

**“BETA RISK ESTIMATION OF COMPANIES LISTED
ON THE GHANA STOCK EXCHANGE”**

BY

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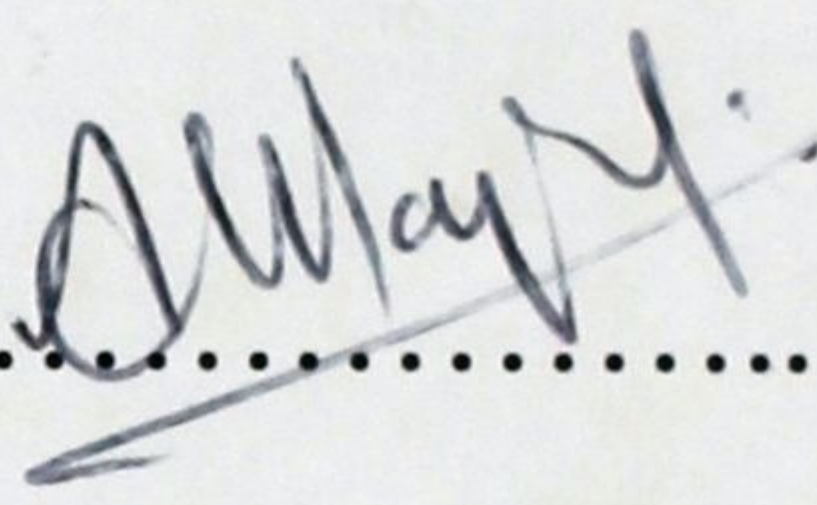
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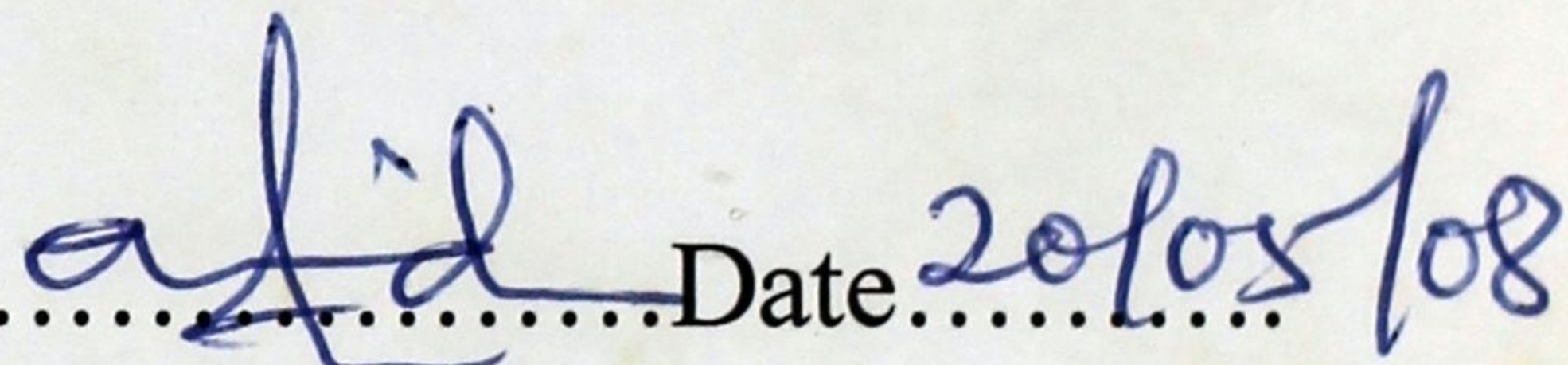
DECLARATION

I hereby declare that this submission is my own work towards the MBA(BANKING AND FINANCE) and that, to the best of my knowledge, it contains no material previously published by another person or material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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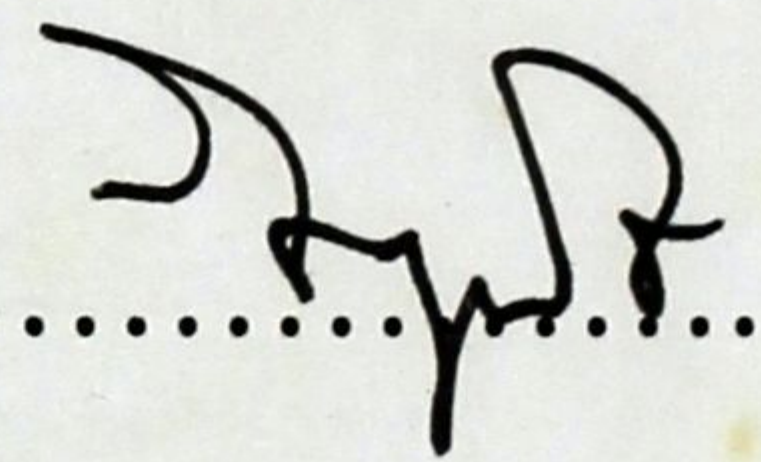
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DEDICATION

I dedicate this to my late grandmother, Grace Ayorkor Hammond and my late father, Emmanuel Quartey-Papafio, mother Beatrice Briandt- Coker, brother Justus John Quartey-Papafio and wife, Mrs Evelyn Quartey-Papafio.

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ABSTRACT

Both researchers and practitioners have used beta as estimation for risk. Beta is usually estimated by running a regression on the market model. However, this estimation procedure can result in a variety of beta estimates. Some of the issues that can affect beta estimates are the measurement of returns, the choice of market index used, the length of estimation period and the sampling interval. The issue of normality, autocorrelation and the effect of thin trading, seasonality and stability also affect beta estimations. This project investigates these estimation issues using thirty-five companies. The empirical results generally confirm the evidence by various researchers in the literature review some which are Pike and Neale, Roll, French and Fama, Chan and Lakonishak, Amihud and Christen Damodaran. However, the tests for the effect of thin trading and the effect of seasonality reject the null hypothesis ($H_0: \beta_{\text{Monday}} = \beta_{\text{Tuesday}} = \beta_{\text{Wednesday}} = \beta_{\text{Thursday}} = \beta_{\text{Friday}}$)

According to Bradfield, detecting the beta stability is clouded by the fact that only estimates of beta are observable and that changing estimates do not necessarily imply stable underlying betas. Bowie and Bradfield (1997) found that the tests of beta stability are difficult to interpret on their own. Gombola and Kahl advocate that an OLS estimate of beta requires an estimation period during which the relationship between stock return and market return is stable. Without this stability, they suggest that an alternative for forecasting a time-varying relationship such as the general Bayesian adjustment process will be required.

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CHAPTER ONE
GENERAL INTRODUCTION

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1.1 BACKGROUND OF STUDY

1.1.1 Beta and the Capital Asset Pricing Model

Markowitz introduced modern portfolio theory with his paper 'Portfolio Selection', in the 1952 Journal of Finance. There are many extensions of this theory and one of these extensions is the Capital Asset Pricing Model – CAPM. The original theory of the CAPM was erected by Sharpiro (1964) to explain how the capital market sets share prices. The CAPM model explains how the market values investments with expected returns and provides additional insight to the nature of risks. However, the theory does not always show reality. CAPM classifies risk as diversifiable risk (non-systematic) and non-diversifiable (systematic) risk. The former risk is avoidable and investors will not be compensated for this type of risk under the model. However the latter cannot be diversified away. The model therefore rewards investors for assuming this risk. The CAPM measures systematic risk through BETA. The beta parameter in the model is historical data and may therefore not reflect future results. This project concentrates on the beta measure.

The question as to whether the CAPM works or not and also whether beta is a good proxy for risk has been widely debated in recent years. Early tests of the model suggested that 'the beta and returns were positively related' (Pike and Neale, 1999). However, other measures of risks, such as variance, continued to explain differences in actual returns (pike and Neale). This variation was attributed to limitations in the testing technique. Roll (1997), in a semi critique of the model's tests, suggested that since the market portfolio could never be observed, the CAPM could never be tested.

Therefore any test of the CAPM could only show whether the model worked or did not work. Damodaran (1997) therefore argues that in any empirical test that claimed to reject the CAPM, the rejection could be of the proxy used for the market portfolio rather than of the model itself. Roll (1977) therefore noted that there was no way to prove that CAPM worked and thus no empirical basis for using the model. Do Roll's findings render the CAPM invalid? He claims that the CAPM can only be tested if the market portfolio is mean-variance efficient.

Fama and French (1992) examined the relationship between betas and returns between 1963 and 1990 and concluded that no relationship exists between the two. They noted that size and book-to-market ratio explains differences in returns across firms much better than beta and may in fact be better proxies for risk. The conclusions of Fama and French have not gone unchallenged. Amihud, Christensen, and Mandelson performed different statistical tests using the same data. They concluded that betas did in fact explain returns during this period. Another test by Chan and Lakonishak examined a much longer time series of returns from 1926 to 1991 and found that a positive relationship between betas and returns only broke down in the period after 1982. They argued that this breakdown is due to indexing which has allowed the larger, lower-beta stocks in the S & P 500 to outperform smaller, higher-beta stocks. They also found betas to be useful guide to risk in extreme market conditions, with the riskiest firms performing far more badly than the market as a whole, in the 10 worst months for the market between 1926 and 1991.

1.1.2 Beta and the Market Model

The CAPM describes the relationship between risk and expected return, and serves as a model for the pricing of risky securities. In equilibrium, the CAPM asserts that the expected return of a security or a portfolio equals the rate of a risk-free security plus a risk premium. CAPM defines risk using the concept of beta. Beta measures the risk associated with one particular asset in relation to the overall market. Beta is defined as the covariance of the returns of the stock and the market divided by the variance of the returns of the market. Beta has been used by many practitioners, among other things, for estimating the cost of capital, determining risk and valuation models.

The commonly used formula to describe the CAPM relation is as follows:

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f] \quad 1$$

Where; $E(R_i)$ is the expected return on the asset i

R_f is the risk free rate of return

$E(R_m)$ is the expected return on the market portfolio

β_i is the systematic risk of asset i

$$\beta_i = \frac{\text{Cov}(R_i, R_m)}{\sigma_m^2} \quad 2$$

The market model is claimed to be a counterpart of the CAPM. The market model is used in the estimation of beta and is given as:

$$R_{it} = \alpha_i + \beta_i R_{m_t} + \epsilon_{it} \quad 3$$

Where:

R_{it} is the realised return on asset i for the period t

t is the measurement interval and $t = 1, 2 \dots T$

T is the number of measurement intervals

α_i is the intercept term for asset i .

β_i is the sensitivity measure of return on asset i to market

Returns assumed to be constant through time

R_{m_t} is the realised return on the market index for period t

ϵ_{it} is the residual term for asset i in period t .

The estimation of beta cannot be ex ante as it is not possible to record people's expectations (Damoradan, 1997). Thus beta is measured using past observations of actual values of both the return of the individual company's shares, and that of the overall market, that is R_{it} and R_{m_t} . Pike and Neal advocates that, 'so long as the past is accepted as a reliable indication of likely future events, observed betas can be taken to indicate the extent to which R_{it} may vary for specified variations in R_{m_t} . If CAPM holds α_i is expected to be zero.

1.2 PROBLEM STATEMENT

The Ghana Stock Exchange (G S E) for sometime has lost its tempo for trading. The thirty - two membership has been stagnant for sometime. Some investors have expressed misgivings about the failure of the G S E. Therefore this project shares in the estimation of **BETA RISK** in various forms of the companies enlisted by the Ghana Stock Exchange.

1.3 OBJECTIVES OF THE STUDY

The objective of the study was:

- a) To examine the details of **BETA** and **CAP M**
- b) To examine the details of **BETA** and **MARKET MODEL**
- c) To identify the problems with **BETA**, **CAP M**. and the **MARKET MODEL**

1.4 METHODOLOGY

In this project the market model was used in estimating beta through ordinary least squares regressions. According to Gujarati (1995), the main idea behind regression analysis is the statistical dependence of one variable, the dependent variable, on one or more variables, the explanatory variable. A regression run to estimate the market model involves only one explanatory variable, and thus, the returns on a given asset is regressed on the market returns. However, some of the complex issues underlying the regression are measurement assumptions and assumptions relating to the regression. Issues such as the effect of choosing alternative returns measure, effect of using different market proxies, effect of varying the length of the estimation period, effect of varying the sample period and the effect of thin trading might change the result of the estimated beta and its properties.

1.5 HYPOTHESIS

The hypotheses tested in this project were as follows:

The effect of choosing alternative returns measure:

$$H_0: \beta_{\text{discrete}} = \beta_{\text{continuous}} = \beta_{\text{excess}}$$

The effect of varying the length estimation period:

$$H_0: \beta_{\text{6years}} = \beta_{\text{4years}} = \beta_{\text{2years}}$$

The effect of varying the sample interval

$$H_0: \beta_{\text{monthly}} = \beta_{\text{quarterly}}$$

The effect of any outlier or influential observations:

$$H_0: \beta_{\text{OLS including Sept - Dec 2006}} = \beta_{\text{OLS excluding Sept - Dec 2006}}$$

Diagnostic analysis of the market model regression residuals

Excess Kurtosis test for non-normality of residuals

Skewness test for non-normality of residuals

Jacque-Bera test for non-normality of residuals

Runs Test test for autocorrelation

Durbin-Watson test for autocorrelation

The effect of applying robust regression techniques:

$$H_0: \beta_{\text{OLS}} = \beta_{\text{TRLS 5\%}} = \beta_{\text{TRLS 10\%}}$$

The effect of thin trading and the need for alternative thin trading adjustment technique

$$H_0: \beta_{\text{OLS}} = \beta_{\text{Scholes-Williams}} = \beta_{\text{Fowler-Rorke}}$$

The issue of beta stability

$$H_0: \beta_{\text{OLS}} = \beta_{\text{Castagna & Matolcsy}}$$

The issue of seasonality

$$H_0: \beta_{\text{Monday}} = \beta_{\text{Tuesday}} = \beta_{\text{Wednesday}} = \beta_{\text{Thursday}} = \beta_{\text{Friday}}$$

1.6 ORGANISATION OF STUDY

The study is made up of six chapters

Chapter 1: General introduction where historical background of BETA , CAPM and MARKET MODEL were explored.

Chapter 2 : Reviewed literature on the topic

Chapter 3: Overview of the Ghana Stock Exchange

Chapter 4: Summarised data from the Ghana Stock Exchange.

Chapter 5: Analysed data and comparative study of the various BETAS

Chapter 6: Conclusions and Recommendations

1.7 LIMITATION OF STUDY

a) Financial Constraint

The budget estimate for completing the whole study was under estimated. This included; data cost from G S E, cost of stationery, travel expenses, photocopying, typing, binding cost, telephone expenses and other miscellaneous expenses.

b) Time Constraint

There was time constraint as the study was combined with academic work giving limited room for extensive search for relevant works on the topic.

c) Access To Software For Analyses

During the course of study, it was difficult getting the software (“mini tab”) for the analyses.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter reviews the different studies of beta estimation conducted by various researchers.

2.1 THE EFFECT OF CHOOSING ALTERNATIVE RETURNS MEASURES

Although the definition of returns may seem obvious, but there are several definitions. Should discrete returns be used or continuous returns or excess returns? Discrete returns have the advantage of providing an accurate measure of the value of the ending portfolio. Continuous returns have the advantage of using a linear model of returns across periods (Grinold and Kahn, 1997). However, choosing one over the other does not necessarily mean that one measure is superior to the other. The more important indication is that consistency is important. The three different measures of return used in this project are;

Discrete return

Log or Continuous return

Excess return

The discrete return on a share is defined as:

$$R_t = P_t - P_{t-1} / P_{t-1}$$

Where: R_t is the discrete return

P_t is the price of stock at date t

The simple gross return on the asset is therefore $1 + R_t$.

The continuous compounded return or log return R_t^c is defined to be the natural logarithm of its gross return $1 + R_t$. That is:

$$R_t^c = \ln [1 + R_t] \quad \text{or } R_t^c = \log (P_t / P_{t-1})$$

The advantages of continuously compounded returns become obvious when multiperiod returns are considered. The continuously compounded returns multiperiod return is simply the sum of continuously compounded single-period returns. The prices of shares for the thirty two companies in this project have been converted to discrete and continuous returns using the above equations.

Unlike the continuously compounded returns, the discrete return on a portfolio of assets is a weighted average of the discrete returns on the assets themselves, where the weight on each asset is the share of the portfolio's value invested in the asset. Continuously compounded returns do not have this advantage since the log of a sum is not the same as the sum of logs. When returns are measured over short intervals of time, and are therefore close to zero, the continuously compounded return on a portfolio is close to the weighted average of the continuously compounded returns on the individual assets. However, the distribution argument favours log returns as they are empirically closer to the normal distribution than discrete returns, in longer time intervals and results are always lower than that of discrete returns. The portfolio argument on the other hand favours the discrete return for a cross section of assets (Zimmermann and Mertens, 2001). However, it is the discrete returns that are usually used when a cross section of assets is being studied and the continuously compounded return is used when the temporal behaviour is the focus of interest.

When the risk free rate is subtracted from either the discrete or log returns, the resulting return is called excess returns. The excess return is the excess of the log or discrete return over the benchmark return. The excess return equation is therefore given as:

$$R_t^E = R_t^c - R_f$$

Where R_f is the risk free rate

2.2 THE EFFECT OF USING DIFFERENT MARKET PROXIES

In theory market capitalisation weighted indices are preferred to equally weighted indices because they are superior proxies and consistent with the true market portfolio. However, the use of an equally weighted index as a proxy for the market was very popular because it is easy to calculate. Roll (1977) argues that a proxy must be used, because it is difficult to construct a true market portfolio. According to, Stambaugh (1982) the CAPM tests are generally insensitive to the choice of market proxy used, however, others believe that the broader the selected indices the better the market proxies. In the UK market the two main indices used are the FT100 and FT All Shares. The FT100 is made up of the top one hundred companies and FT All Shares index is made up of all companies traded on the exchange.

According to Bailsford, Faff and Oliver, the composition and weighting of the index used can affect the individual asset betas and also the conclusions drawn from the application of these beta estimates. Braidfield(2003) states that the market index should be as comprehensive as possible in covering the market.

2.3 THE EFFECT OF VARYING THE LENGTH OF THE ESTIMATION PERIOD

The length of estimation periods is also important in the estimation of beta. Bradfield states in the Investment Analysts Journal (No. 57 2003) that, estimation based on many years of historical data may be of little relevance. This is because the nature of business risks undertaken by companies may have changed significantly over a long period such as twenty years. Harrington (1983) found that the longer the horizon, the more accurate the beta forecast Damodaran(1997) states that, most estimates of beta such as that by Value Line and Standard and Poor use five years of data while Bloomberg uses two years of data. However, Damodaran suggests a longer estimation period. Betas based on daily returns may differ significantly from betas based on monthly returns even if the betas were estimated over the same calendar period. Hawawini (May/June 1983), states that, the betas of securities may vary depending on the length of estimation period used, for example, whether daily, weekly or monthly.

2.4 THE EFFECT OF VARYING THE SAMPLE INTERVAL

The sampling intervals are usually daily, weekly, and monthly. Hawawini (May/June 1983), states that, the beta of a security may vary depending on the length of estimation period used, for example, whether daily, weekly or monthly.

Betas of securities with a smaller market value than the average of all securities are expected to decrease as the return interval is shortened and vice versa. Hawawini suggests that this will make the betas measured over return interval of arbitrary length biased and make securities of small market value companies appear less risky and vice versa. According to Handa, Kothari, and Wasley (1989), "the size effect is

sensitive to the length of the return interval used in estimating beta. They state that "beta changes with return because an assets covariance with the market and the market's variance do not change proportionately as the return interval is changed. Handa, Kothari, and Wasley (1989), found that "the size effect becomes statistically insignificant when risk is measured by betas estimated using annual returns". They also found that beta estimate change predictably as the return interval is varied from one day to one year and also the size effect is sensitive to the choice of beta estimates. Like Hawawini, Handa, Kothari, and Wasley (1989) found that beta of high-risk securities increase with the return interval, whereas betas of low-risk securities decrease with the return interval.

According to Hawawini, a major factor that causes beta to shift is the existence of intertemporal relationships individual security's daily returns and the market return. Early studies has shown that the "fundamental cause of these intertemporal cross-correlations is friction in the trading process which delays the response of securities' prices to new information" (Hawawini). Any calculation that uses beta may be affect by the length of the return interval because beta estimate depends on the length of estimation period used in measuring securities.

Handa, Kothari, and Wasley (1989), offer a competing explanation for the changes in beta with the return interval. They claim that the standard error of the beta estimate increases as the return interval is lengthened, meaning that beta estimates using longer interval returns lack statistical accuracy which makes them less able to explain return difference.

Much study have been directed at the effect of that different sampling intervals have on the estimation of beta. Blume (1975), Eubank and Zumwait (1979) and Corhay (1992) have investigated the effect of interval length on the power of beta estimates.

As a result many researchers usually use monthly intervals of over five years (that is sixty data points of monthly returns) to calculate the returns needed for the estimation process. According to Bailsford, Faff, and Oliver "the basic premise is that beta is sensitive to the return interval because the covariance of asset returns with market index returns does not change proportionately as the return interval is varied".

2.5 THE EFFECT OF ANY "INFLUENTIAL" OR "OUTLIER" OBSERVATIONS

The evaluation of the relative strengths of asset pricing models is usually by the estimation of the factor premiums and testing whether it captures some of the persuasive economy wide risk, or whether its factor mimicking portfolio carries a significant risk premium.

This existence of influential observation is a positive outcome since it provides evidence for a link between economic activity and cross-sectional variation in average returns. Menzly noted that most influential observations are concentrated around recession periods and therefore concluded that during recessions, portfolio returns are less affected by idiosyncratic shocks and coincide instead with the determining factors of the cross-section of average returns.

According to Bailsford, Faff, and Oliver, 'non-normality can occur when sample contains outlier observations that are extreme by virtue of their absolute size'. Also outliers can crop up due to errors in the data or actually extreme observation. Bailsford, Faff, and Oliver, gave the observed October 1987 return as an example. It is not always easy to identify outliers; however, plotting the data will make them more obvious. Outliers can be treatment by ordinary least squares (OLS) estimation or

contained within the OLS estimation. The outlier can be excluded from the sample and a dummy variable included to reflect the consequence of the outlier.

It has been noted that the existence of only few influential observations poses a critical problem – the robustness of estimation. According to Fama (1976) and Roll (1977), it is always possible to find a factor in sample that generates a perfect linear relation between average returns and covariance. Kandel and Stamburgh (1995) and Roll and Ross (1995) suggest that as long as there is no misspecification, such that the market proxy is not exactly on the mean-variance frontier, then there are portfolios that produce arbitrarily good or bad fits in plots of expected returns versus beta.

Although outliers affect beta estimates, the extent of this effect depends on the enormity of the observation and the sample size. It has been argued that outliers should not be excluded from the analysis because they are true observations and there is no guarantee they are not going to occur again.

Bailsford, Faff, and Oliver argue that, outliers are ‘the result of unique events such that their recurrence is highly unlikely’ and should therefore not be excluded from the analysis. Bailsford, Faff, and Oliver therefore suggest that the analysis should therefore be carried out including and excluding outliers to verify the effect of outliers.

2.6 DIAGNOSTIC ANALYSIS OF THE MARKET MODEL REGRESSION RESIDUALS

The method of Ordinary Least Squares (OLS), attributed to Carl Friedrich Gauss is of the most popular and most powerful method of regression analysis. OLS estimation has a distinct advantage. It is consistent and asymptotically efficient if certain statistical assumptions are met. Using OLS are the best linear unbiased estimators.

OLS is a standard technique for estimating beta. The technique assumes that the residuals have uniform variance and are uncorrelated with each other.

An assumption of the classical linear regression is that the error terms in a regression model have a constant model, the error terms are normally distributed, and that the error terms are uncorrelated. If the error variance is not constant, the disturbances are said to be heteroscedastic and homoscedastic when the disturbances have a uniform variance. Whites test is a general test for heteroscedasticity based on the relationship of a regression of the squared residuals of the original regression on a constant and all the unique variables of the cross-product of the independent variables

Other diagnostic tests of heteroscedasticity include the Goldfeld-Quandt and the Breusch-Pagan test. The Gold-Quandt test is a popular method and is used if it is assumed that 'the heteroscedastic variance is positively related to one of the explanatory variables' in the regression model (Gujarati). Kurtosis is also explained to indicate the presence of heteroscedasticity. Bailsford, Faff, and Oliver argue that, 'it is well known that the distribution of stock returns exhibit skewness and kurtosis particularly over short sample intervals such as daily periods'. The most popular test

for detecting serial autocorrelation is the Durbin-Watson statistic test. An advantage of this test is that 'it is based on the estimated residuals, which are routinely computed in regression analysis' (Gujarati).

Although OLS estimation assumes a normal distribution of residuals, Richardson and Smith (1993) found that the distribution of residual from market model regressions is not consistent with the assumption of normality. According to Bailsford, Faff, and Oliver, large absolute values of residuals can result in non-normality and can therefore have a strong effect on the estimation of coefficient obtained under OLS.

2.7 THE EFFECT OF APPLYING ROBUST REGRESSION TECHNIQUE

It is known that outliers have a distorting influence on least square estimates. Martin and Simin (1999) suggest that the OLS estimates, in this case are not the best estimates in the class of all linear and non-linear estimates. They also claim that outlier-generating distributions can cause the OLS estimates to suffer from large bias in the presence of outliers. It is therefore suggested that, an alternative robust estimators that are not much influenced by outliers and still perform nearly well as OLS when the data is outlier free and has a normal distribution (Martin and Simin, 1999). The problems of non-normality caused by extreme observations can be addressed using robust estimation techniques such as trimmed least squares (TRLs) and mean absolute deviation (MAD). MAD minimises the sum of absolute deviations, and it is argued that, this is less influenced by outliers. The TRLs on the other hand identifies extreme observations and omits them from the regression.

However, robust estimators have received little attention in finance and in the context of beta estimation. Sharpe (1979) and Cornell and Dietrich (1978) suggested that this

may be due to the negative results and unimpressive positive results given by robust estimators. The work of Knez and Ready (1997), reported by Martin and Simin (1999) used robust regression to establish the striking result that negative risk premium on size. They concluded for most firms that, the relationship between returns and firm size is positive, but there exist a very small fraction of small-sized firms that have exceptionally large outlier returns. Based on Knez and Ready findings, Martin and Simin (1999) proposed the use of a new robust beta estimate that is well suited for dealing with outliers that distort OLS estimate of beta in the market model.

2.8 THE EFFECT OF THIN TRADING

Thin trading is a declaration about the level of trading frequency in a particular stock. Beta estimates are often biased when shares are traded infrequently. Non-synchronous trading becomes a problem when stocks are thinly traded. According to Dimson (1979), 'the major source of bias is the tendency for prices recorded at the end of a time period to represent the outcome of a transaction which occurred earlier in or prior to the period in question'. Also widening of the bid-ask spread and an increase in measurement errors can result in estimation bias.

According to Dimson, infrequently traded securities have a beta estimate which is biased downwards while that of frequently traded securities is upward biased. As reported by Dimson, Blume (1971) found that beta regress only part of the way back to their mean value, even when the beta estimate is adjusted for regression bias.

According to Dimson, infrequent trading will bias beta estimates to make the estimates appear to be stable. Low beta estimates are associated with infrequently traded securities while high beta estimates are associated with frequently traded

securities. Dimson stated that, 'provided the frequency of trading is serially correlated, the beta estimate will be relatively stable, regressing somewhat to the mean'. He also suggested that when trading is not frequent, 'unbiased estimates of beta can be inferior to conventional estimators as predictors of the beta estimate in subsequent period'. Stocks returns are observed only when trading takes place and therefore an implicit price movement which is associated with any trading activity will be recorded as a zero return. The price movements are observed only when stocks are traded and 'in such cases, observed returns are too large and infrequent. Dimson concluded that 'when non-trading is a problem, it is unlikely that empirical evidence will enable to determine the ideal estimation method'.

Some of the techniques for overcoming the problems of thin trading in beta estimation are:

1. Scholes-Williams' beta,
2. Dimson's beta, and
3. Fowler-Rorke's beta.

2.8a Scholes-Williams' beta,

Scholes-Williams' equation suggested for the adjustment of beta to account for thin trading is:

$$B_n^{sw} = \beta_n^{-1} + \beta_n + \beta_n^{+1} / 1 + 2\rho$$

Where β_n^{-1} , β_n , and β_n^{+1} are the coefficient of the 'return on the market from three separate regressions in which the return on the security or portfolio is regressed, in turn, on lagged, coincident, and leading returns on the market, and ρ is the first-order autocorrelation coefficient of the market return proxy' (McInish and Wood, 1986).

According to Dimson (1979), Scholes and William's method merely requires a record of whether a share was traded within a time period. Returns here are only calculated and used only if transaction is known to have occurred in conservative time periods. According to Dimson, shares which are traded infrequently or very frequently tend to have their risk underestimated.

2.8b Dimson's beta

Dimson's beta is given as:

$$\beta_n^{DM} = \sum \beta_{n+k}$$

As the systematic risk of the market is given as unity, it will be necessary for β_{i+k} have a zero value for the whole market. Dimson noted that if 'the market is very frequently traded relative to a share, and then the leading coefficient will be small compared to the lagged coefficient'. According to Dimson(1974), when shares are being regressed on an index which is composed of large companies and/or which is value weighted, it is the lagged coefficient which is of importance. The bias of the the equation above reduces as the number of non-synchronous term used in the regression is increased. However, the efficiency of the equation reduces because the lagged and leading coefficients, β_{n+k} bear estimation error. Estimation errors can be only be reduced either including fewer lagged (leading) terms, 'in the knowledge that a residue of non-trading bias will be reintroduced into the least (most) frequently traded shares. It has been suggested that, leading coefficients are more important for frequently traded securities and lagged coefficient, for infrequently traded securities.

2.8c Fowler-Rorke's beta.

The Fowler-Rorke's beta is given as:

$$\beta_n^{FR} = \frac{(1 + 2_1\rho_m + 2_2\rho_m)}{(1 + 2_1\rho_m + 2_2\rho_m)} \beta_n^{-2} + \frac{(1 + 2_1\rho_m + 2_2\rho_m)}{(1 + 2_1\rho_m + 2_2\rho_m)} \beta_n^{-1} + \beta_n + \frac{(1 + 2_1\rho_m + 2_2\rho_m)}{(1 + 2_1\rho_m + 2_2\rho_m)} \beta_n^{-1} + \frac{(1 + 2_1\rho_m + 2_2\rho_m)}{(1 + 2_1\rho_m + 2_2\rho_m)} \beta_n^{-2}$$

The difference between the Dimson and Fowler-Rorke procedure is in the aggregation of the beta coefficients. McInish and Wood (1986) found that the betas produced by this technique slightly reduce the amount of bias.

2.9 THE ISSUE OF BETA STABILITY

According to Bradfield, detecting the beta stability is clouded by the fact that only estimates of beta are observable and that changing estimates do not necessarily imply stable underlying betas. Bowie and Bradfield (1997) found that the tests of beta stability are difficult to interpret on their own. Gombola and Kahl advocate that an OLS estimate of beta requires an estimation period during which the relationship between stock return and market return is stable. Without this stability, they suggest that an alternative for forecasting a time-varying relationship such as the general Bayesian adjustment process will be required.

Various studies on the stability of beta support the instability in security betas. According to Gombola and Kahl, beta instability does not necessarily include application of the CAPM unless combined with a random walk process for beta. Gombola and Kahl found that companies with high beta variability tend to have betas that return quickly to an underlying mean and companies with low or zero return have

low beta variability. They concluded that high variability with low or zero return rates would lead to extreme beta instability and prohibit application of the CAPM.

As reported by Collins, Ledolter and Rayburn (1987), the empirical work of Bogue (1973), Fabozzi and Francis (1978), Fisher and Kamin (1978), Sunder (1980), Alexander and Benson (1982), Lee and hen (1982), Ohlson and Rosenberg (1982) and Bos and Newbolb (1984) provide evidence to support the instability of beta risk of equity security and that it is best described by some type of stochastic parameter model. This suggests that the market model is mis-specified. Gombola and Kahl found the evidence against constancy much stronger at the portfolio level than at the individual security level 'because of a higher ratio of beta variance to background noise'.

The CAPM has given the beta of the value-weighted market portfolio as one, however, Bailsford, Faff, and Oliver advocates that as new companies are formed and new stocks are listed, their betas are offset by shifts in beta of existing stocks towards one, so that the market portfolio beta is maintained as one.

Blume (1971, 1975) found that individual stock betas had a regression tendency towards the grand mean of all stocks on the exchange. The Bayesian approach is used to correct for regression bias, and as reported by Bailsford, Faff, and Oliver, Castagna and Matolcsy (1978) suggested the following adjustment:

$$B_n^{CM} = 0.541 + 0.464\beta_n^*$$

where β_n^* is estimated under standard OLS regression.

2.10 THE ISSUE OF SEASONALITY

Evidence suggests that beta is not the only factor that affects the pricing security returns. Seasonality and firm size are two of the factors, and their existence there may be occasions when their inclusion in beta estimation is justified. It has been noted that seasonality is an explanatory factor of risk-adjusted returns and Bailsford, Faff, and

Oliver gave examples of large returns in January and low returns on Mondays and Tuesdays. The effect of seasonality can be removed by including dummy variables in the OLS regression. Draper and Paudyal (1995) found that UK stock beta have day of the week or day of the month effect when using weekly or monthly observation respectively.

They also noted that the variation in the estimates is often statistically significant and that estimates from weekly returns calculate on Monday or at the end of the month were significantly different from those derived for other days of the week or selected days of the month. Draper and Paudyal suggest that the variation in beta could affect the estimates of companies, cost of capital and other uses of beta that involve no portfolio pooling effect.

CHAPTER THREE

OVERVIEW OF THE GHANA STOCK EXCHANGE

3.1 Brief History of the Ghana Stock Exchange

The Ghana Stock Exchange was incorporated in July, 1989 as a private company limited by guarantee under Ghana's Companies Code, 1963 (Act 179). The Exchange was given recognition as an authorized Stock Exchange under the Stock Exchange Act of 1971 (Act 384) in October 1990, and trading on the floor of the Exchange commenced in November 1990. In April, 1994, it converted into a public company limited by guarantee.

The Ghana Stock Exchange is a private sector initiative and is not founded by Government. It currently has sixteen Stock broking firms licensed to deal on the Exchange. These are: Merban Stockbrokers Ltd., EDC Stockbrokers Ltd., NTHC Ltd., Gold Coast Securities Ltd., Databank Brokerage Ltd., CDH Securities Ltd., Cal Brokers Ltd., SDC Brokerage Services Ltd., First Atlantic Brokers Ltd., Worldwide Securities Ltd., Capital Alliance Company Ltd., Prudential Securities Ltd., HFC Brokerage Ltd., and SIC -FSL Ltd.

The Exchange is governed by a Council with representation from Licensed Dealing Members, Listed Companies, the Banks, Insurance Companies, Money Market and the general public. Managing Director of the Exchange is an ex-officio member. The council sets the policies of the Exchange and its functions include preventing fraud and malpractices, maintaining good order among members, regulating stock market business and granting listing.

Trading takes place daily from Mondays to Fridays starting at 10:00am. The market capitalization as at December, 31 2006 was 112,496.01 billion cedis. An indication of

the value of listed companies with about 1,003.81 million shares was traded between November 1990 and December, 31 2006. The main index is GSE All-Shares index. This index is published by Ghana Stock Exchange. The types of Securities traded and number of listings include ordinary Shared (Common Stock), and Debt Securities which are subdivided into Corporate and Government.

Trading is carried on the Floor of the Exchange under the Continuous Auction Trading system (CAT). Over the counter trading is however allowed in AngloGold Ashanti Ltd's shares. Trading is done in lots of 100 shares.

Settlement is manual but centralized. Currently, the settlement period is T+3(business days). It is also delivery versus payment. The seller (Stockbroker) of a security is responsible for the validity of all documents delivered.

A minimum of 1.5% and a maximum of 2.5% is charged as commission on the value of shares traded. Exchange Control permission has been given to non resident Ghanaians and foreigners to invest through the Exchange without any prior approval. However one external resident portfolio investor (whether individual or institutional) can hold up to 10% of any security approved for listing on the Exchange. Furthermore, the total holdings of all external residents in one listed security shall not exceed 74%.

Ghanaians externally resident and foreigners' resident in Ghana, though, may invest without any limit. The limits also apply in the case of AGC and PBC shares. There is free and full foreign exchange remittability for the original capital plus all capital

gains, and related earnings. There is a 10% withholding tax (which is also the final tax on dividend income) for all investors, both resident and non-resident.

The Exchange has various regulations which have been designed to protect the investor and these are:

A. MEMBERSHIP REGULATIONS- stipulate criteria for membership of the Exchange, regulations to be abided by the Licensed Dealing Members in their operations, code of conduct or ethics for members, etc.

B. LISTING REGULATIONS- these regulations prescribe among others criteria for listing securities; application procedures; contents of application and prospectus; and continued obligations of the listed companies and provisional listing procedures.

Under the SECURITIES INDUSTRY LAW PNDCL 333 (1993) as amended, the apex regulatory body in the Securities market is a Securities and Exchange Commission and its functions include:

- Maintaining surveillance over the securities business to ensure orderly, fair and equitable dealing in securities.
- Registering, licensing, authorizing, or regulating the Stock Exchange, investment advisors, securities dealers etc.
- Protecting the integrity of these securities markets against any abuses arising from the practice of insider trading.

The Exchange's Council (Board of Directors) has supervisory roles and its duties include the prevention of fraud or malpractices. The Council also has the power to suspend or expel any member who contravenes any of the regulations of the

Exchange. The Council membership includes some of the most distinguished and competent persons in Ghanaian commerce, industry, finance and public service.

3.2 LISTING ON THE GHANA STOCK EXCHANGE

For a company to have its shares or stocks listed on the GSE, it must first be registered as a public limited liability company under the Companies Code, 1963 (Act 179) or a unit trust or mutual fund or other public corporate body recognized under any law of Ghana. Briefly, a public limited liability company may be defined as a company which:

- a. Is registered with shares;
- b. Has no restriction on the transferability of its shares;
- c. Has no limitation on the number of shareholders and/or debenture holders; and
- d. Can make invitations to the public to acquire any of its shares or debentures.

There are many benefits that accrue to public companies whose shares are listed.

These include:

A. Easier Access to Long Term Capital

Going public enables the company to raise long-term capital by issuing securities to the public. Going public thus provides access to numerous investors (individuals and institutions, local or foreign) who, in aggregate, have a significant amount of funds to invest. This ability to raise funds from the investing public by the issue of securities is perhaps the most valuable of all the benefits that accrue to public companies. The raising of such capital allows for future expansion, growth and greater ability to stand competition.

B. Improvement in the Financial Position of the Company

An immediate benefit enjoyed by a newly-registered public company is the considerable improvement in its overall financial position. The injection of substantial equity funds, for example, greatly improves the company's balance sheet. With such capital reinforcement and good management, higher earnings and dividends are almost certain to follow.

C. Enhanced Status in the Community

Going public will raise the level of the investing community's awareness of the company and its products. This can result, for example, in a greater ability to attract high calibre employees and increased general business opportunities. Public companies also benefit from access to the useful information brought to them by their advisers, financial analysts, stockbrokers and shareholders.

D. Provision of Incentives for Employees

Both for existing employees and those to be recruited, the ability of companies to offer share options and employee share ownership schemes is a key advantage of public companies. The investing public and the existing shareholders also derive some benefits when private companies go public. These include:

i. Provision of Avenues for Investment

Public companies offer the investing public, including institutional investors and Pension funds, and attractive avenue for investment by virtue of the liquidity of the listed securities.

ii. Freedom to Diversify Investment

By going public, existing shareholders are placed in a position to diversify their interest and invest in other assets elsewhere.

iii. Transferability of Shares

A private company restricts the right to transfer its shares. Shares in a private company can generally only be sold to other existing shareholders. Shares in public companies are, on the other hand, freely transferable. Therefore liquidity is far higher in listed securities than private unlisted ones.

iv. Realization of Investment

A key benefit that shareholders in private companies derive from going public is the ability to establish a market value of the shares, thereby enhancing tradability.

3.3 HOW COMPANIES GET LISTED ON THE GHANA STOCK EXCHANGE

For a company to be listed on the Ghana Stock Exchange there are certain requirements the company should meet. These include the following:

- First the shareholder(s) must meet and agree (pass a resolution) to change a private company to a public one.
- The company with the help of external solicitors or in-house lawyer prepares new Company Regulations which conforms to that of the Companies Code and also meet the listing requirements of the Ghana Stock Exchange.
- The new Regulations are discussed with the GSE and if found satisfactory, filed with the Registrar of Companies.

- The company's board then appoints a team of advisors to assist the company to prepare its offer document. The team will include brokers, lawyers, reporting accountants, financial valuation advisors, etc.
- The draft report of the advisors is then discussed. Key decisions such as the price of the share to be sold, the proportion of shares of the company to sold, etc will have to be taken by the shareholder(s)
- An application to list on the GSE will have to be submitted and at the same time the draft public offer prospectus will have to be submitted to the Securities and Exchange Commission (SEC) for approval.
- Once the regulatory approvals are obtained, a date is set for the launch of the public offer.
- At the end of the offer, if it is successful, allotment is done and successful applicants are advised.
- The company then agrees a date for the commencement of trading in its shares on the floor of the GSE.

Thus, a company is said to be listed when its securities are approved to be bought and sold on the Stock Exchange. Newly issued shares cannot trade in the OTC Market before getting listed on the GSE. In order to get a newly issued shares listed on the GSE, one needs to communicate this intention early to the GSE and work with the Exchange so that ones prospectus will satisfy the Exchange's listing requirements before the public flotation.

There are certain requirements that a company must meet in order to qualify for listing on the Exchange. These requirements are stipulated in GSE Rule Book. Many companies will meet these qualifications.

To make it possible for companies to list on the Exchange, there are two lists with fairly easy requirements:

- a. The first official list (FOL)
- b. The second official list(SOL)

The requirements are specified below but are only standards for the guidance of potential listing applicants. The approval of an application for the listing of securities on the Exchange is a matter solely within the discretion of the Council of the Ghana Stock Exchange.

3.4 LISTING REQUIREMENTS FOR SHARES

A company applying for listing of any class of its shares is, as a general rule, expected to meet the following requirements:

Minimum Stated Capital

- Shares issued to the public must not be less than 25 per cent of the number of shares issued by the company unless reasonable justification is provided for a smaller percentage.

Payment of Shares

- Shares must be fully paid for, except in very exceptional circumstances, the Exchange will refuse listing in respect of partly paid shares.

Spread of Shares

- The spread of shareholders existing at the close of an offer should be in the GSE's opinion adequate with at least 50 shareholders after the public offer.

3.5 LISTING REQUIREMENTS FOR DEBT SECURITIES

- A company seeking the admission of debt securities to the GSE may be considered for such admission if the security concerned has a total issue amount of not less than 10 billion cedis face value or there are at least 50 holders of such securities.

In the case of Government securities, there is no prescribed minimum in respect of either amount of issue or number of holders to permit admission to the GSE's list.

- Debt securities for which listing are sought shall be created and issued pursuant to approval by SEC of the Offer prospectus.

The following additional requirements apply to both applications for listing of equities and debt securities:

Period of Existence

- For a company's securities (whether equity or debt) to be eligible for admission to the GSE, the company must have published or filed audited accounts in accordance with the Companies Code, 1963, (Act 179), for at least the three years immediately preceding the date of its application for listing.

For the SOL, in respect of shares, the period is one year.

Profitability

- Profitability must have been reasonable through the periods stated above or the company must have strong potential to be profitable.

Conditions relating to Directors and Management of Applicant

- There must have been continuity in the management of a company seeking admission to the GSE.

- The character and integrity of the directors and management of the company will be among the criteria taken into account by the Council of the Exchange.
- At least 50% of the Board must be non-executive directors and of this number at least two (2) or 25% shall be independent.

The Listing Rules specify the information that is to be provided in an original listing application.

The application requires information in the following areas:

- Background of the Company- (history, type of business, etc.)
- Capitalization and share distribution- (authorized and issued capital, distribution of share holding etc.)
- Directors and key management staff
- Long-term and funded debt-(financing arrangement, interest rates, maturity dates, etc.);
- Investments and properties;
- Competition and industry
- Profit and loss record for three years or one year as the case may be;
- Dividend records and
- Other information-(fiscal year end, date of annual meeting, pending legal actions, etc.).
- A copy of the prospectus submitted to the SEC.

The objective of all the information requirements is to provide sufficient information to investors on a consistent basis so that they can make an informed investment decision. It is the responsibility of the sponsoring Licensed Dealing Member to verify all the information provided by the company and then file with the Exchange all the necessary documentation to support the application.

Listed companies can issue new stocks and shares and seek additional listing on the Exchange. A listed company is, however, not permitted to issue or to authorize its Registrars to issue or register additional securities of the class listed until after it has filed with the Exchange an application for listing of the additional shares and has been notified by the Exchange that they have been authorized for listing.

The following steps are to be taken by a company seeking additional listing.

- a. The company decides to issue additional securities, get the relevant resolutions passed and makes the appropriate announcement to the Exchange;
- b. The company submits listing application to the Exchange together with supporting papers;
- c. The Exchange approves in principle an additional listing application; and
- d. The company fixes relevant books, closing dates and makes public announcements to the Exchange with respect to such dates.
- e. The offer circular is sent to the all shareholders or as may be required.
- f. At the close of offer, results are announced and GSE informed.
- g. The GSE endorses the results and commence trading in the new shares alongside existing ones.

Information required on an on-going basis for compliance purposes is your financial statements on quarterly basis and the timely disclosure of any information material to an investor in deciding whether or not to invest in ones company's shares or stocks.

Ones company's continued listing with the Exchange is subject to on-going compliance with the listing regulations. The SEC may also apply penalties. Non-

compliance can lead to your company's securities being suspended from listing or being delisted. This action would be in addition to any fines imposed by the Exchange.

The GSE Rule Book makes provisions for various fees. Most fees are based on the amount of market capitalization fees, listing fees and annual fees.

3.6 RULES FOR PROVISIONAL LISTING

The purpose of the guidelines is to encourage Government to privatize state-owned enterprises (SOEs) through the Exchange and for the Exchange to facilitate the divestiture by adopting simpler approach to the entire process without sacrificing rules or standards. The requirements equally apply to Private Sector companies especially SMEs wishing to take advantage of the approach for getting listed on the Ghana Stock Exchange. Therefore under the provisional listing approach, the Exchange seeks to secure these companies on its Official List right at the beginning of the process thereby giving it a platform for it to gain greater visibility to make its public offer more successful.

Under the provisional listing process the Exchange is committed to a two-stage approach.

- a) In the first stage, a provisional listing status is to be granted to the companies once the conditions for provisional listing are satisfied.
- b) The second stage is for companies and their sponsoring brokers to work closely with the Exchange, to formalize the listing status within an agreed time

frame (not more than 18 months) and after having satisfied the conditions ordinarily required for Formal Listing.

The period between the acceptance for provisional and formal listing shall be referred to as the transitional period. There will be privileges to be enjoyed as well as obligations that the companies will have to observe during the transitional period. This is because during the transitional period, not all the continuing listing obligations shall be imposed on these companies. For now, among other things, during the transitional period the following are permitted:

1. Privileges

- I. The companies shall be identified on the Exchange's Official List in a separate section thereof under the caption "Provisional List".
- II. The companies can advertise to the effect that they are provisionally listed on the Exchange and that an Offer to the public is to be done in due course using one or other of the various alternatives to an Offer.
- III. The companies can hold public meetings, press briefings, etc as other listed companies do.

2. Obligations

- I. The companies must announce quarterly, half year and full year results as are appropriate during the transitional period.
- II. Block transactions in the company's shares will be allowed on the floor of the Exchange through a Licensed Dealing Member (LDM).

III. An Offer for Sale or Subscription of shares of the company to the general investing public shall be based on a price at which the most recent block transaction between joint venture partners was executed (in the case of SOEs) unless a new valuation has been incorporated in an approved Public Offer document. In the case of private sector companies, the Public Offer shall be based on a price indicated in an approved prospectus.

IV. The Public Offer in (III) above must be done using a Prospectus or Statement in lieu of Prospectus approved, by the Securities and Exchange Commission.

The following conditions should be satisfied in order that a prospective company is granted "Provisional Listing" status.

1. The Shareholders must endorse a Special Resolution authorizing the company to be listed.
2. The Shareholders must endorse a Special Resolution undertaking to do the following:
 - Seek listing on the Exchange first by provisional arrangement and subsequently by formal listing.
 - Abide by the continuing listing obligations.
 - Not to sell any shares immediately prior to the provisional listing indicated above, without an approved announcement through the Exchange.
3. The following additional documents shall be submitted to the Exchange:

- Draft Regulations conforming to that of a public limited liability company as well as the requirements of GSE, a copy of which shall be filed Registrar of Companies.
 - Brief Information Statement or write up on the company outlining the corporate information, history, nature of business; list of directors (including present occupation); key executive officers and their qualification and experience; shares; capital and debts of the company; prospects and risks and summary of financials.
 - Copies of audited financial statements for the last three completed financial years
4. An undertaking to complete the formal listing process within a period of eighteen months from the date do provisional listing or in a shorter period as may be agreed with the Exchange.

Moreover, the conditions for formal listing shall ordinarily be the same as per the Ghana Stock Exchange (GSE) Rule Book. In particular, the following conditions are brought to the early attention of prospective listed companies.

- a) Appointment of a Licensed Dealing Member of the Exchange to sponsor the formal listing which may be done by Introduction, Public Offer for Sale or Subscription, Private Placement, etc.
- b) Compliance with the Listing Rules of the GSE including;
 - i. approval of public offer document (Statement in lieu of Prospectus or Prospectus which ever is applicable) by the Securities and Exchange Commission; and
 - ii. The appointment of a Share Registrar.

c) The Official List (1st or 2nd), on which the prospective company will be placed, will be determined during the approval process for the formal listing.

CHAPTER FOUR
METHODOLOGY

4.1 DATA

This project is based on observed daily share prices on thirty - two Ghana Stock Exchange listed companies from January 1993 to December 2006. The table below is a brief description of the companies used in this project. In the market model historical stock returns are regressed on historical returns from a proxy for the market portfolio. The following market index is used in this project:

1. G S E All Shares Index

The sample size was reduced to nineteen and the estimation period being six years for consistency. This is because only these companies had consistent data. The regression was run on log or continuous monthly returns. Table 3.1 shows the company description of all thirty - two companies.

Table 4.1 COMPANY DESCRIPTIONS

Company Code	Company Name	Market Value	Industry
ABL	Accra Brewery Company Ltd .	¢73,316,000,000	Brewery
AGA	AngloGold Ashanti Ltd	\$3,364,000,000	Mining
ALW	Aluworks Ltd	¢50,024,000,000	Manufacturing of aluminium
AYRTN	Ayton Drugs Manufacturing Company Ltd	¢15,000,000	Manufacturing of pharmaceuticals

BAT	British American Tobacco Ghana Ltd	€6,586,000,000	Manufacturing of tobacco
BOPP	Benso Oil Palm Plantation Ltd	€20,000,000,000	Agriculture
CAL	Cal Bank Ltd	€70,588,000,000	Finance - Banking
CFAO	CFAO Ghana Ltd	€10,884,000,000	Trading
CLYD	Clydestone Ghana Ltd	€5,548,000,000	
CMLT	Camelot Ghana Ltd	€1,686,642,000	
CPC	Cocoa Processing Company	€24,167,256,000	Cocoa
EBG	Ecobank Ghana Ltd	€72,981,000,000	Finance - Banking
EIC	Enterprise Insurance Company Ltd	€12,355,675,000	Finance - Insurance
ETI	Ecobank Transnational Incorporation	\$179,026,000,000	Finance - Banking
FML	Fan Milk Ltd	€6,000,000,000	Manufacturing of food
GCB	Ghana Commercial Bank Ltd	€20,000,000,000	Finance - Banking
GGBL	Guinness Ghana Breweries Ltd	€262,520,000,000	Brewery
GWEB	Golden Web Ltd	€5,541,217,200	
HFC	HFC Bank Ltd	€76,791,949,000	Finance - Banking
MLC	Mechanical Lloyd Company Ltd	€27,714,856,000	Trading in motors

PKL	Pioneer Kitchenware Ltd	€666,500,000	Manufacturing of household goods
PBC	Produce Buying Company Ltd	€49,144,000,000	Trading
PZ	PZ Cussons Ghana Ltd	€11,600,000,000	Trading
SCB	Standard Chartered Bank Ghana Ltd	€40,405,000,000	Finance – Banking
SPL	Starwin Products Ltd	€19,820,383,000	Manufacturing of pharmaceuticals
SPPC	Super Paper Product Company	€892,000,000	Manufacturing of paper products
SG-SSB	SG-SSB Ltd	€70,000,000,000	Finance – Banking
SWL	Sam Woode Ltd	€2,210,000,000	Timber
TBL(The Gambia)	Trust Bank Ltd(The Gambia)	\$30,000,000	Finance – Banking
TOTAL	Total Petroleum Ghana Ltd	€386,000,000	Trading in petroleum
TRANSOL	TRANSOL Solutions Ghana Ltd	No Value	Manufacturing of Chemicals
UNIL	Unilever Ghana Ltd	€9,900,000,000	Manufacturing of general goods
AADs	AngloGold Ashanti Ltd	\$3,364,000,000	Mining

CHAPTER FIVE

DATA ANALYSIS

5.1 The Return Measure

The table below shows the betas for the different mean betas of the thirty-two companies and the difference between the mean betas. It is evident from the table below that there is not much difference between the discrete betas log betas and excess betas. However, Aluworks Ltd showed the highest difference of 0.7418 between discrete and log returns and -0.7405 between log and excess returns

Table 5.1a comparison of the three main return measures with GSE All Shares as Market Index

Company Name	Beta Discrete	Beta Log	BETA Excess	Discrete - Log	Discrete - Excess	Log - Excess
Accra Brewery company limited	0.45172	0.47274	0.44957	-0.02102	0.00215	0.02317
AngloGold Ashanti Ltd	0.87175	0.87548	0.85287	-0.00373	0.01888	0.02261
Aluworks Ltd	1.88236	1.14055	1.88105	0.74181	0.00131	-0.7405
Aryton Manufacturing Company Ltd	1.4043	1.59908	1.40286	-0.19478	0.00144	0.19622
British American Tobacco Ghana Ltd	2.44831	2.1848	2.44755	0.26351	0.00076	-0.26275
Benso Oil Palm Plantation Ltd	0.36457	0.38137	0.36396	-0.0168	0.00061	0.01741
Cal Bank Ltd	0.41366	0.5718	0.41378	-0.15814	-0.00012	0.15802
CFAO Ghana Ltd	0.83858	0.86065	0.83603	-0.02207	0.00255	0.02462
Clydstone Ghana Ltd	0.32091	0.3587	0.32016	-0.03779	0.00075	0.03854
Camelot Ghana Ltd	1.09636	1.06976	1.09653	0.0266	-0.00017	-0.02677
Cocoa Processing Company	0.27589	0.28876	0.27314	-0.01287	0.00275	0.01562
Ecobank Ghana Ltd	0.32762	0.38925	0.27978	-0.06163	0.04784	0.10947
Enterprise Life Insurance	1.1098	1.46553	1.10688	-0.35573	0.00292	0.35865
Fan milk Ltd	-0.15234	-0.14959	-0.15223	-0.00275	-0.00011	0.00264
Guinness Ghana Breweries Ltd	0.88912	0.93301	0.92198	-0.04389	-0.03286	0.01103
Golden Web Ltd	1.5646	1.54211	1.56183	0.02249	0.00277	-0.01972

HFC Bank Ltd	0.44119	0.49144	0.43849	-0.05025	0.0027	0.05295
Mechanical Lloyd Company Ltd	0.81713	0.77702	0.82573	0.04011	-0.0086	-0.04871
Pioneer Kitchenware Ltd	0.92807	0.90203	0.92532	0.02604	0.00275	-0.02329
Produce Buying Company Ltd	0.71997	0.73948	0.7181	-0.01951	0.00187	0.02138
PZ Cussons Ghana Ltd	0.09447	0.12516	0.09177	-0.03069	0.0027	0.03339
Standard Chartered Bank Ghana Ltd	0.87181	0.87545	0.85681	-0.00364	0.015	0.01864
Starwin Products Ltd	0.74123	0.71575	0.73921	0.02548	0.00202	-0.02346
Super Paper Product Company	1.10881	1.03211	1.1068	0.0767	0.00201	-0.07469
SG-SSB Ltd	0.32539	0.30662	0.32264	0.01877	0.00275	-0.01602
Sam Wood Ltd	0.52067	0.25221	0.51792	0.26846	0.00275	-0.26571
Trust Bank Ltd (The Gambia)	0.61452	0.51492	0.66288	0.0996	-0.04836	-0.14796
Total Petroleum Ghana Ltd	2.2439	1.86148	2.24258	0.38242	0.00132	-0.3811
TRANSOL Solution Ghana Ltd	0.8665	0.88306	0.86181	-0.01656	0.00469	0.02125
Unilever Ghana Ltd	0.4405	0.35082	0.43881	0.08968	0.00169	-0.08799
AngloGold Ashanti Ltd	0.49784	0.48615	0.49516	0.01169	0.00268	-0.00901

The table below shows the P-Values for the Two-Sample T-Test run for the three different returns. The test at 5% significance level indicate high P-values and therefore the null hypothesis ($H_0: \beta_{\text{discrete}} = \beta_{\text{continuous}} = \beta_{\text{excess}}$) cannot be rejected. The excess returns are most identical to discrete returns with the highest P-value of 0.968. this is consistent with the literature that

Table 5.1b

Two-Sample T-Test	P - Values
Beta Discrete, Beta Log	0.916
Beta Discrete, Beta Excess	0.968
Beta Log, Beta Excess	0.949

5.2 Effect of different Market Proxies

The work could not estimate the values for two proxies for comparison because there is only one proxy at the GSE which is the GSE All Share Index.

5.3 The Length of Estimation Period

It has been argued that a four to five – year length of estimation period is an appropriate trade-off between the number of observations and the stability of the beta estimate when dealing with monthly data (Brailsford et al). However, for the sample used in this project, nineteen companies have consistent six years data, and therefore subsequent analysis adopts a six – year estimation period and the analysis uses log monthly returns. The three different estimation periods involve monthly log returns from January 2001 to December 2006: six years of monthly returns from January 2001 to December 2006, four years monthly returns from January 2003 to December 2006 and two years monthly returns from January 2005 to December 2006.

The table below shows OLS betas from the three different estimation periods. It can be seen from the table that these differences in beta estimation are substantial, with the maximum range of 1.46978 for Fan Milk Ltd and a minimum range of 0.08798 for Aluworks.

Table 5.3a OLS betas from different length estimation periods

Company Code	2001 - 2006	2003- 2006	2005 - 2006	Range
ABL	0.29697	0.18247	0.25274	0.04423
ALW	0.36178	0.12108	0.2738	0.08798
BAT	1.08315	1.65483	1.11454	0.57168
CFAO	0.4368	0.33835	0.52574	0.08894
CMLT	0.2593	0.29901	0.12165	0.17736
EIC	0.19269	0.21436	0.8926	0.69991
FML	1.55159	1.96493	3.02137	1.46978
GCB	1.08879	1.4741	1.24019	0.38531
GGBL	1.58513	1.95156	1.41881	0.53275
HFC	0.4867	0.6157	1.06132	0.57462
MLC	0.31995	0.18176	0.00233	0.32228
PKL	0.91925	1.04571	1.80677	0.88752

PBC	1.14746	1.01047	1.55963	0.54916
PZ	0.12974	0.34424	0.50639	0.37665
SCB	0.36515	0.07595	0.16189	0.52704
SPPC	0.94197	1.63991	1.78888	0.84691
SG-SSB	1.06223	1.02188	0.8138	0.24843
TOTAL	0.21719	0.12054	0.12446	0.34165
UNIL	0.46988	0.98017	0.86435	0.51029

Range is calculated as: largest estimated beta minus smallest estimated beta.

The observed P-value for the six and two year estimation period is relatively low, indicating the substantial difference in estimated betas. However, the null hypothesis ($H_0: \beta_{6\text{years}} = \beta_{4\text{years}} = \beta_{2\text{years}}$) cannot be rejected.

Table 5.3b

Two-Sample T-Test	P-Values
Beta 6yrs, Beta 4yrs	0.606
Beta 6yrs, Beta 2yrs	0.168
Beta 4yrs, Beta 2yrs	0.416

5.4 The Sampling Interval

The table below shows the effect of varying the interval from monthly to quarterly returns, and the estimation period is from January 2001 to December 2006. The difference in beta estimates ranges from -0.75812 for UNIL to 0.71136 for Fan Milk Ltd. The results shown in the table is consistent with the argument that large variation in beta estimates can be obtained from different estimation procedure.

Although table 5.4a shows variations in beta estimates, the observed P-value in table 4.4b indicates that these variations are statistically insignificant.

Therefore the null hypothesis ($H_0: \beta_{\text{monthly}} = \beta_{\text{quarterly}}$) cannot be rejected at the conventional significant levels

Table 5.4a OLS beta estimates for different sampling intervals

Company Code	2001-2006 Monthly Returns	2001-2006 Quarterly Returns	Difference
ABL	0.29697		
ALW	0.36178	0.17932	0.11765
BAT	1.08315	0.56288	-0.2011
CFAO	0.4368	1.78142	-0.69827
CMLT	0.2593	0.44305	-0.00625
EIC	0.19269	0.29239	-0.03309
FML	1.55159	0.20885	-0.01616
GCB	1.08879	0.84023	0.71136
GGBL	1.58513	1.03327	0.05552
HFC	0.4867	1.09411	0.49102
MLC	0.31995	0.40205	0.08465
PKL	0.91925	0.22474	0.09521
PBC	1.14746	1.03548	-0.11623
PZ	0.12974	1.46637	-0.31891
SCB	0.36515	-0.17809	0.30783
SPPC	0.94197	0.63876	-0.27361
SG-SSB	1.06223	0.91872	0.02325
TOTAL	0.21719	0.35601	0.70622
UNIL	0.46988	0.63249	-0.4153
		1.228	-0.75812

Table 5.4b

Two-Sample T-Test	P -Values
Monthly, Quarterly	0.947

5.5 The Effect of Outliers

Within the six year estimation period, that is January 2001 to December 2006, an event that gave rise to outliers is the September to December 2006 energy crisis. Below therefore shows OLS betas including September to December 2006 and OLS betas excluding September to December 2006. A dummy variable was included to capture the effect of the outlier. By excluding the September to December 2006, the resultant beta estimates were quite different. The largest difference is 0.85853 for Fan Milk Ltd and -0.12409 for SCB

Table 5.5a The impact of September 2006 Energy Crisis in Ghana on Beta Estimates

Company Code	Monthly OLS β including September 2006	Monthly OLS β excluding September 2006	Difference
ABL	0.29697		
ALW	0.36178	0.23178	0.06519
BAT	1.08315	0.31064	0.05114
CFAO	0.4368	0.75809	0.32506
CMLT	0.2593	0.36267	0.07413
EIC	0.19269	0.20642	0.05288
FML	1.55159	-0.12631	0.319
GCB	1.08879	0.69306	0.85853
GGBL	1.58513	0.70499	0.3838
HFC	0.4867	1.33371	0.25142
MLC	0.31995	0.19111	0.29559
PKL	0.91925	0.31272	0.00723
PBC	1.14746	0.88562	0.03363
PZ	0.12974	0.84864	0.29882
SCB	0.36515	0.00645	0.12329
SPPC	0.94197	0.48924	-0.12409
SG-SSB	1.06223	0.64017	0.3018
TOTAL	0.21719	0.98104	0.08119
UNIL	0.46988	0.17432	0.04287
		0.23384	0.23604

As shown in the table below, the P-value for the two-sample t-test is quite low.

However the null hypothesis ($H_0: \beta_{OLS}$ including September –December 2006 = β_{OLS} excluding September –December 2006)

cannot be rejected at the conventional significance level of 5 and 10%.

Table 5.5b

Two-Sample T-Test	P –Values
Quarterly OLS including Sept- Dec. vs. Quarterly OLS excluding Sept- Dec 2006	0.126

5.6 Diagnostic Analysis

Table 5.6a reports the results of the diagnostic analysis of OLS market-model residuals over the period January 2001 to December 2006 using monthly log returns.

Excess kurtosis, skewness and Jacque-Bera tests for normality whiles Durbin-Watson

and the runs test, tests for autocorrelation. The null hypothesis tests whether the residuals are normally distributed. For the test of normality, excess kurtosis is expected to be approximately zero, skewness is expected to be zero and Jacque-Bera for large samples is expected to be 2 degrees of freedom. The Durbin-Watson test does not reject the null hypothesis of no autocorrelation (positive or negative) if $d_u < d < 4 - d_u$. with seventy-two observations and one explanatory variable for the regression, the lower and upper bounds are given as approximately 1.54 and 2.51 respectively.

The values for excess kurtosis are significantly different from zero with only four companies' value close to zero. The values for skewness are also significantly different from zero with nineteen companies showing values close to zero. The Jacque-Bera statistics shows high values with most companies showing non-normality. Only three companies were found not to be within the acceptance zone for the Durbin-Watson statistics test. The Runs test rejects five companies at the 5% significance level. Thus confirms the statistical insignificance of the autocorrelation residuals.

Table 5.6a Diagnostic analysis of OLS market-model residuals

Company Code	Excess Kurtosis	Skewness	Jacque-Bera	Durbin-Watson	Runs Test: Test is Significant at
ABL	0.137	-0.134	0.189	2.32	0.6776
ALW	-2.733*	0.375	16.727*	2.06	0.78
BAT	22.699*	4.124*	1215.246*	2.23	0.5194
CFAO	-1.343	-0.036	3.765	2.51	0.353
CMLT	15.986*	3.247*	620.337*	2	0.0323*
EIC	3.471*	-2.268*	67.978*	1.69	0.8099
FML	2.754*	1.6434*	38.312*	1.92	0.2947
GCB	5.244*	-1.081*	67.042*	2.18	0.7589
GGBL	-1.305	-0.261	4.11	2.09	0.7693
HFC	-1.625	-0.218	5.895	2.23	0.3257
MLC	-0.454	0.617*	3.605	1.86	0.3927
PKL	-2.389*	0.104	11.983*	2.11	0.1377
PBC	-0.688*	0.909*	7.884*	1.85	0.46
PZ	2.923*	-0.322	18.677*	1.54*	0.0251*
SCB	-2.836*	0.564*	19.401*	1.92	0.7245
SPPC	-1.197	0.458	4.732	1.82	0.4253
SG-SSB	-1.179	0.396	4.207	2.22	0.5456

TOTAL	0.025	-0.567*	2.689	2.04	0.9191
UNIL	12.393*	-1.595*	341.215*	2.04	0.0143*

5.7 The Effect of applying Robust Regression Techniques

A departure from the normality assumption (results in table 5.6a) suggests that another choice of estimation technique to OLS be used. The robust estimation technique used here is the trimmed least squares at 5% and 10% levels. The table below shows results of a comparison of beta estimates from three different estimation procedures – OLS, TRLS 5% and TRLS 10%. The largest variation across the different estimation procedures is for the Fan Milk Ltd, with a range in beta of 1.121327. The test under the null hypothesis suggests that the three different procedures are not statistically different from each other. However, the low P-values suggests that the null hypothesis ($H_0: \beta_{OLS} = \beta_{TRLS\ 5\%} = \beta_{TRLS\ 10\%}$) can be rejected at the conventional significance levels.

Table 5.7a Beta Estimates using various Robust Estimation Procedures

Company Code	OLS	TRLS 5%	TRLS 10%	Range
ABL	0.29697	0.488161	0.391387	0.191191
ALW	0.36178	0.222421	0.22107	0.14071
BAT	1.08315	0.427679	0.118807	0.964343
CFAO	0.4368	0.323401	0.256063	0.180737
CMLT	0.2593	0.18067	0.049688	0.130982
EIC	0.19269	0.323801	0.267208	0.131111
FML	1.55159	0.722464	0.430263	1.121327
GCB	1.08879	0.717437	0.581288	0.507502
GGBL	1.58513	0.811304	0.710317	0.874813
HFC	0.4867	0.421275	0.288419	0.198281
MLC	0.31995	0.226146	0.081427	0.238523
PKL	0.91925	0.545371	0.29271	0.62654
PBC	1.14746	0.674981	0.709036	0.472479
PZ	0.12974	0.130637	-0.01844	0.149073
SCB	0.36515	0.158607	0.008446	0.356704
SPPC	0.94197	0.579821	0.170549	0.771421
SG-SSB	1.06223	0.522449	0.253966	0.808264
TOTAL	0.21719	0.174482	0.165636	0.051554
UNIL	0.46988	0.511444	0.540268	0.070388

Table 5.7b

Two-Sample T-Test	P-Values
OLS, TRLS 5%	0.035
OLS, TRLS 10%	0.001
TRLS 5%, TRLS 10%	0.091

5.8 The Effect of Thin Trading

The table below reports on the comparison between estimates of OLS regression, the Scholes – Williams's beta and the Fowler – Rorke's beta. It is evident from the table that the variations in beta estimates are substantial. However, the P-values shown in table 5.8b suggest that these variations are statistically insignificant. The most frequently traded stocks have upward biased OLS beta estimates, and this is consistent with the findings of Dimson (1979). For example, SG-SSB and the GCB, who have frequently traded stock, have OLS betas higher than their adjusted betas. Less frequently trading companies such as SCB and MLC have downward biased OLS betas. However, not all stocks are consistent with this rule of thumb. ALW and PZ which are regarded as frequently traded stock have downward biased betas.

Table 5.8a The Effect of Thin-Trading Adjustments on Beta Estimation

Company Code	OLS Beta	Scholes-Williams beta	Fowler-Rorke's beta	Difference (OLS-SW)	Difference (OLS-FR)
ABL	0.29697	-0.25263	0.178896	0.5496	0.118074
ALW	0.36178	0.58763	0.531816	-0.22585	-0.17004
BAT	1.08315	2.48784	0.89899	-1.40469	0.18416
CFAO	0.4368	2.84327	3.403158	-2.40647	-2.96636
CMLT	0.2593	0.63047	0.978897	-0.37117	-0.7196
EIC	0.19269	0.3597	0.07603	-0.16701	0.11666
FML	1.55159	0.26025	0.86557	1.29134	0.68602
GCB	1.08879	-0.18187	-1.81114	1.27066	2.899926
GGBL	1.58513	1.93749	1.326415	-0.35236	0.258715
HFC	0.4867	0.97773	0.359794	-0.49103	0.126906
MLC	0.31995	1.86364	1.107134	-1.54369	-0.78718
PKL	0.91925	0.86144	0.784434	0.05781	0.134816
PBC	1.14746	0.30729	0.500409	0.84017	0.647051
PZ	0.12974	0.52174	1.250942	-0.392	-1.1212
SCB	0.36515	1.19914	1.167915	-0.83399	-0.80277

SPPC	0.94197	0.72706			
SG-SSB	1.06223	0.58465	0.704744	0.21491	0.237226
TOTAL	0.21719	0.43902	0.994761	0.47758	0.067469
UNIL	0.46988	1.36857	-0.35878	-0.22183	0.575969
			2.357817	-0.89869	-1.88794

The P-values shown in table 4.8b suggest that the null hypothesis ($H_0: \beta_{OLS} = \beta_{Scholes-Williams}$) cannot be rejected at the conventional significances levels.

Table 5.8b

Two-Sample T-Test	P - Values
OLS beta, Scholes – Williams beta	0.288
OLS beta, Fowler – Rorke's beta	0.450
Scholes – Williams beta, Fowler – Rorke's beta	0.857

The table below reports on beta estimates from OLS regression and beta estimates from applying the Castagna and Matolcsy adjustment. The largest difference in beta estimates is 0.3086 for Total Ltd. and the smallest difference is -0.4541 for SCB. The results conform to Blume's conclusion that individual stock betas have regression tendency toward the grand mean of unity. The results of the null hypothesis ($H_0: \beta_{OLS} = \beta_{Castagna \& Matolcsy}$) for the statistical test indicate that the null cannot be rejected at the conventional significance level.

Table 5.8c OLS versus Mean-Reversion-Adjusted betas

Company Code	OLS Beta	Castagna and Matolcsy's β	Difference
ABL	0.29697	0.67879408	-0.38182408
ALW	0.36178	0.70886592	-0.34708592
BAT	1.08315	1.0435816	0.0395684
CFAO	0.2593	0.6613152	-0.4020152
CMLT	1.55159	1.26093776	0.29065224
EIC	1.58513	1.27650032	0.30862968
FML	0.91925	0.967532	-0.048282
GCB	1.14746	1.07342144	0.07403856
GGBL	0.36515	0.7104296	-0.3452796
HFC	0.94197	0.97807408	-0.03610408
MLC	1.06223	1.03387472	0.02835528

PKL	0.11893	0.59618352	-0.47725352
PBC	0.4003	0.7267392	-0.3264392
PZ	0.32528	0.69192992	-0.36664992
SCB	0.16204	0.61618656	-0.45414656
SPPC	1.06612	1.03567968	0.03044032
SG-SSB	1.22302	1.10848128	0.11453872
TOTAL	1.35094	1.16783616	0.18310384
UNIL	0.36692	0.71125088	-0.34433088

Table 5.8d

Two-Sample T-Test	P-Values
OLS, Castagna and Matolcsy's Beta	0.250

5.9 The Effect of Seasonality

The effect of seasonality will be considered under the day of the week effect. The table below reports the estimated betas for the days of the week for individual companies. It can be seen from the table that there are differences in the beta estimates. This conforms to Draper and Paudyal findings that Ghana stock betas have the day of the week effect when using weekly observations.

They also noted that the variations in the estimates are often statistically significant and that estimates from weekly returns calculated on Monday were significantly different from those derived for other days of the week.

This evidence is confirmed in table 5.9b. although the null hypothesis ($H_0: \beta_{\text{Monday}} = \beta_{\text{Tuesday}} = \beta_{\text{Wednesday}} = \beta_{\text{Thursday}} = \beta_{\text{Friday}}$) cannot be rejected at the 5% significant level, the P-values for Monday on the Tuesday, Wednesday, Thursday and Friday are lower than between Tuesday and the other days of the week.

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Table 5.9a Estimated Betas for Days of the Week

Company Code	Monday	Tuesday	Wednesday	Thursday	Friday
ABL	-0.02912	0.913895	0.91574	0.91724	0.915928
ALW	0.069	-0.018892	0.02545	-0.05837	-0.076997
BAT	0.56655	0.080509	0.08425	0.1507	0.178656
CFAO	1.00357	0.427773	0.44665	0.35282	0.400549
CMLT	0.23637	0.574363	0.3789	0.0856	0.430527
EIC	0.0643	0.114924	0.00271	0.0907	0.251995
FML	-0.02338	0.061666	0.02317	0.02061	0.126352
GCB	0.46745	0.049335	0.22061	0.21248	-0.119614
GGBL	0.43535	0.677951	0.72999	0.58374	0.607516
HFC	0.86734	0.455023	0.4331	0.41888	0.4288
MLC	0.20015	0.606346	0.47394	0.49643	0.680121
PKL	0.20545	0.211157	0.26624	0.18575	0.13594
PBC	0.74527	0.147533	0.18334	0.2327	0.234152
PZ	0.48655	0.738258	0.33569	0.24537	0.317988
SCB	0.05137	0.259676	0.39371	0.54328	0.506853
SPPC	0.89954	0.007008	0.11826	0.10825	0.096913
SG-SSB	0.87695	0.994426	0.94584	0.94462	0.880389
TOTAL	0.39524	0.583076	0.29553	0.51132	0.726109
UNIL	0.09165	0.215342	0.12871	0.17391	0.241463

Table 5.9b

Two-Sample T-Test	P - Value
Monday, Tuesday	0.632
Monday, Wednesday	0.454
Monday, Thursday	0.448
Monday, Friday	0.684
Tuesday, Wednesday	0.779
Tuesday, Thursday	0.778
Tuesday, Friday	0.931
Wednesday, Thursday	0.995
Wednesday, Friday	0.707
Thursday, Friday	0.705

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

Beta has occupied centre stage in both risk management and risk measurement since the concept was introduced by Markowitz (1959). Beta parameter is used in finance in the form of the market model to estimate systematic risk. Although such betas are assumed to be time invariant, considerable evidence shows that beta risk is not constant over time. Beta estimation has been traditionally achieved by running a market model regression. It is also common to measure beta by estimating the market model using ordinary least squares (OLS) in obtaining the beta estimates. The beta of a stock is important in a variety of contexts, ranging from the cost of capital, asset pricing theory, to hedging using index derivatives.

The main aim of this project is to consider models of beta estimation and their ability to estimate beta parameter. This project was based on a sample of thirty-two Ghanaian companies selected in the period January 2001 to December 2006. The results showed that there was not much difference between the three measures of return and the choice of market index used. The results for the effect of using different market proxies could not be tested because G S E has only one proxy. Although the results obtained for varying the length of the estimation period showed substantial change in betas, the more rigorous t-test showed that the differences are not statistically significant. Evidence showed no impact on beta estimates by varying the sampling interval from monthly to quarterly. The effect of outliers (September 2006 to December 2006 energy crisis) was substantial on beta estimates. Most companies obtained values for excess kurtosis which were significantly different from zero. The

values for skewness also showed figures that were significantly different from zero with the exception of nineteen companies.

A departure from the normality assumption suggested another choice of estimation technique. The robust technique used here was the TRLS at 5% and 10% levels. The t-test for the results suggests that these two procedures compared with the OLS betas were not statistically different from each other. There were substantial variations between the Scholes – Williams' betas and the Fowler-Rorke's betas. However, the t-test suggests that these differences were not statistically significant.

The results for the effect of thin trading was consistent with the conclusions of Dimson (1979) that most frequently traded stocks have upward biased betas and less traded stocks have downward biased OLS betas. However, not all stocks in the sample were consistent with this rule of thumb. Results also showed evidence of beta instability. This supports the literature that beta risk is not constant over time. Castagna and Matolcsy adjustment confirms Blume's evidence that individual stock betas have regression tendency towards the grand mean of unity. On the issue of seasonality, the different beta estimates obtain for the days of the week conforms to Draper and Paudyal findings that Ghana stock betas have the day of the week effect when using weekly observation.

The estimation beta is central to the implementation of the capital asset pricing model (CAPM) and the market model for both financial economists and practitioners. Jesev and Brailsford (1996) advocate that, it is well known that a variety of beta estimates can result for one stock depending on factors such as the calculation of returns, choice of market index, sample period and the length of estimation period. Also a further set

of considerations involve the assumptions and the interferences such as the problem of thin trading, market segmentation and the stability of beta.

6.2 RECOMMENDATIONS

- a) The Ghana Stock Exchange should consider having a second proxy for comparison. For example "Ghana Club 100" (G. C. 100).
- b) Investors (companies) should hedge using index derivative while considering, cost of capital and asset pricing theory
- c) Investors should trade in infrequently traded stocks, because beta risks are not constant overtime. That is to say that, they change overtime.

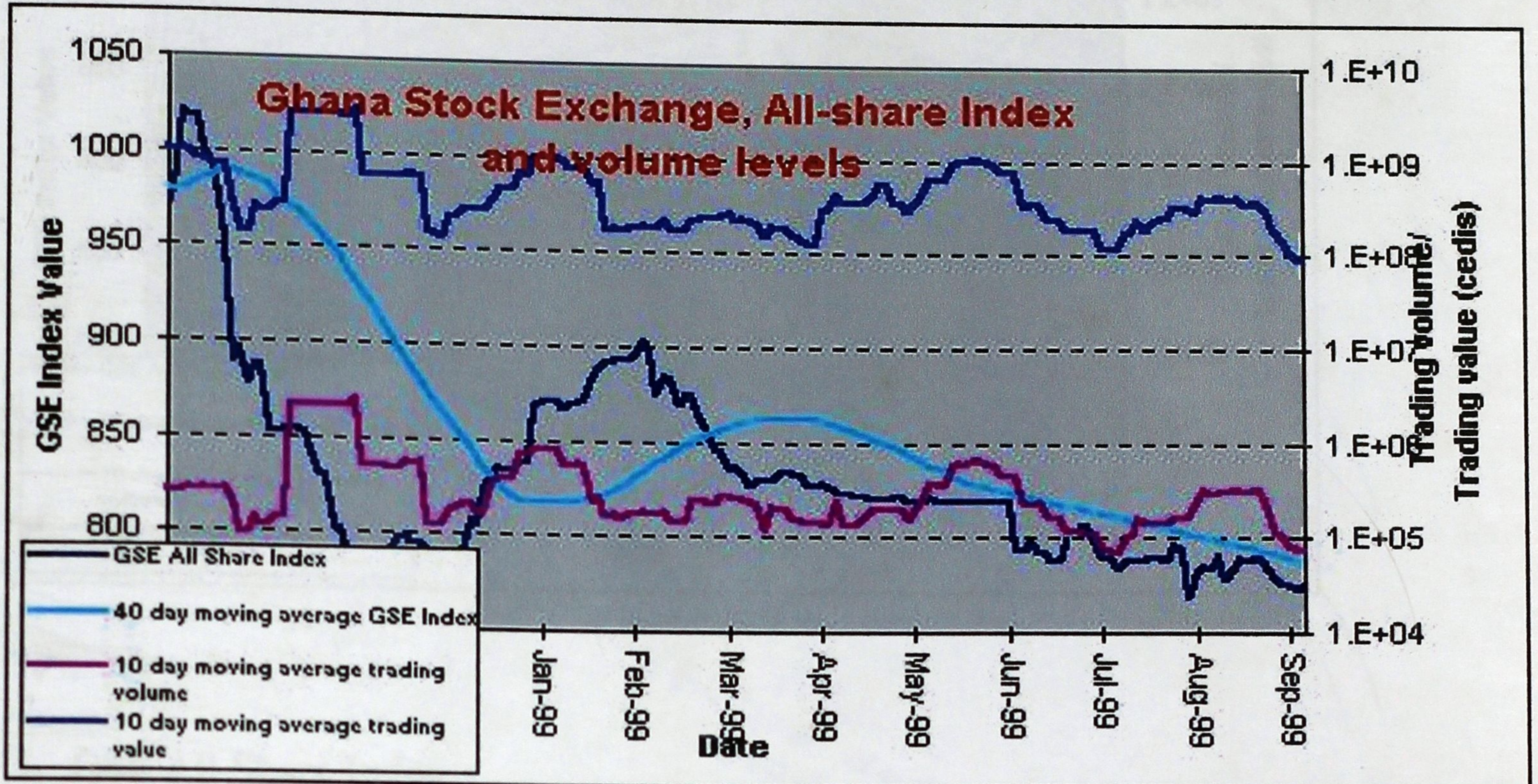
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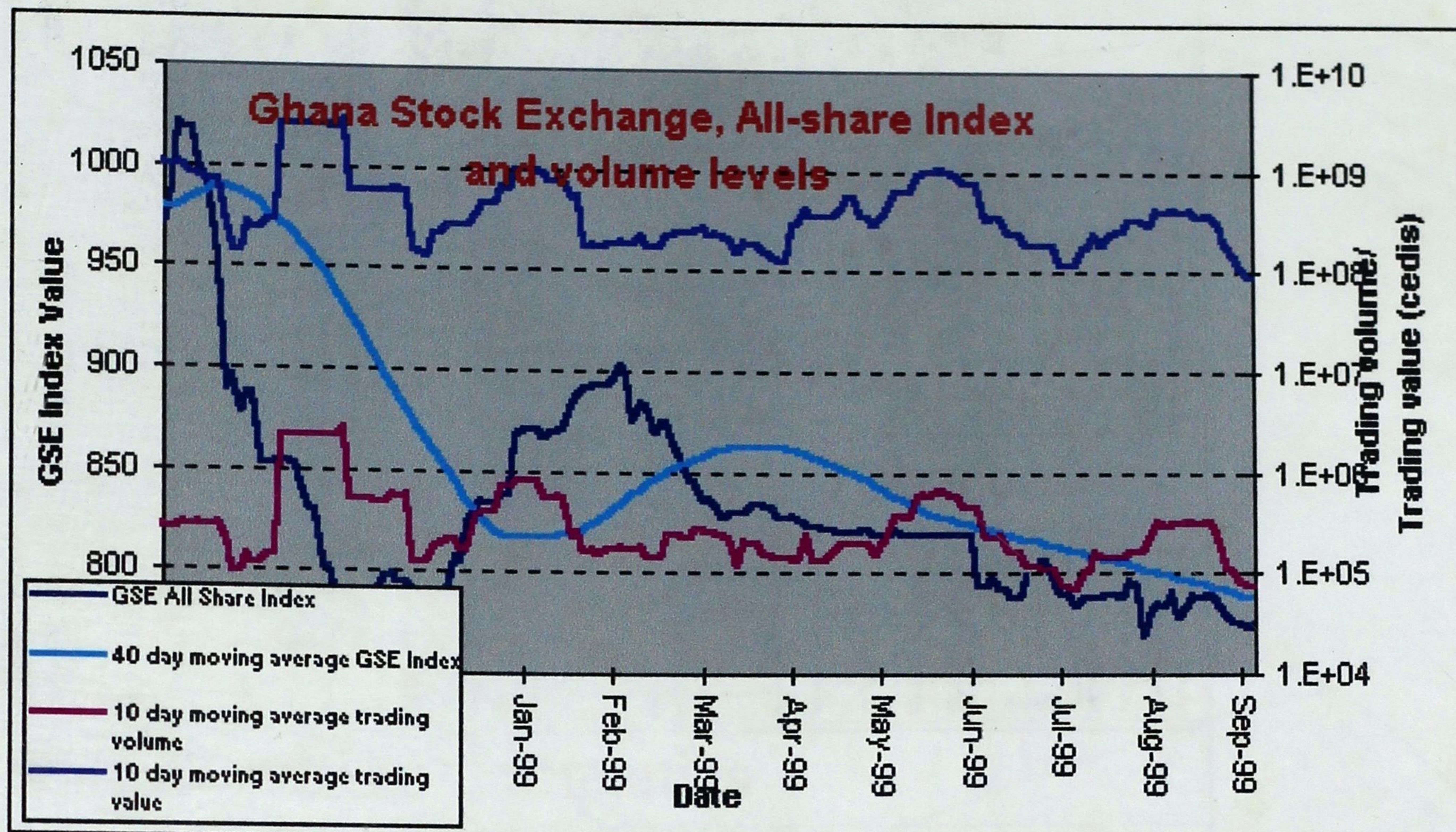
APPENDICES



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GSE All-Share Index

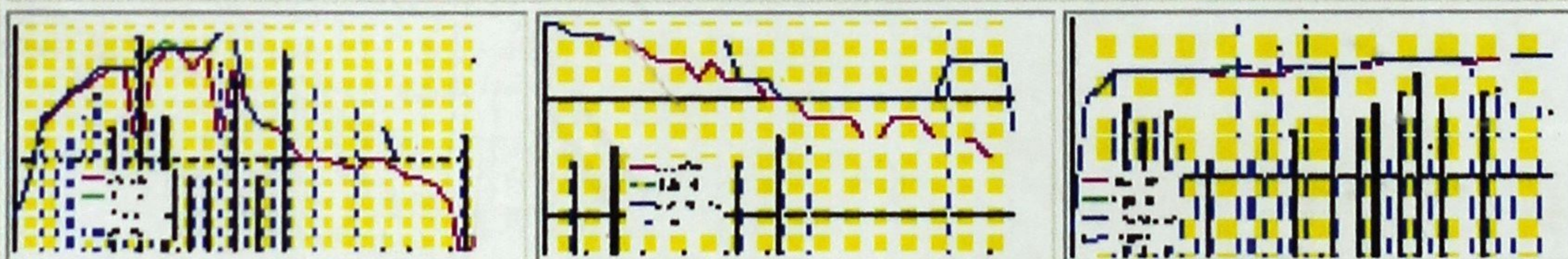
Closing Level	819.14	31 May 99
Previous close	819.14	28 May 99
12 month high	1201.08	6 May 98
12 month low	818.17	7 May 99
All-time high	1201.08	6 May 98
All-time low	55.49	17 May 91

Major movements 1999

Guinness Ghana Ltd	↑ 16.9%
Fan Milk Ltd	↑ 13.6%
Ghana Commercial Bank	↓ -23.1%
Accra Brewery Ltd	↓ -23.5%
SSB Ltd	↓ -26.0%

1.1.1 Share price performance charts

Banks



Breweries

