

6

**Oyinlola Oluw
g. No. PGD/MCS**

**DEPARTMENT OF MATHEMATICS
SCIENCE, SCHOOL OF SCIENCE
EDUCATION, FEDERAL UNIVERSITY
MINNA – NIGERIA**

NOVEMBER, 2003

**Application of Computer on Time Series
Analysis on Deposits Acquisition
Case Study: Bank Of The North Limited Kwali**

BY

**Oyinlola Oluwole Amos
(Reg. No. PGD/MCS/2001/ 1085).**

**In Partial Fulfillment of the Requirements for the Award of Post
Graduate Diploma (PGD) In Computer Science.**

Submitted To

**DEPARTMENT OF MATHEMATICS AND COMPUTER
SCIENCE, SCHOOL OF SCIENCE AND SCIENCE
EDUCATION, FEDERAL UNIVERSITY OF TECHNOLOGY,
MINNA – NIGERIA.**

November, 2003

CERTIFICATION

This is to certify that Oyinlola Oluwole Amos (Reg. NO. PGD/MCS/2001/1085) Submitted this project work as part of requirements of the Department of Mathematics and computer Science, Federal University of Technology, Minna for the award of Post graduates Diploma (PGD) in computer Science.

Professor K. R. Adeboye

Project Supervisor

Date

Dr. L. N. Ezeako

Head of Department

Date

External Examiner

Date

DEDICATION

This research project is dedicated to God and to my loving wife Rebecca Iyabode Oyinlola who has done great thing in my life and with which I attain my present situation today.

ACKNOWLEDGEMENT

God Almighty the compass of my life and indeed my source of joy and inspiration, through whom the completion of this research work has been made possible, I am deeply indebted.

I perpetually remain grateful to my research project supervisor, Prof. K. R. Adeboye for his wise counsel. Guidance, understanding and confidence that he gave me the courage which enabled me to grapple effectively with the demands of a study of this nature. My gratitude also goes to Mallam Audu Isah (Coordinator of the programme) for his love and guidance. I wish to acknowledge Mr. Joseph Musa Uyamsow of Bank of the North, Kwali whose contributions have helped in no small measure to the fulfillment of this work.

My next stream of thanks goes to my parents, brothers and sisters, whose prayers have guided me and brought my dream to fulfillment. My immeasurable thanks also goes greatly to my wife Mrs. R. 'Funmilayo. Oyinlola whose financial support, prayer, understanding and encouragement have made this project work a success.

I am equally grateful to all the academic staff of the department of Maths and Computer Science, Federal University of Technology Minna for their human attitude as well as their unique approaches to problem solving.

To thank exclusively are Mr. & Mrs. Bello Olaniran, Dr. & Mrs. Sebastine, Mr & Mrs Shola John, Miss Rose Etuk, Miss Mary Udoh, Elder Ayeni , Mr & Mrs. J. Oyinlola for their contributions to the success of this research work.

I am equally grateful to friends who have directly or indirectly contributed my welfare while at school. My prayer is that God will reward you accordingly.

TABLE OF CONTENTS

TITLE PAGE	i
CERTIFICATION	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv - v
TABLE OF CONTENTS	vi - vii
ABSTRACT	viii
CHAPTER ONE (GENERAL INTRODUCTION)	
1.1 INTRODUCTION OF TIME SERIES ANALYSIS	1 - 2
1.2 A BRIEF HISTORICAL BACKGROUND OF THE BANK	2 - 6
1.3 GROWTH PROFILE OF BON	6
CHAPTER TWO (PRELIMINARY)	
2.1 LITERATURE REVIEW	7 - 8
2.2 SCOPE OF THE STUDY	8
2.3 METHODS OF DATA COLLECTION	8
2.4 IMPORTANCE OF TIME SERIES ANALYSIS	9
CHAPTER THREE (THE MATHEMATICAL MODEL)	
3.1 MATHEMATICAL MODEL	10 - 11
3.2 COMPONENTS OF TIME SERIES	12 - 14
3.3 SMOOTHING OF THE SERIES	14 - 16
3.3.1. MOVING AVERAGE	15
3.3.2. DESEASONALIZED DATA	15

3.3.3. FORECASTING DATA	16
-------------------------	----

CHAPTER FOUR (ANALYSIS)

4.1 INTRODUCTION	17 - 18
4.2 ANALYSIS OF COMPONENTS	18
4.3 ESTIMATION OF SEASONAL VARIATION	18 - 20
4.4 ESTIMATION OF TREND	20 - 28
4.5 RESIDUAL ANALYSIS	29
4.6 FORECASTING	29

CHAPTER FIVE (COMPUTER PROGRAMMING)

5.1 PROGRAMMING AND IMPLEMENTATION	30 - 32
5.2 SUMMARY AND CONCLUSION	32
5.3 RECOMMENDATIONS	33

APPENDIX	34-45
-----------------	-------

REFEREES	46-47
-----------------	-------

ABSTRACT

In this present time there is an increased interest in knowing about the future, with which this project provides an insight to.

The analysis of time series which is aimed at explaining the past and forecasting the future applies to many field economics, statistical data such as bank deposits which we shall be dealing with is quantified in time series.

Chapter one which introduces the basic concept of time series analysis and its important also. Chapter two constitutes the literature review and a brief historical background of he bank of the North limited.

Chapter three talks about analysis the components of time series and make assumption on mathematical analysis model of the analysis. In chapter four the main analysis of data is made on certain quantitative spelt of forecasting, it definition and uses. Chapter five is basically on the computer implementation of the series and also highlights the observations, possible recommendations and conclusion of the research work.

CHAPTER ONE (GENERAL INTRODUCTION)

1.1 INTRODUCTION OF TIME ANALYSIS

In economics today ability to predict what will happen in the future is very important and this is all what time series is about. Time series is defined as a sequence of measurement arranged in a chronological order. There is a lapse of time between the dropping of a weight and the movement that it hits the ground but this is in itself does not give rise to time series.

A time series consists of a sequence of values of a variable with respect to time. Observation of the variable is usually made for successive periods of equal lengths or equally spaced points in times.

The analysis of time series applies to many areas such as the aggregate values of Gross National Product, hourly demand of electricity, the monthly volume index of industrial production and daily stock prices etc. In economics, the recorded history of the economy is in the form of time series. Such series is of particular importance in the field of economic statistics. Examples are Bank deposits, population and sales record, etc. In this research work, we will only consider bank deposits.

The mathematical theory of time series has its application in the physical sciences such as in the development and the design of aeroplanes and rockets, the improvement of radar and other electronics devices and in investigation of certain production in chemical process.

Time series analysis has two goals: one is "explaining the past" and "forecasting the future". Explaining the past includes finding a model, which reveals the character of the phenomenon behind the observations. An example is a time series analysis of discrete data of the monthly deposit of bank of the North. While future forecasting includes the calculation of probability limit of the forecast. The maximum time span of a forecast depends on the inertia of the phenomenon.

There are four factors which are needed in time series analysis .

These include:

- 1 The time series itself
- 2 An understanding of the process
- 3 A method of modeling and
- 4 A Computer knowledge.

The process of the analysis of the monthly deposits acquisition of the bank of the North. Limited is intended to isolate and measure the separate effects of composite forces called components of time series. It is therefore absolutely imperative of the bank to undertake time series analysis of different components of deposit and also to know when to employ more workers into the establishment.

1.2 A BRIEF HISTORICAL BACKGROUND OF BANK OF THE NORTH (BON) LIMITED.

Bank of the North Limited was incorporated on the 17th September, 1959. It started with an initial paid up capital of 12,500 made up of 12,500 shares of 1 each. The first

meeting of the board of directors of the bank was held the same day at 54 Denton Street, Ebute Meta, Lagos, where the 12,500 shares were completely paid for.

1.2.1 BRANCH NETWORK AND DEVELOPMENT

The first two branches of the bank of the North Limited were opened in Kano and Kaduna on the 5th and 7th of January, 1960. During the last four decades and against the background of the expansion in business and commercial transactions across the country, Bank of the North Limited has pursued vigorously and cautiously, the opening of its branches. The general increase and changing nature of the sophisticated needs of a growing customer base necessitated the simultaneous geographical spread of the branches to enable the bank provide effective and efficient services nationwide.

Also as a deliberate policy, the bank own's majority of the buildings from which it operates branches and area offices. Today bank of the North Limited has about 100-branch network nationwide.

In developing the branch network, conscious emphasis was placed on acquiring suitable premises which provide a conducive and pleasant atmosphere for business transactions. These branches are equipped with modern information technology to facilitate instant communication and ease of contact between the branches, the head office and the correspondent bank worldwide.

1.2.2 SERVICES:

The bank's philosophy is driven by the need to assist in the growth and transformation of the business and commercial activities of the people. These cover

mainly general merchandising, produce buying and transportation. The primary objective from inception was to assist their ultimate graduation to become owners and operators of organized, industrial, commercial and manufacturing concerns. To this end, the bank continues to develop suitable and cost effective services tailored to meet the identified and ever-changing needs of its customer. Over the last forty years therefore, the hitherto strict provision of trade and agricultural finance has been developed and diversified to accommodate different and specialized forms of financing. Here is a checklist of these services.

1.2.2 A PERSONAL LOANS

The bank provides short-term personal loans to individual account holders. This facility enables them to tide over immediate financial needs of a temporary nature or purchase of consumer durables.

1.2.2B THE OVERDRAFT

The revolving facility is available to corporate customers to meet any short fall in their working capital requirements. It is a very flexible and cheap source of finance as customers are charged interest only for the amount utilized periodically.

1.2.2C PROJECT FINANCING

The bank provides finances to back up different types of viable projects especially in agriculture, manufacturing and exports. These funds are arranged as short, medium and long term loans with attractive interest margins.

1.2.2D LOAN SYNDICATION

For sizeable credit requirements, syndication is arranged. Given the strategies strength, reputation and performance profile of Bank of the North Limited, it is able to

deploy its clout to arrange loan syndication for sizeable credit requirements. Packaging of such financing is done with minimum delay.

1.2.2E AGRICULTURAL FINANCE

The response of Bank of the North Limited to the encouragement and priority attention government accords agricultural activities. Indeed, the nature and extent of the bank's rural branch network has afforded large-scale farmers access to its agricultural finances scheme with ease.

1.2.2F HOUSING/ VEHICLE LOAN SCHEME

Soft loans are granted deserving customers for the purchase or development of their own residential accommodation. Collateral is usually the house to be built or purchased. The bank will also grant vehicle loans to deserving employers for on lending to their employers.

1.2.2G FINANCIAL ADVISORY SERVICE

Bank of the North Limited ensures that its customers enjoy free access to professional advice on how best to handle their financial matters at no cost. Thus, ranging from the setting up of new projects, acquiring new ones. Capital restructuring, mergers, reorganization, equipment leasing etc. Bank of the North Limited is on hand always to put its professional team at the disposal of all cherished customers.

1.2.2H IMPORTS

Bank of he North Limited is an authorized dealer and an active participant in the foreign exchange market. It will open letters of credit and get them confirmed through its correspondent banks around the world. The bank also accepts proceeds

on behalf of the exporters for goods consigned to Nigerian importers on collocation basis.

1.3.3 DOMICILIARY ACCOUNTS

Deposits in foreign currency are accepted to the credit of customer's account. Interest on such accounts is paid in foreign currency and a prevailing rate. With draws and transfers are quick and are conducted with confidentiality. Bank of the North Limited also purchase foreign currencies from customer's domiciliary accounts at competitive rates.

1.1.4 GROWTH PROFILE (FORTY YEARS ON)

Bank of the North Limited to day stands out as one of the premier finance institutions that has weathered the volatile business storms which have characterized the Nigeria banking industry. Without doubt, it can be safely asserted that forty years on, the bank has come of age and has since commenced the affirmation of a good life for its shareholders and staff members alike.

In its history, bank of the North Limited has had the good fortune of having been managed by some of the best and selfless professional hands in the business. From its historical antecedents, this was an institution that was consistently powered by the dream and vision of it founding father, conceived to play a leading role in the emerging business terrain of its primary region the North and the country as a whole.

CHAPTER TWO (PRELIMINARIES)

2.1 LITERATURE

Many statistical procedures have been introduced into various fields of human endeavor such as agriculture, education, engineering, medicine business, insurance, physical and natural sciences. Some of these procedures aim at predicting or measuring the relationship between the factor to successive days, months and years.

Kingsley M. Nsini carried out time series analysis of (daily stock prices) and came out with the conclusion that the first and the last six month of the range of analysis has no estimated trend. Also according to E. A. Edem of the research department of merchant bank of Nigeria, Calabar, who carried out the same research on time series analysis of monthly deposit acquisition for a period of five years from 1977 to 1982, he employed additive model and discovered that the deposition in the bank was rising. He went on to assert that upward trend would indicate a rise on the value of deposits.

"History is bank", said Henry Ford, when he and his company proceeded to relinquish its control of the automobile market by failing to learn from the past mistakes. By studying historical time series data, patterns are often revealed that give insight into business and economic decision-making performance.

It is important at this juncture to note that among the various research work carried out in this areas or related ones, nothing have been said of residual analysis which is paramount in forecasting and it is this area that time series is mainly aimed at.

For this research, we will use computer programme to analyze the residual. In short residual analysis is the one that involves the goodness of fit test. Putting a suitable stochastic model to the income data and forecasting is the main areas of our interest in this research work.

2.2 SCOPE OF THE STUDY

This research work is restricted to bank of the North Limited, Kwali, Located at Kwali Area Council, Abuja. Some basic and most important fact about the bank are considered in this study. For example the monthly deposit in the bank. Basically for this work, we will limit ourselves to savings, fixed and demand deposits, which will generally referred to as "deposits". The period under study is between 1991 to 2000 which is an interval of ten years.

2.3 METHODS OF DATA COLLECTION

Data can be defined as the facts about an establishment. Basically there are two types of data collection they are: primary data collection and secondary data collection. Primary is the one collected directly in which the researcher produce a questionnaire and from the collection of the questionnaires he deduce result, while secondary is the data generated using various ways such ass library and records.

Therefore the secondary data collection was the major way by which data used for this project were collected by using the following:

- i. Official records and documents were extracted mainly from the monthly reports, annual reports and article of association.
- ii. Library was also consulted to pile up the material for this research work.

2.4 IMPORTANCE OF TIME SERIES

There are two principal reasons for studying time series data:

1. To understand and explain the past.
2. To predict and plan for the future.

By studying historical time series data, patterns are often revealed that gives insight into business and economic decision-making performance.

The knowledge gained from studying past data helps us, in turn to forecast the future. All decision-making is concerned with future events. Future sales influence virtually every measure of a company's performance earnings, cash flow, dividends etc. By anticipating the movement of sales and related variable, the decision maker can better plan and control for the company's/ establishments needs; inventory needs, personnel requirements, capital investments all the decision areas critical to business success. Economic forecasting is a vital part of government planning. The prediction of income price inflation and unemployment are just three of the major prognoses affecting government policies at the Local, State and national levels. In short, it is difficult to over state the importance of careful time series analysis.

CHAPTER THREE (THE MATHEMATICAL MODEL)

3.1 MATHEMATICAL MODEL:

A model is not an arbitrary construction rather is it specification made formal and specific to the investigation. The two mathematical models used in the time series analysis are the multiplicative model and additive model. The multiplicative model is in the form $Y = T \times C \times S \times I$ in the multiplicative model, the (long – term) trend sets the general level of the series. This value is then inflated deflated by the value of the shorter – term components C. S. And I. The additive model form is represented by $Y = T + S + C + I$.

LEGENDS

Y = original or observed values. For example sales as recorded by the bank.

T = Trend that is the relatively long- term movement, indicating the general direction of the change of values.

S = Seasonal effect or variation which is a short time recurring pattern determined by external factors. The most suitable examples are sales or deposits affected by the season such as ice cream selling during the summer, railway tickets at holiday time etc. seasonal movements are confined to changes produced by the natural seasons. The traffic on some major roads usually follows a pattern, which repeats itself weekly. For example, there is always a traffic jam on Friday evening and a reduction on the Sunday morning also some firm's accounts tend to a pattern of one month's duration, reaching a peak towards the end of the month. All these are regarded as seasonal.

C = Cyclical variation is of longer duration than seasonal and the pattern tends to be less rigid. An example is the "measles cycles" – There is tendency for number of cases of measles to reach peak every second year. Cyclical movement tend to be self-generating, the causes bring about the upward rise presently entailing effects which reverse the tendency. In a free economy, the slump naturally follows hyper-inflation.

I = Random residual or irregular. In most business situations T S and C are unlikely to account completely for Y.

The difference are describe by irregular movements. Before applying this simple analysis to a time series, an abnormal or unusual events be put into consideration. For example tax change will automatically affects the sale of a product and also strike action will affect production.

In order to choose an appropriate model for time series, time series plot of original data is obtained and certain observations made with regard to variation in the data. The plot will suggest the model to be adopted. In applying the additive model, assumptions must be that T. S. and C are mutually independent and that each follows a fixed pattern of the period of time under review must be made. In practice the assumptions may be unjustified and more complex methods may need to be followed. But for this research work, multiplicative model will be used.

The multiplicative seasonal model is appropriate for the time series analysis in which the height of the seasonal pattern is proportional to the average level of the series.

3.2. COMPONENTS OF TIME SERIES ANALYSIS.

Most data such as population, bank deposit sales and profits are of important in the fields of economic statistics, when these data are segregated by days, months or years we would find out that the variable under investigation is fluctuation from time to time. Composite forces that are constantly at work cause these fluctuations. Many business and economic time series share these certain basic composite forces or characteristics called components. These include:

- (I) Trend
- (II) Cycle
- (III) Seasonal
- (IV) Irregular.

3.1 TREND

The trend in a time series is the long – term pattern of movement. In business, long – term usually means an interval of several years or more. The purpose of trend analysis is to describe the broad pattern without attempting to capture short- term detail. Simple curves like the straight line give the proper description of long – term trend. Once a graph has been drawn, the next step in analysis is to identify, measure and if need be eliminate the trend. The following are the main methods available:

1. Free hand curve
2. The method of semi- average
3. Mathematically based trends
4. Moving average trends.

Trend occurs when a series contains a smoothly increase or decrease in components. This study revealed that most of the series have a natural tendency to increase or decrease over a period of time. This is true most especially in economics, business statistics like that of bank deposits

3.2.2 CYCLE

Many time series exhibit a clear pattern of rise and decline, a wave- like movement like those in trigonometry. In business and economics we often associate this cyclical behavior with alternating levels of business activity. The business activity. The business cycle is an oscillating pattern that repeats at irregular interval usually between three and ten years. Moreover, the intensity, or amplitude, of the cycle varies from one period to another, with shorter cycles typically displaying less-extreme " peaks" and " troughs" in general, the business cycle is difficult to analysis, and experts in business and economics frequently disagree on the timing and prediction if cyclical effects.

3.2.3. SEASONAL

Seasonality is one type of cyclical behavior that is regular and relatively predictable. The seasonal

Components of a time series accounts for patterns of fluctuation that are tied to the events of the calendar year. For instance, a persons checking account balance is likely to follow a recurring pattern if he or she is paid once each month. Similarly, a

restaurant may experience a predictable pattern of business each week, with traffic peaking on weekends.

3.2.4 IRREGULAR

The actual value of a time series in a given period is finally determined by a fourth factor, the irregular component. The irregular component is viewed as the cumulative contribution of many factors, the effects of which cannot be anticipated. These may include weather conditions, political movements, labour difficulties, and many other occurrences. Graphically, the irregular component appears as a sequence of random fluctuations. A time series of this type is sometimes called "whiter noise" or simply "noise". This expression originated in engineering descriptions of electrical signals that contain no discernable pattern.

3.3 SMOOTHING OF THE SERIES

In something the time series we have four main method these includes:

1. Free hand curve.
2. Method of semi-averages.
3. Mathematically based trends.
4. Moving average trends.

For this research work we will employ the method of moving average trends.

Moving averages have the property that it trend reduce the amount of variation present in a set of data. In the case of time series this property is used to eliminate unwanted fluctuations and the process is called the smoothing of time series.

3.3.1 MOVING AVERAGES

Moving averages are smoothed values of time series that result from averaging the values of the series over successive time interval. Example given a set of numbers $U_1 U_2 \dots U_N \dots$ (1)

We define a moving average of Nth order to be the sequence of arithmetical means.

$$U_1 = \frac{U_1 + U_2 + \dots + U_N}{N}, \quad U_2 = \frac{U_2 + U_3 + \dots + U_{N+1}}{N}, \quad U_3 = \frac{U_3 + U_4 + \dots + U_{N+2}}{N}$$

The total number in the numerators of sequence (2) are called moving average total of order N.

3.3.2 DESEASONALIZED DATA

If the original monthly data are divided by the corresponding seasonal index numbers, (a set of numbers showing relative values of a variable during the month of the year) the resulting data are said to be deseasonalized or adjusted for seasonal variation. Such data includes trend, cyclical and irregular variation (residual fluctuations). This is only true for the multiplication model. But for additive model, the seasonal index should be subtracted from the corresponding original monthly data. The data obtained from this subtraction is said to be deseasonalized.

3.3.3. FORECASTING

Projecting future trends is an essential, but hazardous, business. When the time series is well behaved, we can use simple models to make routine predictions. But the successful forecaster will always watch for signs of change, signals that past patterns do not apply to the future. Forecasting requires a study of the past, comparison with the present and prediction for the future. One must realize, of course that mathematical treatment of data does not itself solve all the problems but coupled together with common sense, experience, ingenuity and good judgment, mathematical analysis has proved valuable, both in long range and short range forecasting.

CHAPTER FOUR ANALYSIS

4.1 INTRODUCTION OF THE ANALYSIS

Production, Sales and profit are some of the goals of private business. In the pursuit of these goals, management must plan for to future making forecasts or predictions. Valid fore its can is made only after management has a thorough understanding of how various conditions affect their business operations. Much of this understanding may be obtained by observing the past, careful examination of past experience reveals much about what must be considered in making forecasts and planning future operations.

A retail business may examine the pattern, of sales over several years in order to plan for the expecting season/ variation. Management may also consider how various economic factors such as inflation, unemployment, interest rates etc, affect retail sales. This may require a study of the past, comparison with the present and prediction for the future.

Analyzing information for previous time periods is the subject of time series analysis the analysis of time series simply means the composition of the time series variable Y, is a product of the variables T, C, S and I that produce the Trent, cyclic, seasonal and irregular movements respectively .in symbolic, $Y = T \times C \times S \times I = TCSI$ -----(I).

Time series analysis amount investigating the time actors T, C, S and I is often referred to as the composition of time series into this basic component movement. of

Examples includes the estimation of seasonal variation (movement), estimation of trend etc.

4.2 ANALYSIS OF COMPONENTS

There are four main component of time series, which are often classified as following:-

- (1) Secular Movement
- (2) Cyclic Variation (movement)
- (3) Seasonal Variation (movement)
- (4) Random Movement

These can be analyzed depending on the type of data available. For the research work, our analysis will be based on using under listed points.

4.3 ESTIMATION OF SEASONAL VARIATION AND DESEASONALIZED OF DATA

Most data are normally expressed in annual form, do not have seasonal variation. However, it comes into play quite strongly when the data is expressed in months or quarters. Before we can statistically describe a pattern of seasonal variations we must separate our data from the varying effects of the trend, cyclical and irregular variation.

Afterwards we can calculate a measure of seasonal variation in index form which is generally called seasonal index.

To determine the seasonal factors, S , the seasonal indices must be calculated. The seasonal index for a variable is a set of numbers showing relative values of a variable during the months of the year.

By and large, there are various methods in which seasonal variation can be measured, they are:

(1) Average Percentage Method,

(2) Ratio to moving average method

(3) Average Percentage Method: The data for each month are expressed as percentage of average for the year. The percentage for corresponding months of different year are then average using whether a mean or media.

(11) In the Ratio to Trend method, the data for each month are expressed as percentage of monthly trend values. An appropriate average of the percentages for corresponding months then gives the required index.

(111) Ratio to moving Average method is the most generally satisfactory way devised for measuring seasonal variation. This method is also known as the **PERCENTAGE MOVING AVERAGE METHOD**.

Below are the procedures:

(1) A 12 months moving total of the original data computed .

(11) We compute 2 month moving total of that of 12 month moving average results.

(111) Calculating 12 month centered moving averages by dividing the 2 month moving total by 24.

(I) Divide each of the actual monthly deposits by the corresponding 12 month centered and express the result as a percentage.

The Average percentage is obtained for each month in the various years by using median. The seasonal index is given by the medium.

4.3 ESTIMATION OF TREND.

The estimation of trend can be achieved by the following methods.

- (i) Method of Least Squares.
- (i) Free – Hand Method
- (ii) Moving Averages Method
- (iii) Method of semi average

(iv) METHOD OF LEAST SQUARES:

This is a mathematics method extensively employed for fitting the trend to time series which approximated to a straight line trend. Linear relationship of this kind is usually represented by an equation of first degree.

$$Y = a + bx$$

If the independent variable X is time, the data should the values of Y at various time, considered two various X and Y such that Y depends on X, where Y could be referred to as the monthly deposit and x being the actual values.

In a sample $[x_1, y_1], [x_2, y_2] \dots [x_n, y_n]$ of sizes n is draw from the joint distribution of x and y.

This relationship is called regression and present this linear regression of y and x.

The regression line of y and x is often called a trend line ; 'b' represent the intercept And 'a' the slope of the trend line.

If we substitute in the equation any value of x, we can derive a value for y, hence

It is often used for prediction.

THE MODEL

$Y = a + bx$ where a and b are constant the researcher decided to use an alternate method for estimation x and y .

Assumption

Let y_i denotes the deviation of y and $y = y_i - y_y$ where $i=0,1,2,3, n - 1 = y$.

(ii) FREEHAND METHOD.

Here, a sketching through the middle of fluctuation is done, simply looking at the graph. The method has a disadvantage of depending too much on individual judgement.

(iii) MOVING AVERAGE METHOD

This is an artificially constructed time series in which each annual figure is replaced by the average. This is the mean of itself and values that correspond to a number of preceding and succeeding periods. This is based solely on the substitution of the original set of observations with a smoother series.

To compute the moving average, the first step is to calculate the moving totals, which is done by summing the values over the assigned period. The assigned period (X), say 12 months, 5 months etc. is then denoted as the N – point moving total.

Given a set of observation $Y_1, Y_2, Y_3 \dots Y_n$ we define a moving average of order N to the sequence of arithmetic means.

$$\frac{Y_1 + Y_2 + Y_3 + \dots + Y_N}{N} \quad \frac{Y_2 + Y_3 + Y_4 + \dots + Y_{N+1}}{N}$$
$$\frac{Y_3 + Y_4 + Y_5 + \dots + Y_{N+2}}{N}$$

The sums in the numerators are called the moving totals. When the moving average have been calculated, such is moving average.

In addition, when N is odd the moving average falls against a particular observation or time point in the original data, these are centered moving averages. But when N is even, then to obtain moving averages, it will fall against particular time points, we take (again) then we precede to take two points moving average of the N- point moving average .

A disadvantage with this is that at the beginning and end of a series, data are lost, also it generate cycles or other movements, which are not present in the original data.

(iv) SEMI AVERAGE METHOD.

Here the data is separated into two equal parts, data is the arranged in each part, this obtaining two points on the graph of he time series. A trend line.

PRESENTATION OF DATA

(i) ESTIMATION OF SEASONAL VARIATION.

YEAR	MONTH	ORIGINALS	12MMT	2MMT	2CMV
1993	0	54.40	0.00	0.00	0.00
	1	61.40	0.00	0.00	0.00
	2	44.39	0.00	0.00	0.00
	3	49.40	0.00	0.00	0.00
	4	59.37	0.00	0.00	0.00

	5	48.37	0.00	0.00	0.00
	6	59.40	718.54	0.00	59.35
	7	59.48	725.70	1447.64	60.32
	8	68.28	757.57	1486.27	61.23
	9	73.03	777.39	1534.96	63.96
	10	74.30	792.82	1590.22	65.43
	11	53.70	814.26	1607.09	66.96
1994	12	67.80	1877.23	1641.49	68.00
	13	71.18	842.58	1669.81	69.50
	14	73.26	850.72	1693.30	70.55
	15	69.22	855.95	1706.07	71.11
	16	74.81	860.38	1716.33	71.51
	17	09.80	869.12	1729.50	72.06
	18	72.37	870.33	1729.12	72.48
	19	74.83	873.06	1739.50	72.64
	20	76.42	877.20	1750.26	72.93
	21	78.26	886.87	1764.07	73.50
	22	78.73	880.55	7767.42	73.64
	23	62.46	853.73	1734.28	72.26
1995	24	69.01	849.56	1703.29	70.97
	25	73.89	853.13	1702.69	70.97
	26	77.40	857.44	1710.57	71.27
	27	78.89	862.36	1719.80	71.66

	28	68.49	869.25	1731.61	72.15
	29	42.98	888.69	1757.94	73.25
	30	68.20	890.99	1779.68	74.15
	31	78.40	889.30	1780.29	74.18
	32	80.73	881.70	1771.00	73.79
	33	83.18	881.10	1762.80	73.45
	34	85.62	893.95	1775.05	73.96
	35	81.90	934.83	1828.78	76.20
1996	36	71.31	952.98	1887.81	78.66
	37	72.20	967.98	1920.96	80.04
	38	69.80	984.03	1952.01	81.33
	39	78.29	998.01	1982.04	82.58
	40	81.34	1012.20	2010.21	83.76
	41	83.86	1020.28	2032.48	84.69
	42	86.35	1070.77	2091.05	87.13
	43	93.40	1147.37	2218.14	92.42
	44	96.78	1510.37	2657.74	110.74
	45	97.16	1756.09	3266.46	136.10
	46	99.81	2174.25	3930.34	163.76
	47	89.98	2668.59	4842.84	210.78
1997	48	121.80	3255.13	5923.72	246.82
	49	148.80	3885.53	7140.66	297.53
	50	432.80	4532.35	8417.88	350.74

	51	324.01	5183.79	9716.14	404.84
	52	499.50	5870.70	11054.49	460.60
	53	578.20	6628.95	12499.65	520.82
	54	672.89	7528.36	14157.31	589.89
	55	723.80	8492.80	16021.16	667.55
	56	743.60	9073.27	17566.07	731.92
	57	748.60	9838.47	18911.74	787.99
	58	786.72	10228.21	20066.68	836.11
	59	848.23	10733.35	20961.56	873.40
1998	60	1021.21	11155.32	21888.67	912.30
	61	1113.24	11547.94	22703.26	945.97
	62	1013.27	11942.98	23490.92	978.79
	63	1089.21	12331.24	24274.22	1011.43
	64	889.24	12718.30	25049.54	1043.73
	65	1083.34	12969.08	25687.38	1070.31
	66	1094.86	13063.89	26032.97	1084.71
	67	1116.42	13283.37	26247.26	1093.64
	68	1138.64	13219.74	26403.11	1100.13
	69	1136.86	13484.87	26704.61	1112.69
	70	1173.78	13311.42	26796.29	1116.51
	71	1099.01	13190.73	26502.15	1104.26
1999	72	1116.02	13591.27	26782.00	1115.92
	73	1232.72	14006.93	27598.20	1149.93

	74	1049.64	14541.92	28548.85	1189.54
	75	1354.34	15389.59	29931.51	1247.15
	76	715.79	15818.40	31207.99	1300.33
	77	962.65	16042.01	31860.41	1327.52
	78	1495.40	16184.07	32226.08	1342.75
	79	1532.08	16214.07	32398.14	1349.92
	80	1673.63	16428.26	32642.33	1360.10
	81	1984.53	16357.60	32785.86	1366.08
	82	1602.59	16817.56	33175.16	1382.30
	83	1322.62	17743.33	34560.89	1440.04
2000	84	1258.08	17923.65	35666.98	1486.12
	85	1262.72	17922.62	35846.27	1493.59
	86	1263.83	17874.84	35797.46	1491.56
	87	1283.68	17520.84	35395.68	1474.82
	88	1175.75	17185.25	34706.09	1446.09
	89	1888.42	17323.45	34508.70	1437.86
	90	1675.72	18258.29	35061.74	1460.91
	91	1532.05	18258.26	35996.55	1499.86
	92	1625.85	18876.05	37134.31	1547.26
	93	1630.53	19476.15	38352.20	1598.01
	94	1267.00	20217.18	39693.33	1653.89
	95	1460.82	35448.49	55665.67	2319.40
2001	96	1672.92	53758.26	89206.75	3716.95

	97	1782.69	74251.93	128010.19	5333.76
	98	1881.62	91298.73	165550.66	6897.94
	99	1883.78	109392.01	200690.73	8362.11
	100	1916.78	127957.52	237349.53	9889.56
	101	17119.73	142231.42	270188.94	11257.87
	102	19985.49	156391.14	298622.56	12442.61
	103	22024.72	170944.39	327335.53	13638.98
	104	18672.65	183197.47	354141.88	14755.91
	105	19723.81	195651.63	378849.09	15785.38
	106	19832.51	208652.13	404603.75	16858.49
	107	15734.73	208774.06	417726.219	17405.26
2002	108	15832.63	206984.63	415758.69	17323.28
	109	16335.95	203224.95	410209.56	17092.06
	110	14134.68	202897.97	406122.94	16921.79
	111	14337.93	201617.27	404515.25	16854.80
	112	15217.28	200187.87	401805.25	16741.88
	113	16941.68	200798.91	400986.88	16707.79
	114	18196.03	184966.28	385765.19	16073.55
	115	18265.05	168630.34	353596.63	14733.19
	116	18345.70	154495.66	323126.00	13463.58
	117	18443.10	140157.72	294653.38	12277.22
	118	18403.20	124940.45	265098.16	11045.76
	119	16345.68	107998.76	232939.20	9705.80

can then be drawn between those two points and the trend values can then be determined. However, this method is easy to apply but can only be used where the trend is approximately linear.

4.5 RESIDUAL ANALYSIS:

To obtain the residuals, that is the irregular variation the researcher adjusted the original data for seasonal variation. The data adjusted for seasonal variation is again adjusted for trend.

The following are procedures to obtain residual:

1. Dividing each of the monthly deposition tables by the corresponding seasonal index, to obtain the adjusted data for seasonal variation result.
2. Dividing each entry in adjusted data for seasonal variation result by corresponding monthly trend value to obtain adjusted data for trend.
3. Subtraction 100 from each of the monthly values in adjusted data for trend to obtain the residual.

4.6 FORECASTING:

In Business, forecasting is inevitable, to be able to do this effectively a record of Past event is very necessary, the choice of a particular forecasting procedure depends on many factors, for example the purpose of the forecast and the degree of accuracy required by definition forecasting is simple an array of information that helps in reaching a decision, and estimating, future conditions are made on a systematic basis and the figures or statement is referred to as forecasting and the figures or statement obtained to known as a forecasting. The procedures of forecasting can be classified into three broad categories.

$$\sum_{i=1}^N (x_i^2) = \sum (x_i - \bar{x})^2 + n\bar{x}^2$$

(i) SUBJECTIVE:

Forecast made by using judgment, Instruction commercial knowledge and any other information.

(ii) UNVARIATE:

This type is based on past observation in a given time series by fitting a model extrapolating.

(iii) MULTIVARIATE:

Forecast made by taking observation on other variable into account.

(iv) FORECASTING USING TREND AND SEASONAL INDEX

Here the researcher used the projected trend values and the seasonal index in forecasting. This was accomplished by projecting the trend line into future expecting that the corresponding value to each month was then read which was the trend valued for the respective months. The corresponding monthly trend value was multiplied by the corresponding monthly seasonal index.

For example, the forecasted deposit for the month of September, 1998 is calculate be multiplying the trend value by the corresponding month seasonal index (s) to obtain the forecasted value for that month

CHAPTER FIVE (PROGRAMMING IMPLEMENTATION)

5.1 PROGRAMMING AND IMPLEMENTATION

This chapter discusses the results obtained from the application of the software developed for the "Application of computer on Time series Analysis on deposits Acquisition; case study; Bank of the North Limited, Kwali, Abuja. This involves the program implementation of the software.

5.1.1 SYSTEM IMPLEMENTATION

This program did not stop at the system design stage alone, it is also required that it should be put into useable form that the computer can understand.

The programming language used for this project is Quick Basic

System implementation could be simply defined as the execution of designed elements and programs. These elements are then implemented. The process of putting the new system into use and the process of maintaining the new system is referred to as programming implementation.

Programs must of necessity be subject to trial runs with data, consisting of both valid and invalid data for the purpose of ensuring that this program can contend with all possible eventualities. Corrections are done either to the programs or to the system which are then subjected to further trials. Basically implementation also involves the cooperation of the efforts of the users in getting the new system into operation.

This chapter deals with the implementation process from making the new system error free to the time when it is fully used as well as its full documentation.

5.1.1. SYSTEM DEBUGGING AND TESTING

This involves executing a system on a life or artificial test data set to detect any faults or errors with the aim of correcting them. The test data are the data that have been supplied to show how the program works. The test data have been written in accordance with the program instructions. During the development of the system, the process of debugging is carried out in two phases.

(A) SYSTEM TESTING

Where the working capability of the whole system was tested using life and artificial data sets and the interaction between the modules were accessed.

(B) MODULE TESTING

Each module was debugged and tested on a life and artificial data sets to ensure that it works as required. The testing of this package was best done by running it on the computer.

5.1.2 PROGRAM CODING

The actual set of instructions which the computer has to follow (program) in the computerized system is attached.

5.1.3. PROGRAM DOCUMENTATION

The program is written in a modular form, having a main program through which each of the rest sub-programs used in the main program can be accessed, a marked selection and documentation is displayed enlightening the use on what can be done, how it can be accomplished by taking the right option.

5. 1. 4. PROGRAM MAINTENANCE

It is very important that every application package be maintained in order to make it relevant, otherwise obsolete will render it unworkable. Operational changes, customizing of packages, correction of errors, end-user demand for additional features, report or information as well as programming errors are some other common causes of program maintenance..

For this purpose, the computerized forecasting procedures have been written in modules to make the program easy to maintain.

5.2. SUMMARY AND CONCLUSION

The following conclusions can be deduced from this study :

1. There is a very high rate in the volume of deposits yearly and there is also a reduction in the volume of deposits just before Christmas, Islamic festivities and summer holidays.
2. The forecasted values are fairly accurate since the monthly residual Fluctuation is within the mean, meaning that the residuals is stationary and are relatively small. Thus it is unlikely to be seriously influenced by interruptive events, such as strikes, out breaks of war, sudden political or economic waves.

5.3. RECOMMENDATIONS

The recommendations for this research work is as follows:

- (i) The Management of the Bank needs to consider the advanced approach of analysis of time series, where auto regressive processes can be used in forecasting rather than the moving average approach used in this research work.
- (ii) The management should try as much as possible to appreciate their workers, in order to make them more dedicated to their duty and make them more comfortable.
- (iii) There should be a kind of Training involving the customers, where they would stress the importance and disadvantages of deposits with bank and also, they should allays the fear of being distress their customers.
- (iv) There is also need for the management to checkmate the top and make sure that the detail report of the bank is being published at least quarterly.
- (v) Finally, the reason for sudden changes in deposits in the recent years could be traced back to the lack of precautionary measures which was not adopted in time as to check mate the bank activities; which is still affecting many banks and some institutions. Today, this project is a good phenomena which should be strictly and wisely encourage and carried out in institutions of higher learning, hospitals, insurance institution and banks to help them checkmate their activities.

Estimation of Trend

Year	Month	Orig_Data	X=x-x	Y=y-y	XX	XY
	X	y				
1993	0	54.40	-60	-3302.55	3600	198153.00
1993	1	61.40	-59	-3295.55	3481	194437.45
1993	2	44.39	-58	-3312.56	3364	192128.48
1993	3	49.40	-57	-3307.55	3249	188530.35
1993	4	59.37	-56	-3297.58	3136	184664.48
1993	5	48.37	-55	-3308.58	3025	181971.90
1993	6	59.40	-54	-3297.55	2916	178067.70
1993	7	59.48	-53	-3297.47	2809	174765.91
1993	8	68.28	-52	-3288.67	2704	171010.84
1993	9	73.03	-51	-3283.92	2601	167479.92
1993	10	74.30	-50	-3282.65	2500	164132.50
1993	11	53.72	-49	-3303.23	2401	161858.27
1994	12	67.80	-48	-3289.15	2304	157879.20
1994	13	71.16	-47	-3285.79	2209	154432.13
1994	14	73.26	-46	-3283.69	2116	151049.74
1994	15	69.22	-45	-3287.73	2025	147947.85
1994	16	74.81	-44	-3282.14	1936	144414.16
1994	17	69.80	-43	-3287.15	1849	141347.45
1994	18	72.37	-42	-3284.58	1764	137952.36
1994	19	74.83	-41	-3282.12	1681	134566.92
1994	20	76.42	-40	-3280.53	1600	131221.20
1994	21	78.26	-39	-3278.69	1521	127868.91
1994	22	78.73	-38	-3278.22	1444	124572.36
1994	23	62.46	-37	-3294.49	1369	121896.13
1995	24	69.01	-36	-3287.94	1296	118365.84
1995	25	73.89	-35	-3283.06	1225	114907.10
1995	26	77.40	-34	-3279.55	1156	111504.70
1995	27	78.89	-33	-3278.06	1089	108175.98
1995	28	68.49	-32	-3288.46	1024	105230.72
1995	29	42.98	-31	-3313.97	961	102733.07
1995	30	68.20	-30	-3288.75	900	98662.50
1995	31	78.40	-29	-3278.55	841	95077.95
1995	32	80.73	-28	-3276.22	784	91734.16
1995	33	83.18	-27	-3273.77	729	88391.79
1995	34	85.62	-26	-3271.33	676	85054.58
1995	35	81.90	-25	-3275.05	625	81876.25
1996	36	71.31	-24	-3285.64	576	78855.36
1996	37	72.20	-23	-3284.75	529	75549.25
1996	38	69.80	-22	-3287.15	484	72317.30
1996	39	78.29	-21	-3278.66	441	68851.86
1996	40	81.34	-20	-3275.61	400	65512.20

1996	41	83.86	-19	-3273.09	361	62188.71
1996	42	86.35	-18	-3270.60	324	58870.80
1996	43	93.40	-17	-3263.55	289	55480.35
1996	44	96.78	-16	-3260.17	256	52162.72
1996	45	97.16	-15	-3259.79	225	48896.85
1996	46	99.81	-14	-3257.14	196	45599.96
1996	47	89.98	-13	-3266.97	169	42470.61
1997	48	121.80	-12	-3235.15	144	38821.80
1997	49	148.80	-11	-3208.15	121	35289.65
1997	50	432.80	-10	-2924.15	100	29241.50
1997	51	324.01	-9	-3032.94	81	27296.46
1997	52	499.50	-8	-2857.45	64	22859.60
1997	53	578.20	-7	-2778.75	49	19451.25
1997	54	672.89	-6	-2684.06	36	16104.36
1997	55	723.80	-5	-2633.15	25	13165.75
1997	56	743.60	-4	-2613.35	16	10453.40
1997	57	748.60	-3	-2608.35	9	7825.05
1997	58	786.72	-2	-2570.23	4	5140.46
1997	59	848.23	-1	-2508.72	1	2508.72
1998	60	1021.21	0	-2335.74	0	0.00
1998	61	1113.24	1	-2243.71	1	-2243.71
1998	62	1013.27	2	-2343.68	4	-4687.36
1998	63	1089.21	3	-2267.74	9	-6803.22
1998	64	889.24	4	-2467.71	16	-9870.84
1998	65	1083.34	5	-2273.61	25	-11368.05
1998	66	1094.86	6	-2262.09	36	-13572.54
1998	67	1116.42	7	-2240.53	49	-15683.71
1998	68	1138.64	8	-2218.31	64	-17746.48
1998	69	1136.86	9	-2220.09	81	-19980.81
1998	70	1173.78	10	-2183.17	100	-21831.70
1998	71	1099.01	11	-2257.94	121	-24837.34
1999	72	1116.02	12	-2240.93	144	-26891.16
1999	73	1232.72	13	-2124.23	169	-27614.99
1999	74	1049.64	14	-2307.31	196	-32302.34
1999	75	1354.34	15	-2002.61	225	-30039.15
1999	76	715.79	16	-2641.16	256	-42258.56
1999	77	962.65	17	-2394.30	289	-40703.10
1999	78	1495.40	18	-1861.55	324	-33507.90
1999	79	1532.08	19	-1824.87	361	-34672.53
1999	80	1673.63	20	-1683.32	400	-33666.40
1999	81	1984.53	21	-1372.42	441	-28820.82
1999	82	1602.59	22	-1754.36	484	-38595.92
1999	83	1322.62	23	-2034.33	529	-46789.59

2000	84	1258.08	24	-2098.87	576	-50372.88
2000	85	1262.72	25	-2094.23	625	-52355.75
2000	86	1263.83	26	-2093.12	676	-54421.12
2000	87	1283.68	27	-2073.27	729	-55978.29
2000	88	1175.75	28	-2181.20	784	-61073.60
2000	89	1888.42	29	-1468.53	841	-42587.37
2000	90	1675.72	30	-1681.23	900	-50436.90
2000	91	1531.05	31	-1825.90	961	-56602.90
2000	92	1625.85	32	-1731.10	1024	-55395.20
2000	93	1630.53	33	-1726.42	1089	-56971.86
2000	94	1267.00	34	-2089.95	1156	-71058.30
2000	95	1460.82	35	-1896.13	1225	-66364.55
2001	96	1672.92	36	-1684.03	1296	-60625.08
2001	97	1782.69	37	-1574.26	1369	-58247.62
2001	98	1881.62	38	-1475.33	1444	-56062.54
2001	99	1883.78	39	-1473.17	1521	-57453.63
2001	100	1916.78	40	-1440.17	1600	-57606.80
2001	101	17119.73	41	13762.78	1681	564273.98
2001	102	19985.49	42	16628.54	1764	698398.68
2001	103	22024.72	43	18667.77	1849	802714.11
2001	104	18672.65	44	15315.70	1936	673890.80
2001	105	19723.81	45	16366.86	2025	736508.70
2001	106	19832.51	46	16475.56	2116	757875.76
2001	107	15734.73	47	12377.78	2209	581755.66
2002	108	15832.63	48	12475.68	2304	598832.64
2002	109	16335.95	49	12979.00	2401	635971.00
2002	110	14134.68	50	10777.73	2500	538886.50
2002	111	14337.93	51	10980.98	2601	560029.98
2002	112	15217.28	52	11860.33	2704	616737.16
2002	113	16941.68	53	13584.73	2809	719990.69
2002	114	18196.03	54	14839.08	2916	801310.32
2002	115	18265.05	55	14908.10	3025	819945.50
2002	116	18345.70	56	14988.75	3136	839370.00
2002	117	18443.10	57	15086.15	3249	859910.55
2002	118	18403.20	58	15046.25	3364	872682.50
2002	119	16345.68	59	12988.73	3481	766335.07

Seasonal Index

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993	0.00	0.00	0.00	0.00	0.00	0.00	100.08	98.61	110.26	114.19	113.56	80.22
1994	99.13	102.28	103.84	97.34	104.61	96.86	99.85	103.01	104.79	106.47	106.91	86.44
1995	97.24	104.15	108.60	110.09	94.93	58.68	91.97	105.69	109.40	113.25	115.76	107.48
1996	90.66	90.20	85.82	94.80	97.11	99.02	99.11	101.06	87.39	71.39	60.95	44.59
1997	49.35	50.01	123.39	80.03	108.44	111.02	114.07	108.43	101.60	95.00	94.09	97.12
1998	111.97	117.68	103.52	107.69	85.20	101.22	100.94	102.08	103.50	102.17	105.13	99.52
1999	100.01	107.20	88.24	108.60	55.05	72.52	111.37	113.49	123.05	145.27	115.94	91.85
2000	84.66	84.54	84.73	87.04	81.31	131.34	114.70	102.08	105.08	102.04	76.61	62.98
2001	45.01	33.42	27.28	22.53	19.38	152.07	160.62	161.48	126.54	124.95	117.64	90.40
2002	91.40	95.58	83.53	85.07	90.89	101.40	0.00	0.00	0.00	0.00	0.00	0.00
EDIAN	91.40	95.58	88.24	94.80	90.89	101.22	100.94	103.01	105.08	106.47	106.91	90.40

Estimate of Data

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993	59.52	67.18	48.57	58.05	64.96	52.92	64.99	65.08	74.71	79.91	81.30	58.78
1994	70.94	74.45	76.65	72.42	78.27	73.03	75.72	78.29	79.96	81.88	82.37	65.35
1995	78.21	83.74	87.72	89.40	77.62	48.71	77.29	88.85	91.49	94.27	97.03	92.82
1996	75.22	76.16	73.63	82.58	85.80	88.46	91.09	98.52	102.09	102.49	105.29	94.92
1997	134.00	163.71	476.16	356.47	549.54	636.13	740.31	796.32	818.10	823.60	865.54	933.21
1998	1008.92	1099.85	1001.08	1076.11	878.54	1070.31	1081.69	1102.99	1124.94	1123.18	1159.66	1085.79
1999	1105.67	1221.29	1039.91	1341.78	709.15	953.72	1481.53	1517.87	1658.11	1966.13	1587.73	1310.36
2000	1221.28	1225.79	1226.86	1246.13	1141.36	1833.18	1626.71	1486.27	1578.29	1582.84	1229.94	1418.09
2001	1592.06	1696.52	1790.67	1792.73	1824.13	16292.23	19019.47	20960.13	17770.09	18770.44	18873.88	14974.17
2002	14870.23	15342.96	13275.86	13466.39	14292.29	15911.87	17089.97	17154.80	17230.54	17322.03	17284.55	15352.10

ESTIMATION OF TREND

1993	3322.09	2894.24	3955.76	3488.01	2842.76	3438.36	2739.82	2685.40	2289.04	2095.97	2018.97	2753.74
1994	2225.59	2074.21	1970.62	2042.81	1845.02	1935.45	1821.88	1718.75	1641.15	1561.62	1512.28	1865.26
1995	1513.48	1372.22	1271.21	1209.96	1355.75	2109.15	1276.53	1070.11	1002.67	937.68	876.57	882.14
1996	1048.30	991.97	982.18	833.71	763.53	703.01	646.31	563.12	510.95	477.09	433.11	447.45
1997	289.71	215.56	61.41	76.57	41.60	30.58	21.75	16.53	12.78	9.50	5.94	2.69
1998	0.00	-2.04	-4.68	-6.32	-11.24	-10.62	-12.55	-14.22	-15.78	-17.79	-18.83	-22.87
1999	-24.32	-22.61	-31.06	-22.39	-59.59	-42.68	-22.62	-22.84	-20.30	-14.66	-24.31	-35.71
2000	-41.25	-42.71	-44.36	-44.92	-53.51	-23.23	-31.01	-38.08	-35.10	-35.99	-57.77	-46.80
2001	-38.08	-34.33	-31.31	-32.05	-31.58	34.63	36.72	38.30	37.92	39.24	40.15	38.85
2002	40.27	-41.45	40.59	41.59	43.15	45.25	46.89	47.50	48.71	49.64	50.49	49.92

```
OPEN "Outputl.bas" FOR OUTPUT AS #1
```

```
DIM a(161), mmtl2(120), mmt2 (120), cmal2(120), scaind(120), season(19, 11)
```

```
DIM aa(9), median(11)
```

```
CLS
```

```
FOR i = 0 TO 119  
  READ a(i) NEXT i
```

```
startl2mmt = 0  
start2mmt = 6  
FOR i = 0 TO 119
```

```
  IF i < 5 THEN 10  
  sum = 0
```

```
  FOR k = startl2mmt TO startl2mmt + 11  
    IF k > 119 THEN 5  
    sum = sum + a(k)  
  NEXT k
```

```
5  mmtl2 (i) = sum
```

```
  IF i < 6 THEN 9  
  sum = mmtl2 (i) + mmtl2 (i - 1)  
  mmt2(i) = sum  
  cmal2(i) = sum / 24  
  scaind(i) = (a(i) / cmal2(i)) * 100
```

```
9  startl2mmt = startl2mmt + 1  
10 REM just continue
```

```
NEXT i
```

```
FOR i = 0 TO 9  
  FOR j = 0 TO 11  
    IF (i = 0) AND (j < 6) THEN 70  
    k = i + j  
    mrow = 11 * i + k  
    season(i, j) = (a(mrow) / cmal2(mrow)) * 100  
70 NEXT j
```

```
NEXT i
```

```
myear = 1993
```

```
mcnt = 0
```

```
FOR i = 0 TO 119  
  REM IF cmt = 12 THEN PRINT #1, : myear = myear + 1: cmt = 0  
  IF i = 0 THEN msave = a(i)
```

```
  PRINT #1, USING "#####"; myear,  
  PRINT #1, USING "#####"; i,  
  PRINT #1, USING "#####.##"; a(i),  
  PRINT #1, USING "#####.##"; mmtl2(i),  
  PRINT #1, USING "#####.##"; mmt2(i),  
  PRINT #1, USING "#####.##"; cmal2(i)
```

```
  cnt = cnt + 1  
  IF cnt = 12 THEN PRINT #1, : myear = myear + 1: cnt = 0
```

```
NEXT i
```

```
PRINT #1, " Jan Feb March April May June July August Sept. Oct. Nov. Dec."
```

```
PRINT #1, "=====
```

i = 9

```
FOR j = 6 TO 11
  season(i, j) = 0
NEXT j
```

```
FOR i = 0 TO 9
  PRINT #1,
  PRINT #1, 1993 + i;
  FOR j = 0 TO 11
    PRINT #1, USING "#####.#"; season(i, j);
  NEXT j
NEXT i
```

```
REM *****
PRINT #1, ""
PRINT #1, ""
PRINT #1, "MEDIAN";
```

```
FOR m = 0 TO 11
```

```
  k = 1
```

```
  FOR n = 0 TO 9
    IF season(n, m) > 0 THEN
      aa(k) = season(n, m)
      k = k + 1
    END IF
  NEXT n
```

```
20 FOR i = 1 TO 9
```

```
  FOR j = 2 TO 9
```

```
    IF aa(j) < aa(j - 1) THEN 50 ELSE 72
```

```
50    REM shift base (interchange)
```

```
      temp = aa(j)
```

```
      aa(j) = aa(j - 1)
```

```
      aa(j - 1) = temp
```

```
72    NEXT j
```

```
NEXT i
```

```
PRINT #1, USING "#####.#"; aa(5);
```

```
median(m) = aa(5)
```

```
NEXT m
```

```
myear = 1993
```

```
mcnt = 12
```

```
mmonth = -1
```

```
FOR i = 0 TO 119
```

```
  IF mcnt < 0 THEN 88
```

```
  PRINT #1,
```

```
  PRINT #1, USING "####"; myear,
```

```
  myear = myear + 1
```

```
  mmonth = mmonth + 1
```

```
  mcnt = 0
```

```
madjust = (a(i) * 100)
madjust = madjust /
median(mmonth)
```

```
PRINT #1, USING "#####"; madjust;
```

```
Mcmt mcmt + 1
```

```
NEXT i
```

```
CLOSE #1
```

```
REM *****
```

```
DATA 54.40,61.40,44.39,49.40,59.37,48.37,59.40,59.48,68.28,73.03,74.30,53.72
```

```
DATA 67.80,71.16,73.26,69.22,74.81,69.80,72.37,74.83,76.42,78.26,78.73,62.46
```

```
DATA 69.01,73.89,77.40,78.89,68.49,42.98,68.20,78.40,80.73,83.18,85.62,81.90
```

```
DATA 71.31,72.20,69.80,78.29,81.34,83.86,86.35,93.40,96.78,97.16,99.81,89.98
```

```
DATA 121.80,148.80,432.80,324.01,499.50,578.20,672.89,723.80,743.60,748.60,786.72,848.23
```

```
DATA 1021.21,1113.24,1013.27,1089.21,889.24,1083.34,1094.86,1116.42,1138.64,1136.86,1173.78,1099
```

```
DATA 1116.02,1232.72,1049.64,1354.34,715.79,962.65,1495.40,1532.08,1673.63,1984.53,1602.59,1322.'
```

```
DATA 1258.08,1262.72,1263.83,1283.68,1175.75,1888.42,1675.72,1531.05,1625.85,1630.53,1267,1460.8;
```

```
DATA 1672.92,1782.69,1881.62,1883.78,1916.78,17119.73,19985.49,22024.72,18672.65,19723.81,19832.51,15734.73;
```

```
DATA 15832.63,16335.95,14134.68,14337.93,15217.28,16941.68,18196.03,18265.05
```

```
DATA 18345.70,18443.10,18403.20,16345.68
```

```
END
```

OPEN "output2.bas" FOR OUTPUT AS #1

DIMA(161), mmt12(120), inmt2(120), cma12(120), seaind(120), season(19, 11)

CLS

sumX = 0

SUMY = 0

FOR I = 0 TO 119

 READ A(I)

 SUMY = SUMY + A(I)

 sumX = sumX + I

NEXT I

MEANX = sumX / 119

MEANY = SUMY / 119

MYEAR = 1993

MCNT = 0

FOR I = 0 TO 119

 BIGX = I - MEANX

 BIGY = A(I) - MEANY

 PRINT #1, USING "#####"; MYEAR;

 PRINT #1, USING "#####"; I;

 PRINT #1, USING "#####"; A(I);

 PRINT #1, USING "#####"; BIGX;

 PRINT #1, USING "#####"; BIGY;

 PRINT #1, USING "#####"; BIGX ^ 2;

 PRINT #1, USING "#####"; BIGX * BIGY

 cnt = cnt + 1

 IF cnt = 12 THEN PRINT #1, : MYEAR = MYEAR + 1: CNT = 0

NEXT I

DATA 54.40,61.40,44.39,49.40,59.37,48.37,59.40,59.48,68.28,73.03,74.30,53.72

DATA 67.80,71.16,73.26,69.22,74.81,69.80,72.37,74.83,76.42,78.26,78.73,62.46

DATA 69.01,73.89,77.40,78.89,68.49,42.98,68.20,78.40,80.73,83.18,85.62,81.90

DATA 71.31,72.20,69.80,78.29,81.34,83.86,86.35,93.40,96.78,97.16,99.81,89.98

DATA 121.80,148.80,432.80,324.01,499.50,578.20,672.89,723.80,743.60,748.60,786.72,848.23

DATA 1021.21,1113.24,1013.27,1089.21,889.24,1083.34,1094.86,1116.42,1138.64,1136.86,1173.78,1099.01

DATA 1116.02,1232.72,1049.64,1354.34,715.79,962.65,1495.40,1532.08,1673.63,1984.53,1602.59,1322.62

DATA 1258.08,1262.72,1263.83,1283.68,1175.75,1888.42,1675.72,1531.05,1625.85,1630.53,1267,1460.82

DATA 1672.92,1782.69,1881.62,1883.78,1916.78,17119.73,19985.49,22024.72,18672.65,19723.81,19832.51,15734.73

DATA 15832.63,16335.95,14134.68,14337.93,15217.28,16941.68,18196.03,18265.05

DATA 18345.70,18443.10,18403.20,16345.68

END

```
OPEN "output3.bas" FOR OUTPUT AS #1
```

```
DIMa(161), mmtl2(120), mmt2(120), cmal2(120), seaind(120), season(19, 11)  
DIM aa(9), median(11), madjvar(120), bigxbigy(120)
```

```
CLS
```

```
sumX = 0
```

```
SUMY = 0
```

```
FOR i = 0 TO 119
```

```
  READ a(i)
```

```
  SUMY = SUMY + a(i)
```

```
  sumX = sumX + i
```

```
NEXT i
```

```
MEANX = sumX / 119
```

```
MEANY = SUMY / 119
```

```
myear = 1993
```

```
mcnt = 0
```

```
FOR i = 0 TO 119
```

```
  BIGX = i - MEANX
```

```
  BIGY = a(i) - MEANY
```

```
  bigxbigy(i) = BIGX * BIGY
```

```
  cnt = cnt + 1
```

```
  IF cnt = 12 THEN myear = myear + 1: cnt = 0
```

```
NEXT i
```

```
startl2mmt = 0
```

```
start2mmt = 6 FOR i = 0 TO 119
```

```
  IF i < 5 THEN 10
```

```
  sum = 0
```

```
  FOR k = startl2mmt TO startl2mmt + 11
```

```
    IF k > 119 THEN 5
```

```
    sum = sum + a(k)
```

```
  NEXT k
```

```
5 mmtl2(i) = sum
```

```
  IF i < 6 THEN 9
```

```
  sum = mmtl2(i) + mmtl2(i - 1)
```

```
  rmt2(i) = sum
```

```
  cmal2(i) = sum / 24
```

```
  seaind(i) = (a(i) / cmal2(i)) * 100
```

```
9 startl2inmt = startl2mmt + 1
```

```
10 REM just continue
```

```
NEXT i
```

```
FOR i = 0 TO 9
```

```
  FOR j = 0 TO 11
```

```
    IF (i = 0) AND (j < 6) THEN 70
```

```
    K = i + j
```

```
    mrow = 11 * i + k
```

```
    season(i, j) = (a(mrow) / cmal2(mrow)) * 100
```

```
70 NEXT j
```

```
NEXT i
```

```
myear = 1993
i = 9
FOR j = 6 TO 11
    season(i, j) = 0
NEXT j
```

```
REM *****
```

```
FOR m = 0 TO 11
    K = 1
    FOR n = 0 TO 9
        IF season(n, m) > 0 THEN
            aa(k) = season(n, m)
            K = K + 1
        END IF
    NEXT n
```

```
20
FOR i = 1 TO 9
    FOR j = 2 TO 9
        IF aa(j) < aa(j - 1) THEN 50 ELSE 72
```

```
50     REM shift base (interchange)
        temp = aa(j)
        aa(j) = aa(j - 1)
        aa(j - 1) = temp
```

```
72 NEXT j
NEXT i
median(m) = aa(5)
NEXT m
```

```
myear = 1993
mcent = 12
mmonth = -1
```

```
FOR i = 0 TO 119
    IF mcent <> 12 THEN 88
        myear = myear + 1
        mmonth = mmonth + 1
        mcent = 0
```

```
88
        madjust = (a(i) * 100)
        madjust = madjust / median(mmonth)
        madjvar(i) = madjust
        mcent = mcent + 1
```

```
NEXT i
```

```
myear = 1993
mcent = 12
mmonth = -1
```

```
FOR i = 0 TO 119
    IF mcent <> 12 THEN 99
        PRINT #1,
        PRINT #1, USING "## #"; myear,
        myear = myear + 1
        mmonth = mmonth + 1
        mcent = 0
```

```
9
```

```
PRINT #1, USING "#####"; bigxbigy(i) / madjvar(i);
```

```
      mcnt = mcnt + 1
NEXT i

PRINT #1, " "
PRINT #1, "" FOR i = 0 TO 119
      PRINT #1, USING "#####"; bigxbigy(i) / madjvar(i);
NEXT i

CLOSE #1
REM *****
DATA 54.40,61.40,44.39,49.40,59.37,48.37,59.40,59.48,68.28,73.03,74.30,53.72
DATA 67.80,71.16,73.26,69.22,74.81,69.80,72.37,74.83,76.42,78.26,78.73,62.46
DATA 69.01,73.89,77.40,78.89,68.49,42.98,68.20,78.40,80.73,83.18,85.62,81.90
DATA 71.31,72.20,69.80,78.29,81.34,83.86,86.35,93.40,96.78,97.16,99.81,89.98
DATA 121.80,148.80,432.80,324.01,499.50,578.20,672.89,723.80,743.60,748.60,786.72,848.23
DATA 1021.21,1113.24,1013.27,1089.21,889.24,1083.34,1094.86,1116.42,1138.64,1136.86,1173.78,1099.01
DATA 1116.02,1232.72,1049.64,1354.34,715.79,962.65,1495.40,1532.08,1673.63,1984.53,1602.59,1322.62
DATA 1258.08,1262.72,1263.83,1283.68,1175.75,1888.42,1675.72,1531.05,1625.85,1630.53,1267,1460.82
DATA 1672.92,1782.69,1881.62,1883.78,1916.78,17119.73,19985.49,22024.72,18672.65,19723.81,19832.51,15734.73
DATA 15832.63,16335.95,14134.68,14337.93,15217.28,16941.68,18196.03,18265.05
DATA 18345.70,18443.10,18403.20,16345.68

END
```

```
OPEN "output4.bas" FOR OUTPUT AS #1
```

```
DIMa(161), mmtl2(120), mmt2(120), cmal2(120), seaind(120), season(19, 11)  
DIMaa(9), median(11), madjvar (120), bigxbigy (120)
```

```
CLS
```

```
sumX = 0
```

```
SUMY = 0
```

```
FOR i = 0 TO 119
```

```
    READ a(i)
```

```
    SUMY = SUMY + a(i)
```

```
    sumX = sumX + i
```

```
NEXT i
```

```
MEANX = sumX / 119
```

```
MEANY = SUMY / 119
```

```
myear = 1993
```

```
mcnt = 0
```

```
FOR i = 0 TO 119
```

```
    BIGX = i - MEANX
```

```
    BIGY = a(i) - MEANY
```

```
    bigxbigy(i) = BIGX * BIGY
```

```
    cnt = cnt + 1
```

```
    IF cnt = 12 THEN myear = myear + 1: cnt = 0
```

```
NEXT i
```

```
startl2mmt = 0
```

```
start2inmt = 6
```

```
FOR i = 0 TO 119
```

```
    IF i < 5 THEN 10
```

```
    sum = 0
```

```
    FOR k = startl2mmt TO startl2mmt + 11
```

```
        IF k > 119 THEN 5
```

```
        sum = sum + a (k)
```

```
    NEXT k
```

```
5 mmtl2(i) = sum
```

```
    IF i < 6 THEN 9
```

```
    sum = mmtl2(i) + mmtl2(i - 1)
```

```
    fmm2(i) = sum
```

```
    cmal2(i) = sum / 24
```

```
    seaind(i) = (a(i) / cmal2(i)) * 100
```

```
9 startl2mmt = startl2mmt + 1
```

```
10 REM just continue
```

```
NEXT i
```

```
FOR i = 0 TO 9
```

```
    FOR j = 0 TO 11
```

```
        IF (i = 0) AND (j < 6) THEN 70
```

```
        k = i + j
```

```
        mrow = 11 * i + k
```

```
        season(i, j) = (a(mrow) / cmal2(mrow)) * 100
```

```
70 NEXT j
```

```
NEXT i
```

```

myear = 1993
i = 9
FOR j = 6 TO 11
    season(i, j) = 0
NEXT j

REM *****
FOR m = 0 TO 11
    k = 1
    FOR n = 0 TO 9
        IF season(n, m) > 0 THEN
            aa(k) = season(n, m)
            k = k + 1
        END IF
    NEXT n

20
FOR i = 1 TO 9
    FOR j = 2 TO 9
        IF aa(j) < aa(j - 1) THEN 50 ELSE 72

50    REM shift base (interchange)
        temp = aa(j)
        aa(j) = aa(j - 1)
        aa(j - 1) = temp
72 NEXT j
NEXT i
median(m) = aa(5)
NEXT m

myear = 1993
mcnt = 12
mmonth = -1

FOR i = 0 TO 119
    IF mcnt <> 12 THEN 88
        myear = myear + 1
        mmonth = mmonth + 1
        mcnt = 0

88    madjust = (a(i) * 100)
        madjust = madjust / median(mmonth)
        madjvar(i) = madjust
        mcnt = mcnt + 1
NEXT i

myear = 1993
mcnt = 12
mmonth = -1

FOR i = 0 TO 119
    IF mcnt <> 12 THEN 99
        PRINT #1,
        PRINT #1, USING "### #"; myear,
        myear = myear + 1
        mmonth = mmonth + 1
        mcnt = 0

```

```

OPEN "output5.bas"
FOR OUTPUT AS #1
DIM a(161), mmt12(120), mmt2(120), seaind(120), season(19, 11)
DIM aa(11), median(11), madjvar(120), bigxbigy(120)
CLS
sumX = 0
sumY = 0
FOR i = 0 TO 119
  READ a(i)
  SUMY = SUMY + a(i)
  sumX = sumX + i
NEXT i
MEANX = sumX / 119
MEANY = SUMY / 119
myear = 1993
mcnt = 0
FOR i = 0 TO 119
  BIGX = 1 - MEANX
  BIGY = a(i) - MEANY
  Bigxbigy(i) = BIGX * BIGY
  cnt = cnt + 12
  IF cnt = 12 THEN myear = myear + 1: cnt = 0
NEXT i
start12mmt = 0
start12mmt = 6
FOR i = 0 TO 119
  IF i < 5 THEN 10
  sum = 0
  FOR k = start12mmt TO start12mmt + 11
    IF k > 119 THEN 5
    Sum = sum + a(k)
  NEXT k
5  mmt12(i) = sum
  IF i < 6 THEN 9
  sum = mmt12(i) + mmt12(i - 1)
  mmnt2 (i) = sum
  cma12(i) = sum / 24
  seaind(i) = (a(i) / cma12(i)) * 100
9  start12mmt = start12mmt + 1
10 REM just continue

```

NEXT i

FOR i = 0 TO 9

FOR j = 0 TO 11

IF (i = 0) AND (j < 6) THEN 70

k = i + j

mrow = 11 * i + k

season(l, j) = (a(mrow) / cma12(mrow)) * 100

70 NEXT j

NEXT i

myear = 1993

i = 9

FOR j = 6 TO 11

season(i, j) = 0

NEXT j

REM *****

FOR m = 0 TO 11

k = 1

FOR n = 0 TO 9

IF season(n, m) > 0 THEN

aa(k) = season(n, m)

k = k + 1

END IF

NEXT n

20 FOR i = 1 TO 9

FOR j = 2 TO 9

IF aa(j) < aa(j - 1) THEN 50 ELSE 72

50 REM shift base (interchange)

temp = aa(j)

aa(j) = aa(j - 1)

aa(j - 1) = temp

72 NEXT j

NEXT i

median(m) = aa(5)

NEXT m

myear = 1993

mcnt = 12

mmonth = -1

FOR i = 0 TO 119

IF mcnt <> 12 THEN 88

myear = myear + 1

mmonth = mmonth + 1

mcnt = 0

88

madjust = (a(i) * 100)

madjust = madjust / median(mmonth)

madjvar(i) = madjust

mcnt = mcnt + 1

NEXT I

myear = 1993

mcnt = 12

mmonth = -1

FOR i = 0 TO 119

IF mcnt <> 12 THEN 99

PRINT #1,

PRINT #1, USING "### #"; myear,

myear = myear + 1

mmonth = mmonth + 1

mcnt = 0

PRINT #1, USING "### #"; myear,

99

PRINT #1, USING "#####.##"; bigxbigy(i) / madjvar(i);

mcnt = mcnt + 1

NEXT i

PRINT #1, ""

PRINT #1, ""

mont = -1

FOR i = 0 TO 119

mont = mont + 1

IF mont > 11 THEN mont = 0: PRINT #1, ""

REM USING "### #"; i;

PRINT #1, USING "#####.##"; bigxbigy(i) * (median(mont) / 100)

NEXT i

CLOSE #1

DATA 54.40,61.40,44.39,49.40,59.37,48.37,59.40,59.48,68.28,73.03,74.30,53.72

DATA 67.80,71.16,73.26,69.22,74.81,69.80,72.37,74.83,76.42,78.26,78.73,62.46

DATA 69.01,73.89,77.40,78.89,68.49,42.98,68.20,78.40,80.73,83.18,85.62,81.90

DATA 71.31,72.20,69.80,78.29,81.34,83.86,86.35,93.40,96.78,97.16,99.81,89.98

DATA 121.80,148.80,432.80,324.01,499.50,578.20,672.89,723.80,743.60,748.60,786.72,848.23

DATA 1021.21,1113.24,1013.27,1089.21,889.24,1083.34,1094.86,1116.42,1138.64,1136.86,1173.78,1099.01

DATA 1116.02,1232.72,1049.64,1354.34,715.79,962.65,1495.40,1532.08,1673.63,1984.53,1602.59,1322.62

DATA 1258.08,1262.72,1263.83,1283.68,1175.75,1888.42,1675.72,1531.05,1625.85,1630.53,1267,1460.82

DATA 1672.92,1782.69,1881.62,1883.78,1916.78,17119.73,19985.49,22024.72,18672.65,19723.81,19832.51, 15734.73

DATA 15832.63,16335.95,14134.68,14337.93,15217.28,16941.68,18196.03,18265.05

DATA 18345.70,18443.10,18403.20,16345.68

END

REFERENCES

- 1. ANDERSON, T. W.** THE STATISTIC ANALYSIS OF TIME SERIES.
(NEW YORK. JOHN WILLEY AND SON INC.
(1971)
- 2. ALEXANDER E. INNES** BUSINESS STATISTIC
(REVISED EDITION)
- 3. BOX, G. E. F AND
JENKINS, G. M** TIME SERIES ANALYSIS FORECASTING and
CONTROL, 2nd ED, HOLDEN DAY, SAR
FRANCISON (1976)
- 4. CHATFIELD, C.** THE ANANLAYSIS OF TIME SERIES.
(THEORY AND PRACTICES LONDON:
CHAPMAN AND HALL LTD. (1975).
- 5. DAVIS O. & COLD SMITH** STATISTICAL METHODS IN RESEARCH AND
PRODUCTION (MC GRAW- HILL, NEW YORK,
1969).
- 6. FULLER, W.A.** INTRODUCTION TO STATISTICAL TIME
SERIES (NEW YORK, JOHN WILLEY SON
INC.) (1971).