the country, weather patterns, increased costs of production and so forth, the drop-off is a result of a decline in the real price of marketed milk (relative to the prices of other products) and a consequent increase in rural consumption.

The 1974-78 Development Plan projects that marketed milk production will increase from 270 million litres in 1972 to 400 million litres in 1978 for a 6.8 per cent growth rate per annum. The increase in production, the Plan states, will be entirely through a rapid increase in the number of dairy cattle. The "strategy is attractive because it is extremely easy to increase the size of the national dairy herd through upgrading stock using artificial insemination, while raising productivity through a combination of breeding and management is much more difficult and costly". There are reasons to suppose that the Plan projections may not materialise. Surplus dairy cattle for sale to small-holders are not as plentiful as was envisaged in 1972, and the levels of management and nutrition required for efficient milk production may have been underestimated. Indeed, K.C.C. milk intake has not yet come back up to 1972 levels.

The K.C.C. sales in Kenya have shown a steady growth of around 8.8 per cent in recent years. The 1973 liquid milk sales were up by 54.6 per cent above the 1968 level. For the manufactured products, whole milk products have recorded a growth rate of 18 per cent per annum and skim milk powder 23 per cent per annum over the 1970-72 period. With the abolition of the quota and

Table 5. K.C.C. milk intake utilisation (million litres).

Year	Liquid milk intake	Butterfat intake: milk equivalent	Total intake	Liquid sales in Kenya
1968	129.6	79.8	209.4	69.7
1969	141.2	68.9	210.1	76.7
1970	172.1	51.0	223.1	85.1
1971	195.4	18.6	214.0	89.8
1972	248.4	16.0	264.4	97.6
1973	265.6	9.0	274.6	103.8
1974	240.0	6.4	246.4	115.7
Average annual % change 1971-1974	8.1	-28.9	5.7	8.8

Source: Kenya Dairy Board.

Liquid milk exports	Total liquid	Liquid milk intake for manufactures	Liquid sales as % of total liquid intake
16.8	86.5	43.1	67
13.7	90.4	50.8	64
9.6	94.7	77.4	55
9.3	99.1	96.3	51
18.3	115.9	132.5	46
29.9	133.7	131.9	50
33.0	148.7	91.3	62
56.8	14.5	2.1	7.6

contract system in 1971, the proportion of milk received by the K.C.C. as liquid increased sharply. The greater proportion received as liquid milk (higher average price for milk received) led to a sharp decline in the percentage of liquid milk intake sold as liquid milk and a severe financial squeeze on the K.C.C. The K.C.C. did not, furthermore, have the necessary capacity to handle all the flush season milk. In the Kitale and Eldoret areas in 1972, for instance, milk was skimmed and simply poured away. Partly as a result of the wide seasonal fluctuations in the use of that capacity, the K.C.C. estimates a net revenue loss for virtually all items sold except liquid milk. A substantial profit must then be made on liquid milk sales to subsidise losses incurred in the production of other products and thus help preserve K.C.C.'s financial viability. In 1974 a fortuitous combination of the decline in milk intake, the growth of local liquid sales and substantial exports to Uganda raised liquid sales to 62 per cent of liquid intake and allowed K.C.C. recoup its earlier losses and go substantially into the black.

Tables 6 and 7 give the intake, utilisation and sales projections used for the current Development Plan.

The pattern of consumption of dairy products in Kenya is not easy to document except for sales through the formally organised marketing system (see Table 8). The vast majority of these sales have been in the urban areas, with Nairobi and Mombasa taking about 50 and 20 per cent respectively.

A more detailed breakdown of exports of dairy products from Kenya is given in Table 9. The principal markets have been the other East African partner states, with milk sales - mainly to Uganda - showing spectacular growth. Payment problems and trade impediments, however, make a reliance on these markets somewhat risky. (As with everything else, these states are eager to develop their own dairy industries. Uganda had expected to phase out milk imports altogether by 1970.) Export sales outside the Community are generally undertaken only at a financial loss. Kenya is not, at current prices, a successful competitor with New Zealand and other significant dairy exporters. Neither can she afford the costly subsidies of dairy exports that some more developed countries engage in.

Just as cattle are valued by most traditional societies in Kenya, milk and milk products are highly valued and, when available, are regularly consumed throughout the country. At the same time, milk may be considered something of a luxury food, and consumption is restricted because of the relatively high

Table 6. Sales projections for the dairy industry, 1973-78.

UTILISATION OF MILK	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	Increase per annum
1. Liquid Milk (1000 litres per day)							
- Sales in Kenya	2[illegible].2	321.7	354.0	385.3	416.7	452.1	+ 9.2%
- Sales to Uganda & Tanzania	44.6	50.0	50.0	42.0	42.0	42.0	- 1.2%
- Sales outside E.A.C.	1.3	8.4	9.8	11.1	12.2	13.6	
Sub-Total (1000 l. per day)	337.1	380.1	413.8	438.4	470.9	507.7	+ 8.6%
Sub-Total (1000 l. per year)	123,000	1[illegible],700	151,000	160,000	171,900	183,300	
2. Whole Milk Products (1000 l. per year)							
- evaporated	16,200	21,800	23,700	25,200	26,800	28,200	+ 11.7%
- powder	26,300	31,100	35,100	39,800	43,500	45,900	+ 11.8%
- cheese	4,500	5,400	6,200	7,000	8,100	9,300	+ 15.6%
- condensed	260	280	290	300	320	340	+ 5.5%
Sub-Total E. Africa (1000 l. per year)	47,260	58,580	65,290	72,300	78,720	83,740	+ 12.1%
- cheese exports (outside E.A.C.)	160	200	260	330	370	450	
- powder exports (outside E.A.C.)	1,000	1,300	1,580	1,120	1,410	1,700	
Sub-Total (1000 l. per year)	48,420	60,080	67,130	73,750	80,500	85,990	) + 12.2%
Sub-Total (1000 l. per day)	132.8	164.6	133.9	202.5	220.5	235.4	
3. Skim Milk Products (1000 l. per year)							
- powder	37,700	40,650	42,650	46,150	50,000	54,100	
- condensed) and butterfat	520	550	600	600	630	660	
- others)	5,100	5,200	5,300	5,300	5,400	5,500	
Sub-Total E. Africa (1000 l./year)	43,320	46,400	48,550	52,050	56,030	60,260	) + 6.8%
Sub-Total E. Africa (1000 l./day)	118.7	127.1	133.0	142.6	153.5	165.0	
4. Allowance for wastage (1000 l./year)	6,100	6,500	6,900	7,[illegible]00	[illegible],800	8,400	
(1000 l./day)	16.6	17.7	18.8	20.1	21.5	22.9	
5. Total Utilisation (1000 l./year	220,[illegible]0	251,680	273,580	293,100	31[illegible],230	337,950	) + [illegible]%
(1000 l./day)	605.0	689.5	749.5	803.0	866.4	923.9	
6. Intake of Whole Milk (1000 l./year	246,200	269,800	290,000	309,400	329,000	348,600	
(1000 l./day)	674.5	789.1	794.5	847.8	901.4	955.0	
7. Exportable Surplus (1000 l./year)	25,360	18,120	16,420	16,800	12,770	10,650	) - 9.6%
(1000 l./day)	69.5	49.4	45.0	44.8	35.0	29.1	

Source: Ministry of Agriculture.

Table 7. Intake and sales projections, 1972/73 to 1977/78.

A. SALES PROJECTIONS FOR BUTTERFAT & MILK	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78
1. Resources of butterfat (in 1000 kg.)						
a. Butterfat from supplies	450	360	280	250	210	170
b. Butterfat from separation	3,610	2,452	2,469	2,597	2,614	2,695
c. Butterfat from standardisation	1,160	1,680	1,760	1,900	2,050	2,200
d. Butterfat from whey	16	15	15	15	15	15
TOTAL available Butterfat	4,286	4,457	4,524	4,762	4,889	5,080
2. Requirements of butterfat markets (in 100 kg.)						
- butter market	2,760	2,880	3,000	3,120	3,240	3,380
- ghee market	1,180	1,270	1,370	1,490	1,610	1,740
- cream market	50	50	50	55	60	60
TOTAL Requirements	3,990	4,110	4,420	4,665	4,910	5,180
- shortage or surplus	+246	+347	+104	+97	-21	-100
(Surplus to be converted to butter, shortage to be deducted from ghee)						
B. SUMMARY PROJECTIONS INTAKE & SALES OF MILK(1000 l.)						
a. Liquid milk sales	123,000	138,700	151,000	160,000	171,900	183,300
b. Whole milk products	48,420	60,080	67,130	73,750	80,500	85,990
c. For separation (butterfat & skim milk product)	68,680	64,520	64,970	68,350	68,800	70,910
d. Allowance for wastages (2.5%)	6,100	6,500	6,900	7,300	7,800	8,400
INTAKE OF WHOLE MILK (TOTAL UTILISATION)	246,200	269,800	290,000	309,400	329,000	348,600

Source: Ministry of Agriculture.

Table 8. Consumption of milk and dairy products in Kenya, 1969/70 to 1974/75.

YEAR	CHEESE tonnes	BUTTER tonnes	MILK POWDER tonnes	GHEE tonnes	LIQUID MILK million litres	CASEIN tonnes	CONDENSED MILK tonnes	MALA MILK million litres	EVAPORATED MILK million litres
1969/70	290	2,151	2,809	421	81	14	n.a	n.a.	n.a.
1970/71	256	2,168	3,110	353	87	13	267	0.4	3
1971/72	307	2,216	3,258	390	92	11	217	1.8	4
1972/73	312	2,142	3,693	442	95	14	178	2.2	5
1973/74	309	2,191	2,915	532	108	15	153	0.9	4
1974/75	267	2,210	3,629	469	112	1	20	little	3

Source: Kenya Dairy Board.

Table 9. Dairy Products Exports, 1968 - 1974.

	CHEESE tonnes	BUTTER tonnes	MILK POWDER tonnes	GHEE tonnes	MILK million litres
1968	210	2,140	943	451	17
1969	209	1,624	1,221	257	14
1970	197	1,596	2,310	327	10
1971	96	891	1,641	180	9
1972	324	2,399	3,900	359	18
1973	557	2,463	4,410	265	30
1974	267	1,742	1,273	155	33

Source: Kenya Dairy Board.

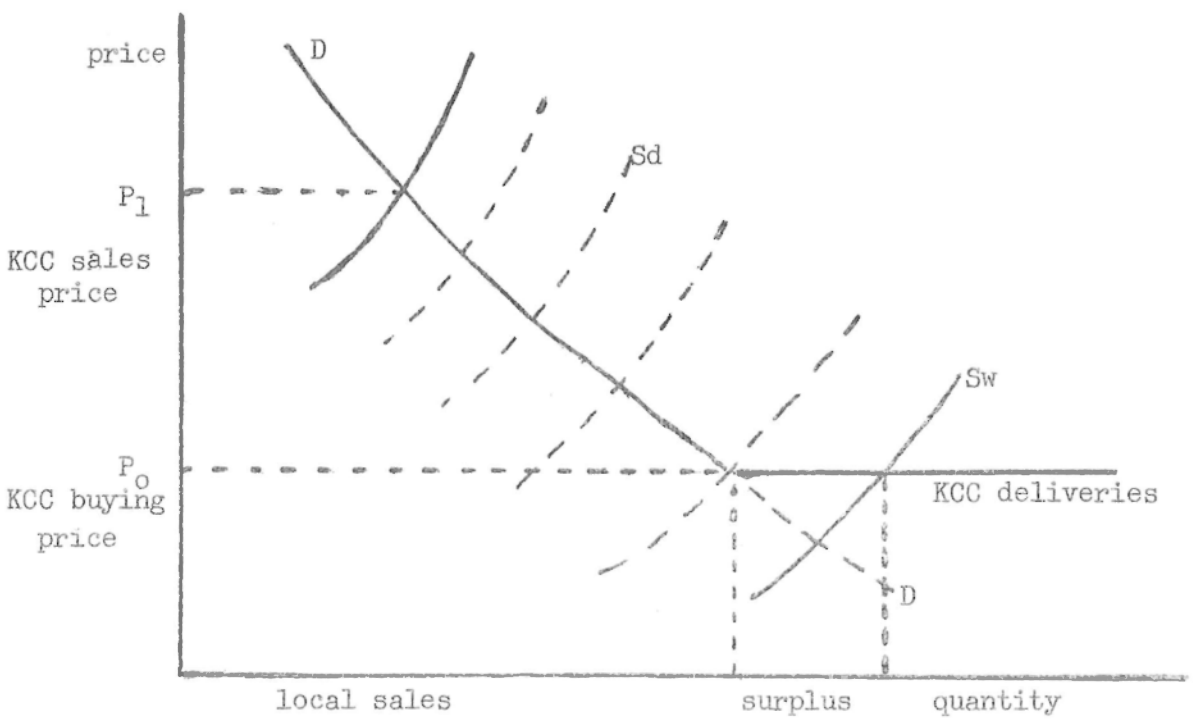
price of milk in both formal and informal markets. In his interpretation of the Nutrition Survey, 1964-1968, Radetzki concluded that almost half of the rural households studied did not consume milk on any regular basis.

Income elasticity figures are difficult to derive but are clearly related (inversely) to income, so that a given percentage increase in income will lead to a far greater percentage increase in milk consumption if people are currently too poor to satisfy their demand for milk. Among higher income groups, milk consumption is not constrained by income levels and increasing incomes are unlikely to lead to significant increases in demand (i.e. demand is inelastic). While income elasticity for milk in rich countries is considerably less than one (implying that per capital milk consumption grows more slowly than incomes), there is little doubt that in Kenya it is substantially greater than one. If one assumes an elasticity of 1.2 and a growth in per capita income of 3 per cent, the growth in demand for milk explainable by increased incomes is 3.6. per cent. If to this is added the growth in demand explainable by a population growth rate of 3.3 per cent, then the estimated growth rate for the demand for milk is nearly 7 per cent. This does not take into account factors such as increased availability, decreased price, changes in the population distribution, tastes, and so forth. When these are taken into account the expected growth in demand may be higher. Commercial milk sales have in fact shown a growth rate of 9 to 10 per cent per annum. This undoubtedly reflects the high urbanisation rates in Kenya and perhaps the more rapid growth of urban incomes.

Much of the increased production of milk in recent years has clearly gone into home consumption and informal local marketing channels. Especially in the small-farm areas where grade cattle are a relatively recent innovation, as yet little milk is exported . The main mechanism that seems to be at work as production increases in the small-farm areas is a price decline from the price at which K.C.C. sells to the price at which K.C.C. buys fluid milk. Milk in these low-income communities has a very substantial price elasticity of demand (i.e. for a percentage decrease in price the percentage increase in milk consumed in high), and large production increases are absorbed by local consumers as milk becomes increasingly available and the price declines. The nutritional and welfare implications of this consumption increase are considerable.

When milk is scarce, consumers tend to come to the dairy farmers with their bottles. As production increases in an area, the farmers must take a more aggressive sales approach. At this point, if not before, the farmers tend to form 'societies' or marketing co-operatives. In the dry season these societies generally dispose of all their milk locally (except where the local market is insignificant), but the K.C.C., of which they may be members, provides a floor price, P in Figure 1, and when surpluses develop they are sent to the K.C.C. At first deliveries to the K.C.C. are strictly seasonal and in some areas they are likely to remain so. This can be represented by a shifting supply curve S_d. The local sales are more lucrative than the surplus, S, which is delivered to the K.C.C. S_w represents the wet season supply. Even in areas where a permanent surplus is produced, however, the K.C.C. tends to remain the residual buyer with local demand, D, met first at something of a premium price.

Figure 1. Smallholder milk marketing.



According to this consumption and marketing model, in areas where the local price for milk is considerably higher than the price obtained from the K.C.C. (i.e., the price paid out minus the transport costs of delivering the milk to the nearest factory or creamery), then increases in production can be expected to be marketed locally until the price is driven down to the K.C.C. floor price. For instance, the only active dairy co-operative in Murang'a District, Kiriti, does not deliver any milk to the K.C.C. at all during the dry season of January, February and March. The co-operative cannot even meet the local demand in Murang'a town, so it 'imports' milk from co-operatives in Nyeri.

The implication of having a relatively fixed local demand which is met before supplies go to the K.C.C. (with deliveries to the K.C.C. drying up altogether at times) is that percentage fluctuations in K.C.C. milk deliveries are very much greater than fluctuations in overall production. (If 15,000 litres per day are produced in one season and 11,000 in another and all are delivered, the increase in deliveries from the dry to the wet season is 36 per cent. If the same production fluctuation takes place but a delivery of 10,000 litres to a local market is maintained throughout, the change in K.C.C. deliveries between the dry and the wet season is 400 per cent.) This issue will be discussed further when we consider the question of the producer price for milk.

The K.C.C. is currently paying Shs.4.25 per gallon (Shs.0.93 per litre) for milk supplied to them. This includes the November 1975 producer price increase of Shs.0.50 per gallon (11 cents per litre). A survey of Livestock Officers from eighteen of the country's dairy areas, asking them to estimate the dry season and the wet season informal market milk prices, is tabulated in Table 10. While these estimates are not necessarily reliable, they are made by officers resident in the areas concerned. It will be seen that only two of the areas have an estimated dry season milk price that is below the K.C.C. producer price.

If the consumption and marketing model outlined above is correct, those areas where the local milk price is below the supply price to K.C.C. (i.e., the price obtained from K.C.C. minus the transport costs of delivering the milk to the nearest factory or creamery) can be regarded as being 'saturated' with milk for local consumption (at that supply price). Those areas where the local price is significantly higher than the supply price to K.C.C. can be expected to absorb considerable additional supplies as production increases and the price goes down to the K.C.C. producer price. Only when the price is

Table 10. Estimates of local milk prices in several dairy areas of Kenya.

Area*	Dry Season Price per gallon	Wet Season Price per gallon	Average Price per gallon
Nyeri	-	-	7.20
Kiambu	7.20	6.00	4.50
Kirinyaga	5.40	4.20	4.60
Murang'a	5.40	4.30	4.50
Tigoni	8.00	5.50	6.50
Embu	6.00	5.40	5.70
Machakos	6.00	3.00	4.00
Kitui	10.00	10.00	10.00
Kirangop	4.80	4.80	4.80
Naivasha	7.20	7.20	7.20
Nakuru	5.40	5.40	5.40
Eldoret	4.20	3.50	3.80
Kericho	4.80	4.20	4.50
Sotik	4.80	4.20	4.50
Nandi	4.80	3.60	4.20
Kisii	3.50	2.80	3.00
Kakamega	6.00	4.80	5.40
Busia	6.00	-	5.40

* The area sometimes corresponds to a District, sometimes it does not.

Source: Estimates made by the Veterinary Department Livestock Officers (A.I.), compiled by the authors.

driven down to that floor price can an area be expected to start sending supplies to the K.C.C. The K.C.C. is, in other words, the buyer of the residual surplus once the local market is satisfied at the K.C.C. producer price.

Milk pricing

The prices paid for fluid milk at K.C.C. creameries and factories, and the prices of K.C.C. marketed fluid milk, are given for the years since 1966 in Figure 2.

Prior to July 1970 there were announced prices for milk supplied under pool I (quota), pool II (contract), and pool III (for separation) categories. Pool I implied a farmer's obligation to supply a given volume of milk every day of the year and the K.C.C.'s reciprocal obligation to purchase that amount every day of the year. Farmers qualified for a quota by supplying milk continuously throughout the dry season, i.e.from January 1 to April 30. If a farmer's deliveries fell below his quota for a certain length of time, he was penalised by a permanent reduction of his quota. The amount of contract milk purchased by the K.C.C. was subject to the dairy industry's requirements for manufacturing, but the farmer was also allowed more flexibility in that his deliveries could fall 25 per cent below his contract without penalty. The announced prices were not uniform throughout the country, but varied widely according to distance from the principal consuming areas. As Table 11 shows, there was a premium of 35 cents per gallon in the Nairobi area, 20 cents in Kisumu and 65 cents in Mombasa. In 1966/67 there was an announced price of Shs.1.80, 1.30 and 0.90 per gallon (Shs.0.396, 0.286 and 0.198 per litre) for pool I, pool II and pool III milk respectively. The average payout for pool I and II was Shs.2.67 and for pool III Shs.1.29, with an overall average payout of Shs.2.05 per gallon (Shs.0.45 per litre) for all milk received. This average payout is the price shown in Figure 2 for the years up until 1970. The figures from July 1970 give the uniform price paid for all milk received by the K.C.C. With respect to the consumer milk price, there was a de facto change in price when a switch was made from pint to half-litre packaging in July 1971, another rise in price in 1972 and two price increases in 1975.

The quota system in operation prior to July 1970, was a method for maintaining supplies of milk in the dry season by paying the farmer a higher price for a given quantity of milk that had to be supplied daily throughout the year, or the quota was forfeited. In effect a farmer was rewarded for maintaining his quota in the dry season by receiving a higher price for milk even in the flush season so that he had a strong incentive to maintain production even when this was done at a loss. While quotas are a fairly common

Figure 1. KCC milk prices.

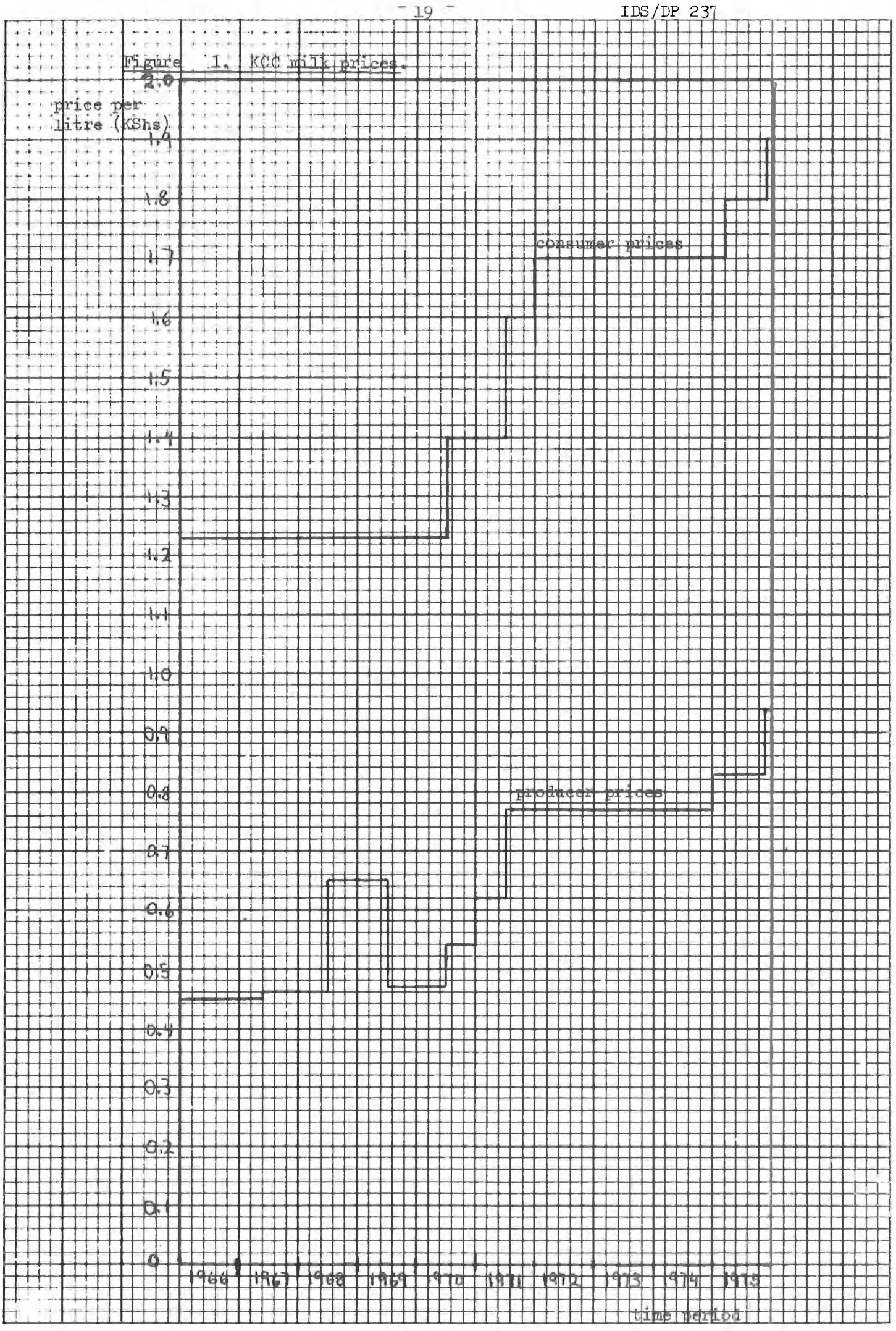


Table 11. K.C.C. milk payout prices, May 1968.

		Quota	Contract	Separation
ELDORET, NAKURU	Basic Price	1.90	1.90	1.00
AND NAIVASHA	Quota Premium	.50	-	-
	Total for Month	2.40	1.90	1.00
THOMPSON'S FALLS	Basic Price		1.90	1.00
	Less Transport		.20	.20
	Total for Month		1.70	.80
NAIROBI, INCL.	Basic Price	1.90	1.90	1.00
THIKA	Quota Premium	.50	-	-
	Geographic Premium	.35	.35	.35
	Total for Month	2.75	2.25	1.35
KISUMU	Basic Price	1.90		
	Quota Premium	.50		
	Geographic Premium	.20		
	Total for Month	2.60		
KERICHO	Basic Price	1.90	1.90	1.00
	Quota Premium	.50	-	-
		2.40	1.90	1.00
	Less Transport	.20	.20	.20
	Total for Month	2.20	1.70	.80
MOMBASA	Basic Price	1.90	1.90	1.00
	Geographic Premium	.65	-	
	Special Premium	.50	-	
	Past. & Delvy. Allowance	.45	-	
	Additional Payment	-	-	
	Total for Month	3.50	1.00	

method of maintaining off-season supplies, the problem in Kenya was that most of the quota suppliers were large established farmers (mostly European) with the effect that they were seen to be getting a higher price for their milk than the smaller less established African farmers who supplied contract milk or milk for separation. While quota suppliers earned a higher basic price plus a 50 per cent premium for the proportion of their sales used as fluid milk, producers with no quota received 22 cents per litre (Shs.1.00 per gallon) delivered to the factory. Indeed, for the small producers who marketed their milk through co-operatives, it was not unusual for the net farm price to be as low as 11 cents per litre (50 cents per gallon). The quotas were, of course, worth money and were, infact, traded at a substantial price per gallon. Thus distribution of whatever quotas were available was based on the ability to pay for them as well as on the ability to maintain milk supplies. The other problem was that some of the newer, less experienced farmers who bought quotas had difficulty filling them in the drought and consequently lost them. The quota system had a further disadvantage in that the quantity for which a high price was paid was fixed; there was no incentive for the efficient producer to improve his methods of production and increase his output once his quota objectives were met. The system thus tended to freeze milk output when there was a need for substantial expansion. The quota system eventually became a bone of contention and was abandoned in July 1970 in accordance to the recommendations of the Tentoni (F.A.O. advisor) Report and the Kibaki Commission.

Quotas were replaced by a new pool pricing system involving a guaranteed minimum price of 46 cent per litre. (Shs.2.10 per gallons) plus a bonus based on amount realised by the K.C.C. from the sale of liquid and processed products. All producers received an increased return, except perhaps those who had been selling large quantities of quota milk. The producers were enabled to share more equitably in the relatively more remunerative liquid milk sales.

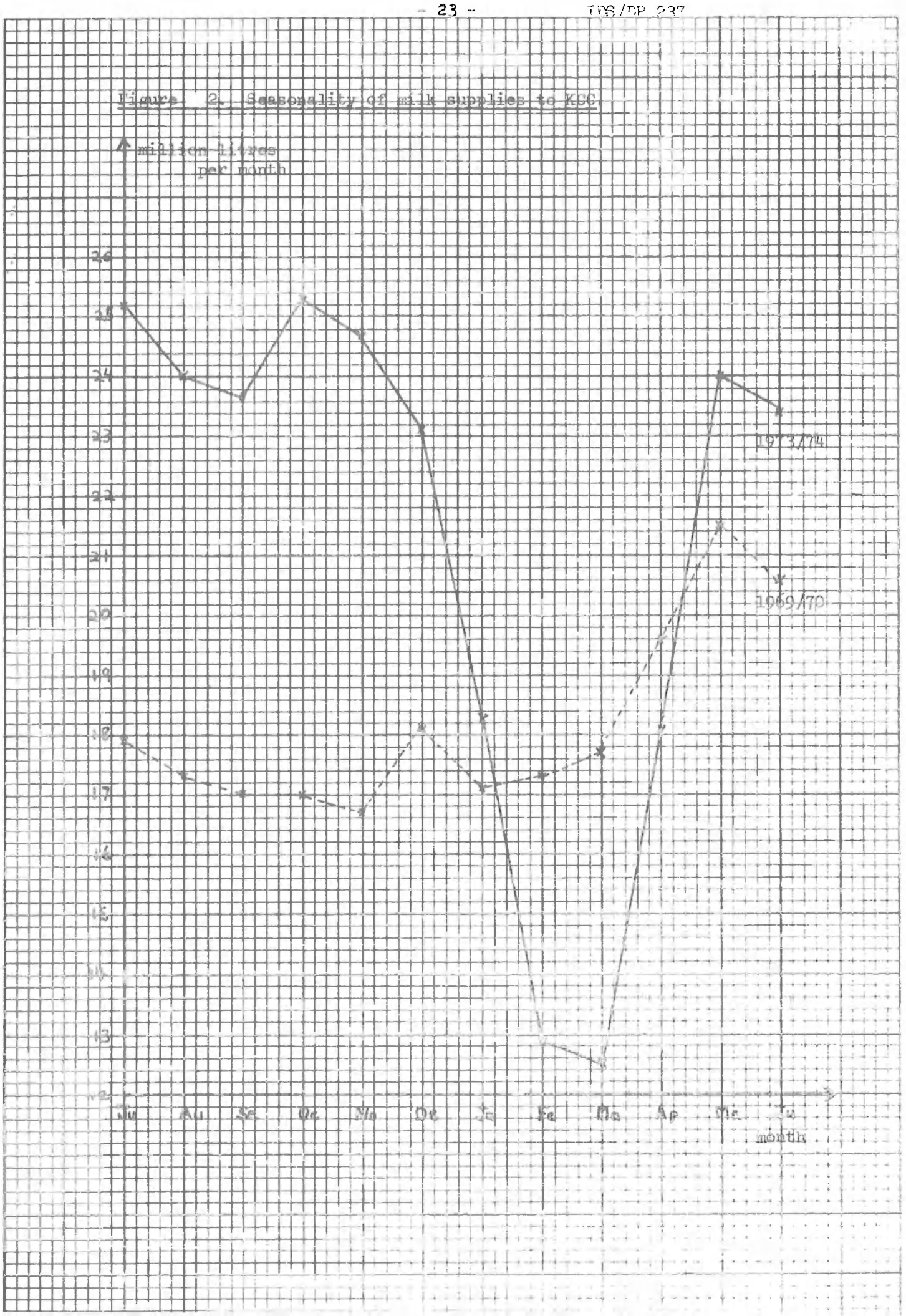
Since July 1971 the K.C.C. producer price has been set by presidential decree. In that year a factory door price of 77 cents per litre (Shs.3.50 per gallon) was set. This represented a boost of about 45 per cent which was such an enormous increase that substantial supplies were stimulated in the flush season. The boost in price also led to milking beef cows which had implications for beef output. Stolz notes that because of the favourable price of milk, and also partly in order to increase land productivity, former beef ranches are shifting towards a combined milk and beef production system. He further notes that these beef ranches only produce milk during the flush season when grass is available, thus further aggravating the seasonality of milk output.

Table 12. Seasonality of milk supplied to K.C.C. (milk and butterfat intake in milk equivalent, litres).

	1969/70		1970/71		1971/72		1972/73		1973/74	
MONTH	p.m. mill.	p.day '000	p.m. mill.	p.day '000	p.m. mill.	p.day '000	p.m. mill.	p.day '000	p.m. mill.	p.day '000
July	17.9	577	20.6	665	22.5	726	25.0	806	25.2	818
August	17.3	557	19.1	616	22.2	716	25.5	823	24.1	777
Sept.	17.0	566	17.8	593	22.0	733	23.3	777	23.7	790
Total 3rd quarter	52.2	567	57.5	625	66.7	725	73.8	802	73.0	793
Oct.	17.0	550	18.2	587	22.2	716	23.6	761	25.3	816
Nov.	16.7	557	17.4	580	20.3	677	25.8	860	24.7	823
Dec.	18.1	584	16.6	535	18.7	603	27.8	897	23.1	745
Total 4th quarter	51.8	563	52.2	567	61.2	665	77.2	839	73.1	795
Jan.	17.1	552	14.8	477	19.0	613	25.4	819	18.3	590
Feb.	17.3	618	12.3	439	17.6	607	21.0	750	12.9	461
Mar.	17.7	571	10.2	329	19.2	619	21.6	697	12.5	408
Total 1st quarter	52.1	579	37.3	405	55.8	613	68.0	756	43.7	486
April	19.6	653	9.9	330	15.6	520	16.7	557	18.1	603
May	21.5	694	17.8	574	19.1	616	20.7	668	24.0	774
June	20.6	687	20.6	687	23.7	790	24.1	803	23.4	780
Total 2nd quarter	61.7	678	48.3	531	58.4	642	61.5	676	65.5	720
Whole Year	217.8	597	195.3	535	242.2	662	280.5	768	255.2	700

Source: Kenya Dairy Board, 1975.

Figure 2. Seasonality of milk supplies to KCC



The requirement that the K.C.C. purchase all supplies offered at that price brought about a major financial crisis (involving a net loss of about K£ 800,000) which has only eased as a result of increased demand for fluid milk and short fall in production because of drought in two consecutive years. The recent producer price increase from Shs.0.80 per litre (Shs.3.75 per gallon) to Shs.0.93 per litre (Shs.4.25 per gallon) is undoubtedly going to set the process of excess wet season supply and accumulated losses in motion again. Informal estimates put the anticipated deficits resulting from the price increase at Shs. six million per annum.

SEASONAL FLUCTUATIONS AND THE LOCATION OF PRODUCTION

Predictably, the seasonal fluctuations in milk supplied to the K.C.C. increase markedly with the introduction of a uniform milk price. Table 12 gives monthly milk intake figures for the K.C.C. between 1969/70 and 1973/74. The increase from the lowest monthly intake to the highest monthly intake was 28.7 per cent in 1969/70. In 1973/74 the fluctuation was much greater, with a 102.4 per cent increase in intake from the lowest month to the highest. The intake fluctuation for the two years is illustrated in Figure 3. For the highest month the intake is markedly higher in the latter year, but for the lowest month it is 4.2 million litres lower. This is what should be expected with a uniform price between seasons and no incentive to maintain supplies in the off-season. The uniform price is clearly too high for the flush season, but too low for the dry season when costs of production and the value of additional milk are both a great deal higher. It implies an interseasonal subsidy, i.e.dry season production subsidising production in the flush season.

GEOGRAPHIC AND SEASONAL EFFECTS OF A UNIFORM MILK PRICE

It is, in our view, completely clear that the existing K.C.C. pricing structure in which a uniform price is paid for milk regardless of the location of the receiving point and regardless of the time of year, is in urgent need of review.

The uniform price paid in different parts of the country has the effect of hiding the transport costs involved in supplying milk to the consuming areas. The consequence is that, rather than encouraging the economically optimal location of milk production in the country, the most distant producers are given too great an incentive and those nearest the consuming areas too little. The total cost of milk reaching the main consumption centres therefore differs widely according to where it was produced. The K.C.C. currently employs

a fleet of large tankers to transport milk from the more distant milk supplying areas, and this very substantial cost is not reflected in a lower price to producers in those areas. Production in the more remote areas, therefore, receives excessive stimulation and production in the areas where the hidden transport costs are either non-existent or a great deal less receives inadequate stimulation. Areas near the main markets are thus subsidising the areas that are more remote.

Processed milk products as such as cream, butter, cheese and dried or condensed milk incur far lower transport costs per unit of milk, but the realised price per litre is considerably less when milk is used to produce these products. Rational pricing systems for milk are complex, but if whole milk is being transported to an urban centre such as Nairobi, the value of milk at any given distance from Nairobi is the Nairobi price minus the cost of transporting the milk to Nairobi. Let us suppose that a single price, P_N, is established at the market centre (Nairobi) and that transfer costs T (d) are known. The price at the farm, P_f, would be equal to the market price minus the appropriate transfer cost, which is also a function of the distance from the market T (d);

$$P_f = P_N - T\ (d)$$

In economic terms, surplus milk produced far from consuming centres has a lower value and therefore the establishment of processing facilities in those locations is justified as long as adequate supplies are forthcoming so that processing facilities can be large enough to benefit from economies of scale. Processing reduces the physical bulk of the product and enhances its value, making it suitable for long distance transportation. (Transporting raw milk costs about ten times as much as transporting butterfat.) Such processing facilities are bound to operate at a loss if a high price is paid for the milk, just as the marketing system must sustain a loss if high priced whole milk must be transported long distances to consuming areas.

The K.C.C. creameries around the country are organised on a national basis in the interest of efficiency so that they can specialise in the manufacture of particular products. According to this national organisation, no differences in producer or consumer prices are determined on a geographical basis. However, there is certainly an economic case to be made for differential producer and consumer prices based on the existence of surplus and deficit areas and transport costs. In determining the price paid to the producer, a premium might be paid for milk supplied to creameries where there is a large demand and where up to now considerable quantities of milk have had to be 'imported' from other creameries, often over rather large distances.

The second clearly irrational element in the milk pricing system is its uniformity between seasons, to which reference has been made. The chronic surpluses in the flush season and the chronic deficits in the dry season that characterise milk supply in Kenya are a direct and inevitable consequence of this pricing policy. As shown in Figure 4, producing milk in the rainy season, when grazing is abundant and has high nutritional value (which is represented by supply curve Sw) is a very great deal cheaper than producing milk in the dry season when grazing is scarce and of low nutritional value (represented by supply curve Sd). Stated another way, it is more expensive to produce an additional kilogram of milk in the dry season than in the flush season, or the marginal cost in the dry season (MC_{dm}) is higher than in the wet season (MC_{fs}) — $MC_{dm} > MC_{fs}$

Figure 4.

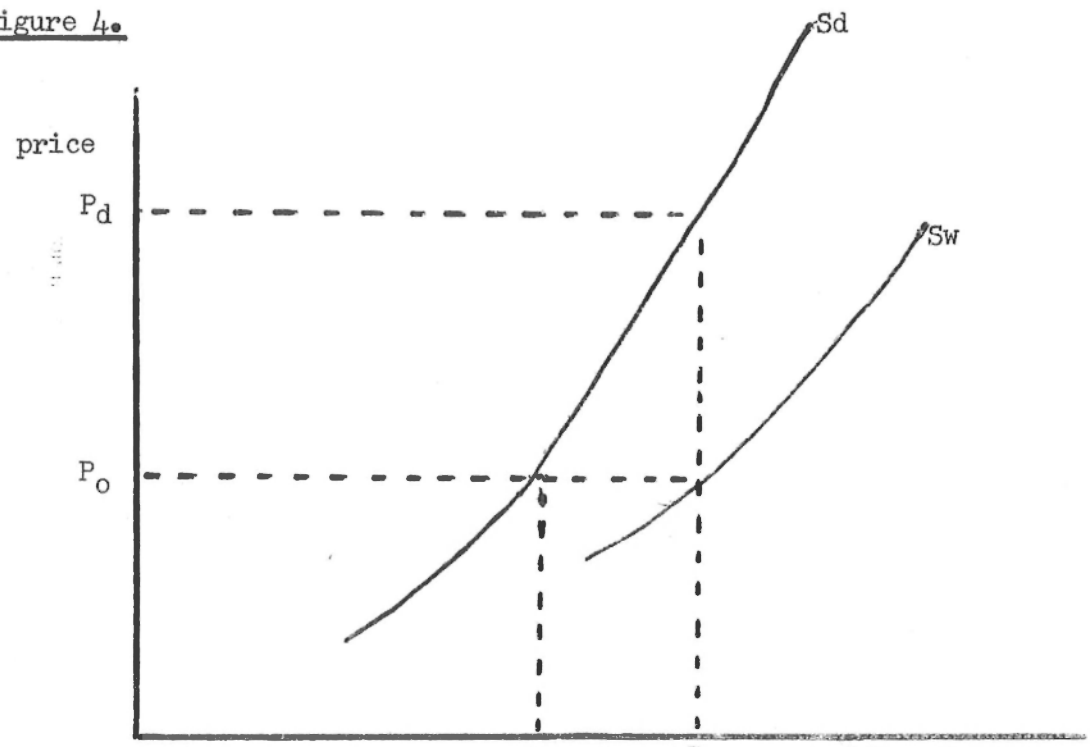
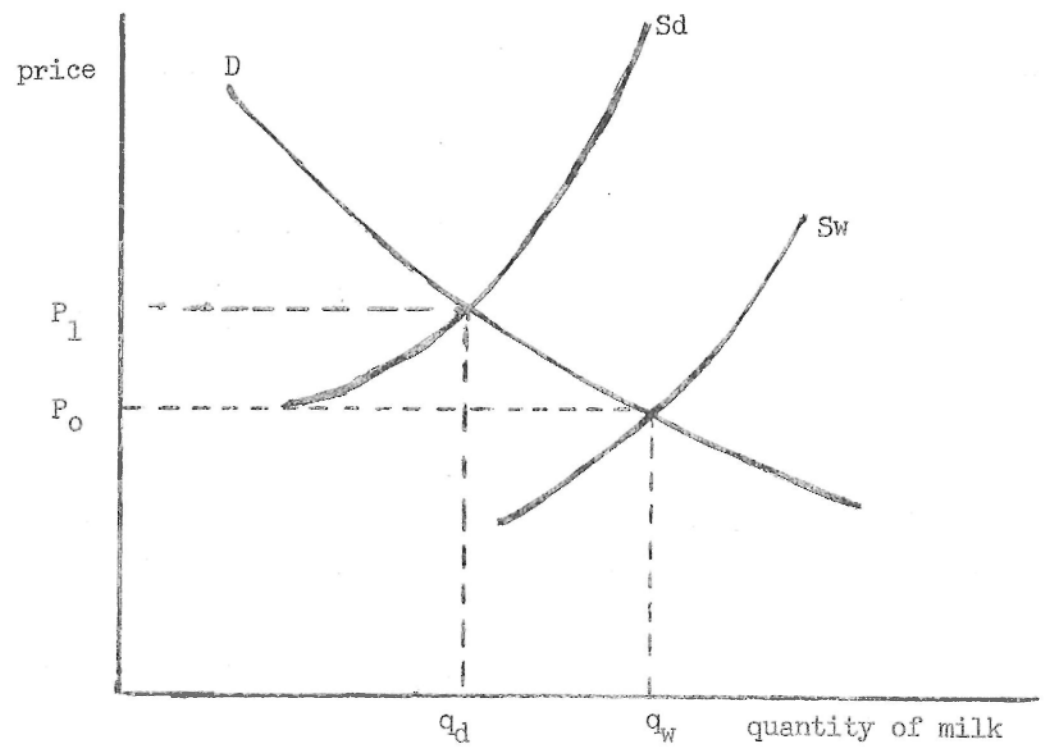


Figure 4 shows that for the same price (P_o) a larger quantity of milk (q_w) will be produced in the wet season than in the dry season (q_d). If farmers are to be encouraged to produce the larger quantity in the dry season, a higher price (P_d) would have to be offered. As it is now, a rational farmer's response to a uniform milk price is likely to be to calve seasonally, concentrate milk production in the flush season and aim to dry off his cows when it is expensive and difficult to provide them with the necessary feed to maintain yields. Year after year the dry season fluid milk shortages are

blamed on drought as if a dry season were an annual surprise. They are, to repeat, the predictable result of a uniform price, given the fact of seasonal rainfall variations.

We can now extend Figure 4 to include demand dimensions. In economic terms the value of additional milk (value of marginal product) in the two seasons is markedly different because the demand for milk does not show the same pattern of seasonality as the supply. (There is only a slight increase in the demand for liquid milk in the dry season.) Figure 5 shows the flush and dry season supply curves (S_w and S_d) and the demand curve (D-D). In the absence of controls, the consumer price for milk would fluctuate between P_0 and P_1 to reflect the different supplies in the wet and dry seasons.

Figure 5.



The situation that actually exists in Kenya is shown in Figure 6. The uniform producer price offered by the K.C.C. is too low to encourage production of the market clearing quantity (M) in the dry season, and too high in the wet season. A deficit (A) and a surplus (S) are realised in the dry and wet seasons respectively.

	Shs. per litre	(per gallon)
Liquid milk	1.02	(4.64)
Whole milk products	0.58	(2.64)
Milk for separation	0.50	(2.27)

Source: 1.

The KCC's own estimates are that a net loss is made with ten of the fourteen products they produce, with only fluid milk being a significant source of net revenue.

In the dry season, not only could the fluid milk market absorb additional supplies (as indicated by the milk shortages that are now becoming an annual phenomenon), but the entire stock of equipment for processing milk products is substantially idle. There are some costs of this processing facility that are dependent on the throughput of the factories, but there are very substantial costs which are incurred whether or not the capacity is being utilised. The problem is that the capacity of the processing facilities must be capable of handling the peak output of the wet season, so the extreme seasonality of the supply necessitates investment in capacity that may be only utilised for short periods during the year.

The earlier intention of the K.C.C. was to raise the price off season milk by paying producers a floor price throughout the year with a bonus on the basis of an ex poste monthly realised price for milk; if a larger proportion of the milk went into the whole milk market the realised price would be greater and those who produced milk in that month would receive more. The 1971 political announcement sharply raising the price of milk, resulted in adequate (for that time) dry season supplies and large excesses in the flush season. The dry season premium was thus abandoned, and since then a uniform price has been paid regardless of seasonal shortages or seasonal excesses in supply.

The result is that while enormous costs are imposed by the extreme seasonality of production, the producer pricing system is further encouraging that seasonality. Unless the price structure is changed, furthermore, the amplitude of the seasonal fluctuations is likely to increase. As described earlier in small-holder areas the price of milk sold locally is generally more attractive than the K.C.C. price, so that the K.C.C. provides a floor

price at which only surplus milk, over and above the total consumed locally at the supply price to K.C.C., will be sold. Management practices are such that considerable onfarm seasonality is to be expected, so that milk supplies marketed from many areas may, and often do, dry up altogether in favour of local consumption in the dry season, while very large surpluses are brought onto the market in the rainy season.

The position of the K.C.C. in this situation is untenable. They are required to purchase all milk supplied to them regardless of whether or not it is financially appropriate. In general, large losses are made in the flush season when a large proportion of milk purchased must be processed and sold at a loss. In the dry season huge financial gains are made as virtually all milk is sold as whole milk at a high price, but during this time the very considerable processing facilities, necessary to handle the peak of flush season supplies, lie idle. An excessive consumer price for milk is maintained and is deemed necessary to recoup the losses incurred in handling flush season supplies. This high consumer price markedly curtails consumption and forces the K.C.C. to put milk into unprofitable processing channels. In the meantime pressures from farmers, who are themselves incurring substantial dry season losses, call for raising the milk price merely to cover their costs. In the context of a uniform price policy, this would worsen the flush season over-supply. Clearly what is needed is a recognition that neither production costs nor the value of additional milk supplies is uniform between seasons. Milk supplies can be maintained in the dry season, but only at a substantially higher production cost. To stimulate such production, higher dry season revenues are necessary for farmers.

In terms of proposals, the quota system, with its obvious problems and inequities, should not in our view be re-introduced. The pricing system that we would recommend is a floor price for all seasons with an ex poste additional payout depending on the proportion of milk intake that is sold as fluid milk. When milk is scarce, and a high proportion of milk is sold as fluid, the total price received by the farmer would then be high. In the flush season the price would move down towards or to the floor price which should be the weighted average realised price for the milk products sold in that season, net of all processing and handling costs. Just as with any other perishable, locally-consumed commodity with seasonally fluctuating costs of production, the price would then vary by season depending on the production costs and factors of supply and demand. It is possible that the consumer price for milk could vary also to raise consumption in the flush

season, and reduce the need for manufacturing capacity to handle seasonal excesses in supply, but even if the consumer price does not vary the producer price should. A further case can be made for a lower milk price for consumers on the grounds that this would bring new, more marginal consumers into the market with marked benefits for nutrition and for the long-run expansion of the more lucrative market for liquid milk.

It is clear that a dry-season bonus should be paid to the producers. As with other perishable commodities, farmers would then be given an off-season price stimulus to incur the greater costs of production and increase the quantity supplied in the off-season. Fresh market prices would not, as a consequence, have to be paid for milk that was to be used for manufacturing. The price of fluid milk to the consumer could then be reduced, and the financial viability of the K.C.C. maintained.

It is, incidentally, essential that the payout to farmers be on the basis of a clearly stipulated, well understood formula relating prices to K.C.C. milk intake and fluid milk sales. This formula should be subject to regular review, perhaps six-monthly, but at least yearly. In view of the monopolistic and monopsonistic structure of dairy marketing (i.e. there is only one buyer of milk to be exported from a District, and effectively only one seller to urban consumers), the discretionary element in price setting must not be in the hands of the K.C.C. alone. Only in this fashion will the lobbying and political pressures on milk prices be reduced (or at least balanced out, with both producers and consumers being represented). When there are milk shortages or when all milk purchased by the K.C.C. is sold as fluid milk, the price paid to the farmer should rise up to the consumer price for milk less whole milk handling and processing costs. When milk intake is surplus to the fluid milk market requirements, the price paid to farmers should take account of that surplus. The realised price per litre in the sale of that milk as milk products, net of the full costs incurred in the manufacturing process, would then be reflected in a weighted average payout price to farmers for that period. The final payout price to farmers would then exhibit a marked seasonal fluctuation and this would reflect the wide seasonal differences in both the cost of production and the value of additional milk supplies.

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