THE RELATIONSHIP BETWEEN STOCK RETURNS AND REAL ACTIVITY IN KENYA

BY

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UNIVERSITY OF NAIROBI

DECLARATION

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

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This management Research Project has been submitted for examination with my approval as University Supervisor

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DEDICATIONS

This project is dedicated in all sincerity to my wife, daughter, and mother.

To my wife ***Marylyn Akoth,*** for her patience, understanding and support during the course.

To my daughter ***Achieng Ochuka***, whose patience let the father complete the course.

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ABSTRACT

This study was conducted to assess the relationship between stock market returns and real economic activity in the economy. Data was collected from the Nairobi Stock Exchange and from the Central Bureau of Statistics. The study covered the period 1998 to 2004. The stock market returns were regressed against production figures and empirically tested. The analysis revealed that there was positive correlation between stock returns and real activity, and that future production can explain present returns.

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LIST OF ABBREVIATIONS

APT:	Arbitrage Pricing Theory
ARM:	Athi River Mining Company
BAT:	British America Tobacco
BMV:	Bolsa Mexicana de Valores
CBS:	Central Bureau of Statistics
DCF:	Discounted Cash Flow
EABL:	East Africa Breweries Limited
EAPC:	East Africa Portland Cement Limited
GDP:	Gross Domestic Product
GNP:	Gross National Product
IIP:	Index of Industrial Production
IPC:	Indice de Precios y Cotizaciones
KLSE:	Kuala Lumpur Stock Exchange
NSE:	Nairobi Stock Exchange
NYSE:	New York Stock Exchange
OECD:	Organization for Economic Cooperation and Development

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

The discounted cash flow (DCF) model tells us that stock prices should reflect expectations about future corporate performance, specifically the expected cash flow generating power of the firm. On the other hand, corporate profits generally may reflect the level of economic activities. Apart from the value of the firm being a function of a firms earning power, a competing hypothesis is that the fundamental value of a firm's stock will equal the expected present value of a firm's future dividend payout. The future dividend payouts ultimately reflect real economic activity measured by industrial production or GDP, Morck et al., (1990); Shapiro (1998). Movement in industrial production and GDP are expected to be associated with movements in corporate earnings (Choi et al, 1999). Given that stock prices are built around earnings expectations, stock prices should lead measures of real activity (Lovatt, 2000).

The relationship between stock market returns and fundamental economic activities is well documented (Morck et al., (1990), Shapiro (1998)). Researchers have modeled the relation between asset prices and real economic activities in terms of production rates, productivity, GNP growth rate, unemployment, yield spread, interest rates, inflation, dividend yields, etc (Moore and Visscher 1993, Lee (1992)).

The relationship between stock returns and real economic activity has been reported in many countries. For example, an article in the CORNELL'S Global Economy Review (2003) stated the following: "The U.S. stock market has seen a stellar performer since the spring racking up impressive gains. The gains in stocks are reflecting improved economic activity across the board… index of manufacturing activity rose to 54.7 in August."

If stock prices accurately reflect the underlying fundamentals, as the article above implies, then the stock prices should be employed as leading indicators of future economic activity.

Lovatt (2000) states that agents buy and sell on the basis of expected future income flows. He uses forecasts of real GDP and estimates a series of 'expected' real GDP growth

as a measure of expected future income flows. GDP is a composite index of economic activity, including production activity for the entire economy. Lovatt (2000) anticipated that expected real GDP growth will be positively related to future returns.

Real activity refers to the industrial production activities in an economy, usually a country. The sectors of the economy engaged in industrial production activities are referred to as the real sectors. Not all the sectors of an economy qualify as real sectors. Schwert (2001) studied this phenomenon in Germany and identified the real sectors as Manufacturing, Mining, and Agriculture.

Several finance researchers (Fama (1990), Binswanger (2000), Schwert (1990)) have considered the relationship of stock returns to expected variations in real activity. It has however been noted that expected variations in real activity are not the only source of variations in stock returns in standard valuation models. Fama (1990) identifies other three possible sources: shocks to expected cash flows for which future growth rates of GDP or industrial production are used as proxies; shock to discount rates; and predictable return variation due to predictable variation through time in the discount rates that expected cash flows.

This study is about the relationship between stock returns of real sector firms listed at the Nairobi Stock Exchange (NSE) and industrial production. An attempt is made to look at the stock returns and the returns co-movement with actual production in the economy. Similar studies have been done in other countries, mostly developed, especially the G-7. Other studies in the emerging markets have also been done. There is very little work done in this area in the developing countries.

1.2 STATEMENT OF THE PROBLEM

The Kenyan economy as measured by GDP from 2002 to 2004 had an up and down movement, while some companies declared steady profits (Annual Report of the Central Bank of Kenya for the Financial Year 2003/04). The implication of this might be that there is no relationship between the profitability of firms and by extension their returns, and the economy wide real activity, such as level of production.

Economic theory and the resulting valuation model (arbitrage pricing theory (APT)) suggest that stock prices should reflect expectations about future corporate performance (Sieng and Goh). Corporate performance depends on how well the economy is performing (Sieng and Goh). However, expectations about corporate performance (in terms of earnings and earnings growth) useful in firm valuation are made earlier both by managers of the firms and investors. This is obviously before actual production or even before confirming the actual level of production; of course production is based on anticipated demand. In simple words, by purchasing shares investors are buying future earnings; but future earnings depend on saleable production. Logically a relationship between the stock returns and the future actual output in these industries should be visible. This is the testable proposition in this study.

Yet, the empirical evidence regarding the dynamic interaction among these variables (stock returns and industrial output) is incomplete in at least two respects: it is available primarily for the US and European economies and it concerns domestic variables taken in isolation from the rest of the world. There is therefore no research literature for the developing economies. By contrast, recent developments in the world economy are marked by the relative decline of the importance of the US and European economies and by the fast pace of integration of the real, financial and monetary sides of industrialized countries. Such studies in the developing economies are limited.

It is worth determining whether the economic role of the stock markets in relatively less developed countries, such as Kenya is significant. Specifically, it is interesting to examine how the Kenyan market responds, in terms of stock market returns, to changes

in its fundamental economic variable of production. This study seeks to find out any linkages between stock returns and economic activity in the Kenyan economy.

It is important understanding the course of national economy because of the assumption that economic activity affects corporate profits, investor attitudes and expectations and ultimately shares prices (Fischer and Jordan, 1991).

1.3 OBJECTIVES OF THE STUDY

The purpose of this study is to explore the following:

a) The relationship between stock market prices and real activity as measured by production.

b) The extent to which stock returns at the NSE are correlated to future production in the economy.

c) The extents to which stock returns at the NSE can be explained by future production in the economy.

1.4 JUSTIFICATION OF RESEARCH

Forecasts of real economic activity are a critical component of many decisions. Businesses rely on such forecasts in forming their production plans. Policymakers rely on such forecasts when choosing the path of monetary policy or when forming the national budget.

The appropriateness of these choices depends, in large part, on the quality of the forecast.

The following are expected to find the research useful: -

a) **Practitioners**: they would have more information and advice their clients accordingly

b) **Policy makers**: The study would help government make favorable policy decision, which would further deepen the capital market, especially the futures market.

c) **Investors**: The study will help investors to be at a position to make decision on which company to invest if the said investor prefers firms whose returns move in close tandem with their productivity.

d) **Managers**: They would know how their companies share prices perform in relation to their firm's productivity. They can then use this to predict future productivity and hence improve their planning.

e) **Academicians**: The study would add to the body of knowledge in the Finance discipline and form a basis for further research.

f) **Businesses**: The study would assist businesses in forecasts and in forming their production plans.

CHAPTER TWO: LITERATURE REVIEW

2.1 THEORETICAL MODEL OF THE STOCK RETURN PROCESS

Lovatt argues that a stock price, and hence some composite index of stock prices, equals the discounted present value of the future income to which the security or group of securities give rise. Lovatt (2000) and Balvers et al. (1990) provide theoretical justification in an intertemporal equilibrium model. In this model, there is a single all-purpose good, used as both consumption (c_t) and as capital (q_t). Used as capital, the good is fully depreciated during the current period. All net cash flows to companies are paid out as dividends (d_t) and the representative consumer chooses between consumption and saving in equity, the quantity of which, held in the next period, is denoted (s_{t+1}).

Output (y_t) is equal to the sum of investment and consumption and, given full depreciation during the current period, the next period's capital stock is equal to the current period's investment. All variables are in real terms.

Note first that the price of any security, or composite index of securities, is the discounted present value of the income stream to which they give rise,

$$Pt = \mathrm{E}t\sum_{\theta=0}^{\infty} \frac{dt+0}{(1+k)^{\theta}} \qquad (1)$$

Applying recursion, they obtain,

$$Pt = Et\left[\frac{dt+1+pt+1}{1+k}\right] \qquad (2)$$

$$k = Et[\left[\frac{dt+1+pt+1}{pt}\right]-1 \qquad (2a)$$

In 2(a), (k) is the expected or required total return on the security or securities concerned.

In the model of Balvers et al., (k) is also the discount factor for utility units. The representative consumer maximizes,

$$Eo\sum_{t=0}^{\infty}\frac{1}{(1+k)}u(ct)$$

Subject to,

$C_t + p_t(y_t)\, st{+}1 = [p_t(y_t) + d_t(y_t)]\, s_t$

The budget constraint states that the sum of consumption in the current period and investment in equity in the next period at the current period's price is equal to total wealth held in the current period where $d_t(y_t)$ represents the dividends per share paid at the beginning of the period.

Maximization yields,

$$p_t(y_t)u'(c_t) = E_t\{[p_t{+}1(y_t{+}1) + d_t{+}1(y_{t+1})]u'(c_{t+1})\} \qquad (4)$$

Note that (4) is the same as (2) except that prices are now related to marginal utility. In (4), one plus the discount rate is equal to one plus the expected return multiplied by the ratio of marginal utilities.

The realized return is defined as,

$$k'(y_{t+1}, y_t) = \{[p_{t+1}(y_{t+1}) + d_{t+1}(y_{t+1})] / p_t(y_t)\} - 1 \qquad (5)$$

Solving (4) forward yields the analogue of (1) with respect to marginal utility,

$$P_t = E_t \sum_{\theta=1}^{\infty} \frac{1}{(1+k)^{\theta}} [u'(c_{t+0}) / u'(ct)]\, d_{t+0} \qquad (6)$$

Assuming a logarithmic utility function and normalizing the system by setting $s_t = 1$ so that the budget constraint implies that $c_t = d_t$, (6) yields,

$$P_t = E_t \sum_{\theta=1}^{\infty} \frac{1}{(1+k)^{\theta}} d_t = \frac{d_t}{k} \qquad (7)$$

assuming a constant discount rate.

Substitution of (7) into (5) gives,

$$(1 + k') = \frac{d_{t+1}}{d_t} (1 + k) \qquad (8)$$

If we now assume that investment, conceptualized as next period's capital stock, is a constant proportion of output, $q_{t+1} = \alpha y_t$, we have, from the fact that, $d_t = y_t - q_{t+1}$, $dt = (1 - \alpha)y_t$. Accordingly, (8) can be re-written,

$$(1 + k') = \frac{y_{t+1}}{y_t}(1+k) \qquad (8a)$$

Broadly interpreted, (8a) states that realized returns are a function of expected returns and macro-economic conditions.

2.2 STUDIES ON STOCK RETURNS AND REAL ACTIVITY

Several previous studies examined the causal relationship between stock return and economic activity (Fama (1990), Schwert (1990)). Fama (1990) on investigating the rationality of stock prices, shows that monthly, quarterly, and annual stock returns are highly correlated with future production growth rates for 1953-1987. Fama regressed growth rate of production (which was measured as the production rate for the month from month *t* to month *t+1*) on stock returns. The hypothesis was that, in regressions *P(t, t+1)*, the production growth rate for the month from *t* to *t+1*, on lags of monthly returns, more than one past return should have explanatory power.

The complete equation used by Fama

$$R(t, t+T) = a + b_1P(t, t+3) + b_2P(t+3, t+6) + b_3P(t+6, t+9) + b_4P(t+9), t+12) + b_5P(t+12, t+15) + b_6P(t+15, t+18) + b_7P(t+18, t+21) + b_8(t+21, t+24) + e(t, t+T)$$

R (t, t+T) is the monthly (T=1), quarterly (T=3), or annual (T=12) value weighted NYSE real return from t to t + T.

P (t + k, t+k+3) is growth rate of seasonally adjusted industrial production for the quarter from t + k to t + k + 3 (the log of production for month t + k +3 minus the log of production for month t + k.

It uses 12 lags of the NYSE monthly value-weighted return. Fama then regresses the returns on production growth rates. The results were that leads of quarterly production of up to three or four quarters earlier help explain monthly, quarterly, and annual stock returns. Also three or four lags of quarterly stock returns help to forecast monthly, quarterly and annual production growth.

Schwert (1990) replicated Fama's study in order to investigate the stability of the relations estimated by Fama using different data. This was to explain variation in real returns to a value-weighted portfolio of common stocks. Schwert uses capital gains from the end-of-month values of the Dow Jones composite portfolio and adds dividend yields from Cowles (1939) to measure total stock returns. Real returns are nominal returns adjusted for the inflation rate. Schwert uses a value-weighted average of indexes for 13 industrial products that is not seasonally adjusted. The tests are continuously compounded for horizons T of one month, one quarter and one year. The study reported that the US stock market acted as signal to changes in real economic activity. The study also found out that the strong positive relation between real stock returns and future production growth rates existed even when variables that proxy for time-varying expected returns and shocks to returns are included in the regressions.

Lee (1992) investigated the causal relations and dynamic interactions among asset returns, real activity, and inflation in postwar United States and found that the US stock market acted as signal to changes in real economic activity. Lee (1992) employed real stock returns, and growth in industrial production among other variables with a constant and six month lags; and computed real stock returns as nominal returns less the expected inflation rate. One of the empirical results of this study was that stock returns are positively correlated with growth in industrial production, which seems to support the claim that an increase in real stock returns anticipates upward movement in growth in industrial production. He also found that the stock market typically signals (or leads) changes in real activity, and that the relation between the stock returns and real activity is positive. Furthermore, the study found that inflation explains little variation in real activity.

Bittlingmayer (1992) regressed quarterly returns on concurrent changes in industrial production and wholesale prices. He uses the simple production change over the quarter that starts one month instead of a sequence of current and future production. He states that using changes in production from two and three quarters do not alter the results. He uses the contemporaneous rate of inflation as a separate explanatory variable instead of using real returns as the dependent variable.

Binswanger's (2000) study revealed that stock variation did not lead real activity in US any longer since the occurrence of the stock market boom in early 1980s. In his other work, Binswanger investigated whether the breakdown in the traditional relations between real stock returns and growth rates of real economic activity in the US could also be found in the G-7 countries (Canada, France, Germany, Italy, Japan, UK). He found that there existed such a breakdown.

Sieng and Goh studied this phenomenon in Malaysia and found out that stock prices, economic activities, real interest rates and real money balances are linked together in the long run using a simple theoretical model formulated based on the monetary approach. They also found out that the industrial production is led by stock prices, real interest rate and real money.

The study used data series for the period from January 1987 to December 2001. To measure the general stock price level they use the end-of-month values of Kuala Lumpur Stock Exchange (KLSE) Composite Index.

The real economic activity is measured by the Index of Industrial Production (IIP). The IIP series is seasonally adjusted using an additive time series component model.

Perales and Russell studied the relationships among financial activity, real economic activity and monetary factors. He investigated lead-lag relationships among the IPC (Indice de Precios y Cotizaciones) returns of the Bolsa Mexicana de Valores (BMV), Industrial Production and the money supply. He found evidence indicating that the stocks returns of the BMV are a leading indicator of future Mexican real economic activity measured by the Industrial Production; and money supply plays a significant role in

leading the stock returns of the BMV and the real variables measured by Industrial Production. He also found that the volatility of the IPC returns predicts the volatility of industrial production.

The IPC is an index based on a value-weighted representative sample of stocks traded on the BMV.

Industrial production is the measure of changes in the volume of output given a reference level of inputs and technology for all producer units. It is defined as the measure of change in the volume of industrial output of a set of products of constant price (base period price) for all producer units. The basic information used is monthly. Extrapolating from values at basic GDP prices derives the indicator. This indicator includes the following economic activities: mining, manufacturing, construction, and electricity, gas and water.

Wouter, Haan, Sumner (2002) studied the short-run and long-run co-movement between prices and real activity in the G7 countries during the postwar period. They found several patterns of the correlation coefficients that are robust across countries and time periods; typically, the correlation coefficients at long-run horizons are significantly negative and the correlation coefficients at short-run horizons are substantially higher. This research was important as it has been shown that the there is a relationship between stock returns and prices (Moore and Visscher 1993).

Canova and De Nicolo (1997) found that in the US, the term structure predicts real activity and inflation better than nominal stock returns, which appear to be unrelated to the other three variables. This further confirms the view that stock returns is not the only predictor of real activity. In the UK and Germany the interdependences between stock returns, slope of the term structure, growth rate in real activity and inflation are very small. Japan appears to be an intermediate case between the previous two. There is a significant relationship among the slope of the term structure, the growth rate in industrial production and inflation.

Rangvid (2001) used a simple general equilibrium version of an intertemporal capital asset pricing model to investigate the predictions of changes in real activity and stock returns in 24 developed and emerging markets. The research questions of the study were:

Are the series for real activity and real returns cointegrated and thus driven by the same common stochastic trend?; Do the same variables predict both changes in real activity and returns?; and Are the predictions of returns proportional to the predictions of the changes in real activity? His findings are that share prices contain information for predictions of changes in real activity and returns in mainly developed but also a number of emerging economies; and that changes in share prices (returns) are also proportional to the changes in real activity. The enlightenment was that the share prices and the real activity were driven by the same common stochastic trends; that stock returns are predictable, and the extent to which stock returns are predictable are generally higher in emerging economies as compared to developed economies and changes in real activity are predictable and the extent to which these changes can be predicted are generally higher than the extent to which returns can be predicted, and this is even more so in developed economies.

In addition Rangvid (2001) found that changes in real stock may directly or indirectly (through changes in consumer confidence) have a significant effect on new home sales This study suggests that it was the stock returns that led activity and not vice versa.

Dumas and Harvey (2002) set to establish whether the observed level of international stock market correlations is too high to be justified by subsequent changes in national outputs. Using twelve OECD countries and data from January 1970 to June 1996 and using an estimation method that goes through two steps, one of which was to estimate a statistical model for the behaviour of outputs and the other assuming that output and securities' payoffs are closely linearly related to each other, they apply a dynamic representative-agent asset-pricing kernel to the estimated behavior of output. They used the monthly time series of real industrial production with a 1990 basis year, deseasonalized, as published for each of the twelve countries by the OECD.

The values they found reasonably support the view that national outputs and international stock market returns are correlated.

2.3 STUDIES AT THE NSE

Several studies have been conducted at the Nairobi Stock Exchange (NSE) on the subject of stock returns. A review of some of the pertinent ones follows below.

Nyamute (1998) studied the relationship of the NSE index to major economic variables i.e. inflation rate, money supply and treasury bills rate and exchange rate. Nyamute (1998) set out to: Determine whether or not there is a relationship between performance of NSE, as measured by movement of the NSE 20 share index and the movement on the inflation rate, money supply, and interest rates in the economy; to measure the magnitude of the strength of the relationship; and to develop a regression model that can be used to predict the movement of the stock index vis-à-vis the movement of the four variables of economic indicators. He employed the following model:

$$S_t = b_i + b_i p_{t-n} + b_i m_{t-n} + b_i I_{t-n} + b_i R_{t-n} + \varepsilon$$

Where

b_i are the coefficients of the predictor variables to be estimated

i=1, 2, 3 and 4

p_{t-n} is the month on month inflation

m_{t-n} is the money supply at period t-n.

I_{t-n} is the 3 month Treasury Bill rate at period t-n

R_{t-n} is the shilling exchange rate against the US dollar at t-n

n is the lag period

Nyamute (1998) found that macroeconomic variables employed in his study do impact on the performance of the NSE. Nyamute looked at only the macroeconomic variables but did not look at how the NSE index relates to the real economic variables of production. This is an area that needs to be researched on further.

Rioba (2003) studied the predictability of ordinary stock returns at the NSE. The objectives of the study were to develop a model for predicting returns at the NSE and test the suitability of the model using in sample and out of sample data. Rioba (2003 hypothesized model was as follows:

$$R_{it+1} = \beta_o+\beta_1 D_{yt}+\beta_2 Ep_t+\beta_3 TB_i+\beta_4 \Pi_t+\beta_5 \Delta APt+\beta_6 \Delta M_t+E_{pt}$$

Where

βi = constant and return sensitivity to stated variables i=0, 1, 2, 3, 4, 5 and 6

Dyt = dividend yield

E_p = earnings price ratio

Π = month on month inflation

ΔAP = % change in earnings from agricultural exports

ΔM = % change in broad money supply

He found that the predictability evidence for ordinary shares in the NSE is weak and not conclusive. One shortcoming with this study was the use of the change in earnings in agricultural exports as one of the predictors of returns. This was used on the basis that Kenya is an agricultural country. The stock market returns has firms from various sectors and the exclusive use of the agricultural sector to represent all the other sectors was not justified.

Basweti (2002) identified the macro economic variables affecting performance at the NSE. These were inflation, interest rates, foreign exchange, government expenditure, etc. He also found out that there were barriers to dissemination of information. Less information is disseminated with a greater time lag. He also identified poor corporate

governance as the one of the major shortcomings at the NSE. This has an impact on the quality of information emanating from the stock exchange.

CHAPTER THREE:RESEARCH METHODOLGY

3.1 Introduction

This chapter outlines the methodology used in carrying out the study. Aspects covered include research design, population and sampling design, data collection methods and data analysis methods. The basic objective was to assess the possible relations between stock returns and production in the real sectors. The relationship between production with stock prices was tested.

3.2 Population and Sample

The Nairobi Stock Exchange (NSE) is divided into the following sectors: Agricultural Sector; Commercial and Services Sector; Finance and Investment Sector; Industrial and Allied Sector. There is also the Alternative Investment Market Segment. Of these, only two qualify as real sectors: agricultural sector and industrial and allied sector.

The Alternative Investment Market Segment has companies that could fall in the above two categories but because of low trading in their shares, they were not considered in this study. The study therefore identified the relationship between industrial production activity in the manufacturing and agricultural sector and the respective stock returns of these sectors for the period 1998 to 2004.

The population of the study was all the companies listed at the Nairobi Stock Exchange (see appendix I)

The sample was selected companies listed under the Agricultural and Industrial and Allied sectors (see appendix II). The companies were selected because of data availability, and well representation of the two sectors.

3.3 Data Collection Methods

Secondary data was used in the study. Stock returns data was collected from the NSE Library. Production figures which are used as proxy for real activity was collected from the Central Bureau of Statistics, under their manufacturing sector.

3.4 Scope of the Study

The study covered companies quoted at the NSE during the period 1998 to 2004. The possibility of returns leading production was empirically examined in this period. The period was picked because of availability of data.

3.5 Variables of the Study

The major variables in the study were derived from two sources:

1. The stock return figures from the Nairobi Stock Exchange. The data was collected for the selected companies.
2. The production figures were collected from the Central Bureau of Statistics.

The assumption is that the stock returns are determined by the production capacity in the economy.

Stock returns are defined as follows:

$$Rt = \left[\frac{P_{t+1} + D - P_t}{P_t} \right]$$

P_t is the price of shares at beginning of period.

Where P_{t+1} is the Price of shares at end of period.

D is the dividend paid during the period.

The production was measured using production figures picked from the Indicators of Economic Activity as computed by the Central Bureau of Statistics (CBS). Each firm was matched to the economic activity relating to its produce.

The CBS statistics identifies 44 indicators of economic activity used in analyzing the performance of the manufacturing sector in the country. The list of the 44 economic indicators is provided in Appendix III.

Proxies of Production

The following products were used as proxies for economic activity.

1. Sugar
2. Coffee
3. Tea
4. Beer
5. Cigarettes
6. Paints
7. Tires
8. Cement

Proxies for Returns

The returns of the following companies were used to assess the nature of the relationship

1. Unilever Tea Kenya Ltd – Brooke Bond
2. Sasini Tea & coffee Ltd
3. Athi River Mining.
4. Bamburi Cement Ltd

5. British American Tobacco Kenya ltd.

6. Crown Berger

7. E.A. Portland Cement Ltd

8. E.A. Breweries Ltd

9. Firestone East Africa Ltd.

10. Mumias Sugar Company Ltd

The returns were then paired with production, each company being assigned to the proxy of production it produces. The pairing resulted into the following matrix.

Company	**Proxy for production**
Unilever Tea Kenya Ltd – Brooke Bond	Tea
Sasini Tea & coffee Ltd	Tea and Coffee
Athi River Mining.	Cement
Bamburi Cement Ltd	Cement
British American Tobacco Kenya ltd.	Cigarettes
Crown Berger	Paints
E.A. Portland Cement Ltd	Cement
E.A. Breweries Ltd	Beer
Firestone East Africa Ltd.	Tyres
Mumias Sugar Company Ltd	Sugar

3.6 Research Design and Data Analysis

The research relied on the hypothesis that movements in common stock prices contain useful information concerning subsequent movements in economic indicators, especially changes in real activity, and hence production is back tested by applying regression.

3.6.1 Relations of Stock Returns with Future Production.

Returns, R*t* are calculated for period *t* defined as follows:

R*t* = *monthly, quarterly, annual returns.* For this study production will be measured on a monthly, quarterly and annual basis to conform to the model for returns

Production, P*t* for period *t* is the change in production for the month.

3.6.2 Monthly Prices on Contemporaneous Leads of Production

The relation between current stock prices and lagged production was determined using the following regression formula

$Pt = a + bPt$	For no lag
$Pt = a + bPt + 1$	For one month lag
$Pt = a + bPt + 2$	For two-month lag
$Pt = a + bPt + 3$	For three-month lag
$Pt = a + bPt + 12$	For twelve-month lag

This regression is estimated for production for the month following price recording *(t+1)*, for the second month following price recording *(t+2)*, for the third month following return *(t+3)*, and for the twelve months following price recording *(t+3)*.

3.6.3 Returns on Production Growth Rates

Variations in stock returns due to expectations of future cash flow is estimated by regressing returns on future production growth rates of real activity. Quarterly growth rates of production up to four quarters ahead are used to explain monthly, quarterly, and annual returns

The relations between stock returns and future production should in part reflect the information about cash flows in production. Thus an increase in stock prices is an increase in wealth, which is likely to increase the demand for consumption and/or investment goods.

The equation used to test this was the one used by Fama (1990).

$$R(t,t+T) = \alpha + \sum_{k=1}^{8} \beta_k P(t,t+3) + \varepsilon(t,t+T)$$

Where

$R\ (t,\ t+T)$ is the real stock return from period t to $t+T$

$P\ (t,\ t+3)$ is the production growth rate for the month t, to t+3

α is the constant term

β is the coefficient of the predictor variables to be estimated

$\acute{\varepsilon}$ is the error term

The results in this study were tested for significance at 10% level.

CHAPTER FOUR: FINDINGS AND INTERPRETATIONS

4.1 Introduction

This chapter presents the findings and interpretations of the study. During the seven year period of the study, 1998 to 2004, there was observed a positive correlation between the price of shares and production. Some of the firms, though few had a negative correlation with production.

The length of time over which returns were measured had a significant influence on the strength and sometimes the direction of the relationship. Annual returns were better explained by annual production than were monthly or quarterly returns explained by the monthly and quarterly production respectively.

The use of future production to predict returns was also investigated. There was found to exist generally a positive correlation between returns and future production, although the relationship was weak.

The study analyzed the changes in monthly, quarterly and annual production.

4.2 Production

Changes in production figures were considered. The range of variation between the lowest mean and the highest mean of all the indicators reduced as the period of change was lengthened. The findings are shown in the Table 1 to Table 3.

Production generally had positive growth for the period under observation, except for paints and cigarettes which recorded some negative growth figures. This also depended on the length over which the change was considered. In analyzing monthly growth figures, paints recorded negative growth. When the duration of change was changed to quarterly or annual intervals, the growth was positive throughout. This can be explained by the fact that one month negative change was smoothened out by subsequent greater positive growth in the following months.

4.2.1 Changes in Monthly Production.

The average change in monthly production for all the eight indicators varied from -0.09% for paints to 30.20% for tires. The changes in monthly production varied widely with coefficient of covariation, ranging from -244.33 to 120.89. This shows that production in the economy was very erratic and did not reflect a particular pattern for any of the proxies of production. The findings are summarized in Table 1 below.

Table 1

Descriptive Statistics for Changes in Monthly production: Sugar, Coffee, Tea, Beer, Cigarettes, Paints, Tires, Cement

Variable	N	N*	Mean	StDev	Min	Q1	Median	Q3	Max	CoV
Sugar	83	0	4.63	34.34	-54.00	-14.00	-1.00	12.00	160.00	7.42
Coffee	83	0	19.52	87.18	-85.00	-31.00	0.00	32.00	438.00	4.47
Tea	83	0	2.18	21.10	-44.00	-10.00	-2.00	17.00	88.00	9.68
Beer	82	0	0.18	21.76	-100.00	-10.50	-2.00	9.00	71.00	120.89
Cigarettes	83	0	8.33	44.49	-62.00	-26.00	1.00	26.00	163.00	5.34
Paints	81	2	-0.09	21.99	-100.00	-7.50	0.00	4.00	66.00	-244.33
Tires	83	0	30.20	173.80	-86.00	-19.00	2.00	23.00	1412.00	5.75
Cement	83	0	1.76	12.68	-25.00	-7.00	1.00	8.00	40.00	7.20

4.2.2 Changes in Quarterly Production

The changes in quarterly production varied from 1.78% for Beer to 27.2% for Coffee. It is worth noting that the variation in this data is less than that for the monthly changes in production. The negative mean recorded for paint in Table 1 is smoothened out when three month period is used. However the coefficient of variation is still large and shows that production in the economy was erratic even if viewed on quarterly basis. The findings are summarized in Table 2.

Table 2

Descriptive Statistics for Changes in Quarterly production: Sugar, Coffee, Tea, Beer, Cigarettes, Paints, Tires, Cement

Variable	N	N*	Mean	StDev	Min	Q1	Median	Q3	Max	CoV
Sugar	81	0	8.31	45.74	-56	-21	1	21.5	193	5.50
Coffee	81	0	27.2	110.5	-82	-42	-10	56.5	589	4.06
Tea	81	0	5.25	31.57	-56	-23	2	33	70	6.01
Beer	81	0	1.78	25.36	-100	-10	-1	17	89	14.25
Cigarettes	81	0	5.23	36.77	-59	-15.5	-3	19	124	7.03
Paints	81	0	2.28	29.18	-100	-9.5	-1	17	112	12.80
Tires	81	0	34.7	189.9	-94	-21.5	5	27.5	1524	5.47
Cement	81	0	3.11	14.2	-32	-5	2	13.5	36	4.57

4.2.3 Changes in Annual Production

The average annual percentage change in return varied from product to product. Cigarettes recorded a low -3.40%, while coffee recorded the highest average change at 17.03%. Although no negative change in quarterly production was recorded, negative values reappear when annual figures of production are used. Cigarettes record a negative change in annual production. Half of the coefficients of variation are lower than those for quarterly changes. This split in the middle makes it difficult to determine whether annual changes in production are more stable than quarterly changes in production. Both are however observed to be more stable than the figures for changes in monthly production. The findings are summarized in Table 3 below.

Table 3

Descriptive Statistics for Changes in Annual production: Sugar, Coffee, Tea, Beer, Cigarettes, Paints, Tires, Cement.

Variable	N	N*	Mean	StDev	Min	Q1	Median	Q3	Max	CoV
Sugar	72	0	9.37	42.05	-57	-13.75	3	15.75	170	4.49
Coffee	72	0	17.03	70.68	-78	-34.5	1	41.75	361	4.15
Tea	72	0	4.74	27.45	-51	-11.25	2.5	11.75	119	5.79
Beer	72	0	0.29	25.9	-100	-11.75	-2	10	80	89.31
Cigarettes	72	0	-3.4	25.3	-49	-17	-10	5	88	-7.44
Paints	70	2	8.1	38.5	-100	-11	10.5	37	156	4.75
Tyres	72	0	11.5	85.8	-54	-15.8	1.5	16.5	657	7.46
Cement	72	0	6.54	15.88	-32	-5.75	6.5	18.75	44	2.43

4.3 Returns

Returns at the NSE were on a general decline from January 1998 to May 2002. The period June 2002 to December 2004 was a period of steady growth in the NSE. Of the firms surveyed, Firestone, Brooke Bond, Sasini, had a mean decline in their returns for the period under survey. All the other eight firms recorded a positive growth rates for their returns.

The percentage change in returns varied for both the monthly, quarterly and annual data. Table 4 shows these variations for monthly data, Table 5 for quarterly and Table 6 for annual data.

4.3.1 Monthly Return

The monthly returns varied widely. Firestone recorded a mean negative monthly return while Mumias had the highest mean monthly return of 3.36. The monthly returns are not stable as is shown by the big coefficient of variation. The findings are summarized in Table 4 below.

Table 4

Descriptive statistics for Monthly Return

Variable	N	N*	Mean	StDev	Min	Q1	Median	Q3	Max	CoV
EAPC	82	1	1.31	14.29	-26.03	-4.79	-1.21	2.91	67.1	10.91
Bamburi	83	0	1.49	9.88	-15.29	-5.34	0.04	6.22	30.28	6.63
ARM	83	0	1.37	13.55	-22.68	-6.54	-0.69	5.08	54.44	9.89
Firestone	83	0	-0.03	8.87	-16.92	-4.92	-0.69	2.9	39.41	-295.67
Crown Berger	75	8	2.21	14.85	-20.8	-7.15	-0.48	6.16	73.63	6.72
BAT	83	0	2.52	9.9	-31	-4.05	0.77	6.59	35.33	3.93
EABL	83	0	2.01	11.26	-77.79	-1.27	2.18	6.68	21.24	5.60
Brooke bond	79	0	-0.38	7.79	-18.62	-4.26	-0.73	2.85	26.9	-20.50
Sasini	83	0	-0.70	8.29	-14.26	-6.27	-1.69	2.44	29.97	-11.84
Mumias	37	46	3.36	21.85	-30.87	-7.88	-2.58	8.54	66.77	6.50

4.3.2 Quarterly Return

The mean quarterly returns were higher than the monthly returns, with less variation. The implication of this is that data benefits from smoothing when longer periods are studied. The stability of the data also improves significantly with the increase in the period studied. Mumias Sugar had the highest mean return at 12.67 while Sasini Tea and Coffee had the lowest mean return at -2.86. Table 5 below summarizes the findings.

Table 5

Descriptive statistics for Quarterly Return

Variable	N	N*	Mean	StDev	Min	Q1	Median	Q3	Max	CoV
EAPC	81	0	5.68	35.77	-39.69	-12.94	-3.99	12.28	185.71	6.30
Bamburi	81	0	5.76	24.36	-28.36	-13	1.68	18.56	100.98	4.23
ARM	81	0	4.82	29.73	-34.17	-10.13	-3.13	8.27	157.75	6.17
Firestone	81	0	-0.5	14.53	-32.67	-11.05	-0.71	7.33	45.66	-29.06
Crown Berger	77	4	6.64	29.07	-24.23	-13.4	-2.57	14.89	102.59	4.38
BAT	81	0	8.72	23.09	-32.31	-8.82	3.48	19.43	81.34	2.65
EABL	81	0	9.04	19.9	-79.96	-2.39	5.45	20.94	55.17	2.20
Brooke bond	79	0	-0.66	16.33	-31.83	-11.28	-1.85	7.75	60.42	-24.74
Sasini	81	0	-2.86	14.66	-28.32	-14.37	-4.3	3.02	38.98	-5.13
Mumias	35	46	12.67	48.88	-45.86	-13.26	2.42	24.15	191.52	3.86

4.3.3 Annual Return

Mumias Sugar recorded the highest return of 80.10 while Sasini Tea and Coffee recorded the lowest return at -14.30. The coefficient of covariation is very low implying that this data is quite stable and benefits from the smoothing that occurs with the increase in the period of time under study. All the firms except for Mumias recorded positive returns over the entire seven year period. Table 6 summarizes the findings.

Table 6

Descriptive statistics for Annual Return

Variable	N	N*	Mean	StDev	Min	Q1	Median	Q3	Max	CoV
EAPC	72	0	47.9	130.0	-48.2	30.6)	-1.1	27.7	424.2	0.37
Bamburi	72	0	48.6	116.6	-51.9	-19.1	-1.8	40.8	395.8	0.42
ARM	72	0	46.0	125.7	-40.6	-21.0	-11.6	22.9	451.2	0.37
Firestone	72	0	-2.1	29.8	-45.8	-24.6	-5.7	16.8	81.6	-0.07
Crown Berger	72	0	56.9	133.1	-44.8	-21.9	2.3	45.1	440.4	0.43
BAT	72	0	56.2	101.2	-32.5	-7.0	13.9	85.0	402.9	0.56
EABL	72	0	59.6	85.9	-76.6	4.2	21.9	82.4	305.6	0.69
Brooke bond	72	0	-5.0	29.6	-52.3	-33.0	-1.6	13.9	60.2	-0.17
Sasini	72	0	-14.3	31.7	-58.2	-38.0	-24.5	3.2	74.5	-0.45
Mumias	26	46	80.1	86.7	-56.9	-4.4	66.1	138.7	242.3	0.92

4.4 Monthly, Quarterly and Annual Return with Changes in Monthly, Quarterly and Annual Production.

Most of the firms surveyed had a positive correlation between stock returns and production growth rates. The degree of correlation however increases with the length of time period for which growth rates and returns are calculated. The explanation offered by Fama (1990) is that information about a certain production period is spread over many previous periods. Therefore short horizon returns only explain a fraction of future production growth rates but this fraction gets the larger the longer is the time horizon of returns.

The argument simply takes care of the fact that not all information about future production becomes publicly known over a short time period. Information is rather disseminated over longer time periods as production activities actually take place. And

indeed results in Fama (1990) as well as in Binswanger (2000) suggest that monthly stock returns possess only little explanatory power for subsequent growth rates in real activity.

Consequently, evidence concerning the relation between stock returns and real economic activity mainly comes from regressions using quarterly and annual observations.

Table 7, 8 and 9 depict these findings.

Table 7

Monthly Returns versus Changes in Monthly Production

	α	β	F	ρ	r-squared
East African Portland	1.30	0.000	0.000	0.999	0.000
Bamburi Cement	1.50	-0.010	0.010	0.909	0.000
Athi River Mining	1.50	-0.075	0.400	0.531	0.005
Firestone	0.03	-0.002	0.120	0.726	0.002
Crown Berger Paints	2.09	-0.052	0.510	0.478	0.006
British American Tobacco	2.36	0.019	0.560	0.455	0.007
East African Breweries	2.00	0.029	0.240	0.623	0.003
Brooke Bond	-0.30	-0.027	0.470	0.495	0.006
Sasini Tea and Coffee - Tea	-0.88	0.080	3.490	0.065	0.041
Sasini Tea and Coffee - Coffee	-0.71	0.005	0.000	0.965	0.000
Mumias Sugar	3.23	0.015	0.030	0.864	0.001

Table 8

Quarterly Returns versus Changes in Quarterly Production

	α	β	F	ρ	r-squared
East African Portland	5.22	0.146	0.270	0.605	0.003
Bamburi Cement	5.95	-0.059	0.100	0.758	0.001
Athi River Mining	4.49	0.106	0.210	0.652	0.003
Firestone	-0.21	-0.008	0.910	0.344	0.011
Crown Berger Paints	6.50	0.113	1.060	0.306	0.014
British American Tobacco	8.88	-0.032	0.200	0.656	0.003
East African Breweries	9.22	-0.104	1.400	0.240	0.017
Brooke Bond	-0.29	-0.067	1.380	0.244	0.017
Sasini Tea and Coffee - Tea	-3.14	0.054	1.090	0.300	0.014
Sasini Tea and Coffee - Coffee	-2.79	-0.002	0.030	0.873	0.000
Mumias Sugar	14.20	-0.117	0.410	0.528	0.012

Table 9

Annual Returns versus Changes in Annual Production

	α	β	F	ρ	r-squared
East African Portland	48.00	-0.004	0.000	0.997	0.000
Bamburi Cement	49.20	-0.081	0.010	0.927	0.000
Athi River Mining	45.40	0.100	0.010	0.916	0.000
Firestone	-1.93	-0.015	0.130	0.715	0.002
Crown Berger Paints	64.50	-0.645	2.410	0.125	0.034
British American Tobacco	58.60	0.710	2.270	0.136	0.031
East African Breweries	59.40	0.453	1.330	0.253	0.019
Brooke Bond	-6.20	0.256	4.180	0.045	0.056
Sasini Tea and Coffee - Tea	15.20	0.191	1.960	0.166	0.027
Sasini Tea and Coffee - Coffee	14.60	0.034	0.400	0.532	0.006
Mumias Sugar	78.40	0.101	0.080	0.780	0.003

4.5 Monthly Prices on Contemporaneous Leads of Production

Production was found to have a positive correlation with prices. Although some instances were found when a negative relationship existed, these were few and far between. The table below presents these findings.

Proxy of Production: Cement

The production of cement had a positive relationship with the stock market prices of East African Portland Cement, Bamburi Cement and Athi River Mining shares. The strength of the relationship was good with r^2 values of between 0.184 to 0.353. The strength of the relationship decreased with the length of the lagging, i.e. recent production explained stock prices better than lagged production. The results are statistically significant with p-values of 0.000. Table 10 shows the results

Table 10

Results of Returns regressed against cement as a proxy for production

	β	ρ	r-squared
East African Portland			
Unlagged	0.000501	0.000	0.306
Lag 1	0.000513	0.000	0.307
Lag 2	0.000503	0.000	0.296
Lag 3	0.000478	0.000	0.269
Lag 12	0.000343	0.000	0.208
Bamburi Cement			
Unlagged	0.000889	0.000	0.353
Lag 1	0.000869	0.000	0.331
Lag 2	0.000816	0.000	0.299
Lag 3	0.000768	0.000	0.270
Lag 12	0.000553	0.000	0.240

	β	ρ	r-squared
Athi River Mining			
Unlagged	0.000162	0.000	0.294
Lag 1	0.000169	0.000	0.307
Lag 2	0.001670	0.000	0.301
Lag 3	0.000162	0.000	0.284
Lag 12	0.000102	0.000	0.184

Proxy of Production: Tyres

The production of tyres had a positive relationship with the share prices of Firestone East Africa Limited, except for the twelve month lag. The r^2 were low meaning that tyre production did not explain well the share prices observed in the market. With most of the p-values less than 0.10, the results are statistically significant. Tyre production therefore did explain well the share prices at the market. See Table 11 below

Table 11

Results of Returns regressed against tires as a proxy for production

	β	ρ	r-squared
Firestone			
Unlagged	0.000064	0.077	0.038
Lag 1	0.000109	0.004	0.099
Lag 2	0.000092	0.170	0.069
Lag 3	0.000073	0.067	0.042
Lag 12	-0.000013	0.001	0.785

Proxy of Production: Paints

The production of paint had a positive correlation with the share prices of Crown Berger Paints. The low r^2 values imply that it did not explain the share prices well. However the results are statistically significant, as p-value are low. However the strength of the relationship reduces with lagging. See Table 12 below

Table 12

Results of Returns regressed against paints as a proxy for production

	β	ρ	r-squared
Crown Berger Paints			
Unlagged	0.000016	0.085	0.008
Lag 1	0.000016	0.009	0.083
Lag 2	0.000014	0.021	0.066
Lag 3	0.000012	0.042	0.053
Lag 12	0.000002	0.590	0.004

Proxy of Production: Cigarettes

The production of Cigarettes had a negative correlation with the price of BAT shares in the market. The strength of the relationship is weak, and the results for the lags beyond three months are statistically insignificant. See table 13 below.

Table 13

Results of Returns regressed against cigarettes as a proxy for production

	β	ρ	r-squared
British American Tobacco			
Unlagged	-0.000115	0.021	0.064
Lag 1	-0.000106	0.032	0.055
Lag 2	-0.000090	0.066	0.041
Lag 3	-0.000071	0.171	0.024
Lag 12	0.000032	0.356	0.012

Proxy of Production: Beer

The production of beer had a very strong positive relationship with the market price of EABL shares. The R^2 values varied from 0.033 to 0.480 implying a strong relationship. The strength of the relationship increases with the length of the lagging. Twelve month lag explains returns better than one to three month lags. The p-values also decrease with the length of the lagging. See table 14

Table 14

Results of Returns regressed against beer as a proxy for production

	β	ρ	r-squared
East African Breweries			
Unlagged	0.006590	0.102	0.033
Lag 1	0.013500	0.001	0.135
Lag 2	0.013900	0.000	0.153
Lag 3	0.014400	0.000	0.175
Lag 12	0.138000	0.000	0.480

Proxy of Production: Tea

The production of tea was used to assess the relationship of the prices of Brooke bond and Sasini Tea and Coffee. In both instances, tea production was found to have a negative correlation with the market price. The R^2 values were also observed to be low. Because of the high p-values for Sasini Tea and Coffee, other factors seem to explain the variations in the prices.

A possible explanation is that the firms surveyed deal with many other products (Sasini has major dealings in coffee) and as such tea as the only predictor of market share prices might be inappropriate. See Table 15

Table 15

Results of Returns regressed against tea as a proxy for production

	β	ρ	r-squared
Brooke Bond			
Unlagged	-0.001110	0.079	0.037
Lag 1	-0.001370	0.031	0.056
Lag 2	-0.001320	0.041	0.051
Lag 3	-0.001370	0.035	0.055
Lag 12	-0.002750	0.000	0.223
Sasini Tea and Coffee - Tea			
Unlagged	-0.000620	0.164	0.023
Lag 1	-0.000914	0.043	0.050
Lag 2	-0.001000	0.026	0.060
Lag 3	-0.001110	0.015	0.073
Lag 12	-0.001700	0.000	0.500

Proxy of Production: Coffee

Coffee production had a positive relationship with markets prices. However the results are statistically insignificant and the strength of the relationship is low. See table 16 below.

Table 16

Results of Returns regressed against coffee as a proxy for production

	β	ρ	r-squared
Sasini Tea and Coffee - Coffee			
Unlagged	0.000653	0.500	0.006
Lag 1	0.000717	0.464	0.007
Lag 2	0.000655	0.508	0.005
Lag 3	0.000680	0.498	0.006
Lag 12	0.003120	0.003	0.123

Proxy of Production: Sugar

Sugar has a positive relationship with market prices for lags below three months. Beyond that the relationship changes. However the results are statistically significant. See Table 17.

Table 17

Results of Returns regressed against coffee as a proxy for production

	β	ρ	r-squared
Mumias Sugar			
Unlagged	0.000047	0.407	0.019
Lag 1	0.000041	0.500	0.013
Lag 2	0.000019	0.774	0.002
Lag 3	-0.000005	0.931	0.000
Lag 12	-0.000002	0.936	0.000

4.6 Monthly, Quarterly, and Annual Stock Returns versus Contemporaneous and one Year of Leads of Quarterly production Growth Rates, 1998 – 2004.

The study was also interested in finding out whether future production can be used to explain returns. The Tables 18 to 28 show regressions of returns on quarterly growth rates.

The regression equation used was:

$$R(t,t+T) = \alpha + \sum_{k=1}^{8} \beta_k P(t,t+3) + \varepsilon(t,t+T)$$

The regression was done for the period of one year following return, using quarterly observations. For example, monthly returns will be regressed against quarterly production up to the quarter P (t+9, t+12). Quarterly returns were tested up to quarter P (t+12, t+15). Annual returns were tested up to quarter P (t+21, t+24).

The strength of this relationship was tested at significance level of "p<0.10"

The symmetry between the return regressions and the production regressions is apparent. The general finding is that if too long a period is used against changes in quarterly production occurring too long in the future, the relationship fails to hold. This is observed for annual returns against changes in quarterly production occurring after the fourth quarter. This might be explained by the fact that information about future production is not disseminated over a period of more than four quarters. The dissemination therefore occurs within one year.

The focus of the study was to test this relationship for the four quarters following return. Results for longer periods are however shown for the interest of the reader.

The expected result was that returns are explained by growth in future production growth rates.

Table 18

Regression of Returns on Leads of Quarterly Production: East Africa Portland Cement

	Monthly R(t, t+1)							Quarterly R(t, t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	0.98	0.11	0.01	14.38	0.86	0.55	81	5.22	0.15	0.00	35.94	0.27	0.61	81	47.50	0.15	0.00	130.92	0.02	0.89	72
P (t+3, t+6)	2.04	-0.23	0.05	14.36	3.94	0.05	78	6.67	0.26	0.01	36.49	0.77	0.38	78	47.50	0.19	0.00	30.91	0.03	0.86	72
P (t+6, t+9)	1.44	0.10	0.01	14.90	0.59	0.45	75	6.87	0.08	0.00	37.21	0.06	0.80	75	47.80	0.08	0.00	130.93	0.00	0.94	72
P (t+9, t+12)	1.99	-0.07	0.00	14.96	0.30	0.58	72	7.50	0.02	0.00	37.73	0.00	0.94	72	48.40	-0.21	0.00	130.91	0.00	0.85	72
P (t+12, t+15)	2.00	0.02	0.00	15.26	0.03	0.17	69	8.49	0.14	0.00	38.39	0.18	0.68	69	54.10	-0.96	0.01	132.08	0.72	0.40	69
P (t+15, t+18)	1.16	0.19	0.03	15.14	2.11	0.15	66	6.76	0.42	0.02	38.69	1.59	0.21	66	55.10	-0.16	0.00	134.83	0.02	0.89	66
P (t+18, t+21)	0.61	0.16	0.02	14.81	1.42	0.24	63	4.73	0.45	0.03	38.16	1.78	0.19	63	52.70	1.09	0.01	137.05	0.81	0.37	63
P (t+21, t+24)	-0.34	-0.13	0.02	12.23	1.15	0.29	60	0.46	-0.11	0.00	21.92	0.26	0.61	60	40.50	1.11	0.01	128.83	0.82	0.37	60

The correlation between quarterly production growth rates and monthly returns are mixed, though generally positive. A few observations are statistically insignificant. All quarterly returns are positively correlated with the quarterly growth rates in production, though statistically insignificant. The annual returns have positive correlation with the production for the first three and last two quarters. However the high p-values imply that returns are not explained only by the production. Other factors are also involved. Quarterly changes in production show results more in line with the expected results.

Table 19

Regression of Returns on Leads of Quarterly Production: Bamburi Cement

	Monthly R(t, t+1)							Quarterly R(t, t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	1.33	0.03	0.00	10.02	0.14	0.71	81	5.95	0.06	0.00	24.50	0.10	0.76	81	47.30	0.48	0.00	117.22	0.25	0.62	72
P (t+3, t+6)	1.91	-0.23	0.10	9.69	8.31	0.01	78	6.06	0.25	0.02	24.66	1.59	0.21	78	47.90	0.37	0.00	117.31	0.14	0.71	72
P (t+6, t+9)	1.25	0.13	0.03	10.15	2.36	0.13	75	5.67	0.04	0.00	25.28	0.03	0.86	75	48.50	0.08	0.00	117.43	0.01	0.94	72
P (t+9, t+12)	2.39	-0.14	0.04	10.03	2.83	0.10	72	7.57	-0.19	0.01	24.74	0.80	0.38	72	49.70	-0.44	0.00	117.27	0.20	0.66	72
P (t+12, t+15)	1.49	0.12	0.03	10.15	1.93	0.17	69	6.89	0.07	0.00	25.24	0.10	0.75	69	53.30	-0.67	0.01	118.89	0.43	0.51	69
P (t+15, t+18)	1.39	0.04	0.00	10.25	0.24	0.63	66	6.24	0.10	0.00	25.63	0.21	0.65	66	55.50	-0.42	0.00	121.09	0.17	0.69	66
P (t+18, t+21)	0.98	0.00	0.00	10.05	0.00	0.98	63	5.13	-0.01	0.00	25.31	0.00	0.96	63	55.10	-0.03	0.00	123.95	0.00	0.98	63
P (t+21, t+24)	0.14	0.14	0.04	9.82	2.20	0.14	60	2.12	0.33	0.04	23.96	2.12	0.15	60	47.60	0.81	0.01	124.64	0.47	0.50	60

The nature of the relationship is mixed. The second, third fourth and fifth quarters of changes in production following returns explain a large degree of returns and are statistically significant. He R^2 is relatively strong. The quarterly returns are positively correlated to quarterly production changes. The annual return regressions are statistically insignificant.

Table 20

Regression of Returns on Leads of Quarterly Production: Athi River Mining

	Monthly R(t, t+1)							Quarterly R(t,t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	1.35	0.01	0.00	13.77	0.02	0.90	81	4.49	0.11	0.00	29.87	0.21	0.65	81	44.40	0.61	0.01	126.26	0.36	0.55	72
P (t+3, t+6)	1.95	-0.11	0.02	13.89	0.93	0.34	78	5.51	-0.06	0.00	30.33	0.06	0.81	78	46.40	-0.17	0.00	126.55	0.03	0.87	72
P (t+6, t+9)	1.79	0.03	0.00	14.20	0.08	0.78	75	6.35	0.14	0.00	30.71	0.31	0.58	75	45.20	0.38	0.00	126.46	0.12	0.73	72
P (t+9, t+12)	2.18	-0.09	0.01	14.29	0.58	0.45	72	7.05	-0.10	0.00	31.08	0.16	0.70	72	46.80	-0.31	0.00	126.50	0.09	0.77	72
P (t+12, t+15)	1.81	0.13	0.02	14.45	1.17	0.28	69	7.02	0.07	0.00	31.69	0.06	0.81	69	51.10	-0.58	0.00	128.00	0.28	0.60	69
P (t+15, t+18)	1.16	0.19	0.03	15.14	2.11	0.15	66	5.70	0.17	0.01	31.75	0.37	0.55	66	53.30	-0.50	0.00	130.48	0.20	0.66	66
P (t+18, t+21)	0.90	0.03	0.00	12.94	0.08	0.78	63	4.42	0.34	0.02	31.62	1.51	0.22	63	50.90	0.59	0.00	133.32	0.26	0.62	63
P (t+21, t+24)	-0.38	0.03	0.00	11.78	0.06	0.80	60	0.03	0.01	0.00	20.15	0.00	0.98	60	40.00	1.13	0.01	129.55	0.84	0.36	60

The correlation holds. Where relationship is negative, p-value tends to be higher than where positive correlation is observed. Some quarters' production are negatively correlated to production while R^2 shows strong correlation between monthly returns and quarterly production. Annual return regressions show some positive R^2 values, but are generally weak. Expected results generally hold for the monthly and quarterly returns but not for annual returns.

Table 21

Regression of Returns on Leads of Quarterly Production: Firestone Tyres

	Monthly R(t, t+1)							Quarterly R(t,t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	-0.15	0.08	0.00	8.96	0.02	0.89	81	0.21	0.01	0.01	14.54	0.91	0.34	81	-2.02	0.00	0.00	30.03	0.02	0.90	72
P (t+3, t+6)	-0.21	0.00	0.00	8.83	0.23	0.64	78	-1.34	0.02	0.04	14.46	3.04	0.09	78	-1.93	-0.01	0.00	30.02	0.09	0.76	72
P (t+6, t+9)	-0.29	0.00	0.00	9.01	0.06	0.81	75	-0.96	-0.01	0.01	14.84	0.50	0.48	75	-2.07	0.00	0.00	30.04	0.00	0.95	72
P (t+9, t+12)	0.01	0.00	0.01	9.02	0.59	0.44	72	-0.53	0.00	0.00	14.93	0.06	0.81	72	-1.89	-0.01	0.00	30.01	0.14	0.71	72
P (t+12, t+15)	-0.38	0.01	0.02	9.14	1.47	0.23	69	-1.02	0.01	0.00	15.17	0.28	0.60	69	-2.73	0.01	0.01	30.58	0.31	0.58	69
P (t+15, t+18)	-0.34	0.02	0.01	9.38	0.70	0.41	66	-1.42	0.04	0.02	15.35	1.57	0.21	66	-2.86	0.05	0.01	31.20	0.48	0.49	66
P (t+18, t+21)	-0.61	0.01	0.00	8.06	0.21	0.65	63	-0.54	-0.06	0.04	14.94	2.58	0.11	63	-2.28	0.02	0.00	31.79	0.05	0.83	63
P (t+21, t+24)	-0.33	-0.01	0.00	0.01	0.49	0.49	60	-1.92	0.00	0.00	14.44	0.00	1.00	60	-3.01	-0.02	0.00	32.13	0.01	0.80	61

The correlations were generally positive. The quarterly returns are the best explained by the changes in quarterly productions. The monthly and annual returns are positively related to the quarterly changes in production, but are statistically insignificant with p-values of up to 0.90. Only one p-value is statistically significant.

Table 22

Regression of Returns on Leads of Quarterly Production: Crown Berger Paints

	Monthly R(t, t+1)							Quarterly R(t,t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	1.90	0.08	0.03	14.30	2.13	0.15	79	6.50	0.11	0.01	28.57	1.06	0.31	79	59.60	-0.17	0.00	135.18	0.10	0.76	70
P (t+3, t+6)	0.03	-0.11	0.05	14.18	3.97	0.05	76	7.41	-0.22	0.05	28.56	3.98	0.05	76	59.40	-0.31	0.01	135.17	0.34	0.56	70
P (t+6, t+9)	2.17	0.04	0.01	14.35	0.61	0.44	73	6.89	0.07	0.01	28.85	0.37	0.54	73	58.00	-0.06	0.00	135.87	0.01	0.91	70
P (t+9, t+12)	3.23	-0.03	0.00	14.81	0.25	0.62	70	9.38	-0.13	0.02	29.33	1.24	0.27	70	58.80	-0.27	0.00	135.58	0.27	0.61	70
P (t+12, t+15)	2.72	-0.03	0.00	15.36	0.25	0.62	67	7.89	0.00	0.00	30.10	0.00	0.98	67	61.30	-0.27	0.00	137.82	0.25	0.62	67
P (t+15, t+18)	1.53	-0.01	0.00	14.81	0.02	0.88	64	6.33	-0.05	0.00	27.39	0.20	0.65	64	62.30	-0.06	0.00	140.98	0.01	0.92	64
P (t+18, t+21)	0.47	0.04	0.01	11.84	0.56	0.46	61	3.38	0.20	0.05	24.78	3.27	0.08	61	57.60	0.38	0.01	139.62	0.36	0.55	61
P (t+21, t+24)	0.20	0.00	0.00	11.65	0.00	0.95	58	-0.03	0.13	0.03	17.35	1.49	0.23	58	39.30	0.38	0.01	117.86	0.27	0.61	58

The earnings are negatively correlated to the changes in quarterly production. Some p-values are statistically significant, though the majority are statistically insignificant. These results are in direct contrast to the expected results. Interestingly, the coefficient of determination show some of the highest values recorded in these regressions.

Table 23

Regression of Returns on Leads of Quarterly Production: British American Tobacco

	Monthly R(t, t+1)							Quarterly R(t,t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	2.52	0.01	0.00	10.07	0.08	0.77	81	8.88	-0.03	0.00	23.21	0.20	0.66	81	55.80	0.14	0.00	101.75	0.16	0.69	72
P (t+3, t+6)	2.66	0.00	0.00	10.24	0.00	0.96	78	9.02	-0.01	0.00	23.65	0.04	0.85	78	56.00	0.05	0.00	101.86	0.02	0.89	72
P (t+6, t+9)	2.83	-0.01	0.00	10.42	0.11	0.74	75	9.20	0.05	0.01	23.92	0.40	0.53	75	55.90	0.11	0.00	101.80	0.10	0.75	72
P (t+9, t+12)	3.11	0.04	0.02	9.69	1.28	0.26	72	10.90	0.04	0.00	22.93	0.26	0.61	72	56.20	0.01	0.00	101.87	0.00	0.99	72
P (t+12, t+15)	2.55	0.03	0.02	9.33	1.07	0.31	69	9.62	0.07	0.01	22.31	0.92	0.34	69	57.60	0.22	0.01	102.86	0.42	0.52	69
P (t+15, t+18)	1.91	0.01	0.00	8.64	0.12	0.73	66	7.40	0.03	0.00	19.42	0.16	0.69	66	58.20	0.21	0.01	105.05	0.38	0.54	66
P (t+18, t+21)	1.37	-0.01	0.00	7.41	0.05	0.82	63	4.90	0.08	0.04	16.06	2.33	0.13	63	53.60	0.38	0.02	105.40	1.18	0.28	63
P (t+21, t+24)	1.19	-0.02	0.01	7.44	0.57	0.45	60	4.07	-0.02	0.00	15.00	0.22	0.64	60	39.20	0.34	0.03	83.68	1.46	0.23	60

The annual returns are more positively correlated to the changes in quarterly production than are the monthly and quarterly returns. Return increases in general as production increases. The results concur with expected results and confirm that information about returns of a given period is spread across several future periods of production. The results also confirm that leads of quarterly production of up to four quarters ahead explain monthly, quarterly and annual stock returns.

Table 24

Regression of Returns on Leads of Quarterly Production: East African Breweries

	Monthly R(t, t+1)							Quarterly R(t,t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	3.10	-0.02	0.00	7.02	0.29	0.59	81	9.22	-0.10	0.02	19.86	1.40	0.24	81	59.10	0.26	0.00	86.35	0.31	0.58	72
P (t+3, t+6)	3.11	-0.01	0.00	7.04	0.08	0.78	78	10.40	-0.01	0.00	17.54	0.02	0.88	78	59.50	0.06	0.00	86.53	0.01	0.91	72
P (t+6, t+9)	3.14	0.04	0.02	7.04	1.53	0.22	75	10.20	0.06	0.01	17.75	0.61	0.44	75	59.50	0.03	0.00	86.54	0.00	0.95	72
P (t+9, t+12)	3.48	-0.03	0.01	7.09	0.98	0.33	72	11.20	-0.01	0.00	17.66	0.02	0.89	72	59.60	0.01	0.00	86.54	0.00	0.99	72
P (t+12, t+15)	3.09	0.02	0.00	7.13	0.28	0.60	69	10.80	-0.01	0.00	17.81	0.01	0.93	69	62.70	-0.03	0.00	86.58	0.01	0.94	69
P (t+15, t+18)	2.63	0.00	0.00	6.81	0.00	0.98	66	9.30	0.01	0.00	16.78	0.02	0.90	66	62.30	-0.04	0.00	88.52	0.01	0.93	66
P (t+18, t+21)	2.41	0.01	0.00	6.81	0.09	0.77	63	8.35	-0.06	0.01	15.89	0.66	0.42	63	60.60	-0.20	0.00	89.88	0.21	0.65	63
P (t+21, t+24)	1.89	-0.24	0.01	6.17	0.59	0.45	60	6.39	-0.01	0.00	13.85	0.01	0.94	60	51.60	-0.09	0.00	82.79	0.05	0.83	60

The monthly and quarterly returns have mixed correlation with changes in quarterly production. The first four quarters changes in production have positive correlation with annual returns, and can be used to explain annual returns. After the fourth quarter, monthly returns are negatively correlated. Since these are the quarters of interest, the results do not hold, and the expected results are at a variance with expected results.

Table 25

Regression of Returns on Leads of Quarterly Production: Brooke Bond

	Monthly R(t, t+1)							Quarterly R(t,t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	-0.18	-3.73	0.02	7.65	1.90	0.17	81	-0.29	-0.07	0.02	16.08	1.38	0.24	81	-5.22	0.05	0.00	29.79	0.18	0.68	72
P (t+3, t+6)	-0.62	0.03	0.02	7.81	1.43	0.24	78	-1.19	0.08	0.03	16.33	1.92	0.17	78	-5.49	0.10	0.01	29.68	0.73	0.40	72
P (t+6, t+9)	-0.51	0.00	0.00	7.85	0.00	0.98	75	-1.03	-0.02	0.00	16.65	0.12	0.73	75	-4.90	-0.02	0.00	29.83	0.02	0.89	72
P (t+9, t+12)	-0.90	0.02	0.01	7.56	0.59	0.45	72	-1.57	0.05	0.01	16.72	0.57	0.45	72	-5.28	0.05	0.00	29.79	0.20	0.66	72
P (t+12, t+15)	-0.26	-0.04	0.03	7.53	1.92	0.17	69	-0.28	-0.12	0.05	16.58	3.44	0.07	69	-5.63	0.01	0.00	30.36	0.01	0.94	69
P (t+15, t+18)	-0.58	0.01	0.00	7.79	0.12	0.74	66	-1.29	0.05	0.01	17.30	0.49	0.49	66	-5.83	-0.01	0.00	31.02	0.00	0.97	66
P (t+18, t+21)	-0.56	-0.04	0.00	7.60	1.90	0.17	63	-0.07	-0.13	0.05	16.93	3.28	0.08	63	-4.76	-0.20	0.04	31.00	2.51	0.12	63
P (t+21, t+24)	-0.15	0.08	0.12	7.02	7.79	0.01	60	-2.86	0.18	0.10	16.82	6.49	0.01	60	-6.56	-0.03	0.00	32.30	0.04	0.85	60

The nature of correlation is mixed. Many of the correlations are statistically significant. The expected results hold for monthly and quarterly returns but not for annual returns. The implication is that tea production as an explanatory variable for returns can not be used when the period of return is beyond four quarters. Other variables seem to come into play.

Table 26

Regression of Returns on Leads of Quarterly Production: Sasini Tea and Coffee - Tea

	Monthly R(t, t+1)							Quarterly R(t,t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	-0.85	-0.03	0.01	8.15	0.75	0.39	81	-3.14	0.05	0.01	14.65	1.09	0.30	81	-14.30	0.00	0.00	31.93	0.00	0.93	72
P (t+3, t+6)	-1.50	0.05	0.03	8.91	2.46	0.12	78	-4.05	0.03	0.01	14.00	0.43	0.51	78	-14.40	0.00	0.00	31.93	0.00	0.98	72
P (t+6, t+9)	-1.49	0.01	0.00	8.20	0.15	0.70	75	-4.32	0.01	0.00	14.18	0.07	0.80	75	-14.40	0.01	0.00	31.93	0.01	0.93	72
P (t+9, t+12)	-1.19	-0.02	0.01	7.95	0.59	0.45	72	-4.26	0.00	0.00	14.42	0.01	0.94	72	-15.00	0.12	0.01	31.72	0.95	0.33	72
P (t+12, t+15)	-1.15	-0.01	0.00	8.08	0.10	0.75	69	-3.90	-0.02	0.00	14.56	0.09	0.77	69	-15.90	0.05	0.00	31.88	0.16	0.69	69
P (t+15, t+18)	-1.58	0.02	0.01	7.75	0.53	0.47	66	-4.61	-0.01	0.00	14.56	0.04	0.85	66	-16.10	-0.03	0.00	32.38	0.07	0.79	66
P (t+18, t+21)	-1.76	-0.01	0.00	6.79	0.13	0.72	63	-4.76	0.01	0.00	14.49	0.00	0.89	63	-16.40	-0.03	0.00	33.09	0.05	0.83	63
P (t+21, t+24)	-2.06	0.02	0.01	6.91	0.60	0.44	60	-6.15	0.05	0.02	13.47	0.91	0.34	60	-18.10	0.03	0.00	33.35	0.04	0.84	60

The general direction of the relationship is positive. Returns will be high if production is expected to increase in the future. The strength of the relationship is stronger for the monthly than for the quarterly or annual returns. The other observation is that is that these results are statistically insignificant for the three sets of returns.

Table 27

Regression of Returns on Leads of Quarterly Production: Sasini Tea and Coffee - Coffee

	Monthly R(t, t+1)							Quarterly R(t,t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	-0.89	0.00	0.00	8.18	0.16	0.69	81	-2.79	0.00	0.00	14.75	0.03	0.87	81	-15.90	0.05	0.03	31.42	2.33	0.13	72
P (t+3, t+6)	-1.36	0.00	0.00	8.21	0.26	0.61	78	-3.52	-0.01	0.01	13.99	0.61	0.44	78	-14.90	0.02	0.00	31.88	0.23	0.64	72
P (t+6, t+9)	-1.30	0.00	0.00	8.21	0.18	0.67	75	-3.82	-0.01	0.01	14.10	0.91	0.34	75	-13.90	-0.02	0.00	31.89	0.21	0.65	72
P (t+9, t+12)	-1.07	-0.01	0.01	7.93	0.99	0.32	72	-4.48	0.01	0.00	14.40	0.18	0.67	72	-13.90	-0.02	0.00	31.88	0.22	0.64	72
P (t+12, t+15)	-1.43	0.01	0.01	8.04	0.69	0.41	69	-4.15	0.00	0.01	14.56	0.07	0.79	69	-15.20	0.01	0.00	31.81	0.15	0.70	69
P (t+15, t+18)	-1.22	-0.01	0.01	7.73	0.79	0.38	66	-4.29	-0.01	0.01	14.47	0.79	0.38	66	-15.90	-0.01	0.00	32.35	0.18	0.68	66
P (t+18, t+21)	-1.80	0.00	0.00	6.79	0.03	0.88	63	-4.44	-0.01	0.01	14.46	0.33	0.57	63	-16.30	-0.01	0.00	33.08	0.08	0.78	63
P (t+21, t+24)	-1.96	0.00	0.00	6.94	0.02	0.88	60	-6.51	0.02	0.03	13.34	2.00	0.16	60	-18.10	0.01	0.00	33.35	0.03	0.87	60

The general direction of the relationship is positive. An increase in return predicts an increase in future production. This means that future production explain current returns. The strength of the relationship is not strong, and results are statistically insignificant. Other variables might be responsible for the correlation.

Table 28

Regression of Returns on Leads of Quarterly Production: Mumias Sugar Company

	Monthly R(t, t+1)							Quarterly R(t,t+3)							Annual R(t, t+12)						
	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N	α	β	R^2	S(e)	F	ρ	N
P (t,t+3)	4.14	-0.03	0.00	22.71	0.12	0.73	35	14.20	-0.12	0.01	49.32	0.41	0.53	35	78.60	0.09	0.00	88.42	0.06	0.81	26
P (t+3, t+6)	4.65	-0.08	0.02	23.58	0.57	0.46	32	19.30	-0.65	0.27	44.38	10.82	0.00	32	82.10	-0.33	0.03	87.31	0.67	0.42	26
P (t+6, t+9)	3.07	0.06	0.01	24.74	0.27	0.61	29	8.82	0.49	0.14	50.41	4.42	0.05	29	84.00	-0.44	0.05	86.42	1.19	0.29	26
P (t+9, t+12)	-0.36	0.14	0.07	17.65	1.74	0.20	26	9.90	0.43	0.07	53.41	1.82	0.19	26	78.30	0.36	0.02	87.68	0.47	0.50	26
P (t+12, t+15)	0.50	-0.02	0.00	19.39	0.03	0.86	23	1.84	0.03	0.00	41.02	0.01	0.91	23	72.60	0.00	0.00	91.79	0.00	1.00	23
P (t+15, t+18)	2.70	-0.34	0.33	15.56	8.90	0.01	20	6.93	-0.60	0.20	38.16	4.59	0.05	20	53.10	0.02	0.00	80.84	0.00	0.97	20
P (t+18, t+21)	-3.18	0.22	0.08	19.58	1.29	0.28	17	3.20	-0.62	0.12	43.65	2.05	0.17	17	41.40	-0.74	0.07	69.55	1.15	0.30	17
P (t+21, t+24)	0.38	0.09	0.01	21.69	0.14	0.72	14	-1.20	0.86	0.17	46.54	2.52	0.14	14	19.20	0.51	0.07	47.43	0.84	0.38	14

There are more cases of positive correlation than for the negative correlation. The strength of the correlation is good, with R^2 values of up to 0.33 for the monthly data. Some of the results are statistically significant. The quarterly returns are better explained than monthly and annual returns. Too short a period of returns is not explained very well by future production. Too long a period of returns is also not properly explained.

5.0 CONCLUSION AND FINDINGS

5.1 Summary of Findings and conclusion

In this chapter, the findings of the research has been summarized and discussed in relation to the objective of the study. Included are the limitations of the study and suggestions for further research.

During the seven years of study, there is a positive correlation between stock market prices and real activity estimated using production. Though this relationship is not very strong, the correlation coefficient between share prices and production is more than 0.30 most of the time.

The period over which returns and changes to production were measured determine the explanatory power of the predictor variable. Returns measured over a longer period and explained by longer period changes in production were better explained than those involving shorter periods. The annual returns were explained well by annual change in production than were the monthly and quarterly returns explained by monthly and quarterly changes in production. The information in the market is disseminated over long periods of time.

Stock market returns are also generally positively correlated with future production growth rates though the relationship is weak. It seems most unlikely that a single macro-variable, production, captures all variation in returns. It seems that there is a variation in future production that is irrelevant for current returns.

5.2 Limitations of the Study

a. The Nairobi Stock Exchange is an emerging market. Studies have also shown that information in this market is not disseminated instantly, yet the study relied on perfect dissemination of information about production in the market.

b. Stock prices and production can respond together to other variables. Stock returns might also cause changes in real activity. The study did not address the cause and effect in the relations between stock returns and real activity.

c. The use of production as the only determinant of returns is not plausible as various studies have shown that returns respond to various macro economic variables.

d. Availability of time for research. If time was available the study would have examined relationship over longer time periods, thus giving more meaningful relationship.

e. The variable used to explain returns are chosen largely on the basis of goodness-of-fit rather than the directives of a well researched theory. It is possible that with fresh data the explanatory power of the variables used could be different.

f. The assumption that the relationship between the variables is linear. This allows for the use of the ordinary least squares as the basis of analysis. This might not be the case.

5.3 Recommendations

The Nairobi Stock Exchange ought to be studied extensively to determine the relationships that exist between the share prices and other macro variables. This will avail more information to the stakeholders in the market, and the public at large.

Such information will attract more investors to the market. The purpose of this study was to examine the relationship between the stock market returns and real activity in the economy.

5.4 Suggestion for further research.

Further research and study can be done in the following areas:

a. Researchers can extend the study to include more macro-economic variable, like term spread, rate of employment, default spread, bankruptcies, etc to explain the stock returns.

b. The length of period of the study can be increased to find out whether the effect existed before and after the period of the study.

c. The number of firms in the study can be increased to see whether this effect exists in most of the firms or not.

d. To conduct further research on this relationship using returns as the predictor variable, and regress the same on production.

e. Extend the study to include the companies not listed on the Nairobi stock Exchange.

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Appendix I

Population of the Study: Listed Companies at the Nairobi Stock Exchange

Agricultural

Unilever Tea Kenya Ltd

Kakuzi Ltd

Rea Vipingo Plantations Ltd

Sasini Tea & coffee Ltd

Commercial and Services

Car & General (K) Ltd

CMC Holdings Ltd

Kenya Airways Ltd

Marshall's (E.A) Ltd

Nation Media Group

Tourism Promotion Services Ltd

Uchumi Supermarket Ltd

Finance and Investment.

Barclays Bank Ltd

C.F.C. Bank Ltd

Diamond Trust Bank (K)

Housing Finance Company of Kenya

I.C.D.C. Investments Co. Ltd

Jubilee Insurance Co. Ltd

Kenya Commercial Bank Ltd

National Bank of Kenya Ltd

NIC Bank ltd

Pan Africa Insurance Ltd

Standard Chartered Bank Ltd

Industrial and Allied

Athi River Mining.

B.O.C. Kenya Ltd

Bamburi Cement Ltd

British American Tobacco Kenya Ltd.

Carbacid Investments Ltd

Crown Berger

Olympia Capital Holdings Ltd (Dunlop Kenya)

E.A. Cables Ltd.

E.A. Portland Cement Ltd

E.A. Breweries ltd

Firestone East Africa Ltd.

Kenya Oil Co. Ltd

Kenya Power & Lighting Company Ltd.

Mumias Sugar Company Ltd

Total Kenya Ltd

Unga Group Ltd

Alternative Investment Market Segment.

A. Baumann & Co. Ltd

City Trust Ltd

E.A. Packaging Ltd.

Eaagads Ltd

Express Ltd

George Williamson Kenya Ltd

Kapchorua Tea Co. Ltd

Kenya Orchards Ltd

Limuru Tea Co. Ltd

Standard Newspaper Group.

Fixed Income Securities Market Segment

Safaricom Kenya Limited

EADB

Mabati Rolling Mills

PTA

Faulu

Appendix II

Sample of the Study

Agriculture

Unilever Tea Kenya Ltd – Brooke Bond

Sasini Tea & coffee Ltd

Industrial and Allied

Athi River Mining.

Bamburi Cement Ltd

British American Tobacco Kenya ltd.

Crown Berger

E.A. Portland Cement Ltd

E.A. Breweries Ltd

Firestone East Africa Ltd.

Mumias Sugar Company Ltd

Appendix III

List of Economic Indicators by Central Bureau of Statistics

1. Processed Chicken
2. Milk
3. Baby Food with Milk base
4. Canned Fruit
5. Canned Vegetables
6. Edible Fats & Margarine
7. Edible oils
8. Wheat Flour
9. Maize Meal
10. Bread
11. Sugar
12. Sweets
13. Chewing Gum
14. Milled Coffee
15. Tea
16. Salt
17. Cattle Feeds
18. Poultry Feeds
19. Pig Feeds
20. Spirits
21. Beer
22. Mineral Water (soft drinks)
23. Cigarettes
24. Leather Shoes
25. Wrapping Paper
26. Corrugated paper Containers
27. Newsprint

28. Pyrethrum Extract
29. Paints
30. Drug Tablets
31. Laundry Soap
32. Toilet Soap
33. Motor Spirits
34. Kerosene
35. Plastic Bottles
36. Motor Vehicle Tyres
37. Glass Bottles
38. Cement Production
39. Galvanized Sheets
40. Dry Cells
41. Assembled Vehicles
42. Ball Pens
43. Cotton Woven Fabrics
44. Blankets

Appendix IV

Changes in Monthly Production

Month	Sugar	Coffee	Tea	Beer	Cigarettes	Paints	Tires	Cement
Feb-98	1%	165%	-15%	-10%	23%	-17%	622%	27%
Mar-98	12%	0%	6%	-1%	44%	-1%	19%	2%
Apr-98	-12%	-85%	-6%	9%	-35%	8%	-14%	5%
May-98	-27%	438%	-7%	9%	-4%	1%	13%	1%
Jun-98	48%	-28%	-9%	-13%	-35%	-10%	-32%	-3%
Jul-98	-29%	2%	-24%	-2%	74%	21%	49%	-11%
Aug-98	36%	-37%	-3%	-9%	-10%	-5%	-33%	32%
Sep-98	-3%	19%	31%	4%	17%	-4%	46%	3%
Oct-98	11%	-2%	27%	6%	-22%	-9%	-11%	-15%
Nov-98	-14%	8%	-19%	-7%	22%	-2%	5%	8%
Dec-98	-4%	-19%	18%	33%	19%	-8%	-55%	13%
Jan-99	25%	32%	-18%	-44%	-44%	8%	-86%	-16%
Feb-99	-15%	31%	-33%	17%	3%	-15%	1412%	-8%
Mar-99	19%	54%	-4%	-14%	54%	43%	26%	9%
Apr-99	-11%	-32%	88%	-9%	-22%	-36%	-14%	0%
May-99	-30%	17%	-17%	-6%	8%	65%	0%	-8%
Jun-99	61%	-15%	-10%	-8%	21%	11%	-55%	7%
Jul-99	-1%	84%	-9%	5%	-14%	15%	166%	-1%
Aug-99	-8%	-35%	-9%	38%	-13%	-4%	-29%	20%
Sep-99	18%	-25%	31%	0%	29%	-3%	-26%	-9%
Oct-99	-17%	-12%	14%	2%	-24%	-100%	-26%	1%
Nov-99	1%	-14%	-2%	-5%	49%		1%	-24%
Dec-99	-1%	-36%	14%	22%	-14%		-54%	-1%
Jan-00	20%	194%	-1%	-22%	-57%	-55%	119%	21%
Feb-00	-11%	10%	-44%	-12%	75%	-11%	49%	-4%
Mar-00	23%	19%	-21%	35%	-2%	4%	3%	14%
Apr-00	-43%	11%	27%	-6%	-3%	-24%	-6%	6%
May-00	1%	23%	49%	-3%	10%	2%	19%	0%
Jun-00	36%	-26%	-23%	-16%	12%	4%	-42%	-9%
Jul-00	-7%	-11%	-13%	16%	-11%	-2%	71%	13%
Aug-00	-10%	-11%	7%	7%	0%	-5%	-37%	-15%
Sep-00	-18%	39%	26%	-5%	26%	-1%	51%	-1%
Oct-00	-18%	25%	9%	-2%	-31%	-9%	-8%	-17%
Nov-00	3%	-49%	9%	13%	37%	0%	7%	40%
Dec-00	-5%	-54%	23%	-2%	-45%	0%	-34%	-14%
Jan-01	96%	36%	-2%	-25%	-34%	66%	13%	-6%
Feb-01	-13%	28%	-5%	-15%	137%	-11%	9%	0%
Mar-01	36%	4%	-7%	46%	2%	4%	2%	2%
Apr-01	-32%	20%	-6%	-2%	-24%	-11%	11%	-3%
May-01	-22%	26%	16%	0%	14%	2%	18%	14%

Jun-01	51%	-36%	-32%	-21%	37%	4%	-57%	-5%
Jul-01	-9%	12%	-10%	27%	-19%	10%	142%	5%
Aug-01	-20%	7%	24%	-9%	0%	-5%	-55%	12%
Sep-01	-24%	-34%	6%	2%	18%	-1%	69%	-13%
Oct-01	-28%	-10%	7%	-12%	-31%	0%	-1%	4%
Nov-01	12%	-23%	-4%	29%	42%	0%	15%	0%
Dec-01	1%	-73%	26%	-10%	-52%	0%	-32%	0%
Jan-02	160%	218%	-8%	-15%	-35%	35%	43%	6%
Feb-02	-18%	64%	-22%	-18%	107%	-7%	14%	-11%
Mar-02	0%	32%	1%	71%	9%	3%	-5%	8%
Apr-02	4%	48%	30%	-4%	-14%	-2%	0%	-1%
May-02	-54%	-39%	-14%	0%	3%	10%	-2%	7%
Jun-02	138%	-46%	-13%	-26%	16%	-19%	-14%	1%
Jul-02	13%	42%	-9%	40%	-27%	34%	45%	14%
Aug-02	-9%	-63%	-3%	-14%	6%	-2%	-60%	6%
Sep-02	6%	325%	24%	1%	49%	0%	79%	6%
Oct-02	-9%	-3%	17%	-17%	-44%	-2%	9%	-9%
Nov-02	-20%	-38%	-5%	44%	84%	3%	21%	-11%
Dec-02	6%	-43%	16%	-21%	-27%	-5%	-15%	-17%
Jan-03	0%	155%	10%	29%	-62%	0%	-15%	24%
Feb-03	5%	37%	-28%	-8%	163%	-11%	23%	-2%
Mar-03	-42%	-2%	-36%	9%	-2%	4%	1%	7%
Apr-03	-22%	21%	28%	-2%	-13%	-11%	-5%	2%
May-03	96%	-31%	35%	-16%	1%	2%	16%	-7%
Jun-03	12%	-3%	-25%	-7%	17%	4%	-13%	-1%
Jul-03	-19%	41%	-3%	22%	-31%	10%	4%	32%
Aug-03	26%	-81%	5%	-7%	14%	-5%	-70%	-25%
Sep-03	20%	332%	33%	5%	54%	-1%	154%	15%
Oct-03	1%	-10%	20%	11%	-49%	0%	-13%	-3%
Nov-03	-12%	-28%	-12%	-6%	96%	0%	40%	-12%
Dec-03	2%	-55%	19%	21%	-26%	0%	-35%	2%
Jan-04	12%	122%	-5%	-14%	-42%	26%	49%	23%
Feb-04	-1%	52%	-10%	-8%	107%	-27%	12%	-24%
Mar-04	-4%	47%	3%	16%	19%	35%	6%	18%
Apr-04	-8%	-34%	2%	-12%	-32%	-35%	-19%	-4%
May-04	-13%	-15%	-3%	3%	20%	10%	17%	5%
Jun-04	-25%	-1%	-16%	7%	40%	34%	-17%	-3%
Jul-04	31%	-39%	-22%	-5%	-40%	-14%	27%	2%
Aug-04	13%	-20%	1%	11%	0%	8%	-23%	2%
Sep-04	9%	9%	22%	1%	51%	1%	32%	15%
Oct-04	0%	24%	19%	-6%	-26%	-6%	-17%	-7%
Nov-04	-1%	21%	17%	-100%	91%	34%	6%	10%
Dec-04	8%	-56%	8%		-13%	-32%	-22%	2%

Appendix V

Changes in Quarterly Production

Month	Sugar	Coffee	Tea	Beer	Cigarettes	Paints	Tires	Cement
Apr-98	-1%	-61%	-15%	-2%	16%	-12%	644%	36%
May-98	-29%	-22%	-7%	18%	-9%	8%	16%	9%
Jun-98	-6%	-44%	-20%	4%	-59%	-2%	-34%	3%
Jul-98	-23%	295%	-35%	-6%	9%	10%	14%	-13%
Aug-98	43%	-54%	-33%	-22%	2%	3%	-33%	13%
Sep-98	-6%	-23%	-3%	-7%	83%	10%	45%	20%
Oct-98	46%	-26%	62%	1%	-17%	-18%	-14%	15%
Nov-98	-8%	26%	34%	3%	11%	-15%	37%	-6%
Dec-98	-8%	-14%	21%	33%	13%	-18%	-58%	2%
Jan-99	4%	15%	-22%	-30%	-19%	-2%	-94%	2%
Feb-99	2%	40%	-36%	-12%	-32%	-15%	-9%	-13%
Mar-99	26%	167%	-47%	-43%	-11%	31%	156%	-16%
Apr-99	-10%	37%	21%	-8%	24%	-22%	1524%	0%
May-99	-25%	22%	50%	-26%	30%	52%	7%	0%
Jun-99	1%	-32%	41%	-22%	2%	18%	-62%	-2%
Jul-99	13%	84%	-32%	-10%	12%	112%	20%	-3%
Aug-99	46%	1%	-26%	33%	-10%	23%	-15%	27%
Sep-99	7%	-10%	8%	44%	-3%	7%	40%	8%
Oct-99	-10%	-57%	36%	40%	-15%	-100%	-61%	10%
Nov-99	-1%	-43%	47%	-3%	46%	-100%	-45%	-30%
Dec-99	-17%	-52%	27%	18%	-3%	54%	-66%	-24%
Jan-00	21%	60%	11%	-10%	-45%		1%	-9%
Feb-00	6%	105%	-37%	-17%	-35%		49%	15%
Mar-00	31%	282%	-56%	-8%	-26%	-59%	235%	33%
Apr-00	-38%	44%	-44%	12%	67%	-29%	43%	16%
May-00	-29%	61%	50%	24%	4%	-19%	15%	20%
Jun-00	-22%	1%	46%	-23%	19%	-19%	-35%	-4%
Jul-00	28%	-19%	0%	-5%	9%	4%	19%	2%
Aug-00	14%	-41%	-28%	4%	-1%	-4%	-37%	-13%
Sep-00	-32%	10%	18%	17%	12%	-8%	63%	-5%
Oct-00	-40%	55%	47%	-1%	-13%	-15%	-12%	-30%
Nov-00	-31%	-12%	49%	5%	19%	-10%	49%	16%
Dec-00	-20%	-71%	45%	8%	-48%	-9%	-35%	0%
Jan-01	92%	-69%	32%	-16%	-50%	66%	-20%	12%
Feb-01	62%	-20%	15%	-37%	-14%	49%	-19%	-20%
Mar-01	131%	82%	-12%	-6%	59%	53%	26%	-4%
Apr-01	-19%	60%	-17%	21%	85%	-18%	23%	-2%
May-01	-27%	58%	1%	43%	-11%	-5%	34%	12%
Jun-01	-19%	-3%	-26%	-23%	19%	-5%	-43%	4%

Jul-01	8%	-10%	-29%	0%	27%	17%	24%	14%
Aug-01	10%	-23%	-24%	-9%	12%	9%	-53%	12%
Sep-01	-44%	-21%	19%	17%	-3%	4%	83%	2%
Oct-01	-56%	-36%	40%	-19%	-18%	-6%	-25%	1%
Nov-01	-38%	-54%	10%	15%	16%	-1%	94%	-10%
Dec-01	-19%	-82%	30%	2%	-52%	1%	-22%	3%
Jan-02	193%	-35%	12%	-1%	-56%	35%	12%	6%
Feb-02	114%	39%	-10%	-37%	-35%	26%	11%	-6%
Mar-02	113%	589%	-28%	19%	46%	29%	54%	2%
Apr-02	-15%	220%	2%	34%	94%	-7%	8%	-5%
May-02	-53%	20%	13%	64%	-3%	10%	-7%	15%
Jun-02	13%	-51%	-2%	-29%	3%	-13%	-15%	8%
Jul-02	22%	-53%	-31%	4%	-13%	20%	22%	23%
Aug-02	145%	-72%	-22%	-11%	-10%	7%	-50%	22%
Sep-02	9%	124%	10%	21%	15%	32%	3%	28%
Oct-02	-11%	53%	41%	-28%	-11%	-4%	-22%	3%
Nov-02	-22%	158%	38%	20%	54%	1%	137%	-14%
Dec-02	-22%	-65%	29%	-6%	-24%	-4%	13%	-32%
Jan-03	-15%	-9%	21%	47%	-49%	-2%	-12%	-8%
Feb-03	12%	100%	-8%	-7%	-27%	-15%	-10%	1%
Mar-03	-40%	240%	-50%	29%	-3%	-8%	7%	29%
Apr-03	-53%	62%	-41%	-2%	124%	-18%	19%	6%
May-03	-12%	-18%	10%	-10%	-14%	-5%	12%	1%
Jun-03	71%	-19%	29%	-23%	3%	-5%	-4%	-6%
Jul-03	78%	-5%	-2%	-5%	-18%	17%	5%	21%
Aug-03	15%	-75%	-24%	5%	-9%	9%	-73%	-2%
Sep-03	23%	13%	35%	19%	20%	4%	-21%	14%
Oct-03	54%	-28%	67%	8%	-10%	-6%	-34%	-16%
Nov-03	7%	182%	39%	9%	54%	-1%	212%	-2%
Dec-03	-9%	-71%	25%	26%	-26%	1%	-21%	-13%
Jan-04	1%	-28%	-1%	-2%	-16%	26%	35%	10%
Feb-04	13%	52%	2%	-5%	-11%	-8%	8%	-5%
Mar-04	7%	394%	-12%	-9%	42%	23%	77%	11%
Apr-04	-12%	48%	-6%	-6%	67%	-36%	-4%	-14%
May-04	-23%	-17%	1%	5%	-4%	-3%	1%	19%
Jun-04	-40%	-44%	-17%	-2%	14%	-3%	-21%	-3%
Jul-04	-15%	-48%	-36%	5%	1%	28%	23%	4%
Aug-04	11%	-52%	-33%	13%	-16%	25%	-19%	1%
Sep-04	62%	-47%	-4%	7%	-9%	-6%	29%	20%
Oct-04	24%	8%	47%	6%	12%	3%	-15%	9%
Nov-04	8%	64%	70%	100%	114%	27%	16%	18%
Dec-04	7%	-33%	50%	89%	23%	-14%	-31%	4%

Appendix VI

Changes in Annual Production

Month	Sugar	Coffee	Tea	Beer	Cigarettes	Paints	Tyres	Cement
Jan-99	15%	30%	-31%	-35%	-16%	-22%	-53%	39%
Feb-99	-4%	-36%	-46%	-16%	-30%	-19%	-2%	0%
Mar-99	3%	-1%	-51%	-26%	-25%	16%	3%	6%
Apr-99	4%	361%	-2%	-39%	-10%	-31%	2%	2%
May-99	1%	0%	-13%	-47%	1%	13%	-10%	-8%
Jun-99	10%	19%	-13%	-45%	88%	40%	-40%	1%
Jul-99	53%	114%	3%	-41%	-7%	34%	7%	13%
Aug-99	3%	119%	-4%	-11%	-11%	35%	14%	3%
Sep-99	26%	38%	-3%	-15%	-1%	37%	-42%	-9%
Oct-99	-6%	24%	-13%	-18%	-4%	-100%	-52%	9%
Nov-99	11%	-2%	6%	-17%	17%	-100%	-54%	-23%
Dec-99	14%	-23%	2%	-24%	-15%	156%	-53%	-32%
Jan-00	10%	72%	24%	5%	-35%	6%	657%	-2%
Feb-00	15%	43%	3%	-21%	12%	11%	-25%	3%
Mar-00	19%	11%	-15%	23%	-29%	-19%	-39%	8%
Apr-00	-24%	81%	-43%	27%	-12%	-4%	-33%	14%
May-00	9%	89%	3%	32%	-10%	-41%	-20%	24%
Jun-00	-9%	65%	-12%	20%	-17%	-45%	4%	5%
Jul-00	-14%	-20%	-16%	33%	-14%	-53%	-34%	20%
Aug-00	-16%	10%	0%	4%	-2%	-54%	-41%	-15%
Sep-00	-42%	103%	-4%	-2%	-4%	-53%	21%	-8%
Oct-00	-42%	190%	-9%	-6%	-13%		51%	-24%
Nov-00	-42%	71%	1%	12%	-20%		60%	40%
Dec-00	-44%	23%	9%	-10%	-49%	-72%	131%	21%
Jan-01	-8%	-43%	8%	-12%	-22%	4%	20%	-6%
Feb-01	-10%	-33%	85%	-16%	6%	4%	-13%	-3%
Mar-01	-1%	-42%	119%	-9%	11%	4%	-13%	-13%
Apr-01	19%	-37%	62%	-5%	-13%	21%	3%	-21%
May-01	-7%	-35%	26%	-2%	-10%	21%	2%	-9%
Jun-01	3%	-44%	12%	-8%	10%	21%	-24%	-6%
Jul-01	1%	-30%	16%	1%	1%	37%	7%	-12%
Aug-01	-10%	-15%	33%	-15%	1%	37%	-24%	16%
Sep-01	-16%	-60%	12%	-8%	-5%	37%	-15%	2%
Oct-01	-26%	-71%	10%	-17%	-5%	51%	-8%	27%
Nov-01	-20%	-56%	-2%	-6%	-1%	51%	-1%	-10%
Dec-01	-15%	-74%	0%	-14%	-13%	51%	2%	5%
Jan-02	13%	-40%	-6%	-2%	-15%	23%	29%	19%
Feb-02	6%	-23%	-23%	-6%	-26%	29%	35%	6%
Mar-02	-22%	-2%	-17%	9%	-20%	27%	25%	12%

Apr-02	19%	20%	15%	8%	-10%	40%	13%	15%
May-02	-31%	-42%	-14%	7%	-19%	49%	-7%	8%
Jun-02	9%	-51%	9%	2%	-31%	17%	86%	15%
Jul-02	34%	-38%	10%	11%	-38%	43%	11%	25%
Aug-02	53%	-78%	-13%	6%	-35%	47%	-1%	18%
Sep-02	114%	38%	1%	5%	-18%	49%	4%	44%
Oct-02	170%	49%	11%	-2%	-33%	45%	15%	27%
Nov-02	93%	21%	9%	10%	-14%	50%	21%	13%
Dec-02	104%	161%	0%	-4%	31%	42%	51%	-5%
Jan-03	-21%	109%	20%	46%	-24%	5%	-10%	11%
Feb-03	1%	75%	11%	63%	-3%	1%	-2%	22%
Mar-03	-42%	29%	-30%	4%	-13%	2%	4%	20%
Apr-03	-57%	6%	-31%	7%	-12%	-7%	-1%	24%
May-03	86%	20%	8%	-10%	-13%	-13%	17%	7%
Jun-03	-12%	116%	-7%	12%	-13%	11%	18%	5%
Jul-03	-36%	115%	-1%	-2%	-17%	-9%	-15%	22%
Aug-03	-13%	7%	6%	6%	-12%	-12%	-36%	-14%
Sep-03	-1%	9%	14%	10%	-9%	-13%	-9%	-6%
Oct-03	10%	1%	16%	48%	-17%	-11%	-27%	0%
Nov-03	21%	17%	7%	-3%	-11%	-14%	-16%	-2%
Dec-03	15%	-7%	10%	49%	-10%	-9%	-36%	20%
Jan-04	30%	-20%	-5%	-2%	38%	15%	11%	19%
Feb-04	23%	-11%	19%	-1%	8%	-7%	1%	-8%
Mar-04	105%	34%	92%	5%	31%	21%	6%	3%
Apr-04	141%	-26%	53%	-6%	2%	-11%	-10%	-4%
May-04	8%	-10%	9%	15%	21%	-4%	-9%	9%
Jun-04	-28%	-8%	23%	33%	44%	24%	-13%	7%
Jul-04	16%	-60%	-2%	4%	26%	-3%	6%	-18%
Aug-04	4%	72%	-5%	24%	11%	10%	175%	12%
Sep-04	-6%	-57%	-13%	20%	9%	13%	42%	12%
Oct-04	-7%	-40%	-13%	3%	58%	5%	35%	7%
Nov-04	5%	1%	16%	-100%	54%	41%	3%	34%
Dec-04	11%	-2%	5%	80%	81%	-3%	24%	35%

Appendix VII

Correlations (Share Prices and Returns): EAPort, Bamb, Athi, FireSt, Cberg, BAT, EABrew, Bbond, Sasini, Mum

	EAPort	Bamb	Athi	FireSt	Cberg	BAT	EABrew	Bbond
Bamb	0.915							
	0.000							
Athi	0.947	0.883						
	0.000	0.000						
FireSt	0.166	-0.023	0.238					
	0.091	0.813	0.014					
Cberg	0.840	0.912	0.875	0.005				
	0.000	0.000	0.000	0.963				
BAT	0.771	0.919	0.769	-0.194	0.944			
	0.000	0.000	0.000	0.047	0.000			
EABrew	0.766	0.890	0.744	-0.260	0.884	0.939		
	0.000	0.000	0.000	0.007	0.000	0.000		
Bbond	-0.158	-0.338	-0.011	0.760	-0.222	-0.413	-0.480	
	0.107	0.000	0.911	0.000	0.023	0.000	0.000	
Sasini	-0.161	-0.314	-0.168	0.791	-0.286	-0.443	-0.485	0.690
	0.101	0.001	0.087	0.000	0.003	0.000	0.000	0.000
Mumias	0.441	0.498	0.493	0.460	0.644	0.661	0.683	0.574
	0.006	0.001	0.002	0.004	0.000	0.000	0.000	0.000
EAPortD	-0.085	0.008	-0.002	-0.087	-0.097	-0.067	-0.022	-0.074
	0.388	0.933	0.986	0.382	0.328	0.499	0.821	0.453
BambD	-0.042	-0.024	-0.007	-0.109	-0.101	-0.061	0.002	-0.172
	0.673	0.810	0.945	0.272	0.309	0.537	0.984	0.080
AthiD	-0.018	0.034	-0.080	-0.211	-0.108	-0.034	0.019	-0.191
	0.853	0.735	0.421	0.032	0.277	0.734	0.848	0.052
FireStD	0.023	0.001	0.050	-0.132	-0.016	-0.002	0.043	-0.065
	0.820	0.993	0.613	0.181	0.869	0.984	0.665	0.512
CbergD	0.131	0.145	0.056	-0.105	-0.058	0.046	0.090	-0.203
	0.184	0.142	0.574	0.288	0.557	0.641	0.361	0.039
BATD	0.153	0.158	0.076	-0.091	-0.003	0.012	0.098	-0.149
	0.121	0.109	0.442	0.356	0.978	0.901	0.325	0.132
EABrewD	-0.029	-0.053	-0.034	-0.077	-0.115	-0.120	-0.127	-0.061
	0.766	0.595	0.731	0.435	0.246	0.224	0.199	0.540
BbondD	0.071	0.134	0.077	-0.021	0.098	0.094	0.102	-0.141
	0.471	0.176	0.439	0.829	0.321	0.345	0.303	0.152
SasiniD	0.235	0.176	0.230	0.127	0.120	0.076	0.132	0.000
	0.016	0.073	0.019	0.200	0.223	0.445	0.182	0.997

MumiasD	0.291	0.330	0.252	0.180	0.294	0.318	0.242	-0.263
	0.081	0.046	0.133	0.286	0.078	0.055	0.149	0.116

	Sasini	Mumias	EAPortD	BambD	AthiD	FireStD	CbergD	BATD
Mumias	0.548							
	0.000							
EAPortD	-0.196	-0.313						
	0.046	0.059						
BambD	-0.220	-0.480	0.395					
	0.025	0.003	0.000					
AthiD	-0.230	-0.341	0.314	0.429				
	0.019	0.039	0.001	0.000				
FireStD	-0.111	-0.143	0.202	0.507	0.398			
	0.261	0.398	0.040	0.000	0.000			
CbergD	-0.128	-0.372	0.298	0.393	0.490	0.410		
	0.196	0.023	0.002	0.000	0.000	0.000		
BATD	-0.087	-0.442	0.176	0.398	0.442	0.302	0.474	
	0.378	0.006	0.074	0.000	0.000	0.002	0.000	
EABrewD	-0.087	-0.470	0.196	0.300	0.288	0.142	0.175	0.328
	0.379	0.003	0.046	0.002	0.003	0.150	0.075	0.001
BbondD	0.001	0.039	0.091	0.203	0.131	0.330	0.097	0.082
	0.990	0.820	0.359	0.039	0.185	0.001	0.326	0.409
SasiniD	-0.063	0.075	0.034	0.309	0.226	0.361	0.249	0.076
	0.524	0.658	0.730	0.001	0.021	0.000	0.011	0.445
MumiasD	-0.091	-0.119	-0.096	0.150	0.089	0.299	0.230	0.202
	0.591	0.483	0.571	0.376	0.600	0.072	0.170	0.232

	EABrewD	BbondD	SasiniD
BbondD	0.095		
	0.337		
SasiniD	-0.050	0.245	
	0.617	0.012	
MumiasD	0.154	0.452	0.368
	0.363	0.005	0.025

Cell Contents: Pearson correlation
P-Value

Appendix VIII

Correlations of Production: Cement, Tires, Paint, Cigarettes, Beer, Tea, Milled Coffee, Sugar

	Cement	Tires	Paints	Cigarettes	Beer	Tea	Coffee	Sugar
Tires	0.126							
	0.203							
Paints	0.371	-0.055						
	0.001	0.627						
Cigaret	-0.189	0.348	-0.101					
	0.054	0.000	0.366					
Beer	0.322	0.236	0.104	0.336				
	0.001	0.016	0.357	0.000				
Tea	0.089	-0.287	0.192	-0.256	0.127			
	0.365	0.003	0.084	0.008	0.200			
Coffee	-0.150	0.247	-0.347	0.149	-0.222	-0.348		
	0.172	0.024	0.001	0.176	0.043	0.001		
Sugar	0.140	-0.243	0.389	-0.250	-0.041	0.206	-0.139	
	0.155	0.013	0.000	0.010	0.681	0.035	0.208	
Cement	-0.412	-0.077	0.087	-0.053	-0.158	-0.103	-0.048	0.043
	0.000	0.441	0.442	0.594	0.110	0.300	0.670	0.666
Tires	-0.213	-0.548	-0.026	-0.056	-0.058	0.058	-0.139	0.134
	0.031	0.000	0.818	0.573	0.562	0.560	0.217	0.179
Paints	-0.058	0.058	-0.448	-0.166	-0.146	0.090	-0.136	-0.125
	0.608	0.613	0.000	0.141	0.199	0.426	0.229	0.269
Cigaret	0.107	-0.067	0.004	-0.526	-0.068	0.107	-0.015	0.193
	0.278	0.503	0.974	0.000	0.497	0.279	0.890	0.049
Beer	-0.136	0.042	-0.036	0.055	-0.461	-0.136	0.022	0.149
	0.173	0.674	0.754	0.584	0.000	0.173	0.845	0.134
Tea	0.117	0.259	0.038	0.186	0.091	-0.474	0.031	-0.143
	0.236	0.008	0.738	0.058	0.362	0.000	0.781	0.148
Coffee	-0.128	-0.361	0.132	-0.163	0.067	0.096	-0.496	0.109
	0.248	0.001	0.239	0.140	0.549	0.387	0.000	0.326
Sugar	0.065	0.008	0.010	-0.002	-0.002	0.056	-0.145	-0.538
	0.514	0.933	0.927	0.988	0.986	0.574	0.191	0.000