AN EMPIRICAL INVESTIGATION INTO THE BEHAVIOUR OF ANNUAL CORPORATE EARNINGS AMONG KENYAN PUBLICLY QUOTED COMPANIES.

BY

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A MANAGEMENT RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREEE OF MASTER OF BUSINESS AND ADMINISTRATION, FACULTY OF COMMERCE, UNIVERSITY OF NAIROBI.

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DECLARATION

THIS PROJECT IS MY ORIGINAL WORK AND HAS NOT BEEN PRESENTED FOR A DEGREE IN ANY OTHER UNIVERSITY

Signed _____ Date 25/9/91

Hedrick Masaki Omanwa

THIS PROJECT HAS BEEN SUBMITTED FOR EXAMINATION WITH MY APPROVAL AS UNIVERSITY SUPERVISOR

Signed Kinandu Muragu Date 25/09/91

Dr. Kinandu Muragu

DEDICATION

To James Omanwa and Rael Masese who bore all, and giving everything at their disposal.

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I however shoulder any errors of omission or commission such as may exist in this project.

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ABSTRACT

Existing evidence, particularly from developed countries, indicate that the time-series behaviour of corporate annual earnings is well approximated by a random-walk, or some similar process. This evidence is scarce in developing countries andthere is no known Kenyan evidence of this issue.

The study presents the results of an empirical investigation into the behaviour of annual corporate earnings of a sample of thirty four companies quoted on the Nairobi Stock Exchange. It utilizes four definitions of earnings and applies two data analysis techniques to determine whether they exhibit any random behaviour. The conclusion is that changes in such earnings are independent and thus can well be approximated by a random-walk. This is consistent to the majority of existing evidence.

CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND TO THE STUDY:

A lot of accounting literature has developed over the last 30 years on the empirical description of the behavior of accounting earnings[1] over time and on the use of observed patterns to forecast future earnings [Ball and watt (1972), Beaver (1970), Lookabill (1976), Foster (1977) and Griffin (1977)]. These researchers tried to infer the process generating accounting numbers by looking at their sequence in order to determine what it tells about the firms' future earnings.

The stimulus for these studies started with the economists concern of accounting earnings as a surrogate for returns. Modiglian and Miller (1958), in their development of a theory of investment, showed that there is a relationship between earnings and the value of the

[1] The term, earnings and income are often used interchangeably. However, income connotes Hicksian economic income a concept not identical to earnings in this study.

firm, and stated that it was necessary to consider the the capitalized value of the "stream of profits over time". Two of the earliest studies of the behaviour of accounting earnings were Little (1962) and Little and Rayner (1966). Since then a lot of studies have been conducted on the subject in the U.K and U.S utilizing earnings from quoted companies at the London and the New York Stock Exchange [Beaver (1970), Ball and Watts (1972), Albrecht, Lookball and McKeown (1977), and Watts and Leftwich (1977)]. Studies from other countries include those from Australia [Whittred (1978)] and New Zealand [Caired and Emanuel (1981)].

These researchers have used various statistical approaches to explain the behaviour of earnings over time. They examine the properties of reported earnings, derive a statistical model that has those properties and fit it to the data. The statistical models they have employed include the random walk model, the random walk with a trend and the Box-Jenkins procedures. The major conclusion of these studies have been that non-deflated earnings appear to follow either a random walk or a random walk with a drift pattern, while deflated earnings can be characterized by a moving average or mean reverting type model.

The Kenyan Companies Act (Cap.486 of the Laws of Kenya) impose a responsibility on a corporation to report annually to the shareholders and thus entitles each shareholder access to the corporation's annual financial report. Also for those corporations that are or desire to be registered and trade their securities at the Nairobi Stock Exchange, they have to meet the requirement of filing their accounts annually at the exchange's offices. These accounts consists of;

i) Statement of financial position (Balance sheet),

ii) A profit and loss statement, and

iii) Statement of changes in financial position,

These accounts comprise the most complete package of financial data that is given to the shareholders and other interested external parties. Thus, annually, the decision makers can use this information to evaluate that particular corporation and reconsider their objectives. One such way of evaluating accounting information is via earnings forecastings. However, the use of such information is dependent upon the assumption that historical data are relevant to a meaningful formation of expectation. This is based on the assumed continuity of events and activities engaged in by the corporation. Also although many aspects

of a corporation's activities, for example, production processes may change over time, many important aspects remain constant or change slowly, thus enabling the immediate past to provide a context to consider future possibilities.[2]

Using such data as described above, empirical investigation into various aspects of the investment decision process, such as cost of capital, firm valuation and the relationship between earnings and stock prices have utilized forecasted accounting earnings extensively as a measure of earnings expectations [Collins and Hopwood (1980, p.390)]. It is for these seemingly important reasons that the study of earnings behaviour has been chosen to be undertaken.

1.2. THE NEED FOR THE STUDY:

Philippatos and Sihler (1987, p.17) point out that understanding the time-series behaviour of accounting numbers is extremely important in that it allows us to predict sales or earnings more accurately. Earnings

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[2] Demski, J.S. and G.A. Feltham, "Forecast Evaluation", The Accounting Review (July 1972), pp.533 - 548

forecasts are critical in investment analysis and may provide information about future security returns. Bar-Yosef, Callen and Livnat (1987) have explained that future corporate earnings are an important parameter in almost all stock valuation models. It is therefore not surprising to find that enormous amount of intellectual capital has been expended studying whether corporate earnings exhibit any patterns and whether they can be forecasted.

Further, existing evidence on the behaviour of annual corporate earnings indicate that they are well approximated by a random-walk or some similar process [Ball and Watts (1972), Watts and Leftwich (1977), Albrecht, Lookaball and McKeon (1977)]. There is however no known documented Kenyan evidence on this issue.

The motivation for the present study stems from the fact that despite the various empirical studies on the behaviour of accounting earnings in the U.S, U.K, and other parts of the world , and the research findings reported, no currently identifiable research has been done in the Kenyan environment related to this area of the behaviour of accounting earnings. This is surprising given that the study of earnings behaviour and forecasting is a popular

intellectual area in finance and accounting. There then arises a need to carry out some empirical study into the behaviour of annual accounting earnings among Kenyan Companies.

This study aims at filling the existing gap by replicating studies carried elsewhere and provide evidence from the Kenyan context.

1.3. OBJECTIVE OF THE STUDY:

This study was prompted by the inadequacy of the literature on the behaviour of corporate earnings in Kenya. The objective of the study is to examine the behaviour of annual corporate earnings for Kenyan publicly quoted companies.

1.4. IMPORTANCE OF THE STUDY:

It is hoped that this study will be useful to the following groups of interested parties who make or use earning forecast for various reasons in order to maximize their interests:

(i) Investors. They are interested with future dividend flow which is based on future earnings and therefore they can use such information in valuing securities in their investment decisions.

(ii) Management. The findings will be of use to management in their decision making purposes. For example earnings forecasts are important to management in financial planning areas like capital budgeting, working capital management and alternative combination of financing. Therefore they may benefit a lot from the results of the study.

(iii) Lending institutions. The loan procedures followed at many financial institutions include a forecast of an applicant's or client's earnings over the term of a loan. Understanding earnings behaviour therefore will aid in establishing the correctness of such forecasts.

(iv) Researchers and scholars. This study could be useful to academicians as a motivation for further research, on the behaviour of accounting numbers and as a foundation for pursuing the same issue by different approaches.

1.5 OVERVIEW OF THE STUDY:

The rest of the study is in chapters. Chapter Two presents the literature review on prior research findings on annual and quarterly corporate earnings.Chapter Three details the various alternative models which have been used

to study the behaviour of earnings.

The fourth chapter details the methodology used in the study. Here, the population of interest, data collection and analysis procedures are discussed.

The fifth chapter detail the data analysis and findings of the study. Chapter Six summarises and discusses the findings of the study. The limitations of the study and suggestions for further research are also discussed.

CHAPTER TWO

LITERATURE REVIEW

The behaviour of corporate annual accounting income numbers has attracted the interest of scholars for a long time. This can be traced back to the work of Little (1962) for U.K companies and by Lintner and Glauber (1967) for U.S companies. Most of the studies have concentrated in examining the behaviour of corporate annual income numbers through comparing the forecasting abilities of competing models using actual data. The models employed rely completely on extrapolatory models of annual earnings behaviour. The driving force behind the empirical work is because of its relation to other issues, such as interim reporting, income smoothing, relative forecast ability of alternative income measurement and cross-sectional valuation [Beaver (1970), Ball and Watts (1972), Griffin (1977), Jensen (1970)]. If earnings are found to be best approximated by a random walk, then logically the latest income number of a particular firm's series should be used as input to various models of valuation.

The conclusions of these studies have major implications for financial theories which rely on

assumptions of income predictability, for example, the capital asset pricing model, cost of capital, firm valuation, and the relationship between earnings and stock prices[3]. These extrapolatory models are: random walk, random walk with a trend, average growth model,exponential smoothing model, and Box-Jenkins models (autoregressive, moving average processes).

Little (1962) used U.K firms over a period 1951 - 1959 to examine the correlation between successive growth rates in their earnings. His sample consisted of 441 firms from the Moodies Services for which the growth rates were derived in respect of three magnitudes: (1) dividends expressed as a percentage of equity, (2) earnings, net of interest, taxation, minority interest and preference dividends expressed as a percentage of equity capital, and (3) pre-tax earnings expressed as a percentage of equity capital. He also examined a number of distributions, both for individual groups and the sample as a whole, of the logs of the deviations of growth rates relative to the mean growth rate for different periods. He found out that

3 Brown, L.D. and M. S. Rozeff, "The superiority of analyst forecasts as measures of expectations: Evidence from earnings", The Journal Of Finance (March 1978), pp. 1 - 16

changes in earnings follow a random walk. This meant that successive changes in earnings per share were statistically independent and the study of the sequence of historical changes in earnings per share was useless as an aid in predicting future changes. This implies that historical rates of growth provide no clue to the future rates of growth. He concluded that "the true relationship was rather random"(p.408), making him to entitle his paper "Higgledy - Piggledy growth".

Little's work was followed by that of Little and Rayner (1966) study. They introduced in addition to correlation various naive extrapolative models. But they found that the earnings showed a random behaviour as had earlier been reported by Little himself. They concluded that "changes in earnings for British corporations follow a random walk", and therefore entitled their paper "Higgledy - Piggledy growth again".

Murphy (1966) studied the correlation between relative rates of growth of earnings per share in successive periods between 1950 and 1965 for 344 companies in 12 industries for U.S. Compustat firms. He computed the correlations for successive one-year, two-years, and five-years periods. In 240 or 69% of the tests, he found no

significant correlation in successive growth rates of earnings per share of companies in an industry. In 25% of the tests, the correlations were significantly negative. Only 6% of the tests showed significant positive correlations. He concluded that changes in American corporate earnings, like changes in British corporate earnings follow a random walk.

Lintner and Glauber (1967) investigated the growth rates for earnings of 323 U.S companies having positive earnings in the years 1945 - 1965 drawn from the New York Stock Exchange. For each company, they calculated the five year trend in earnings per share for each of the four, five-year periods and found very little association between the growth rates in successive periods. This result suggested to them that changes in earnings are random (i.e. annual earnings follow a random walk). They concluded that "changes in American earnings, like changes in British earnings, follow a random walk".

The result from Lintner and Glauber study cited above led Ball and Watts (1968) to investigate the time-series of annual earnings of U.S corporations with a sample of about 700 drawn from Compustat over the period 1947 - 1966. They used four different kinds of tests: (1) a

runs test, which examined if the signs of successive changes in earnings was independent, (2) an analysis of autocorrelation coefficients, (3) mean squared successive differences, and (4) estimated exponential smoothing models. The result of these tests were consistent with the previous findings that annual earnings for firms in general can be characterized as a random walk.

Ball and Brown (1968) investigated whether changes in earnings are serially correlated from a sample of 261 New York Stock Exchange firms and found that they were serially uncorrelated. This implied that earnings follow a random walk.

Using a sample of 100 "industrial" firms randomly selected from a population of firms listed in the New York Stock Exchange on December 31,1954, Beaver (1970) based his study on both a simulated and empirical analysis for a period 1926 to 1968. He reports findings regarding the statistical properties of the simulated (98) firms and the 57 compustat New York Stock Exchange firms. He directed his attention on three major aspects of the series; (1) the dispersion parameter , (2) the serial correlation of the original series and of the first difference in the series, and an analysis of high and low rates of return. He

concludes that "much of the behavior of accounting rates of return is consistent with these measurements coming from a moving average model, where the underlying process is pure mean reverting in particular. Accounting rates of return also appear to be mean reverting, but the reversion takes over several years."(p.86)

In contrast with Beaver (1970), Ball and Watts (1972) examined the income of U.S corporations using data from Standard and Poor compustat file for the twenty years 1947-1966 .In this study they used four definitions of "income" namely (1) net income after income taxes, (2) adjusted earnings per share ,adjusted for stock splits and dividends, (3) net income ,deflated by total assets and,(4) sales. As a consequence, the earnings of more than approximately 900 firms on the Standard and Poor file were investigated,the number differing according to the specific definition of net income used. Since they did not have a theory to predict the behaviour of earnings changes,they subjected their sample to a variety of tests for different kinds of statistical dependencies in earnings. The tests used by Ball and Watts were runs test, serial correlation, average changes, mean squared successive differences and partial adjustment models. They held that "results from

the variety of testing procedures lead us to the conclusions that measured accounting income is submartingle or some very similar process."(p.680). As is evident from this study, the researchers arrived at a different finding from that found out by Beaver (1970).

Albrecht,Lookabill and Mckeown (1977) estimated their models on twenty-five observations and reported superior predictive ability for Box-Jenkins models specific to individual firm's available for common earnings. However, when fitted to earnings deflated by stockholder equity, the firm specific Box-Jenkins models are out performed by the random walk model. They defined the deflated series as earnings available to common stock divided by stockholders equity of the previous period. Their study argued that deflated earnings represent only one stochastic process (earnings per dollar investment base) while undeflated earnings represents a mixture of two stochastic processes (earnings per dollar of investment base and investment changes over time), and therefore the time series properties of the two series need not be same. They concluded from their study that there was "little difference in the predictive accuracy of the best random walk model and fitted Box-Jenkins models" (p.242)

Watts and Leftwich (1977) attempted to determine whether Box- Jenkins techniques applied to a larger number of observations on annual earnings produce estimates of individual firms generating processes that out predict the random walk model. The sample consisted of thirty-two companies in three industries (rail-roads,petroleum, and materials) for periods 1927 to 1974 in Moody's Transportation and Industrial Manuals. In their forecast they state that "if any conclusion is to be drawn from the above, it must be that a random walk model predicts "better" than the identified models according to the sum of ranks based on squared errors" (p.267).This led them to conclude that "the ability of random walk models to out predict the identified Box-Jenkins models suggests that the random walk is still a good description of the process generating annual earnings in general, and for individual firms."(p.269).

Seeking evidence from the Australian corporations, Whittred (1978) used a sample selected from the 1970 edition of Ian Potter and company's Australian company reviews , with 104 industrials over a period 1960-1974. He used the following four definitions of earnings variables to describe their behaviour; (1) net income after taxes ,

(2) net income after taxes and extraordinary items, (3) earnings per share after taxes , and (4) earnings per share after taxes and extraordinary items. He used both a runs and serial correlation tests in data analysis and concluded that "successive changes in reported earnings of Australian corporations are essentially independent and well approximated by a random walk .

Examining a sample of U.S compustat firms over the period 1955-1974, Brooks and Buckmaster (1980) detected "large" changes by dividing the yearly earnings change by the standard deviation of such changes in the past years and then ranking the resultant standard changes, "large" changes were defined as those observations in either tail of the normal curve distribution. Basing their findings on systematic partitioning of the sample to facilitate an empirical search for departures from the random walk model, they report that a random walk model best explains "the time-series behaviour of unpartitioned set of individual firm specific income series"(p.450).

The study of the behaviour of accounting earnings is not restricted to annual data alone. Quarterly accounting data provide a much larger data base for identifying the behaviour models than do annual accounting data. The

analysis of the behaviour of quarterly data mean more observations to identify and estimate the parameters of specific models. However, issues of stationality occur in using quarterly data. Lorek, McDonald and Patz (1976) examined the quarterly earnings behaviour of thirty-seven firms from U.S using Box-Jenkins models. They fitted these models to individual firms with thirty-five to fifty-two quarterly earnings observations. They demonstrated that quarterly earnings series contain exploitable patterns for predictive purposes and noted the "pervasive importance of seasonality[4] in the models. Thirty-five of the forty time-series analyzed required either seasonal parameters or seasonal differencing of the data"(p.328).They ended up by stating that "we did not find for any of the thirty-seven firms studied, any evidence of the simpler models here to be offered as descriptive of earnings series, we conclude that more complicated ARIMA models may be necessary to

[4] Seasonality refers to the tendency of a time series to repeat a pattern of behaviour over the span of seasonal period. Wherever intra year data (e.g quarterly earnings data) are utilized, the likelihood of seasonality being a factor in the identification process increase.

describe the time series properties of quarterly earnings.(p.329)

Griffin (1977) applied Box and Jenkins analysis for the identification of autoregressive integrated moving average (ARIMA) time-series models to quarterly earnings available for common stockholders series for a sample of ninety-four large firms listed on the New York Stock Exchange over the period 1958 - 1971. The analysis suggested that there are two components to the quarterly earnings process : (1) a four-period seasonal component and, (2) an adjacent quarter component which describes the seasonally adjusted series. Of the several candidate models for the dual characterization that were examined, either a stationary first-order autoregressive or a nonstationary first-order moving average process adequately described the sample. He concluded that "the results clearly indicate that quarterly earnings process cannot be adequately described as a random walk or a martingale and that successive changes in quarterly earnings are not independent"(p.82).

Foster (1977) using quarterly data of sixty-nine firms from the New York Stock Exchange for the 1946 -1974 period investigated several Box-Jenkins identified models

and found an autoregressive model to be the "best" predictor of quarterly earnings.

Bathke and Lorek (1984) examined the quarterly earnings per share series of 240 firms, using the period 1962 -1974 to identify and estimate the time-series models. The period 1975 - 1977 was used to test the forecasting ability of each model. In each of the four fiscal quarters a combined autoregressive moving average provided the most accurate forecasts. Also they found out that the fourth fiscal quarter had a higher forecast error than the first three quarters. "These results are suggestive of a fourth-quarter dumping process by which accruals and deferrals on an interim basis are brought into correspondence with annual figures. This phenomenon evidently induces a random shock or noise component in the quarterly earnings per share time-series which may impend the modelling process".(p.168)

In summary, most of the studies so far reviewed, for example Ball and Watts (1972), Lintner and Glauber (1967), and Little (1962) have all presented evidence that earnings in general can best be approximated by a random walk or by a random walk with a trend. This literature provides the justification for specifying a priori the models of the

earnings generating process of firms.

CHAPTER THREE

ALTERNATIVE MODELS FOR STUDYING EARNINGS NUMBERS.

There are a huge number of models which have been used to extrapolate from past data, and as such if one had sufficient knowledge about the properties of these techniques and about the underlying process generating earnings, then the particular version of the technique that worked best could be specified a priori. Lookabill (1976) gives two reasons as to why the processes are discussed.First, each process reasonably could be expected as a result of different assumptions about the type of events affecting a firm and its historical cost accounting system. Second, there are relatively convenient methods of distinguishing among these particular processes. That is, relatively simple tests are utilized for identification purposes - as opposed to more sophisticated procedures needed for identification of a more complex process. Several of these models which have been identified include Random walk, Random walk with a trend, Autoregressive processes, and Box-Jenkins methodology. These are discussed in turn below.

3.1 RANDOM WALK PROCESS.

This model is often applied in the market efficiency literature and suggests that current observation on some variable is related to its immediately preceding observation, that is

$$Z_t = Z_{t-1} + \delta_t \qquad (1)$$

Where, Z_t represent earnings in period t

δ_t represents unexpected component in period t and it satisfies the assumptions that, it has a mean of zero and a variance of 1. This is a simple model which is also known as a martingle model. Once year t's earnings (Z_t) are realised, they become the expected earnings for year t+1's earnings.

The model derives its name from an important problem addressed by mathematicians at the turn Of the century. The problem concerns the search for a drunk who was left wandering in a random fashion in a field one night (time t-1). Where should he be looked for the next morning (time t)? The solution is to look at the sport where he was last observed (i.e Z_{t-1}) since that is the best guess as to

where he will be in the morning[5]. Therefore it is used in the finance and accounting literature to characterise anearning series where all subsequent earning changes represent random departures from previous earnings.

The explanation is that our best prediction of Z_t is Z_{t-1} if earnings do in fact follow a random walk. The model also implies that the expected change in a firms earnings from one period to the next is zero: $E(Z_t - Z_{t-1}) = E(\delta_t) = 0$. Where E represents expectation operator.

To detect if a firm's earnings series could be adequately described as a random walk, one has to make a comparison of known properties of the model, for example, using the autocorrelation function. The autocorrelation structure display of a series is given as[6]

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Watts, R and J.L., Zimmerman, "Positive Accounting Theory", Prentince-Hall, Inc., Englewood Cliffs, New Jesey (1986), p.137

6 ---

Foster, G., Financial Statement Analysis, Prentice-Hall, Englewood cliffs, New Jersey (1986), pp. 232

$$r_j = 1/T \sum_{t=1}^{T-j} \left[\left(Z_{t+1} - Z_t \right) \left(Z_{t+2} - Z_{t+1} \right) \right] \qquad (2)$$

$$\gamma_o$$

Where, r_j is the autocorrelation coefficient

Z_t is earnings at point in time

γ_o is the variance of a stationary series.

T is the number of observations.

The range of r_j for j = 1 to T - j is from -1 to +1.

The theoretical property of the random walk model is that the autocorrelations of the ($Z_t - Z_{t-1}$, $Z_{t-1} - Z_{t-2}$, $Z_{t-2} - Z_{t-j-1}$ .....) sequence are zero. This property implies that $r_j = 0$ for j = 1 to N. Where N is the number of autocorrelations computed for all values. Thus testing whether a firm's earnings series behave as a random walk involves estimating the r_j's for the series and comparing them with the theoretical predictions of the random walk model.

3.2 RANDOM WALK WITH TREND.

A random walk model can have a trend (or drift term) in the series Z_t and thereby allows the user to

embody that trend in his or her forecast. For example the following model is a random walk with a trend:

$$Z_t = Z_{t-1} + d + \delta_t \qquad (3)$$

Where, d is the trend term

δ_t is the white noise

$E(\delta_t) = 0$, Variance is constant for all t, and $cov(\delta_t, \delta_{t-1}) = 0$ for all observations. Here forecasts increase linearly with period. This gives a linear function of time and the variance about the trend is constant over time. This process is also called a submartingle process[7] as described by Ball and Watts (1972).

[7] A submartingle by definition is a process in which any one observation becomes the basis for the expectation of the next. If Z_1, Z_2, ... are random variables with expectation. Then the sequence (Z_t) is a submartingle if $E(Z_{t+1} / Z \ldots\ldots Z_t) >= Z_t$ for all t. Where E is an expected operation. [Ball and Watts (1972)]

3.3 AUTOREGRESSIVE PROCESS.

The general autoregressive process has the following processes[8]

$$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \ldots\ldots + \phi_p Y_{t-p} + \delta + y_t \quad (4)$$

Where,

Y_t = earnings in period t

ϕ = the weight on earnings in period t-i

p = the order of the process

δ = a constant growth component

y_t = the unexpected component in period t

The first order autoregressive process has the following properties as a simple case of the general process

$$Y_t = \phi_1 Y_{t-1} + \delta + y_t \quad (5)$$

$$E(Y_t) = \phi_1 Y_{t-1} + \delta \quad (6)$$

The y_t are assumed to be independent and identically distributed. The interpretation of the δ can be the intercept while ϕ_1 represent slope coefficients from a

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[8] Lookabill, L.L., "Some additional evidence on the time series properties of accounting earnings", Accounting Review, Vol. L1. No. 4 , October 1976, pp.742 - 738.

regression of Y_t on Y_{t-1}. As can be seen from the above properties of the autoregressive process, the martingle and the submartingle described by Beaver (1970) are special cases of the first order autoregressive model.

3.4 BOX-JENKINS METHODOLOGY.

The methodology suggested by Box and Jenkins represents a systematic approach to modelling and forecasting discrete time-series. Marbert and Radcliffe (1974) have put forward two basic reasons why Box-Jenkins methodology will lead to better forecasts than traditional forecasting methods and is thus preferred. First, using traditional approaches the forecaster would select more or less arbitrarily a specific forecasting model. But this suggested methodology begins with a broad, generalized model which is inclusive of all possible separate model combinations of moving average and autoregressive models. One therefore eliminates inappropriate models until he or she is left with the most suitable one. Second, the specific form of a given model which is to be tested has traditionally been the result of trial and error with a great deal of judgment, which is not the case with Box-Jenkins methodology.

The Box-Jenkins methodology has successfully been used to study the behaviour of accounting numbers as it has been evidenced by many researchers in the area. The technique basically involves five steps as follows:

First, one has to plot the data series. This is important or necessary because it helps to search for outliers as well as check whether the series is stationary. The analysis requires that the series be stationary.

The second step is that of model identification. This involves finding a theoretical Box-Jenkins model that is in line with the data. Possible models from the Box-Jenkins approach include moving average, autoregressive and autoregressive moving average, and in case one has to specify the length of lag for the models.

The third step stems right from the second one and is that of model estimation. This is followed by the fourth step which involves diagnostic checking. Here testing of the significance of the estimated coefficients as well as the randomness in the resultant residual terms is performed. Non-randomness in the residuals indicate that the model is not adequate.

The last step is that of forecasting estimated values for the economic series in the data under investigation.

3.5 MODEL USED IN THIS STUDY.

This study uses the random walk model to investigate the behaviour of annual earnings among Kenyan publicly quoted companies. The model was adopted because it is well supported from the literature [Ball and Watts (1972), Watts and Leftwich (1977), Albrecht, Lookabill and Mckeon (1977), Whittred (1978)]. The researcher acknowledges that other models reviewed in this chapter may be useful, but resource, time and scope limitations do not allow them to be applied for now.

CHAPTER FOUR

RESEARCH DESIGN.

This chapter details out the research design so as to achieve the objective stated out above

4.1. POPULATION AND PERIOD OF STUDY:

The population is all those companies which were quoted in the Nairobi Stock Exchange during the period 1974 to 1989. It is for these companies that data was sort. 1974 was chosen because well defined data is available up to that time. 1989 was selected as it is the most recent time for which valid data is available. Quoted companies are, by Nairobi Stock Exchange rules, required to submit their financial statements to the Exchange and that provides the most reliable and economical data collection point. Hence, it is a relevant population for external users of earnings data, and it has the added advantage of greater availability of data than would hold for nonmembers of the population.

4.2. SAMPLE:

The rules of sampling that were used in this study were as follows:

(1) A company must have been continuously quoted from 1974 to 1989. This ensured total availability of data and consistency for all members of the sample.

(2) Annual financial statements were available for all years of the test period.

When the above rules were applied, only 35 firms met them. This figure was further trimmed down by one company that was under receivership, thus leaving 34 as the sample for the study.

The sample criteria that was used here may have introduced a severe survivorship bias since companies must have existed for sixteen consecutive years. Ball and Watts (1978) report that the effect of such bias is minimal in that their results appear quite similar among samples which have exaggerated differences in survival requirement.

4.3. DATA COLLECTION:

This study relied entirely on secondary data. Data that was collected was in the form of annual earnings for the period 1974 to 1989 both years inclusive. This data was obtained from audited published annual accounts of the quoted companies.

The reports were obtained from the secretariat to

the Nairobi Stock Exchange. A few reports that were missing were obtained from the companies themselves, and from the registrar of companies office.

Data was collected by use of data collection form as per specimen shown as Appendix A.

4.4. DATA ANALYSIS:

Whittred (1978) argued that meaningful analysis of a company's performance and accurate prediction of its future earnings can not be achieved, unless the results are presented in such away that the profits from operations is separated from profit from transactions which occur infrequently and outside a company's normal course of business. For purposes of the study, various definitions of earnings were used and included both deflated and undeflated measures. Such earnings have been used in many studies including Beaver (1970), Albrecht et. al (1977), and Watts and Leftwich (1977).

Four definitions of earnings in year t, Y_t were used in the study:

(1) Earnings before taxes and extraordinary items. This correspond to the operating income as obtained from the published accounts.

(2) Earnings attributable to ordinary shareholders. This correspond to the net earnings belonging to ordinary share holders after all the necessary deductions had been effected.

(3) Earnings before taxes and extraordinary items, deflated by the number of ordinary shares at each year end. This correspond to the operating income for the period divided by the number of ordinary shares on issue at the end of that period.

(4) Earnings attributable to ordinary shareholders, deflated by the number of ordinary shares at each year end. This correspond to the simple earnings per share as presented in the annual accounts of the companies. Where earnings per share were not calculated the researcher took net earnings and divided it with the number of ordinary share on issue at year end.

No adjustments were made for changes in accounting techniques, hence the earnings variables examined were not all calculated on the same basis. Further no attempt was made to ensure a uniform classification of "extraordinary" across companies and even by one company through time.

Under the rational expectation hypothesis [Muth (1961)], market earnings expectation should be measured by

the best available earning forecasts. However, according to Foster (1978), available evidence on the exact nature of the process generating accounting earnings suggest that:

> "It is difficult to find models that yield more efficient forecasts of earnings of individual firms than does the random walk model".(p.85)

This means that changes in earnings are supposed to be independent over time. For the purpose of this study, earnings change have been considered as any increase or decrease of reported earnings between two consecutive years. Given this, the following hypothesis was tested:

H_o: Earnings changes are independent over time

H_a: Earnings changes are not independent over time.

To test the hypothesis, both a parametric and nonparametric tests for independence in the earnings stream were conducted. The hypothesis were tested at 95% level of confidence and the analysis was done on the basis of first differences. The study adopts the Ball and Watts (1972) methodology.

4.4 (a) Non-parametric test

A non-parametric test was necessary since there was

little evidence on the underlying nature of the earnings distribution to be tested. The runs test provide a powerful tool of analysis under these conditions.

Runs test was done to test for independence in the earnings series by comparing the actual and the expected number of runs in a series. This was to test for the independence of the sequential arrangement in signs of deviations with the earnings numbers. A run here was defined as a sequence of elements of the same type resulting from first differences[9].

Under the assumptions that earnings are independent, the expected number of runs is given by the formula[10]:

$$\text{Mean } \bar{N} = \frac{2n_1 n_2}{n_1 + n_2} + 1 \text{ [see also Beaver (1970)]} \quad (7)$$

Where, n_1 and n_2 are number of observations in the increase or decrease categories respectively, and $\bar{N} = n_1 + n_2$.

9 Srivastava, U.K., G.V. Shenoy and S.C. Sharma, Quantitative Techniques For Managerial Decision Making, Wiley Eastern Limited, New Delhi (1987), pp.232

10 Ibid. pp.235

Assuming n_1 and n_2 are large, the statistics

$$Z = \frac{N - \bar{N}}{\sigma_R} \qquad (8)$$

Is normally distributed, with limiting distribution normal (o, 1). Where N is the actual runs, $\bar{N}$ is the expected runs and σ_R is the variance of the runs. The mean Z for independently distributed earnings should be equal to zero.

A series with positive dependencies will exhibit few runs, on average, than expected under independence. A series with negative dependencies exhibit more runs than expected.

4.4 (b) Parametric test

The results of nonparametric tests may not be sufficient to make strong conclusions on the independence of earning changes. In any case they are considered to be weaker than parametric tests [Taylor (1986)]. Parametric test were performed for this reason. The random walk model posits that for independence the serial correlation coefficient is zero.

The serial correlation test represent a powerful tool of analysis of independence. Serial correlation was also performed in this study. Serial covariance of changes in

equally lagged drawings from an independently distributed process is zero. The expectation of the serial correlation coefficients, computed from an independent process is zero.

Therefore the expected runs, serial coefficients and Z- values are used in analyzing the data. Both tests were performed by the use of a computer statgraphics package[11], and the results are summarised in the form of tables.

Due to the limited number of observations for each firm, the results obtained from the study may be sensitive to violations of each assumption of each test. Analytical results for most tests are for "Large" samples [Kendall and Stuart (1966)]. However since the earnings data was subjected to two tests, this problem is minimised. Mean results also ensured the elimination of outliers effect. Small samples have been used by Whittred(1978) who used 15 observations, Little (1962) with 10 observations and Ball and Watts (1972) with 20 Observations.

11 Statistical Graphics Corporation, Statistical Graphics System

CHAPTER FIVE

DATA ANALYSIS AND FINDINGS.

5.1. Introduction

In this section the findings of the study are presented. This study sought to determine the behaviour of annual corporate earnings for Kenyan publicly quoted companies. It provides an extension and replications of the previous research from the U.S and U.K. The results for this study pertain to a sample of Kenyan companies, thus providing opportunities for international comparisons.

5.2. Coverage

The sample companies that were used for the study are thirty-four as shown in Appendix B. This sample was from a possible number of fifty-six and thus represent about 61% coverage of the Stock Exchange. The study period taken, and unavailability of data for the entire study period made up for the other companies not included in the research. The researcher considers 61% coverage to be sufficient to enable meaningful valid conclusion to be reached about the quoted companies.

5.3 EMPIRICAL RESULTS

5.3.1 RUNS TEST

5.3.1 (a) Overall Results

Results for runs in the signs of earnings changes are summarised and reported in Appendix C. Tables 1 and 2 below, give a summary of two comparisons each of the observed number of runs in the series with the expected number of runs under the assumption of independence.

Table 1:

Runs in signs of earnings changes (undeflated)

	operating earnings		net earnings	
	Number	percent	Number	percent
Firms with more runs than expected under independence	15	44.0	16	47.0
Firms with number of runs expected under independence	9	26.5	10	29.5
Firms with fewer runs than expected under independence	10	29.5	8	23.5
TOTAL	34	100.0	34	100.0
Total runs in sample	342	100.0	359	100.0
Total expected runs, assuming independence	336	100.0	336	100.0

Table 2:

Runs in signs of earnings changes (deflated)

	operating earnings per share		net earnings per share	
	Number	percent	Number	percent
Firms with more runs than expected under independence	16	47.0	16	47.0
Firms with number of runs expected under independence	9	26.5	10	29.5
Firms with fewer runs than expected under independence	9	26.5	8	23.5
TOTAL	34	100.0	34	100.0
Total runs in sample	355	100.0	356	100.0
Total expected runs, assuming independence	336	100.0	335	100.0

From the two tables above, the total number of runs for the whole sample is 342 for operating earnings, compared to the expected number of 336. This gives a deviation of 1.79% , similarly we have 6.85% for net earnings , 5.65% for operating earnings per share and 5.95% for net earnings. The percentage deviations stated here are based on the difference between actual and expected, divided by the expected. As can be seen the actual number of runs in all the four cases is greater than the expected number of runs in both cases. The results indicate the

existence of negative dependencies in both the operating earnings, net earnings, operating earnings per share and the net earnings per share series.

5.3.1 (b) Results for individual Companies

Runs test was undertaken for each company. Under the assumption of independence, the decision rule used to determine whether the runs are significantly different from random was $\pm$ 1.96 (95% level of confidence) for the two-tailed Z- values. This values are presented in Table 3 below.

Table 3

Two tailed Z - values distribution of runs in the sample

Company code	Operating earnings	Net earnings	Operating EPS	Net EPS
1	.985674	1.000000	1.000000	.273565
2	1.000000	.795805	.577923	1.000000
3	.577923	.577923	.577923	.577923
4	.577923	.577923	.029869	.231169
5	.403984	1.000000	.780874	.734091
6	.403984	.273565	.577923	.273565
7	.002214	.002141	.403984	1.000000
8	.795805	.795805	.577923	.913316
9	.602698	.602698	.577923	.012295
10	1.000000	.437556	.437556	.437556
11	.795805	1.000000	1.000000	1.000000
12	1.000000	.795805	.795805	.599775
13	.602698	1.000000	.437556	1.000000
14	.795805	.602698	.602698	.913316
15	.795805	.795805	1.000000	1.000000
16	.985674	1.000000	.795805	.195709
17	.403984	1.000000	.273565	.602698
18	1.000000	.577923	1.000000	1.000000
19	.195709	1.000000	1.000000	.599775
20	1.000000	.403984	.195709	.798050
21	.029869	1.000000	.273565	1.000000
22	1.000000	.403984	.273565	.023117
23	.985674	1.000000	1.000000	1.000000
24	.795805	.273565	1.000000	.446087
25	.795805	.577923	.577923	.586266
26	.577923	.795805	.795805	.916415
27	1.000000	.577923	.577923	.913316
28	1.000000	.577923	1.000000	.795805
29	1.000000	1.000000	1.000000	1.000000
30	.795805	.795805	.437556	.462577
31	.437556	.795805	.195709	1.000000
32	.403984	.780874	.403984	.308178
33	.795805	.195709	.070075	.172482
34	.437556	.195709	.577923	.916415

As the calculated values of Z in Table 3 show, all fall in the acceptance region. We fail to reject the hypothesis that the earnings are independent

5.3.2 SERIAL CORRELATION

The decision rule applied here for the serial correlation coefficients was that it is significant if it is outside the range of (Standard error * $\pm$ 1.96) for all earnings variables and all lags. The standard errors for lags 1, 2 ,3 and 4 are .2500. .2582, .2673 and .2774 respectfully. This gave the critical values above which a coefficient was considered significant. The serial coefficients are presented in Appendix D.

For operating earnings, only 4 companies out of 34 show significant results. This represent 11.7% of the total sample for lag one, only 2 companies at lag 2 accounting for 5.8% of the total sample, while there is no significant results for lags 3 and 4. We consider this not to be significant enough to reject the hypothesis of independence.

As For net earnings, only 3 companies out of 34 show

significant results. This only represent 8.8% of the total sample companies for lag one, only 1 company accounting for 2.9% of the total sample for lag 2, while there is no significant results for lags 3 and 4. This are not significant enough to prompt us to reject the hypothesis of independence.

For operating earnings per share, only 6 companies out of 34 show significant results. This represents 17.6% of the total sample companies for lag one, while there are no significant results for lags 2, 3 and 4 . This proportion is not considered significant enough to reject the hypothesis of independence.

For net earnings per share, only 4 companies out of 34 show significant results. This represent 11.8% of the total sample for lag one, only 2 companies at lag 2 accounting for 5.8% of the total sample, no significant results for lag 3, and only 1 company representing 2.9% of the total sample for lag 4 were significant. We consider this to be insignificant enough to reject the hypothesis of independence.

The departure indicated by these results of individual firms earnings analysis was suspected to have resulted from the presence of outliers in the population sample. To

confirm this we computed mean results for all firms in the sample. The results are presented in Table 4 below.

Table 4:

Mean Autocorrelation coefficients for first-difference earnings 1974 - 1989

	r_1	r_2	r_3	r_4
Operating earnings	-.1719	.0153	.0465	.0058
Net earnings	-.1729	.0525	-.0515	.0039
Operating earnings per share	-.2584	-.0648	-.0593	-.0543
Net earning per share	-.2241	-.0673	-.0553	-.0368

We have observed that for the first lag serial correlation coefficient, the estimated serial correlation coefficients do not vary considerably between earnings variables that were investigated. That also applies for the second, third and fourth lag mean coefficients presented in Table 4 above . It can be noted that the first lag serial coefficients are lower (more negative) in both the earnings per share (operating and net) series than the corresponding undeflated earnings series. This is also true for the second, third and fourth lags tested.

The second , third and fourth order coefficients in Table 4 above were computed to enable us to check whether there existed any factors tending to cause a one-year, two-year and three-year cycles in earnings. This also

turned out to be negative, except as for operating earnings. This coefficients are not significantly different from zero and thus we conclude that there are no dependencies in the earnings after one year onwards.

As expected, if earnings are independent over time, the autocorrelation coefficients for any lag r_j for earnings change should not be significantly different from zero. However, if earnings follow a different process, the correlation coefficients are not necessarily zero. From our findings, the first lag mean coefficients do not appear to be significantly different from zero, that is -0.1719, -0.1729, -0.2584, and -0.2241 for the four earnings studied. This implies that successive changes in corporate annual earnings appear largely independent and well approximated by a random-walk. The most extreme value is that of the operating earnings per share of -0.2584. This implies an explanatory power of $(-.2584)^2$, that is 6.67% for an autoregressive prediction model. This coefficients imply that annual earnings can best be approximated by a random-walk model. This result is consistent with that from other countries.

From Table 4 , the results are consistent with those reported in the runs test results above. The presence of

negative first-order serial correlation can be confirmed by the negative signs that correspond to the mean coefficients.

Given the results from the runs test and the autocorrelation coefficients above, the null hypothesis set out above that annual earnings of kenyan publicly quoted companies are independent over time can not be rejected.

CHAPTER SIX

SUMMARY, CONCLUSION, LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH.

6.1 SUMMARY AND CONCLUSION

This study used the two tests , the runs test and autocorrelation function to test for the independence of corporate annual earnings for publicly quoted companies in the Kenyan context.

The major findings are that the earnings had a negative serial correlation and the runs test and computed mean autocorrelation coefficients are not significant so as to initiate any doubt for lack of independence.

In the current case the annual earnings of one year are not related to the earnings of two, three and four years ahead. This was evidenced by the mean serial correlation coefficients computed for the second, third and fourth lags. This are not significantly different from zero.

The conclusion is that successive changes in reported annual corporate earnings for Kenyan publicly quoted companies are essentially independent and can be well approximated by a random-walk. This finding is

consistent with that already established by studies in other countries.

Lastly nothing can be said about the possible problem of not controlling for changes in accounting techniques, that is accounting policies and consistent classification of extraordinaries mentioned in chapter four of this study. This might have accounted, in part, for the observed results.

6.2 LIMITATION OF THE STUDY

The first limitation of this study is that of historical data. Utilizing historical financial data without adjusting for any inflationary tendencies might have contributed to the findings reported by this study.

The second limitation was the unavailability of data. This led to the exclusion of those companies which had no data available, thus reducing the population to a sample of 34 from a possible population of 56 companies.

A third limitation to the study was that it selected a few tests (runs test and serial correlation). However, the runs test is a weak test to be relied on solely for the purpose. We also studied only 61% of the NSE companies. for these reasons, the study does not pretend to be conclusive,

nor are its findings and inference to be extended arbitrarily to companies which are not members of NSE.

Lastly the time frame chosen for the study was short. with 15 observations for each firm, some dispersion across firm's is to be expected even if earnings are independent.

6.3 SUGGESTIONS FOR FURTHER RESEARCH

The following suggested research areas would be very useful if the conclusions made in this study are to be validated and thus be generalised in the Kenyan context.

The first suggestion is for a similar study to be undertaken but using a sample from the unquoted and private. Also here different criterion can be used to sample and study the quoted companies.

The second suggestion is to apply the various prediction models to the sample companies studied and therefore leading to more confirmation as to the best predictor of earnings. This will go a long way to confirming the results of this study.

A third suggestion is to undertake the same study but using the current cost accounts in steady of the historical cost earnings figures adopted in this study. This will enable the behaviour of historical earnings to be

compared to the same at current prices.

Fourthly, the study utilizes the earnings variable and the same deflated by issued share capital to describe their annual behaviour. Another study utilizing revenues (sales) is viable for further confirmation. Also deflating the earnings and sales by total assets to reduce investment effects will enhance the validation of these results.

APPENDIX A

DATA COLLECTION FORM.

COMPANY NAME _____

YEAR	1974	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
Operating earnings																
Earnings attributable to shareholders																
Earnings per share																
No.of issued ord. shares																

APPENDIX B

NAIROBI STOCK EXCHANGE SAMPLE COMPANIES

Company Code	
1.	ELLIOTS BAKERIES LIMITED
2.	KENYA ORCHARDS LIMITED
3.	KENYA NATIONAL MILLS LIMITED
4.	A. BAUMAN AND COMPANY LIMITED
5.	B.A.T. (K) LIMITED.
6.	CAR AND GENERAL LIMITED
7.	PEARL DRY CLEANERS LIMITED
8.	HUTCHING BIEMER LIMITED
9.	AFRICAN TOURS AND HOTELS LIMITED
10.	BROOKE BOND LEIGBIG (K) LIMITED
11.	EAAGADS LIMITED
12.	GEORGE WILLIAMSON (K) LIMITED
13.	KAKUZI LIMITED
14.	KAPCHORUA TEA COMPANY LIMITED
15.	LIMURU TEA COMPANY LIMITED
16.	SASINI TEA AND COFFEE LIMITED
17.	COOPER MOTOR CORPORATION LIMITED
18.	MOTOR MART GROUP LIMITED
19.	KENYA BREWERIES LIMITED
20.	CARBACID INVESTMENTS LIMITED
21.	EAST AFRICAN OXYGEN LIMITED
22.	KENYA POWER AND LIGHTING LIMITED
23.	KENYA OIL COMPANY LIMITED
24.	BAMBURI PORTLAND CEMENT LIMITED
25.	E. A. PORTLAND CEMENT LIMITED
26.	CITY BREWERY INVESTMENT LIMITED
27.	KENSTOCK LIMITED
28.	SOFAR INVESTMENT LIMITED
29.	UNGA GROUP LIMITED
30.	NATIONAL INDUSTRIAL CREDIT CORPORATION
31.	CREDIT FINANCE LIMITED
32.	NATION PRINTERS AND PUBLISHERS LIMITED
33.	CONSOLIDATED HOLDINGS LIMITED
34.	E. A. PACKAGING INDUSTRIES LIMITED

APPENDIX C (1)

Operating Earnings
Runs test results for each company

Company code	Number of expected runs	Actual number of runs	Z - Value
1	10	7	.985674
2	10	7	.985674
3	10	11	.577923
4	10	11	.577923
5	9	10	.403984
6	10	12	.403984
7	9	13	.002214
8	10	9	.795805
9	10	7	.602698
10	10	6	.437556
11	10	10	1
12	10	9	.795805
13	10	10	1
14	10	7	.602698
15	10	8	.795805
16	10	11	.795805
17	10	9	.985674
18	10	12	.403984
19	10	10	1
20	10	12	.195709
21	10	10	1
22	10	12	.029869
23	9	9	1
24	10	8	.985674
25	10	11	.795805
26	10	12	.795805
27	10	13	.577923
28	10	10	1
29	10	10	1
30	10	10	1
31	10	8	.795805
32	9	10	.403984
33	10	12	.795805
34	10	13	.437556

APPENDIX C (2)

Operating Earnings per share
Runs test results for each company

Company code	Number of expected runs	Actual number of runs	Z - Value
1	10	10	1
2	10	10	1
3	10	11	.577923
4	10	11	.029869
5	9	8	.780874
6	10	12	.577923
7	9	13	.403984
8	10	9	.577923
9	10	11	.577923
10	10	6	.437556
11	10	10	1
12	10	9	.795805
13	10	12	.437556
14	10	9	.602698
15	10	10	1
16	10	9	.795805
17	10	7	.273565
18	10	10	1
19	10	10	1
20	10	9	.195709
21	10	9	.273565
22	10	12	.273565
23	9	9	1
24	10	10	1
25	10	11	.577923
26	10	12	.795805
27	10	13	.577923
28	10	10	1
29	10	10	1
30	10	12	.437556
31	10	11	.195709
32	9	11	.403984
33	10	12	.070075
34	10	11	.577923

APPENDIX C (3)

Net earnings
Runs test results for each company

Company code	Number of expected runs	Actual number of runs	Z - Value
1	10	10	1
2	10	9	.795805
3	10	11	.577923
4	10	12	.577923
5	9	9	1
6	10	12	.273565
7	9	13	.002141
8	10	9	.795805
9	10	9	.602698
10	10	6	.437556
11	10	10	1
12	10	9	.795805
13	10	10	1
14	10	9	.602698
15	10	8	.795805
16	10	10	1
17	10	10	1
18	10	12	.577923
19	10	10	1
20	10	12	.403984
21	10	10	1
22	10	12	.403984
23	9	9	1
24	10	11	.273565
25	10	11	.577923
26	10	12	.795805
27	10	9	.577923
28	10	11	.577923
29	10	10	1
30	10	12	.795805
31	10	13	.795805
32	9	10	.780874
33	10	13	.195709
34	10	11	.195709

APPENDIX C (4)

Net earnings per share
Runs test results for each company

Company code	Number of expected runs	Actual number of runs	Z - Value
1	10	12	.273565
2	10	10	1
3	10	11	.577923
4	10	12	.231169
5	9	10	.734091
6	10	12	.273565
7	9	9	1
8	10	9	.913316
9	10	14	.012295
10	10	8	.437556
11	10	10	1
12	10	9	.599775
13	10	10	1
14	10	9	.913316
15	10	10	1
16	10	11	.195709
17	10	9	.602698
18	10	10	1
19	10	9	.599775
20	10	13	.798050
21	10	10	1
22	10	12	.023117
23	9	9	1
24	10	8	.446087
25	10	11	.586266
26	10	11	.916415
27	10	9	.913316
28	10	11	.795805
29	10	10	1
30	10	12	.462577
31	10	10	1
32	9	11	.308178
33	10	13	.172482
34	10	11	.916415

APPENDIX D (1)

NAIROBI STOCK EXCHANGE COMPANIES

Sample autocorrelations of each company

Operating earnings

	r_1	r_2	r_3	r_4
1. ELLIOTS BAKERIES LIMITED	.12837	.45781	.09999	.18077
2. KENYA ORCHARDS LIMITED	-.15499	-.49099	.17930	.06146
3. KENYA NATIONAL MILLS	-.27832	-.08773	.13419	-.45408
4. A. BAUMAN AND COMPANY	-.55565*	.35583	-.46173	.31341
5. B.A.T. (K) LIMITED.	-.13610	.16053	-.02454	.29565
6. CAR AND GENERAL	-.03410	-.27337	-.04708	.04899
7. PEARL DRY CLEANERS	-.75627*	.38583	-.21646	.19009
8. HUTCHING BIEMER	-.29957	-.29950	.20546	-.09707
9. AFRICAN TOURS AND HOTELS	-.42948	-.15697	-.10192	.43299
10. BROOKE BOND LEIGBIG (K)	-.13791	.01956	-.19490	-.13555
11. EAAGADS LIMITED.	-.46012	-.10280	.27034	-.15449
12. GEORGE WILLIAMSON (K)	-.05504	-.29200	.05309	-.40643
13. KAKUZI LIMITED	-.53518*	.13576	-.14012	-.00640
14. KAPCHORUA TEA COMPANY	-.05826	-.19971	.09992	-.27869
15. LIMURU TEA COMPANY	.19814	-.45936	-.13334	.05141
16. SASINI TEA AND COFFEE	-.21804	.01235	-.28526	-.06551
17. COOPER MOTORS	.17535	-.05301	-.10795	-.26267
18. MOTOR MART GROUP	-.14442	.08642	.17397	-.01691
19. KENYA BREWERIES	-.11348	-.15818	.00406	-.21907
20. CARBACID INVESTMENTS	.12569	.56134*	-.00091	.12001
21. EAST AFRICAN OXYGEN	-.28451	.19210	-.27787	.37439
22. KENYA POWER AND LIGHTING	-.53964*	.22012	-.14535	-.14686
23. KENYA OIL COMPANY LIMITED	.07338	-.21605	-.07846	-.37957
24. BAMBURI PORTLAND CEMENT	-.07653	-.54912*	.00217	.06859
25. E. A. PORTLAND CEMENT	-.38111	-.15956	-.09270	.18562
26. CITY BREWERY INVESTMENT	-.06860	.18179	-.03451	-.12591
27. KENSTOCK LIMITED	-.20613	.09296	-.37685	-.00099
28. SOFAR INVESTMENT LIMITED	.06927	-.15259	.42799	.20340
29. UNGA GROUP LIMITED	-.14257	-.32735	.18660	-.12064
30. NATIONAL INDUSTRIAL CREDIT	-.28138	.04448	-.13181	-.03958
31. CREDIT FINANCE LIMITED	.06221	.14940	-.00145	-.12325
32. NATION PRINTERS	.08984	.20541	-.04981	.10127
33. CONSOLIDATED HOLDINGS	-.39575	.11799	-.38327	.22875
34. E. A. PACKAGING INDUSTRIES	-.02522	.07776	-.13287	.37240

Note: The asterisk * indicate significant coefficients

APPENDIX D (2)

NAIROBI STOCK EXCHANGE COMPANIES
Sample autocorrelations for each firm
Net earnings

	r_1	r_2	r_3	r_4
1. ELLIOTS BAKERIES LIMITED	-.21285	.17368	.25255	-.06760
2. KENYA ORCHARDS LIMITED	-.20728	-.47353	.17682	.12651
3. KENYA NATIONAL MILLS	-.21285	-.04630	.12047	-.50325
4. A. BAUMAN AND COMPANY	-.55476*	.23172	-.40628	.47104
5..B.A.T. (K) LIMITED	-.06447	-.27080	.13857	.29132
6. CAR AND GENERAL	-.22344	-.20469	.00028	.01343
7. PEARL DRY CLEANERS	-.83912*	.56265*	-.32288	.20208
8. HUTCHING BIEMER	-.39711	-.19762	.39116	-.34615
9. AFRICAN TOURS AND HOTELS..	-.53764*	.02574	-.15716	.38070
10. BROOKE BOND LEIGBIG (K).	-.13027	-.02450	-.20048	-.12661
11. EAAGADS LIMITED.	-.46896	-.10192	.28746	-.16462
12. GEORGE WILLIAMSON (K)	-.08911	-.27312	.05755	-.39277
13. KAKUZI LIMITED.	-.32058	.26957	-.41001	-.22559
14. KAPCHORUA TEA COMPANY	-.14903	-.09220	-.19377	-.13382
15. LIMURU TEA COMPANY	.19803	-.45204	-.12250	-.05640
16. SASINI TEA AND COFFEE	-.07974	-.27186	-.13352	-.17202
17. COOPER MOTORS	.08791	-.25652	-.14631	-.27194
18. MOTOR MART GROUP	.03773	.03547	.05422	-.14507
19. KENYA BREWERIES	-.19986	-.36455	-.06879	.19806
20. CARBACID INVESTMENTS	.29816	.45439	.16114	.12658
21. EAST AFRICAN OXYGEN	-.46759	.34592	-.21149	.33609
22. KENYA POWER AND LIGHTING	-.40371	.26519	-.38274	.16575
23. KENYA OIL COMPANY LIMITED	.04949	-.27290	-.04346	-.17358
24. BAMBURI PORTLAND CEMENT	-.17084	-.34414	.21107	-.19181
25. E. A. PORTLAND CEMENT	-.22788	-.47347	.01668	.24069
26. CITY BREWERY INVESTMENT	.02525	.07932	-.07746	.03845
27. KENSTOCK LIMITED.	-.19722	-.44593	.22207	.09058
28. SOFAR INVESTMENT LIMITED.	-.27135	.11996	-.20489	-.12637
29. UNGA GROUP LIMITED	.16205	-.50234	-.17036	-.02562
30. NATIONAL INDUSTRIAL CREDIT	-.33150	.10670	-.15400	.06465
31. CREDIT FINANCE LIMITED	.25350	.36446	-.10991	-.16337
32. NATION PRINTERS	.13755	.00057	-.01738	.11469
33. CONSOLIDATED HOLDINGS	-.44914	.16900	-.43570	.33310
34. E. A. PACKAGING INDUSTRIES	.10761	.07860	.12829	.22571

Note: The asterisk * indicate significant coefficients

APPENDIX D (3)

NAIROBI STOCK EXCHANGE COMPANIES
Sample autocorrelation for firm
Operating earnings per share

	r_1	r_2	r_3	r_4
1. ELLIOTS BAKERIES LIMITED.	-.07690	-.24402	-.05790	.09387
2. KENYA ORCHARDS LIMITED.	-.33556	-.27234	.22992	-.13354
3. KENYA NATIONAL MILLS	-.25080	-.08920	.09514	-.44566
4. A. BAUMAN AND COMPANY	-.55536*	.35556	-.46093	.31277
5..B.A.T. (K) LIMITED.	-.31743	-.36915	.25089	.08289
6. CAR AND GENERAL	-.04548	.07473	-.29412	.03212
7. PEARL DRY CLEANERS.	-.78659*	.47218	-.32827	.28729
8. HUTCHING BIEMER.	-.29993	-.29896	.20584	-.09772
9. AFRICAN TOURS AND HOTELS.	-.42588	.10213	-.28193	.46737
10. BROOKE BOND LEIGBIG (K).	-.13868	-.01949	-.19453	-.13561
11. EAAGADS LIMITED.	-.47899	-.25154	.43324	-.17260
12. GEORGE WILLIAMSON (K)	-.01541	-.34632	.04949	-.29695
13. KAKUZI LIMITED.	-.08210	-.37118	-.07641	-.04142
14. KAPCHORUA TEA COMPANY	-.01873	-.18751	-.30554	-.18996
15. LIMURU TEA COMPANY	-.28428	-.02713	-.08268	-.26268
16. SASINI TEA AND COFFEE	-.49558*	-.00768	.00252	.00379
17. COOPER MOTORS.	.37113	-.01248	-.07207	-.39722
18. MOTOR MART GROUP	.05254	-.03691	.07806	-.19783
19. KENYA BREWERIES	-.13019	-.25794	.11252	-.24425
20. CARBACID INVESTMENTS	-.10227	.09315	.00344	-.24179
21. EAST AFRICAN OXYGEN	-.18438	.08886	-.32059	.20534
22. KENYA POWER AND LIGHTING	-.54357*	.17790	-.07033	-.19660
23. KENYA OIL COMPANY LIMITED	.08128	-.39324	-.08561	-.15515
24. BAMBURI PORTLAND CEMENT	-.35738	-.10692	-.07496	.10800
25. E. A. PORTLAND CEMENT	-.38093	-.15950	-.09285	.18543
26. CITY BREWERY INVESTMENT	-.26260	-.10432	-.22250	.11198
27. KENSTOCK LIMITED.	-.54922*	.26432	-.09789	.02603
28. SOFAR INVESTMENT LIMITED.	.04817	-.14371	.44991	.18749
29. UNGA GROUP LIMITED.	-.15286	-.30157	.16720	-.10369
30. NATIONAL INDUSTRIAL CREDIT	-.16217	-.00185	-.07725	-.10688
31. CREDIT FINANCE LIMITED	-.20968	-.13413	.26478	-.25403
32. NATION PRINTERS	-.38019	.11171	-.03107	-.50705
33. CONSOLIDATED HOLDINGS	-.40935	.07815	-.25420	.12664
34. E. A.PACKAGING INDUSTRIES	-.49616*	.10917	.04408	.06750

Note: The asterisk * indicate significant coefficients

APPENDIX D (4)

NAIROBI STOCK EXCHANGE COMPANIES
Sample autocorrelation for each firm
Net earnings per share

	r_1	r_2	r_3	r_4
1. ELLIOTS BAKERIES LIMITED.	-.21251	.23647	.04097	.00114
2. KENYA ORCHARDS LIMITED.	-.45989	-.17695	.28511	-.21190
3. KENYA NATIONAL MILLS	-.16672	-.10223	.12000	-.56136*
4. A. BAUMAN AND COMPANY.	-.55900*	.23270	-.40798	.47287
5..B.A.T. (K) LIMITED.	-.31657	-.06272	-.19125	.08105
6. CAR AND GENERAL	-.21649	.08900	-.23479	.06069
7. PEARL DRY CLEANERS.	-.46318	.18621	.02059	-.35152
8. HUTCHING BIEMER.	-.39788	-.19693	.39315	-.07854
9. AFRICAN TOURS AND HOTELS.	-.60506*	.36302	-.34261	.40699
10. BROOKE BOND LEIGBIG (K).	-.16041	.06457	-.25451	-.11115
11. EAAGADS LIMITED.	-.48316	-.25306	.44424	-.17954
12. GEORGE WILLIAMSON (K)	-.33337	-.13973	.10674	-.14479
13. KAKUZI LIMITED.	-.08456	-.33732	-.10686	-.00728
14. KAPCHORUA TEA COMPANY	-.08642	-.12855	-.36036	-.07854
15. LIMURU TEA COMPANY	-.29738	-.01370	-.08599	-.21568
16. SASINI TEA AND COFFEE	-.51585*	.03061	-.01210	-.00383
17. COOPER MOTORS.	.05630	-.09474	-.04244	-.30951
18. MOTOR MART GROUP	.05254	-.03691	.07806	-.19783
19. KENYA BREWERIES	-.14297	-.56202*	.07765	.21515
20. CARBACID INVESTMENTS	-.00042	.19612	-.18121	.00944
21. EAST AFRICAN OXYGEN	-.46305	.15757	-.20045	.18123
22. KENYA POWER AND LIGHTING	-.30223	-.13144	.00794	.13341
23. KENYA OIL COMPANY LIMITED	.26523	-.42226	-.33565	-.14078
24. BAMBURI PORTLAND CEMENT	-.10546	-.40457	-.05186	.05186
25. E. A. PORTLAND CEMENT	-.13878	-.62567*	.01857	.36174
26. CITY BREWERY INVESTMENT	-.07200	-.09753	-.45254	.02148
27. KENSTOCK LIMITED.	-.20027	-.48566	.20696	.06567
28. SOFAR INVESTMENT LIMITED.	-.06228	-.03212	.48551	-.00539
29. UNGA GROUP LIMITED.	.10968	-.50072	-.13754	-.05868
30. NATIONAL INDUSTRIAL CREDIT	-.05777	-.01563	-.14039	-.06771
31. CREDIT FINANCE LIMITED.	-.02235	.33582	-.42159	-.23218
32. NATION PRINTERS	-.23368	-.03007	.04130	-.18955
33. CONSOLIDATED HOLDINGS	-.46920	.17037	-.36739	.31034
34. E.A. PACKAGING INDUSTRIES	-.51876*	.10640	.14486	-.00402

Note: The asterisk * indicate significant coefficients

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