BIBLIOGRAPHIC DATA SHEET

1. CONTROL NUMBER	2. SUBJECT CLASSIFICATION (695)
PN-AAJ-502	AE10-1440-G214

3. TITLE AND SUBTITLE (240)

The economics of cowpea marketing in Nigeria

4. PERSONAL AUTHORS (100)

Ejiga, N. O. O.; Robinson, K. L.

5. CORPORATE AUTHORS (101)

Cornell Univ. Dept. of Agr. Economics

6. DOCUMENT DATE (110)	7. NUMBER OF PAGES (120)	8. ARC NUMBER (170)
1981	77p.	NI338.17333.E36

9. REFERENCE ORGANIZATION (130)

Cornell

10. SUPPLEMENTARY NOTES (500)

(In Cornell international agriculture mimeograph 82)

11. ABSTRACT (950)

12. DESCRIPTORS (920)

	Nigeria	Grain marketing
Distribution systems	Cowpeas	Grain legumes
Marketing	Prices	Storage

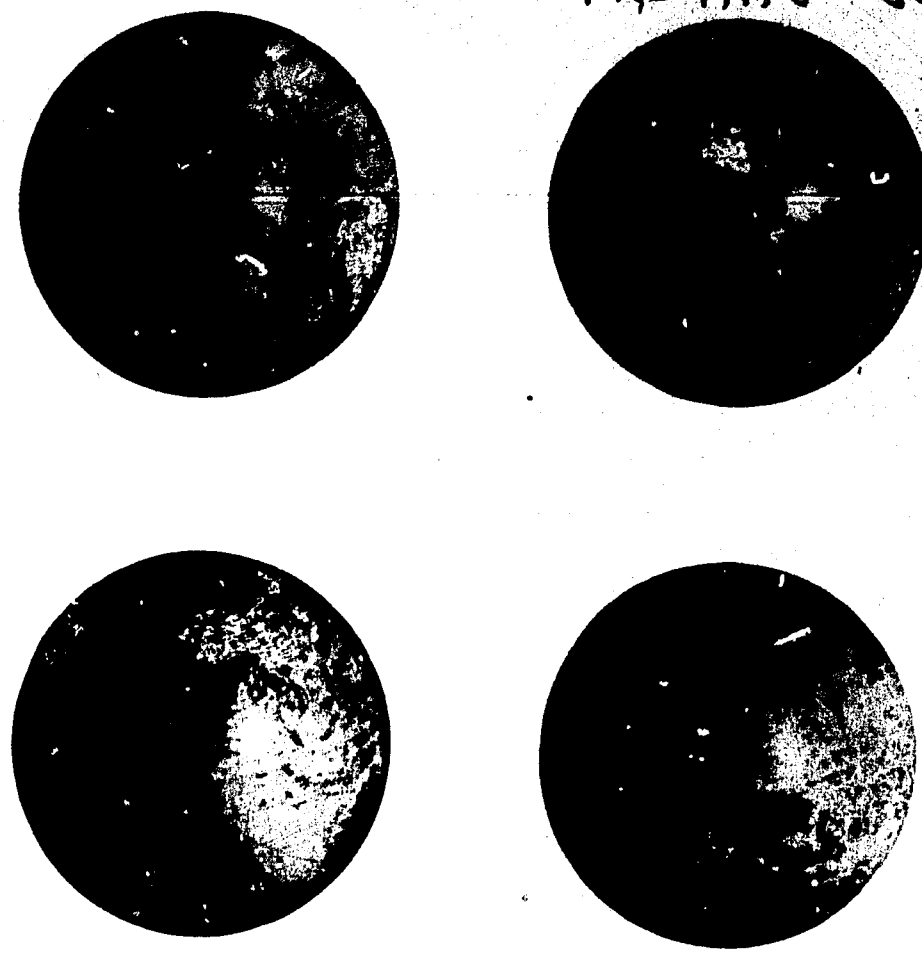
13. PROJECT NUMBER (150)	
9-1001137	
14. CONTRACT NO.(140)	**15. CONTRACT TYPE (140)**
AID/ta-BMA-8	
16. TYPE OF DOCUMENT (160)	

AID 590-7 (10-79)

NI
338.17333
E36

CORNELL INTERNATIONAL AGRICULTURE MIMEOGRAPH 82

PN-AAJ-50



THE ECONOMICS OF COWPEA MARKETING IN NIGERIA

N. O. O. Ujiga and K. L. Robinson

DEPARTMENT OF AGRICULTURAL ECONOMICS
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Cornell University, Ithaca, New York

January 1981

THE Program in International Agriculture publishes manuscripts resulting from international research and other activities of faculty and graduate students in the College of Agriculture and Life Sciences at Cornell University. A Bulletin Series and a Mimeograph Series include comprehensive and definitive topics relating to international agricultural and rural development. An annual Dissertation Abstract Series summarizes the Cornell Ph.D. theses concerned with agricultural and rural development abroad.

A list of topics published in these series may be obtained from the Program in International Agriculture, 252 Roberts Hall, Cornell University, Ithaca, New York 14853. Upon written request, educational, research and other public and private organizations will be placed on a mailing list to obtain future publications.

Single Copy Free
Additional Copies 25¢ Each

1/81 CU 1.2M

THE ECONOMICS OF COWPEA MARKETING IN NIGERIA

by

N. O. O. Ejiga*

and

K. L. Robinson**

* Senior Lecturer/Senior Research Fellow, Department of Agricultural Economics & Rural Sociology, Ahmadu Bello University, Zaria, Nigeria.

** Professor of Agricultural Economics, Department of Agricultural Economics, Cornell University, Ithaca, New York, U.S.A.

This study is the result of cooperation among numerous persons and agencies that assisted in the collection and analysis of data.

The field research would not have been successful without the assistance offered by a large number of individuals. We wish to thank our colleagues in the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University for their suggestions and comments during the preliminaries for the study. In particular, mention must be made of Dr. H. M. Hays, Jr., and Mrs. E. B. Simmons for many useful suggestions. Professor W. O. Jones, Food Research Institute, Stanford University, also made helpful comments and suggestions on an early draft of the research proposal.

Some of the analysis would not have been possible without the generosity of Professor G. H. Caswell of the Department of Crop Protection, Ahmadu Bello University in supplying the cowpea damage data and his authorizing his assistants to assess the damage in the cowpea samples collected in this study. We wish to thank Sule Akibu, who carried out the damage assessments. Dr. Q. B. O. Anthonio, Department of Agricultural Economics, University of Ibadan, was very helpful in making available the cowpea prices he has collected in an Ibadan market. He was also very kind in making available his Federal Office of Statistics files on retail cowpea prices in other markets.

Much of the data was collected under the auspices of the Institute for Agricultural Research, Ahmadu Bello University and the kind permission of the Director of the Institute for Agricultural Research to publish this report is gratefully acknowledged.

CHAPTER I

INTRODUCTION

There is a growing realization that food distributional arrangements can affect the pace of economic development in general and that of agricultural development in particular. One vital function of the marketing system is to signal prices to producers and consumers, thus rationing supplies among consumers and affecting the allocation of resources among producers. The popular view about the agricultural marketing systems in developing countries in general and those of African countries in particular is that the marketing arrangements do not operate efficiently in performing this function (Jones, 1972, p. 2). This study summarizes the findings concerning an indigenous marketing system for a widely traded food grain in Nigeria. More specifically, the objectives of the study were to:

1. Describe the marketing channels for cowpeas and the role of various intermediaries.
2. Ascertain whether intertemporal and spatial price relationships were consistent with differences in costs;
3. Estimate the costs and returns associated with cowpea storage; and
4. Identify any areas of gross inefficiencies or exploitation by middlemen of farmers or consumers.

Marketing Imperfections in Developing Countries

A number of alleged imperfections are said to exist in the food distribution systems of developing countries. Those imperfections cited here are those thought particularly relevant or applicable to Nigeria. One allegation is that the marketing system is disorganized (FAO, 1966, p. 13). The colorful and bustling market meetings common in West Africa present an appearance of congestion and confusion. Units of measurement are not necessarily uniform within one market, let alone from one market to another and quality standards are often elusive. Under these circumstances, an unwary observer might conclude that the marketing system is disorganized (Jones 1972, pp. 6-7).

Another common complaint is that there are too many intermediaries in the food marketing chain (Gilbert, p. 7; Thodey, p. I-55; Whitney, pp. 66-67). This is said to increase the cost of marketing and also tends to divert labor from more productive types of employment.

Another allegation commonly discussed is the inadequacy of physical and institutional infrastructures (FAO, pp. 352-53; Ilori; Olayemi, Chap. 4; Thodey, P. I-58). Among the deficiencies mentioned are inadequate quantity and quality of storage, lack of credit facilities, inadequate transportation network, lack of market information and the need for standardized weights and measures.

Finally, critics of the existing marketing system assert that prices are manipulated by middlemen to their advantage (Gilbert, pp. 345-47; Adeyokunnu; Thodey, p. 1-61; FAO, p. 352). Gilbert has given numerous newspaper accounts of Nigerian Military Government's attempts at controlling food prices based on this belief.

Margins are believed to be enhanced by manipulating weights and measures.[1/] Another form of exploitation often alleged is that traders are said to restrict entry into the market and sometimes to collude in an attempt to regulate prices. It is widely held that farmers are forced to sell their crops at low prices after harvest because of their pressing need for cash, indebtedness to traders and lack of storage facilities.

More objective information is needed about these allegations. It is essential to examine the available evidence to ascertain whether or not markets do in fact show a great deal of inefficiency, and if so, the principal causes. This study, based on the cowpea marketing system in Nigeria, attempts to provide information which might shed some light on some of these allegations. Such information becomes very useful when marketing reforms are contemplated. In their enthusiasm to introduce marketing reforms, policy makers often act in ignorance of the existing situation. The importance of obtaining information of this type is emphasized by Jones, who believes that policy makers should be "provided

---

1/ The collection of data from traders at Lafia was at one point threatened when the local authority went through the markets seizing what were said to be false measures and the traders attributed that action to the data that were being collected from them.

with the soundest possible information about the present operation of the system so that they may identify where governmental intervention might improve the system's operation and where it might be harmful." He goes on to point out that, "Such decisions have most often been made almost completely without the detailed knowledge and often without understanding the task that is performed by the thousands of assemblers, wholesalers, and retailers who undertake the distribution of foodstuffs from growers to consumers" (Jones, 1972, pp. 2-3).

Food Distribution Studies in Nigeria

A number of food distribution studies have been conducted in Nigeria with objectives similar to this study. For the most part the aims of these studies were: first to describe existing conditions; and second to determine any areas of gross inefficiencies. A number of suggestions and recommendations for improvements in marketing have been made as a result of these studies.

As far back as 1957, the government of the Northern Region of Nigeria was interested in food movements within the region and ordered a study of the situation. The study was confined mainly to food movements by rail (Nigeria, Northern Region 1957). Smith and Hill studied the workings of the marketing system among the Hausa of Northern Nigeria. Gilbert studied the staple food marketing in Northern Nigeria in the 1960s with particular reference to the system serving Kano City. Later Hays studied the storage and marketing of food grains in three villages in an adjacent area and one urban center (Zaria).

Western Nigeria, especially the Ibadan market, has been the subject of a number of studies. Ilori (1967) made an integrated study of production, marketing and consumption of staple foods in Western Nigeria. Anthonio (1968) studied price spreads or deviations among markets. Thodey made a detailed study of the marketing of staple foods in Western Nigeria with emphasis on the system serving Ibadan. Gusten looked at the movement of foodstuffs in and out of Western Nigeria especially Ibadan and Lagos. Whitney made a general study of food distribution in Eastern Nigeria and Welsch studied rice marketing, specifically in

Eastern Nigeria. Internal trade in delicacy foodstuffs (Kolanuts, oranges, dried meat, dried fish and onions) was the subject of Onakomaiya's study. Other publications on the marketing of staple foodstuffs in Nigeria include the comprehensive work by Jones and his associates (1972), various sections of FAO's agricultural development study in Nigeria (1966), the report of the National Committee on Food Marketing Problems and the survey of food marketing literature by Olayemi (1974).

Recommendations and Policy Implications

Policy recommendations based on the foregoing studies include construction of storage facilities, the acquisition of buffer stocks and creation of a central buying agency (FAO, 1966, pp. 352-353). Other recommendations which have been offered by almost all writers include: collection and dissemination of market information; road development programs to improve market integration; more and better market facilities; standardization of measures; grading of products to encourage quality production; establishment of food marketing cooperatives; research and extension to improve storage practices; some form of credit to be given various groups to encourage storage and development of larger firms; reforming existing institutions such as the commission agent system and market guilds or associations; and finally the establishment within the government of a department to give full attention to marketing problems. But not everyone concludes that further government intervention is desirable. Jones, for example, advises against government participation in food marketing (1972, p. 273); Thodey does not believe additional credit should be offered to retailers (p. I-71); Gilbert expressed some doubt about the wisdom of a buffer stock scheme (p. 289); while Olayemi (1974) argues that the government should confine its activities to advising cooperatives, not regulating them (p. 82). There were also a few radical suggestions. Whitney suggested restricting the number of wholesale outlets by increasing rental rates to develop large scale wholesalers (p. 66); and Thodey suggested compulsory fumigation of cowpeas entering inter-regional trade (p. I-68).

Since these suggestions were given by people with different values and perspectives, it is inevitable that conflicts between them will arise. Some suggestions are based on inadequate information. For example, the suggestion to build more storage facilities in urban areas fails to recognize that storage space is not the limiting factor. Urban traders have market stalls which could be used for storage but they generally prefer not to store beyond their immediate inventory needs as empirical studies have shown (Gilbert, p. 75; Hays, p. 55; and Whitney, pp. 24-25).

Some suggestions are not feasible at the moment. For example, there are no known safe, cheap, effective and simple techniques which can be used to prevent yams from deteriorating in storage. Nor is there any technique available for preventing cowpea damage by insects.[2/]

A major omission of many policy recommendations is the lack of any analysis of costs. To be helpful to policy makers, one needs to be able to compare alternatives. This type of analysis is necessary to help establish priorities in the allocation of scarce government funds.

Cowpeas in Nigeria

The cowpea, popularly called beans, is one of the best known and most extensively grown grain legume crops in Nigeria. Although the crop is grown in almost all ecological zones, by far the greatest producing areas are in the northern half of the country where the climate is much more favorable to its production. In 1968-69 crop year, about 60 percent of farmers in Northern Nigeria were growing the crop which is almost always grown in mixtures on small farms with other crops (Nigeria, Federal Office of Statistics, 1971, p. 28; Norman, 1972a, p. 76). Average yields are low (less than 224 kilograms seed grains per hectare or less than 200 lbs. per acre).

2/ The New York Times, Wednesday, 27 October 1976 reported that the International Institute of Tropical Agriculture at Ibadan, Nigeria was investigating the use of groundnut oil in coating cowpea seeds. Five milliliters of the oil coating 1 kilogram of seeds was said to prevent the hatching of new weevil larvae but does not kill the adult weevils and neither does it prevent them from laying new eggs.

The cowpea is the fourth most important food grain crop in the northern states of Nigeria.[3/] Nutritionally, cowpeas are superior to any of the staple foodstuffs because of their high quality protein (Oyenuga, pp. 79-83; Doughty and Orraca-Tetteh). But unfortunately, the cowpea is highly susceptible to insect damage both in the field and in storage (Caswell, 1968, p. 5). In addition, it is an expensive source of nutrients; only rice among the principal food crop costs more per pound.

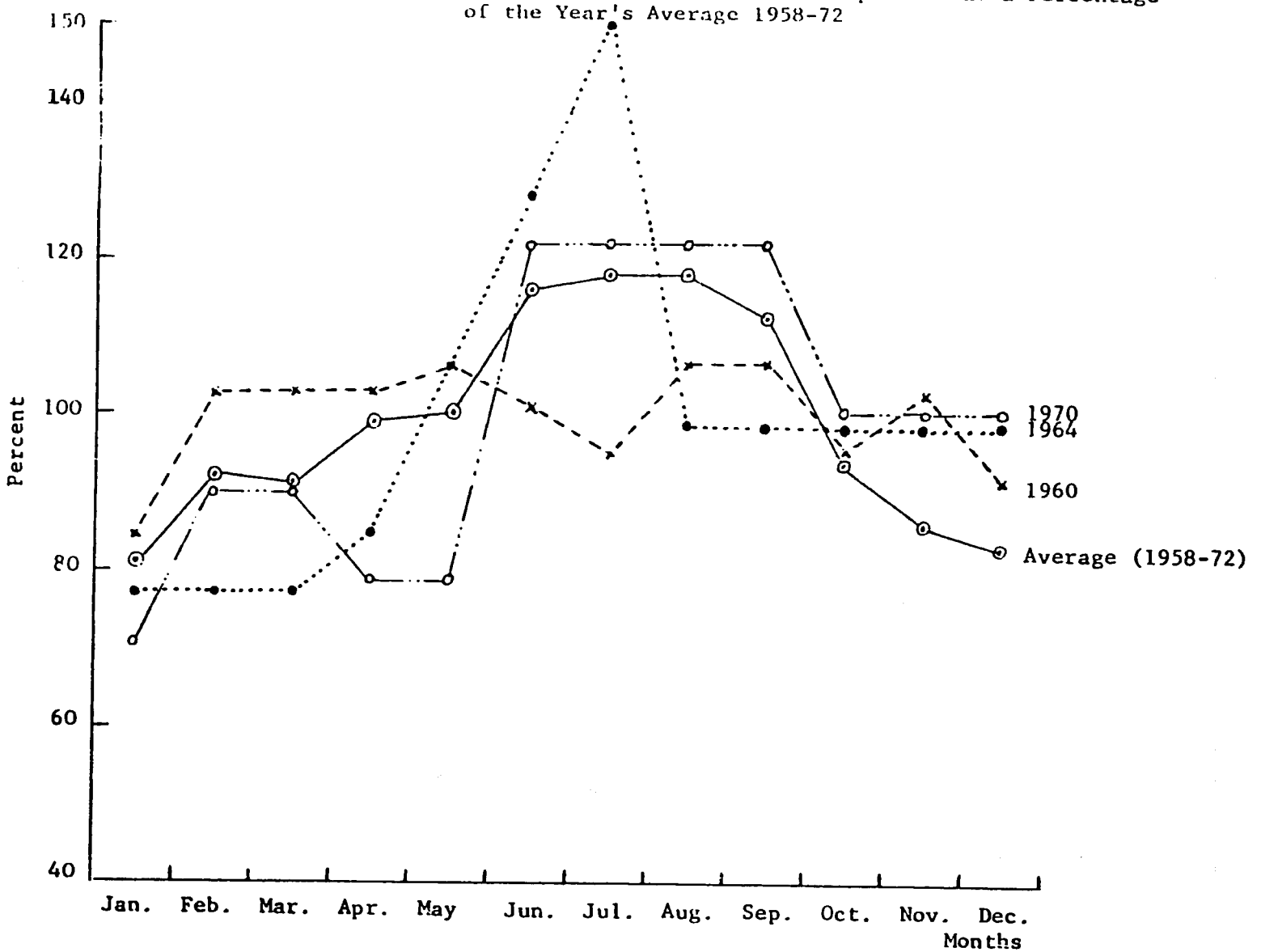
Most of the cowpeas which are sold off the farm are eventually consumed in the western and southern states. The commodity features significantly in the diets of Nigerians contributing an average of about sixteen percent of the daily protein consumption and as high as sixty percent of the protein intakes of some families in Western Nigeria (Ogunmodede and Oyenuga, 1967, p. 1).[4/]

Cowpea prices are highly variable both within seasons and between seasons. To illustrate the point, seasonal price indexes have been calculated by expressing the monthly prices as percentages of the year's average price. The variability indicated by these indexes is illustrated in Figure 1 for the Sokoto market. Means and standard deviations of prices for four other markets in northern parts covering the period 1959-1972 are shown in Appendix I.

3/ The most important food grain crops in terms of production are sorghum, millet and groundnuts in that order.

4/ In a survey of three rural villages around Zaria, Simmons reported that cowpeas contributed about 2.6 percent of per capita intakes of protein (1976b, p. 30).

Figure 1. Monthly Retail Cowpea Prices at Sokoto Expressed as a Percentage of the Year's Average 1958-72



CHAPTER II

SOURCES OF DATA

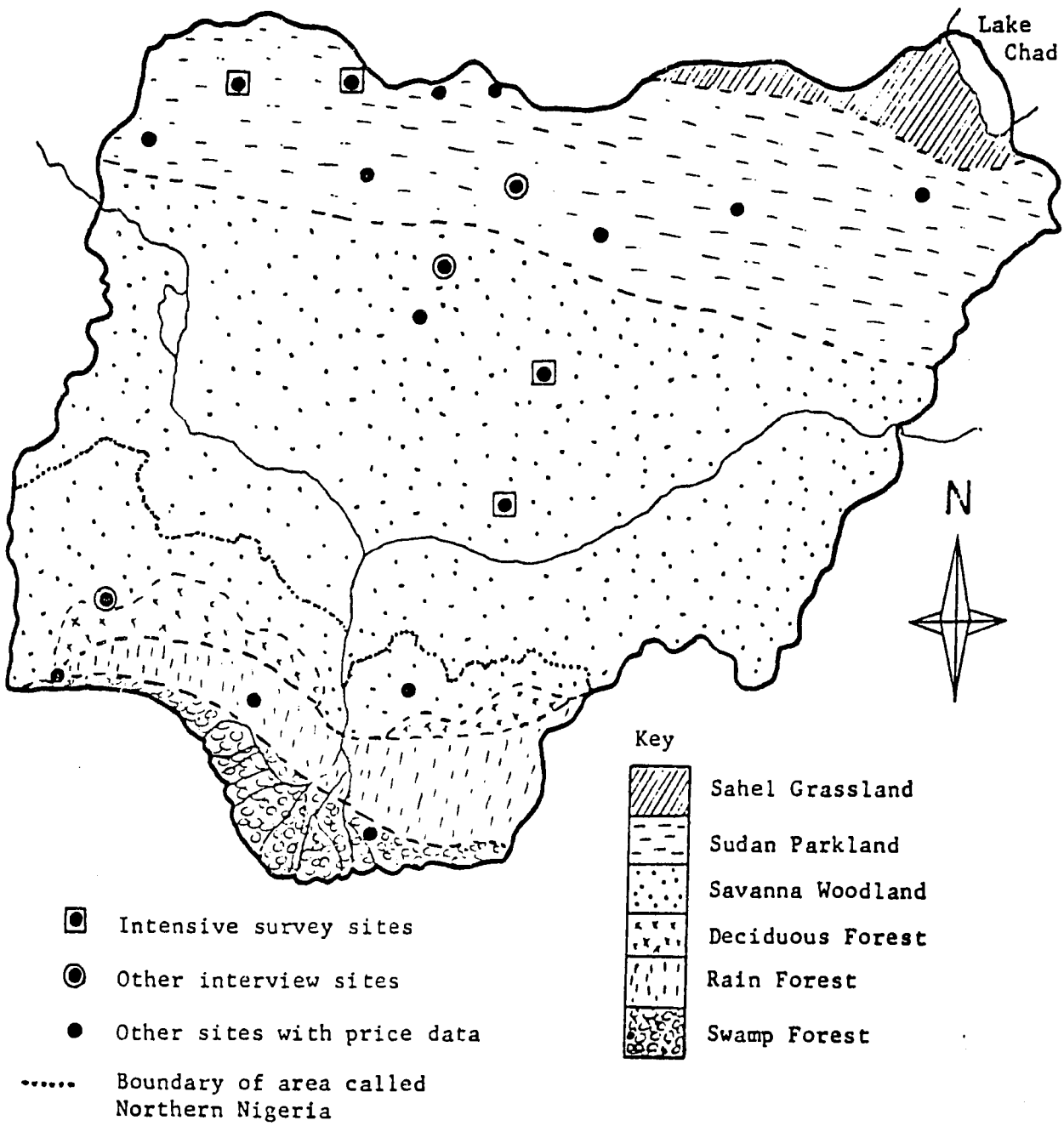
This report is based largely on data collected from November 1972 to February 1974 at two principal survey sites (Figure 2). Several criteria were used in selecting the study areas. One was that the two major ecological zones spanning Northern Nigeria be represented. Most of the cowpeas grown in Nigeria are produced in either the Sudan parkland or the Savanna woodland zones. Since an urban consumption survey was planned along with a detailed description of marketing channels, at least some of the sites selected for study had to include areas in which consumption of cowpeas is significant. Originally, a parallel study of rice marketing and consumption was planned to coincide with the cowpea survey and, therefore, to save transportation costs, several sites were selected in which both cowpeas and rice are produced and marketed. Unfortunately, the rice study had to be dropped. Two producing areas, one in the far Northwestern region of the country (Sokoto-Shinkafi), and the other in the Central region (Jos-Lafia) were ultimately chosen as survey sites. Additional data on consumption was obtained from an urban market in the Western region (Ibadan).

Production-Consumption Survey Sites

The Sokoto area in Northwestern Nigeria was selected as one of the study sites because it is the source of a high proportion of cowpea production. In 1969-70, about 40 percent of the cowpea crop in Nigeria was produced in North-western State (Nigeria, Federal Office of Statistics, 1972, p. 8).[5/] Sokoto town is the most important urban bulking market for cowpeas in the state. It has good road connections to other towns south of it.

5/ In February 1976, more states were created in Nigeria and North-western State was divided into two states, namely Sokoto State and Niger State. The data refer to the origin of North-West State.

Figure 2. Map of Nigeria Showing Major Ecological Zones and Location of Study Sites



Source: Harold Fullard, ed., Philips' Modern College Atlas for Africa (11th Edition). London: George Philip & Son Limited, 1973, pp. 66-67.

The rural survey site selected to go with the Sokoto urban market was Shinkafi, which is located about 112 kilometres (70 miles) from Sokoto. While the roads connecting it to other neighboring villages are poor, it is an important bulking market. Traders located in Shinkafi travel as much as 140 kilometres (90 miles) from the market to buy cowpeas and truckers come from as far as Western Nigeria to purchase supplies at the weekly market.

The Jos-Lafia survey site is located in the Savanna woodland zone. Jos is a major urban market for cowpeas and draws supplies from producing areas located both to the south and northeast of the city. It has good road connections in many directions.

Lafia lies 240 kilometres (150 miles) south of Jos. There is a good road connecting the two towns. Lafia is an important bulking market for cowpeas as well as other foodstuffs (mainly yams and rice). The major rail line connecting the northern and eastern parts of the country goes through Lafia as well as one of the two principal north-south highways. Local traders draw supplies from villages located as much as 130 kilometres (80 miles) from Lafia.

Data from the two principal survey sites were augmented by interviews with traders in Kano, a major urban center located north of Jos in the center of the Sudan parkland zone. This market draws supplies from across the border in Niger as well as from the Northeastern region of Nigeria.

Sampling Procedures

At each of the two principal production-consumption survey sites, interviews were conducted with a sample of farmers and various types of traders, including rural traders who assemble cowpeas from farmers, and urban traders who sell to wholesalers, truckers and retailers. Urban households also were surveyed; however, the results of the consumer survey are not included in this report. (For details regarding consumption, see Ejiga, pp. 329-360.)

The sample size was determined on the basis of experience and judgement since no list of farmers or traders was available from which

names might be drawn and sampling errors calculated. Limited resources, mainly of supervisory time and skilled enumerators, also made it necessary to restrict the sample size. The numbers of farmers and traders interviewed in each of the two principal locations and adjacent villages are shown in Table 1.

Table 1. Distribution of Sampling Units by Type and Location

Area and Location	Number of Sampling Units		
	Farmers	Rural Traders	Urban Traders
Sokoto-Shinkafi area:			
Sokoto	--	--	12
Shinkafi	20	12	--
Badarawa	30	0	--
Jos-Lafia area:			
Jos	--	--	14
Lafia	21	10	--
Agyragu Tasha	8	0	--
Agyragu Tofa	5	0	--
Ambana	10	0	--
Akunzan Jarme	5	0	--

-- = Not applicable.

The actual selection process in the rural areas differed between farmers and traders. In each village the total sample of farmers to be drawn was divided equally between village subdivisions called wards. To ensure the cooperation of sample members, ward heads were included in all samples but the village heads were not. The ward heads and the government agricultural officers were asked to help select samples to include three categories of farmers, namely large, medium and small with more farmers in the medium category than others. Farmers selected

were given the option to decline interviews and if they declined, another farmer was selected. In each case, the sampling unit was an individual farmer, usually the household head, who sometimes asked that one of his sons (usually the eldest) be included in the sample instead of himself.

Trader samples in both urban and rural areas were selected in a different way. Since there are usually few wholesalers of a particular commodity, all cowpea wholesalers at the study locations were asked if they would participate; however, some declined. The resulting number of traders participating in the study is shown in Table 2. All the traders interviewed at Sokoto and Shinkafi were wholesalers. No attempt was made to include retailers in the sample at these two locations because it was thought that retail sales would not be much different from sales made by farmers selling small amounts of their produce directly to consumers.

Table 2. Number of Different Types of Traders Interviewed

	Number of Traders*					
Location	Wholesaler	Wholesaler/ Commission Agent	Commission Agent	Commission Agent/ Retailer	Wholesaler/ Retailer	Retailer
Sokoto		12				
Shinkafi	12					
Jos	4	5	1	1	2	1
Lafia	6	1			1	2

* Classification based on traders' self-description.

Retail sales in Jos - unlike those in Sokoto and Shinkafi - are made exclusively by retailers who first buy their cowpeas from wholesalers. Consequently, the sample of Jos traders included retailers. The Lafia sample of traders also included both wholesalers and retailers. The number of different types of traders who were interviewed is shown in Table 2.

There is no doubt that the sample sizes are small in relation to the total number of farmers and traders in Northern Nigeria. Because of the care taken in the selection of the samples, however, the results probably reflect fairly accurately the general pattern of production and marketing in the region.

Types of Data Collected

Data were collected from farmers and the various types of traders by personal interviews. Seven questionnaire forms were completed for farmers and five for traders. The information collected from farmers consisted mainly of data on their cowpea production, storage and disposal activities. Rural and urban traders were asked mainly about their cowpea buying, selling and storage activities.

CHAPTER III

PARTICIPANTS IN THE COWPEA DISTRIBUTION SYSTEM

Farmers

Cowpeas are produced mainly by small-scale farmers. Typically a farmer will sell less than one sack (the wholesale unit) at a time. Sales are made initially to farm-gate middlemen or local assemblers who perform most of the bulking activity. If farmers have full sacks, they may sell directly (or through commission agents) to either rural assemblers or to rural-urban wholesalers. These two groups of traders also may act as commission agents. Sometimes farmers sell to other farmer-traders. When farmers live close to urban centers, they may sell the crop directly to urban consumers or to urban retailer commission agents who, in turn, sell to consumers.

Farmer-traders

Some farmers, who have money to invest, do so by buying grain at harvest time and storing the grain hoping to make a profit through price rises. Some of these travel to other towns in the north and south of Nigeria to make their sales. After making their sales in such far-away places they may buy some manufactured goods to sell back home.

Farm-gate Middlemen or Local Assemblers

Initial purchases are often made by itinerant traders who perform most of the initial bulking function. They buy less than wholesale units from many farmers and then bag them in wholesale units (sacks). Some may act as commission agents when they sell full sacks on behalf of farmers. In whatever capacity they act, they are the first group of wholesalers to come in contact with farmers. They usually are not big operators. Some choose to speculate by storing what they purchase until they think they can make the maximum profit. Those who store for any reasonable length of time use rooms in their houses or open

spaces in their compounds if they live in the drier parts of the north, or they may rent storage space from rural assemblers. By and large, the farm-gate middlemen are merchant middlemen (i.e., they take title to the commodity).

Rural Assemblers

Rural assemblers usually operate on a much larger scale than farm-gate middlemen. They customarily live close to rural bulking markets and often own storage facilities which they may rent to others. They obtain their supplies from farm-gate middlemen or directly from farmers selling in wholesale units. Thus, their role is similar to that of farm-gate middlemen. Rural assemblers likewise may speculate by storing grain until they can get the most favorable price. They sell whatever they have purchased to rural-urban wholesalers or through urban wholesalers/commission agents.

The farm-gate middlemen and rural assemblers sell to rural retailers who are not farmer-retailers. The three groups (farmers, farm-gate middlemen and rural assemblers), probably do most of the storing of cowpeas. Farmers generally store less than the two groups of traders. Enumerators were told that a few big rural assemblers stored cowpeas in both urban and rural areas but none was contacted as those who disclosed the information were not willing to identify the traders. A few rural assemblers owned and made use of storage facilities located in other rural areas.

Sometimes, when prices in rural markets are considered unfavorable, both the local assemblers and rural assemblers will transport their cowpeas from the rural bulking markets to urban markets and may even go to the next urban market if it is thought that prices are higher there.

Rural-Urban Wholesalers

Rural-urban wholesalers provide a link between the rural and urban markets. They could be described as rural assemblers or they could be traders who come from urban markets to purchase cowpeas in small local markets. They do a minimum of storage (unless they are also rural assemblers) and try to sell their commodity as quickly as possible when they reach urban markets.

Typically this group of wholesalers resides in the rural area and invariably tries to sell whatever has been purchased through urban wholesaler/commission agents who are resident in urban areas. Wholesalers in this group tend to deal with the same urban commission agents over a period of years, once they have established a mutual relationship.

When these wholesalers bring their goods to urban markets, they at first try to sell them through urban wholesalers who act as commission agents. But if the price at the time is thought to be unfavorable or if there are no buyers, they may then sell to urban wholesalers for cash or less frequently on credit. Usually as a last resort, a rural-urban wholesaler will consign his cowpeas to a wholesaler/commission agent with instructions to sell at not less than a specified minimum price. If the sale is made, he will collect the money on the next visit to the urban market. It is at this point that mutual trust is required. If it is discovered that the urban wholesaler/commission agent cannot be trusted (for example when he fails to report or returns reflect sales at less than the specified minimum price) the rural-urban wholesaler may seek a new agent. Such changes do not occur very often. While the rural-urban wholesaler is in town, the urban wholesaler/commission agent provides accommodation and meals. For taking care of their clients, urban wholesalers/commission agents are rewarded by taking their commission on sales and by occasional bonuses paid by their clients.

Whether the buyer or seller actually pays the commission depends upon the agreement reached at the time of the transaction between the contracting parties. Commission rates are usually set by a general consensus among commission agents but may vary from agent to agent. In Sokoto and probably in Kano, the rates are set at a meeting of the commission agents. In areas where no such organization of wholesaler-commission agents exists, the commission rates are probably set by agents who play a leadership role.

If a rural-urban wholesaler resides in an urban area, he probably will handle his own sales and even act as commission agent for wholesalers who reside in rural areas or who have come from other towns. This arrangement (i.e. non-resident traders carrying out their transactions through resident traders) is common for many other agricultural

commodities traded over long distances such as cattle and kolanuts and is generally referred to as the maigida or landlord institution (for example, see Hill, 1966a). As the name implies, one must be a resident (landlord) to provide the services needed by the visitors such as accommodation and knowledge of the local situation.

The rural-urban wholesalers sometimes buy directly from farmers, but more often from farm-gate middlemen or rural assemblers. Because they perform the function of linking the rural and the urban markets or the linking of two urban markets, it is likely that this group faces the smallest price risk. On theoretical grounds, it can be shown that variability in returns is a function of the sum of the variance in price in each market minus a covariance term (the relationship between prices in each market).[6/] If prices in the market in which a buyer sells and

---

6/ Assume two markets are designated A and B and the variance in prices in market A is V_A^2 and in market B it is V_B^2. Suppose a trader buys at price B and sells at price A; his profit (Y) is then given by A-B. The variance of his profit (V_Y^2) is given by the relation

$$V_Y^2 = V_A^2 + V_B^2 - 2 \text{ Cov } (A, B)$$

The covariance between A and B is related to the correlation coefficient between A and B (r_{AB}) by

$$\text{Cov } (A,B) = r_{AB} V_A V_B \text{ (Snedecor and Cochran, p. 181).}$$

Therefore the variance of the spread (V_Y^2) is given by

$$V_Y^2 = V_A^2 + V_B^2 - 2r_{AB} V_A V_B$$

If the variances in A and B are of about the same magnitude, then

$$V_Y^2 = 2V^2 - 2r_{AB} V^2$$

$$= 2V^2 (1 - r_{AB})$$

If the correlation coefficient is greater than 0.5, then V_Y^2 is less than V^2. (For further details, see Ejiga, pp. 98-100.)

the one in which he buys are correlated to a substantial degree (i.e. if the correlation coefficient exceeds 0.5), then the variance of returns will be less for a trader operating in two markets (i.e. one who buys and sells more or less simultaneously) than one who operates in only one market (i.e. one who buys for sale at a later time). Thus, a trader who buys with the objective of storing grain may face a greater degree of risk than one who buys with the expectation of reselling immediately.

Urban Wholesaler/Commission Agent

Wholesaler/Commission agents are usually resident in towns and prefer to be commission agents but may occasionally buy and sell on their own account. By acting as commission agents they avoid any price risks themselves. They wield their powers by having a base from which to operate such as ownership of rented stalls and spaces around the stalls in the markets. Consequently market stall allocation is critical for success as an urban wholesaler/commission agent.

Traders which fall in this category sell to local urban retailers and local small processors and occasionally supply some government institutions but their big sales are to traders from other towns. Urban wholesalers whose activities are mainly buying and selling on their own account rather than acting as commission agents often have helpers who they send in search of new supplies when their normal inventory is low. When the supply on hand is larger than normal, helpers may be sent to other towns, especially southern towns in Western Nigeria in an effort to increase sales. Wholesalers also may have an arrangement with buying agents located in the regular supply areas to whom they advance money to make purchases when they can get good bargains. Urban wholesalers do a minimum of storage and mainly make their profits from price differentials between locations or short-term price advances.

Interregional Wholesalers

Other wholesalers specialize in moving cowpeas from one urban market to other urban markets especially from northern supply areas to urban

markets in the south. Interregional wholesalers generally deal on a much larger scale than rural-urban wholesalers. There is no doubt that these two groups of traders overlap in the functions they perform. A rural-urban wholesaler, for example, on arriving at an urban center may find the price unattractive and consequently will move on to another urban market. Some of these traders go directly from their rural bulking markets to southern towns and some interregional wholesalers coming from the south may go directly to rural bulking markets to purchase their supplies rather than going to an urban center.

Deficit Area Wholesalers

Another group of specialized wholesalers located in such markets as Ibadan (the principal market in Southwestern Nigeria) buy cowpeas coming from the North and break down supplies into smaller units for sale to wholesalers or retailers in surrounding markets. Gusten and Thodey are among the authors that have called attention to the fact that a substantial volume of cowpeas shipped to Ibadan ends up in other towns and villages. It is not known how many additional exchanges are involved before cowpeas reach the ultimate consumer in remote villages.

Commission Agents

Commission agents whose function is to bring sellers and buyers together are found all along the marketing chain at each exchange point. They reach the highest level of sophistication in urban markets. Commission agents generally risk very little of their own money. Their return for services is based on their knowledge of the local situation.

Speculators

There also are individuals all along the marketing chain who invest their money in commodities hoping to make profits from seasonal price changes. This is a very heterogeneous group and may include farmer-traders and even civil servants. Individuals who fall in this category do not normally engage in the everyday buying and selling of commodities as traders do. Once they have acquired as much stock as they desire or can afford, they wait to sell until they think the seasonal price rise has reached its peak.

Retailers

Most of retail sales are handled by small traders, but in the North, farmers may occasionally sell directly to consumers at local markets. Specialized retailers in northern cities and towns often obtain their supplies directly from farmers early in the season, and later turn to wholesalers. In most towns, rural-urban wholesalers who specialize in buying supplies in rural areas are a major source of supply for retail traders. Retailers generally keep small inventories and consequently are not involved in storing cowpeas.

Principal Trading Routes

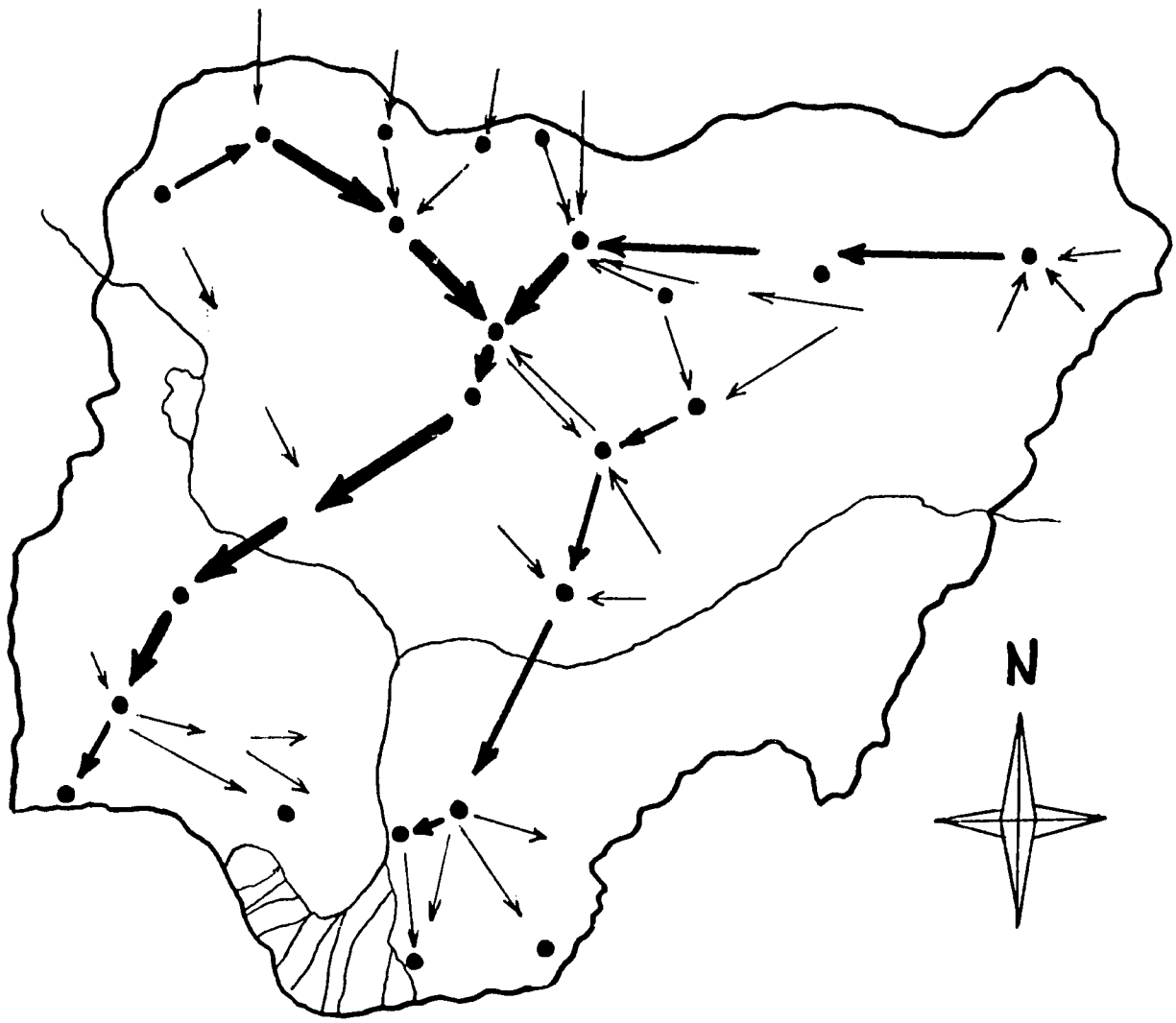
Few of the specialized traders described above handle only one commodity. Other commodities traded include rice, sorghum and millet although sorghum and millet are not traded over as wide an area as cowpeas since only small quantities of these commodities are consumed in the south. The general pattern of trade in cowpeas is shown in Figure 3. More of the total supply moves through the western north-south route (through Ibadan) than along the eastern route.

Relationships Among Participants

From the foregoing comments, it is apparent that while specialization exists among traders, there is also considerable overlapping of functions. Some members of one group may perform the tasks of the next group in the marketing chain. There is some evidence of upward mobility among traders. A successful farmer, for example, may become a farmer-trader or even a wholesaler.

Greater specialization or division of functions tends to occur as one moves along the marketing chain from producers to consumers. The number of traders also tends to diminish as one moves from the farm to urban centers. There are fewer rural or rural-urban wholesale traders, for example, than farmer-traders, and still fewer interregional traders (those that link the towns in different regions). But the number of handlers tends to increase again as commodities are broken down into small units for sale to retailers, and then ultimately to consumers. The possible effects of this type of structure on prices and marketing margins are discussed in a subsequent section.

Figure 3. Cowpea Distribution Routes in Nigeria



Light cowpea traffic

Medium cowpea traffic

Heavy cowpea traffic

Source: Cowpea Study Questionnaire.

CHAPTER IV

THE ECONOMICS OF COWPEA STORAGE

Seasonal price increases are characteristic of most agricultural commodities that are harvested at one period with consumption spread over the remaining months of the year. Generally prices are low immediately following harvest and then rise during the marketing season until a new crop is about to be harvested. With storable commodities, the seasonal price rise (under competitive conditions) is approximately equal to the cost of storage, including an allowance for storage losses (Tomek and Robinson, p. 167). If the seasonal increase in prices exceeds storage costs, this implies that there are imperfections in the marketing system. In an attempt to determine whether or not such imperfections exist with cowpeas in Nigeria, seasonal price changes were compared with estimates of within-season storage costs. The procedures used to estimate storage costs, based on information obtained from traders, are described in the section which follows. Storage costs are then compared with observed changes in seasonal prices to determine the profitability of storage.

Storage Costs

The principal cost elements which need to be considered are: depreciation on storage facilities, interest on capital which is invested in storage facilities and tied up in inventories, handling costs and storage losses. The analysis is based mainly on costs associated with storing grain in a type of structure commonly used in Northern Nigeria called a rumbu.

Depreciation of Structures

Depreciation is a function of the cost of constructing new facilities and the length of life of the structure. In 1972/73, the average cost

per metric ton of capacity of building a rumbu-type structure in the Shinkafi area was estimated to be ₦ 2.25[7/] (Ejiga, 1977, p. 123). Construction costs were nearly double that in the Lafia area. The difference in costs is due partly to climate and partly to the cost of labor. The long dry season in Shinkafi makes it feasible to use cheap open space for storage, whereas in Lafia, it has to be closed. The average rainfall in Lafia is more than 50 per cent above that in Shinkafi. In addition, Lafia is a more urbanized area located on a major rail line with more alternative opportunities available for employment nearby and hence higher costs.

Two methods were used to estimate the life expectancy of storage structures. First, farmers and traders were asked to make an estimate of how long their structures would last; second, the life expectancy was estimated based on the average or median age of existing structures. It was easier to obtain estimates of the age of existing facilities than to get farmers and traders to say how long a new structure would last. If storage facilities have been in place for some time and there is a normal distribution of the age of structures (i.e. the population of storage facilities has reached an equilibrium with new facilities being constructed at about the same rate that only structures are abandoned), the average life expectancy can be estimated by multiplying the average age of existing facilities by two. The results obtained using these two methods of estimating life expectancy are shown in Table 3.

Table 3. Life Expectancy of the Rumbu Storage Facility

Information	Location			
	Shinkafi	Badarawa	Lafia	Lafia Villages
Estimates of average life expectancy (yrs)	13.6	12.1	6.5	7.5
Two times the average age of existing structures (yrs)	13.0	17.6	11.2	10.2

7/ Costs are reported in Nigerian currency. In 1973, Nigeria adopted the naira as the unit of exchange. At that time one naira was equal to $1.52.

Farmers' estimates of the life expectancy of their structures and those based on twice the average age are about the same only for Shinkafi. Lafia farmers' estimates of life expectancy for storage structure appear to be too low. Their responses averaged around 7 years which is close to the median age of existing facilities. If their estimates of life expectancy were correct, it would have been necessary to replace a high proportion of the existing structures within one or two years, which farmers and traders were not planning to do. There is, however, a logical explanation for expecting storage structures to last longer in Shinkafi than in Lafia. The rainfall, as previously mentioned, is higher in Lafia; rainfall is one of the principal causes of deterioration in both the mud walls of the rumbu and the grass thatched roofs. Lafia also is in an ecological zone where termite damage to wood and thatching is likely to be greater.

Based on the responses of farmers in the two areas and the average age of existing structures, a figure of 14 years was finally selected as a reasonable estimate of the average life of structures in Shinkafi and 11 years in Lafia. These estimates are lower than the 20 years used by Norman (1972a, p. 46) and the 18-year estimate of life expectancy used by Giles (p. 200). Based on these estimates of life expectancy and construction costs prevailing in the early 1970s, annual depreciation costs were estimated to be ₦ 0.16 per metric ton capacity in Shinkafi and ₦ 0.39 per metric ton capacity in Lafia.

To these costs must be added the average amount that must be spent annually to maintain the structures. No estimates of the cost of repairing walls and replacing or repairing roofs were obtained from the sample of farmers and traders interviewed. A figure of ₦ 0.25 per metric ton of capacity was used based on estimates of annual repair costs reported by Hays (p. 37) who looked at grain storage facilities in the Zaria area which is located between Lafia and Shinkafi.

Cost of Renting Storage Space

An alternative way of estimating the annual cost of storage is to find out what traders are paying for additional space. Traders were asked whether they rented space, and at what price. Storage facilities

were available for rent at all locations. None of the traders interviewed at Shinkafi rented any storage space themselves, but they offered space to others, mainly to traders and farmers from other places. Some of the traders interviewed at Sokoto and Jos were renting whole market stalls, while at Lafia, traders were renting both stalls and other types of storage space. The rental rates reported are shown in Table 4.

Table 4. Rental Rates for Storage Space, 1972-73

Type of Space	Location			
	Shinkafi	Sokoto	Jos	Lafia
	Naira/ton			
Sack rate converted to ton rate/year				
Closed space	12.00	n.a.	n.a.	30.00
Open space	7.20	n.a.	n.a.	n.a.
Annual rate/ton/year	n.a.	.79	.85	1.72

n.a. = not available or not applicable.

Interest Cost

Interest cost is based on the value of the goods held in storage and the opportunity cost of capital. The latter figure proved to be difficult to obtain. Interest rates on loans obtained outside the commercial banks are said to be very high (FAO, 1966, p. 363). However, none of the traders interviewed said they advanced any money to farmers. Similarly, none of the traders reported taking out loans for operating expenses. Traders were asked to state their sources of starting capital. The sources reported are shown in Table 5.

The answers by traders shown in Table 5 indicate that when loans are needed, one generally goes first to relatives and friends before seeking other sources. Relatives and friends are not likely to charge exorbitant interest rates. Twenty farmers from the total sample of 100 were asked about borrowed funds and if they had pledged their cowpeas

Table 5. Traders' Source of Capital

Sources	Location				
	Kano	Sokoto	Jos	Shinkafi	Lafia
No. of traders interviewed a/	11	11	8	9	11
Personal savings	3	4 b/	4	5 b/	7
Loan from relative	3	5	2	4 b/	3
Loan from friend	1	2 b/	2	1	0

a/ Numbers may not add to total because some failed to respond to specific questions.

b/ One trader cited both as sources of capital.

as security for loans. None had borrowed any money and none had offered his cowpeas as security for a loan. Thus, repayments in kind which are often said to be responsible for high interest rates (Abbott, p. 10) did not appear to apply in this case. Hays also found that credit was involved only in a small per cent of millet and sorghum sales and no interest was charged for those who did borrow (p. 39).

The opportunity cost of money in rural areas is low if there are no banks available locally in which one can deposit funds. This was the situation that prevailed in most rural areas at the time of the survey. Many people in small villages simply hide money in the house rather than attempt to lend it to others. For lack of a better method of assessing interest cost, it was decided to use something close to the rate prevailing on savings deposits held with commercial banks. These rates are controlled by the government. At the time of the survey, the passbook rate was 3.5 per cent, and the rate paid on time deposits was somewhat higher. A rate of 5 per cent ultimately was selected as an appropriate rate to use in estimating interest on capital invested in facilities and inventories.

Interest was calculated on the average capital invested per metric ton of storage capacity. Based on the preceding estimates of the capital

tied up in facilities, the average interest cost was estimated to be ₦ 0.06 in Shinkafi and ₦ 0.11 in Lafia. The interest cost of holding inventories was calculated by multiplying the average wholesale price of cowpeas at each location by 5 per cent. Based on these calculations, the interest cost of money invested in holding cowpeas was ₦ 8.81 in Shinkafi, ₦ 8.83 in Lafia, ₦ 9.76 at Sokoto and ₦ 10.71 at Jos.

Depreciation of Sacks

For the purpose of this analysis, storage is assumed to be in sacks which is the most common way in which traders store cowpeas. As was indicated earlier, most farmers store their cowpeas unthreshed in their storage bins and, therefore, do not need to incur the costs of sacks.

Traders were asked to estimate the life expectancy of sacks. Most said they last about one year. However, if the sacks are used strictly for storage and not for transporting grain, sacks could last as much as 3 years. Using the average price of sacks at each location and assuming 3 years of use, the depreciation cost of sacks is estimated to range from ₦ 1.67 to ₦ 2.00 per ton per year (Table 6).

Table 6. Cost of Sacks to Store 1 Ton of Cowpeas, 1972-73

Information	Location			
	Shinkafi	Sokoto	Lafia	Jos
Price of one sack[a/] (₦)	0.60	0.60	0.50	0.50
Cost of sacks per ton[b/] (₦)	6.00	6.00	5.00	5.00
Cost of sacks per ton per year[c/]	2.00	2.00	1.67	1.67

a/ Sacks were cheaper at Jos and Lafia because of a jute factory at Jos.

b/ Each sack is assumed to have a capacity of 0.1 metric ton and, therefore, 10 sacks are needed for one metric ton of grain.

c/ A sack is assumed to last 3 years if used for storage only.

Handling Costs

Additional costs are often incurred in moving cowpeas to and from storage. Obviously the cost of doing so varies with distance. The rate charged for transporting a sack of grain over short distances averaged around 3 kobo at Shinkafi and Lafia and 5 kobo at Sokoto and Jos. Taking a sack to be 0.1 of a metric ton, these rates translate to ₦ 0.60 to transport one metric ton of grain to and from storage at Shinkafi and Lafia and ₦ 1.00 at Sokoto and Jos.

If cowpeas are stored in bulk, the cost of resacking needs to be included but very few reported storage in bulk. Cowpeas are mainly stored in the sacks in which they are purchased.

Insecticides and Other Control Costs

Even though farmers and traders reported the use of chemical insecticides, these insecticides are not very effective. Caswell (1973, p. 73) observes that "no insecticide which is safe for the farmer to use has been found to give satisfactory control." Nor has the use of local plant materials as insecticides been considered mainly because the prices and effectiveness of such materials are not known. Sand is used at Sokoto to "wash out" insects but this is considered an operational rather than a storage cost.

Allowance for Storage Losses

Since insecticides are ineffective, losses due to insect damage are almost inevitable if cowpeas are stored for even a brief period of time. Estimates of losses due to insect damage were obtained by purchasing cowpeas from local markets at monthly intervals. Each sample purchased was divided into four parts and 250 seeds were selected at random from each part. The number of samples and the average proportion of damaged seeds from each sample are reported in Table 7.

The average proportion of damaged seeds from all the samples was 34.6 percent. Caswell, in monthly samples drawn from about 50 markets over a period of 3 years, found 37 per cent of the cowpea seeds were damaged (manuscript in preparation). The damage level varies with the

Table 7. Number of Samples and Proportion of Damaged Cowpea Seeds, 1972-73

Location	Number of samples analysed	Proportion damaged (%)
Shinkafi	9	46.3
Lafia	14	39.1
Sokoto	20	25.0
Jos	2	45.6
Total	45	34.6

length of storage. Caswell reported that when cowpeas are stored in the traditional manner without threshing, the farmer "can expect about 30 percent of his beans to be attacked after three months storage and 50 to 60 percent will have been attacked after six months." Damage probably will not exceed this figure because predators, especially parasitic wasps, increase along with the number of bean beetles. If an insecticide is used, the natural predators will be destroyed and damage may go up to as high as 80 or 90 percent (Caswell, 1973, p. 73). Damage which is caused by insects making holes in the seeds amounts to only a 10 per cent weight loss for the damaged seeds (O'Dowd, 1971a, p. 18). Since not all seeds are damaged, the average weight loss is about 4.7 per cent (Caswell, manuscript in preparation). This estimate of storage loss is much less than the 20-25 per cent figure which was mentioned by both FAO (p. 352) and the Nigerian National Committee on Food Marketing Problems (p. 9). In Nigeria, since sales are made using volume measures, rather than by weight, the weight loss may not be considered as serious as the downgrading of the cowpeas that occurs because of insect damage.

Assuming that either weight loss or poor quality discount amounts to 5 percent of the value of the commodity, the losses due to insect damage have been estimated for each location and recorded in Table 8. Average weekly wholesale prices at each location have been used to value the pest damage losses.

Table 8. Value of Cowpea Loss Due to Insect Damage, 1972-73

Location	Average price[a] per metric ton (₦)	Average loss[b] per metric ton (₦)
Shinkafi	176	8.81
Lafia	177	8.83
Sokoto	195	9.76
Jos	214	10.71

a/ Average of weekly wholesale prices.

b/ 5% of average price.

Other Storage Losses

Storage losses resulting from rats, thieves, rain damage, etc. vary from place to place. Traders and farmers were asked to identify the principal causes of loss or damage to cowpeas. Their responses are reported in Table 9. The interviews helped to identify sources of loss, but did not provide a statistical basis for estimating the magnitude of losses incurred from each of these sources. Thus, the total allowance for losses probably is understated. In some cases, losses from other sources exceed those from insect damage. For example, urban traders cite thieves as an important source of loss. When a thief steals one sack of cowpeas per ton, this is equivalent to a 10 per cent loss.

Aggregate Within-season Storage Costs

Estimates of storage costs and losses based on the preceding analysis have been brought together in Table 10. The minimum within-season cost in each market studied ranges between 20 and 25 naira per ton. Actual costs may be somewhat higher if one takes account of losses other than those caused by insects, and traders are compelled to rent space for a small quantity of cowpeas for short periods of time. Sack rental rates for storage space, computed on a per ton basis, are substantially higher as shown in Table 4. Renting an entire storage shed is much less costly than renting space for only a few sacks of cowpeas.

Table 9. Sources of Loss in Stored Cowpeas

Source of Loss	Location				
	Shinkafi	Lafia	Sokoto	Jos	Kano
Traders					
Number* interviewed	9	11	11	8	11
Number citing loss due to:					
Insects	9	7	6	6	4
Rats	0	5	1	4	0
Thieves	0	0	2	6	7
Rain	1	0	6	5	0
Other	0	0	0	0	1[a/]
Farmers					
Number interviewed	14	6	--	--	--
Number citing loss due to:					
Insects	14	6			
Rats	0	0			
Thieves	0	0			
Rain	0	0			
Other	0	0			

* Total number of causes cited may exceed total number interviewed because some cited more than one cause.

a/ The trader specified "accident."

-- Not applicable.

Table 10. Average Within-Season Cost of Storing One Ton of Cowpeas, 1972-73

Cost Elements	Location			
	Shinkafi	Lafia	Sokoto	Jos
	(₦/ton)			
Annual depreciation of facilities	0.16	0.39	-	-
Annual repairs (rumbu)	0.25	0.25		
5% interest on capital invested in facilities	0.06	0.11		
Annual cost of facilities	0.47	0.75		
Annual rental cost - stall space	-	1.72	.79	.85
5% interest on inventory	8.81	8.83	9.76	10.71
Depreciation on sacks	2.00	1.67	2.00	1.67
Transportation to and from storage	.60	.60	1.00	1.00
Weight loss due to insect damage	8.81	8.83	9.76	10.71
Total Cost	20.69	20.68 (21.65)[a]	23.31[a]	24.94[a]

a/ Based on annual rental rates per ton of cowpeas; short term rates per sack computed at an annual rate are somewhat higher (see Table 4).

No estimates have been made of the cost of carrying cowpeas over from one season to the next. Survey data indicated that this was not commonly done. In fact, inventory data obtained at the beginning of the 1973 marketing season revealed that none of the farmers or traders interviewed had any cowpeas in storage left over from the previous season at that time.

There are several reasons for not carrying over cowpeas from one season to the next. First, one would have to store cowpeas until well after the new crop was harvested to avoid depressed prices at that time. This would require storing cowpeas for at least 15 months. By the time they were sold, insect damage undoubtedly would be very high, and thus they would probably sell at a discount. A second reason for not storing cowpeas beyond the current marketing season is the high cost and risk involved. Prices would have to rise considerably to make storage for an extended period profitable. One can store profitably into the next season only if there is a short crop. The probabilities of this are not known, and hence farmers and traders are unwilling to risk carrying inventories into the next crop season.

Profitability of Within-Season Storage

Because prices are depressed in the immediate post-harvest period, it was hypothesized that cowpea storage within a season pays only if the crop is held beyond the first few months. If storage is to be profitable for farmers or traders, the price must rise by more than enough to cover storage costs.

To ascertain whether or not storage was profitable, acquisition plus storage costs were computed for the 1972-73 crop season and compared with the actual prices prevailing during that period. Costs were computed on a monthly basis and added to the purchase price of cowpeas to obtain a monthly series. It is simpler to assume costs rise in a linear fashion, but probably incorrect to do so since storage losses due to insect damage do not rise at a constant rate. For this reason, losses were estimated for each month assuming that damage tends to rise and to reach a peak of about 60 per cent in 6 to 7 months. As has already been noted, insect damage leads to about a 10 per cent weight loss per seed. The maximum weight loss per ton is then 60 per cent damaged seeds multiplied by 10 per cent weight loss per seed or 6 per cent. The weight loss in each month was valued at the average wholesale price for that month.

The low-cost estimates shown in Table 10 were used to calculate monthly storage costs by dividing the annual cost for each market by 12.

The sum of these costs plus acquisition costs and storage losses are shown graphically for each market in Figures 4 through 7. Monthly wholesale prices also are shown for each of these markets. The calculated harvest price plus storage cost was generally above the wholesale market price for the period beginning with harvest and ending with the month of May. Thus, if the 1972-73 season is typical, this means that farmers and traders must store cowpeas for 6 to 7 months before they can earn a profit from storage. The data indicate that storage would have been very profitable in that year provided the cowpeas were held for sale late in the season.

It has been noted that cowpeas stored for 6 months could have up to 60 percent of the seeds damaged by insects. Clearly, there is a need to find a cheap, safe, effective and easy method for controlling cowpea infestation. If cowpeas are to be stored for this length of time credit may be needed to tide the farmer over this period. A farmer's inventory can be used as a basis for such loans.

A note of caution about the preceding analysis is in order. The length of time for storage to pay will likely vary from year to year. One cannot be assured that the seasonal price movements will always follow the 1972-73 pattern. The seasonal pattern of prices does, in fact, vary greatly from year to year. There is also no reason to believe that traders make their purchases immediately after harvest, which was the assumption made in calculating costs. If purchases in 1972 had been made one month later than the one assumed (the harvest month), the time required to break even or to earn profits would have been shorter.

Profitability of Storage Based on a Simple Decision Rule

Average seasonal price changes over a period of several years can be estimated if time series data are available. Examples of average seasonal price patterns for selected markets are shown in Figures 8 and 9. The data for these graphs were obtained by computing the average price for each month over the period 1958-72. From the graphs, one can identify the typical low-priced month and the magnitude of the seasonal

Figure 4. Shinkafi Wholesale Cowpea Prices 1972-73

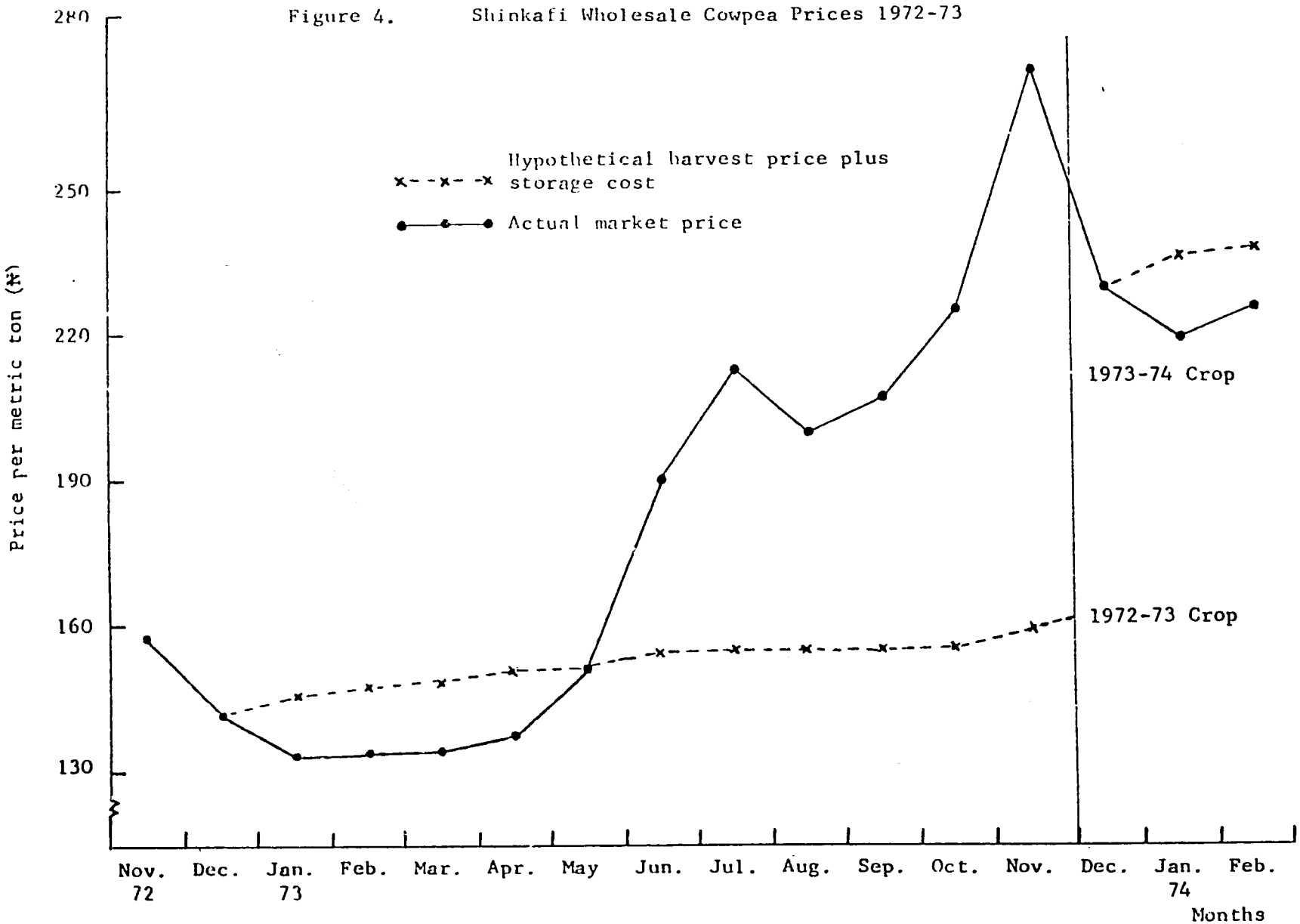


Figure 5. Wholesale Cowpea Prices at Lafia 1972-73

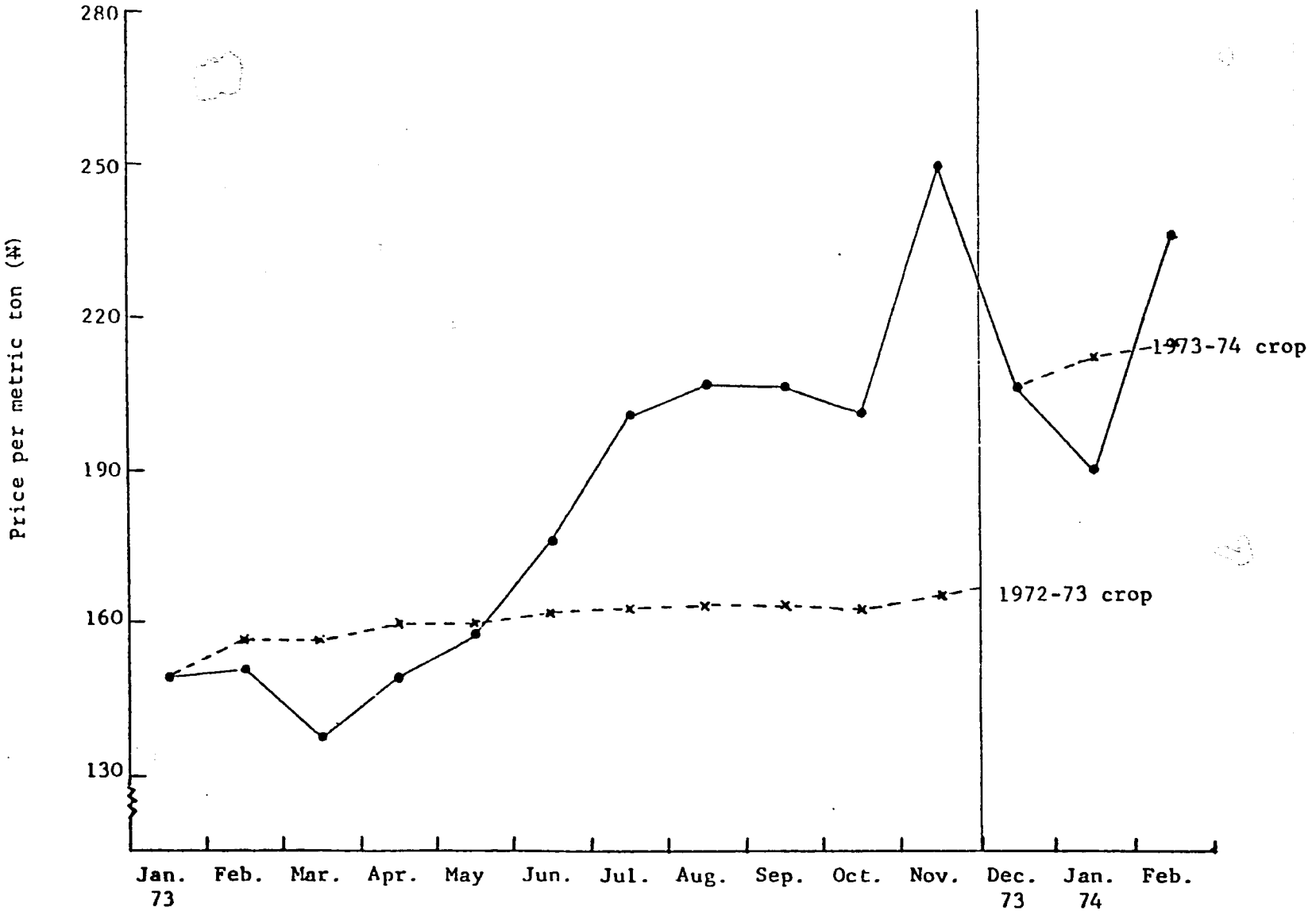


Figure 6. Sokoto Wholesale Cowpea Price Movement 1972-73

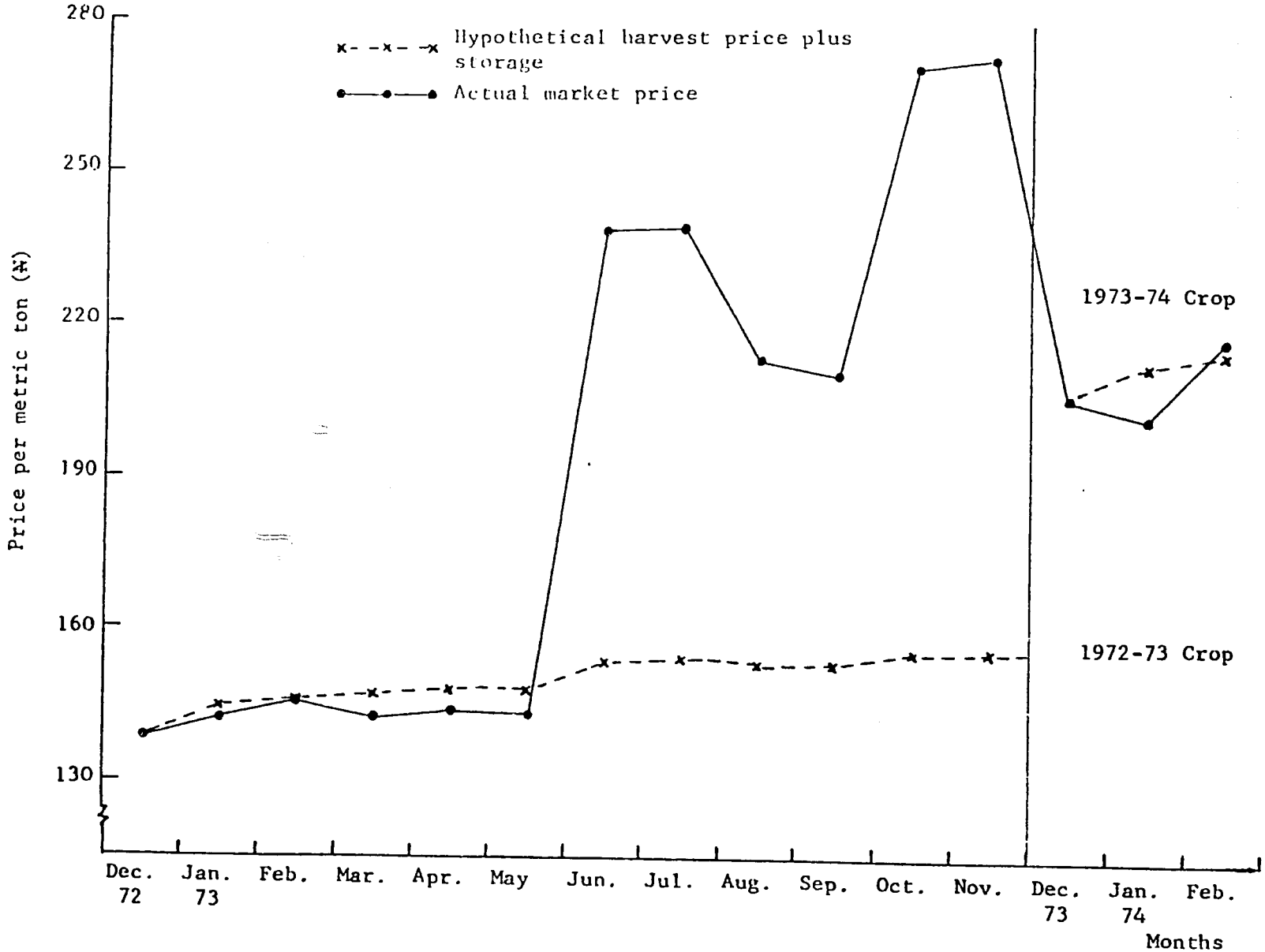


Figure 7. Jos Wholesale Cowpea Price Movement 1972-73

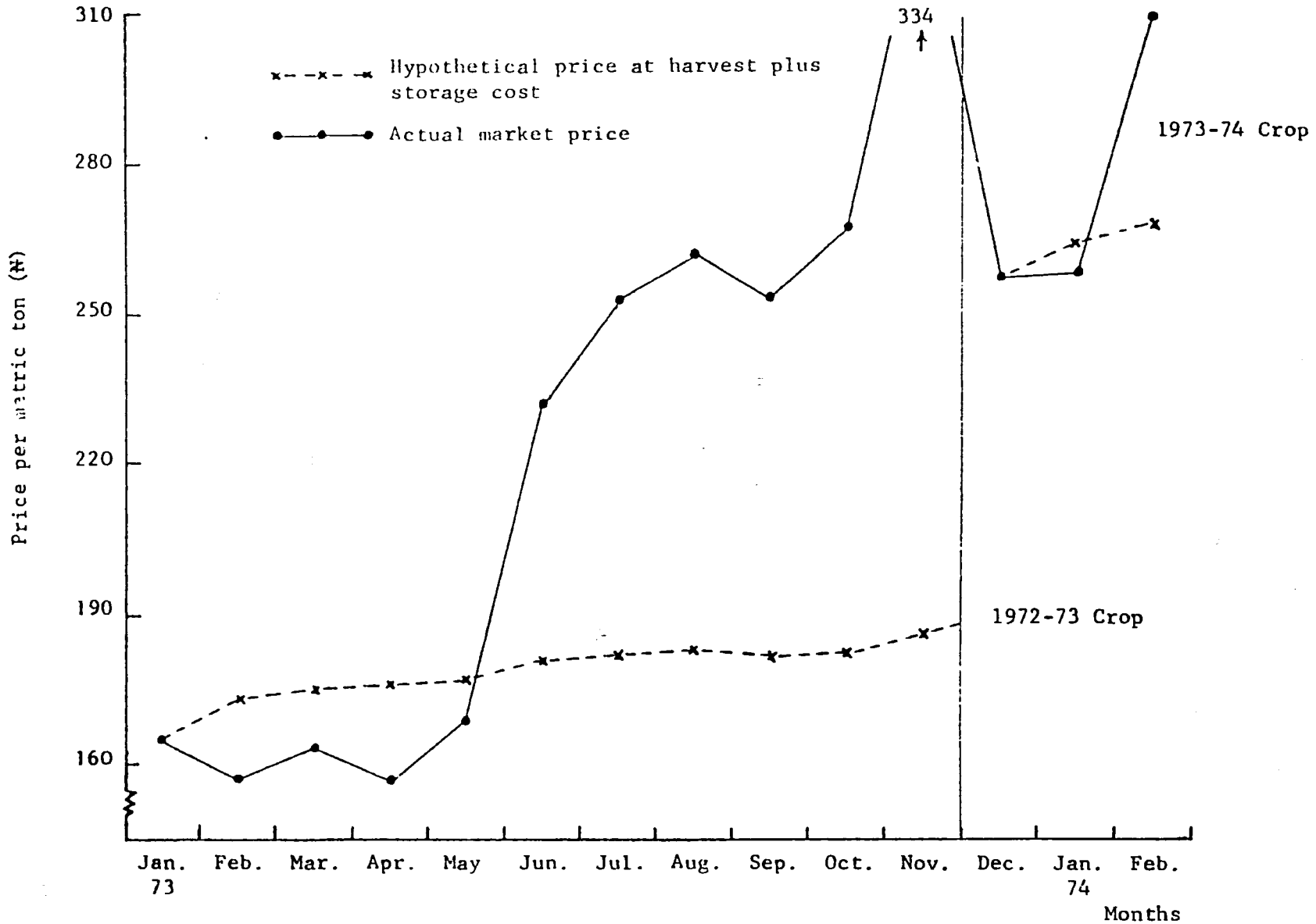


Figure 8. Average Monthly Prices for Cowpeas in Producing Areas, 1958-1972

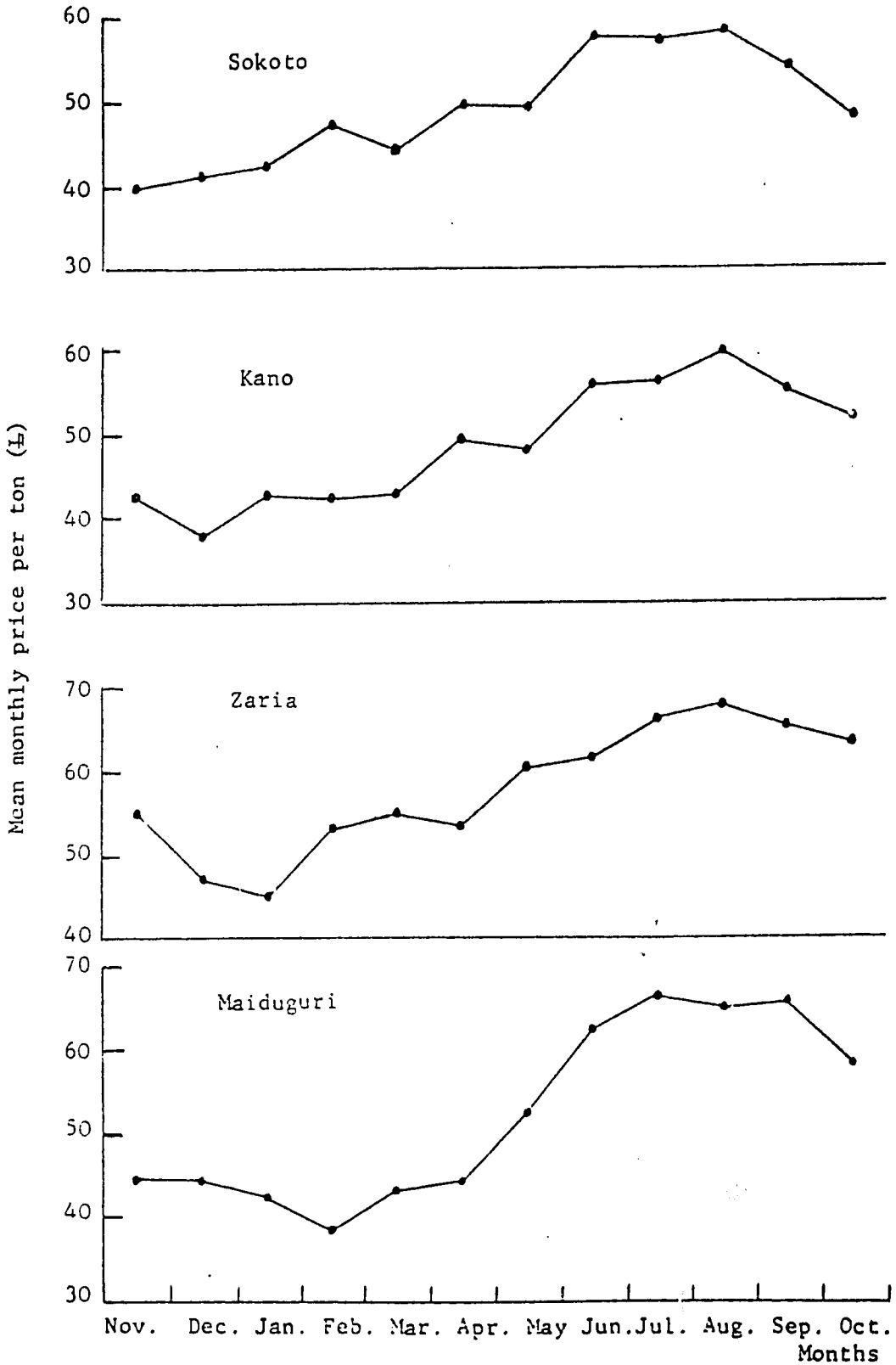
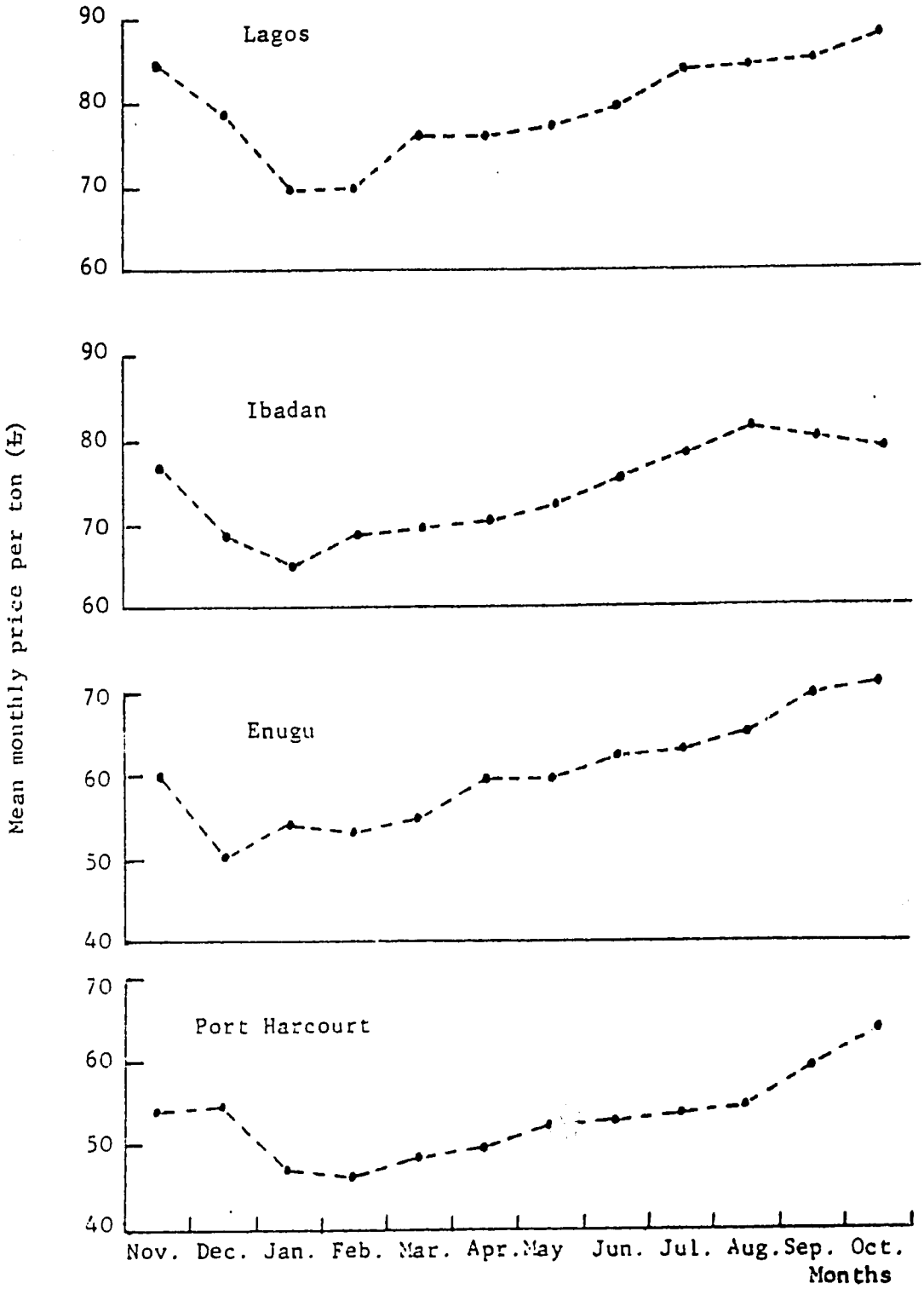


Figure 9. Average Monthly Prices for Cowpeas in Deficit Areas, 1959-1972



price increase. Using these data, one can devise decision rules for storage operators. One such rule is to purchase grain for storage in the typical low-priced month each year, and to sell the grain previously acquired in the typical high-priced month. The performance of this simple decision rule was evaluated for 8 separate markets using data for the period from 1958 through 1972.

Ideally, storage costs should be calculated separately for each market, but storage cost estimates were not available in many of the markets for which wholesale price data were available. Storage cost data were available only for Sokoto and Jos. These data were used to represent costs in other markets as well. The average cost of storing cowpeas in these two markets, based on the information presented earlier, was ₦ 24.13 per ton per year. As a rough approximation, it was assumed storage costs would amount to ₦ 24 per year or ₦ 2 per month. Because the price data over the period from 1958 through 1972 were in currency units in effect at that time, i.e. £ per ton rather than ₦ per ton, storage cost data were converted to £ per ton. Since one pound equals two Naira, storage costs are assumed to be 1 £ per ton per month.

The price margin in every year was compared with the assumed cost of storage to determine whether or not a trader would have earned a profit from buying and selling in the months indicated. The results are shown in Table 11. The average price increase during the period from 1958 through 1972 was sufficient to insure profits from storage. Average seasonal price increases ranged from about £ 16 to £ 28 per ton, with most of the markets falling within the range of £ 18 to £ 22. Storage costs for the period in which traders were assumed to hold inventories ranged from £ 5 to £ 10 per ton. What is of particular interest, however, is the number of "profit" as compared to "loss" years. Since price patterns are not uniform from year to year, traders will lose money from storage in some years, and earn substantial profits in other years. Profit and loss years were about evenly balanced in 5 of the 8 markets, while in two of the markets (Zaria and Maiduguri), the number of profit years greatly exceeded the number of loss years. In the latter two markets, cowpeas were assumed to be held for a shorter period than in the other markets.

Table 11. Profitability of Storage Based on a Simple Decision Rule a/, 1958-72

Market	Buying Month	Selling Month	Average Price Difference 1958-72 b/	Assumed Storage Cost b/	Number of Years With: Loss	Break even	Profit
			₦/ton				
Sokoto	Nov.	Aug.	18.88	9.00	5	1	6
Kano	Dec.	Aug.	22.22	8.00	6	0	6
Zaria	Jan.	Aug.	22.66	7.00	2	0	9
Maiduguri	Feb.	July	28.40	5.00	1	0	8
Ibadan	Jan.	Aug.	16.25	7.00	4	1	5
Lagos	Jan.	Oct.	18.44	9.00	5	1	4
Enugu	Dec.	Oct.	20.60	10.00	5	0	3
Port Harcourt	Feb.	Oct.	17.00	8.00	6	0	5

a/ Assumes purchases are made in the typical low-priced month and sold in the typical high-priced month as shown in the 2nd and 3rd columns.

b/ Prices are in ₦ since this was the unit of currency from 1958 through 1972. 1 ₦ = 2 Naira.

The results were subjected to sensitivity analysis in which the cost of storage was permitted to vary by plus or minus ₦1 at each location. Permitting costs to vary within this range did not alter the distribution of profit and loss years very significantly. Obviously, results would have been different if the level of costs had been raised significantly. Since no allowance was made in estimating total costs for operating expenses such as payments to helpers, commissions paid to agents, bagging costs, or the use of insecticides (even though they may be ineffective), total costs probably have been underestimated. Sometimes different qualities of cowpeas are blended together which may require rebagging and hence the need for additional labor.

It can be argued, of course, that traders don't follow the simple rules assumed in the foregoing analysis. A trader who is exceptionally astute may be able to identify years in which the price pattern will deviate from the average and hence earn additional profits. Some traders buy and sell continuously. Those who do so, however, will obtain about the same returns as they would if they followed the rules outlined above. Continuous trading in a period of rising prices leads to the same results as a one-time purchase and one-time sale. This is demonstrated mathematically in Appendix II.

The results of this simple simulation analysis indicate that there is a considerable degree of risk associated with storage of cowpeas. On the average, traders can expect to earn profits from storage, but they may incur losses in a particular year if the seasonal price pattern is abnormal. The evidence suggests that trading in most markets is reasonably competitive. This is consistent with other evidence, which indicates that foodstuff traders are not exceptionally wealthy, and that entry barriers are modest. But there may be exceptions to this generalization. Analysis of the kind that has been presented can be used to identify markets in which storage margins may be excessive.

CHAPTER V

INTER-MARKET PRICE RELATIONSHIPS

Reported cowpea prices in the major markets in Nigeria were analyzed in an attempt to determine whether or not there is evidence of serious price distortions between markets. Under perfectly competitive conditions, price differences between markets are a function of transfer costs. For any two markets that engage in trade, the price difference should be approximately equal to the transfer cost per unit of product, while in markets that do not trade with each other, price differences should be either equal to or less than transfer costs. If the difference in price between any two markets exceeds transfer costs, this is usually taken as evidence of imperfections in marketing or non-competitive behavior. If competition exists, alert buyers will purchase commodities in the lower-priced market and sell them in the higher-priced market as long as the price difference exceeds transfer costs. This will tend to raise prices in the lower-priced market and depress them in the higher-priced market. Under competitive conditions, one also would expect prices in all markets to move together. Thus, two types of evidence are examined in order to assess the competitiveness of markets and pricing efficiency: first price differences are examined in relation to transfer costs or the distance between markets (which serves as a proxy for transfer costs); and second, the degree of correlation between price changes in the principal markets is examined.

Spatial Price Relationships

The analysis of spatial price relationships is based on reported retail prices for from 14 to 17 markets for the period from 1959 through 1964 and 1970 through 1972. The years 1965-69 have been omitted because of distortions in the data due to political unrest and the civil war which took place during that period. Price data for northern markets

were obtained from the Crop and Weather Reports first collected by the Government of Northern Region and later by the governments of the states that replaced the regional government. Corresponding data for southern markets were obtained from the Federal Office of Statistics. The reported retail prices in all cases were converted into an equivalent value per ton. It would have been preferable to base the analysis on wholesale price data, but unfortunately, wholesale price information had not been collected during this period. The principal limitations of the data are: (1) possible errors in converting local retail units to tons; (2) failure to collect price data at approximately the same time for each market; (3) the small size of samples used to represent prices in each market; (4) non-uniform quality; and (5) inadequate supervision that could lead to false or inaccurate reporting.

Price differences between all the markets that logically can be expected to trade with each other were calculated for every year for which reasonably accurate data were available. Ideally, these differences should then be compared with transfer costs calculated for the same year. But transfer cost data were not available except for the year in which the study was conducted (1973). Thus, a two-step procedure was adopted. First, the data on transfer costs (which were collected for a period of 6 months in 1973) were related to market distances to determine the nature of the relationship between distance and transportation costs; and second, price differences for each market in each year were regressed against the corresponding distance between markets. The first relationship was examined in order to ascertain whether or not it was reasonable to use distance as a proxy for transportation costs.

Transportation rates per passenger (R_p) and per sack (R_s) were regressed against mileage (M). The results obtained from these two regressions were as follows:

(1) For the passenger rates

$$R_p = \underset{(1.918)}{0.510} + \underset{(9.355)}{0.00567}\, M \qquad \text{(t-values)}$$

$$\bar{R}^2 = 0.695$$

$$Se = 0.801$$

(2) For the sack rates

$$R_s = 0.0996 + 0.00283\ M$$
$$(1.233)\ (15.331) \qquad \text{(t-values)}$$

$$\bar{R}^2 = 0.860$$

$$Se = 0.244$$

These results indicate that the relationship between each of the rates and distance is approximately linear and therefore the mileage between markets can be used in place of transportation costs. The scatter of the observations and the average relationship for each set of data are shown in Figure 10.

Price differences between markets were regressed against mileage between the same markets to find out the average relationship between distance and price differences and what proportion of observed price differences appears to be associated with distance rather than other variables. The former relationship is measured by the slope of the regression coefficient attached to mileage, while the latter is measured by the squared coefficient of correlation (R^2). More precisely, the relationship estimated was as follows:

$$PD_{ij} = a + b\ M_{ij} + e$$

where PD_{ij} = the mean absolute price differential between locations i and j in any year

M_{ij} = mileage separation between i and j

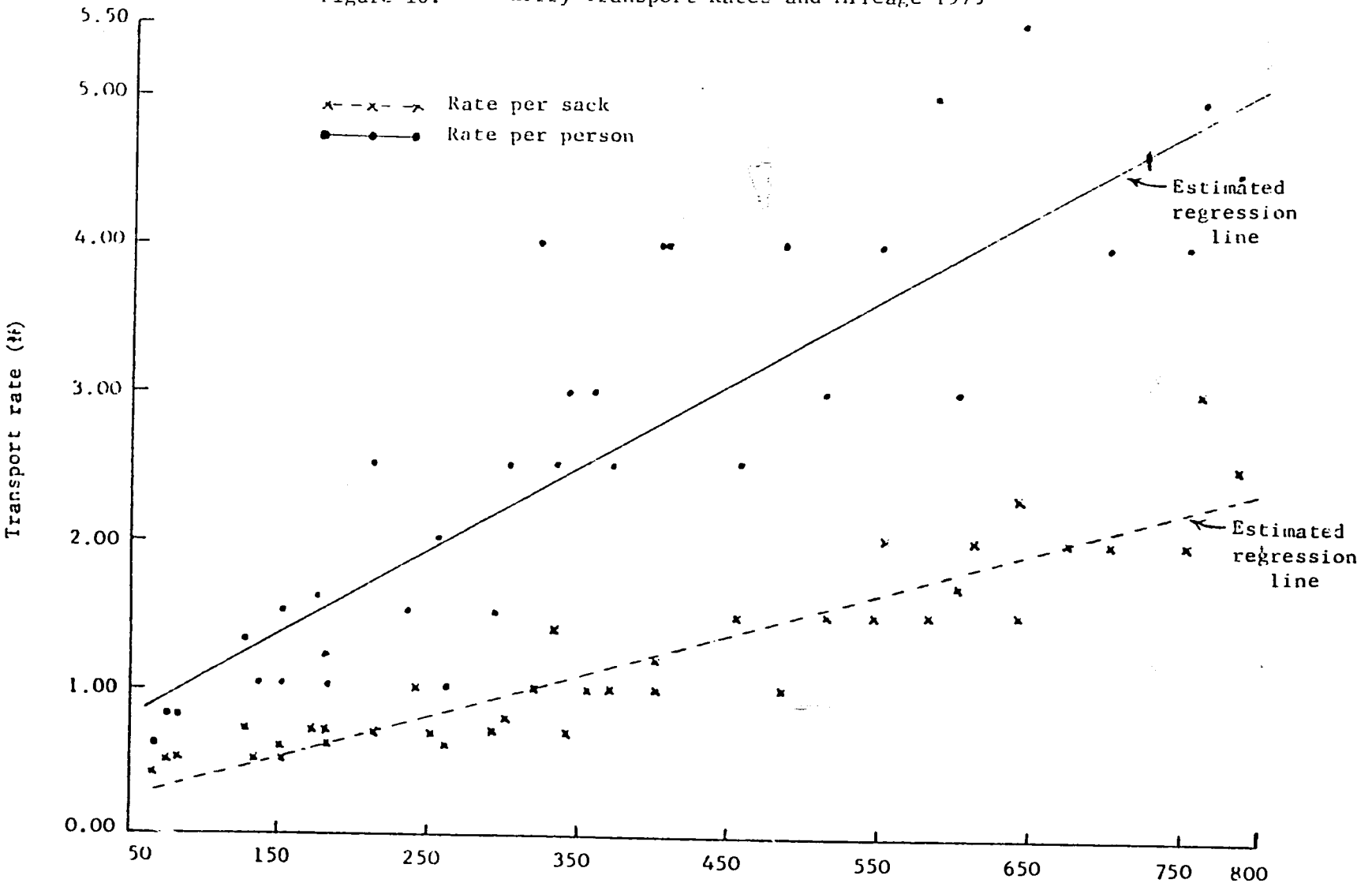
e = error term

a and b are constants.

The regression results for each year are shown in Table 12.

Except for the years 1971 and 1972, the t-values for the coefficient of the mileage variable indicate that the slope coefficients are significantly different from zero at the 5 per cent level. Thus, it may be assumed that price differences and mileage are related. For all years, the sign of the coefficient of the mileage variable agrees with the hypothesized direction of its influence.

Figure 10. Lorry Transport Rates and Mileage 1973



Source: Cowpea Study Questionnaire.

Table 12. Results of Regressing Mileage Against Price Differences Between Markets

Year[a/]	Number of Observations	$\bar{R}^2$	Mileage Coefficients
1959	29	.35	.026≠
1960	34	.52	.033≠
1961	35	.36	.033≠
1962	34	.40	.033≠
1963	35	.50	.028≠
1964	34	.63	.030≠
- -			
1970	28	.17	.016≠
1971	28	.06	.020*
1972	26	.05	.028*

≠ T value > 2.0.

* T value > 1.5 < 2.0

a/ The years 1965-1969 have been omitted because of distortions due to political unrest and civil war.

The mileage coefficients shown in Table 12 can be used to estimate transfer costs, using the data derived from the previous analysis of the relationship between transport costs in 1973 and mileage. The coefficient relating transport cost per sack of cowpeas to mileage was ₦ 0.00283. A sack of cowpeas is approximately one tenth of a metric ton. Thus, the cost per ton mile is approximately ₦ 0.0283.

The foregoing estimate of transport cost per ton can be compared with the average increase in price per ton based on the coefficients reported in the last column of Table 12. The average increment in price

per ton mile (based on averaging the significant coefficients in the last column of Table 12) is ₦ 0.0286. Note that the price differences are in ₦ per ton, while the cost data are in ₦ per ton. Thus, the mileage coefficient must be multiplied by two to convert it to naira per ton (1 ₦ = 2 ₦). The resulting figure (₦ 0.0572) is greater than the estimated transportation cost per ton of ₦ 0.0283. The difference per ton mile is ₦ 0.0289. This presumably covers the cost of the trader's labor and other expenses incurred in moving commodities between markets.

In many cases, the trader accompanies the commodities he has to sell. The trader's own transportation costs must then be added to the transport costs for the commodity. The owner's transport cost per unit of product shipped will decline as the volume transported increases. Assume the trader accompanies a shipment of 20 sacks or 2 tons. In this case, the cost of transportation for the trader would be spread over a two-ton load. This cost can be estimated based on the mileage coefficient of the passenger rate regression equation. The slope coefficient for this equation was ₦ 0.00567 per mile. For a trader transporting two tons, this amounts to ₦ 0.00284 per ton mile. Subtracting both the transport cost per ton for the cowpeas (₦ 0.0283) and the accompanying cost of the trader (₦ 0.00284) from the increased price per ton mile (₦ 0.0572) leaves a residual of ₦ 0.0261, which is approximately 3 kobo per ton mile. No precise information is available on other costs which the trader incurs such as the cost of loading and unloading, loss in transit and payments to commission agents, but it is likely that these costs would account for most of the remaining difference. Thus, it appears that price differences between markets are competitively determined and that arbitrage by traders is reasonably successful in keeping prices approximately in line with transfer costs. It should be kept in mind, of course, that the foregoing analysis is based on costs prevailing in the early 1970s and, therefore, cannot be used to ascertain whether or not current price differences are in line with costs.

The correlation coefficients shown in column three of Table 12 indicate that there is a substantial part of the variation in price differences between markets that is not accounted for by differences in mileage. The correlation coefficients for the years 1970-72 are especially low;

those for earlier years are much higher. These "unexplained" differences may be due to imperfect knowledge, errors in data, physical losses due to theft, or the failure to take specific account of loading and unloading costs which are not proportional to distance.

Market Integration

In a competitive market structure, prices in different markets are expected to move together since all are influenced by the same set of forces and are tied together by transfer costs. One method of indicating the extent of market integration is to compute bivariate correlation coefficients (r) between prices at different locations and interpret this as an index of market integration. The use of correlation coefficients to indicate the extent of market integration is common (for example, see Farruk, Chap. V; Gilbert, Chap. XI; Lele, Chapters 1 and 4; and Jones, 1972, Chap. 6).

The method adopted for this study was to calculate the correlation coefficients between prices for each year of the data. This is different from the method used by Gilbert, Hays, Jones and Lele cited above. These authors pooled the data for the entire period. By performing the analysis for each year separately, differences between years or trends in the degree of integration from year to year can be detected. This information is lost when the analysis is done using pooled data.

The analysis of market integration was based on the same retail price series as that used in the analysis of spatial price relationships. Results are reported only for the years 1959-65 and 1970-72 because of incomplete information for the years 1966-69. Retail prices in each market were correlated with those from every other market. The distribution of simple correlation coefficients between markets is reported in Table 13. For each year, the proportion of coefficients that exceed three critical values was calculated. The lowest value (.576) is based on the 5 per cent level of significance, that is the value which the simple correlation coefficient must exceed to be significantly different from zero at the 5 per cent level. The second critical value (.708) is the boundary for a correlation coefficient to be significant at the 1 per cent level. The final value (.9) was arbitrarily selected to indicate what proportion of markets have a high degree of price integration.

Table 13. Summary of Intermarket Price Correlations

Year[a/]	Number of Markets	Number of Intermarket Correlations	Percent of bivariate correlation coefficients exceeding: .576[b/]	.708[c/]	.900
1959	15	105	39	25	6
1960	17	136	22	8	0
1961	17	136	50	42	5
1962	17	136	68	43	2
1963	17	136	17	5	1
1964	17	136	31	14	2
1965	17	136	59	42	9
- -					
1970	15	105	43	28	9
1971	14	91	80	55	16
1972	14	91	60	47	5

a/ The years 1966-1969 have been omitted because of incomplete data.

b/ Critical value for the correlation coefficient to be significantly different from zero at the 5% level.

c/ Critical value for the correlation coefficient to be significantly different from zero at the 1% level.

The proportion of markets with correlation coefficients exceeding either the 5 per cent or the 1 per cent level of significance varies greatly from year to year. The years with a high proportion of significant correlation coefficients are 1961, 1962, 1965, 1971 and 1972. The years with a low proportion of significant correlation coefficients are 1960, 1963 and 1964. The post civil-war years generally show a higher proportion of coefficients significantly different from zero than the

years before 1966. The extensive improvement in roads that occurred between these two periods probably has been a contributing factor to improved market integration.

There was a marked decline in the proportion of significant coefficients when the level of significance was raised from 5 per cent to 1 per cent. The proportion of all coefficients which exceeded the critical values declined from 47 per cent at the 5 per cent level to only 31 per cent at the 1 per cent level and to around 5 per cent when the critical value was raised to .9. This is a much lower proportion of markets with a high degree of correlation than reported by Lele; however, her analysis was based on wholesale rather than retail price data and for wheat, rice and jowar, rather than a legume crop. Farruk, using wholesale price data for rice in East Pakistan (Bangladesh) found that about 80 per cent of the simple correlation coefficients exceeded .8 (p. 60).

In a few instances, negative correlation coefficients were obtained although they were not significantly different from zero at an acceptable level of significance. The negative correlations may be attributable to poor data or sampling errors although they may also reflect poor integration between selected markets. For example, negative coefficients were obtained in certain years for such markets as Ibadan, Enugu and Port Harcourt, but there appears to be no simple explanation for these results since the coefficients were not consistent from year to year.

Differences in the Degree of Integration Within and Between Regions

In an attempt to determine whether or not the degree of integration varies among regions, markets were subdivided into two groups. Five markets were selected to represent the North (Sokoto, Kano, Maiduguri, Zaria and Kaduna); five more were selected to represent the South (Ibadan, Lagos, Benin, Enugu and Port Harcourt). Bivariate correlation coefficients within and between these groups of markets were then calculated and grouped according to level of significance. The results for the entire period are summarized in Table 14. The distribution of coefficients for individual years is reported in Appendix III.

Table 14. Summary of Within and Between Region Intermarket Price Correlations

	North	South	Between North and South
Number of correlations[a/]	92	96	230
Percent of correlation coefficients exceeding:			
.58	53	42	45
.80	14	28	15
.90	1	14	7

a/ Based on data for 1959-65 and 1970-72; the distribution of coefficients for individual years is shown in Appendix III.

The proportion of coefficients exceeding the 5 per cent level (.58) was slightly higher during the period under review for the northern group of markets than for the southern group; however, the proportion exceeding .9 was higher in the South. Interregional coefficients indicate a fairly high degree of integration between the North and the South. The proportion of correlation coefficients exceeding .9 was higher between the North and South than within the North. These results suggest that horizontal flows among surplus markets in the North are less well developed than north-south flows between surplus and deficit markets. Trade between the North and South is more likely to occur than trade within the North. The foregoing results are consistent with those obtained by Jones (1972, p. 143) and Gilbert (p. 262) who found higher correlations between northern markets and Ibadan than between markets within the same region. Improved market information might help to raise the level of market integration within surplus-producing regions.

Data for all the years were combined for individual markets in an attempt to identify situations where the degree of integration appears to have been relatively low during the period under review. This was done by calculating the proportion of correlation coefficients between

particular markets that exceeded the three critical levels described earlier. The results for selected markets and only the intermediate level of significance (the proportion of coefficients exceeding .8) are reported in Table 15. The proportion of coefficients exceeding .8 is relatively high for Kaduna with Zaria, Ibadan, Lagos and Benin, but not with Sokoto, Kano and Port Harcourt. The high degree of integration between northern and southern markets in the western region is facilitated by a rail line and a modern highway which goes from Lagos, through Ibadan, to Kaduna, and then on to Kano. It is surprising, however, that prices in Kaduna and Kano are not more highly correlated. Kaduna, Zaria and Kano have had good road connections for a long time. The lower degree of integration between northern and southeastern markets (Enugu and Port Harcourt) than between northern and western markets (Lagos and Ibadan) probably reflects the fact that road connections are more direct between the latter markets than the former.

Table 15. Proportion of Price Correlations Exceeding .8 Between Selected Markets, 1959-65 and 1970-72

	Percentage of Simple Correlation Coefficients Exceeding .8						
	Northern Markets				Southern Markets		
	Kano	Zaria	Kaduna	Katsina	Ibadan	Lagos	Enugu
Northern Markets							
Sokoto	0	17	20	27	9	18	0
Kano	-	25	10	18	9	18	10
Zaria	25	-	56	20	40	20	11
Southern Markets							
Ibadan	9	40	60	11	-	64	33
Lagos	18	20	70	22	64	-	33
Benin	10	22	40	12	40	40	22
Port Harcourt	0	0	10	11	10	10	30

Only about 19 per cent of the intermarket correlations for the entire period exceeded .8; however, the results suggest a somewhat higher degree of intermarket integration for cowpeas than for other commodities. Hays, using similar data for millet and sorghum, found only 1 per cent

of the intermarket correlations for these commodities exceeded .8 (p. 74). Similar results were obtained by Gilbert (pp. 248-250). Cowpeas are more widely traded than are millet and sorghum and this may account for the higher proportion of coefficients exceeding .8.

While the results for cowpeas suggest a higher degree of integration for this commodity than for millet and sorghum in Nigeria, the intermarket price correlations generally were lower than those obtained by Lele for India and Farruk for East Pakistan. Part of the difference may be attributable to the fact that they based their analysis on wholesale rather than retail price data. One might expect wholesale prices to be more highly correlated than retail prices since traders who deal between markets have much greater knowledge of wholesale than retail prices. Low correlations also may be attributed to lags in adjusting retail prices to reflect changes in wholesale prices, especially in more distant markets.[8/] Sampling errors, as pointed out earlier, and the difficulty of obtaining a representative price for all retail sales likewise may have contributed to the low correlation coefficients obtained for some markets.

One more test of market integration was conducted using data collected for 6 markets in 1973.[9/] Weekly wholesale and retail price data were obtained from traders and retail distributors. The results of correlation analysis based on these two sets of data are shown in Table 16.

High correlations for both wholesale and retail prices prevailed among all the markets in the North. The degree of integration was much less between northern markets and Ibadan, even for wholesale prices. Retail price correlations for Ibadan were all negative. This may be due in part to the lag in adjusting retail prices to changes in wholesale prices. The markets are widely separated, and therefore a week may be too short a period to permit adjustments in retail prices to show up in correlation

---

8/ The relationship between prices in Sokoto and southern consuming centers was tested by lagging prices in the consuming areas first by one month and then by two months. The one-month lag raised the proportion of correlation coefficients significant at the 5 per cent level very slightly, but a lag of two months reduced the proportion of coefficients exceeding this level of significance.

9/ N.O.O. Ejiga collected the price data for all of the markets except Zaria and Ibadan. H. M. Hays was responsible for collecting the data from Zaria and Q.B.O. Anthonio from Ibadan.

Table 16. Intermarket Price Correlations Based on Weekly Wholesale and Retail* Price Data Collected in 1973

Markets	Shinkafi	Sokoto	Zaria	Jos	Lafia	Ibadan
Shinkafi	1.00 (1.00)					
Sokoto	0.89 (0.91)	1.00 (1.00)				
Zaria	0.94 (0.97)	0.89 (0.93)	1.00 (1.00)			
Jos	0.92 (0.85)	0.86 (0.83)	0.93 (0.82)	1.00 (1.00)		
Lafia	0.87 (0.92)	0.77 (0.86)	0.91 (0.92)	0.90 (0.90)	1.00 (1.00)	
Ibadan	0.65 (-0.30)	0.53 (-0.27)	0.67 (-0.25)	0.73 (-0.29)	0.75 (-0.21)	1.00 (1.00)

* Correlations for retail prices are shown in parentheses.

results. The higher correlations obtained with these data than with the data used in the preceding section is probably due in part to the use of weekly rather than monthly data, and to the greater accuracy of the 1973 data, all of which were collected specifically for this study by responsible individuals.

Summary and Conclusions

An attempt has been made in this chapter to assess pricing efficiency in marketing cowpeas by analyzing intermarket price differences in relation to transportation costs and the degree of correlation that exists between prices in different markets. The evidence indicates that intermarket price differences are related to transport costs; however, there is a residual margin that is not explained solely by transport costs. The level of market integration varies from year to year and is not uniform among markets. In some years, prices are highly correlated

between markets, while in other years this does not appear to be the case. Higher correlation coefficients were obtained with weekly wholesale and retail price data collected for a small sample of markets in 1973 than for monthly retail price data covering a larger sample of markets for the period 1959-65 and 1970-72. The poor quality of the latter data may account for the low coefficients obtained for some markets.

The analysis showed little evidence of serious departures from results that would be expected under competitive conditions although there were substantial "unexplained" variances in several of the markets and for certain years. The performance of the system might be improved by providing additional and more accurate price information, basing price reports on standardized measures and quality, and improving roads.

CHAPTER VI

FARM-RETAIL PRICE RELATIONSHIPS AND MARKETING MARGINS

In this chapter, farm-retail price relationships are examined in an attempt to ascertain whether there is evidence of "profiteering" by traders or distortions in price relationships at various stages along the marketing chain. The analysis is based on a "snapshot" of price relationships and marketing margins at a particular point in time (1973) rather than over a period of years and for two principal locations (Sokoto-Shinkafi and Jos-Lafia). Weekly price data and interviews with traders provided the information on which the analysis of intra-market price relationships is based.

Intra-Market Price Relationships

Weekly farm, wholesale and retail prices were found to be highly correlated within each of the markets. Correlation coefficients between the 42 weekly price observations at various stages of marketing are shown in Table 17.

Table 17. Correlation Coefficients Between Prices at Different Marketing Stages 1973

Link and Type of Price	Correlation Coefficients*				
	(1)	(2)	(3)	(4)	(5)
Sokoto-Shinkafi link					
Shinkafi price received by farmers (1)	1.00				
Shinkafi market wholesale price (2)	0.93	1.00			
Shinkafi market retail price (3)	0.94	0.93	1.00		
Sokoto market wholesale price (4)	0.84	0.89	0.84	1.00	
Sokoto market retail price (5)	0.88	0.92	0.91	0.94	1.00
Jos-Lafia link					
Lafia price received by farmers (1)	1.00				
Lafia market wholesale price (2)	0.83	1.00			
Lafia market retail price (3)	0.88	0.95	1.00		
Jos market wholesale price (4)	0.85	0.90	0.89	1.00	
Jos market retail price(5)	0.87	0.84	0.90	0.85	1.00

* Based on prices reported for each of 42 weeks during 1973.

The correlation between prices, as one would expect, decreases slightly as one moves from rural to urban markets, i.e. from Shinkafi to Sokoto, and Lafia to Jos; however, the correlation between retail and wholesale prices in each of the urban markets was also quite high, especially in Sokoto. This suggests there is very little lag in adjusting retail prices to changes in wholesale and farm prices at each of these two locations.

Gross Marketing Margins

The size of the marketing margin depends on what prices are selected to represent farm, wholesale and retail prices. Since prices, even at the same stage of marketing, frequently vary among traders, it is not easy to determine precisely the magnitude of the marketing margin.

A number of problems were encountered in defining farm, wholesale and retail prices. Ordinarily, one would expect farm prices to be the lowest, and retail prices the highest prevailing in a given market, but this was not always the case. In markets where farmers sold part of their crop directly to consumers, they received what amounted to a retail price, but this price was less in some cases than the prevailing wholesale price. Buying prices reported by traders who traveled to other areas to purchase cowpeas in some instances were less than those which local farmers received. Retailers, also, sometimes reported buying cowpeas at less than wholesale prices, especially early in the season, when they bought their supplies directly from farmers.

Marketing margins were estimated at each stage of marketing, where data permitted, and a gross margin was calculated for each market based on the difference between the highest price prevailing in the market (usually the retail price) and the farm price. In each case, margins were estimated on the basis of price differentials. The margins of rural traders and farm-gate middlemen, for example, were estimated by taking the difference between average farm and wholesale prices. The margins of other traders were estimated by subtracting the average buying price from their average selling price. In some cases, traders operated in two markets. Sometimes a dealer sold part of his crop

locally and the rest in an urban market. An attempt was made to segregate such sales and compute a separate margin for each. These complicating factors make it difficult to identify and compare margins among traders in different markets.

Margin estimates were based on average price differentials prevailing for the entire period for which data were collected (42 weeks). The results of these calculations are shown in Table 18. Because of overlapping functions by traders, the margins calculated for each subgroup do not necessarily add up to the gross margin which was defined as the difference between the highest average price prevailing in a particular market during the period of the study and the average farm price. Gaps in the data made it impossible to estimate a margin for each type of trader at every location.

Rural and urban commission agents appear to operate on about the same margin in all markets (about 1 ₦/ton). Farm gate middlemen's margins (those obtained by rural wholesalers) also were remarkably similar in both markets. The Jos urban wholesaler margin is high mainly because it covers transportation costs incurred by traders who travel to other markets to make their purchases. No estimate of the wholesaler's margin at Sokoto was made as the period during which the traders there reported buying and selling on their own account was considered too short to be representative for the year. Retailers were not included in the Shinkafi trader samples.

"Strangers' margin" refers to the difference between the price which retailers pay for cowpeas and the average wholesale price prevailing in the market. It is called a "strangers' margin" because it reflects the prices a trader coming from outside the market has to pay to obtain cowpeas. It also might be referred to as a "speculator's margin" because it is the amount which will be available to a speculator who buys and sells in the same location, a common practice in the area. The similarity of estimates for this margin in both Jos and Lafia suggests that it is a relatively accurate figure.

A rural wholesaler who purchases from more distant areas will have higher costs than one who buys locally. This probably accounts for the difference in wholesale assembler margins between Lafia and Shinkafi

Table 18. Cowpea Marketing Margins at Two Locations in Nigeria, 1973

Market Location and Trading Margin	Estimated Margin	
	Skinkafi	Lafia
	----------N/ton----------	
Rural Location:		
Rural commission agent	1	1
Bulking wholesaler	12	12
Wholesale assembler	13	4
Rural retailer	*	26
Strangers' margin[a]	*	8
Gross margin[b]	24	33
Urban Markets:	Sokoto	Jos
Urban wholesale	*	19[c]
Urban commission agent	1.5	1
Urban retailer	12	12
Strangers' margin[a]	*	8
Gross margin[b]	54	67

* Insufficient data to compute a margin.

[a] The difference between the average wholesale price and retailers' buying prices.

[b] Difference between the highest average price prevailing in the market (wholesale or retail) and the average farm price. Individual trader margins do not add to gross margin because of overlapping functions (see text).

[c] Includes transportation cost from rural areas.

since more of the traders in the latter market made purchases in markets other than Shinkafi. Wholesale assemblers in Shinkafi also were more likely to hold cowpeas for longer periods before selling which widened the margin between the average buying and selling prices. Thus, the margin reflects in part a payment for storage.

Urban retail margins were the same in both Sokoto and Jos. Retailers in these markets bought supplies from traders coming directly from rural areas, whereas in the rural market of Lafia, retailers tended

to buy at least part of their supplies directly from farmers. Thus, the higher margin in Lafia reflects the cost of transportation plus what amounts to a wholesaling margin as well as a retail mark-up.

Whether the gross margin is excessive is difficult to judge because no cost data were available with which margins might be compared. One can, however, compute the gross margin as a percent of the retail price and compare it with the proportion that goes to middlemen handling other commodities. In a similar analysis of trader margins based on data collected in 1971-72, Hays estimated the gross margin (retail less farm price) for millet and sorghum in the Zaria market (an urban market) and found it to be around 31 per cent (pp. 58-68). The gross margin for cowpeas was 26 per cent of the retail price in Sokoto and 30 per cent of the retail price in Jos. Jones reported that the gross margin for yams and gari in the Ibadan market varied from 20 to 30 per cent, and for maize from 40 to 60 per cent (1972, p. 115). Thus, in comparison with other crops, the total marketing margin for cowpeas appears reasonable.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The main objective of this study was to describe and evaluate the traditional marketing system for cowpeas in Nigeria.

The channels and participants identified show that the system effectively links the surplus producing areas and the deficit areas of the country. The distribution system shows a high degree of organization and specialization among middlemen which is contrary to the general belief that the system lacks organization.

Data on the average level of use of storage facilities indicate that storage capacities for cowpeas are adequate even though the quality might be deficient. The flexibility in capacity expansion was indicated by traders erecting private facilities for rent and by the widespread use of dwelling houses for storage by farmers and traders when the need arises. Traditional storage facilities were found to be cheap to erect and maintain.

Damage loss and interest costs account for a high proportion of total storage costs. The average physical loss was found to increase during the period cowpeas were held in storage and to reach a maximum of around 6 percent by weight. Storage was not found to be profitable in 1972-73 unless cowpeas were held for a period of at least 6 months. Farmers and traders held no inventories from one year into the next because of the high cost of storing for the additional time that would be required to avoid depressed prices at harvest and in the following months, and because of the high risk of storage losses. Uncertainty with respect to next year's harvest and the high variability in cowpea prices from year to year tend to discourage farmers and traders from attempting to store from one season to the next.

Farmers store substantial quantities of cowpeas during the early part of the marketing season; later they are transferred to intermediate handlers. Rural traders were found to be the principal storers of cowpeas although some speculators in urban areas also store small quantities.

A decision rule was tested to determine whether it would be profitable to acquire stocks every year during the month in which prices average the lowest, over a period of years, and to sell in the month in which prices reach their highest level. The performance of such a decision rule was tested using actual price data for the period from 1958 through 1972. On the average, stocks should have been held about 8 months to achieve maximum gains. If a farmer or trader had followed this rule, the number of "loss" years would have been about equal to the number of "profit" years; however, the average price increase over the period exceeded the average cost of storage, thus indicating that profits were potentially greater in years of gain than than were losses in years when prices failed to rise by enough to cover storage costs. The empirical evidence indicates that there is a high degree of price variability from year to year which means that a farmer or trader cannot be assured of profits from storage every year.

Pricing efficiency was evaluated in a number of ways. Price differences between markets were compared with transfer costs and correlated with distance to ascertain how much of the difference in price between markets was associated with distance. In addition, bivariate correlation coefficients were calculated using retail price data to determine the degree of integration in prices between markets. Spatial price relationships were related to transfer costs and to distance, but in several years there was a substantial unexplained residual which may have been due to poor data or the failure to include other costs not related to distance. Price correlations tended to be higher between surplus and deficit areas than within surplus-producing regions. This reflects the fact that north-south trade in cowpeas, especially with markets in the Southwestern part of the country, is well organized.

Weekly wholesale and retail price data were collected in 1973 for two locations in northern Nigeria. These data showed a high degree of correlation between prices at different stages of marketing and between nearby rural and urban markets.

Marketing margins accruing to various middlemen also were estimated. The results showed a fair degree of consistency in the margins of the same class of traders in different locations. The average gross margin

as a percent of the retail price in the markets studied was lower for cowpeas than for other food crops. It was not possible to determine whether or not margins were "excessive" because of the lack of accurate cost information.

The picture that emerges from the various analyses is that the traditional food grain marketing system (at least as identified for cowpeas) operates in a competitive manner. The pricing efficiency analyses showed a fair degree of pricing efficiency. But pricing efficiency is not the same as operational efficiency. Indeed, operationally, the system may be inefficient as evidenced by the high degree of damage to cowpeas which are stored for any extended period and high transfer costs between rural and urban markets. What the results of the various analyses indicate is that for the prevailing level of technology and institutions, the pricing mechanism is fairly efficient and competitive.

One of the important conclusions that emerges from the study is that efforts to increase marketing efficiency should receive high priority. It is more important to remove the basic constraints that reduce efficiency than it is to attempt to reorganize the system while leaving the basic constraints unchanged. Efficiency can be improved by doing something about transport, storage and processing facilities, inadequate market information, non-standardized weights and measures and credit arrangements. The efficiency of any market system, whether private, public or cooperative will still be low unless these basic constraints are removed.

Public policy makers should concern themselves more with the operational aspects of the food distribution system than with pricing per se. Prices appear to be reasonably well integrated and related to costs. Efforts directed at providing improved roads and services are likely to yield greater dividends than direct government intervention or involvement in marketing and pricing.

REFERENCES

Abbott, J. C. 1967. "The Role of Marketing in the Development of Backward Agricultural Economies." Marketing and Economic Development, ed. Clarence J. Miller, pp. 3-19. Lincoln: University of Nebraska Press.

Adeyokunnu, T. O. 1969. "The Marketing of Foodstuffs and Trade Associations in Ibadan, Western Nigeria." Bulletin of Rural Economics and Sociology, no. 2 (1969):183-199.

Anthonio, Q.B.O. 1968. "The Marketing of Staple Foods in Nigeria: A Study of Pricing Efficiency." Ph.D. thesis, University of London.

Baker, M. J. 1974. Marketing: An Introductory Text. London: Macmillan and Co., Ltd.

Bressler, R. G. and Richard A. King. 1970. Market, Prices, and Interregional Trade. New York: John Wiley & Sons, Inc.

Caswell, G. H. 1961. "The Infestation of Cowpeas in the Western Region of Nigeria." Tropical Science, III (1961):154-158.

_____. 1970. The Storage of Cowpeas in the Northern States of Nigeria. Samaru Research Bulletin, 120, Institute for Agricultural Research, Samaru, Ahmadu Bello University. Also available in Proceedings of the Agricultural Society of Nigeria, Vol. 5, July 2-6, 1968.

_____. 1973. "The Storage of Cowpea." Samaru Agricultural Newsletter, 15 (1973):73-75.

Catt, C. C. 1966. "Surveying Peasant Farmers: Some Experiences." Journal of Agricultural Economics, XVII (1966):99-100.

Collinson, M. P. 1972. Farm Management in Peasant Agriculture, A Handbook for Rural Development Planning in Africa. New York: Praeger.

Doughty, Joyce, and R. Orraca-Tetteh. 1966. "The Contribution of Legumes to African Diets." Grain Legumes in Africa, ed. W. R. Stanton, pp. 2-32. Rome: FAO.

Ejiga, N.O.O. 1977. "Economic Analyses of Storage, Distribution and Consumption of Cowpeas in Northern Nigeria." Ph.D. thesis, Cornell University.

Faruk, Muhammad Osman. 1972. Structure and Performance of the Rice Marketing System in East Pakistan. Cornell International Agric. Development Bulletin 23, Cornell University.

Fullard, Harold, ed. 1973. Philips' Modern College Atlas for Africa (11th Edition). London: George Philip and Son Limited.

Gilbert, Elon H. 1969. "The Marketing of Staple Foods in Northern Nigeria: A Study of the Staple Food Marketing Systems Serving Kano City." Ph.D. thesis, Stanford University.

Giles, P. H. 1964. "The Storage of Cereals by Farmers in Northern Nigeria." Tropical Agriculture, 41 (1964):197-212.

Gusten, Rolf. 1968. Studies in the Staple Food Economy of Western Nigeria. Munich: Weltforum Verlag.

Hays, Jr., Henry M. 1975. The Marketing and Storage of Food Grains in Northern Nigeria. Samaru Miscellaneous Paper No. 50 Institute for Agricultural Research, Samaru, Ahmadu Bello University.

Hill, Polly. 1969. "Hidden Trade in Hausaland." Man, 4 (1969):392-409.

Ilori, C. O. 1967. "Towards a Policy of Marketing Improvement in Western Nigeria." Bulletin of Rural Economics and Sociology, No. 3 (1967), pp. 229-45.

Jones, William O. 1968. "The Structure of Staple Food Marketing in Nigeria as Revealed by Price Analysis." Standford Food Research Institute Studies in Agricultural Economics, Trade and Development, VIII(1968):95-123.

_____. 1972. Food Marketing in Tropical Africa. Ithaca: Cornell University Press.

Lele, Uma J. 1971. Food Grain Marketing in India: Private Performance and Public Policy. Ithaca: Cornell University Press.

MacArthur, J. D. 1968. "The Economic Study of African Small Farms: Some Kenya Experiences." Journal of Agricultural Economics, XIX (1968): 193-205.

Miracle, Marvin P. 1972. "Market Structure and Conduct in Tropical Africa: A Survey." South of the Sahara: Development in African Economies. ed. S. P. Schatz. London: MacMillan Press Ltd., pp. 88-107.

Nigeria, Federal Republic of, Department of Statistics. Annual Abstract of Statistics. Lagos: Federal Office of Statistics, various issues.

_____. 1972. National Food Marketing Committee. Report of the Committee on Food Marketing Problems. Lagos: Federal Department of Agriculture.

_____. Northern Region: Crop and Weather Reports. Kaduna: Ministry of Agriculture, various issues.

Norman, David W. 1972. An Economic Survey of Three Villages in Zaria Province, 2. Input-Output Study Vol. i, Text, Samaru Miscellaneous Paper No. 37. Institute for Agricultural Research, Samaru, Ahmadu Bello University.

_____. 1973. Methodology and Farm Management Investigations: Experiences from Northern Nigeria. Department of Agricultural Economics, African Rural Employment Paper No. 8, Michigan State University.

O'Dowd, E. T. 1971. Hermetic Storage of Cowpea in Small Granaries, Silos and Pits in Northern Nigeria. Samaru Miscellaneous Paper No. 31. Institute for Agricultural Research, Samaru, Ahmadu Bello University.

Ogunmodede, B. K. and V. A. Oyenuga. 1969. "Vitamin B Content of Cowpeas (Vigna unguiculata Walp)." J. Sci. Food Agriculture, 20 (1969): 101-103.

Olayemi, J. K. 1974. Food Marketing and Distribution in Nigeria: Problems and Prospects. Ibadan: Nigerian Institute of Social and Economic Research, University of Ibadan.

Onakomaiya, S. O. 1970. "The Spatial Structure of Internal Trade in Delicacy Foodstuffs in Nigeria." Ph.D. thesis, University of Wisconsin.

Oyenuga, V. A. 1968. Nigeria's Foods and Feeding-Stuffs (3rd Edition). Ibadan: Ibadan University Press.

Samuelson, Paul A. 1960. "Proof that Properly Anticipated Prices Fluctuate Randomly." Industrial Management Review, no. 2 (1960), pp. 41-49.

Smidt, Seymour. 1965. "A Test of the Serial Independence of Price Changes in Soybean Futures." Food Research Institute Studies, V (1965): 117-136.

Smith, Michael G. 1962. "Exchange and Marketing Among the Hausa." Markets in Africa, eds. P. J. Bohannan and George Dalton, pp. 299-334. Evanston, Ill.: Northwestern University Press.

Snedecor, George W., and William G. Cochran. 1967. Statistical Methods (6th Edition). Ames: The Iowa University Press.

Thodey, Alan R. 1968. "Marketing of Staple Foods in Western Nigeria." 3 volumes, Draft Report. Menlo Park, Calif: Stanford Research Institute.

Tomek, William G., and Kenneth L. Robinson. 1972. Agricultural Product Prices. Ithaca: Cornell University Press.

United Nations, FAO. 1966. Agricultural Development in Nigeria 1965-1980. Rome.

Whitney, Anita. 1968. Marketing of Staple Foods in Eastern Nigeria. Department of Agricultural Economics, Agricultural Economics Report No. 114, Michigan State University.

Working, Holbrook. 1958. "A Theory of Anticipatory Prices." The American Economic Review, XLVIII (1958):188-199.

_____. 1964. "Note on the Correlation of First Differences of Averages in a Random Chain." The Random Character of Stock Market Prices, ed. Paul H. Cootner, pp. 129-131. Cambridge, Mass.: The M.I.T. Press.

Zarkovich, S. S. 1966. Quality of Statistical Data. Rome: FAO.

APPENDIX I

MEAN AND STANDARD DEVIATION OF RETAIL COWPEA PRICES (₦ PER TON) 1959-1972

Year	Data	Markets			
		Sokoto	Kano	Zaria	Maiduguri
1959	Mean	34.50	31.92	--	--
	s.d.	6.59	4.46	--	--
1960	Mean	27.25	28.33	32.42	29.08
	s.d.	1.87	3.70	5.00	5.16
1961	Mean	27.17	32.25	33.83	33.58
	s.d.	5.49	5.01	8.37	7.82
1962	Mean	43.58	47.17	54.83	59.00
	s.d.	15.71	14.35	15.24	13.34
1963	Mean	23.83	27.33	30.92	27.17
	s.d.	4.63	3.80	3.60	8.96
1964	Mean	24.42	20.58	23.92	19.25
	s.d.	5.38	6.23	7.67	6.59
1965	Mean	37.33	37.50	45.17	39.50
	s.d.	10.66	8.81	10.67	21.32
1966	Mean	71.89	59.00	74.00	108.44
	s.d.	19.29	26.47	23.98	50.96
1967	Mean	36.80	34.00	41.00	62.90
	s.d.	10.35	6.13	4.06	10.37
1968	Mean	--	--	--	62.13
	s.d.	--	--	--	21.34
1969	Mean	50.75	49.92	60.58	--
	s.d.	18.75	11.87	20.06	--
1970	Mean	46.67	48.25	52.33	47.75
	s.d.	8.76	6.40	11.67	3.49
1971	Mean	116.83	100.08	104.00	104.75
	s.d.	36.36	40.00	17.15	39.89
1972	Mean	122.17	123.17	140.67	--
	s.d.	34.28	16.89	30.04	--

s.d. = Standard deviation.

-- = No data.

APPENDIX II

STORAGE DECISION RULE

We wish to show that continuous trading in the period of rising prices leads to the same results as a one-time purchase and one-time sale decision rule.

Let X_{ij} be the price in year i and month j.

Let the month (column) of highest sum of monthly prices and hence highest average price be month (column) r. Similarly let the month (column) of lowest price be month (column) t.

Under the one-time buying and one-time selling rule, buying takes place in month t and selling takes place in month r. For any given year i, the difference between buying and selling prices is

$$X_{ir} - X_{it}$$

Under continuous buying and selling, the sum of the price differences in buying in month j and selling in the next month j + 1 in any given year i is

$$\sum_{j=t}^{r-1} (X_{i,j+1} - X_{ij})$$

The summation goes from t to r - 1 because month r is the highest price month and only sales are made in month r. Any purchase in month r for future sale will not be rational.

We want to prove that for any given year i

$$X_{ir} - X_{it} = \sum_{j=t}^{r-1} (X_{i,j+1} - X_{ij})$$

where $i = 1, 2, \ldots, n$

$j = 1, 2, \ldots, \ldots r, \ldots, 12$

Expanding the right hand side (RHS) term

$$\text{RHS} = \sum_{j=t}^{r-1} (X_{i,\ j+1} - X_{ij})$$

$$= (X_{i,t+1} - X_{it}) + (X_{i,t+2} - X_{i,t+1}) + (X_{i,t+3} - X_{i,t+2})$$

$$+ \ldots\ldots + (X_{i,r-1} - X_{i,r-2}) + (X_{ir} - X_{i,r-1})$$

$$= X_{ir} - X_{it}.$$

When the parentheses are removed, all the terms cancel out except $(-X_{it})$ in the first parentheses and $(+X_{ir})$ in the last parentheses. If it holds for any given year i, then it holds for all years i = 1, 2, ...,n. That is, the one-time buying and selling decision rule has the same outcome as the continuous buying and selling rule.

APPENDIX III

SUMMARY OF WITHIN AND BETWEEN REGION INTERMARKET PRICE CORRELATIONS

	Within the North				Within the South				Between North and South			
		Correlation coefficients equal to or greater than				Correlation coefficients equal to or greater than				Correlation coefficients equal to or greater than		
Year	Total No.[a]	0.58	0.80	0.90	Total No.[a]	0.58	0.80	0.90	Total No.[a]	0.58	0.80	0.90
1959	6	1	0	0	10	3	1	0	15	5	2	2
1960	10	3	0	0	10	1	0	0	25	3	1	0
1961	10	5	1	0	10	3	1	1	25	9	5	2
1962	10	8	4	0	10	7	3	0	25	12	2	1
1963	10	2	0	0	10	0	0	0	25	2	0	0
1964	10	4	1	0	10	1	0	0	25	7	0	0
1965	10	10	5	1	10	7	6	0	25	19	13	5
1970	10	3	0	0	6	3	3	3	20	12	2	0
1971	10	8	1	0	10	10	10	8	25	23	12	6
1972	6	5	1	0	10	5	3	1	20	12	7	1
Total	92	49	13	1	96	40	27	13	230	104	44	17
%	100	53	14	1	100	42	28	14	100	45	19	7

a/ The years 1966-1969 have been omitted because of incomplete data.

CORNELL UNIVERSITY
Founded by Ezra Cornell

STATE UNIVERSITY OF NEW YORK
TO LEARN TO SEARCH TO SERVE
1948