FORECASTING VOLUNTARY CASH DONATIONS IN PRIVATE HOMES FOR THE NEEDY CHILDREN : THE CASE OF THOMAS BARNARDO CHILDREN'S HOME, NAIROBI.

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This Project is my original work and has not been presented for a degree in any other University.

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This Project has been submitted for examination with my approval as a University Supervisor.

DR. J.T ROTICH

I dedicate this Project to all the Needy Children in Kenya and elsewhere. It is misleading to forecast their future lives based on their agonizing past.

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ABSTRACT

Private homes for the needy children receive 90% of their income by way of voluntary cash donations from individuals and organisations. This huge part of their income, by its very nature is highly unpredictable and makes the homes' planning activities extremely difficult.

The objective of this study was to develop a simple time-series forecasting model for the Thomas Barnardo children's home which could be used to forecast its monthly voluntary donations. It is hoped that such a model could easily be adopted by other children's homes and also the Children's Department of the Ministry of Home affairs for advisory purposes.

The study found that monthly voluntary donations exhibited some predictable pattern from month to month, with some months consistently having high donations while others have low donations. The trend of voluntary donations over the years was found to exhibit a general linear upward direction. Using the findings of the study, a forecasting model was developed.

The model that was developed utilized monthly seasonal indices and the linear trend equation to forecast monthly voluntary donations. The model was tested for its suitability in forecasting and was found to be suitable.

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1. INTRODUCTION

1.1 BACKGROUND

When speaking of Development, many people are likely to think mainly of higher standards of living, i.e, more food, more things to buy, better houses, motorcars, better education etc. All these are good and are embodied in the spirit of "positive attitude". However, in the midst of all this, certain social problems like poverty, bad housing, homeless people, crippled, blind, orphaned and destitute children and a myriad other problems continue to exist and cannot simply be ignored.

Certain benevolent individuals take great concern to this suffering of some members of our society, and believe very strongly that they are our own 'flesh and blood' and that each one of them has a potential of one sort or another. They feel that it is their societal role to positively contribute financially and materially, towards easing , to some extent, the suffering of the less fortunate.

Among the many ways in which the benevolent personalities contribute towards this noble goal is by setting-up homes and institutions that care for the less fortunate and offer basic necessities such as Food, Clothing, Education, and a good start in life.

This study is mainly concerned with the homes and institutions that care for the needy children, i.e, Orphaned, Abandoned, and those from extremely poor families.

Needy children end-up in these homes in several ways, notable ones being the following:

i) Through social workers who find them in desperate circumstances and in need of care and attention.

ii) When parents have died and relatives are not available or willing to care for the orphaned children.

iii) Mothers may be in prison or in mental hospitals and the children get neglected or rejected.

iv) Where prostitutes, unwilling to face their responsibilities, abandon unwanted babies in markets, toilets, or outside police stations.

v) Where mothers die at childbirth and the fathers fail to cope with a large family and a baby.

vi) Because of sheer poverty or drunkenness by the parents, children get neglected and the Homes care for them while their home circumstances are investigated.

Seventy years ago, homes for the needy children were virtually non-existent in Kenya. With the passage of time however, the population of the needy children has steadily grown, and with it, the establishment of homes and institutions all over the country to care for these children.

Several causes have been identified to be responsible for the rapid growth in population of the needy children in the society[1]:

i) The rapid social changes taking place with a decline of authority and responsibility of traditional institutions.

ii) Dislocation of family life and parental control.

iii) The increase in divorce rates, prostitution and an influx of unmarried mothers in the country.

Today, data from the Ministry of Home Affairs, Children's Department indicates that there are at least 105 children's homes and institutions scattered all over the country.

1.1.1 Types and distribution in Kenya.

Table 1 given below shows the distribution of the four classes of homes and institutions for children in the country.

1. Reiner. J : "Survey on Residential Children's Intitutions in Nairobi". M.A Thesis. University of Nairobi, 1976.

Location (Province)	Home/Institution type				
	Needy	Blind, Deaf Dumb	Physically Handicapped	Mentally Handicapped	Total
Nairobi	13	-	-	1	14
Central	15	5	2	-	22
Eastern	18	3	2	-	23
N. Eastern	5	-	-	-	5
Coast	5	5	-	-	10
R. Valley	12	1	1	-	14
Western/ Nyanza	11	5	1	-	17
Total	79	19	6	1	105
Percent	75	18	6	1	100

Table 1: Number and distribution of different types of children's Homes/institutions in Kenya[2]

It is evident from the above table that most of these homes/institutions in the country (75 percent) fall under the category of Needy Children's Homes, the main focus of this study.

1.1.2 Sponsorship

Sponsorship for this category of children's homes is either Private (by individuals and/or organisations) or Public (by the Government e.g Local Government council).

2. "Ministry of Home Affairs", Children's Department January 1992.

Table 2 given below shows the type of sponsorship for the 79 needy children's homes in the various parts of the country.

Location (Province)	Sponsorship		
	Private	Public	Total
Nairobi	12	1	13
Central	6	9	15
Eastern	17	1	18
N. Eastern	4	1	5
Coast	4	1	5
R. Valley	12	-	12
Western/Nyanza	8	3	11
Total	63	16	79
Percent	80%	20%	100%

Table 2: Sponsorship for Homes for the Needy Children in Kenya[3]

From the above table, the majority (80 percent) of the homes for the Needy children in Kenya are privately sponsored by individuals and/or religious or non-religious organisations.

1.1.3 Funding

Private homes for the needy children in Kenya get their financial and material support from the Government, their sponsors and voluntary donations from local or foreign individuals and organisations.

3. "Ministry of Home Affairs", Children's Department, January 1992.

The average contribution from these benefactors for a typical private home is shown in table 3 given below:

Sponsor	Contribution
Government	3.50%
Private Sponsor	6.50%
Voluntary cash donations	90.00%
Total	100.00%

Table 3: Average percent contribution of support to a typical private children's Home in Kenya[4]

The above table indicates that Shs.9 out of every Shs.10 has to be raised through voluntary contributions from individuals and organizations.

This source of funding, by its very nature, is highly risky and depends on a complex set of factors such as time of the year, the general economic conditions and the emotional status of the donors.

Clearly, this high degree of unpredictability of the major portion of their income places these homes in a very vulnerable situation from a planning point of view and almost nullifies any degree of budgeting. It is not uncommon, for example, to find most of these homes operating without a budget and simply *"surviving through the week"*, hoping that some donation will be

4. "If these children belonged to you , what would you do?". Current Brochure, Thomas Barnardo's Children's Home, Nairobi.

forthcoming.

Several homes contacted in Nairobi admitted that a simple forecasting model to predict voluntary cash donations would be of great help from a planning point of view. Staff in the Children's Department of the Ministry of Home Affairs also echoed the same sentiments.

This study has taken this problem into account and intends to demonstrate that a simple forecasting model can be developed for use in the planning activities of these homes.

1.2 STATEMENT OF THE PROBLEM.

About 90 percent of the total income of a typical private home for the needy children comes from voluntary cash donations of individuals and organisations. These donations, by their very nature, are highly risky and make it very difficult for these homes to practice any meaningful planning.

A general preliminary study on some homes in Nairobi revealed that none of them did any forecasting of donations despite the fact that they varied widely from month to month. The study also indicated that the administrators in these homes were not fully aware of the underlying factors in these variations but were definitely sure of seasonality variations. However, they

acknowledged the need for a simple forecasting model of the donations in order to do meaningful planning.

Barron and Targett[5], have underscored the need for forecasting as follows:

> *".....the rewards of good forecasting are extremely high: the penalties for bad forecasting or for no forecasting at all are greater than ever".*

The problem in this study is the lack of a forecasting model for predicting voluntary cash donations which can be used in the planning activities of the private homes for the needy children.

1.3 OBJECTIVES OF THE STUDY

The main objective of this study is to develop a Time-Series Forecasting model for predicting voluntary cash donations for the Thomas Barnardo children's home, a typical private home for the needy children. This will be achieved through the identification of the patterns of monthly donations to this home.

1.4 IMPORTANCE OF THE STUDY

Considering that voluntary donations account for 90 percent of the income of private homes for the needy children and are at the same time very unpredictable, a forecasting model that can fairly predict next period's donations is bound to be very helpful in

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5. Barron D & Targett M : The Manager's Guide To Business Forecasting. Basil Blackwell Ltd, Oxford, 1985.

the planning and management of funds.

Although this study only intends to develop a model for the Thomas Barnardo children's home, its success will mean that similar ones can be developed and used for such homes in Kenya since the conditions that govern the variations in voluntary donations are similar.

Such predictions will greatly help in planning activities in that should the budget for a particular period exceed the forecast for the same period, concerted appeals for extra donations or other means to correct the difference should be considered in good time.

Such forecasting systems for these homes can also be used by Government officials in the Children's Department to decide which home may be in a better position to take in new cases of needy children, or for other advisory purposes.

1.5 PROJECT REPORT LAYOUT

This project consists of five chapters. This first chapter considers the background, the statement of the problem, the objectives and the importance of the study.

The second chapter gives a review of the literature and includes

the following topics; the definition, nature, characteristics and methodology of Operations Research (OR), community OR, 'voluntary OR', related research on children's homes in Kenya and elsewhere, current practise in business forecasting and forecasting accuracy.

The third chapter gives the research design and it includes the description of the preliminary study conducted prior to this case study, the sampling method and the data collection procedure used.

The fourth chapter explains in detail how the collected data was analyzed to derive a simple short-term forecasting model based on Time-series decomposition technique.

The fifth and last chapter gives the conclusion; including a summary of the findings, limitations of the study and suggestions for further study.

2. LITERATURE REVIEW

2.1 OPERATIONS RESEARCH

2.1.1 Historical Background

Operations Research (OR) as a discipline proved its usefulness in search of solutions to management problems during the World War II. The words 'Operations Research' themselves were coined by military officers in connection with the efficiency of operations during military exercises. Later however, OR permeated into many other non-military areas and to-date, this discipline is highly developed and extensively applied in many areas in industry, government and community generally.

2.1.2 Definitions of OR

Many authors have attempted to give a generally acceptable definition of OR but this has not been easy as evidenced by the overwhelming number of different definitions encountered in the literature. However, the author of this study would like to maintain that at the moment, there is no universally accepted specific definition of OR mainly due to its multidisciplinary-problem-solving nature.

It is for this reason that the author of this study will adopt

a rather general definition given by Ackoff[6] as;

> *" the application of scientific methods, techniques and tools to problems involving the operations of systems, so as to provide those in control of the operations with optimum solutions to the problems".*

Or more broadly,

> *" A research into the operations of technical, social and managerial systems with a view to deriving optimal decisions".*

2.1.3 **Nature and Characteristics of OR**

OR practice combines science with management, i.e, it uses scientific approaches to arrive at better solutions to management problems. Solutions are invariably better since scientific approaches to decision making provide a rational, objective and systematic base rather than a casual or sporadic one.

Some distinct features of OR are its emphasis on measurement, use of conceptual models and experimental verification. OR uses teamwork, scientific method, systems approach and helps to uncover new problems in a given management situation.

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6. Ackoff R.L et al: Introduction to Operations Research. John Wiley and Sons, 1969.

2.1.4 **OR Methodolgy**

Literature on OR methodology mainly differentiates between *'Hard'* and *'Soft'* OR. While *'Hard'* OR gives more emphasis to mathematical modelling, *'Soft'* OR utilizes general systems thinking and behavioral science concepts. However, both are scientific methods which lead to the determination of evidence through observation of the system under investigation and verification of the results so obtained.

Success of OR practice in solving real management problems depends on the practitioner's competence and ability in accurately identifying the problem context without prejudice. For this very reason, OR practitioners need an understanding of certain basic principles, and according to Rotich[7],

> *".....an exposure to the rigours of academic life and scientific argument, because this will help to develop broader thinking and create flexibility that is necessary for success in applying the discipline in real life situations".*

OR is currently taught in several major Universities (including Nairobi University) as a major discipline in an attempt to produce competent practitioners in this field.

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7. Rotich J.T: "Operational Research and Mangement Science in a developing country: The development of a promotional strategy for Kenya". Ph.D Thesis, Lancaster University, 1991.

2.1.5 **Community OR**

The multidisciplinary nature of OR has given it diverse application in many community projects in both the developed and developing countries. Literature[8] in various OR and Management Science Journals gives OR applications in agriculture (e.g, cropping systems, livestock management, irrigation systems etc), communication (e.g, railways, waterways, road transport etc), health, water supply, demography, and many other community projects. Many other opportunities where OR can be applied for the benefit of the community exist especially in the developing countries where the practice has not taken root due to several problems that the author does not wish to get into in this discussion.

However, an important point to be noted is the fact that OR implementation in a community is a social change and the change itself should be managed efficiently. According to Rotich[9],

> *"....effectiveness of OR/MS work is judged by the success of its implementation which should not be based only on the extent to which OR/MS models are used, but also on the benefits of that usage".*

A sub-type of community OR is voluntary OR, i.e, OR practise in voluntary organisations which is the focus of this study and is discussed in next section.

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8. See Appendix B.

9. Ibid.

2.2 'OR' IN VOLUNTARY ORGANISATIONS

Very little OR activity has been done in voluntary organisations in Kenya and elsewhere. This sentiment is shared by Sims and Smithin[10], who have also given some reasons for this low activity.

Firstly, there is a lack of competition in voluntary OR since there is no money or payments involved.

Secondly, it simply never occurs to OR specialists that their skills could be of value to voluntary organisations just as they are to the other organizations.

Thirdly, the fact that there is not much of a tradition of OR in voluntary organizations, the organisations do not know whether or not it could be useful to them and so they do not ask for it.

Fourthly, the consultant-client relationship is much more ambiguous since there are no payments involved and one will not be sure whether a non-paying client is continuing to work with you for the sake of politeness rather than the value of your work.

Fifthly, many consultants feel that *"clients value only those*

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10. Sims D & Smithin T: "Voluntary Operational Research". Jour. of the Oper. Res. Soc., Vol. 33, No. 1, 1982.

services that they pay for"[11]. Such expectations by the client about an OR Researcher's effectiveness are greatly assisted by charging high fees, or at least some fees.

Benedictus[12], posed the question as to why it is that many Operational Researchers who are interested in one or more voluntary organisations do not include OR as one of their forms of involvement. He also tends to echo the same reasons as Sims and Smithin.

2.2 RESEARCH ON CHILDREN'S HOMES.

Social Workers got involved in child care and spurred research in this field after World War I. Literature on child care indicates that most of the early research work mainly focused on the *"maladjusted"* family while psychologists in the same period carried out research which was more scientifically structured and focused on cognitive development of a child's life. Other studies were later developed on emotional and physical aspects of children. According to Robins and Weiner[13],

> *"....most conspicuously missing is comparable Research and analysis of the economic issues...At best, what is normally found are estimates of the costs of various types of child care services".*

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11. Maclean A et al : Changing organisations: organisations development in practice. Wiley, London, 1982.

12. Benedictus S. : "Letter to the Editor". OR Newsletter, Vol.9, No. 4, 1981.

13. Robins P.K & Weiner S : "An introduction to the economic and policy issues of child care". Child care and public policy. D.C Heath & Co. Mass., 1978.

Joseph Rainer[14], carried out a general survey on residential children's homes in Kenya. In his survey, he tackled only some general questions, i.e, financial, nutritional, recreational, medical and other requirements for children. He did not explicitly consider the issue of donations although he pointed out their importance to the survival of the homes.

In 1970 Edmund Mech[15], reviewed literature on planning and decision making in children's institutions in the *USA* and noted an absence of a framework and recommended that one be developed. These suggestions were repeated in subsequent literature by Gambrill and Wiltse[16] and Palmer[17].

Arden Hall[18], estimated cost equations for child care in the *USA* in an attempt to understand the important determinants of child care cost, to derive a relationship that would predict the cost of a unit child care produced with a specified set of inputs and to learn the trade-off between cost and quality in child care.

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14. Reiner J : Ibid.

15. Mech E. V : "Decision analysis in child care practice". Forster care in question. Helen D. Store, New York, 1970.

16. Gambrill E.D & Wiltse K.T : "Forster care: prescription for change". Public welfare, Vol. 32, 1974.

17. Palmer S.E : "The decision to seperate children from their natural parents". Social Worker, Vol. 39, 1971.

18. Hall A : "Estimating cost equations for child care". Child care and public policy, 1978.

2.3 CURRENT FORECASTING PRACTICE -Empirical Evidence

Different methods of forecasting are used in varying extents by practitioners. The requirements of a good forecasting technique are summarised by Little[19], in the following table:

Requirements	Notes
Understanding	The forecasting approach must be easily understood by those using it.
Control	The user should be able to direct and constrain the model as he considers appropriate.
Response	The model should possess the capability to modify itself in the face of underlying changes in the environment.
Communication	Readily comprehensible output should be easily obtainable.
Completeness	All factors having a significant effect on the forecast variable should be included in the model.
Robustness	The model should produce plausible output given reasonable input.

Table 4: Requirements of a good forecasting model.

Two surveys of forecasting technique usage in the *USA* and the *UK* by Mentzer and Cox[20], and by Sparkes and McHugh[21], are respectively discussed below.

Mentzer and Cox did their survey on *USA* companies with turnovers ranging from $3 million to $10,000 million and 160 of them

19. Little J.D: "Models and Managers: the concept of a decision calculus". Management Science, Vol. 16, 1970.

20. Mentzer J & Cox J: "Familiarity, application and performance of sales forecasting techniques". Jour. of forecasting, Vol. 3, 1984.

21. Sparkes J & Mchugh A : "Awareness and use of forecasting techniques in British industry". Journal of Forecasting, Vol. 3, 1984.

replied. About 50 percent of these companies had senior staff members who had received some formal tuition in forecasting. At one extreme, 85 percent were familiar with *moving averages* while only 26 percent were familiar with *Box and Jenkins* analysis. Mentzer and Cox's findings are summarised in table 6 given below.

Technique	% Respondents "very familiar" with technique.	% of those familiar who were satisfied.	% of respondents using different techniques for different horizons. 3-4mths	3-24mths	over 24
Subjective	80	48	32	32	20
Objective					
Moving Aver.	85	58	24	22	5
St.Line Projection	82	32	13	16	10
Exponential Smoothing	73	67	24	17	6
Trendline Analysis	67	58	21	28	21
Classical T-S Decomposition	42	55	9	13	5
Box-Jenkins	26	30	5	6	2
Regression Analysis	72	60	14	26	28

Table 5: Summary of Mentzer and Cox's Results.

It is important to note that *regression* was the only multivariate/causal method encountered in the study.

The most important conclusion from Mentzer and Cox's findings was that the statistically sophisticated techniques of *Box and*

Jenkins were used by only a small minority of practitioners. In addition, of those who used them, over half were not satisfied.

In the *UK*, Sparkes and McHugh found a similar preference for *easier-to-use* techniques with 88 percent of the respondents having no knowledge of *Box and Jenkins* technique. Trend analysis was the most frequently used technique (by 63 percent of the respondents), mainly for medium-term forecasting. *Box and Jenkins* did not register any mention at all. The results of Sparkes and McHugh's study are summarised in table 7 given given below.

Technique	**Application.**			
	Market Size	Market Share	Production stock control	Financial Planning
Subjective	2.6	42.1	13.1	26.3
Trend Analysis	1.3	22.4	3.9	3.9
Moving Averages	0	15.8	10.5	3.9
Surveys	19.7	7.9	0	0
Exponential Smoothing	2.6	0	2.6	1.3
Regression Analysis	2.6	0	0	0

Table 6: Sparkes and McHugh: Techniques usage by forecasting application (% of respondents)

These surveys indicate a lack of enthusiasm by practitioners of adopting *"new"* forecasting products. Armstrong[22], justifies this reluctance very strongly. The disadvantages of the newer sophisticated techniques that he identifies are the difficulty in comprehension, greater development costs and difficult

22. Armstrong J : "Forecasting by extrapolation: Conclusions from 25 years of research". Interfaces, Vol. 14, 1984.

maintenance and operation.

The expected advantage is increased accuracy and whether they deliver this is debatable. Some earlier studies by some authors indicated they did, but later ones associated with Makridakis indicated they did not.

This study has attempted to develop a simple Time-Series forecasting model using the Classical Decomposition approach to help private homes for the needy children in Nairobi in short-term forecasting of voluntary cash donations.

2.4 **FORECASTING ACCURACY**

Statistical forecasting is based on a misleading premise: the assumption of constancy. This assumption

> *".....fails to capture the essence of business and economic data which changes continually and is inherently unstable*[23]".

In stable economic and environmental conditions, forecasting involves continuation of established patterns /relationships in which case the forecasting is usually accurate. In turbulent environments, and during which forecasts are most necessary, forecasting errors can be serious, a situation which creates a lot of dissatisfaction. Unfortunately however, Forecasters have

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23. Makridakis S : "Forecasting accuracy and the assumption of constancy". Omega, Vol. 9, No. 3, 1981.

not only failed to communicate this point to users, but also to make explicit the alternative to statistical forecasting.

Since the interest in the field of forecasting is growing rapidly, Makridakis[24], suggests that

> *"....the challenge is not to attempt to blame who or what has been wrong but rather to enlarge the role of forecasting.."*

This will be especially useful when the assumption of constancy fails.

The problem in enlarging the role of forecasting would be how to continue forecasting when systematic changes from established patterns/relationships are involved. Unfortunately, systematic changes from patterns are not repetitive or if they were, the length between two successive occurrences is not necessarily constant. Furthermore, even when repetitive events are involved, the effect of change cannot always be quantified because of a multitude of factors. The inevitable therefore has to be accepted by forecasters and users alike, i.e, the inability to forecast statistically when the assumption of constancy does not hold.

With this acceptance, it would be necessary to device ways of knowing as soon as possible when systematic changes of past patterns/relationships are taking place, a situation which would

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24. Ibid.

necessitate having a monitoring system. If such a system indicated some systematic change, and the errors became non-random, this would be when to take action in the form of adjustments to quantitative forecasts.

3. RESEARCH DESIGN

3.1 PRELIMINARY STUDY.

A preliminary investigation on some of these homes in Nairobi indicated the following:

i) That the amounts of voluntary donations varied widely from month to month.

ii) That the administrators in these homes were not explicitly aware of the factors that are responsible for the variations in amounts of donations from period to period. And that they were only vaguely aware of the importance of the time of the year, the general economic conditions and the emotional status of the donors.

iii) That although none of the homes investigated did any formal forecasting of voluntary donations, their administrators were aware of some pattern recurring over time with definite peaks in December and troughs in January/February. Three years monthly data (1989, 1990 and 1991) from Thomas Barnardo Children's home revealed peaks in December and May/June periods and troughs in April and August.

iv) That the administrators and even the staff in the Ministry of Home Affairs, Children's Department, would welcome any simple forecasting model that would help in predicting in the short term, the next period voluntary donations to be

applied in planning activities.

3.2 THE CASE

This was a case study involving Thomas Barnardo children's home and utilised data covering a period of 8 years, between 1984 and 1991. This children's home was selected since it was considered to be a fair representation of a typical private home for the needy children. It also has good record keeping practices and is in a convenient location within Nairobi.

3.3 SAMPLE AND SAMPLING DESIGN.

Historical data on voluntary donations for the Thomas Barnardo children's home over a period of 7 years (1984-1990) was used for model development purposes. Data for 1991 was used for out-of-sample model validation.

Monthly data for a period for 7 years contained 84 data points which were considered adequate for detecting any existing pattern. Also, the 12 data points contained in monthly data for 1991 provided a good model validation scheme.

3.4 DATA COLLECTION METHOD.

Secondary data was personally extracted from the home's accounting records stored within the premises with the permission of the home's administrators.

Data collection forms were used to record the information directly from the data sources. These forms were of the type shown below:

Year	Month	Voluntary Donation('000').
-	-	----
-	-	----
-	-	----
etc	etc	etc

This data is contained in table 7 of appendix A.

3.5 AN OVERVIEW OF DATA ANALYSIS.

Data was analyzed by Time-Series using the classical decomposition technique by a combination of manual computations and use of the Harvard Graphics computer package (for plotting the Graphs). This technique is simple enough and it fairly suits short-term forecasting purposes. It was chosen because the system that governs the variations in voluntary donations in the homes

for needy children are not clearly understood, as was revealed in the preliminary study. Also, the factors that may be relevant here (i.e the emotional status of the donors, the general economic conditions, etc) are extremely difficult to measure.

In any case, the administrators in the homes covered in the preliminary study expressed knowledge of some recurring pattern over time which was confirmed using 3 years monthly data.

This analysis technique attempts to identify three separate components of the basic underlying pattern that tends to characterise economic and business series. These are trend, the cycle and the seasonal factors.

A study conducted in the *USA* on companies with a turn-over of $3m-$10,000m by Mentzer and Cox[25], in 1984 indicated that 42 percent of the respondents were *"very familiar"* with Time-Series decomposition techniques. Of those familiar with the technique, the study further indicated that 55 percent expressed satisfaction with it.

The general mathematical representation of the decomposition approach is:

$$X_t = f(S_t, T_t, C_t, E_t)$$

25. Ibid.

where X_t is the time-series value (actual data) at period t.

S_t " " seasonal component (index) " "

T_t " " trend " " "

C_t " " cyclical " " "

E_t " " random " " "

Since the multiplicative form is the one most commonly used, it will be the focus of this study and its specific mathematical representation used is

$$X_t = S_t \times T_t \times C_t \times E_t$$

3.5.1 **Model Development.**

Actual data collected (X_t)

This constituted the actual voluntary cash donation figures collected from the accounting records.

The Secular Trend (T_t)

This was the long-term variation of the donations over the years and was fitted using the least squares method. For example, assuming that the trend is linear, the equation would be of the form;

$T_t = a + bt$, where, **a** and **b** are constants and **t** denotes the time period.

The Cyclical (C_t) and the Random or Error (E_t) components.

The cyclical component tends to oscillate above and below the trend line for periods longer than one year and can be calculated for each year as follows:

Actual donation/Estimated donation x 100

However, this method only calculates past cyclical variations which are useless for prediction purposes. More complicated techniques like *Fourier* and *Spectral* analysis can be used for predicting future cyclical variations.

The random or error component cannot be predicted and can only be used to explain random fluctuations around the trend line. For this reason therefore, the cyclical and the random components in this study were combined and isolated for the purpose of explaining fluctuations around the trend line only.

The seasonal component (S_t)

Seasonal variations are repetitive and periodic with the period of oscillation being less than one year, e.g week, month, quarter, etc.

Monthly seasonal indices were calculated by the use of a 12-point

Moving Average of the voluntary cash donations.

Predictions (Forecasts)

In forecasting using Time-Series decomposition technique, the trend value was calculated using the trend equation which was then multiplied by the monthly (seasonal) index. The resulting value was the short-term forecast for the voluntary donation.

3.5.2 Model validation technique.

This involved testing whether there was any real difference between the actual voluntary donations received in 1991 and those predicted using the model. The Non-parametric Sign test of the difference between the two sets of data was conducted at 95% confidence level.

This test determined whether the difference between the two sets of data was significant or not. If significant, then the model would not be suitable for forecasting monthly voluntary donations, but if not significant, then it would be used for the purpose at the specified confidence level.

Detailed data analysis and findings are given in the chapter 4.

4. DATA ANALYSIS AND FINDINGS

4.1 INTRODUCTION

The actual monthly voluntary donations for the Thomas Barnado children's home (in thousands of Kenya Shillings) was analyzed. The analysis consisted of the following steps:

i) Identification of the underlying data pattern from the monthly voluntary donations by use of a scatterplot.

ii) Calculation of Seasonal Indices for each Month, January to December.

iii) Calculation of the suitable trend equation.

iv) Identification of the cyclical and the random (error) components.

v) Predicting (forecasting) the monthly voluntary donations for the year 1991 using the developed model.

vi) Testing the suitability of the developed model for prediction/forecasting purposes.

The following sections describe in detail how each of the above steps were carried out and the results that were obtained.

4.2 IDENTIFICATION OF THE UNDERLYING DATA PATTERN.

To identify the underlying data pattern for the monthly voluntary donations, a connected Scatterplot was prepared with the help of

the Harvard Graphics package in an *Acer* microcomputer. The scatterplot is shown in the figure 1 given below.

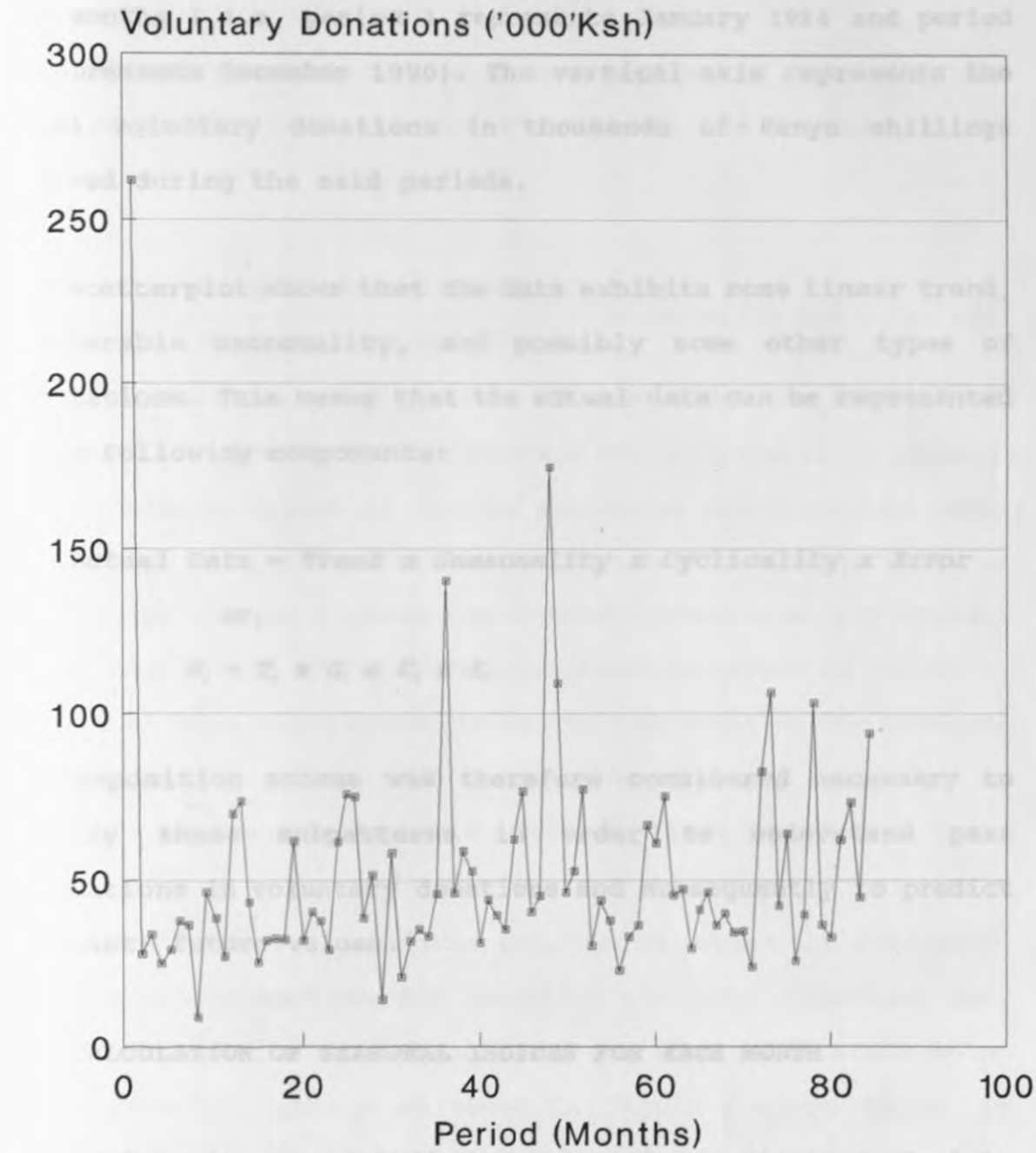
Monthly Voluntary Donations for TBH
Actual Data Plot
Voluntary Donations ('000'Ksh)
300
250
200
150
100
50
0
0
20
40
60
80
100
Period (Months)

Figure 1

The horizontal axis represents the period of 7 years broken down into months (i.e, period 1 represents January 1984 and period 84 represents December 1990). The vertical axis represents the actual voluntary donations in thousands of Kenya shillings received during the said periods.

This scatterplot shows that the data exhibits some linear trend, considerable seasonality, and possibly some other types of fluctuations. This means that the actual data can be represented by the following components:

$$Actual\ Data = Trend \times Seasonality \times Cyclicality \times Error$$

or,

$$X_t = T_t \times S_t \times C_t \times E_t$$

A decomposition scheme was therefore considered necessary to identify these subpatterns in order to understand past fluctuations in voluntary donations and subsequently to predict (forecast) future values.

4.3 CALCULATION OF SEASONAL INDICES FOR EACH MONTH

Calculation of seasonal indices was done in an attempt to isolate the seasonality **(S)** subpattern identified in the actual data.

It was done indirectly by first isolating the combined trend and

cyclical components **(TC)** by computation of the ***Moving Averages***.

The combined seasonality and error components **(SE)** were then isolated by dividing the actual data by the moving average values.

i.e, $$\frac{\textit{Actual data} \quad \textit{(TSCE)}}{\textit{Moving Averages (TC)}} = \textit{Seasonality and Error (SE)}$$

These tabulations and calculations are shown in table 8 of appendix A. A 12-month moving average was used and this explains the 12 missing values (6 at the beginning and 6 at the end). Column 3 of this table shows a 12-month moving average which is not centred. Column 4 shows the centred 12-month moving average computed by simply averaging two consecutive values of column 3. Column 5 of this table shows the ratios representing the combined seasonality and error **(SE)** components and was computed by dividing the values in column 2 **(TSCE)** by those in column 4 **(TC)**.

To compute the seasonal indices **(S)**, the **SE** ratios for each month were simply averaged thereby isolating the error component **(E)**. Table 9 of appendix A shows how this was done and a scatterplot of the seasonal indices is shown in figure 2 given below. It indicates that peaks exist in December and January while troughs are in May and August periods. Other smaller peaks can also be seen in June.

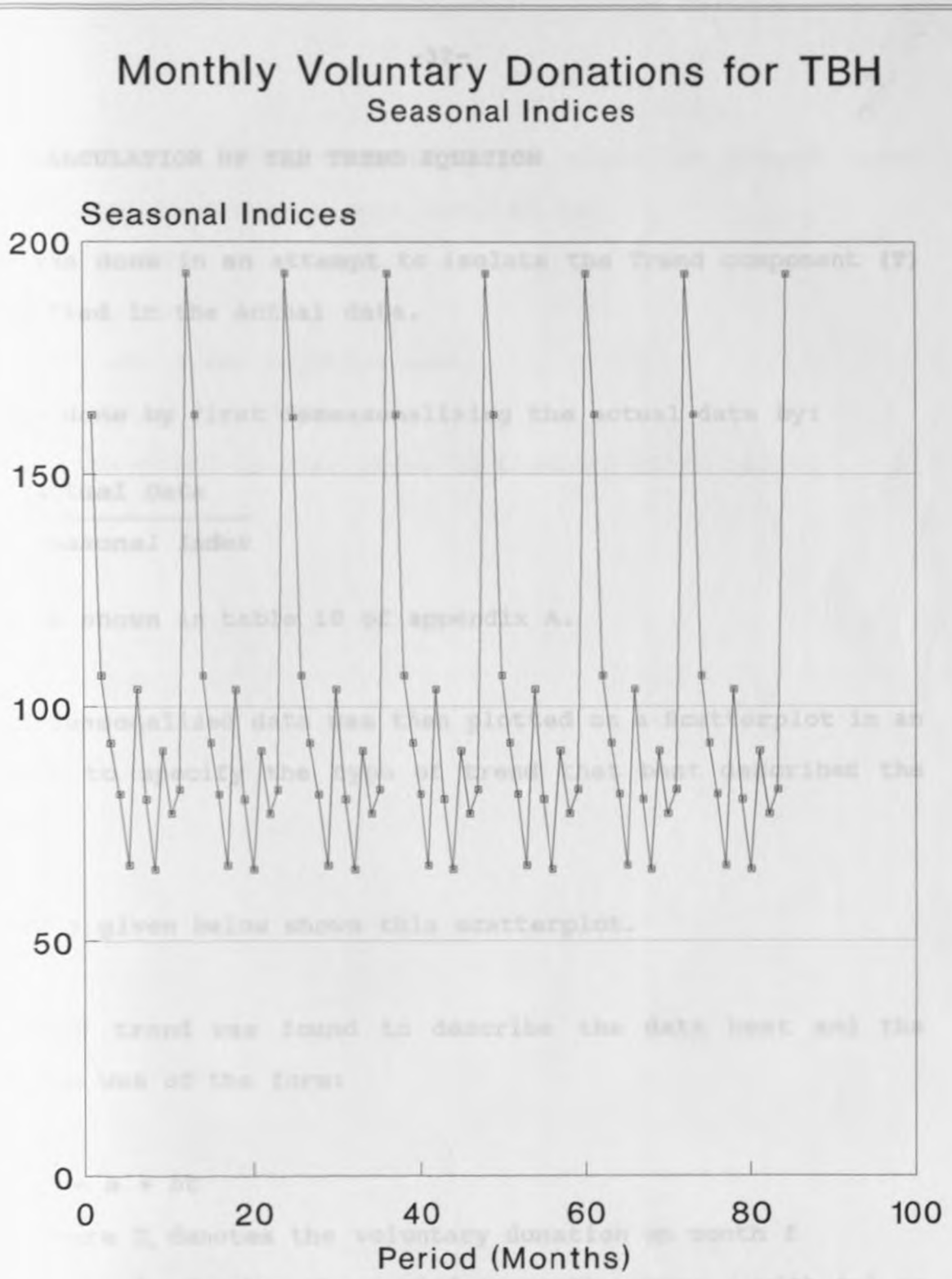
Monthly Voluntary Donations for TBH
Seasonal Indices
Seasonal Indices
200
150
100
50
0
0
20
40
60
80
100
Period (Months)

Figure 2

4.4 CALCULATION OF THE TREND EQUATION

This was done in an attempt to isolate the Trend component **(T)** identified in the actual data.

It was done by first deseasonalizing the actual data by:

$$\frac{\textit{Actual Data}}{\textit{Seasonal Index}}$$

This is shown in table 10 of appendix A.

The deseasonalized data was then plotted on a Scatterplot in an attempt to specify the type of trend that best described the data.

Figure 3 given below shows this scatterplot.

A linear trend was found to describe the data best and the equation was of the form:

$$T_t = a + bt$$

Where T_t denotes the voluntary donation on month t

t denotes the period or month number (with t=1 as january 1984 and t=84 as december 1990.)

a and ***b*** are constants of the equation.

The constants ***a*** and ***b*** were estimated using the simple least squares method, and they were found to be:

$a = 44.90$

$b = 0.1375$

Therefore the trend equation was:

$$T_t = 44.90 + 0.1375t$$

This linear trend is also shown in figure 3 given below.

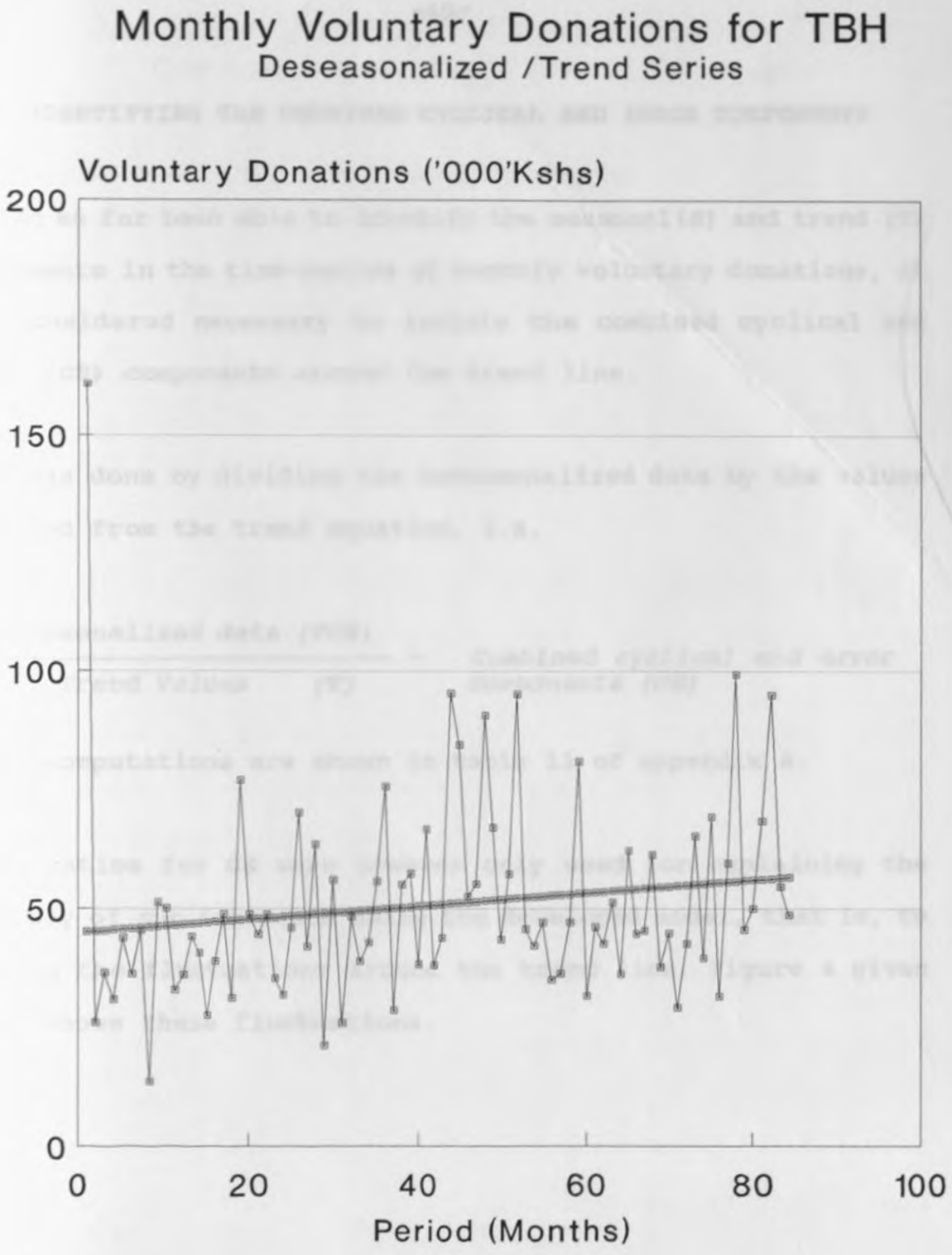
Monthly Voluntary Donations for TBH
Deseasonalized /Trend Series
Voluntary Donations ('000'Kshs)
200
150
100
50
0
0
20
40
60
80
100
Period (Months)

Figure 3

4.5 IDENTIFYING THE COMBINED CYCLICAL AND ERROR COMPONENTS

Having so far been able to identify the seasonal **(S)** and trend **(T)** components in the time-series of monthly voluntary donations, it was considered necessary to isolate the combined cyclical and error **(CE)** components around the trend line.

This was done by dividing the deseasonalized data by the values computed from the trend equation, i.e,

$$\frac{\textit{Deseasonalized data (TCE)}}{\textit{Trend Values (T)}} = \textit{Combined cyclical and error components (CE)}$$

These computations are shown in table 11 of appendix A.

These ratios for **CE** were however only used for explaining the accuracy of our forecasts using the developed model, that is, to explain the fluctuations around the trend line. Figure 4 given below shows these fluctuations.

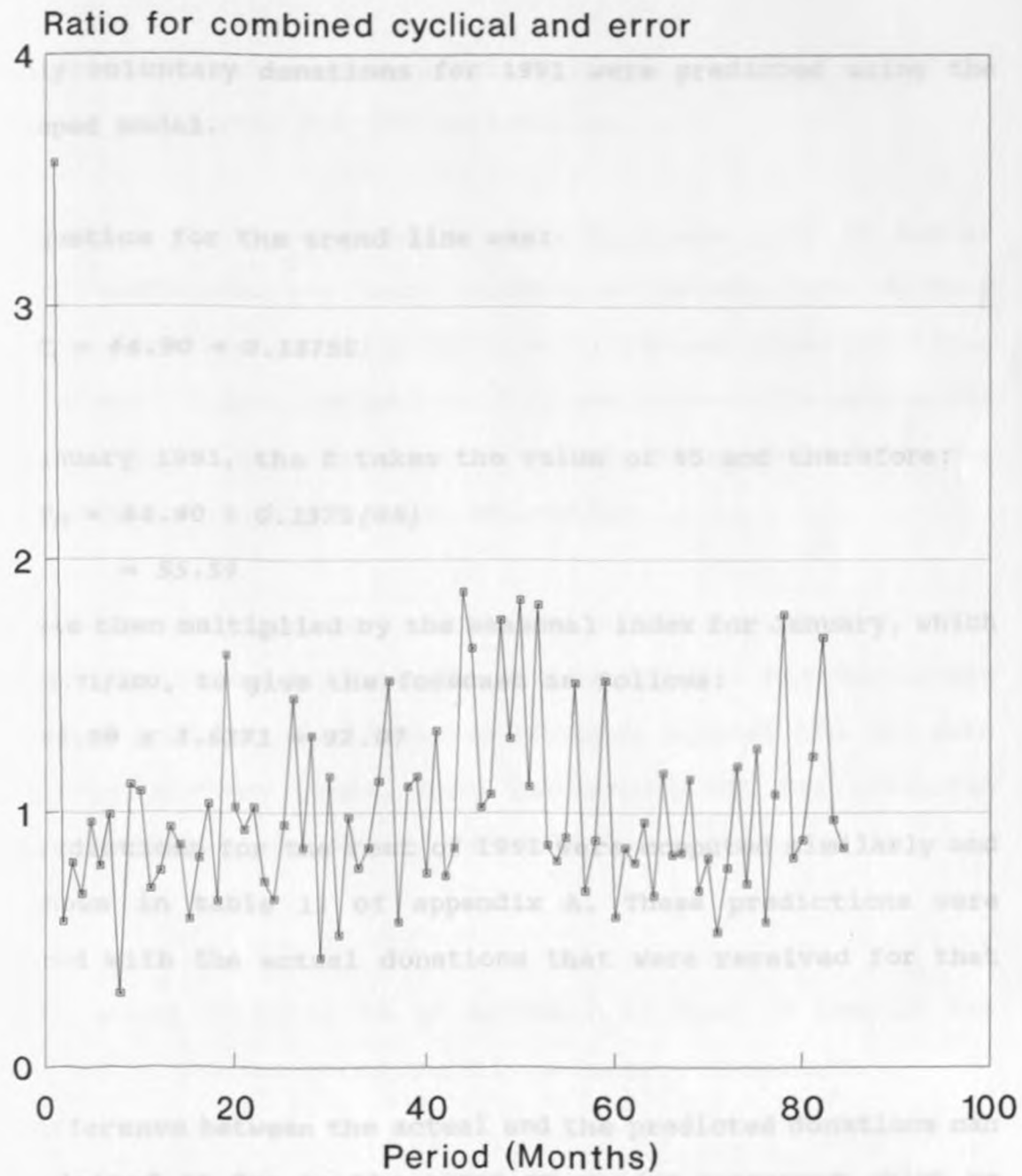
Monthly Voluntary Donations for TBH
Combined cyclical and error components
Ratio for combined cyclical and error
4
3
2
1
0
0
20
40
60
80
100
Period (Months)

Figure 4

4.6 PREDICTING (FORECASTING) FUTURE MONTHLY VOLUNTARY DONATIONS.

Monthly voluntary donations for 1991 were predicted using the developed model.

The equation for the trend line was:

$$T_t = 44.90 + 0.1375t$$

For january 1991, the t takes the value of 85 and therefore:

$$T_{85} = 44.90 + 0.1375(85)$$

$$= 55.59$$

This was then multiplied by the seasonal index for January, which was 162.71/100, to give the forecast as follows:

$$55.59 \times 1.6271 = 92.07$$

The predictions for the rest of 1991 were computed similarly and are shown in table 12 of appendix A. These predictions were compared with the actual donations that were received for that year.

The difference between the actual and the predicted donations can be explained as due to the error or random component which we could not predict and/or the cyclical component which was not considered in the prediction.

4.7 TESTING THE SUITABILITY OF THE MODEL FOR FORECASTING PURPOSES

The model that was developed for predicting monthly voluntary donations was tested for its suitability.

To do this, the Non-parametric Sign test was used to assess whether there was any real difference between the monthly voluntary donations actually received in 1991 and those predicted by the model for the same period. This was an out-of sample model validation technique since data for 1991 was not used for model development but only for model validation.

Computations for this test were quite simple and were all done through manual computations. The null hypothesis (H_o) tested was that there was *"no significant difference between the two sets of data"*, in other words, that the actual and the predicted monthly voluntary donations for 1991 were not significantly different.

This is shown in table 13 of appendix A, where x denotes the actual and y the predicted monthly voluntary donations.

A positive sign was then assigned where x was greater than y; zero where $x = y$ and a negative sign where x was less than y.

The number of positive and negative signs were then counted and

the proportion of the positive denoted as p'.

The statement of the null hypothesis meant that this proportion should be 0.5, that is,

$H_o : p = 0.5$, and the alternative hypothesis,

$H_1 : p \neq 0.5$

The number of positive signs were 8 and therefore the proportion

$$p' = 8/12$$
$$= 0.667$$

The binomial distribution was then used for construction of the rejection region. For large values of n, the normal distribution can be used as an approximation to the binomial, and the standard deviation then is:

$$\sqrt{\frac{pq}{n}}$$

Where, p and q are equal to 0.5 and denote the proportions for positive and negative signs respectively, and,

n denotes the total number of positive and negative signs.

So the normal variate was,

$$Z = \frac{p' - p}{\sqrt{\frac{pq}{n}}} = \frac{0.667 - 0.5}{\sqrt{0.25/12}} = 1.155$$

At 5% level of significance, the acceptance region is $-1.96 \leq Z \leq 1.96$. As the calculated Z value was within the acceptance region, the null hypothesis H_o was accepted, that is, there was no significant difference between the actual and the predicted monthly voluntary donations for 1991. And for this reason, it can be concluded that the model is appropriate for predicting monthly voluntary cash donations for the Thomas Barnado children's home.

5. CONCLUSIONS AND RECOMMENDATIONS

The main objective of the study as stated above was to develop a time-series forecasting model for predicting voluntary donations for the Thomas Barnardo children's home through the identification of the patterns of these donations. This objective was satisfactorily achieved as explained below.

5.1 SUMMARY OF THE RESULTS OF THE STUDY

The results of the study are summarised as follows in relation to the objective mentioned above.

The monthly voluntary donations data for a period of 8 years (1984-1991) was obtained as was described in chapter 3.

The pattern of these donations was presented in the form of a scatterplot which exhibited some linear trend, considerable seasonality, and some random and/or cyclical fluctuations.

A decomposition scheme was then embarked upon to identify the seasonality and trend components in order to understand the exhibited patterns and subsequently predict or forecast future voluntary donations.

Seasonality was isolated by calculation of the seasonal indices

while the trend was isolated by deriving the linear equation of the exhibited trend by the method of least squares.

The cyclical and error components were only isolated to explain the variation around the trend line and the accuracy of predictions.

Monthly voluntary cash donations for 1991 were predicted using the model and compared with the actual donations received at the home for the same period. The Non-parametric Sign test conducted showed that the model was suitable for predicting monthly voluntary donations for the Thomas Barnado children's home, which was the prime objective of the study.

This implies that other private homes for the needy children could be assisted to develop such a model to predict 90% of their monthly income. Such predictions, as pointed out earlier in this study would be of immense help to the planning activities of these homes, as for example, an early warning system to a budgetary deficit and therefore allowing timely plans for soliciting for extra funds or, in the case of a predicted surplus, prior preparations for proper utility of the expected extra funds. The model could also be used by the Ministry of Home Affairs officials for advisory purposes.

5.2 CONCLUSIONS AND RECOMMENDATIONS

The major purpose of this study was to develop a simple time-series forecasting model for predicting voluntary cash donations for the Thomas Barnado children's home.

The first chapter of this report dwells at length on the nature of children's homes in Kenya and also points out that the private homes for the needy children require simple forecasting models for their voluntary donations which form 90% of their income. Such models would ease the homes' planning activities.

The model developed in this study was found suitable for forecasting the donations as confirmed by the validation technique used. This kind of model is quite simple to develop and use since it does not require complicated mathematical formulations and the use of computer packages. Preference for the *easier-to-use* techniques was demonstrated through the studies by Mentzer and Cox, and Sparkes and McHugh discussed in chapter 2. Private homes for the needy children can easily develop and adopt such a forecasting model with the help of their staff. The advantages of forecasting are numerous and the key among them is the direction it gives to the planning activities.

In this study, the interest was on forecasting monthly voluntary donations although certain homes may need to forecast quarterly

or other periods instead, in which case the data would be adapted accordingly. Whatever the case however, users of any forecasting system need to appreciate and understand forecasting accuracy and this is learnt through experience. Once this is appreciated, the user can then easily blend his own judgement with the prediction to improve the accuracy of the forecast.

5.3 **LIMITATIONS OF THE STUDY.**

The major limitations of this study were found to be time and cost for data collection and analysis.

With more time, it would have been possible to enlarge the study to cover some other children's homes of different size categories. Again, it would have been possible to cover a longer data period, say 20 years rather than just 8.

With more time and money, it would have been possible to experiment with other time-series forecasting tools, like *Box-Jenkins* and the *stochastic* models. For the same reason, it was not possible to research on other validation techniques.

Numerous manual arithmetic computations were involved in all the stages of data analysis. Although great care was exercised when doing so, errors are still likely to have been committed.

5.4 SUGGESTIONS FOR FURTHER STUDY

It is being suggested that further studies in this area may experiment with other time-series forecasting tools like *Box-Jenkins* and the *stochastic* models.

Also a seperate study may be conducted which will attempt to identify the specific factors that influence individuals and organisations to make donations to children's homes. Such a study would open the way for the *causal* (e.g, regression analysis) and *simulation* techniques for predicting voluntary donations.

A greater utilisation of the *Statgraphics* computer package available at the Faculty of Commerce may be advisable so as to avoid most of the manual computations.

APPENDIX A

Table 7: Monthly Voluntary Donations Data in '000'Kshs for the period between January 1984 and December 1991.

Year	*Month*	*Actual Donation ('000'Kshs)*	*Year*	*Month*	*Actual Donation ('000'Kshs).*
1984	1	261.65	1987	1	46.10
	2	27.57		2	58.52
	3	33.49		3	52.66
	4	24.94		4	30.94
	5	28.91		5	43.96
	6	37.41		6	39.30
	7	36.31		7	35.02
	8	8.76		8	61.93
	9	46.29		9	76.24
	10	38.51		10	40.35
	11	26.80		11	45.20
	12	69.51		12	174.59
1985	1	73.31	1988	1	108.88
	2	43.25		2	46.27
	3	25.17		3	52.56
	4	31.51		4	77.04
	5	32.22		5	30.13
	6	32.11		6	43.70
	7	61.50		7	37.63
	8	31.66		8	22.65
	9	40.24		9	32.74
	10	37.46		10	36.24
	11	28.86		11	66.29
	12	61.29		12	60.87
1986	1	75.47	1989	1	74.86
	2	74.66		2	45.36
	3	38.52		3	47.15
	4	51.43		4	29.26
	5	13.92		5	40.95
	6	57.94		6	46.26
	7	20.61		7	36.21
	8	31.39		8	39.81
	9	35.07		9	33.98
	10	32.91		10	34.42
	11	45.62		11	23.73
	12	140.12		12	82.22

Table 7 continued:

Year	*Month*	*Actual Donation ('000'Kshs)*	*Year*	*Month*	*Actual Donation ('000'Kshs)*
1990	1	106.00	1991	1	284.11
	2	42.05		2	71.50
	3	63.67		3	49.17
	4	25.41		4	55.95
	5	39.25		5	73.80
	6	102.92		6	81.38
	7	36.39		7	43.66
	8	32.48		8	48.67
	9	61.79		9	42.10
	10	73.05		10	67.81
	11	44.69		11	117.11
	12	93.75		12	107.55

Table 8: Calculation of the SE Ratios of Actual Donations to Moving Averages.

	Period (Month)	Actual Donations ('000'Kshs) (TSCE)	12-Month Moving Averages	Centred 12-Month Moving Averages (TC)	Ratio TSCE/TC (SE x 100)
'84	1	261.65	-	-	-
	2	27.57	-	-	-
	3	33.49	-	-	-
	4	24.94	-	-	-
	5	28.91	-	-	-
	6	37.41	-	-	-
	7	36.31	53.35	45.50	**79.80**
	8	8.76	37.65	38.31	**22.87**
	9	46.29	38.96	38.61	**119.89**
	10	38.51	38.26	38.54	**99.92**
	11	26.80	38.81	38.95	**68.81**
	12	69.51	39.09	38.87	**178.83**
'85	13	73.31	38.65	39.70	**184.66**
	14	43.25	40.75	41.70	**103.70**
	15	25.17	42.65	42.40	**59.36**
	16	31.51	42.15	42.11	**74.83**
	17	32.22	42.06	42.15	**76.44**
	18	32.11	42.23	41.89	**76.65**
	19	61.50	41.55	41.64	**147.69**
	20	31.66	41.73	43.04	**73.56**
	21	40.24	44.35	44.91	**89.60**
	22	37.46	45.46	46.29	**80.93**
	23	28.86	47.12	46.36	**62.25**
	24	61.29	45.59	46.67	**128.57**
'86	25	75.47	47.75	46.05	**163.89**
	26	74.66	44.34	44.33	**168.42**
	27	38.52	44.32	44.11	**87.33**
	28	51.43	43.89	43.70	**117.69**
	29	13.92	43.51	44.21	**31.49**
	30	57.94	44.90	48.19	**120.23**
	31	20.61	51.47	50.25	**41.02**
	32	31.39	49.02	48.38	**64.88**
	33	35.07	47.73	48.32	**72.58**
	34	32.91	48.91	48.06	**68.48**
	35	45.62	47.20	48.45	**94.16**
	36	140.12	49.70	48.93	**286.37**
'87	37	46.10	48.15	48.75	**94.56**
	38	58.52	49.35	50.63	**115.58**
	39	52.66	51.90	53.62	**98.21**
	40	30.94	55.33	55.64	**55.61**
	41	43.96	55.95	55.93	**78.60**

Table 8 continued:

	Period (Months)	Actual Donations ('000'Kshs) (TSCE)	12-Month Moving Averages	Centred 12-Month Moving Averages (TC)	Ratio TSCE/TC SE x 100
'87	42	39.30	55.91	57.35	**68.53**
	43	35.02	58.78	61.40	**57.04**
	44	61.93	64.02	63.51	**97.51**
	45	76.24	63.00	63.00	**121.02**
	46	40.35	63.00	64.92	**62.15**
	47	45.20	66.83	66.26	**68.22**
	48	174.59	65.58	65.86	**265.10**
'88	49	108.88	66.04	66.15	**164.60**
	50	46.27	66.26	64.63	**71.59**
	51	52.56	62.99	61.18	**85.91**
	52	77.04	59.36	59.19	**130.16**
	53	30.13	59.02	59.90	**50.30**
	54	43.70	60.78	56.04	**77.98**
	55	37.63	51.30	49.89	**75.43**
	56	22.65	48.47	48.43	**46.77**
	57	32.74	48.39	48.17	**67.97**
	58	36.24	47.94	45.95	**78.87**
	59	66.29	43.96	44.41	**149.27**
	60	60.87	44.86	44.97	**135.36**
'89	61	74.86	45.07	45.01	**166.32**
	62	45.36	44.95	45.67	**99.32**
	63	47.15	46.38	46.44	**101.53**
	64	29.26	46.49	46.42	**63.02**
	65	40.95	46.34	44.57	**91.88**
	66	46.26	42.79	43.68	**105.91**
	67	36.21	44.57	45.87	**78.94**
	68	39.81	47.16	47.03	**84.65**
	69	33.98	46.89	47.58	**71.42**
	70	34.42	48.26	48.10	**71.56**
	71	23.73	47.94	47.87	**49.57**
	72	82.22	47.80	50.16	**163.92**
'90	73	106.00	52.52	52.53	**201.79**
	74	42.05	52.54	52.24	**80.49**
	75	63.67	51.93	53.09	**119.93**
	76	25.41	54.24	55.85	**45.50**
	77	39.25	57.46	58.34	**67.28**
	78	102.92	59.21	59.69	**172.42**
	79	36.39	-	-	-
	80	32.48	-	-	-
	81	61.79	-	-	-
	82	73.05	-	-	-
	83	44.69	-	-	-
	84	93.75	-	-	-

Table 9: Computation of Seasonal Indices from SE Ratios in table 8.

Month	Year								
	1984	1985	1986	1987	1988	1989	1990	Mean	Adjusted Seasonal Index
January	-	184.66	163.89	94.56	164.60	166.32	201.79	162.64	**162.71**
February	-	103.72	168.42	115.58	71.59	99.32	80.49	106.52	**106.57**
March	-	59.36	87.33	98.21	85.91	101.53	119.93	92.05	**92.09**
April	-	74.83	117.69	55.61	130.16	63.03	45.50	81.14	**81.18**
May	-	76.44	31.39	78.60	50.30	91.88	67.28	66.00	**66.03**
June	-	76.65	120.23	68.53	77.98	105.91	172.42	103.62	**103.67**
July	79.80	147.69	41.02	57.04	75.43	78.94	-	79.99	**80.03**
August	22.87	73.56	64.88	97.51	46.77	84.65	-	65.04	**65.07**
September	119.89	89.60	72.58	121.02	67.97	71.42	-	90.41	**90.45**
October	99.92	80.93	68.48	62.15	78.87	71.56	-	76.99	**77.02**
November	68.81	62.25	94.16	68.22	149.27	49.57	-	82.05	**82.09**
December	178.83	128.57	286.37	265.10	135.36	163.92	-	193.03	**193.11**

Table 10: Computation of Deseasonalized data using the Seasonal Indices from table 10.

Period (Months)		Actual Donations ('000'Kshs) TSCE	Seasonal Index S	Deseasonlized Data ('000'Kshs) TSCE/S = TCE
'84	1	261.65	162.71	160.81
	2	27.57	106.57	25.85
	3	33.49	92.09	36.36
	4	24.84	81.18	30.71
	5	28.91	66.03	43.77
	6	37.41	103.67	36.08
	7	36.31	80.03	45.37
	8	8.76	65.07	13.45
	9	46.29	90.45	51.19
	10	38.51	77.02	50.00
	11	26.80	82.09	32.64
	12	69.51	193.11	36.00
'85	13	73.31	162.31	44.06
	14	43.25	106.57	40.57
	15	25.17	92.09	27.32
	16	31.51	81.18	38.80
	17	32.22	66.03	48.80
	18	32.11	103.67	30.97
	19	61.50	80.03	76.86
	20	31.66	65.07	48.65
	21	40.24	90.45	44.49
	22	37.46	77.02	48.63
	23	28.86	82.09	35.14
	24	61.29	193.11	31.72
'86	25	75.47	162.71	45.81
	26	74.66	106.57	70.06
	27	38.52	92.09	41.83
	28	51.43	81.18	63.36
	29	13.92	66.03	21.08
	30	57.94	103.67	55.90
	31	20.61	80.03	25.75
	32	31.39	65.07	48.24
	33	35.07	90.45	38.77
	34	32.91	77.02	42.73
	35	45.62	82.09	55.58
	36	140.12	193.11	75.56
'87	37	46.10	162.71	28.33
	38	58.52	106.57	54.92
	39	52.66	92.09	57.19
	40	30.94	81.18	38.11
	41	43.96	66.03	66.59

Table 10 continued:

Period (Month)	Actual Donations ('000'Kshs) TSCE	Seasonal Index S	Deseasonalized Data ('000'Kshs) TSCE/S = TCE
42	39.30	103.67	37.91
43	35.02	80.03	43.76
44	61.93	65.07	95.20
45	76.24	90.45	84.31
46	40.35	77.02	52.39
47	45.20	82.09	55.07
48	174.59	193.11	90.43
'88 49	108.88	162.71	66.92
50	46.27	106.57	43.42
51	52.56	92.09	57.08
52	77.04	81.18	94.93
53	30.13	66.03	45.63
54	43.70	103.67	42.15
55	37.63	80.03	47.02
56	22.65	65.07	34.80
57	32.74	90.45	36.19
58	36.24	77.02	47.05
59	66.29	82.09	80.77
60	60.87	193.11	31.51
'89 61	74.86	162.71	46.01
62	45.36	106.57	42.56
63	47.15	92.09	51.20
64	29.26	81.18	36.04
65	40.95	66.03	62.02
66	46.26	103.67	44.62
67	36.21	80.03	45.25
68	39.81	65.07	61.18
69	33.98	90.45	37.57
70	34.42	77.02	44.69
71	23.73	82.09	28.91
72	82.22	193.11	42.58
'90 73	106.00	162.71	65.15
74	42.05	106.57	39.46
75	63.67	92.09	69.14
76	25.41	81.18	31.30
77	39.25	66.03	59.44
78	102.92	103.67	99.28
79	36.39	80.03	45.47
80	32.48	65.07	49.92
81	61.79	90.45	68.31
82	73.05	77.02	94.85
83	44.69	82.09	54.44
84	93.75	193.11	48.55

Table 11: Computations of the combined Cyclical and Error components from the Trend values.

Period (Months)		Deseasonalized Data ('000'Ksh) (TCE)	Trend Values $T_t = 44.90 + 0.1375t$ (T)	Cyclical and Error. (TCE/T = CE)
'84	1	160.81	45.04	3.57
	2	25.85	45.18	0.57
	3	36.36	45.31	0.80
	4	30.71	45.45	0.68
	5	43.77	45.59	0.96
	6	36.08	45.73	0.79
	7	45.37	45.86	0.99
	8	13.45	46.00	0.29
	9	51.19	46.14	1.11
	10	50.00	46.28	1.08
	11	32.64	46.41	0.70
	12	36.00	46.55	0.77
'85	13	44.06	46.69	0.94
	14	40.57	46.83	0.87
	15	27.32	46.96	0.58
	16	38.80	47.10	0.82
	17	48.80	47.24	1.03
	18	30.97	47.38	0.65
	19	76.86	47.51	1.62
	20	48.65	47.65	1.02
	21	44.49	47.79	0.93
	22	48.63	47.93	1.02
	23	35.14	48.06	0.73
	24	31.72	48.20	0.66
'86	25	45.81	48.34	0.95
	26	70.06	48.48	1.45
	27	41.83	48.61	0.86
	28	63.36	48.75	1.30
	29	21.08	48.89	0.43
	30	55.90	49.03	1.14
	31	25.75	49.16	0.52
	32	48.24	49.30	0.98
	33	38.77	49.44	0.78
	34	42.73	49.58	0.86
	35	55.58	49.71	1.12
	36	75.56	49.85	1.52
'87	37	28.33	49.99	0.57
	38	54.92	50.13	1.10
	39	57.19	50.26	1.14
	40	38.11	50.40	0.76
	41	66.59	50.54	1.32
	42	37.91	50.68	0.75

Table 11 continued:

Period (Months)	Deseasonalized Data ('000'Ksh) (TSCE)	Trend Values $T_t = 44.90 + 0.1375t$ (T)	Cyclical and Error (TSCE/T = CE)
43	43.76	50.81	0.86
44	95.20	50.95	1.87
45	84.31	51.09	1.65
46	52.39	51.23	1.02
47	55.07	51.36	1.07
48	90.43	51.50	1.76
'88 49	66.92	51.64	1.29
50	43.42	51.78	1.84
51	57.08	51.91	1.10
52	94.93	52.05	1.82
53	45.63	52.19	0.87
54	42.15	52.33	0.81
55	47.02	52.46	0.90
56	34.80	52.60	1.51
57	36.19	52.74	0.69
58	47.05	52.88	0.89
59	80.77	53.01	1.52
60	31.51	53.15	0.59
'89 61	46.01	53.29	0.86
62	42.56	53.43	0.80
63	51.20	53.56	0.96
64	36.04	53.70	0.67
65	62.02	53.84	1.15
66	44.62	53.98	0.83
67	45.25	54.11	0.84
68	61.18	54.25	1.13
69	37.57	54.39	0.69
70	44.69	54.53	0.82
71	28.91	54.66	0.53
72	42.58	54.80	0.78
'90 73	65.15	54.94	1.18
74	39.46	55.08	0.72
75	69.14	55.21	1.25
76	31.30	55.35	0.57
77	59.44	55.49	1.07
78	99.28	55.63	1.78
79	45.47	55.76	0.82
80	49.92	55.90	0.89
81	68.31	56.04	1.22
82	94.85	56.18	1.69
83	54.44	56.31	0.97
84	48.55	56.45	0.86

Table 12: Comparison of the Predicted (Forecasted) Donations and the Actual Donations for 1992.

Period (Month) t		Actual Donation ('000'Ksh)	Predicted Donation ('000'Ksh) (T_t x S)
1991	1	284.11	92.07
	2	71.50	60.45
	3	49.17	52.36
	4	55.95	46.27
	5	73.80	37.73
	6	81.38	59.34
	7	43.66	45.95
	8	48.67	34.45
	9	42.10	52.18
	10	67.81	45.54
	11	117.11	47.58
	12	107.55	112.20

Table 13 : The Non-parametric Sign Test for comparing the actual and the predicted monthly voluntary donations.

Period (Month) t		Actual Donation ('000'Kshs) x	Predicted Donation ('000'Kshs) y	Sign (x - y)
1991	1	284.11	92.07	+
	2	71.50	60.45	+
	3	49.17	52.36	-
	4	55.95	46.27	+
	5	73.80	37.73	+
	6	81.38	59.34	+
	7	43.66	45.95	-
	8	48.67	34.45	+
	9	42.10	52.18	-
	10	67.81	45.54	+
	11	117.11	47.58	+
	12	107.55	112.20	-

APPENDIX B

Some selected articles from literature on community OR

1. "An Approach to the simulation of bus passenger journey times for the Journey to work". Transportation planning and Technology (UK). Vol. 14, No. 1, 1989.

2. "Simulation, Gaming and Training in a competitive multimodel multicompany intercity passenger transportation environment". Jour. of Oper. Res. Soc.. Vol. 40, No. 10, 1989.

3. "An Approach to environmental impact assessment by using cross impact simulation". Environment and Planning. Vol. 21, No. 6, 1989.

4. "Validating the heavy traffic performance of regenerative sumulation". Comm. Statistical Stochastic Models (US). Vol. 5, No. 4, 1989.

5. "A General Purpose simulation program for Agricultural Operations". Computers and Electronics in Agriculture. Vol. 3, No. 1, 1988.

6. "A Simulation model for planning services for renal patients in Europe". Jour. of Oper. Res. Soc.. Vol. 38, No. 8, 1988.

7. "Simulation of transit bus regenerative Braking Systems". Math & Computers in Simulation. Vol. 30, No. 1, 1988.

8. "Global circulation and precipitation changes induced by sea surface temperature. Anomalies to the North of Australia in a general circulation model". Math and Computers in simulations. Vol. 30, No. 2, 1988.

9. "Simulation and models of the role of topographic instability in the formation of atmospheric teleconnection patterns". Math and Computers in Simulation. Vol 30, No. 2, 1988.

10. "Structuring rainfall - land use - run off models for a large catchment NSW". Math and Computers in simulation. Vol. 30, No. 2, 1988.

11. "Input errors in Rainfall - Runoff Modelling". Math and Computers in Simulation. Vol. 30, No. 2, 1988.

12. "Applied environmetrics: Simulation applied to the physical environments. Math and Computers in sumulation. Vol. 30, No. 2, 1988.

13. "Simulating sediment depositon to establish a chronolgy of an Urban Lake". Math and Computers in simulation. Vol. 30, No. 2, 1988.

14. "A simulation study of crown of thorns starfish outbreaks on the Great barrier reef". Math and Computers in simulation. Vol. 30, No. 2, 1988.

15. "A model of the circadian rythm of deep body temperature". Math and Computers in simulation. Vol. 30, No. 3, 1988.

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18. "Root Map: A root growth models". Math and Computers in simulation. Vol. 30, No. 1, 1988.

19. "Simulation of thermal and moisture boundary layers during aeration of cereal grain". Math and Computers in simulations. Vol. 30, No. 1, 1988

20. "An application of trend analysis to model domestic water consumption patterns for selected residential areas of Nairobi". MBA management project, University of Nairobi, 1988.

21. "An evaluation of pre-entry performance predictors for bachelor of commerce students at the university of Nairobi". MBA management project, University of Nairobi, 1988.

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