MICRO-AIDED ANALYSIS OF TIME SERIES OF PRICE DATA OF COWPEAS IN NORTHERN NIGERIA

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CERTIFICATION

This project has been read and approved as fulfilling part of the requirements of the award of the Post-graduate Diploma in Computer Science of Ahmadu Bello University, Zaria.

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DEDICATION

The study is dedicated to my husband Mallam Garba Adamu and my sons Suleman and Abdullahi who have enjoyed less of my companionship during the period of my Post-graduate study.

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ABSTRACT

This research is a study of Cowpea trend over a period of five years. The time series technique is used with the aid of the computer-.

The data is that of cowpea wholesale price from 1971 to June 1976. For each year the monthly price; a r e given in Naira per sack, a sack being equivalent to about 240Ibs or 108 kgs.

The data is subjected to the following calculations average of 12 months, detrended values, and seasonal indices leading to moving averages and seasonally adjusted values.

The data moving averages and the seasonally adjusted values are plotted on the same graph. These plots form the basis of the observation.

All the three plots, that is$_9$ the raw data, moving average. and the seasonal adjusted values show similar' oscillations over the period. The pattern of oscillations of the cowpea price is most clearly shown by the moving average plot; it is observed from the plot that beside the general trend these is a seasonal variation. The seasonal variation adheres strongly to the pattern in which the months of August and September form the period of peak price, while those of December and January form the period of floor price.

The year 1974 displays an inregular high fluctuation in price when compared with the other year's covered by the data.

It is clear that from 1971 through 1976 the floor wholesale price of cowpea was increasing.

From the research it has been established that there is a long-term trend of rise in cowpea wholesale price and there la a seasonal variation in price for each year with the peak price coming up in August and September while the floor price occurs around December and January.

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CHAPTER ONE

GENERAL INTRODUCTION

The economic development of a nation is the result of industrial and agricultural advancement. Industrial and agricultural production is increased at relatively small cost with high technology. The level of technology and management available dictate the efficiency of production.

The efficiency of production will reduce the unit cost of output and hence the price of produce. Such cheap agricultural inputs when used with good management and high technology will increase yields at relatively small cost per unit of product.

In agriculturally developed countries, emphasis is placed on technology. Such technology includes improved variety of seeds, use of chemicals, good management and mechanization. Mechanization has reduced the use of labour resulting in high output at relatively low labour costs. Whereas in agriculturally underdeveloped nations e.g., third world countries, the level of mechanization, management e.t.c is low resulting in over 75% of the population involved in agriculture but with low yields. Some of these countries even import food.

It is said that not more than 2% of the American population is involved in agriculture feeding the nation

and exporting food to other countries. Infact American food is a chip in her diplomacy.

Third world countries are usually subsistence economies producing enough to eat. They use traditional implements, local seeds and local farming methods to produce meagre yields. For commercial production a high technology package must be introduced to boost yields, this involves:-

1) Seeds:- Improved seeds with high yielding potentials, draught resistance, pest and disease resistance. Such seeds are products of agricultural research and hence the importance of Research Institutions.

2) Chemicals:- Chemicals for pest and disease control must be available to ensure that the crop is saved from losses due to pest and diseases.

3) Fertilizers:- These growth sustances must be available and used in the right quantities and at the right time for proper utilization by the plants for proper growth and high yields.

4) Mechanization:- This is necessary to open up large farm areas and save labour costs. In addition mechanization ensures that the proper farm operations are carried out at the right time, e.g., ploughing, weeding, chemical spraying and harvesting.

5) Storage:- A lot of farm yields could be lost to rodents, storage pests, and thieves if proper and secure storage facilities are not available. Storage will also ensure price stabilization throughout the year. Surplus harvests could be stored for release during off seasons viz during non harvest periods.

6) Extension Services:- This must be available to interpret research findings to the farmer in his own language. This covers the crop from site selection, improved seeds to harvesting and storage. The various Ministries of Agriculture offer extension service to farmers at no cost in Nigeria.

7) Marketing:- Outlets for the crop must be available for sales of farm produce. Commodity Boards have in previous years been charged with the responsibilities of farm produce purchase. In other areas farmers'

cooperative bodies have carried out this function. Unless the farmer could sell his produce, he would be forced to reduce his production level.

Commercial agriculture, which entails the utilization of high technology is a business. In Nigeria for example, the vagaries of the weather, price fluctuations, lack of outlets for crop produce, insufficient qualities of inputs or lateness in their provision, high cost of labour, high cost of machinery, and poor management have retarded agricultural advancement. But agriculture has moved from the low level technology to the medium level technology. The use today of simple hand tools in farm operations as against hoes and cutlasses bears testimony to this.

For Nigerian farmers to plan their production within their available resources a fair prediction of their expected returns should be possible. But price fluctuations remain the bane of the Nigerian economy.

An analysis of price trends over long periods could be used to project forward and plan production.

This project analyses a trend over four years in cowpea prices and uses the time series method to project cowpea prices.

The researcher has undertaken this project on the micro-aided analysis in time series in appreciation of the problems generally encountered by agricultural economists in planning agricultural production where price fluctuations abound such as is the case in Nigeria.

Manual calculations are possible but the problems inherent include:-

1) Human errors in data entries due to fatigue and parallax. The sheer volume of data could also contribute to errors of entries.

2) Time is required in manual calculations, resulting in delays in the analysis.

3) Management decisions may be delayed because manual calculations are not completed. Some of the delays may affect immediate field operations which are crucial for farm success. In dynamic operational situations, manual results may come long after the need for it and when it is of little use.

The computer is a modern technology made up of hardware and software packages; which are used to reduce the delay in any operations and eliminate errors.

The hardware components of the computer comprises the memory, processor and peripherals while the software comprises of the program and the job command languages which act as an interface between the programmer's job and the operating system.

The program of this study is written in Fortran to show how the computer can be used to tackle programs of this nature.

1.1 Statement of the Problem

Several problems can be identified with the manual calculations of agricultural price analysis. Firstly, the problem of errors in the entering of raw data. Secondly, the long processing time required and the increases in cost of labour due to overtime payments.

1.2 Aims and Objectives

The data under analysis is that of cowpea wholesale prices from 1971 to June, 1976. For each year the monthly prices are given in Naira per sack, a sack being equivalent to about 240 lbs or 108 kg.

The intention of this analysis is to see the possibility of an established trend in cowpea wholesale prices. It also intends to examine seasonal variations of same. From these it is hoped that a mechanism of

cowpea wholesale price movement will emerge from which useful conclusions can be drawn, and to determine the most efficient pattern of cowpea production to meet annual requirements at least cost.

1.3 Justification for a Computer Base

Problems have been left unsolved in the past because the amount of calculations needed was so great that no individual or team of individuals was capable of performing it in the time available. Cut dated and inefficient methods and practices have been retained on the grounds that improved methods involved far too much calculations to be done by hand.

The human brain is a wonderful computer but the rate at which a man unaided can do arithmetic is pitifully slow by comparison with that of modern equipment. Also the rate at which the brain can absorb, and retrieve information is much inferior to that of any present day machine. The brain also has limited capacity to store information for future use.

For reasons above, the computer was evolved to calculate series of problems and store information. Calculations can be repeated by using the sequence of instructions many times over and entering new data for each operator or operation. It can therefore be used to analize dynamic problems.

1.4 Computer System Used in this Study

The computer resources utilised for this study is Cyber 72 system operated by Iya Abubakar Computer Centre, Ahmadu Bello University, Zaria. The hardware components used in this study include the line printer, memory, processor, cord reader and the terminals.

1.5 The Language Used and Reasons

Fortran is one of the most widely adopted computer language for scientific and general use. It enables programs to be expressed in a way which is very similar to that used in everyday mathematical notations. It is readily available and fully supported by a handy computer centre. It can be used at several different centres and when repeatedly used, it will offer considerable long term savings.

CHAPTER TWO

HISTORICAL REVIEW

Economics is an aspect of human activity closely related with prices. Yet institutions that teach economics have been slow to recognise the importance of specialised studies of prices. Until recent years, the Colleges of Agriculture gave little attention to this subject and Schools of Commerce also ignored it. Recognition of the many practical applications of price analysis and forecasting is much more general among farmers and agricultural businessmen than among other groups.

The growth of work outlook among farmers, using facts from price analysis enables farmers to plan their production and marketing strategies on price forecast.

This required a new and more practical approach to the study of commodity prices. Economic theory was combined with statistical method and the extensive collection of facts about price making forces to form a new branch of agricultural economics and agricultural pricing. Formal courses in the subject began to appear in the curriculae of the agricultural colleges. Agricultural economists with statistical bent began doing research in the field of price analysis. The

results were so novel and impressive that they greatly influenced the methods of economists in other fields including general business analysis and created a wealth of material for students of agricultural prices.

2.1 Introduction

Price analysis is the study of past price movements and of the supply and demand factors associated with them. It is the explanation of how and why prices have behaved in a certain way during some particular period of time. Price analysis has many different uses which may be classified under four headings.

1) In clarifying old or establishing new principles of price

Economics is largely the science of price relationship. Most of economic theory dealing with price has been based on deductive and quantitative reasoning. This theory requires testing, confirmation, rejection, elaboration or refinement by inductive, quantitative methods.

2) In explaining correct price conditions

The continuous changes in commodity prices result in a constant stream of problems or questions. For their solutions price analysis is necessary.

3) In analysing the probable effectiveness of proposal for improving agricultural condition

All economic measures have a direct or indirect relation to price. Methods of price analysis can contribute much to wise selection and effective administration.

In Forecasting Prices

Price analysis is the base upon which the various method of price forecasting are built.

2.2 General Information on Cowpea

Cowpea popularly called beans is one of the best known and most extensively grown grain legume in Nigeria. Although the crop is grown in almost all ecological zones, the greatest producing area is the Northern part of the country where the climate is most favourable to its production. Zaria is one of the highest producing area with about 60% of the farmers growing cowpea in crop mixtures on small farm.

Cowpea is the fourth most important food grain crop in the Northern States of Nigeria. Nutritionally, cowpea is supperior to any of the other stable food stuff because of its high quality protein but unfortunately, cowpea is highly susceptible to insect damage both in the field and in storage.

Marketing Problems: Farmers find it difficult to adjust precisely their production schedules to meet changing marketing conditions.

The major problems in marketing can be identified as

1. Transportation
2. Storage
3. Credit
4. Price.

Transportation: Farmers sell their produce in homes and nearby markets. The problems of farmers and traders are associated with finding buyers and transport. The trader finds it convenient to buy at places where he can arrange for transport to evacuate his purchases.

The weekly nature of village markets forces farmers to store their produce from one market week to another. Transport is available only on market days. Storage during this period is poor. Some farmersstore part or all of their produce in anticipation of price rise. The storage facilities used by farmers are not adequate to protect the produce even for short periods from dampness rodents and storage Insect pests; hence losses are found to be quite high. The high storage losses put some of the farmers in a dilemma whether to store or to sell immediately after harvest at lower prices.

Farmers who sell at the earliest opportunity do so for fear of high storage losses even if the prices are not satisfactory.

Credit: One important source of credit to the farmer is the money lender and some times from friends and traders. Money lenders give loans to the farmers on various conditions including most often, one that the farmer pays back the money with high interest or give a proportion of his produce as payment. The repayment arrangement is exploitative and always to the benefit of the lender. The farmer therefore realises very little return from the sale of his produce.

Price Problem: Since all farmers harvest the same time, there is an abundance of produce in the market during harvest. Prices are low and the farmers' returns poor. Because the farmer has little to live on he is forced to sell at the low rates prevailing.

It has been observed that prices are highest before harvest, lowest during harvest and rise progressively from one harvest to the other.

2.3 Objective of Price Study of Cowpeas

Due to the fact that prices of cowpea are unduelly depressed in the post harvest period and they rise to excessive heights in the period just

before harvest. The great increase in prices is variously attributed to high storage losses, exploitative speculation, and simple improvidence resulting in low income to the farmers and thus the incentive to produce. Dwindling production results in food shortages. Besides the farmer who sold his produce in the glutted post-harvest markets find it necessary to buy them back at three or four times the price in order to feed his family while waiting for the new crop to mature.

Therefore the magnitude and regularity of seasonal price changes are a matter of considerable importance.

2.4 Application of Cowpea Price Information

Information about agricultural prices is used in a variety of ways which may be classified as follows:-

1. Uses by individual farmers:
   - (a) In long time planning of the farm business.
   - (b) In the selection and management of crop enterprises.
   - (c) In planning the time, place, and method of marketing.
2. Uses by private and cooperate business:
   - (a) In planning the character and location of the business.

CHAPTER THREE

ANALYSIS OF TIME SERIES

3.1 Introduction

Agricultural Price problem of developing countries is large seasonal fluctuation. The farmer, because of innate poverty reinforced by rapacious money lenders demanding instant repayment at harvest sells his produce immediately after harvest. Other farmers are also harvesting and selling off their produce during the same season. Because of abundance prices are low. Soon after harvest the price begins to rise as produce are purchased and evacuated and rises to a much higher level as the new harvest approaches. The middle men profit greatly by this seasonal price rise buying produce during harvest at low price, and selling at higher prices as availability reduces.

In order to increase, food production and encourage farmers to grow more crops, price fluctuation should be reduced.

In commodity price movements, this pattern is associated with conditions that have a peculiar relation to time. Changes in supply and demand are occurring continously, these changes require varying length of time to mature. The price of cowpea is never instanteneous and quite frequently time is not a fixed input so it has to be considered explicitly.

The influence of time on cowpea pricing is more pervasive and complex than the physical input. Not only may time directly, affect the physical process but it may also influence response efficiency through time-price effect, through uncertainty about the future, time is a general framework of response efficiency under certainty of prices.

Therefore the price of cowpea depends on the time from the start of the growing season until harvest.

The sample taken over time often do not behave like random samples, and therefore the standard statistical techniques cannot be applied to them. This lack of randomness is, typical of certain sets of economic data such as the price of stocks, cost of living or the consumption of tobacco, one of the techniques applied to test this set of economic data is the time series and the price of cowpea belongs to this group.

Time series is a set of observation taken at specified times usually at equal intervals. Economists in particular have studied such series extensively because so many of the interesting problems of economics involve them. They have also been studied in the physical sciences in connection with periodic phenomena of various kinds. The time series involve calculations of moving averages seasonal index number and seasonally adjusted value.

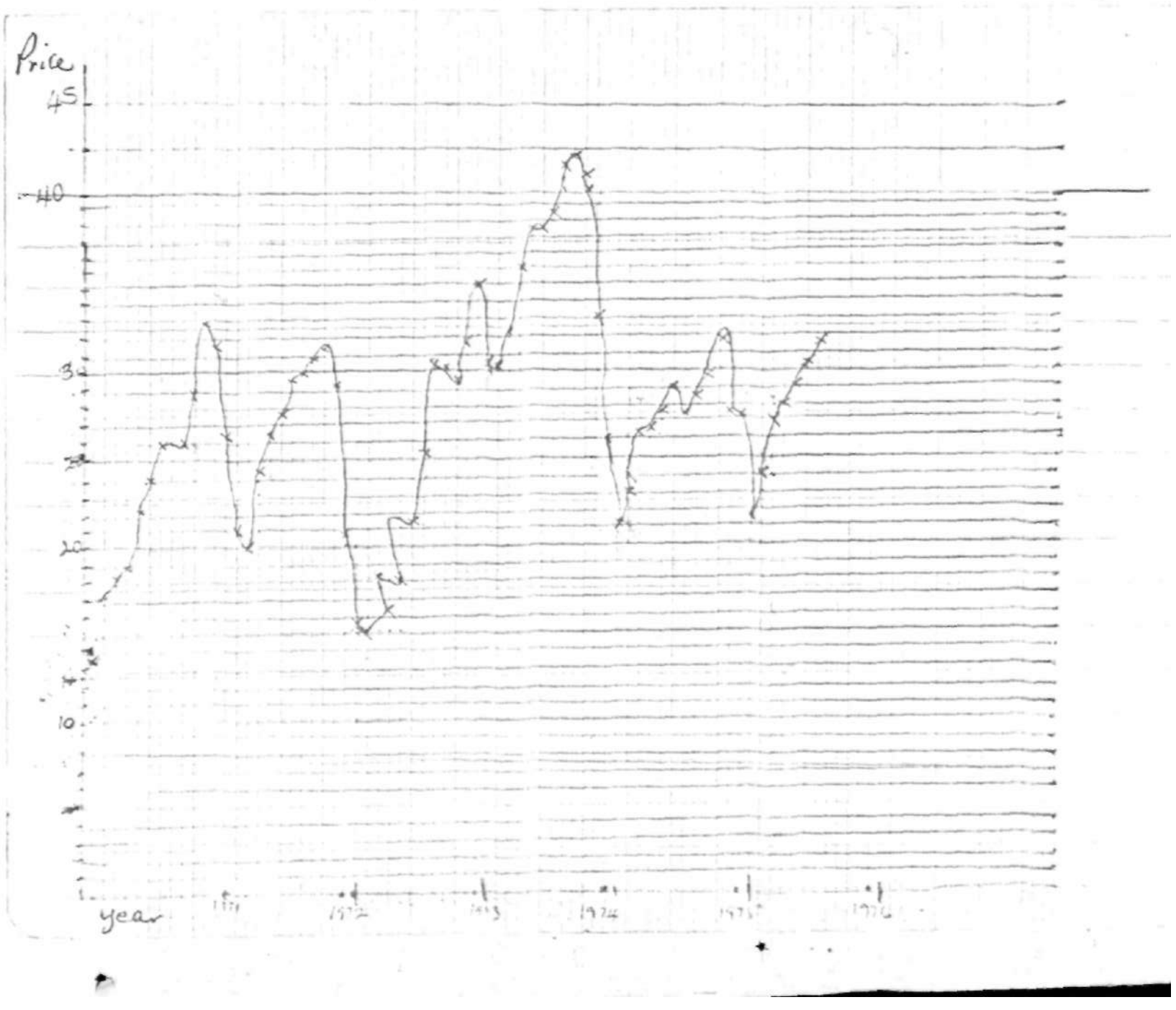
After the major portion of the time dependence of the series has been estimated, the final stage is to predict the future which is the dream and desire of every economist.

The graph of Cowpea Prices

A time series involving raw data of cowpea is represented pictorially by constructing a graph of prices versus year. This is the graph of a time series showing the price of cowpea during the year 1971 - June 1975 (Table 1).

Table 1: The monthly prices per sack in Naira of cowpea from the year 1971 to 1976.

Months	Year					
	1971	1972	1973	1974	1975	1976
Jan.	13.85	20.80	15.05	30.15	23.00	24.10
Feb.	17.85	25.25	18.35	32.10	26.25	27.20
March	18.43	26.50	16.48	36.00	26.40	28.00
April	19.05	27.50	18.00	38.50	27.50	29.25
May	22.40	29.63	21.35	38.50	29.00	30.40
June	24.18	29.75	25.60	39.20	27.50	31.50
July	26.06	30.80	30.50	42.00	28.50	
Aug.	29.10	31.25	30.40	42.80	29.80	
Sept.	33.50	29.30	29.50	41.80	31.75	
Oct.	31.64	20.80	31.88	33.05	27.50	
Nov.	26.50	20.63	35.00	25.00	27.20	
Dec.	21.00	15.80	30.84	19.25	21.50	


Price
45
40
35
30
20
10
1
year
1971
1972
1973
1974
1975
1976

3.2 Classification of Time Series Movements

Characteristic movements of time series may be classified into four main types often called components' in a time series.

1. Long-term or secular movements:- refer to the general direction in which the graph of a time series appear to be going over a long interval of time it is sometimes called secular variation or secular trend.

2. Cyclical movements or cyclical variations refers to the long-term oscillations or swings about a trend line or curve. These cycles are sometimes called periodic. In business and economic activity, movements are considered cyclical only if they recur after a time interval of more than a year.

3. Seasonal movements or seasonal variations refer to the identical or almost identical patterns which a time series appears to follow during corresponding months of successive years, such movements are due to recurring events which take place annually. The ideas involved can be extended to include periodicity over any interval of time such as hourly, weekly, monthly and yearly depending on the type of the data available.

4. Irregular or random movements refer to the sporadic motions of time series due to chance events such as flood, strike, elections etc. Although it is ordinarily assumed that such events produce variations lasting only a short time, it is conceivable that they may be so intense as to result in new cyclical or other movements.

The analysis of time series: It consists of discription of component movements present in the data graph of the data. The analysis of time series consists of an investigation of the factors which are the movements and is often referred to as a decomposition of a time series into its basic component movements.

3.3 Seasonal Fluctuations

Seasonal fluctuations are expressions of changing seasons that recur in the same pattern each year without regard to changes in business cycles such seasons are caused by holiday customs. They affect production, and sales during a high season are above the average and during a low season below average. The average here is taken as the actual arithmetic mean of twelve months production or sales. The analysis of seasonal fluctuations is of interest to the farmer, government or any other institution for a number of reasons.

Price rises of certain agricultural commodities do not necessarily indicate that inflation is setting in. The existence of a seasonal pattern in sales or production causes difficulties for management so it it is therefore quite natural that the agric researcher would like to reduce the amplitude of seasonal fluctuation or at least, know more precisely what the seasonal pattern is.

Because of these considerations there are two basic reasons for statistical analysis of seasonal fluctuation, one is to remove the seasonal pattern so as to be able to better observe cyclical fluctuation. Such operation is called adjusting the time series or generally smoothening of time series.

Another basic reason for statistical analysis of seasonal patterns is the desire of farmer and industrial firms especially to know their seasonal pattern more precisely. As a result on average seasonal pattern for a series is computed.

3.4 Illustration of Calculations

One of the easiest method of finding an average seasonal pattern and adjusting a time series for seasonal fluctuation is the computation of seasonal index number. The seasonal indices were computed for the series. The required computation are done in the following steps.

(A) To calculation of the moving average

The moving average is calculated as follows:-

1. Select the period of time:- Monthly data is used having a twelve months seasonal variation.

2. Average the prices for the first 12 months.

3. Plot the average for December, the mid-month.

4. Drop the price for the first month as (Jan.) and add the price for the corresponding month. January of the succeeding year is added algebraically the difference between these months to the total from which the previous average was calculated add the averages of Dec. and January and Divide by 12 and plot this average for July which is the mid-month of the second average.

5. Continue this process of dropping one month and adding another, plotting each two succeeding average as the mid point of the period for which it was calculated until there are no more months.

It is evident that the beginning and end of the period will not be covered by the moving average by

a number of months equal to half the number of months included in each average.

A set of numbers showing relative values of variable during the months of the year is called a seasonal index for the variable. It can be referred to as seasonal index numbers.

There are different method for computing a seasonal index. They are

1. The average percentage method, in this method the data for each month are expressed as percentage of the average for the year. The percentage for corresponding months of different years are then averaged using either a mean or median.

2. The percentage trend or ratio to trend method:- In this method the data for each month are expressed as percentages of monthly trend values. An appropriate average of the percentages for corresponding months then gives the required index.

3. The link relative method:- In this method data for each month are expressed as percentages of data for the previous month. These percentages are called link relatives since they link each month to the proceding one.

4. Percentage moving average. This is the method choosen for this project which has been described below.

(B) Seasonal indices - <u>The measurement of seasonal indices</u>.

1. Compute - a 12 months moving average centre.
2. Express the original data month by month as percentage of the moving average.
3. Arrange all of the individual January relative according to their years. when secured in an array, strike off the extremes.
4. Average the remaining relations included in the array for January.
5. Do the same for each of the other months.
6. Express each monthly average so obtained as a relative or index number by dividing it by the average of all the monthly averages.

(C) <u>Adjusted Seasonal Values</u>

When the original monthly data are divided by the corresponding seasonal index number; the resulting data are said to be adjusted seasonal values.

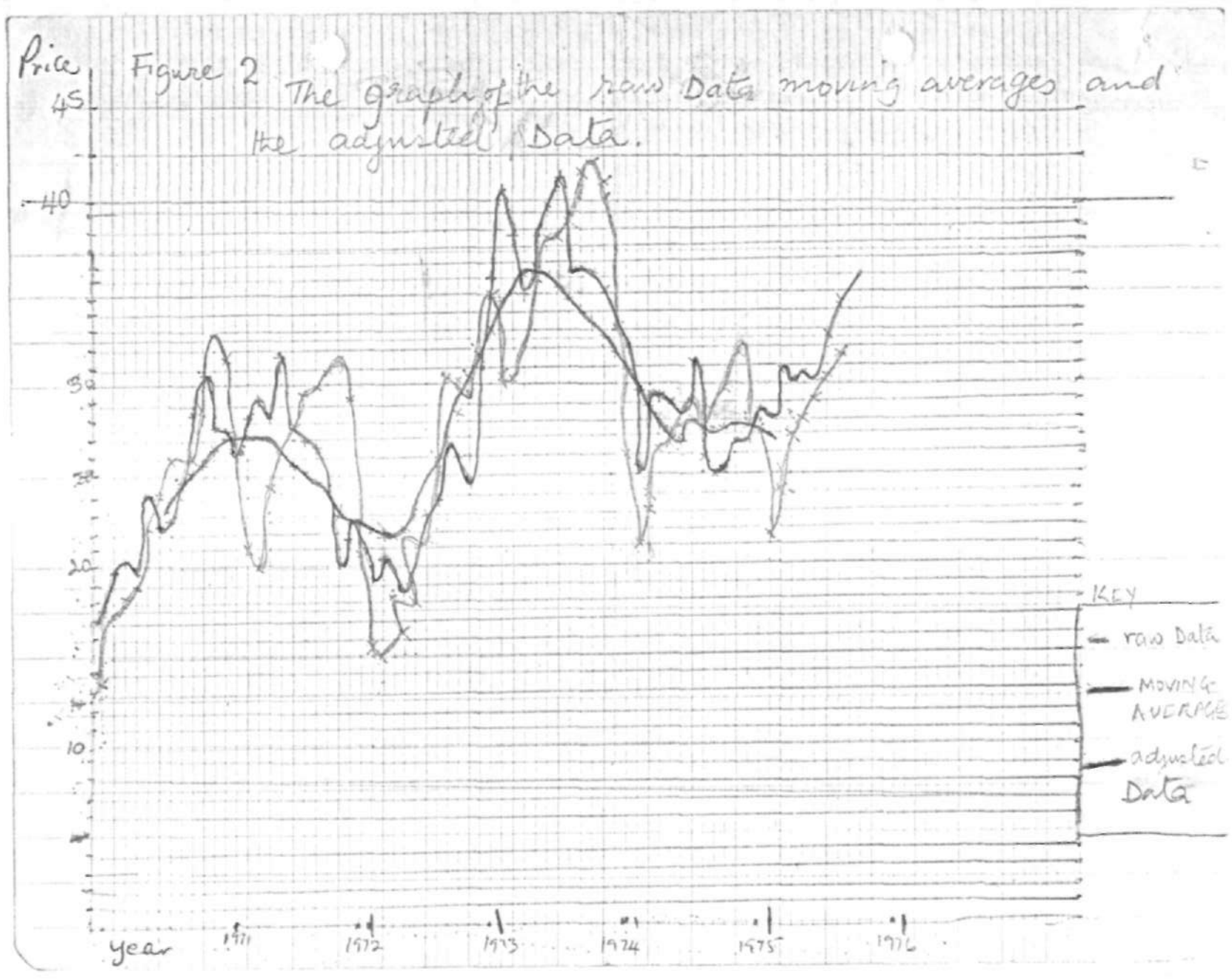
ANNUAL RESULT OF MOVING AVERAGE, SEASONAL INDICES AND SEASONAL ADJUSTED VALUES

Month & Year	Raw Data	Sum of 12 Months	Moving Averages	Detre-nded Values	Seasonal Indices	Seasonal Adjusted Values
1971 Jan.	13.85				0.7999	17.32
Feb.	17.85				0.8953	19.94
Mar.	18.43				0.9173	20.09
Apr.	19.05				0.9729	19.58
May	22.40				1.0445	21.45
June	24.18				1.0785	22.42
July	26.06		23.92	1.0895	1.1483	22.69
Aug.	29.10		24.52	1.1869	1.1828	24.60
Sept.	33.50		25.16	1.3314	1.1979	27.97
Oct.	31.64		25.85	1.2240	1.0372	30.51
Nov.	26.50		26.50	0.9999	0.9574	27.68
Dec.	21.00	283.56	27.04	0.7767	0.7643	27.47
1972 Jan.	20.80	290.51	27.47	0.7573	0.7799	26.00
Feb.	25.25	297.91	27.75	0.9098	0.8953	28.20
Mar.	26.50	305.98	27.67	0.9578	0.9173	28.89
Apr.	27.50	314.43	27.04	1.0169	0.9729	28.26
May	29.63	321.66	26.35	1.1247	1.0445	28.37
June	29.75	327.23	25.88	1.1494	1.0785	27.59
July	30.80	331.91	25.43	1.2113	1.1483	26.82
Aug.	31.25	334.12	24.90	1.2550	1.1828	26.42
Sept.	29.30	327.92	24.20	1.2110	1.1979	24.46
Oct.	20.80	319.08	23.38	0.8896	1.0372	20.05
Nov.	20.63	313.21	22.64	0.9112	0.9574	21.55
Dec.	15.80	308.01	22.12	0.7142	0.7643	20.67

Month & Year	Raw Data	Sum of 12 Months	Moving Averages	Detre-nded Values	Seasonal Indices	Seasonal Adjusted Values
1973 Jan.	15.05	302.26	21.94	0.6860	0.7999	18.82
Feb.	18.35	295.36	21.89	0.8383	0.8953	20.50
Mar.	16.48	285.34	21.86	0.7338	0.9173	17.97
Apr.	18.00	275.84	23.33	0.8060	0.9729	18.50
May	21.35	267.56	23.39	0.9126	1.0445	20.44
June	25.60	263.41	24.62	1.0398	1.0785	23.74
July	30.507	263.11	25.88	1.1787	1.1483	26.56
Aug.	30.40	262.26	27.08	1.1226	1.1823	25.70
Sept.	29.50	262.46	28.47	1.0361	1.1979	24.63
Oct.	31.88	273.54	31.15	1.0575	1.0372	30.74
Nov.	35.00	287.91	31.72	1.1035	0.9574	36.56
Dec.	30.84	302.95	35.00	0.9346	0.7643	40.35
1974 Jan.	30.15	318.05	34.04	0.8856	0.7999	37.69
Feb.	32.10	331.80	35.04	0.9161	0.8953	35.86
Mar.	36.20	351.52	36.07	1.0037	0.9173	39.46
Apr.	38.50	372.02	36.63	1.0511	0.9729	39.57
May	38.50	389.17	36.26	1.0617	1.0445	36.86
June	39.20	402.77	35.36	1.1085	1.0785	36.35
July	42.00	414.27	34.58	1.2145	1.1483	36.59
Aug.	42.80	426.67	34.04	1.2574	1.1823	36.19
Sept.	41.80	438.97	33.39	1.2520	1.1979	34.86
Oct.	33.05	440.14	32.52	1.0163	1.0272	34.86
Nov.	25.00	430.14	31.67	0.7895	0.9574	26.11
Dec.	19.25	418.55	31.78	0.6253	0.7643	25.19

Month & Year	Raw Data	Sum of 12 Months	Moving Averages	Detre-nded Values	Seasonal Indices	Seasonal Adjusted Values
1975 Jan.	23.00	411.40	29.73	0.7735	0.7999	28.75
Feb.	26.25	405.55	28.63	0.9169	0.8953	29.32
Mar.	26.40	395.75	27.67	0.9541	0.9173	28.78
Apr.	27.50	384.75	27.02	1.0178	0.9729	28.26
May	29.00	375.25	26.88	1.0789	1.0445	27.76
June	27.50	363.55	27.06	1.0161	1.0785	25.50
July	28.50	350.05	27.20	1.0476	1.1483	25.2
Aug.	29.50	337.05	27.29	1.0920	1.1823	25.2
Sept.	31.75	327.00	27.54	1.1589	1.1979	26.7
Oct.	27.50	321.45	27.67	0.9987	1.0372	26.7
Nov.	27.20	323.65	27.89	0.0831	0.9574	28.6
Dec.	21.50	325.90	26.87	0.7708	0.7643	28.3
1976 Jan.	24.10	326.00	-	-	0.7999	30.9
Feb.	27.20	327.95	-	-	0.8953	30.2
Mar.	28.00	329.55	-	-	0.9173	30.8
Apr.	29.25	331.30	-	-	0.9729	30.2
May	30.40	332.70	-	-	1.0445	32.7
June	31.50	336.70	-	-	1.0785	29.4

Figure 2 The graph of the raw Data moving averages and the adjusted Data.

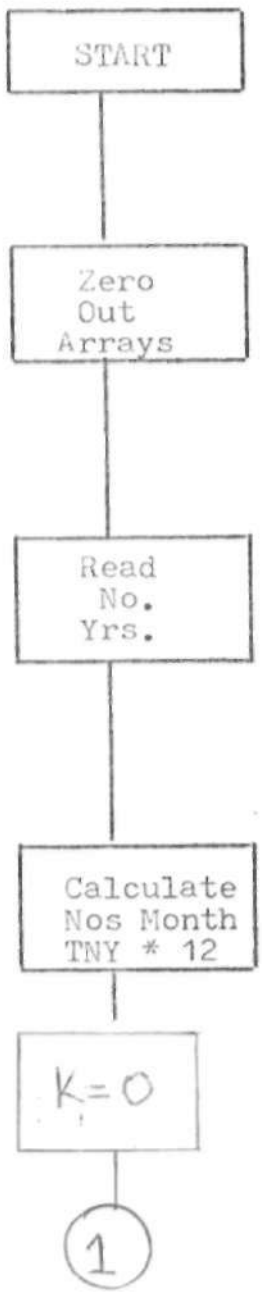


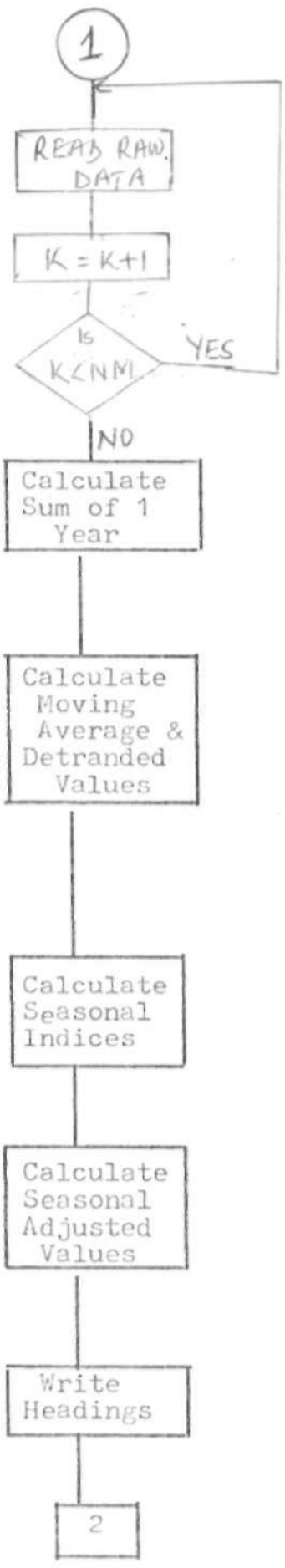
CHAPTER FOUR

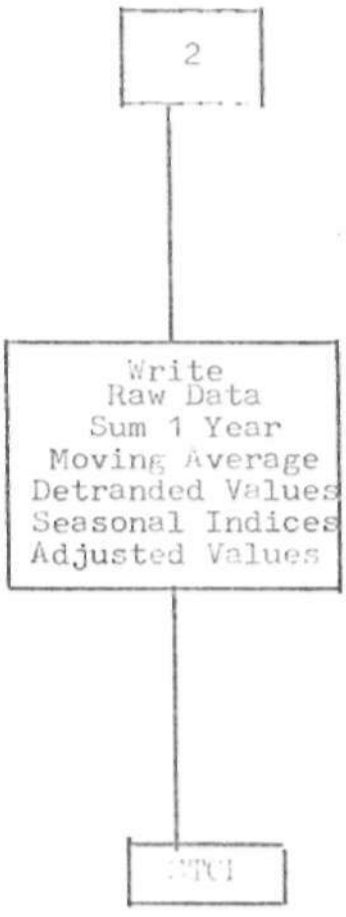
SYSTEM FLOW CHART AND SYSTEM PROGRAM

Flow chart is a technique whereby we can chart the sequence in which the operations constituting the problem are performed.

4.1 System Flow Chart




1
READ RAW DATA
K = K+1
IS K<NM
YES
NO
Calculate Sum of 1 Year
Calculate Moving Average & Detranded Values
Calculate Seasonal Indices
Calculate Seasonal Adjusted Values
Write Headings
2


2
Write
Raw Data
Sum 1 Year
Moving Average
Detranded Values
Seasonal Indices
Adjusted Values

4.2 System Program

```
PROGRAM   TIMO (INPUT, OUTPUT, TAPES = INPUT, TAPES =
      1,  OUTPUT)
DIMENSION X1(100), X2(100), X3(100), X4(100)
      1,  X5(100), X6(100), X7(100)
          DO 100  I = i,100
          X7(I) = 0.0
          X4(I) = 0.0
          X3(I) = 0.0
          X1(I) = 0.0
          X5(I) = 0.0
          X6(I) = 0.0
100       X(2) = 0.0
          READ (5,750) TNY
750       FORMAT (F 3.0)
          NM     = TNY * 12
          DO  99  I = 1, NM
 99       READ (END = 888, 5, 751) X1(I)
751       FORMAT (F 5.0)
888       DO 101  I = 1, 12
101       X2(12) = X2(12) + X1(I)
          K = 1
          DO  102  I = 12, NM
          X(2)(I + 1) = X2(I) + X1(I + 1) - X1(k)
          X(3)(I - 5) = X2(I) + X2(I + 1)/24
          X(4)(I - 5) = X1(I - 5)/X3(I - 5)
102       K = k + 1
```

System Program (Cont'd)

```
      DO  108  I = 1, 12
        N        = 0
       XX        = 0.0
      DO 109  J = 1, 72, 12
      IF (X4(J). NE. 0.0) N = N + 1
      XX = XX + X4(J)
  108 X5(I)    = XX/N
      DO 400 I=1, 12
  400 X6(I)    = X5(I)
      DO 401 I=1, 12
  401 X6(I+12)= X5(I)
      DO 402 I=1, 12
  402 X6(I+24)= X(I)
      DO 403 I=1, 12
  403 X6(I+36)= X5(I)
      DO 404 I=1, 12
  404 X6(I+48)= X5(I)
      DO 405 I=1, 12
  405 X6(I+60)= X5(I)
      DO 406 I=1, NM
  406 X7(I)    = X(I)/X6(I)
      WRITE (6,700)
  700 FORMAT (1H1, 31X, *RAWDATA*, 4X, *SUM
      OF*, 4X, *MOVING*, 4X, *DETRENDED*,
     1 4X, *SEASONAL*, 4X, *SEASONALY*)
      WRITE (6, 701)
```

System Program (Cont'd)

```
701  FARMAT (1H, 43X, *1 YEAR*, 4X, *AVERAGE*,
     6X, *VALUES, 6X, *INDICES* 4X
   1 *ADJ. VALUES*)
     DO 103  I = 1, NM
103  WRITE (6, 800) X1(I), X2(I), X3(I),
   1                X4(I), X5(I), X6(I), X7(I)
800  FORMAT (1H, 32X, F 5.2, 6X, F 6.2,
   1 5X, F 5.2, 6X, F 7.4, 7X, F.6.4, 7X, F 5.2)

S T O P
E N D.
```

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Observations

All the three plots, that is the raw data, moving average and the seasonal adjusted values, showed a similar oscillation over the period. The pattern of oscillation of the cowpea prices is most clearly shown by the moving average plot.

It is observed from the plots that beside the general trend, there is a seasonal variation. The seasonal variation adheres strongly to the pattern in which the months of August and Septembers form the period of peak price while those of December and January form the period of floor price.

The year 1974 displays an irregularly high fluctuation in price when compared with the other years covered by the data.

Another observation is that while the moving average plot smoothens the fluctuations of the raw data, the seasonally adjusted value tends to level them in that the peaks in the raw data are lowered while the floors are raised.

In addition to the above it is clear that from 1971 through 1976, the floor wholesale price of cowpea was increasing, with these observations in mind we can now attempt inferring from and explaining of the same.

5.2 Deductions

One of the deductions from the observation is that there is a rising trend in the price of cowpea over the whole period as well as seasonal variations. The seasonal variation in price is very obvious. The long term strend is difficult to state categorically due to two major reasons (1) The period covered by the data is too short to warrant any serious calculation of a long-term trend (2) even if the time period is enough the calculation of the trend will strongly be influenced by whether 1974 is taken as a normal or irregular year. Bearing these two points in mind the following trend equations were nevertheless filled using two points on the moving average plot and getting simultaneous equations which are then solved to give the intercepts and slopes of the graphs.

(1) with 1974 as normal year

$Y = 22+2.5x$ (July 1971 to July 1974)

(2) 1974 as irregular (Cmitted)

$Y = 18.4+0.7x$ (July 1971 to July 1975).

the experiences of others, as made available through accounts of professional experiments and reports of the result obtained by others, Farmers can also improve their forecast by drawing from events revealed in analysis of prices made by professional workers in economics.

From the analysis it has been established that there appears to be a long-term trend of rise in cowpea wholesale price given by the equation $Y = 18.4 + 0.7x$ if 1974 is considered as an irregular year and by $Y = 22 + 2.5x$ if 1974 is taken to be normal.

It has also been noted that there is a seasonal variation in price for each year with the peak price coming up in August and September while the floor price occurs around December and January.

5.4 Recommendation

Cowpea is one of the most important crops, where a lot of traders flock to buy and it is the most profitable crop in terms of less labour demanding and high demand in the market, but its product and marketing i.e., prices are more risky. The prices farmers receive from the sales is greatly influenced by the place and time. The decision on these two factors are important.

Presently there is no official government price information available. The only source of information to farmers and treders is their own friends and private contacts. The news media should be encouraged to disseminate market price information to be provided by State Government. I think the radio is very an effective communication medium. The availability of adequate price and market information would allow for more effective farming management. The government should try to buy surplus grains from the farmers, this will discourage middle men. This will encourage more production and the farmers will be able to estimate their produce. The surplus grain purchased by the government should be released to the market during the month of August to December to normalise the prices of produce for consumers and this will discourage the middle men.

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2. SHEPHARD, L. S. Marketing Farm Products Economic Analysis, IOWA State University Press 1962.

3. Basic Statistics for Business and Economics by: Paul G. Hoel.

4. Principles of Applied Statistics by Myron Melnyk.

5. Agricultural Prices by Frederick Lundy and Thomsens Richard Jayfote.

6. Agricultural Price Analysis by Geoffrey S. Shephard.

From the slopes of the two equation it is noticed that there is a much sharper rise in price when 1974 is considered as a normal year. This clearly is significant in relation to any decision to be taken based on the analysis of this data. The abnormally high rise in the price of cowpea for the year 1974 may not be connected with the 1973/74 drought which swept across most of the important cowpea producing areas. Another possible reason may be the speculations of the Udoji salary increment and arrears. The seasonal variation are more explicable. The floor price period of December to January fairly coincide, with the period when newly-harvested cowpea reaches the maket in the largest quantity thereby depressing the price. The peak price of August to September on the other hand is the period when most of the crop from last harvest has been dispossed of by then and new harvest has not come up. There is this scarcity of cowpea during the period relatively with the concommittant rise in price.

5.3 Conclusion

Just as any farmer can reach his own conclussion based upon his own experience regarding the best crops to grow, he can make his own price forecast entirely without assistance from others. The farmer has come to accept the fact that he can improve the result obtained from his farming operations by drawing upon