

AN ECONOMETRIC ANALYSIS OF CONSUMER DEMAND FOR SUGAR IN TANZANIA

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I. SUGAR AND FOOD BALANCE SHEET

SUGAR is one of the most important sources of food energy in human diet. This is more so for most African countries whose diet consists of as much as about 80 per cent carbohydrates in sharp contrast to 45–50 per cent consumed by the developed countries [7]. Table I compiled from the food balance sheet of FAO [3] shows the percentages of carbohydrates consumed in 1977 from various commodity sources by economic regions.

The figures for Africa show that in 1977, starchy food comprising cereals, roots and tubers, pulses, nuts, and oilseeds make up to 76.1 per cent of the total intake of 2,205 calories per capita per day, oils and fats provide 7.2 per cent, and complementary food items consisting of sugar, vegetables, fruits, and milk 11.8 per cent of which about 4.5 per cent is the share from sugar (including sugar products) and honey. The corresponding figures for regions with developing market economies (to which Africa belongs) show the dominance of starchy food items in the regions' food baskets. The dietary differences are even more prominent if a comparison is made with developed market economies comprising North America, Western Europe, Oceania, Japan, Israel, and South Africa. The total per capita daily intake in these regions is as much as 3,353 calories; only 33 per cent of this is derived from staple foods, 15 per cent from oils and fats, and more than a quarter (27 per cent) from complementary food items, sugar alone accounting for about one-half of it, namely, 13.2 per cent. It is reported, for instance, that sugar consumption in the United Kingdom in the year 1978/79 was about 50 kg per head per year which is about five times what it was in that country about a century ago [7]. In an article by Gorman [5], it is stated that the present-day diet of an average American consists of between 60–70 per cent fat and sugar, that sugar is consumed not only in the form of sweets and bakery products but in other prepared items like mustard, catsup, etc., and that since World War II, the consumption of soft drinks has gone up by 80 per cent. These striking disparities in the dietary patterns between the various regions arise partly from ecological and mostly from economic factors operating in these areas.

Table II gives the percentage relative changes between 1961–65 and 1977 in calorie intake from various food items over regions classified according to their level of economic development. A study of the table shows that over the period of fourteen years considered, the emphasis has shifted, in almost all parts of the world, from starchy foods toward oils and fats and complementary foods includ-

TABLE I
CARBOHYDRATES INTAKE IN 1977

(%)

Country/Region	Starchy Food Items	Oils and Fats	Complementary Food Items	
			Total	Of Which Sugar and Honey
Tanzania	70.3	4.9	17.0	3.6
Uganda	60.8	2.6	23.3	3.4
Kenya	72.9	3.5	16.0	8.2
Africa	76.1	7.2	11.8	4.5
Latin America	50.7	8.2	28.6	17.2
Near East	67.7	8.5	18.9	9.5
Far East	77.0	6.2	13.8	8.3
Developing market economies	70.5	7.0	16.8	9.5
Asian centrally planned economies	81.1	3.9	4.5	1.9
All developing countries	74.2	5.9	12.7	6.9
Developed market economies	32.9	15.2	26.6	13.2
East Europe and USSR	46.6	11.0	24.8	12.5
All developed countries	37.4	13.8	26.1	13.0
World	60.9	8.8	17.6	9.2

Source: [3].

TABLE II
CHANGES IN CARBOHYDRATES INTAKE BETWEEN 1961-65 AND 1977

(%)

Country/Region	Starchy Food Items	Oils and Fats	Complementary Food Items	
			Total	Of Which Sugar and Honey
Tanzania	12.5	47.9	1.2	10.5
Uganda	10.6	-3.7	-23.1	-38.5
Kenya	-4.8	59.6	8.1	30.7
Africa	-0.8	13.5	7.3	27.2
Latin America	-5.9	9.8	7.9	8.4
Near East	-5.0	16.7	11.8	37.0
Far East	-1.9	16.5	0.7	4.0
Developing market economies	-3.2	14.4	5.7	10.1
Asian centrally planned economies	-2.9	6.8	7.1	17.8
All developing countries	-3.1	12.7	6.7	12.0
Developed market economies	-14.1	8.1	2.7	7.8
East Europe and USSR	-17.4	14.4	18.1	25.1
All developed countries	-15.6	9.7	7.9	12.8
World	-4.1	6.7	4.1	10.2

Source: [3].

TABLE III
PER CAPITA CONSUMPTION OF SUGAR IN KENYA, UGANDA,
AND TANZANIA: 1966-70 TO 1979

Country	1966-70	1971	1972	1973	1974	1975	1976	1977	1978	1979
Kenya	14.1	18.3	17.4	19.1	19.0	18.7	14.4	16.7	19.9	17.2
Uganda	13.3	16.2	12.7	6.6	4.4	2.4	1.2	0.6	0.3	1.1
Tanzania	7.0	9.5	10.0	10.1	9.3	7.7	6.1	7.0	7.3	7.8

Source: [13].

TABLE IV
CALORIE INTAKE FROM SUGAR AND HONEY IN KENYA, UGANDA,
AND TANZANIA: 1967-70 TO 1977

Country	1967-70	1971	1972	1973	1974	1975	1976	1977
Kenya	7.0	8.1	8.4	9.0	9.2	8.2	7.0	8.2
Uganda	6.5	7.4	6.0	4.1	2.7	1.8	1.4	3.4
Tanzania	3.9	5.1	5.2	5.2	4.3	3.5	3.3	3.6

Source: [3].

ing sugar. In respect of calorie intake from sugar and honey, in particular, the developing and developed countries have increased this intake by 12 per cent and 12.8 per cent, respectively, in the above period. Considering the fact that the developing regions had a low consumption of 6.2 per cent of calorie from sugar in 1961-65 and that the developed ones had been consuming nearly double that percentage, namely, 11.5 per cent in the same years, the above increase by the former is considerable; it also points to the fact that the urge for sugar consumption (in direct or indirect forms) in the latter countries has not been satiated over time. We also see that although there have been seemingly large increases between 1961-65 and 1977 in calorie consumption from sugar and honey in countries of Near East, Africa, and centrally planned countries in Asia, Europe (East Europe), and Eurasia (USSR), a closer scrutiny shows that the calorie intake from sugar in these regions is meager in comparison to that of the developed countries.

Narrowing the discussion to the East African region, Tables III and IV give respectively the per capita sugar consumption and the per capita intake of calories per day from sugar and honey for the three countries of the region—Kenya, Uganda, and Tanzania.

As may be seen from Table III, the drop in the consumption of sugar for Uganda is very sharp and abrupt from being as high as 16.2 kg in 1971 to as low as 0.3 kg in 1978 from which it has picked up to 1.1 kg in 1979. The calorie intake from sugar shown in Table IV only reflects this phenomenon. Thus it is clear that from about 1971 until recently, a period during which Uganda went through great political turmoils, the sugar economy, like most others, suffered a serious blow.

On the whole, then, there is a definite trend for increased consumption of sugar by the three countries of the region. Excluding Uganda because of the

TABLE V
SUGAR PRODUCTION AND CONSUMPTION IN KENYA, UGANDA,
AND TANZANIA: 1951-64 AND 1964-79

Country	Growth Rates of Per Capita Production (%)		Growth Rates of Per Capita Consumption (%)		Per Capita Production (Kg)			Per Capita Consumption (Kg)		
	1951-64	1964-79	1951-64	1964-79	1951	1964	1979	1951	1964	1979
Kenya	4.1	11.6	2.1	2.7	2.3	3.9	20.1	8.9	11.6	17.2
Uganda	4.8	-0.9*	4.5	2.3*	9.3	17.1	15.0†	6.5	11.5	16.2†
Tanzania‡	23.5	0.7	5.3	1.9	0.4	6.2	6.9	3.0	5.9	7.8

Sources: [4], [13].

* Relates to the period 1964-71.

† Relates to the year 1971.

‡ Hereafter, Tanzania refers to the mainland only.

abnormal conditions just mentioned, Kenya and Tanzania (as Tables I and II show) have decreased the percentage of calorie intake from cereals and other starchy foods by 4.7 and 3.0 per cent over the period 1961-65 to 1977 even though the calories provided by these sources in 1977 are still as high as about 73 per cent in Kenya and 70 per cent in Tanzania out of the total of 2,166 and 2,066 calories respectively. While these percentages compare favorably with countries in the Far East (viz., 78.5 per cent), they stand out in marked contrast against the corresponding figure of 33 per cent obtaining for countries in the developed region. The decreases in calorie intake in Kenya and Tanzania from starchy and staple food items are compensated for by increases mainly from oils and fats and sugar and honey in that order. As a matter of fact, for the African continent as a whole (excluding South Africa), there is a distinctive shift from staple foods toward items like oils and fats and sugar; among the relative percentage changes in the calorie intake from various items, that for sugar and honey is the highest being 27.2 per cent.

II. A PERSPECTIVE OF PRODUCTION AND CONSUMPTION OF SUGAR IN EAST AFRICA

Prior to World War II, East Africa was a net exporter of sugar. This position has reversed since then, and it has become a net importer in spite of the fact that a large number of sugar factories have been set up in the region in the postwar period, and production of sugar considerably increased. This state of affairs has come about as a result of the growing realization of the importance of sugar as a source of energy and the overall economic development of the region.

Table V gives the annual compound growth rates of production and consumption of sugar over the periods 1951-64 and 1966-79 in the three constituent countries of the region. Although the rates of growth of consumption for the period 1951-64 have been lower than those of production in all the three coun-

tries, production has been falling behind consumption in Kenya and Tanzania as the per capita figures show. The gap between production and consumption has been particularly large in Kenya. In Tanzania, the installation of a new factory in 1962–64 resulted in production exceeding consumption in 1964 for the first time in the long stretch of period between 1951–64. It must be noted, however, that the per capita consumption in Tanzania was only slightly more than one-half that in Kenya or Uganda. Uganda differs from both Tanzania and Kenya in that its sugar production almost always exceeded consumption. It was the main exporter to Kenya and Tanzania and maintained a growth rate of 4.5 per cent per annum in respect of per capita consumption.

A time comparison of this historical development of sugar production and consumption in the three countries of the region can be made by referring to the corresponding figures relating to the period 1964–79. For Uganda, however, this period is restricted to 1964–71 for reasons stated earlier.

Some of the striking features of such a comparison are that Tanzania's growth rate of per capita domestic production has dropped to as low as 0.7 per cent per annum in the fifteen-year period 1964–79, and its growth rate of per capita consumption in this period dropped to nearly one-third of what it was in 1951–64. Whereas its per capita production showed a meager increase of 0.7 kg between 1964 and 1979, its per capita consumption has risen by 1.9 kg. In contrast, Kenya's per capita production has increased fivefold in the same period so much so that it has outstripped the per capita consumption in 1979.

These observations thus suggest that of the three countries of East Africa, Tanzania is the worst off in respect of sugar economy. It was therefore considered worthwhile to study closely some of the major factors affecting it. Such a study has some topical significance, too, for another related reason.

The government of Tanzania has recently raised the retail price of sugar from Sh 8.50 to Sh 10.00 per kg effective July 1981 [12]. Coming as this price rise did "in the wake of saddening story of sugar rotting in godowns," there had been serious objections to it from the members of the Parliament who "decried the practice of forcing consumer to pay higher prices to compensate for losses made by irresponsible institutions" [28]. Prior to the announcement of the price increase, it had been reported that about 620 mt of sugar were not available for consumption because of spoilage through moistening under poor storage conditions or due to wastage through spilling during transportation [29].

The foregoing tables and these recent events all point to the need for a careful and thorough examination of the various interrelated policy issues surrounding economy of the sugar industry in Tanzania. The first and the foremost of them is that of expansion of domestic production of both sugarcane and sugar and its short- and long-run effects on the commodity's international trade together with the associated social costs and benefits. The second relates to product pricing which would evidently include the whole gamut of questions regarding production costs, marketing and distribution costs, levies and taxes, and sugar prices in international markets. The third issue concerns matters relating to economically viable and operationally efficient marketing and distribution strate-

TABLE VI
SUGAR FACTORIES IN TANZANIA IN 1962

Factory (Location)	Region in Which Located	Capacity per Day (Mt)
Kagera	Northwest	6
Arusha-Chini	North	82
Valeska	North	6
Kilombero	East Central	58
Turiani	East Central	14

Source: [6].

gies including the transportation of the commodity to nodal centers within and between various consumer regions of the country. Finally, the most central question of all concerns the overall economic development of the country. In the final analysis, the sum total of these aspects as they relate to sugar, impinge upon its pattern of consumption. It is to this that the present study directs itself. Some of the wide-ranging questions outlined above are matters for extensive investigations and will only be touched upon where they relate to the issues at hand.

III. PRODUCTION AND CONSUMPTION OF SUGAR IN TANZANIA

Tanzania commenced its production of centrifugal sugar in 1936. The average output for the first three crop seasons covering the years 1936/37 to 1938/39 was 4,437 mt *tel quel*.¹ The five year production averages for the crop years between 1940/41 to 1960/61 were about 6,000, 8,000, 10,000, and 20,000 mt. These figures correspond to a steady increase of 6.6 per cent per annum in the period 1936 to 1960. This was partly due to an increase in the area under sugarcane and partly due to improved yields per hectare resulting from more irrigation.

In 1962, there were five factories operating in Tanzania which had a total capacity of 166 mt of sugar, which were distributed as shown in Table VI below.

In February 1974, the Sugar Development Corporation (SDC) was established under the Public Corporation Act of 1969. The main functions of the corporation are to develop and promote sugar industry in the country, to conduct or engage in the business of sugarcane growers and dealers and of sugar manufacturers, processors, importers, and exporters.

In 1976/77, there were once again five sugar factories in the country. These were set up by reorganizing and expanding the existing factories given in Table VI as well as by adding new ones in their vicinities. Table VII lists the factories, their location, capacities, and actual production in 1976/77 (for which year, the published records of the SDC were available) [10]. Of these five factories, the Tanganyika Planting Company, Ltd. is a privately owned factory, and the remaining four are subsidiary companies of the SDC which holds controlling shares.

¹ Refers to centrifugal sugar whose quality cannot be ascertained.

TABLE VII
SUGAR FACTORIES IN TANZANIA IN 1976/77

Factory	Location	Capacity (Mt)	Production in 1976/77 (Mt)	Capacity Utilization Rate
Kagera Sugar, Ltd.	Bukoba District Northwest Region	8,000	2,238	28.0
Tanganyika Planting Co., Ltd.	North Region	77,000	51,914	67.4
Kilombero Sugar Co.				
Factory I	Kilombero District, Morogoro	40,000	35,238	88.1
Factory II	East Central Region	45,000	11,612	25.8
Mtibwa Sugar Estates, Ltd.	103 km north of Morogoro	30,000	13,476	44.9
Total		200,000	114,478	57.2

Source: [10].

The five factories put together crushed a total of 114,478 mt of sugar in 1976/77, the average capacity utilization being 57.2 per cent. The three subsidiary companies of the SDC jointly contributed 55 per cent to the total production utilizing about 51 per cent of their total capacity. According to the 1976/77 annual report of the SDC [10], feasibility studies have been made for two more factory projects. A new factory—the biggest one in the country—has been set up in Bukoba District of Kagera in the Northwest Region, costing about Sh 600 million. The construction of the plant has been undertaken by Walchand Industries of India in 1978, and the trial operations are to commence at the end of 1981. When in full capacity, it will produce 250 mt of sugar daily. This can be expanded to crush 3,500 mt of sugarcane a day [11]. In 1979, the total domestic production stood at 123,105 mt of sugar.

As stated earlier, Tanzania consumes more sugar than it produces and makes good this shortfall through imports. In the sixteen years between 1964–79, it has been a net importer thirteen times. While the average net import in this period was 16,140 mt, they varied widely from 300 to 29,000 mt. The proportion of imports to total supply (i.e., domestic production + imports – exports) also shows large fluctuations and is the highest in the four years 1971–74 being 21.75, 36.19, 29.22, and 21.6 per cent respectively. In 1975, Tanzania commenced participation in the Lomé Convention which is an aid and trade agreement between the EEC and the ACP (Africa, Caribbean, and Pacific countries). Under the convention, Tanzania has a basic export quota of 10,000 mt to the EEC. For the first time in the long period of 1964–79, Tanzania was a net exporter in 1975, the proportion of net exports to total supply being 18.62 per cent.

IV. CONSUMPTION OF SUGAR AND FACTORS AFFECTING IT

In Sections I and II, we have examined the pattern of sugar consumption in

TABLE VIII
 PERCENTAGES OF PRIVATE CONSUMPTION EXPENDITURE
 ON SUGAR IN TANZANIA: 1964-75

Year	PCE on Sugar to That on Total Food	PCE on Sugar to Total PCE	PCE on Sugar Met Out of Imports
1964	3.4	1.7	2.7
1965	4.0	1.8	6.9
1966	3.6	1.7	6.4
1967	3.4	1.7	4.0
1968	3.8	1.9	5.0
1969	3.3	1.6	3.8
1970	3.3	1.7	3.5
1971	4.3	2.2	17.8
1972	5.0	2.7	31.5
1973	5.7	2.9	31.6
1974	3.9	2.1	30.7
1975	1.7	1.0	0.7

Source: [21].

Tanzania from the point of view of calorie intake and per capita physical quantities consumed. We now compare these patterns with that of the private consumption expenditure (PCE) on sugar as reported in [21].

At the aggregate level, the PCE on sugar during the period 1964-75 (no published data are available beyond 1975) ranges from 2 per cent to 6 per cent of the total food expenditure and from 1 per cent to 3 per cent of the total PCE. The smaller variations present in these percentages are perhaps to be expected since the extent of aggregation required to construct these figures as a part of the national accounts tends to mask the differential effects of some of the important determinants affecting consumer demand for sugar. The most notable feature of Table VIII is that in 1971-74, the PCE on sugar met out of imports is very substantial ranging from 18 to 32 per cent in comparison to 3 to 7 per cent in the earlier years.

It is interesting to compare these time series data with those obtained from the family budget studies using the cross-section data collected from specific regions of the country at selected points of time. They reveal some of the distinguishing characteristics pertinent to consumption patterns such as those arising from rural-urban, or agricultural-nonagricultural dichotomies, as also from various socioeconomic groups, household sizes, and so on, most of which get averaged out in the aggregate data as in Table VIII and referred to earlier. Although the budget data collected in Tanzania have been few and infrequent, yet they serve as a useful alternative to Table VIII. The results available in this respect have been compiled from various published sources and are summarized in Tables IX and X.

Table X shows in a condensed form the results from a nation-wide household budget survey conducted in 1969 covering a wide spectrum of socioeconomic groups in the rural-urban areas and agricultural-nonagricultural sectors.

TABLE IX
PATTERN OF SUGAR CONSUMPTION FROM SELECTED FAMILY BUDGET STUDIES

Survey Period	Survey Area	Socioeconomic Characteristics of Respondents	Sample Size	Per Household		
				Total Monthly Expenditure (Sh)	Percentage of Food Expenditure to Total Expenditure	Percentage of Expenditure on Sugar to Total Expenditure
A 1956-57	Dar es Salaam	African laborers*	22	126.24	65.11	8.54
B June 1961	Bagamoyo	No specific group†	49	22.35	82.93	3.58
C Sept. 1961-Aug. 1962	Morogoro	No specific group†	125	18.83	49.12	4.53
D Sept. 1961-Aug. 1962	Bagamoyo	No specific group†	36	28.50	81.56	3.36
E March 1963-May 1963	Dar es Salaam	Civil servant‡	44	723.51	31.96	3.86

Sources: [14] for A and E; [16] for B; and [15] for C and D.

* Mostly unskilled laborers with an average monthly income of Sh158.

† Middle grade African civil servants within salary ranges between Sh 670 and 1,670 per month.

‡ But mostly belonging to rural community.

TABLE X
HOUSEHOLD EXPENDITURE ON SUGAR BY REGION

Total Expenditure Categories (Sh per Year per Household)	Number of Household Budgets Analyzed		Average Expenditure per Household (Sh/Year)		Percentage of Food Expenditure to Total Expenditure		Percentage of Expenditure on Sugar to Total Expenditure	
	Rural	Urban	Mainland	Rural	Urban	Mainland	Rural	Urban
≤ 999	844	4	848	697	620	696	66.4	65.8
1,000-1,999	1,100	14	1,114	1,388	1,321	1,387	61.6	53.2
2,000-3,999	524	45	569	2,594	2,915	2,619	50.9	45.4
4,000-5,999	116	33	149	4,521	4,451	4,505	46.0	42.3
6,000-7,999	33	22	55	6,657	7,487	6,984	39.7	35.5
8,000-9,999	9	10	19	8,633	7,628	8,095	20.8	30.3
10,000-24,999	9	22	31	11,683	22,040	11,933	27.6	13.5
25,000≤	2	6	9	31,208	23,296	25,450	9.6	22.5
Total/Average	2,637	156	2,794	17,000	7,466	1,945	53.7	26.8
				49.9	3.3	5.9	3.5	1.8
				1.8	1.6	1.8	1.6	1.8

Source: [18].

The agreement between the two percentages of sugar expenditure to food and to total in Tables IX and X and the corresponding ones in Table VIII with the exception of those observed in the survey of 1956–57 reported in Table IX is remarkable. In spite of this, they expose some of the important differences too, particularly the ones in Table X. For instance, while the urban consumer's expenditure on sugar (relative to that on total food) is more or less the same (about 6 per cent) irrespective of his income (total expenditure serving as a proxy to income), that of the rural consumer shows a clear tendency to increase with his income; this is reflected for the mainland as a whole as a result of the dominance of the rural households; also, the rural household's share of this item to the total food expenditure ranges between one-third to two-thirds that of the urban household. Tables IX and X demonstrate the well-known inverse relationship that exists between the percentage of expenditure on food items and total income as formulated in "Engel's law."

As we have seen in Section I earlier, the shifts over time from staple and starchy foods to complementary items like sugar are, by and large, related to the economic development of various regions of the world tempered, of course, by sociocultural factors like customs, traditions, habits, and so on. Economic development, in general, connotes rise in per capita (real) income and the attendant overall improvement in the infrastructure of the region. The relative percentage increase in sugar consumption between 1964 and 1979, as we have noted earlier, is as much as 10.5 per cent in Tanzania. In the same period, the country's per capita disposable income rose at the rate of 9.9 per cent per annum. Given the low level of about 6 kg per head of sugar consumption in 1964 and the rise in income above-mentioned, the consumer response in Tanzania toward a commodity like sugar is typical of countries having low-income and underdeveloped economies in that it is most often one of the first food items (excepting those meant for subsistence production) to be favored by income rise. This is also clearly revealed in Tables IX and X, particularly so in the latter.

Another factor which crucially determines the consumer demand for sugar is its price. How responsive is this demand to price changes in developing and underdeveloped countries? This question is taken up later specifically in the context of Tanzania. Suffice it to say here that while temporal shifts in the structure of the sugar industry are influenced by changes in its pattern of consumption resulting from rising income, knowledge as to how and by how much the demand for a "luxury" food item like sugar responds to price changes is vitally important to policy makers in socialist economies who could use this significant information in framing appropriate price policies and in effecting suitable price controls.

As in most countries of the world where sugar prices have been moving up in keeping with the general postwar price trends, the retail price of sugar in Tanzania too, has been on the increase. The annual rate of increase was 19.9 per cent during 1964–79 in comparison to 1.9 per cent during 1951–64. Again, Tanzania is no exception to the general phenomenon observed in a growing number of countries, namely, that over a period of time, the price of sugar has

been subject to increasing government/administrative regulations. Also, the large differences between the ex-factory and retail prices of sugar in various years are attributable to government revenues through sales tax and excise duties as well as to the margins allowed to the SDC toward its marketing expenses and reserve fund. Table XI gives the extent of uneven price spread obtained in certain specific periods.

The table shows that in the periods when the ex-factory price accounted for 45 per cent or more of the retail price, 35 to 50 cents of a shilling paid by the sugar consumer has been shared between the government and the SDC leaving about 6 to 10 cents to be divided between the wholesale and retail traders. Even in the two periods November 1974 and March 1975 when the ex-factory price was as low as only about 23 per cent to 28 per cent of the retail price, the consumer did not get any price relief since the government and the SDC together collected as much as 60 to 70 cents of a shilling paid by the consumer. Also, it may be seen from the table that while the price has been rising rapidly over the years, the traders' margin increased from about 6 per cent in 1972 to about 10 per cent in 1981.

V. SUGAR CONSUMPTION AND ITS RELATIONSHIP TO A PRICE-INCOME COMPOSITE MEASURE

In the next two sections, we explore the possibilities of constructing quantitative relationships for sugar consumption in Tanzania. The period covered is 1964-79. At the aggregate level, the two most dominant variables that shape the consumer demand for sugar over time are, as we have seen earlier, the price of sugar and the income of the consumer.

In this section, an attempt is made to relate the consumption of sugar C_t to a nonmonetary composite measure [6] which combines the retail price of sugar P_t and the disposable income Y_t , all observed at the time point, t . This composite measure is defined as $M_t = (Y_t/N_t)/P_t$ where N_t is the population size. Constructed as it is, M_t reflects the per capita sugar purchasing power of income at time t given the level of price prevailing at that time. Alternatively, it may be looked upon as per capita disposable income expressed in terms of sugar. Although M_t has only a notional interpretation, its chief merit lies in the fact that it helps to minimize, if not eliminate, the intratemporal effects to which both price and income time series are subject. It may be noted that this device of employing a suitable divisor (as P_t in the present case) is not uncommon. For example, in production function analysis, it is primarily employed for handling problems of multicollinearity among the input variables [9].

Table XII gives C_t , M_t , and C_t/M_t for the years 1964-79. It is noteworthy that this proportion bears a very close similarity to the percentage of the PCE on sugar to the total PCE given in Table VIII (except for the year 1975). A plot of (M_t, C_t) shows that the consumption behavior in the years 1971-75 has undergone a clear shift from that of the remaining years. This is also supported by the percentages of sugar consumed as given in the last column of Table XII

TABLE XI
PRICE SPREAD OF SUGAR IN SELECTED PERIODS

	June 1972		April 1974		November 1974		March 1975		August 1976		To July 1981		From July 1981	
	Value (Sh per Mt)	%	Value (Sh per Mt)	%	Value (Sh per Mt)	%	Value (Sh per Mt)	%	Value (Sh per Mt)	%	Value (Sh per Mt)	%	Value (Sh per Mt)	%
Ex-factory price	904.85	45.2	1,700.00	56.7	1,390.00	23.2	1,390.00	27.8	2,200.00	44.0	3,410.00	40.1	4,750.00	47.5
Government revenue (sales tax and excise duty)	462.90	23.1	713.00	23.8	3,513.00	58.5	2,513.00	50.3	1,601.00	32.0	4,160.00	49.0	4,250.00	42.5
SDC (toward marketing expenses and the reserve fund)	501.50	25.1	392.00	13.0	747.00	12.4	573.00	10.7	639.00	12.8				
Wholesale margin	48.75	2.5	65.00	2.2	100.00	1.7	190.00	3.8	190.00	3.8	350.00	4.1	360.00	3.6
Retail margin	82.00	4.1	130.00	4.3	250.00	4.2	370.00	7.4	370.00	7.4	580.00	6.8	640.00	6.4
Total of taxes, duties, and trading margins	1,095.15	54.8	1,300.00	43.3	4,610.00	76.8	3,610.00	72.2	2,800.00	56.0	5,090.00	59.9	5,250.00	52.5
Retail price	2,000.00	100.0	3,000.00	100.0	6,000.00	100.0	5,000.00	100.0	5,000.00	100.0	8,500.00	100.0	10,000.00	100.0

Sources: Figures for June 1972, April 1974, November 1974, and March 1975 from [10]; for August 1976 from [8]; and for the last two periods from [12].

TABLE XII
PER CAPITA SUGAR CONSUMPTION, SUGAR EQUIVALENT OF INCOME,
AND PERCENTAGE OF SUGAR CONSUMED: 1964-79

Year	C_t (Kg)	M_t (Mt)	C_t/M_t (%)
1964	5.34	0.32	1.65
1965	5.90	0.31	1.91
1966	6.53	0.34	1.92
1967	6.33	0.35	1.81
1968	6.76	0.37	1.83
1969	7.06	0.37	1.92
1970	8.35	0.42	1.97
1971	9.46	0.35	2.71
1972	10.04	0.39	2.60
1973	10.05	0.44	2.30
1974	9.34	0.38	2.45
1975	7.71	0.25	3.08
1976	6.07	0.34	1.78
1977	7.01	0.35	1.98
1978	7.25	0.39	1.86
1979	7.79	0.35	2.20

which for the same years are relatively larger than for others. This is perhaps due to the fact that in the entire period 1964-79, Tanzania imported the largest amounts of sugar in the four years 1971-74, as already noted.

In view of the above, two linear regressions of C_t and M_t were fitted, one for the period 1964-79 and another for the same period excluding the years 1971-75. The results are as follows.

Period 1964-79:

$$C_t = 1.20 + 17.80 * M_t, \quad (1)$$

(2.29)

$$R^2 = 0.2724, \quad DW = 0.79*.$$

Period 1964-70 and 1976-79:

$$C_t = -1.38 + 22.85 ** M_t, \quad (2)$$

(4.89)

$$R^2 = 0.7084, \quad DW = 1.99.$$

The figures in parentheses below the slope coefficients are the t -values; the single and double asterisks indicate statistical significance at 5 per cent and 1 per cent probability levels respectively.

As to be expected in the circumstances, equation (1) provides a very poor fit. Chow's test carried out to ascertain whether these two regressions are structurally different concludes quite categorically that they are so. Thus, all the evidence points indisputably to the fact that the pattern of sugar consumption in Tanzania during the years 1971-75 is different from that in the other years of the period 1964-1979.

Equation (2) referring to the eleven-year period excluding 1971-75 shows that

the relationship between C_t and M_t is very close indeed and that the correlation between them as measured by R (in the present case) is as high as 0.84. While the regression coefficient is very highly significant, the elasticity estimated at the mean levels of C_t and M_t is greater than unity and equals 1.20, suggesting that sugar consumption per capita is highly responsive to income. Although such a pattern is not atypical of low-income countries in respect of a food item like sugar, the above result is significant in the context of a least developed country like Tanzania. It is generally argued that in these countries, small peasants constitute a vast majority of their populations; that their incomes being far below the subsistence levels, they have of necessity only very simple diets consisting of starchy foods like cereals in some measure and roots and tubers in substantial quantities; and that in these circumstances, whenever there are increases in income, purchases of relatively more luxury goods belonging to the category of consumer durables (such as bicycles, clothing, radios, etc.) receive a higher priority than those of luxury food-items like sugar. This view does not seem to be supported by our analysis which shows that the income elasticity of demand for sugar does exceed unity. This result is also consistent with our earlier finding that with the rising per capita income, the pattern of calorie intake in Tanzania has shifted from one of starchy foods to sugar and other complementary diets. Further, it has been shown [20] that the annual average cash income per household in the rural areas of Tanzania has increased from Sh 982 in 1969 to Sh 2,168 in 1975/76, which works out to a growth rate of about 13 per cent per annum. The corresponding figures for the urban areas are Sh 6,036 and Sh 7,302 (about 3.00 per cent per annum) and for the country as a whole are Sh 1,271 and Sh 2,945 (an annual growth rate of about 14 per cent).² Thus there is evidence of a transformation, particularly in the rural region of the country, whereby a monetized economy seems to be gradually finding its roots over time.

VI. SUGAR CONSUMPTION AND ITS RELATIONSHIP TO PRICE AND INCOME VARIABLES

In spite of some of the merits pointed out for the measure M_t in the previous section, it suffers from one inherent disadvantage, as such composite measures do, in that it confounds the separate effects of price and income on the demand behavior for sugar. As stated earlier, the demand response of sugar to these two variables has considerable policy implications for a country like Tanzania in respect of its sugar production, pricing, the logistics of marketing, distribution, etc. We have therefore attempted to obtain in this section consumer demand

² Although the latter growth rate should not exceed 13 per cent, that it does so in the present instance only reflects the abnormalities inherent in the statistical data collected and summarized by various statistical agencies in a least developed country like Tanzania. These arise from poorly organized statistical systems in such countries, to which reference is made in the later sections of the paper. Similar inconsistencies have been found to exist, e.g., in the 1978 population census data of Tanzania.

equations explicitly in terms of price, income, and other related variables. Keeping in mind the pros and cons of using various definitional measures of price and income such as current versus real, absolute values versus index numbers, all-items versus food-items price indexes as deflators, aggregate versus per capita demand, a number of regressions have been tried with different but relevant combinations of the above measures. In addition, population size N_t has been considered as an explicit variable in the aggregate consumption functions to see if it could account for the increasing trend in sugar consumption over time. Similarly, time variable t has been included in both the aggregate and per capita specifications. This is expected to explain the unmeasurable changes in tastes, habits, customs, and the like which cannot be identified and/or singled out and yet would jointly influence the consumption behavior.

Three functional specifications, namely, linear, semi-log, and double-log, have been tried for each of the above variable combinations. Finally, the above specifications of variables and forms of equations had been carried out for two sets of years, one covering the entire period 1964–79 and the other excluding the years 1971–75 as in the earlier analysis of Section V. All these variations have naturally led to a large number of regressions being fitted. Their screening had been carried out using (i) the economic criterion of correct signs for the coefficients and (ii) the statistical and econometric criteria of tests of significance, goodness of fit, autocorrelation of errors, and multicollinearity among the explanatory variables. Of the many equations estimated, only two have fulfilled both the above criteria and relate to the sample which excludes the years 1971–75. These are given in (3) and (4) below.

Linear model:

$$D_t = 72,756.93 - 6,546.97^{**}X_t + 1,586.21^{**}Y_t, \quad (3)$$

(3.74)	(3.29)
(-0.80)	(0.76)

$$R^2 = 0.8958, \quad DW = 1.79.$$

Double-log model:

$$\log D_t = 6.8869 - 0.8362^{**} \log X_t + 1.5699^{**} \log Y_t, \quad (4)$$

(3.52)	(4.49)
(-0.78)	(0.85)

$$R^2 = 0.9048, \quad DW = 2.15.$$

The figures in parentheses below the slope coefficients refer to t -values and partial correlation coefficients in that order; and also the natural logarithm is used in equation (4). The variable D_t denotes aggregate consumption of sugar in metric tons, X_t the retail price of sugar in shillings per 10 kg deflated by food-items price index (1969=100) and Y_t the disposable income in million shillings deflated by all-items price index (1969=100). The data on which the above regressions are based as well as those on production, imports, and exports are given in Appendix Table I.

Besides (3) and (4), the semi-log model with the same two variables is also

acceptable by the above criteria except that its R^2 is 0.7981 which is considerably lower than those of the above two models. Moreover, this equation also tends to exaggerate the elasticities at low-income levels into which category Tanzania falls. For these two reasons, it has been considered unsuitable for further analysis and interpretations.

It is of utmost interest and consequence that the coefficients of X_t and Y_t in both the linear and double-log equations are very highly significant (the t -value of the coefficient of Y_t in the linear equation is close to 1 per cent probability level). There are two earlier studies [4] [8] which have investigated the consumption pattern of sugar in Tanzania. The first study related to the period 1951–63 and the second to 1964–74. Both of them have shown that neither the price nor the income variable is significant and that only the time variable representing the trend factor is significant. On the other hand, our results conclusively establish that sugar consumers do respond (and respond very strongly) to changes both in retail prices and income and that the nondescript time variable has little influence on sugar consumption. The most important reason for these differences between the two studies cited and our present one is the fact that we have excluded from our equations (3) and (4), the so-to-speak “outlier” observations corresponding to the years 1971–75 (see Appendix).

A few discernible features distinguishing this subperiod of five years from the remaining ones of the period 1964–79 in so far as they relate to the consumer demand of sugar are:

- (i) The values of price X_t are higher particularly in relation to the years 1976–79;
- (ii) The availability of sugar is greater due to increased imports in the years 1971–74 (as substantiated in Appendix Table and Table VIII);
- (iii) The per capita sugar consumption is higher during 1971–74 (as the last column of Table XII would also show); and
- (iv) The income Y_t has dipped very low and the price X_t has shot up sharply in 1975 in contrast to the years in its immediate vicinity.

While (iii) above may appear incongruous in the presence of (i), contradictions of this nature have been noted by Behrman [1] and Dean [2] for other underdeveloped countries also. The economic logic for such an “irrational” behavior is explained at length by these authors and is therefore not elaborated here. All the same, a brief discussion which may possibly explain this behavior in the present commodity context may be in order.

As argued at the end of Section V, the urge for Tanzanians for moving away from starchy to complementary energy diets such as sugar, coupled with a relatively increased income experienced by them in the period 1971–74 together with very large quantities of sugar made available to them through unprecedented higher levels of import in the same period may all have combined to counter the price effect on the consumption.

Also it is a tenable hypothesis that relative to the sugar price, the higher price of noncentrifugal sugar (jaggery), which is used extensively as a close substitute to sugar particularly in nonurban areas of Tanzania, might have prompted the

consumers to use sugar instead. This hypothesis could not, however, be tested in the present study due to nonavailability of reliable time series data on jaggery as pointed out in the concluding section of this paper.

A close scrutiny of the regressions that we have fitted for the entire period 1964–79 (i.e., including the above five years) has shown that: not a single price coefficient is statistically significant in any of these regressions; in many cases, it has also a wrong sign; and in those equations in which the Durbin-Watson statistic is not significant (the ones which merit consideration), either the income coefficient or that of the time variable is significant but not both. Some of these results are perhaps the consequence of the above four features which we have just listed.

We have discussed this matter of the significance of the price and income coefficients at some length for two main reasons. The first is that it is all too often generalized that peoples' reaction to prices is irrational in the developing and low-income countries of Africa, Asia, and Latin America whose typical characteristics are that their economies are primarily rural-based, agriculture-dependent, and subsistence-oriented. (For instance, according to the 1967 population census of Tanzania, 96.3 per cent of the total population of the country belong to rural areas of which 92.9 per cent have occupations relating to agriculture and the latest census of 1978 [22] show that 96.2 per cent of the households are located in the villages.) This generalization further claims that application of "western" theories of economic behavior is of dubious value if not entirely irrelevant under such conditions and that supply patterns of primary producers (consisting mostly of farmers) and demand patterns of consumers (whose incomes are below or near subsistence levels) are not price responsive particularly in respect of commodities of a nonsubsistence and/or of a "luxury" nature. There is a large body of literature arguing for and against this generalization in the context of specific third-world countries and selected commodities [1] [2] [4]. As a number of empirical studies in respect of supply and the present one, for example, in the case of consumer demand have shown, the above generalization seems to be more opinionated than based on objective scrutiny and careful analyses of factual evidence. The second reason for our emphasis is that problems of data collection and their assembly are immense, and devising suitable diagnostics for identifying dissimilarities in the data and selecting appropriate tools and techniques for their final analyses are of vital importance in trying to establish empirical evidence which would support or refute such controversies. This is particularly so in the underdeveloped countries where for a variety of reasons data collection apparatus is weak and methods unsophisticated. Our study has shown, for instance, that inclusion or exclusion of the data relating to the exceptional period 1971–75 could lead to very different interpretations. The pitfalls in carrying out routine analysis of data formally collected and processed are thus far too important to be ignored.

The two equations (3) and (4) both show that the two variables, the price X_t and the income Y_t , account for about 90 per cent of the fluctuations in the aggregate sugar consumption, that the error terms are free from autocorrelation

TABLE XIII
PRICE AND INCOME ELASTICITIES OF CONSUMER DEMAND FOR SUGAR

Y_t X_t	65	70	75	80	85	90	95
Price Elasticities							
10	-0.59	-0.55	-0.52	-0.49	-0.46	-0.44	-0.41
12	-0.81	-0.75	-0.69	-0.65	-0.61	-0.57	-0.54
14	-1.09	-0.99	-0.92	-0.85	-0.79	-0.74	-0.70
16	-1.47	-1.33	-1.20	-1.10	-1.02	-0.95	-0.88
18	-2.03	-1.79	-1.60	-1.44	-1.31	-1.21	-1.12
20	-2.91	-2.48	-2.15	-1.91	-1.71	-1.55	-1.42
Income Elasticities							
10	0.93	0.94	0.94	0.95	0.95	0.95	0.95
12	1.06	1.06	1.05	1.05	1.05	1.04	1.04
14	1.22	1.21	1.19	1.18	1.16	1.15	1.14
16	1.45	1.40	1.37	1.34	1.31	1.29	1.27
18	1.78	1.68	1.61	1.55	1.50	1.46	1.43
20	2.30	2.10	1.96	1.85	1.76	1.69	1.63

Note: Calculated using the linear equations at various price and income levels.

as established by the nonsignificance of the D.W. statistics, that the coefficients of the two variables are very highly significant at 1 per cent probability level (the coefficient of Y_t in the linear model being close to this level), and that the income elasticity of demand is higher than the price elasticity so that responsiveness to the former is greater than to the latter. For the linear model, these elasticities at the mean levels of X_t and Y_t are -1.00 and 1.30 respectively, and for the double-log model they are -0.84 and 1.57 (and of course, remain invariant to price and income levels). Further, the fact that the partial correlation coefficients of both the slope coefficients in either of the models are of about the same magnitude shows that both income and price are more or less equally important in explaining the variations in sugar consumption.

Table XIII shows the price and income elasticities derived from the linear equation for various combinations of these two variables.

It may be observed from the table that the magnitudes of the elasticities at low incomes and high prices are markedly higher than those at high incomes and low prices. Thus, given that the disposable income Y_t is around 8.6 billion shillings in 1979, the sugar consumption would have been 1.5 to 2 times more than what it was at the then retail price, had this price been pegged at a level nearer to the ex-factory price shown in Table XI. At any rate, the above analysis shows that a suitable price policy for sugar holds considerable scope for boosting the sugar consumption in the country from its present low level of 8 kg per person.

VII. PROJECTIONS OF SUGAR CONSUMPTION FOR THE PERIOD 1980-84

Using the two regressions (3) and (4) estimated in the previous section, three

TABLE XIV
PER CAPITA CONSUMER DEMAND PROJECTIONS: 1980-84

Year	Projection Based on:	
	Linear Equation	Double-log Equation
	1980	6.71
1981	6.60	6.75
1982	6.52	6.74
1983	6.44	6.73
1984	6.35	6.73

TABLE XV
PROJECTIONS OF SUGAR PRICE FOR 1980-84 AT THE GIVEN
PER CAPITA CONSUMPTION LEVELS

Year	Price Projections from:			
	Linear Equation		Double-log Equation	
	8 kg	12 kg	8 kg	12 kg
1980	9.65	0.17	10.94	7.21
1981	9.04	*	10.76	7.09
1982	8.40	*	10.57	6.97
1983	7.71	*	10.39	6.85
1984	6.99	*	10.21	6.73

* Indicates negative prices.

sets of short-term projections of sugar consumption are made for the five-year period 1980-84. For this purpose, it is assumed that the country's population would continue to increase at the present rate of 4.4 per cent per annum.

In the first set of forecasts, we allow an annual growth rate of -1.58 per cent and 1.85 per cent for X_t and Y_t respectively, the same as for the sixteen-year period 1964-79. The forecast estimates of per capita sugar consumption as obtained from the above two models are given in Table XIV.

The forecasts of the linear equation are smaller and decrease more steeply than those of the double-log equation. In any case, they suggest that even if the aggregate consumption of sugar D_t would increase as the price persists to decrease and the income to increase at the same rate as they did in the years 1964-79, the consumption per person would drop from 8 kg in 1979 to between 6 kg and 7 kg in the five-year period 1980-84, presumably as a result of higher population growth rate relative to those of price and income as noted above.

The two sets of projections given in Tables XV and XVI relate to the price X_t and income Y_t respectively for the years 1980-84. The price projections assume that Y_t grows at the same rate of 1.85 per cent per annum as it did in 1964-79, and the income projections assume that X_t has an annual growth rate of -1.58 per cent, the same as it had in 1964-79. Each of these two sets of forecasts are made for two demand levels: (i) the present level of 8 kg per person

TABLE XVI
 PROJECTIONS OF DISPOSABLE INCOME FOR 1980-84 AT THE GIVEN
 PER CAPITA SUGAR CONSUMPTION LEVELS

(Sh billion)

Year	Income Projections from:			
	Linear Equation		Double-log Equation	
	8 kg	12 kg	8 kg	12 kg
1980	10.514	14.228	9.765	12.195
1981	10.640	14.726	9.952	12.430
1982	10.986	15.252	10.144	12.669
1983	11.352	15.806	10.338	12.910
1984	11.739	16.390	10.536	13.159

and (ii) 12 kg per person which is considered as "advantageous" from the nutritional point of view. A human diet which contains less than 12 kg of sugar is considered to be lacking in adequate food energy whereas one exceeding this amount is seen to be accompanied by a rise in the incidence of certain nutritional diseases and dental caries [7].

The linear equation in Table XV shows that given the present increase in income, the consumption level of 12 kg per person is not feasible beyond 1980 and the per capita level of 8 kg would require the price X_t to decrease at the rate of 7.8 per cent every year over the period 1980-84. In comparison, the double-log equation predicts higher values of real prices ranging from Sh 10.9 in 1980 to Sh 10.2 per 10 kg in 1984 if per capita consumption level is to be at 8 kg; however, if this level is raised to 12 kg, the prices in 1980-84 need to be nearly one-half of what they are in 1979.

The income projections from the linear model of Table XVI are higher than those from the double-log model and show that to achieve the per capita consumption of 12 kg of sugar (with the price decreasing at the annual rate of 1.58 per cent), the income has to grow at the rate of 3.6 per cent per annum during the period 1980-84. On the other hand, the double-log model projects a modest income growth rate of about 1.9 per cent per annum in the five-year period both for 8 and 12 kg of per capita consumption, although the incomes required in 1980 are respectively 9.765 and 12.195 billion shillings.

Both tables show that in the given circumstances where the growth rates of X_t and Y_t have been -1.58 per cent and 1.85 per cent per annum in the period 1964-79 with their respective values being Sh 12.46 per 10 kg and Sh 8.610 billion in 1979, it is a formidable task indeed even to maintain the present level of sugar consumption at 8 kg per person in the period 1980-84, let alone increase it to 12 kg per person, unless fresh stimuli are injected into the economy by appropriate policy and other measures. The present study, albeit limited in aim, helps to indicate in quantitative terms, the magnitude and direction of pursuing some such measures. It establishes the overwhelming importance of the price of sugar in influencing its consumption. The price in turn is determined, among other things, by: (i) the extent of domestic production and efficient

marketing and distribution along with their related costs; (ii) the price of the commodity in the international markets and the consequent import/export policies to be adopted by Tanzania consistent with its international obligations; and (iii) the price structure formulated by the government from time to time as a result of manipulating the incidence of duties and taxes on sugar which would affect the government revenues. Considering the fact that (i) the price responsiveness of sugar consumption in Tanzania is conclusively established as in this study and (ii) the present level of consumption in the country is well below those of other countries in the East African region and also lower than the nutritionally desired level, it is within the immediate reach of the government to stimulate sugar consumption in the short run by taking up the third aspect of duties and taxes just mentioned above. As shown in the previous section, there is considerable scope for increasing the consumption of sugar through suitable alterations of the price structure. Simultaneously, supportive measures have to be provided to strengthen and streamline the existing storage facilities and marketing outlets so as to avoid or reduce wastages and ensure equitable distribution of the available supply at controlled prices. In respect of the first two aspects, however, while little can be done by Tanzania alone in so far as sugar prices in international markets are concerned, increasing domestic production of sugar and extending the facilities for better marketing and distribution would need considerable infrastructure and medium- to long-gestation periods and would, therefore, constitute long-term objectives. Nevertheless, such infrastructure would form part of the country's overall economic development, and the resulting feedback would eventually lead to rising incomes which, as the study demonstrates, would contribute to even greater consumption of sugar than reductions in its price.

VIII. LIMITATIONS OF THE STUDY

It is important to point out the limitations (apart from the usual ones which are inherent in the data series compiled from various supplementary sources and are of "statistical" nature) subject to which the foregoing results and interpretations are to be understood.

(i) Sugar, in this study, comprises centrifugal sugar only; noncentrifugal sugar (jaggery) produced in the country and sold currently at a retail price which is nearly (and sometime more than) double that of sugar is also consumed to a considerable extent. However, this is not included here as no reliable data are available.

(ii) It is assumed that the end use of all sugar consumption is by households. As in most of the low-income countries, the major consumers in Tanzania are the households. Its use by industries, such as those making beer, soft drinks, confectionery, and bakery products is not large. It is estimated that in 1961, only 2.3 per cent of the total sugar consumption has been diverted to the above end users [4].

During 1976-77, it is reported [10] that out of total domestic sales of 106,748 mt of sugar, 8,279 mt, i.e., 7.8 per cent of the total, has been sold to industrial

users. This percentage increase between 1961 and 1976-77 is not surprising since production of beer and soft drinks particularly has been on the increase in Tanzania during this period of rising income. For example, the production of beer which was 89,000 hectoliters in 1963 has gone up nearly 8 times to 695,000 hectoliters in 1976; likewise, the production of soft drinks, which was only 72,000 hectoliters in 1966, has increased about 5 times to 353,000 hectoliters in 1976 [25] [26]. All the same, industrial use of sugar is not very high in Tanzania unlike in countries such as the United States where more than 50 per cent of the total use of sugar is by industries alone. Also, no time-series data are available for Tanzania in respect of the major end uses. For these two reasons, the entire consumption is taken to be by the households. However, it should be borne in mind that the variables influencing these two categories of users need not be identical.

(iii) As in all studies on consumption, whether they relate to time series data or family budgets, the term "consumption" in this study conceals the fluctuations (which can be very violent and significant in view of the quite erratic and uncertain supply of sugar over different regions and time points as experienced in the country) in stocks held by various distributors, godowns of industrial users as well as by the households.

(iv) Finally, the study does not take cognizance of the income distribution and its possible shifts over time either of which would affect both the consumption pattern of sugar and the response to changes in price and income. However, as the models selected in the study for final analysis relate to aggregate consumption and income, it is expected that this limitation would not be serious enough to vitiate the final interpretations and conclusions.

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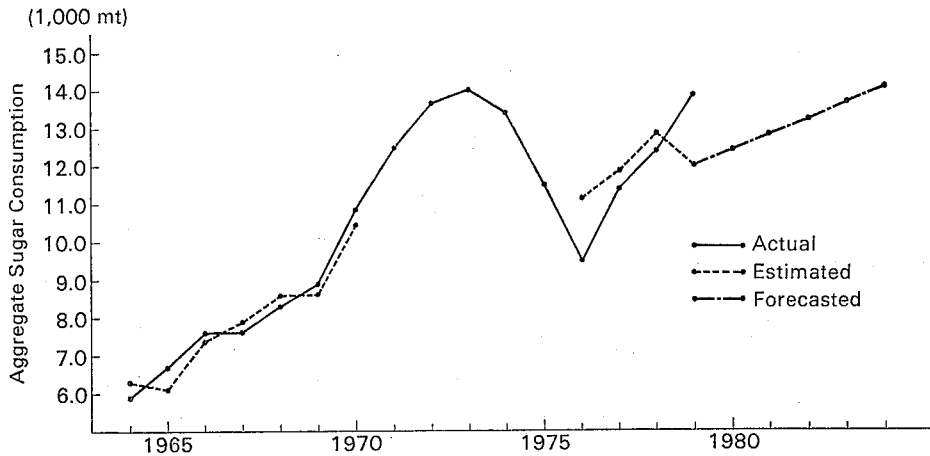
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APPENDIX

CHANGES IN AGGREGATE SUGAR CONSUMPTION

It is shown in the figure that the actual aggregate sugar consumption D_t for the period 1971-74 is distinctly higher than those of the periods 1964-70 and 1976-79. For the year 1975, although the actual value D_t is in the neighborhood of the above two periods, the income Y_t has experienced a sudden dip and the price X_t a sharp rise in relation to those of the immediately preceding and succeeding years. For these reasons, the regression fit for the period 1964-79 which includes the years 1971-75 gives a very poor R^2 in comparison to the equation (3) or (4) which excludes the above five years. The figure also suggests that the inclusion of these years in the regression analysis would increase the value of the regression slope thus rendering the deviations of the actual values for the years 1976-79 from the fitted line to be unduly large.

The figure also shows that the forecast values of D_t for 1980–84 obtained from equation (3) are reasonably in line with the actual values for the periods 1964–70 and 1976–79.



APPENDIX TABLE I
THE DATA USED IN THE REGRESSION ANALYSIS

Year	Production (Mt)	Imports (Mt)	Exports (Mt)	Consumption (Mt)	Real Disposable Income* (Million Sh)	Real Sugar Price† (Sh per 10 kg)
1964	61,440	419	122	59,180	6,541.5	17.274
1965	67,390	5,215	3,192	67,132	6,513.5	17.591
1966	71,020	5,360	185	76,189	7,022.6	16.802
1967	71,751	4,425	50	75,802	7,221.2	16.517
1968	82,429	7,077	135	82,912	7,547.0	16,288
1969	92,043	3,290	22	88,740	7,839.0	16.991
1970	87,254	4,606	269	107,617	8,416.6	15.489
1971	95,787	27,141	518	125,349	8,614.5	18.433
1972	88,483	50,388	235	136,592	8,843.2	16.653
1973	114,278	47,218	36	140,400	9,446.2	14.804
1974	105,422	31,462	2,401	133,965	9,139.6	15.971
1975	112,164	—	17,605	115,491	7,540.8	18.811
1976	110,386	11,933	24,095	94,902	8,691.2	15.244
1977	107,521	19,400	10,990	114,464	8,082.0	12.943
1978	135,537	35,615	13,608	123,656	7,929.8	10.797
1979	123,105	11,340	19,344	138,724	8,609.9	12.457

Sources: Consumption data for 1964–79 from [13]; disposable income data for 1964–76 from [21], for 1977–78 from [27], and the author's estimate for 1979; price index data from [17]; population data for 1967 and 1978 from [22], for 1970 and 1974 from [24], and the author's estimates for the intermediate years; retail sugar price data for 1964–69 from [19], for 1970–74 from [10], for 1975–77 from [23], for 1978 from local inquiry, and the author's estimate for 1979.

* All-items price index (1969=100) is the deflator.

† Food-items price index (1969=100) is the deflator.