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The Production and Distribution of Sugar
in East Africa
"by
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1_f Introduction.

During September of 1963, East Africa^became for the first
time in its history a net exporter of sugar. The price of
sugar on the world market' (c.i.f. London) rose from a January,
1962 low of £20 per ton to about £100 per ton in November of
1963.   This five fold increase in price was in part due to
production problems and the devastation of a hurricane in Cuba,
bad weather in Brazil, political strife in British Guiana and
an Argentinian mill workers strike.   There were also unconfirmed
reports of a failure.of the beet crops in Holland and Russia .
Consequently, major efforts are being made throughout the world
and in East Africa to increase sugar production rapidly to take
advantage of the favorable turn in prices!.   At the same time if
the disruptions in production should prove temporary, sugar
manufacturers must guard against an overexpansion which could
result in a year or two in a precipitous fall in price[4] which
might destroy the profitability of some of the newer ventures.
A fear of an overexpansion of world sugar production in itself
creates certain problems in East Africa.   The internal price of
sugar in East Africa is fixed at about £46 per ton at the factory.
If the world price drops substantially below the internal price,
there will be a premium for selling on the internal market.
Thus there is the likelihood of press-ore from those who are
proposing new sugar ventures in Kenya and Tanganyika on the
governments of these countries to give guarantees for an internal
market.   Unless internal markets are insured for the producers
in each country, there is the possibility that capital will fail
to flow into sugar investment and seek more profitable oppor-
tunities in other lines or, more importantly, in other countries.
This, of covirse can conflict v/ith the objectives of each
government for an expansion of industry and in particular an
expansion of the sugar industry within their own borders.   Thus
the governments of each of the three territories could conceivably
have a stake in satisfyingthe desires on the part of some
producers for national autarky.   Another factor which might
make national autarky attractive to the respective governments
is that the price in eaoh territory need not be the same if
movements of sugar are prohibited across territorial boundaries.
Each governm^Ht could pursue its own policy with respect to excise
taxes, producer prices and consumer prices, and the degree of
government control of the distribution system.

At the one extreme each of the East Africa ocuntrieg may
pursue a policy of autarky with respect to the other two, with
each country completely restricting imports from the other two.
At the other extreme, the governments could co-operate and
pursue a policy of complete integration with respect to
production and distribution.   The latter alternative has two
economic advantages over the former.   First, there may be
considerable savings in transport costs alone.   At present
Uganda has a considerable surplus of production over"consump-
tion.   Kenya's sugar requirements are only partly satisfied
by local production and the shortfall is made up of imports from
Uganda andfrom abroad, and every so often small amounts are
La.   Tanganyika production and
equal, but the government has had to
i time to time.   If each territory '

/attempts

attempts national autarky, then Uganda would pro"ba"bly find it necessary to transport its surplus some 700 miles to the port of Mombassa while Kenya would "be transporting sugar from its factory near Mombassa inland to the Kenya highlands. A system, of distribution in which transport costs were minimized might require that Uganda supply northern Tanganyika and western Kenya, and the overall East African surplus would be exported from the factories of Kenya and Tanganyika near the coast, or the overall East African shortfall would be imported from abroad. A second advantage of complete integration is that production could be encouraged whereever costs are the lowest regardless of the location within a particular country.

In order that a system of complete integration be politically feasible, there may have to be some compromise arrangements among the three territories. To compensate for the loss of capital investment which any one country might suffer by a policy of expansion wherever costs are the lowest, perhar[3] « bargain could be arranged with respect to the location of other industries, or there could "be a method of fiscal compensation. In order to compensate the Kenya and Tanganyika producers if the export pries is lower than the internal price or in order tn compensate the Uganda producers if the opposite si-fc^-bion holds, the governments could institute a system of price equalization payments so that a producer received the same price regardless of the market in which his sugar was sold. Alternatively, the price equalization scheme could work in such a way that each producer was guaranteed the export price for a certain proportion of his output and the internal price for the rest of his output regardless where his sugar was sold. In any case each producer should bear some of the loss of revenue caused by a fall in the world price. This would act as a check on over-expansion in sugar production in the face of a deteriorating world market.

In order to arrive at any intelligent policy decision with regard to national autarky, or complete integration and compromise arrangements, it is necessary to make some judgement of the economic costs of a system of national autarky, or obversely, the saviiig-s which can "be obtained from a system of complete integration. The purpose of this paper is to arrive at a rough approximation of the monetary savings which would accrue if sugar were distributed on an East African basis.

II.   Some Characteristics of the Industry and Its Recent Past

A.   Prices and Consumption

The price of sugar to the producer at the factory in East Africa is at present the same in all three territories and is based on the Commonwealth Sugar Agreement Price (See Table I). This has not always been the case. In 1959? Tanganyika passed price control legislation and fixed the price of sugar at one-half the former common East Africa price and one-half the prevailing world price. At the time it meant that Tanganyika sugar was priced below that in Kenya and Uganda. In July of 1963, however, the common East Africa price was restored. This occurred after the Tanganyika price became very high •under the 1959 formula due to a very large increase in the world price.

/Table I

•Table I

East Africa Producer Price Formula

(a) Commonwealth Sugar Agreement Negotiation
    price C.I.P. U.K. ports for raw sugar   Shs. 920.83

(b) Plus? Premium, for plantation whites _____ 110.00
                                                           1030.83
(c) Less;
    (i) Pre-World War II ocean freight
         to Mombasa   Shs.26.2 5

    (ii) Port handling charges and
         agency fees   "   18.00 _____   44.2 5
                                                           986.58

(d) Less? Douwes Lekker deduction for
           mill white sugar _____   67.20
                                                     Shs. 919.38

Source; Ministry of Commerce and Industry   (£45.97)
         in Tanganyika.

     The effective price to the producer is somewhat different
than that given in Table I because of the existence of an
excise tax in all three territories.   In addition at least
two of the sugar producers in Tanganyika are subject to local
taxes of one cent a pound, and thus the effective price to
these producers is slightly different.

Table II

World Sugar Prices

1955 through June,   1963 s Price per ton of raw sugar in the
Caribbean.   Unit values of the period or averages of monthly
quotations during the period.

July, 1963s End of the month quotation, London C.I.F.

1955	£26	1962	Nov.	£29
1956	28		Dec.	34
1957	41		Jan.	44
1958	28		Feb.	48
1959	24		Mar.	53
1960	25	1963	Apr.	61
1961	' 23		May	84
1962	24		Jun.	79
			Jul.	70

Sources; International Financial Statistics, The International
          Monetary Fund, Volume XVI, Number 9 and Number 7 and
          The Financial Times, London, July 31, 1963

     From January, 1953 up until January of 1963, the
world price of sugar was lower than the East Africa factory
price (See Table II).   For a good part of that ten year
interval, the world price was about one-half the East Africa
factory price of about £46 a ton.   The higher internal price

                                                        /was

was maintained "by strict governmental control of all imports
of sugar except for speciality sugars such as highly refined,
cubed, and powdered sugars. As long as the import price was
lower than the internal price, the Kenya government had to
buy Uganda sugar at a premium. The Kenya government agreed
to do this so long as the Uganda government consented to buy
Kenya wheat which v/as priced above the world market by a
marketing board.

   In February of 1963, the price situation was reversed, and
the world market price was higher than the internal price.
The lower East Africa price is maintained by government licensing
of exports. In the absence of export licensing, the East
African sugar producers would have no incentive to sell on the
internal market and would export all their sugar.

   The average price to the consumer in East Africa is about
50 per cent higher than the factory price. The difference is
attributable to transportation, handling, and marketing costs.
For sake of comparison, among 78 countries considered by
Viton and Pignalosa,^ 35 had lower retain prices in 1957 than
the average retail price in Uganda. The median retail price
was 22.5 U.S. cents per kilogram while the Uganda price was
20.4. Compared with other sugar producing countries the
retail price in East Africa is relatively high (See Table III).

Table III

Retail Prices and Per Capita Consumption in Selected Sugar

Producing Countries 1957

Country	Retail price (U.S. cents per kilogram)	Per Capita Consumpti (Kilograms)
British Guiana	9.6	41.2
Mauritius	9.7	38.7
Argentina	12.0	40.0
Trinidad	12.5	36.3
Barbados	14.1	47.8
Brazil	16.9	33.8
Haiti	17.6	10.2
Jamaica	18.6	36.2
Kenya	18.8	9.3
Cuba	19.7	47.4
Phillipines	20.0	11.7
Uganda	20.4	9.4
Tanganyika	21.6	4.8
Netherlands	23.2	41.2
Hong Kong	24.7	20.0
Bahamas	25.7	26.3

Source; A. Viton and F. Pignalosgu,-. Trends and Forces of World
         Sugar Consumption, .Food and Agricultural Organization of
         the United Nations, Rome, 1961, pp. 18 and 54.

The data in Table III suggest that the price elasticity
of sugar consumption in low income countries is fairly high.
Viton and Pignalosa calculated on the basis of time series
data that the$_f$price elasticity of sugar in South Africa
is about 1.20.   This suggests that the low per capita sugar
consumption in East Africa relative to other sugar producing
areas could be raised substantially by a reduction in the
retail price.

Table IV

Actual Production and Ccnsimption of Sugar in East Africa
(Long tons.)

Kenya-

Year	Consumption per capita(lb.)	Consumption	Production	Shortfall
1953	15.8	46,475	16,612	29,863
1954	16.1	' 48.819	11,988	36.831
1955	17.3	54,087	16,-601	37,486
1956	19.9	63,987	19.886	44ᵣ101
1957	20.4	67,995	20.026	47,969
1958	20.5	69,838	27,931	41,907
1959	22,0	77,155	27,210	49,945
1960	24.0	86,845	29,609	57,236
1961	24.7	92,015	32,606	59,409
1962	25.7	98,950	32,647	65,943

Uganda

Year	Consumption per capita(lb.)	Consumption	Production	Shortfall
1953	15.5	38,761	47,973	-9,212
1954	19.5	50,137	40.813	9,324
1955	21.0	55,396	65,155	-9,759
1956	21.2	57,127	69,036	-11,909
1957	20.6	56,987	80,773	-23,786
1958	€1.6	61,427	80,988	-19,561
1959	22.0	63,831	81,077	-17,246
1960	21.0	62,486	92,978	-30,492
1961	23.6	71,965	95,501	-23,536
1962	21.0	65,870	104,310	-38,440

Tanganyika

Year	Consumption per capita(lb.)	Consumption	Production	Shortfall
1953	8.4	30,453.	10,708	19,745
1954	9.1	33,853	10,734	23,119
1955	9.8	37,106	10,684	26,422
1956	10.3	39.481	17,905	21,576
1957 •	10.5	41,083	19,453	21,630
1958	10.2	40.615	21,243	• 13,371
1959	11.6	46,841	27,649	19,199
1960	12.0	49,650	28,730	20,920
1961	12.7	53,171	28,713	24,458
1962	13.5	57,704	36,880	20,824

Total East Africa

Year	Consumption per capita(lb.)	Consumption	Production	Shortfall
1953	12.7	115,689	75,293	40,396
1954	14.3	132,809	63,535	69,274
1955	15,4	146,'589'	92,440	54,149
1956	16.5	160,595	106,807	53,788
1957	16.6	165,765	120,252	45,513
1958	16.8	171,880	130,162	41,718
1959	17.9	187,827	135,936	51,891
1960	18.6	198,981	151,317	47,664
1961	19.8	217,150	156,820	60,330
1962	19.8	222,164	173,837	48,327

Source: The East >frican.Xomiiion^Service^^rgariiaation.

/Actual

Actual consumption in all three territories and in East Africa as a whole is shown in Table IV for the years .1953 to 1962. The rate of growth of consumption was about 7.2 per ' n cent in Kenya, 5.2 'per cent in Uganda, 6.2 per cent in Tanganyika, and 6.3 per cent in East Africa as a whole.

B. Production

Production in all three territories and in East Africa 'for the years 1953 to 1962 is shown in Table IV also. The rates of increase are about 6.5 per cent for Kenya, 8.0 percent for Uganda, 11.1 per cent for Tanganyika and 7.9 per cent for all of East Africa. Despite the fact that production in East Africa has grown faster than consumption, there has been a consistent shortfall during the ten year period prior to 1963, and East Africa has been a net importer of sugar. On the other hand, for the most part Uganda has had a considerable surplus which has been sold in the Kenya market. Kenya has made up most of the rest of its shortfalls in the period 1953 to 1962 by importing from abroad. Nearly all of the Tanganyika shortfalls during this same period were made up by imports from outside of East Africa.

There are nine sugar producers in East Africa. Uganda has two producers, one at Kaklra and one at Lugazi, both near Jinja. There are two in Kenya, one near the coast about 80 miles south of Mombasa and one at ffiiwani about 20 miles east of Kisumu. Tanganyika has two major producers and three rather small producers. One major producer is at Arusha Chini about 15 miles south of Moshi and the other is in the Kilombero Valley 50 miles south of Kilosa. Of the three small producers one is in Bukoba; one is at Turiani near Morogoro; and the other is somewhat south of Arusha.

C. Distribution

The manner In which sugar is distributed differs from territory to territory. In Kenya, the entire distribution is handled by the Ministry of Commerce and Industry. Every month the ministry sends out directives to the two sugar mills telling them how much to ship to each station on the rail line. The ministry pays each factory the East African producer price less excise plus its estimate of the average transport cost to each point along the rail line. The factories keep track of the transport costs involved and either receive an extra allowance if transport costs exceed the ministry's estimates or must pa;/ back the difference if transport costs are less than the ministry's estimates. The government then sells the sugar at each rail station to a government appointed sub-agent. The price is the same to each sub-agent at each point along the rail line. There are four government appointed main agents who act as book keepers and collection agents from the sub-agents for the government. They are paid a small commission. The sub-agents may then sell to wholesalers or to government appointed local sub-agents. The maximum price at which the sub-agents may sell to local sub-agents and wholesalers is fixed by law as is the wholesale price and the retain price'. The difference-between the sub-agents buying price and the retail price is sufficient to cover the cost of transport and handling from the railhead to the point of consumption and to cover a small commission for the sub-agent, the wholesaler or goveement appointed sub-agent, and the retailer. The government does not have an elaborate inspection system to enforce the legal wholesale and retail prices so it is questionable as to whether the retail and wholesale price of sugar is as specified by law.

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In Tanganyika, the two major manufacturers each have contracts with marketing firms to handle the distribution of their sugar. The Tanganyika Planting Company at Arusha Chini has a contract with Marco Surveys Limited. Marco Surveys "buys the sugar from the factory and sells to Its agents at each point along the rail line. The price to the agent is sufficient to cover the transport cost plus a commission for Marco Surveys. Thus, in contrast to Kenya, prices differ along the rail line according to differences in transport costs. Wholesale and retail prices are suggested by Marco Surveys. The Kilombero Sugar factory has nearly the same distribution arrangements with the International Trading and Credit Company of Tanganyika Limited, otherwise known as Intrata. Intrata is owned partly by private investors and partly by the Tanganyika Development Corporation. Intrata hires inspectors to check at each point in the distribution chain to see that wholesalers and retailers do not sell at prices which are different than the prices specified by Intrata. The wholesale and retail prices are not fixed by law in Tanganyika, but the Ministry of Commerce and Industry has a set of what they consider reasonable prices in each area. If the ministry hears of any divergency from these prices- the trader is given a warning by a locals government official which usually keeps the trader in line. The three smaller sugar firms in Tanganyika do not have such elaborate distribution systems but rather sell at the factory to traders who are willing to supply their own transport.

The distribution system in Uganda is similar to the one in Tanganyika. The two sugar producers have contracts for distribution by other firms. In all three territories, the agents who are appointed by the government in Kenya and the distributing firms in Uganda and Tanganyika are required to keep one month's reserve stocks to forestall disruptions in the flow of sugar to the consumer due to uneveness in production schedules, floods, strikes and so forth.

III. Prospects for the Future

A. Production and Consumption

The relationship between estimated production and consumption for the years 1963 to 1970 is given in Table V.

TABLE V

Estimated Production and Consumption in East Africa for
the Years 1963 - 1970 (Long tons)

Year	Estimated Consumption	Minimum Production Estimate	Maximum Production Estimate	Minimum- Surplus	Maximum Surplus
1963	220,330	215,342	215,342	- 5,012	-5,012
1964	251,000	220,000	246,790	-31,000	-4,210
1965	270,000	247,500	318,500	-22,500	48,500
1966	290,000	276,000	422,000	-14,000	132,000
1967	311,000	298,000	463,750	-13,000	151,750
1968	334,000	328,000	520,500	-6,000	206,000
1969	359,000	356,500	541,500	-2,500	182,500
1970	385,000	376,000	553,000	-9,000	168,000

Source;   East African Common Services Organization and the
          Tanganyika Ministry of Commerce and Industry.

The consumption estimates were prepared "by the East African
Common Services Organization.   The 1963 estimate was considered
abnormally low because of breakdowns in the system of
distribution during the first six months of the year.   The
Kilombero factory found it necessary to shut down in February
because not enough ripe cane was available contrary to
expectations.   The government decided to import through its
co-operative marketing organization Cosata.   Cosata, a
relatively new organization apparently was not equipped for
the job.   There were delays of up to 25 days between an
agent's request and his receipt of sugar,   Finally in June
the delays were cut to about Three days, but in the mean-time
stocks had been depleted and many consumers, especially in
the southern part of Tanganyika went without sugar for long
periods.   Having revised the 1963 estimate on the basis of
what were considered normal distribution procedures, the
Common Services Organization estimated consumption for the
years 1964 to 1970 based on an expected rate of growth of
8 per cent in Kenya, 8 per cent in Tanganyika, and 6 per cent
in Uganda,   These estimated rates of growth v$ere based on the
findings of Viton and Pignalosa."   Note was taken of the fact
that in the Buganda province of Uganda, the population consumes
a large amount of plantains   which have a high sugar content.
The Uganda rate of growth was lower on this account.

     The estimates of production in Table V are based on
information provided by the East African Common Services
Organization and the. Ministry of Commerce in Tanganyika.   The
maximum estimates differ from the minimum estimates largely
because in the next two or three years it is probable that
there will be four new sugar producers in East Africa.   In
addition, there is the possibility that two of the minor
producers in Tanganyika will expand into major producers, and
one of the factories in Kenya may appreciably expand
production.

B.   Exports.

     If the maximum estimates are realized, then production
will more than double in the seven years from, 1964 to 1970
and East Africa will have a large exportable surplus beginning
in 1965.   The East African Common Services Organization is
a signatory of the Commonwealth Sugar Agreement.   East Africa
has a quota of 10,000 tons.   Under the terms of the agreement,
if East Africa as a whole intends to be a net exporter for any
one year, it must fulfill its quota before any sugar can be sold
on the world market.   Although some sugar was exported in
September of 1963, East Africa is   not   a net exporter for
the year, and thus the exporters were able to sell on the
world market and take advantage of the inflated worId market
price,   The price of sugar bought under the Commonwealth
Sugar Agreement is fixed at approximately the East African
internal price for one half of the quota.   If the world price
is to fall "substantially below the Commonwealth Sugar Agreement
price, then it would be to the benefit of East Africa to
negotiate an increase in their quota under the agreement.

     In addition to the Commonwealth quota possible export
markets include Zanzibar (about 6000 tons), Aden, Somalia,
India, and possibly some of the western European countries.
Sugar marketed under the Commonwealth Sugar Agreement must be
raw sugar.   Sugar sold to developing countries such as
Zanzibar, Aden and Somalia can be a low to medium quality mill
white.   However, in order to export to some of the more
developed countries, East Africa must process a highly refined
sugar.   The factory at Kilombero in Tanganyika can produce
refined sugar, but it is now producing mill white, because
it has been unable to obtain a premium on the internal market
for its higher quality sugar.   The factory at Miwani in Kenya
also has a refinery.   The proposed new factory at Wami River

in Tanganyika will "be geared "to producing raw sugar.
All other producers in East Africa process a mill white
sugar of varying equalities. Raw sugar may "be extracted
from a mill white process but at a higher cost than that
of a factory which is geared to producing raws alone. In
any case it"is likely that East African producers will be able
to produce the right quality sugars for all the possible
markets.

C.   Alternative Approaches to Production andDistribution

        There are four important questions with regard to future
policy. The first is whether the East African governments
should encourage the expansion of the sugar industry or
whether sugar production should be discouraged. Secondly,
there is the question of future price policy (should the
internal price be lower, and should there be premiums for
quality on the internal market?^). Third, what should be
the extent and method of government control of the industry
(should the internal price be fixed and exports and imports
licensed or should the free market be allowed to operate
with import duties and excise taxes being the major instrument
of government policy? Should distribution be directed by
government agencies, para-statal organizations, or by
private firms?)? Finally there is the question of whether
the governments' policy should be one of (1) national
autarky where the market in each territory is reserved to
the producers of that territory, where imports across
territorial boundaries are restricted, and where each
territory would export its surplus abroad or import its
shortfall from abroad, or one of (2-) complete integration
where sugar may move freely across territorial borders,
and where transportation and production costs are minimized
throughout East Africa and not just in each territory.
It is this latter question with which we are the most
concerned, and we will attempt to examine it in such a way
that our conclusions will be independent of conclusions
reached concerning the other three questions of policy.

        The present system of production and distribution is
neither one of national autarky nor one of complete
integration where transport costs and production costs are
minimized throughout East Africa. Theoretically, under a
system of. perfect competition a minimization of transport
costs and production costs would be achieved. The present
situation, where distribution in Kenya is controlled by the
Ministry of Commerce and Industry and where the distribution
in Uganda and Tanganyika is mostly controlled by a small
number of firms who have agreements among themselves as to
the extent of each one's market, is hardly one of perfect
competition. Furthermore, there is no conscious effort
by any central authority to attempt to minimize transport
and production costs. The minimization of transport cp^ts
is not necessarily an easy task in the absence of perfect
competition. It would require an analysis of the supplies
at each factory and the demands in each area, and an
attempt to minimize the equation of total transport costs
using rather sophisticated mathematical techniques. That
the minimization of transport cost is not necessarily a
straightforward exercise can be illustrated by the
following considerations. Suppose there are two factories,
Factory A and factory B. It may pay for factory A to
supply point C even though the transport cost from factory
B to point C is lower. The reason is that Factory B may
be able thereby to supply point D at a much lower cost
than factory A. If there are many factories and many
points of consumption, the problem becomes even more complex.
                                              /Because

Because of these considerations, the situation in Tanganyika
is one where the minimization of transport costs does not take
place.   The two major distributing firms have an agreement that
each supplies only those points where its transport costs are
the lowest.   It is likely that in East Africa   production-
costs are not minimized either.   If there are differences in
production costs then the production of a low cost factory
should be expanded.   In fact there are certain checks on the
expansion of some sugar producers so that even if their costs
are lower, it is difficult for them to achieve a rate of output
of the right magnitude,   In Uganda, for example, the present
two sugar manufacturers have had some difficulty in expanding
because of the laws concerning land alienation.   The Uganda
producers have been able to increase their production somewhat
by engaging in rather capital intensive operations.   The
plantations are highly mechanized and use irrigation.

A major disadvantage of the present system of production
and distribution from the East African governments' point of
view is that it limits the extent to which each government
can pursue its own economic objectives and requires a high
degree of consultation and co-ordination among the three
territories.   For example, suppose the Uganda government wants
to lower the price of sugar to the consumer because it feels
that expenditures on sugar form an excessively large proportion
of the cash incomes of most consumers.   At the same time,
Tanganyika may want to keep the price of sugar relatively high
to encourage increases in production in order to attain complete
self-sufficiency.   It is extremely difficult to follow both
these policies simultaneously under the present system or for
that matter -under a completely integrated set up.

The present system of production and distribution has
neither the advantage of a policy of national autarky, the
ability to pursue independent policy objectives, nor the
advantage of a system of complete integration, the minimization
of production and transport costs.   Thus there are forces
which tend to push the governments towards either of the two
extremes, national autarky or more complete integration.
National autarky has the disadvantage that production and
transportation costs will not be minimized for East Africa as
a whole.   Complete Integration has the disadvantage of limited
independence in the pursual of territorial policy objectives
and the drawback that there will be certain costs involved in the
reorganization of the present distribution system.   The Ministry
of Commerce and Industry will have to divest itself of complete
control of the distribution in Kenya, and the contracts between
the Uganda and Tanganyika producers and their distributors will
have to be terminated in an equitable fashion.

The desirability of production and distribution on an East
African basis as opposed to national autarky depends to a large
extent on the amount of savings in production and transportation
costs which can be achieved.   In order to get a quantitative
approximation of these savings, we attempted to formulate a
mathematical model of the system of production and distribution
which is described in the following section.

IV.   '"The Model of Production and Distribution.

Within each of the three territories, it was possible to
separate analytically 38 different focii of consumption.   These
focii comprised most of the major population and distribution
centers in East Africa.   From data supplied by the East African
Railways and Harbours.Administration, the Ministry of Commerce

Given estimates of production for each distribution center, estimates of production by each factory, and estimates of the transport cost's between all points of supply and all points of demand, it is possible to write an equation of total transport costs and to write a set of equations which specify that each point of consumption receives its alloted amount and each factory disposes of its production.   Using linear programming techniques, one can determine which factory should supply which distribution center in order that transport costs be minimized.

For the year 1970, the following exercises were performeds

(1)   Assuming that the minimum production estimates for each factory were realized, total transport costs were minimized subject to the restriction that no sugar could be transported across territorial boundaries.

(2)   Assuming that the minimum production estimates for each factory were realized, total transport'costs were minimized on an East African basis, i.e., we assumed that sugar was free to move across territorial boundaries.

(3)   Assuming that the minimum total production estimate was realized but not necessarily assuming that the minimum estimates for each factory were realized, total transport costs were minimized on an East African basis.

(4)   Steps (l), (2) and (3) were repeated only this time using the maximum production estimates for each factory and the maximum total production estimate.

Subtracting the minimum total transport cost in (2) from that in (1), one obtains an estimate of the savings which would result from a distribution on an East African basis if in fact the minimum estimates of production for each factory in 1970 are realized.   Subtracting the minimum transport cost .in (3) from that in (2), one obtains the additional savings obtained if the minimum total production estimate for 1970 is realized. The minimum total transport cost in (3) is obtained by assuming that each distribution point is supplied by the factory with the lowest transport cost to that point.   The resulting amount supplied by each factory is not necessarily equal to its minimum production estimate, but the total amount supplies by all factories equals the minimum total production estimate.

The above analysis contain several implicit assumptions. One is that there is an even flow throughout the year between all points of demand.   Although production schedules in the past have been uneven, a steady flow can be achieved by holding sufficient stocks at each factory.   Another assumption is that the product is homogeneous, i,e„, there no' differences, in quality or differences are insignificant as far'.as the .consumer- is concerned. This assumption is probably more . justified in the c-.ase of African and Asian consumers than it is for the small number of European consumers.   For the export market quality can be a crucial factor.   In working out the solutions in the four steps above, however, it turned out that in most instances, the factory at Wami River which Will be geared to producing raw sugar -was an exporter in sufficient quantity to satisfy the present obligations for raw sugar exports under the Commonwealth Sugar Agreement.   It is not unreasonable to assume that some market can be found for all other sugar exported regardless of quality, although that is not to "say anything about the price

and Industry in Kenya, and the East African Common Services
Organization, It was possible to determine the approximate
percentage of sugar consumed in a country which must
pass through each of these population centers before being
distributed either in the center itself or in the area
surrounding the center. Given the estimated '..:
consumption for any year, by multiplying by the percentage
passing through each center, it was possible to obtain
estimates of the absolute amount passing through each center.

Next it was necessary to determine the cost of
transporting a ton of sugar from each of the 9 points of
production and from the nearest point of entry (for imports)
to each of the 38 distribution centers and to each port of
exit (for exports). A special problem arose in this
connexion. The two producers in Uganda and the two major
producers in Tanganyika have negotiated special rates with
East African Railways and Harbours. The Kenya producers
and the minor producers in Tanganyika must transport their
sugar on the railways at higher rates. Furthermore, the
Railways and Harbours Administration is considering a
change in their rate system so that rates correspond more
closely with costs. One major change which is being
considered is a modification of the taper. (The taper refers
to a declining average charge per mile as distance increased).
The present taper is such that the charge for each additional
mile declines with distance. The Railways and Harbours
Administration, however, calculates that the actual cost of
each additional mile is the same regardless of distance
although there is an initial handling and loading cost.
If costs and rates are to be more closely correlated, this
would require an initial fee for transporting any distance
at all and a constant charge for each additional mile
travelled. Of course, under such a system, the average
charge per mile would fall with distance.

In view of these considerations, we assumed that by
1970 at least all East African sugar producers will have
negotiated special rates with the railways and that the
taper would be modified to reflect costs more accurately.
We calculated regression coefficients with total transport
charges as the dependent variable and distance in miles
as the independent variable using as our sample the special
rates which were quoted in the Official Tariff Book. The
result was a straight line relationship between total
transport charges and distance. In using this regression
equation has a basis for calculating total transport fees,
one achieves a constant charge for each additional mile and
a falling average charge per mile. Where it was possible
to use the rail or water transport services of East African
Railways and Harbours between any two points, the regression
equation was used to estimate the transport cost between
those two points. The East African Railways and Harbours
provides road transport -over some routes. In order to
estimate road transport costs, we again used the special
rates quoted in the Official Tariff Book for road services
and calculated a regression line. Where neither road
services nor rail or water transport were provided by
East African Railways and Harbours, it was assumed that
the Railways and Harbours road service rates applied.

Finally it was necessary to obtain a set of minimum
and maximum production estimates for each of the sugar
factories in East Africa for the years 1963 to 1970.

/Given

which may Toe obtainable for that sugar. A third implicit assumption is that under national autarky (restricted movement across territorial boundaries) the transport costs will be minimized within each territory and with complete integration, total transport,, costs will be minimized on an East African basis.   If the divergencies from an optimal pattern of• distribution are about the same in either case, however, the estimate of savings will not be substantially affected.

IV.   Results and Conclusions

In Table VI the results of executing the four steps in the previous section are summarized.

Table VI

	Minimum Production Estimates for 1970 Realized	Maximum Production Estimates for 1970 Realized
Savings in transport costs if production of each factory as estimated	£249,391	£ 9,107
Savings in transport costs if production of each factory allowed to vary	£58,990	£342,729
Total possible savings in transport costs	£303.381	£351,836
Estimated total transport costs	£1,263,360	£11,658,080
Total savings as a percentage of estimated total transport costs	24	19
Total value or production (Valued at the East African producer price of £46 per ton).	£17,296,000	£25,438,000
Total savings as a percentage of the total value of croduction		1

The total possible savings in transport costs are about the same whether the minimum or maximum production estimates hold. The source of savings is vastly different, however, If the minimum estimates hold most of the savings occur with a reorganization of the distribution channels.   If the maximum estimates hold, most of the savings occur[1] because of a reallocation of production among the firms.   Since the maximum production estimates are based on the assumption that the newer ventures will go ahead as planned, this leads one to suspect that the relative rates of expansion should be quite different if the maximum savings in transport costs is to be achieved.

If the minimum production estimates hold for each factory, then the pattern of distribution changes drastically when sugar is distributed on an East African basis as opposed to the distribution pattern under national autarky.   Kenya no longer has to import to supply Nairobi and its environs, Voi and Mombasa.

/instead

Instead these centers are supplied by the Kenya factories near
Lake Victoria.   The western part- of Kenya (Kitale, Eldoret,
Kisumu and'N akriruy and the northern part of Tanganyika
(Shinyanga, Mwanza and Musoma) are supplied "by Uganda producers
instead of exportation by the Uganda producers.   Tanganyika
sugar from Arusha C-hini rather than going west to Musoma and
Singidia and east for export goes north to Nairobi, Machakos
and Kitui.   Ramisi sugar comes south to Tanga rather than
north to Mombasa.

     If the maximum estimates hold for each factory, then
there will be little difference in the pattern of distribution
between a situation of national autarky and complete
integration.   The pattern in Tanganyika undergoes no change
at all.   Uganda producers supply western Kenya (Eldoret, Kitale,
Kisumu, Nakuru, and Nairobi), and sugar produced near Lake
Victoria in Kenya is exported.   Uganda still exports but not
so much as under national autarky.

     The estimates of total possible savings in Table VI do
not take into account differences in production costs.   If
production costs plus transportation costs are minimized and
there is a difference in production costs, then the savings
will be even greater.   Although total possible savings is
only a small percentage of the total value of production, if
there is a 10 to 20 per cent difference in production costs
between factories, the savings could be anywhere from 5 to
20 times greater.   It is very likely therefore, that if
policies can be devised and adopted which encourage production
whereever costs are lowest, then very substantial savings in
absolute terms can be realized.

     On the other hand, the total possible savings in
transport Costs alone are quite a large percentage of the
total estimated transport bill in either case.   To give
this figure some context, the total possible savings in
transport costs in either case represents about 17 per cent
of the estimated 1962/63 Uganda government expenditures on
roads, about 10 per cent of the estimated 1962/63 Uganda-
government expenditure on education, and about 10 per cent
of the expenditure on law and order1O.

     One must keep in mind that the savings in transport costs
are based on a set of revised transport charges and not actual
charges as given in the Official Tariff Book.   If the present
official rates were used, the savings would be somewhat
larger.   There is reason to believe, however, that the revised
rates more' accurately reflect the true costs of transport.

     Finally, there is the question of who will benefit from •
the savings in transport costs.   Since the total possible
savings is such a small percentage of the total value of
production, the possible difference in price to the consumer
would be almost negligible.   Most likely, the only way
consumers could benefit significantly would be through a
rationalization on the basis of production costs and/or a
closer relationship between prices and costs.   If the East
African producer price is lowered for example, then retail
prices would be more in line with prices in other sugar
producing countries, and consumers would benefit from this
lower price.   Furthermore,the savings in transport costs
would still be the same and constitute a larger percentage
reduction in price to the consumer.   If the savings resulted
in a higher price to the producer, then it would most likely
mean a significant increase in profits.   Alternatively,the
governments could raise the sugar excise duty and rake off the
savings as increased government revenue.
                                   /Footnotes.

Footnotes;

1. Throughout this paper East Africa refers to the
    three territories of Uganda, Tanganyika and Kenya.

2. See East African Trade and Industry, Volume X,
    Number 113, July, 1963, p.34.

3. See East Africe-n Trade and Industry, Volume X,
    Number 109, p.14.

4. Sugar is an 18 month crop. See The Economic
    Development of Uganda, a report of a mission
    organized by the International Bank for
    Reconstruction and Development, Baltimore, John
    Hopkins Press, 1962, p.176

5. A.Viton and F. Pignalosa, Trends and Forces of
    World Sugar Consumption, Food and Agricultural
    Organization of the United Nations, Rome, 1961,
    p.18.

6. Ibid, p.77

7. See the Laws of Kenya, Price Control Ordinance,
    Chapter 504, Subsidiary Legislation, Orders under
    section 5.

8. Op.cit.

9. For a discussion of quality control and premiums
    for quality see Report by Dr. K. Douwes Dekker on
    the quality of East African sugar, 1959.

10. See Uganda Government, 1962 Statistical Abstract,
    Statistics Branch of the Ministry of Economic
    Affairs, Entebbe, p.68.

TABLE I

PRELIMINARY INPUT-OUTPUT TABLE KENYA 1957[1]

USING SECTORS (Values: £ thousand)

INPUTS

INPUTS	Agriculture Liv. Stock Fishing & Hunt.	Forestry	Mining & Quarrying	Food Manufacture	Drink	Textiles Cloth. & Footwear	Timber	Furniture	Pepar Products	Printing	Leather	Chemicals	Non-Metallic Mineral Prod.	Machinery & Repairs	Transp. Equip. & Repairs	Metal Products	Construction	Government	Misc. Inc.(5) Tobacco	Transport	Services Rents Utilities & Distr.
1. AGRICULTURE	400			11700	650	150					150	1100					1500				
2. FORESTRY																					
3. MINING & FORESTRY												150									
4. FOOD MANUFACTURE				1100	200														1500		
5. DRINK					350																
6. TEXTILES CLOTH. & FOOT.											200										
7. TIMBER							500	500									1400				
8. FURNITURE																	300				
9. PAPER PRODS.										600											
10. PRINTING																					
11. LEATHER																					
12. CHEMICALS	1350		50	150	100	50	150				50	150	50	50	50	50	650				
13. NON. METAL MINS.													100				4000				
14. MACHINERY & REPAIRS							250						450	50	100	50	200				
15. TRANS. EQUIP. & REPAIRS.							250	50			—	300	50	100	100	50	700				
16. METAL PRODS.				700	350			50		50	50	100		50	100	50					
PACKING			100	700	100	50	250	100	200		250	500	200	1250							
TRANSPORT FUEL		150	250	250	100		250	50	200	750	50	850	2000	1500	3450	2150	15700		600		
RENTS & ROYALTIES.				100	100		250	100	50	900	50	2350	450	1500	3450	2000	5900				
UNALLOCATED[3]	5600		50	400	500	50	250	50	200	250	50	1100	300	1250	3100	2000					
TOTAL MATERIAL & OTHER NON PRIMARY INPUT COSTS	7350		850	15000	2050	2500	1450	700		2250	250	2350	2000	1500	3450	2150	15700				
LABOUR COSTS	10950	550	900	1350	600	850	950	400	200	1500	50	850	450	400	650	350	1950	19800	500	4800	30650
PROFIT SHARE	21750	150	400	1500	1100	450	650	150	100	750	—	2350	950	1200	2100	400	9850	19800	600	12400	30650
NET OUTPUT[2]	32700	700	1500	2850	1750	1300	1600	550	300	2250	50	3300	1400	1600	2750	750	11800	19800	1100	17200	50350
GROSS OUTPUT	40050	700	2150	17850	3800	5800	3050	1250	2250	2250	300	5300	3400	3100	6200	2900	27500	19800	1100	17200	50350
IMPORTS[4]	2250	—	200	3750	650	9750	450	150	2250	—	100	4250	1050	7200	10300	7850	—	—	—	—	—

FUEL IMPORTS ETC.			
Fuel Output	10750	3050	13800
CONSUMPTION GOODS IMPORTED, NOT INCLUDED ABOVE		3000	
TOTAL IMPORTS & DUTIES		65500	

(TOTAL WAGE   84500
(TOTAL PROFIT   68900
(TOTAL GDP.   153400

(The Notes to this Table are set out on the next page)