SOME ECONOMIC ASPECTS OF CURRENT PRODUCTION, MARKETING
AND DISTRIBUTION POLICIES OF MAIZE IN KENYA AND A
PROPOSED FRAMEWORK FOR GENERATING INFORMATION
ON ITS DEMAND AND SUPPLY

By

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I. INTRODUCTION AND STATEMENT OF THE PROBLEM

Maize is one of the most important crops grown in Kenya. It is important as a basic staple, a source of income to many Kenyans, a source of raw material for a budding manufacturing industry as well as a source of foreign exchange. Infact, maize has been identified by the government as a major growth factor in agriculture.¹ The principal reason behind this rather special government ranking of the maize industry is that, whereas about 90 percent of the Kenyan population depends on maize as their basic staple food, the country was unable to produce sufficient maize to meet domestic requirements until the early 1970s.² Frequent shortages of maize have sometimes resulted in serious famines which, a part from causing a lot of suffering to many people, have also caused embarrassment to the various administrations of this country whose


agriculture in general, has been described by some as "second to none" in independent Africa. ³

Government attempts to solve the problems of frequent shortages and famines, dates as far as 1922 when a governments commissioned study on maize was published.⁴ Since then, periodic shortages have provoked eleven commissions of inquiry, working parties or select (Parliamentary) committees to investigate the pricing and marketing of maize.

As a result of the intermittent shortages of maize, government administrations in the past, have usually reacted to such crises by introducing controls and regulations on the maize industry in general, and its marketing system in particular. Thus, following one such crisis, in 1941, the then colonial administration decided to intervene in the market on behalf of producers by offering them a "guaranteed" price for their maize as an incentive to increase their production. However, shortages grew even worse in the following year and the government, "vowing never again to be caught in such a situation," imposed strict


controls and regulations on the maize industry on July 1942.  

Behind such strict controls and regulations, was a general policy aimed at making the country self-sufficient in maize apparently at any cost to the nation. This policy was followed for many years and in 1964, it was adopted intact by the new independent Kenyan government. However, maize production has greatly improved since 1964, and it is now recognized by the government and various experts, that the country has finally become a surplus producer of maize.  

Thus, with this breakthrough in production and its attendant marketing and distribution problems, government has come under increasing pressure from various groups of people demanding that the controls and regulations placed on the marketing of maize in the past should now be relaxed or removed altogether. At the same time however, there are other people in the country who do not appear to be convinced by the argument that the attainment of a surplus status in maize is sufficient justification for changing the present pricing and marketing policies. For example,

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5 Ibid., p. 44.


a recent select (Parliamentary) committee on the maize industry reported:

The Committee appreciates that some people will feel uneasy or even apprehensive about entrusting the distribution of maize to a free market. It [the Committee] urges them to consider whether they feel any less uneasy about the current state of affairs outlined in the report and to recognize that an organized market is not necessarily an efficient one.8

Implicit in the uneasiness or apprehension of such people, is the apparent fear that a free market will not prevent "unscrupulous" middlemen from manipulating prices for their own selfish ends. Indeed, these sentiments, founded or unfounded, are similar to those circulated in both Kenya and Tanganyika [Tanzania] before the present controls and regulations were instituted. Asian traders were often accused of "exploiting" farmers and consumers.9 Whether these accusations were true is still unknown since no one appears to have studied their market behavior over time. But as the select committee argues, people harboring such uneasiness, should ask whether the present marketing system serves the country any better than a free market would.


The purpose of this paper is to attempt to evaluate the performance of the present maize marketing system and to develop a framework to determine what would be the overall impact of a return to the free market system. Our motivation for attempting to carry out an evaluation of the present official maize marketing system and a framework to determine the overall impact of the proposed reform stems from two considerations: (1) charges that have been made against the system by various groups of people have been largely unsupported by significant evidence—particularly those relating to market failure, and (2) it appears that the recommendations given by various experts that the present official marketing system be replaced by a free market have been made without detailed understandings of the marketing system as it now operates and consequently, other possible alternatives for the marketing of this important commodity have not been duly considered.

For our purposes, we will approach the evaluation of the present marketing system through the concepts of market structure, market conduct and market performance and their relationship. Market structure will be used here to refer to the economically significant features of a market which affect the behavior of firms constituting that market. Defined this way, an examination of market structure would take into account such factors as: (1) the number of sellers in the market—which gives an idea of the competitiveness of the market; (2) degree of product
differentiation; (3) barriers to entry; (4) rate of growth of market demand; (5) price elasticity of demand; and (6) buyer concentration.

With regard to market conduct, we refer to the firms' policies towards their product market as well as towards the moves made by their rivals, if any. This perspective on market conduct draws attention to the firms' policies towards selling prices of their product (if they are not price-takers), their policies towards the quality of their product as well as strategies aimed at coercing rivals—under imperfect competition.

A general definition of market performance, would include the degree to which the market facilitates the process of economic exchange between sellers and buyers in their attempt to maximize their profits or satisfaction respectively or any other goals. Thus defined, market performance would focus on how well a marketing system performs the various marketing functions such as: (1) facilitating the process of economic exchange; (2) transportation; (3) storage; (4) grading; (5) financing; (6) risk-taking; and (7) market information. This perspective of looking at a marketing system is based on the assumption that the structure of a market influences the behavior of the firms constituting that market which in

\[ \text{10 Some of these concepts are borrowed from E. Jerome McCarthy's Basic Marketing (Homewood, Ill.: Richard D. Irwin, Inc.), 1975.} \]
turn affects the performance of that market. Changes in market structure, e.g., an increase or decrease in the number of sellers, would lead to changes in firms' competitive behaviors and this would, in turn, lead to changes in the way these functions are performed. This would in turn lead to changes in market prices, costs, profits, and so forth. The consequences of these changes would then be reflected in the welfare of all those people who participate in that industry either as sellers or buyers.

To evaluate the performance of the present maize marketing system, a brief review of certain aspects of the industry will be first presented. Such a review is aimed at providing us with background information which will be useful as a reference to our evaluation and subsequent development of the analytical framework alluded to earlier.

To this end, we begin this study with such a review--Section II. This will then be followed in Section III by an evaluation of the present market system within the framework of government controls and regulations as well as the institutions that were created to implement them and in Section IV, we will develop the analytical framework which we hope can be used to determine or at least to gain insights into some of the factors that needs to be considered in any market reform policy considerations.
II. THE IMPORTANCE OF THE MAIZE INDUSTRY IN THE KENYAN ECONOMY

Maize as the basic staple for the majority of the Kenyan population, accounts for as much as 80 percent of the starchy staple calories in the urban areas and perhaps even more in the country-side.\textsuperscript{11} Kenyans have over the past several years become so dependent on maize that, according to William O. Jones, the country has become a monostaple economy.\textsuperscript{12} The evolution of the country from a multistaple to a monostaple economy has brought with it two broad problems. First, from a nutritional point of view, maize is basically a starchy food and the little protein it contains has been found to be deficient in lysine—an essential amino acid. The consequence is that, many people whose diets consist of almost nothing else but maize, are constantly exposed to the dangers of protein deficiency. This danger is particularly real to the so called "vulnerable" groups in such a population—such as pregnant and nursing mothers;

\textsuperscript{11}Gerhart, "Diffusion of Hybrid Maize in Western Kenya," p. 31.

pre-school and school children; and the aged. Currently, the government is attempting to rectify this situation through a special hybrid maize breeding program to develop varieties which are rich in lysine. This program is now well advanced and these varieties should be available for commercial production soon. At another level, attempts have been made to market a new brand of enriched maize-meal containing 20 percent wheat. However, this product was not accepted by consumers and has been withdrawn from the market.

The second problem is related to the amount of maize needed each year to feed the country's population. For more than 70 years, the various colonial administrations struggled to be self-sufficient in maize but with little success. One of the reasons behind this failure was the poor varieties of maize that were being grown in the country and the fact that the production of maize is critically dependent on weather. Thus every time there was adverse weather, maize production would decline and


14 Gerhart, "Diffusion of Hybrid Maize in Western Kenya," p. 36.

a whole crop would be lost. Consequently, the country would find itself threatened by famine. In the event of a real serious threat of famine, consumer prices would sky-rocket and, as a result, there would be urban labor strikes and rural unrest. For example, in 1943, the country was faced by such a critical shortage of maize that 10,000 workers were sent from Nairobi to their homes in the country to avert serious labor unrest and even possible mass riots.\textsuperscript{16} Following this shortage the government initiated a program of grain storage—spending about K\$ 500,000. By 1952, this storage program could handle over one million bags (200 pounds each). The same program has been expanded and improved and current stocks in long term storage in the so called "National Strategic Reserves," are about 1.5 million bags.\textsuperscript{17} With the achievement of surplus status, this problem may have finally been solved.

Maize is, of course, an important source of income to farmers as shown in Table 1.

The figures shown in Table 1 represent only a small proportion of the total volume and value of maize since less than 20 percent of the total output is marketed through

\textsuperscript{16} Gerhart, "Diffusion of Hybrid Maize in Western Kenya," p.

\textsuperscript{17} Republic of Kenya, Report of the Select Committee on the Maize Industry, p. 19.
<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>103.8</td>
<td>134.3</td>
<td>248.8</td>
<td>352.8</td>
<td>280.3</td>
<td>205.7</td>
<td>256.0</td>
<td>376.0</td>
</tr>
<tr>
<td>Value</td>
<td>1.848</td>
<td>2.697</td>
<td>4.218</td>
<td>5.405</td>
<td>4.172</td>
<td>2.853</td>
<td>4.276</td>
<td>7.253</td>
</tr>
</tbody>
</table>

the Maize and Produce Board. Estimates of the value of total output (domestic prices) in 1965 was about KSh 20 million, making it twice as valuable as coffee—the second most valuable crop. The gross value of the 1974 crop was about KSh 32 million. A large part of this value accrues to small scale farmers who control about 97.5 to 98.5 percent of the total maize acreage each year.

With increased adoption of the high yielding hybrid maize seed varieties and the related technology, yields on the more than two million acres estimated to be under maize each season in the small scale sector, are expected to increase. The main hope of planners and policy makers is that a large portion of this acreage will be planted with hybrid maize in due course. Judging by the rate at which hybrid maize has been increasing this hope, as Table 2 indicates, is likely to be fulfilled soon.


Table 2.—Hybrid Maize, Acreage by Type of Farm, 1963-73.

<table>
<thead>
<tr>
<th>Year</th>
<th>Small Scale*</th>
<th>Large Scale*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962/63</td>
<td>10</td>
<td>390</td>
<td>400</td>
</tr>
<tr>
<td>63/64</td>
<td>1,750</td>
<td>28,100</td>
<td>29,850</td>
</tr>
<tr>
<td>64/65</td>
<td>20,040</td>
<td>54,700</td>
<td>74,740</td>
</tr>
<tr>
<td>65/66</td>
<td>37,730</td>
<td>63,900</td>
<td>101,630</td>
</tr>
<tr>
<td>66/67</td>
<td>115,250</td>
<td>137,140</td>
<td>252,390</td>
</tr>
<tr>
<td>67/68</td>
<td>126,840</td>
<td>90,195</td>
<td>217,035</td>
</tr>
<tr>
<td>68/69</td>
<td>158,864</td>
<td>97,605</td>
<td>256,469</td>
</tr>
<tr>
<td>69/70</td>
<td>240,608</td>
<td>113,409</td>
<td>354,017</td>
</tr>
<tr>
<td>70/71</td>
<td>370,316</td>
<td>157,613</td>
<td>527,929</td>
</tr>
<tr>
<td>71/72</td>
<td>511,013</td>
<td>182,718</td>
<td>693,731</td>
</tr>
<tr>
<td>72/73</td>
<td>644,678</td>
<td>133,135</td>
<td>777,813</td>
</tr>
</tbody>
</table>

*Small scale refers to sales of 10 kg. units and large scale to sales of 25 kg. units. Acreages are based on the assumption that 10 kg. of seed will plant one acre.


The importance of maize as a raw material for industrial manufacturing has been confined until very recently to the manufacturing of animal feed. This situation however, has already changed significantly. As a result of Kenya becoming a surplus producer of maize it has been looking for opportunities to expand the industrial use of maize. Two factories to manufacture starch, corn flakes and glucose have already been licensed and are expected to utilize initially about 14,500 metric tons of
maize per annum.\textsuperscript{23} Maize offtake by the animal feed manufacturing industry has also been expanding recently and this expansion is expected to continue as a result of growth in the livestock industry.\textsuperscript{24} Table 3 shows the quantities of maize that has been used for this purpose for the period 1960/61 to 1970/71.

Before 1967, the uptake of maize by the livestock industry was, as can be seen from the table, rather sluggish and intermittent. The problem appears to have been related more to the supply side than to demand. Until the crop year 1967/68, the industry could only be allocated maize after domestic human consumption had been satisfied. Thus whenever there was a maize shortage, supplies to this industry would be the first to be cut.

Maize supplied to the animal feed industry has been subsidized by the Maize and Produce Board—such subsidies being justified on the grounds that the country needs to expand its livestock industry and is offering incentives to producers, particularly of beef, to encourage them to start using beef lots which are said to produce high export quality beef that can be sold at premium prices in the world market. However, the livestock industry using these feeds was controlled by large scale farmers. Since the


\textsuperscript{24} D. W. Hopper, "Opportunities for Increasing the Domestic Offtake of Maize Through Its Use as a Livestock Feed" (Nairobi, February, 1969), p. 5.
Table 3.--Maize and Produce Board: Domestic Purchases and Sales to Livestock Feed Industry, 1960/61-1970/71* (1000 bags, 200 pounds each).

<table>
<thead>
<tr>
<th>Crop Year</th>
<th>Domestic Purchases</th>
<th>Domestic Sales to Livestock Feed Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960/61</td>
<td>1,586</td>
<td>90</td>
</tr>
<tr>
<td>61/62</td>
<td>1,643</td>
<td>21</td>
</tr>
<tr>
<td>62/63</td>
<td>2,233</td>
<td>3</td>
</tr>
<tr>
<td>63/64</td>
<td>1,073</td>
<td>81</td>
</tr>
<tr>
<td>64/65</td>
<td>1,170</td>
<td>22</td>
</tr>
<tr>
<td>65/66</td>
<td>1,474</td>
<td>12</td>
</tr>
<tr>
<td>66/67</td>
<td>2,509</td>
<td>-</td>
</tr>
<tr>
<td>67/68</td>
<td>3,582</td>
<td>86</td>
</tr>
<tr>
<td>68/69</td>
<td>3,246</td>
<td>118</td>
</tr>
<tr>
<td>69/70</td>
<td>2,152</td>
<td>212</td>
</tr>
<tr>
<td>70/71</td>
<td>2,668</td>
<td>236</td>
</tr>
<tr>
<td>71/72</td>
<td>4,211</td>
<td>257</td>
</tr>
<tr>
<td>72/73*</td>
<td>4,700</td>
<td>400</td>
</tr>
</tbody>
</table>

*Estimates

Board subsidize the feeds industry by charging high prices for maize for human consumption, it can be argued that this in effect amounts to the poor subsidizing the rich.

As a source of foreign exchange, maize has contributed varying amounts—amounts that have been dependent on the availability of domestic surpluses. Unfortunately, whenever the country has exported maize, it has always incurred losses because domestic producer prices have been maintained well above export parity. However, recent improvements in world grain prices may have helped to cut such losses. But even with such price rises in the world market, it has been argued that the domestic export parity gap could have been closed if "excessive" handling and transport costs have been reduced appreciably particularly if bulk handling and transport facilities were adopted. The nature of this problem is that, the country until now has had no such facilities and its handling and transportation has been performed through labor intensive methods. At the port of Mombasa, it has often been necessary to unload maize from railway wagons onto trucks, send it into private warehouses for short term storage awaiting shipping and when the ships are ready, load it onto trucks again and deliver it to the loading zones. All these handling by labor intensive methods has ended up widening the gap between

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F.O.B. and Export Parity prices.\textsuperscript{26} Table 4 below, shows a sample of the type and magnitude of costs involved.

Table 4.--Cost of Maize FOB Mombasa, 1967/68.*

<table>
<thead>
<tr>
<th>Hem</th>
<th>Cost/200 lb. Bag in Kenya Shillings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Maize at Board Depot</td>
<td>25.00</td>
</tr>
<tr>
<td>Maize Board's Expenses</td>
<td>4.10</td>
</tr>
<tr>
<td>Railage to Mombasa</td>
<td>5.60</td>
</tr>
<tr>
<td>Port Expenses</td>
<td>6.00</td>
</tr>
<tr>
<td>Cost of Bag</td>
<td>1.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>42.20</strong></td>
</tr>
</tbody>
</table>

*These costs were derived from the Annual Report of the Maize and Produce Board for the crop year 1967/68 when some 2.9 million bags were exported. Export Parity for the same period was k.sh. 19.0. Information on export parity was provided by Dr. Olsf Hesselmark, Economist/Statistician, Maize and Produce Board, in a letter to the author in June 1975.


The Working Party referred to above, made a detailed feasibility study on the economics of installing bulk handling facilities and contended that such facilities substantially reduce port handling costs. The Working Party also contended that the overhead costs of the Board could

be reduced. As a result of these cost saving operations, the Working Party thought that the gap between the F.O.B. Mambasa prices and the export price could be substantially narrowed.\textsuperscript{27} These recommendations were made about six years ago and they do not appear to have been implemented yet.

\textsuperscript{27}Ibid., pp. 74-75.
III. THE ORGANIZATION AND PERFORMANCE OF THE PRESENT MAIZE MARKETING SYSTEM

The most notable feature of the present maize marketing system is the monopoly position occupied by the Statutory Maize and Produce Board. The Board has, under the 1959 Ordinance by which it was established wide-ranging powers over the disposal of surplus maize. It has power to "regulate, control and improve the collection, storage, marketing, distribution and supply of maize and maize products," and with some exceptions, "all maize grown in the country shall . . . vest in the Board as soon as it has been harvested."28 The exceptions include maize grown and consumed on the same farm and within the same district. Thus according to this ordinance, if a surplus of maize occurs, the Board has the power to export it and in the case of shortages, the Board may seek authority from the Minister of Agriculture to import maize. The milling industry also comes under the control of the Board—which requires that all millers are registered with it. Millers must purchase

their supplies from the Board at fixed prices and the Board also fixes ex-mill prices.

Up to 1963, a regional quota system was in force and was aimed at penalizing those regions that contributed most to export surpluses by exceeding their quotas: export losses were apportioned according to how much regions exceeded their quota. For the purposes of implementing this quota system, it became necessary to control and regulate the private movement of maize from one district to another or across regions. This was necessary to make sure that all marketed maize through the Board, could be identified by regions of origin—something that could otherwise not have been possible if people were free to move maize freely across districts and regions. Another objective of this movement restriction was to reduce the volume of maize handled by the "black" market. Individuals however, could transport up to ten bags of maize within a single district and two bags outside the district. 29 That is to say, these amounts were exempted from the movement restriction order. Any one caught transporting more than this amount without a "movement permit" could be imprisoned and his crop plus the transporting vehicle be liable to confiscation.

The creation of the Maize and Produce Board in or about 1956, and the implementation of government pricing

policies with respect to producer and consumer prices, meant—at least officially—the end of the free market in maize. Buyers and sellers could no longer, other than through the "black" market carry out economic exchange guided by prices determined by forces of demand and supply. Thus, assemblers, transporters, processors, wholesalers and retailers became in effect the agents of government receiving for their services arbitrarily fixed commissions or margins.

The absence of price competition greatly restricted the decisions of producers who had a marketable surplus for the market. The development of other forms of competition could not occur first because, maize is a homogeneous product and any firm that tried to compete with others by offering more or better services would lose money since it could not recover the costs of providing these extra or improved services by charging higher prices. Second, through the system of licensing, the government further attempted to reduce competition. To receive a license either to buy or sell maize after it left the farms was like receiving a share of the market since government would not license a rival unless it considered the market big enough for more than one firm. The licensing system accordingly acted as a very effective barrier to entry. In summary, the Board became a monopsonist with respect to the purchasing of maize from farmers and a monopolist
with respect to the selling of maize once it entered the official marketing channel.

To this end, our evaluation of the present marketing system in effect means the evaluation of the government controlled market and which in turn, means the evaluation of the operations of the Maize and Produce Board and other supplementary institutions whose activities have served to condition the overall performance of the maize marketing system and the maize industry in general.

As a guide to our evaluation, we present a flow chart diagram showing the various distributional channels as well as the firms and other institutions which constitute the maize industry's market.

About 90 percent of maize produced by small scale farmers is consumed on the farms. The rest is sold in the local markets either to individual consumers, to unlicensed ("illegal") traders or to the Board's agents. In general, farmers sell their crops first to individual consumers or illegal traders because these usually pay higher prices compared to the Board's agents. However, since the amount of maize which can be sold in the local markets is limited and illegal traders are constrained in the amount they can buy by the need to move their purchases secretly across district boundaries, farmers are forced to sell about 10 percent of their crop to the Board's agents at "guaranteed" prices applicable in their district.
CONSUMERS: Households and Institutions

Fig. 1.—Flow-Chart of Maize Distribution in Kenya.
Key to the Flow Chart Diagram

M.P.B. = Maize and Produce Board


Uplands = A statutory body responsible for the processing and marketing of pigs and their products.


K.F.A. = Kenya Farmers Association. A private organization which acts as the Maize and Produce Board's sole agent for maize produced on large scale farms. There are more than 2,800 licensed agents who purchase maize on behalf of the Board in the small farm sector.
As soon as a maize Board agent purchases sufficient maize for a minimum delivery load (about 30 bags of 200 lbs. each), he starts to "hunt" for transport. Once he gets this, he sends his load to the nearest MPB depot where the load is inspected for moisture content, graded and stored. The agent is then paid cash for his load at a fixed price per bag. 30 This price includes a fixed commission or margin per bag from which the agent is expected to pay for all of his other costs except transport from his premises to the depot. The Board refunds the cost of transport to each agent on a fixed rate per bag per mile.

In the large scale farm sector, about 80 percent of the total output of maize is sold to the Board through the Kenya Farmers Association (KFA) which is the sole agent of the Board for this sub-sector. The KFA buys the farmer's crop again at the government "guaranteed" price and is paid a fixed commission similar to that paid other agents. The KFA is also the sole agent for the wheat Board and in this capacity, it has been able to generate substantial savings which have been invested, in attempts to increase vertical integration, in the milling industry. 31


Maize is then moved from the various up country depots to the Board's main stores which are located in the major urban centers. Some of it, may be sent directly from the up country depots to the "National Strategic Reserve's" storage system. The rest of the maize is then distributed, from these central stores, to the various channels as shown in Fig. 1. After the Board "ascertains" the amount of maize needed for domestic consumption and strategic reserves, the surplus is exported. In 1968, for example, the Board owed up to Kf 200,00 to banks to meet losses incurred in its export transactions for that year. If the Board finds that the marketable surplus is not sufficient for domestic consumption, it may then seek permission from the Minister of Agriculture to import maize. Such imports also involve heavy losses to the Board because local consumer prices are fixed and imported maize in bags is usually well above the local consumer prices because of the high transport costs of moving maize in bags from its country of origin to Kenya. The costs for bagging maize at a USA port for instance, as well as handling costs would be much lower if such maize was handled in bulk. For the crop year 1965/66, the Board incurred import losses of Kf 800,00.32 Yet in spite of such economic losses, it is not clear why the Board and/or the government has been so slow in recognizing the need to

install bulk handling facilities and other modern technologies even after these have been recommended by various experts.

Producer and Consumer Price Determination

Producer prices are determined by the "Price and Costs" committee chaired by the Minister of Agriculture. Information on the methods used in arriving at producer prices and production costs is scanty. However, it seems that the committee bases such prices on expected "average" yields and "average" costs per acre and using these two figures, it figures out a price that is supposed to give a "fair" return to the farmer. For several years in the past, a yield of eight bags per acre was the usual figure used in such calculations. It is not clear whether this yield is based on large scale commercial producers or small scale subsistence producers but whatever type of farmers it is based on, it is probably not a representative figure since yields in the country vary widely from as low as three bags to as high as 36 bags per acre. The cost of production should also differ quite significantly between the small scale farm sector and the large scale sector and also within farms.


34 Personal communication with Research Staff at the National Agricultural Research Station-Kitale, April, 1973.
Once the committee arrives at the producer price, this price is then published in the official Kenya Gazette and henceforth becomes the "guaranteed" price for the crop year. In most cases, this price will remain unchanged throughout the year but occasionally it may be changed halfway through the year. This means that such "guaranteed" prices in the end, never turn out to be the stable prices promised farmers by the government. It is also interesting to note that the "official guaranteed price" as published, is not the final price paid to farmers. Farmers are paid a price significantly lower than the published price since the Maize and Produce Board adjusts the official price to account for transfer costs which vary from area to area depending on the distance between each growing area and the central market. Thus the farther a farmer is located from the central market, the lower his "guaranteed price."

Table 5 shows the price structure that emerges from such transfer cost adjustments. The table also shows the various components of the Board's purchasing price.

From Table 5, we can see that producers in Central Province received the highest guaranteed price relative to producers in other provinces since they are located closest to the main consumer market--Nairobi. But it is also surprising that producers in the Coast, Nyanza and Western Provinces received about shs.2 per bag less than the price paid to producers in Central Province even though each of these three provinces are located about 300 miles farther.
<table>
<thead>
<tr>
<th>Province</th>
<th>District</th>
<th>Pack (kg)</th>
<th>Basic Price 90 kg Without Bag</th>
<th>Trader's Commission</th>
<th>Insecticides</th>
<th>Transport Pool (see Note A)</th>
<th>New Gunny Bag</th>
<th>Price to Traders 90 kg net</th>
<th>Grade Difference</th>
<th>Cost Delivered to MFB Store 90 kg net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nyanza</td>
<td>All Districts</td>
<td>90 kg</td>
<td>30 00  1 15</td>
<td>0 15</td>
<td>3 50</td>
<td>3 00</td>
<td>37 80</td>
<td>0 35</td>
<td>38 15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Western All Districts</td>
<td>&quot;</td>
<td>31 75  &quot; do -</td>
<td>&quot; do -</td>
<td>1 75</td>
<td>&quot; do -</td>
<td>&quot; do -</td>
<td>&quot; do -</td>
<td>&quot; do -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rift Valley Kericho District</td>
<td>&quot;</td>
<td>29 50  &quot; &quot;</td>
<td>&quot;</td>
<td>4 00</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rest</td>
<td>31 75  &quot; &quot;</td>
<td>&quot;</td>
<td>1 75</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central All Districts</td>
<td>&quot;</td>
<td>31 85  &quot; &quot;</td>
<td>&quot;</td>
<td>1 65</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meru (see Note B)</td>
<td>&quot;</td>
<td>29 50  &quot; &quot;</td>
<td>&quot;</td>
<td>4 00</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eastern Machakos</td>
<td>&quot;</td>
<td>30 90  &quot; &quot;</td>
<td>&quot;</td>
<td>2 60</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kitui (see Note C)</td>
<td>&quot;</td>
<td>29 80  &quot; &quot;</td>
<td>&quot;</td>
<td>3 70</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coast All Districts</td>
<td>&quot;</td>
<td>29 50  &quot; &quot;</td>
<td>&quot;</td>
<td>4 00</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td></td>
</tr>
</tbody>
</table>

Note: A. Transport from markets to depots or railheads to be paid at the rate of 7 cts. per mile per 90 kg net maize.
B. The amount of shs. 4.00 includes subsequent transport from Meru to Nanyuki.
C. The amount of shs. 4.50 includes subsequent transport from Kitui Township to Thika or Kibwezi.

Source: Maize and Produce Board--fifth Annual Report, July 31, 1971
from Nairobi as compared with Central Province. Since the cost of transport is more than two shillings per bag for 300 miles it is obvious that the pricing differentials do not fully reflect the real cost of transport (see for instance Table 4 where cost of transport from Nairobi to Mombasa—300 miles by rail is sh. 5.60 in spite of the fact that rail transport is subsidized). In a free market, such advantages would be fully reflected in regional price differences—with regions near the main market getting higher prices due to their lower transport costs.

Table 5 shows that the commission paid to the Maize and Produce Board's agents was fixed at shs. 1.15 per bag delivered to the Board's depots. They are also paid a refund for insecticides, transport as well as for the gunny bags used to pack the maize. We do not know whether this commission was "fair" or not since we do not have data on the costs of the services these agents provide.

With respect to consumer prices, we have already indicated earlier that millers pay a fixed price to the Board for their supplies and the Board fixes their ex-mill prices. Prices for wholesale and retail are fixed through the legal framework provided by the Price Control Ordinance [Chapter 504 of the Laws of Kenya]. Under this ordinance, a "price control" committee chaired by the Minister of

Commerce and Industry acts as the watchdog institution. The committee has the power to adjust prices if a good case is presented by the firms concerned. Table 6 presents the price structure formulated under this ordinance and other supplementary legislations which was in force for Nairobi and its suburbs in 1971.

From Table 5 and 6, we see that the Maize and Produce Board's trading margin for the relevant period was about shs. 10.25 per 90 kg bags. This margin represents the Board's costs for grading, transportation from depots to the main stores in Nairobi, storage and other overhead costs. The marketing costs were about k shs. 4.10 per bag for the 1968/69 crop year. The 1971 figure (shs. 10.25), appears to be too high especially considering the fact that a working party had already studied the cost structure of the Board and had recommended several cost cutting strategies in 1969. Such cost reductions were expected to lower the Board's marketing costs from shs. 4.10 to about shs. 2.10 per bag. The 1971 figure would seem to suggest that, perhaps, such strategies were not adapted.

From Table 6, it can be seen that miller's margin was absent. shs. 3.26 per bag handled (ex-mill sale price of shs. 51.65 less purchase price ex-Boards store of shs. 48.40). Based on similar calculations, wholesaler's

Table 6.--Wholesale and Retail Prices for Whole Maize and Maize Meal [POSHO] for Nairobi, 1971.

<table>
<thead>
<tr>
<th>In Lots of 12.5 Tons or More</th>
<th>shs.</th>
<th>cts.</th>
<th>shs.</th>
<th>cts.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Whole maize</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Sales to millers or traders per 90 kg:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) FOB sender's station carriage paid</td>
<td>48</td>
<td>15</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>(b) Ex-Maize and Produce Board store</td>
<td>48</td>
<td>40</td>
<td>48</td>
<td>65</td>
</tr>
<tr>
<td>(2) Retail sales to consumers extrader's store per 90 kg including price of bag</td>
<td>50</td>
<td>55</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>(3) Retail sales to consumers per 1/2 kg weighed and packed by trader</td>
<td>-</td>
<td>0</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>(4) Retail sale to consumers per 1 kg weighed and packed by trader</td>
<td>-</td>
<td>0</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td><strong>B. Maize Meal (POSHO)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Sales per 90 kg including price of bag</td>
<td>51</td>
<td>65</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>(2) Sales ex-wholesaler's depots</td>
<td>52</td>
<td>35</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>(3) Sales to consumers ex-trader's store per 90 kg including cost of bag</td>
<td>53</td>
<td>40</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>(4) Sales to consumers per 1/2 kg weighed and packed by trader</td>
<td>-</td>
<td>0</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>(5) Sales to consumers per 1 kg weighed and packed by trader</td>
<td>-</td>
<td>0</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td><strong>C. Fibrous Maize Meal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Sales to consumers per 90 kg ex-trader's store including cost of bag</td>
<td>25</td>
<td>35</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>(2) Sales to consumers per 1 kg weighed and packed by trader</td>
<td>-</td>
<td>0</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

Source: Kenya Subsidiary Legislation, 1971. Provided by author by Dr. V. L. Sorenson to whom I am very grateful.
margin was about shs. 0.70 per bag handled while retailers margin was about shs. 1.05. It is not possible to say whether or not these were "fair" margins or not—again because we do not know how much it cost to provide for the processing, packaging, storage, wholesaling and retailing of maize and its products. However, the costs for providing these services notwithstanding, W. D. Hopper, Y. Kyesimira and others have argued that consumer prices for maize and its products have been too high and have served to limit consumer's ability to expand their use of maize and therefore the growth of its domestic demand.\(^{37}\)

The development of the present maize marketing system was preceded by a period in which problems of maize shortages and wide producer and consumer price fluctuations were associated with shortcomings of the free marketing system then in existence. In particular, these shortcomings were closely associated with middlemen who were thought to be responsible for some of the shortages and most of the price fluctuations. To rid the country of such frequent shortages and price fluctuations, the "solution" was to either curtail the operations and behavior of such middlemen or the complete dismantling of the free market replacing it with a more "responsible" government.

administered marketing system. Such a government
rtered marketing system, it was thought, could reduce a
frequency of maize shortages through better management and
coordination of purchasing and storage and at the same
time, stabilize both producer and consumer prices. Impli-
cit in this argument was that, the role of middlemen in the
market was not all that important—a mere question of
buying maize from producers and selling it to consumers—
and that it could be easily performed by a government
controlled marketing system much more efficiently and
responsibly.

Consequently, when the government came around to
providing for "reforms" in the marketing system, the first
policy measure to be taken was, as we have seen earlier, the
introduction of "guaranteed" prices to producers followed
by attempts to "rationalize" the marketing and distribution
of maize once it left the farms. 38 To operationalize these
policies, it became necessary to control and regulate the
marketing system and to do so, the Maize and Produce Board
was created to "regulate, control, and improve the
collection, storage, marketing, distribution and supply of
maize and maize products." To what extent has the Board
achieved these objectives? What has happened to other
functions that are performed by a free market and yet were
not provided for in this set of objectives that the Board

was expected to pursue? For example, the function of providing for market information in the absence of a freely and competitively determined set of market prices which performs this function in a free and competitive market.

To have been able to control, regulate, and improve collection, storage, marketing, etc., it was necessary for the Board to have complete knowledge of the industry including knowledge about aggregate supply, demand and factors that influence both. Needed here was not just general knowledge about these functions and factors influencing them. It was necessary to know how these factors were interrelated to each other and how they interacted to determine quantities supplied and demanded.

This knowledge unfortunately was not available then and it is not available even now. It was, in fact, early this year that the Board and the Bureau of Statistics began to systematically collect data to begin to construct these functions. The proposal developed by the MPB for this study stated the problem this way:

A general lack of information on the size of the total maize harvested in Kenya prevents the effective decision making both with regard to pricing policy, national storage and policies affecting trade with other countries. An efficient and accurate system to estimate, and also to forecast, the size of the crop in a particular year would create a basis for sound and timely decisions by the Government and the Board.39

The absence of sufficient information on the size of the total maize crop harvested has apparently led to ineffective decision making on pricing, storage and external trade. Failure in arriving at effective decision making with regard to these critical variables can be very costly to the country. We have seen for example how the Board has been losing money on its external trade and also how consumer prices have been kept at high levels to maintain a sufficiently large price spread to help pay for such costly undertakings. We have also alluded to earlier, about how producer prices have been maintained at levels well above export parity and thereby helping to protect Kenyan producers from world competition but doing so at the expense of the consumer and taxpayer.

Current debts owed to banks and the treasury by the Board, apparent high consumer prices, high transport costs particularly of exported and imported maize, the apparent lack of formal mechanisms for the acquisition (or production), processing, dissemination and storage of relevant market information as well as the apparent signs of the Board's inability to purchase and distribute increasing quantities of maize offered to it, would seem to suggest that, there is something wrong with the official marketing system. The recent Parliamentary Select Committee on the maize industry concluded that:
The Committee found that recent shortages had little to do with production which is thriving. Indeed, it is partly due to the spectacular increases in production over the last few years that the industry is now facing problems. . . . The Committee found that much of the blame for recent shortages of maize rests with the Maize and Produce Board and the government. . . . The Committee found that the maize marketing system is the source of most of the problems faced by the maize industry currently, and indeed that the whole system is in danger of breaking down. . . .

40 (emphasis mine)

The above conclusion by the Select Committee was not, to our mind, supported by specific data as evidence of the degree of market failure brought about by the present official marketing system. Indeed, the whole report contained little information indicating how the government and its agent--the MPB--have pursued the objectives they originally set for themselves with respect to the maize industry.

Our own attempt to bridge this information gap in this paper, has not been very fruitful on account of the fact that, in the absence of knowledge on the demand and supply relationships for maize and the factors that influence these relationships, we could not assess how the operations of the government has affected parameters defining these relationships.

Accordingly, in the following section, we present a research proposal which contains an analytical framework.

40 Report of the Select Committee.
which we believe can be used to estimate these relationships. Once the demand and supply functions for maize are known, they can then provide means for the evaluation of alternative marketing systems.
IV. A RESEARCH PROPOSAL FOR THE EMPERICAL ESTIMATION OF THE SUPPLY AND DEMAND FUNCTIONS FOR MAIZE IN KENYA

Background and Problem Identification

Maize as we saw in Section I of this paper, is Kenya's staple food. It constitutes a major portion of the daily diets, and therefore, the food budgets of families in rural and urban areas. The consequence of this is that its production, marketing, and distribution are matters of vital concern to producers, consumers, the government, the legislative assembly, and the various business firms which perform many of the several functions involved in moving maize from the farms to the consumers.

Until the early 1930s, the maize industry operated in a relatively free market characterized by almost complete absence of direct government intervention. During this period of time, the supply of maize fluctuated widely--mostly due to extreme weather fluctuations combined with primitive production technology, poorly developed product and factor markets as well as poorly developed communication network. These fluctuations in supply were
accompanied by volatile producer and consumer prices. Thus, in periods of shortages, consumer prices would rise steeply causing much suffering to families—particularly those with limited purchasing power. In "good" seasons, oversupply would drive producer prices downwards, and since the demand for maize, like the demand for most food crops, is price inelastic, such declines in producer prices would be accompanied by declines in their income. Such declines in producer incomes would result in reduced production in the following season, and other things being equal, this would lead to shortages followed by sharp increases in consumer prices. Such a sequence of events would then follow one another in a "cob-web"-like fashion. This type of market behavior was impalatable to producers, consumers, and policymakers.

At times, supply would not only be short in relative but also in absolute terms. Under such circumstances, mostly due to drought, government would be called upon to step in and to provide the country with maize through imports in order to avert hunger and potential or actual starvation. Such interventions were usually short-lived lasting only as long as the shortages lasted. As soon as domestic supplies returned to normal, government would withdraw from the market until the next time when similar circumstances would force it to intervene again.

However, during the period covering the late 1920s, and the early 1930s, Kenya suffered a series of maize
shortages—some due to natural causes and others attributed to "hoarding" by traders and/or smuggling across the bounders. The outcome of these shortages was an increase in the number of people both within and outside government who felt that the government should regulate the industry, particularly its marketing side, as a matter of policy. But apparently, government was not yet ready or willing to carry out such regulations. Later however, supplies improved sufficiently and the country started exporting some maize. Most of the crop that was exported belonged to large-scale European families. Thus, when the Great Depression hit the world, prices of maize plummeted causing these settlers to appeal to government to institute production and marketing restrictions so that exports could be reduced and most of the crop be sold in the domestic market at higher prices. These settlers had a lot of influence on policymakers. W. O. Jones (1970) estimated that there were in Kenya then 55,000 white settlers "[who] dominated export production and were the ruling elites until Independence. . . ."41 As a result of their lobbying, government did finally decide to intervene in the maize industry through policies aimed at stabilizing the market while at the same time improving the production base. A principal objective

of these policies, was the achievement of domestic self-
sufficiency in maize and other food grains.

Included in the package of measures adopted for
the achievement of these goals, was the establishment of a
maize marketing board whose functions were to buy all the
maize produced in the country (with some exceptions) and
to distribute it to millers and wholesalers who would in
turn distribute it to retailers either as maize flour
("PHOSHO") or whole grain, for final conveyance to con-
sumers. This board was also given the responsibility of
exporting and/or importing maize, as well as its storage
in the form of "reserves." In addition, the board was also
responsible for setting margins for assemblers, millers,
and wholesalers. These responsibilities gave the board
monopoly power in setting purchasing as well as its own
selling prices.

Government on its part, was to be responsible for
setting producer as well as consumer prices. Producer
prices were to be set and announced early before planting
to allow farmers to plan their production. A committee
chaired by the Minister for Agriculture was charged with
this responsibility. A similar committee chaired by the
Minister of Commerce and Industry was charged with the
responsibility of setting consumer or retail prices. In
addition to these price setting, marketing and distribution
instruments, government also set out, through a program of
biological, chemical and crop husbandry research together
with extension and credit, to improve production and in general to "modernize" the industry.

The statute under which the marketing board was established allowed or exempted several types of "small" transactions which could be carried out without contradicting the law. These were transactions between producers and consumers in the rural markets. Maize transacted this way, could be transported from one area to another without any legal restrictions. However, due to the imprecise nature of the specifications of the exempted transactions, the board soon realized that most small scale producers preferred to sell their maize through nonofficial or "informal" channels some of which were legal and others illegal. In an attempt to divert as much of this volume to the official channels, the board requested and got additional legislation which put restrictions on inter-district movement of maize and at the same time, specified much more clearly, the quantities individuals could transact and transfer from one part of the country to another.

These added restrictions however, did not stop the traffic they were intended to stop. The board did not have its own means of policing the market especially in the rural areas and consequently, it was forced to rely on the general law enforcement agencies such as the police. But these agencies were limited in their capacity to effectively check on such crop movements. Besides, they had other
duties to perform and which they probably viewed as more important than chasing maize traders across the land. The upshot of this was that throughout the board's history and up to the late 1960s, it was able to to its own channels only about 10 to 20 percent of the total marketed crop. This limited volume made the board's operations rather costly since it could not effect scale economies which could have come with higher volumes. At the same time, this small volume traded by the board ment that the board could not have the necessary market control which could have allowed it to co-ordinate the market at its various levels. The board could not have information relating to supply and demand situation in the country at any one time and consequently, could not plan rational purchasing and sales strategies as envisaged in its formation. On several occasions, the lack of complete knowledge regarding supply and demand led the board to sometimes purchase maize and export a large quantity of it only to announce in two or three months time, that there was a domestic shortage. Infact there were documented occasions where the board was exporting and importing concurrently. These types of operations were expensive since domestic producer prices were maintained above F.O.B. prices while consumer prices were fixed at levels below the C.I.F. upcountry prices. Thus any exports or imports by the board could only be accomplished at a loss.
In recent years however, the supply situation for maize has apparently improved significantly due no doubt to the widespread adoption of the high yielding hybrid maize and related technologies. According to expert opinion\textsuperscript{42} Kenya has now permanently become a surplus producer of maize. Some indications of this for instance is the fact that the board over the past 4-5 years has been receiving large volumes of maize which it has not, according to select committee's report,\textsuperscript{43} been able to handle efficiently. Indeed, the committee reports occasions in 1973 and '74 when the board had to pay farmers to store the crop on its behalf. Such operations apparently have not pleased farmers, politicians, or even the government. Accordingly, it has of late become the opinion of many people that the current problems the board and therefore the industry is facing is the result of present government policies which restrict the operations of a free market—-at least internally, which, it is assumed, could have been able to adjust supply and demand and thereby stem such problems. These people conclude therefore that government ought to reevaluate its present policies towards the industry with a view to removing restrictions on maize trade. Yet for purposes of policy this appears to us to be a rather restricted prescription. The relevant issue

\textsuperscript{42}Hopper, op. cit.

\textsuperscript{43}Select Committee Report, op. cit.
for policy, is we believe; what alternative production and marketing arrangements are available in Kenya and how can policymakers evaluate and subsequently choose between such alternatives? These questions have not, to our mind, been investigated within such a policy context. And not only have such questions not been so investigated but investigations on such fundamental aspects of the industry such as the industry's supply and demand, have not yet been undertaken. In the absence of such basic information on the supply and demand functions for the industry, it would not be possible, we believe, to provide rational means by which policymakers could choose among alternative production and marketing arrangements even if such alternatives had already been identified. For example, can one arrive at a reasonably rational choice between say whether or not to retain the Maize and Produce Board in the absence of knowledge about the supply and demand functions and the various elasticities associated with them?

We believe that information about the supply and demand functions for maize in Kenya ought to be made available to policymakers currently contemplating various choices with respect to alternative production and marketing arrangements for this important crop. Accordingly, the objective of this section of the paper is to propose a framework under which this kind of information can be empirically generated and made available to policymakers and others who have an interest in the maize industry.
Review of Literature

Several studies have been carried out on various aspects of the maize industry in Kenya. We have reviewed some of them in Section I, II, and III of this paper. Of those we have reviewed, we arrived at the general conclusion that most of these studies were in general either too broad or too narrow in their scope and that they were mostly of a descriptive nature. Some of these includes those of Hopper,\(^{44}\) Miracle,\(^{45}\) Kyesimira,\(^{46}\) Wolgin,\(^{47}\) etc. These studies, among others, looked into broad aspects of maize marketing and distribution and associated problems. Alvis and Temn\(^{48}\) reported some preliminary results regarding the existence, size, and price behavior in the so-called "black market" in Kenya. They also attempted to show some historical relationships between government guaranteed producer prices and those ruling in the black market. On general problems associated with storage and handling of exports, there are some findings and certain pieces of information contained in the Ministry of Agriculture's

\(^{44}\) Hopper, op. cit.


\(^{46}\) Kyesimira, op. cit.  \(^{47}\) Wolgin, op. cit.

Report of a Working Party. On production, some of the "best" information available on maize yields response to various imports and cultural practices is contained in Allan,50 Moock,51 and others. Allan and Moock's work refer specifically to Western Kenya and may therefore not be generalizeable to the rest of the country. The diffusion of hybrid, other improved maize varieties, modern imputs and cultural practices has been investigated by among others, Watts,52 Moock,53 Gerhart,54 Roling, Ascroft and Chege,55 and Chege and Ascroft.56 Again these were mostly

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54Gerhart, "Diffusion of Hybrid Maize in Western Kenya."


localized and generally narrow in focus and none, to our mind, attempted an empirical estimation of any economic relationships.

On the demand side we have localized and limited information on certain aspects of the demand for maize and some of its marketing problems from studies such as those by Watt, Massel and Heyer, Karani, and others. Johnson and Whitelaw carried out a household survey in Nairobi in which among other things, they attempted to estimate the relative proportion of the consumers budget taken up by food and especially maize. They did not however, attempt to estimate empirically or otherwise a demand function for food and/or related elasticities.

The information that has been generated by these and other studies of maize is useful in its own right. It

57 W. L. Watt, Food Shortage Periods in Native Reserves (Kenya), East African Ag. (and Forestry) Jr., Vol. IV (March, 1939).


helps to shed some light on certain aspects of this important crop and its industry but such information leaves much to be desired since in this discrete form, it does not assist decision makers who probably need knowledge on the whole industry and overall relationships between relevant economic and other variables that influence the production, market supply and demand for maize.

The above considerations lead us to the conclusion that, the kind of investigation we are proposing is not only necessary for Kenya but that it is also urgently needed if informed policy choices are going to made made among the various policy alternatives open to government. If this assumption is valid, then we believe that, any resources of time, money and effort that might be allocated for such an investigation, would be resources well spent.

Theoretical and Methodological Orientation

The framework developed in this proposal for the empirical estimation of the supply and demand functions for maize in Kenya, is based on the general principles and tools of neoclassical and "modified" neoclassical economics and their application to the analysis of demand and supply relationships for agricultural and other commodities. These principles and tools are used here to provide guidelines in the formulation of aggregate supply and demand functions for maize in forms which lend themselves to empirical estimation by statistical techniques of regression.
Assuming that the neoclassical or modified neo-
classical framework is a suitable one for the reformation of
such functions, and assuming also that the formulated
functions or "models" can be empirically estimated, then
such estimated functions, equations, or models can be used
for the derivation of various elasticities associated with
supply and demand for maize. Such estimated relationships
can also be used as the basis for the construction and
specification of short-range and/or long-range forecasting
models for such variables as expected crop acreages,
quantities to be supplied and/or demanded and prices for
a specified time period in the future.

The principles and tools of neoclassical and
"modified" neoclassical economics, have been largely
developed and applied mostly to problems of resource
allocation in the context of industrialized and highly
market oriented economies of Western Europe and North
America. In such market oriented economies, competition
and the pursuit of monetary profits are assumed to be the
major forces that motivate and guide economic activities in
all sectors of the economy including agriculture. It is
also assumed that such activities take place in an environ-
ment characterized by a high degree of knowledge on the
part of producers and consumers. These and other assumptions
of the neoclassical and "modified" neoclassical economics
makes it possible to derive necessary conditions for a
partial (e.g., sectoral) or general (economy-wide)
equilibrium and to even suggest ways in which such sectors or economies can move from a state of disequilibrium to one of equilibrium.

Many of the assumptions of this neoclassical model have had to be dropped by those who tried to empirically test some of the logical conclusions of such a model. Some of these assumptions have had to be dropped or modified either because they were based on concepts that were difficult to operationalize for empirical testing, e.g., utility, and others because they were simply unrealistic, e.g., the assumption of perfect knowledge and foresight. But even after dropping some of these assumptions, many theoretical as well as measurement problems remain. In the "modified" neoclassical theory of production where time is treated as a variable, uncertainties are assumed to exist in decision-making and acquisition prices are assumed to differ from salvage prices for factor inputs, the problem of "resource fixity" brought about by the existence of situations in which the MVP of a factor currently in use on a farm is lower than the acquisition price of the factor but the factor MVP is higher than its salvage value. This means the producer cannot sell the factor or even add on to it but must continue using it in its present use even though relative product prices may have changed to justify change in product mix. This situation is generally summarized as: $P_{xicq} \geq MVP_{xi} > P_{xisalv}$ where $P_{xicq}$ is the
factor acquisition price, $MVP_{x1}$ is the marginal value product of the factor in present use and $P_{x1}salv.$ is the factor salvage price or value.

In welfare economics, we have the well-known and serious problem brought about by lack of an interpersonally valid measure of utility--making it impossible to offer objective prescriptions regarding contemplated changes in social policies. Thus, the "Pareto Criterion" here does not offer any relief.

There are of course many more problems associated with attempts to empirically test conclusions of the neoclassical and modified neoclassical models or to attempt to describe, explain and predict economic behavior that investigators in these developed economies have had to contend with. But even more problematic have been and continue to be attempts to use these models to describe, explain and/or predict economic behavior of people in other countries such as the developing economies of Asia, Africa, and Latin America. Here, one is not only confronted with the fact that the people of these countries respond to probably different sets of values, beliefs, and attitudes but that even concepts such as profits, etc., may have attached to them meanings which differ fundamentally from those attached to them in the developed Western economies. And even when one adjusts such concepts to accommodate such differences, their operationalization and subsequent measurement may still present serious difficulties. For
instance, one may be able to define a market, say, for maize in Kenya but be at a loss when he attempts to discover and measure the type of signals sent out to consumers and producers by such a market. 61

But inspite of all these problems, we believe that, the principles and tools of neoclassical and modified neoclassical economics provides a source of concepts and methods which, when properly handled, can be used in the development of a framework capable of generating data and eventually information which while they may not be "perfect," could be very useful for practical purposes such as in decision-making. Accordingly, we feel that the supply and demand functions for maize in Kenya and their interrelationships can be fruitfully studied and estimated within such a framework, as long as its limitations are explicitly recognized.

An Analytical Framework for Estimating a Supply Function

Maize in Kenya is produced by three different types of farmers. On the one hand, we have the large-scale commercial producers and the largely commercial small-scale producers. On the other hand, we have the largely subsistence small-scale producers. Large-scale commercial

61 A. C. Gupta (1966) and A. T. Mosher, Georgescu-Roegen, C. R. Wharton, Jr., and others in Wharton (1969). Also see Lipton (1969). These writers discuss among other things, the conceptual and measurement problems confronting researchers in developing countries.
producers are located in the former "white-highlands" mostly in the Rift-Valley and parts of Western Provinces. On these farms, maize production is highly mechanized and most producers use high yielding hybrid maize seed and the associated modern inputs such as fertilizers, insecticides, and herbicides. The use of such modern technologies combined with relatively superior husbandry and other managerial practices, has resulted in high yields per acre.

Small-scale commercial producers and small-scale subsistence producers are scattered all over the country in varying degrees of concentration. The majority are located in the densely populated districts of Central, Eastern, Rift-Valley, Wester and Nyanza Provinces. The rest are to be found in the sparsely populated districts of North Eastern, Eastern and Cost Provinces. Production of maize on the largely commercial small-scale farms is in general labor intensive. A majority of these producers also use the high yielding hybrid or other types of maize seed (e.g., synthetics or katumani), as well as the associated modern technologies. Levels of application of these technologies (seed, fertilizers, and insecticides) are generally lower than those found on large-scale farms and this is probably one of the reasons why yields on the latter tend to be generally lower than those in the former. 62

62 Roling, et al., op. cit.
Production on the largely subsistence small-scale farms is, like that in the largely commercial small-scale farms, labor intensive. In fact, only the very basic implements like the hoe are used on these farms for land preparation, weeding, etc. Harvesting is by hand. Little if any high yielding seeds are used—not even the easy to grow, quick growing katumani seed is used in the majority of these farms. No modern inputs such as fertilizers are used. Some subsistence producers may occasionally use farm yard manure and compost—but this does not appear to be a widespread practice. Consequently, yields on these farms are low by any standards and in many cases, output remains even below subsistence needs.

It seems to us that in attempting to develop an analytical framework for the estimation of an aggregate supply function for maize in Kenya, some recognition of the differences existing among the three types of producers should be given. One way in which such differences can be incorporated into the analysis is to assume that the three groups of farmers use different production processes and therefore operate on different sub-production functions. If this is the case, then different production and supply functions would have to be estimated—one for each group. Another way is to assume that the three groups use essentially the same production process, are on a similar sub-production function and that the only difference between them is that they are located on different levels of the same
sub-production function. This latter assumption appears to be the more reasonable. They all use land, labor, and capital except that these factors differ in their quality. Thus, assuming these three producers are on a similar production function or surface, then we decided to incorporate differences in their levels of output by separating the acreage variable such that acreage of maize for commercial production is estimated differently from acreage specifically for subsistence purposes. This separation should also prove useful in attempts to forecast market supply for maize in a given season since if one could predict the commercial acreage separately and the yield of maize on such acreage, then it would be a matter of multiplying the two estimates to get a rough idea on how much maize can be expected to be marketed at the end of the season. A separate estimate and hence prediction of subsistence acreage and yields could be used in figuring out whether or not subsistence producers would enter the market at the end of the same season either as net buyers or net sellers. If such acreage yields and weather are predicted to yield a subsistence crop short of subsistence needs, government can then make preparation to meet such deficits either from the national strategic reserves or through imports. That is, assuming the commercial crop would not be sufficient to meet the needs of urban and rural nonfarm consumers as well as the deficit of the rural-farm consumers.
Given the above considerations, we present below our proposed analytical framework on which an aggregate supply function for maize in Kenya can be empirically estimated.

\[ Q_{mit} = f(CA_{it}, SA_{it}, Y_{it}) \quad i = 1,2; \ t \text{ stands for season.} \]

\[ CA_{it} = g(Pm_t, Pm_{t-1}, PS_{t-1}, SA_{it-1}). \]

\[ SA_{it} = h(Pm_{it}, Pm_{t-1}, PS_{t-1}, SH_{it}). \]

\[ Y_{it} = F(X_{jit}, \ldots, X_{mit}, Z_{jit}, \ldots, Z_{nit}). \]

Total

\[ Q_{mt} = (CA_t \cdot Y_t) + (SA_t \cdot Y_t). \]

where,

\[ Q_{mit} = \text{total output in bags for producer } i, i=1,2 \text{ in time } t. \]

\[ CA_{it} = \text{commercial acreage for producer } i, i=1,2 \text{ in time } t. \]

\[ SA_{it} = \text{subsistence acreage for producer } i, i=1,2 \text{ in time } t. \]

\[ Y_{it} = \text{yield in bags per acre for producer } i, i=1,2 \text{ in time } t. \]

\[ Pm_t = \text{guaranteed price of maize in Kenya shillings per bag, fixed by the government at the beginning of the season.} \]

\[ Pm_{t-1} = \text{price of maize in Kenya shillings per bag in the open market, lagged one season.} \]

\[ Ps_{it} = \text{prices of competing products in k.shs. per unit.} \]

\[ SH_{it} = \text{size of household on farm } i, i=1,2 \text{ in time } t. \]
\( X_{jit} \) = variable inputs on farm \( i \), time \( t \); \( j=1, \ldots, m \).

\( Z_{jit} \) = fixed inputs on farm \( i \), time \( t \); \( j=1, \ldots, n \).

The above framework identifies several dependent variables (\( Qm_t \), \( CA_t \), \( SA_t \), and \( Y_t \)) and independent variables which determine the dependent variables. We do not know apriori the specific functional forms for these functions. Rather than assume such forms, e.g., assume for instance that the production function \( Y_t = F(X_{jit}, \ldots, X_{mit}; Z_{jit}, \ldots, Z_{mit}) \) is a Cobb-Douglas or a constant elasticity of substitution (CES), or any other form, we suggest that the data on these variables be collected first, then various functional forms be fitted to these data and the form that yields the "best" fit for the data be taken as the true form of the function. This data "mining" may not be acceptable in statistical theory which requires that the "model" be specified first and then data fitted to it.

However if one followed this kind of rule in this type of empirical work, it would mean imposing a functional form on a relationship subjectively while the "mining" strategy allows for some practical "objectivity." Thus, for pragmatic reasons, we chose the "mining" way as the more realistic.\(^\text{63}\)

\(^{63}\) For a discussion of various forms of these types of functions, see for instance E. O. Heady and R. O. Olson's, "Substitution Relationships, Resource Requirements and Income Variability in Utilization of Crops," Iowa State College Research Bulle. No. 390 (Ames, 1952). Also see W. J. Spilman, "Use of Experimental Yield Curve in
Market Supply

As we alluded to earlier, the estimated equations for CA<sub>t<i></sub>e and Y<sub>t<i></sub>e are the two principal determinants of volume of maize marketed. However, SA<sub>t<i></sub>e also influences market supply since in good seasons, subsistence producers will sell some maize as surplus over and above their family requirements. Thus to include this element of supply we can estimate the relation Q<sup>S</sup><sub>t</sub> = f(P<sub>m</sub>, P<sub>M</sub>, SA<sub>t</sub>, C<sub>t<i></sub>e, R<sub>t</sub>
where Q<sup>S</sup><sub>t</sub> is the quantity brought to the market in time t, P<sub>m</sub> is the guaranteed government price, P<sub>M</sub> is the current open market price, SA<sub>t</sub> current acreage on subsistence crops, C<sub>t<i></sub>e are cash requirements for producer i, i=1,2; R<sub>t</sub> is an index of rainfall throughout the season. The C<sub>t<i></sub>e variable is specifically defined to include cash demand for family expenditure for such things as school fees, payment for loan installments, household purchased consumer items, etc. This way, it will mostly influence the small-scale sector more than the large-scale sector. This variable is particularly important in the small-scale sector since it affects significantly both the quantity of maize sold by these producers as well as the timing of marketing and therefore producer's incomes. Situations in which no time series data exists, cross-section data allows us to get some

quantitative relationships between the constant prices, and other independent variables with one selected dependent variables. One can, given such relationships use sensitivity to see what would happen if prices were fixed at different levels. But this amount to speculation on price behavior but at least it is a type of speculation with a better foundation--in the quantitative relationship based on cross-section data--than those based on intuition. Thus given these limitations on the use of cross-section data, we propose that the country also starts to keep time series data which in due course, can be used to re-estimate the same relationships. Techniques to be employed in gathering "good" cross-section data will be discussed later.

Earlier, we suggested that rather than specifying the functional forms for these production and supply relationships, data should be gathered first and then several forms tested. We gave the reasons behind this approach, but so far we have not said anything concerning the type of data that would be collected. Most supply and demand relationships are statistically estimated by various regression techniques using time-series data. In the Kenya situation, there are no time series data for all the variables specified in our framework. Accordingly, only cross-section data can be used. Cross-section data have
certain advantages and disadvantages. On the one hand, it holds all prices constant in both supply and demand relationships eliminating the problem of price interactions which are difficult to estimate but in doing this it also seriously constraints our knowledge on consumers and producer's price behavior through and over time. On the otherhand, given the fact that there are no time series data which is best suited for this type of price analysis, cross-section data can still be used to at least get some information on these functions. However, Dr. S. Thompson suggests that perhaps a linear programming technique can be used to estimate particularly the supply function. We have not investigated this possibility in this paper but we think it is one that should be investigated.

**Market Demand**

A large portion of the total crop of maize produced in Kenya is used, as we have said earlier, for direct human consumption. For this purpose, maize is eaten either as whole grain or in various processed forms—the most common form being maize flour ("or posho").

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64 See Floyd H. Harnstrom and Hiroynki Hino, "Nature of Demand for Food Products," American Journal of Agricultural Economics, Vol. 52, No. 3 (August 1970). These authors discuss some of the advantages of using cross-section data viesz-a-viz time series data especially for statistical estimation of demand functions.

65 Private conversation.
Urban and mostly African families depend on the market for their supply of this product. Some families however, get some maize from their rural relatives but this accounts for a small volume compared to the volume transacted in the market. Another crucial aspect of the demand for maize has been the erratic on-and-off purchases by rural farm families. When the season is good, these families will have enough food for their family needs and even some surplus to sell in the market. However, when the season is poor, a large number of these families rushes into the market as buyers. Such sudden entry into the market by this type of "part time" buyers creates havoc in the market. They may get into the market and quickly buy everything available--leaving the urban families without sufficient volume for the rest of the season. When this happens and urban families experience acute shortages, workers go on strike and in general the urban areas experiences social and/or political disturbances. Some of these disturbances are probably the ones that makes the Kenya government so sensitive to the maize industry as a whole.

These types of problems makes attempts to study the demand for maize--particularly attempts to emperically estimate its market demand function very difficult. In particular, the uncertainty created by the "on-and-off" buying and selling behavior of the subsistence farmers, makes it difficult to decide how to incorporate this behavior in such a function. But perhaps, recent improvements
in the production of this commodity in the whole country may have altered all this. At any rate, we believe the framework suggested earlier for the estimation of an aggregate supply function could be used to generate information as to whether or not, for any given season, the subsistence farmers would enter the market at the end of it as net buyers or sellers. Such information could be derived from estimates of subsistence acreages put under maize at the beginning of the season and this information combined with rainfall data say through the middle of the growing season, could be used to calculate roughly how much output would be expected for that sector. We also assume that the framework we are suggesting here for the estimation of an aggregate demand function for maize would also capture this type of behavior of subsistence farmers.

For the purpose of empirically estimating an aggregate demand function for maize in Kenya, the following general equation first for an individual's demand is suggested:

\[ q^d_{it} = f(P_m, P_{m'}, P_s, Y_{d, it}) \quad i=1, \ldots, N. \]

and

\[ \sum_{i=1}^{n} q^d_{it} = \sum_{i=1}^{n} f(P_m, P_{m'}, Y_{d, it}). \]

where
\( Q_{it}^d \) = quantity of maize or its flour equivalent in kilograms demanded by family \( i \) at time \( t \).

\( P_{mt} \) = the government controlled retail price in cents per kilogram at time \( t \).

\( P_{mt}' \) = the freely determined market price in the informal markets at time \( t \) in cents per kilogram.

\( P_{st} \) = the price of substitutes in cents per kilogram in time \( t \).

\( Y_{dt} \) = the disposable income of household \( i \) in time \( t \) in Kenya shillings per time period \( t \).

\( N \) is the aggregate number of consumers in the country.

The above demand function would then be estimated like the supply function identified earlier using cross-section data. In this case, prices will be constant and the only independent variable that would vary across consumers is income. Accordingly, what we would be estimating in fact is an Engel curve\(^{66}\) from which we could derive the income elasticity of demand. Such an income elasticity of demand for maize could then be used together with the country's population growth rate and the rate of growth—or expected rates of growth of per capita income, to estimate a rate of growth for the demand of maize in the country as follows:

\(^{66}\) Harmsrton and Hiroynki, "Nature of Demand for Food Products," AJAE Vol.
\[ d = h (p + g \cdot N) \] where \( d \) = the growth rate of demand for maize in Kenya, per year

\( p \) = the rate of growth of population per annum

\( g \) = the income elasticity of demand for maize and

\( N \) = the rate of growth of per capita income

Information derived from these two functions would be very useful for the purpose of monitoring the industry. If government had such empirically derived functions, then perhaps it could free the domestic market and then use these functions to monitor the market and the industry--stepping in either to buy excess produce or sell some maize if supply was thought to be insufficient to meet demand. Such operations could be made possible through the operations of the national strategic grain reserve system which has already been established in the country.

**Data Generation**

To generate needed data to estimate all these functions, carefully designed random samples both for consumers and producers would have to be constructed. For the producers, suitable sampling frameworks in the form of comprehensive land registry files kept in each district's land registry offices could be used to generate the desired random samples. For the consumer surveys, one could use the methods used to carry out consumer surveys by the Central Bureau of Statistics.
Cost

We have not attempted to estimate the cost—both in time, effort, and money this whole exercise could take but we believe, given the importance of the maize industry in Kenya and the fact that information such as would be generated by this exercise, does not exist now, the costs that such a study would entail, would be justified. At any rate judging by similar large surveys carried out in Kenya from time to time—say at the Institute for Development Studies, University of Nairobi, the author does not think that the costs would be prohibitive.
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