KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,

KUMASI

COLLEGE OF ARTS AND SOCIAL SCIENCES

DEPARTMENT OF ACCOUNTING AND FINANCE

SCHOOL OF BUSINESS

CONSTRUCTION OF OPTIMAL PORTFOLIOS OF SELECTED COMPANIES ON THE GHANA STOCK EXCHANGE

BY

MEVEMEO ERIC (Bachelor of Science)

A Thesis submitted to the Department of Accounting and Finance, Kwame Nkrumah University of Science and Technology in partial fulfillment of the requirement for the award of degree of

MASTER OF BUSINESS ADMINISTRATION

(FINANCE OPTION)

JULY, 2015

DECLARATION

I hereby declare that this submission is my own work towards the Degree of Masters of Business Administration and that to the best of my knowledge, it contains no material previously published by another person nor 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.

Mevemeo Eric	**…….**	**……**
PG 8361512	**Signature**	**Date**

Certified by:

Dr. Kwame Mireku	**…….**	**……**
Supervisor	**Signature**	**Date**

Certified by:

Dr. K. O. Appiah	**…….**	**……**
Head of Department	**Signature**	**Date**

DEDICATION

This work is dedicated to my beloved late father, Mr. Marinus John Mevemeo, who has been very dear to me throughout, and will continue to be as long as I live. You have in many ways enriched my life. Thank you for the thoughtfulness, the well wishes and the prayers you offered me while you were alive. I deeply appreciate you.

ACKNOWLEDGEMENT

I am greatly indebted to Dr. Kame Mireku my supervisor. He had been patient and kind in guiding me through the study. He also offered me constructive criticisms, encouragement and useful suggestions. I owe a great deal to him. I must mention that I have learnt a lot from him. My sincere thanks go to my friend Asher Wilson who helped me tremendously. I am also extremely grateful to my mothers, Makafui Dzokoto and Esinam Mevemeo as well as my brothers Elikplim Mevemeo and Elorm Mevemeo for their immense support.

TABLE OF CONTENTS

DECLARATION.....i
DEDICATION.....ii
ACKNOWLEDGEMENT iii
TABLE OF CONTENTS.....iv
LIST OF TABLES.....vi
LIST OF FIGURE.....vii
ABSTRACT.....ix

CHAPTER ONE ..... 1 INTRODUCTION 1

1.0 Background of the Study 1

1.1 Problem Statement 4

1.2 Objectives of the Study 5

1.3 Research Questions 5

1.4 Significance of the Study 5

1.5 Scope and Limitation of the Study 6

1.6 Organization of the Study 6

CHAPTER TWO ..... 8 LITERATURE REVIEW 8

2.0 Introduction 8

2.1 Risk and Return 8

2.1.1 Investor Attitude to Risk 10

2.2 Markowitz Portfolio Selection 12

2.3 Assumptions of the Markowitz Model 15

2.4 Criticism of the Markowitz Model and Alternate Models 16

2.5 Modern Portfolio Theory 25

2.6 Diversification 26

2.6.1 Diversification Strategies 27

CHAPTER THREE ..... 29 METHODOLOGY 29

3.0 Introduction 29

3.1 Research Design 29

3.2 Population of the Study 29

3.3 Sample Size and Sampling Technique 30

3.4 Data Collection 30

3.5 Data Analysis 30

3.5.1 MATLAB (Matrix Laboratory) 33

CHAPTER FOUR ..... 34 DATA ANALYSIS 34

4.0 Introduction 34

4.1.0 Mean Returns and Standard Deviations (Risk) Analysis 34

4.1.1 Finance Sector 34

4.1.2 Insurance Sector 35

4.1.3 Information and Communication Technology Sector 35

4.1.4 Mining Sector 36

4.1.5 Agricultural Sector 36

4.1.6 Distribution Sector 37

4.1.7 Food and Beverage Sector 37

4.1.8 Manufacturing Sector 38

4.2 Optimal Portfolios for Different Risk Preference 43

4.3 Diversification 46

4.4 Matlab Code Suitable for the Creation of Optimal Portfolios Using any Five Financial Assets 47

CHAPTER FIVE ..... 49 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS 49

5.0 Introduction 49

5.1 Summary of Findings 49

5.2 Conclusion 50

5.3 Recommendations 51

REFERENCES ..... 53 APPENDICES 56

LIST OF TABLES

Table 1: Estimated Standard Deviations (Risk) and Mean Returns 41

Table 2: Yearly Returns of the Five Selected Stocks 43

Table 3: Mean Returns and Risk of the Five Selected Stocks 43

Table 4: Correlation Matrix of the Five Selected Stocks 44

Table 5: Portfolio Risks, Portfolio Returns and Portfolio Weights 44

LIST OF FIGURE

Figure 1: Mean Returns of the 32 Selected Companies 39

Figure 2: Standard Deviations (Risk) of the 32 Selected Companies 40

Figure 3: The Efficient Frontier 44

ABSTRACT

A portfolio is a collection of financial assets consisting of investment tools such as stocks, bonds, gold, foreign exchange, asset backed securities, real estate certificates, bank deposits, etc. which are held by a person or group of persons, companies, governments etc. In Ghana, constructing optimal portfolios with standardized optimization still remains a myth. In this paper, we analyse the estimated mean returns and standard deviation of thirty-two (32) listed companies on the Ghana Stock Exchange and select five stocks to generate ten optimal portfolios utilising Matlab based on the Markowitz mean-variance analysis. Historical monthly stock prices and dividend per share from 2011 to 2013 were used. Historical monthly stock prices and dividend per share from 2007 to 2008 of the five selected stocks in addition to their data from 2011 to 2013 were used in generating the ten optimal portfolios.

The study revealed the best performing sector is the agriculture sector while the information and communication technology and mining sectors had negative mean returns for the years analysed. The study also revealed that, ideally, a risk-lover investor should invest all of his/her funds into buying the stocks of SCB. A risk-averse investor should invest 69.60%, 16.41%, 0.40% and 13.96% of his/her funds into buying stocks of FML, SCB, SPL and MLC correspondingly. While a risk-neutral investor is free to invest in any of the ten optimal portfolios.

CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Investment activity is essential to the promotion of economic well-being; it is one of the most important economic activities that individuals, businesses and governments undertake. The commitment of resources in anticipation that an affirmative rate of return will be achieved is known as investment (Mensah, 2008). Major considerations when investing include what to invest in, how much to invest and the level of risk an investor is prepared to bear in order to achieve his investment goals. People invest for different reasons. Some of the most important investment goals are – meeting liquidity needs – saving for a large expenditure and – retirement plans. There are many investments to choose from, they include fixed income securities, ordinary shares, preference shares, convertible securities, derivative securities, real estate etc.

Most investors prefer investing in the common stocks of companies since it has historically been shown to yield a higher rate of return compared with other investment options. In comparison with other investment opportunities; stocks are however riskier since in any case of liquidation, investors in common stocks will take delivery of their funds after investors in preference shares, bonds and creditors are taken care of. In the long run, common stocks on the average perform better than preference shares.

An investor who wishes to purchase shares in a company after its initial public offering can do so on a stock exchange. Stock exchanges are secondary markets where stocks are bought and sold. In modern times stock exchanges have become the financial bedrock of most societies helping companies raise capital; investors plan retirements and providing pension funds managers with steady revenues to pay retirees. There are many stock exchanges spread

throughout the world with most countries having at least one. Ghana Stock Exchange, New York Stock (NYSE), NASDAQ, AMEX and London Stock
Exchange are some of the major stock exchanges in the world

In July 1989 under the companies' code of 1963, the Ghana Stock Exchange was incorporated as a company limited by guarantee and it happens to be the major stock exchange in Ghana. Under the Stock Exchange Act of 1971 (Act 384), the Ghana Stock Exchange was recognized as a certified exchange in October 1990. In November 1990, the Exchange started trading. Different kinds of securities can be listed on the Exchange.

A suitable mix or a pool of financial assets such as bonds, gold certificates, stocks, warrants, options, bank deposits, real estate certificates; futures contracts etc. which are held by governments, companies or individual persons is known as a portfolio.

A calculable method for portfolio selection was initially offered by Harry M. Markowitz in his revolutionary work of portfolio construction in 1952 in his article "portfolio selection". A reasonable solution to the problem was obtained by developing a
mathematical framework for the problem. He developed the portfolio selection problem as a static mean variance optimization problem taking into consideration a single period economy. The standard deviation or variance was used as means of evaluating risk while mean was used as a measure of portfolio return. According to the Markowitz mean variance portfolio selection, the optimal portfolio selection carried out by maximizing the expected portfolio return for a certain level of variance or standard deviation of the portfolio or by minimizing the variance or standard deviation of the portfolio return for a certain level of anticipated portfolio return. Risk dispersion is the rudimentary purpose behind portfolio construction. The risk of the portfolio is lesser than that of a solitary asset because the returns

on the assets that make up the portfolio do not go in a similar course. The Markowitz portfolio archetypal thus is one that no additional diversification could reduce the portfolio's risk for a certain return anticipation (in turn, no extra anticipated return could be obtained devoid of a surge in the risk of the portfolio). In choosing portfolios, he suggested that investors must concentrate on choosing portfolios centred on their whole risk reward physiognomies rather than assembling portfolios out of securities that independently have eye-catching risk recompense features. Markowitz Efficient Frontier is defined by a set of entire portfolios of which anticipated returns get to the maximum given a certain level of risk. Consequently traditional portfolio management is premised on the rule of increasing the quantity of assets in a portfolio. This leads us to diversification.

Investing in a wide range of financial resources reduces non-systematic risk and this technique is known as diversification. One of the two broad methods used in decreasing investment risk in finance is diversification. Hedging is the other technique used. The concept of diversification is the age-old "don't place your entire eggs in one basket" (Fisher & Jordan, 1991). It allows investors to reduce company's specific risk. The Markowitz technique can be condensed as follows; one requires to:

- Estimate the expected return rates for every stock to be involved in the portfolio,
- Estimate the variance or standard deviation (risk) for every stock to be included in the stock,
- Estimate the covariance or correlation coefficients for the entire stocks, considering them as pairs.

Even though it is no secret that the Markowitz mean-variance model has empirical setbacks, it is nonetheless the most extensively used model in both academic and actual world applications (Fama, 2004).

Modern portfolio concept is a concept of finance that tries to make the most of portfolio anticipated return for a given quantity of portfolio risk, or to reduce risk for a given level of expected return, by prudently selecting the quantities of the several assets. Modern Portfolio Theory (**MPT**) suggests in what way normal investors can use mathematical methods to optimize their portfolios (Natalie, 2011). The elementary notions of the concept are Markowitz diversification, efficient frontier, capital asset pricing model, alpha and beta coefficients, Capital Market Line and the Securities Market Line.

Therefore based on the Markowitz mean-variance and modern portfolio theory, the risk of the selected stocks shall be estimated and with the help of Matlab, ten optimal portfolios will be generated out of five carefully selected stocks.

1.1 Problem Statement

Most investors and portfolio managers seek to optimally construct their stock portfolio on the Ghana Stock Exchange in order to satisfy their diverse investment aspirations.

However the problem invariably remains "which combination of sets of portfolio must he select for him to reap maximum return given a level of risk preference? Or conversely, which sets of portfolio would yield a minimum risk given a level of return?"Also how do investors estimate the risk and mean returns associated with the selected stocks?

1.2 Objectives of the Study

The chief objective of the study is to construct optimal portfolios from thirty two (32) selected listed companies on the Ghana Stock Exchange. The specific objectives are:

1. To ascertain the risk and mean returns associated with each of the selected stocks on the Ghana Stock exchange.

2. To derive optimal portfolios for investors with different risk preference levels with the help of Matlab.
3. To formulate a model suitable for the selection of any five financial asset portfolio.

1.3 Research Questions

The study seeks to answer the following questions:

1. What is the estimated risk and mean returns of each of the selected stocks on the Ghana Stock Exchange?
2. What is the appropriate optimal portfolio for different risk preferences?
3. What model is suitable for the selection of any asset portfolio on the Ghana Stock Exchange?

1.4 Significance of the Study

At the end of this study, readers and investors will be able to familiarize themselves on how to construct optimal portfolios on the Ghana Stock exchange based on the Markowitz mean-variance and modern portfolio theory with the help of Microsoft Excel and Matlab.

The study will also help investors appreciate the relation between risk and return. The study will inform investors that efficient diversification reduces risk.

1.5 Scope and Limitation of the Study

The scope of the study is estimating the risk of some selected companies on the Ghana Stock Exchange as well as determining appropriate optimal portfolios for different risk preference levels.

The limitations of the study are due to the fact that the researcher relied solely on secondary data. As a result the accuracy of the secondary data is beyond the control of the researcher. In addition, only selected companies on the Ghana Stock exchange were chosen because they are traded actively and information regarding such entities can easily be obtained. Also only three years data has been considered for the study due to time constraints.

1.6 Organization of the Study

The study is structured into five chapters as shown below:

Chapter one of the study covers the background of the study, the problem statement, objectives of the study, research questions and significance of the study. It also includes the scope and limitation of the study and the organization of the study. Chapter two reviewed existing literature relevant to the study.

Chapter three presents the modus operandi used to accomplish the research. This chapter covers the research design, population of the study, sample size and sampling technique used. It also presents the source and method of collecting data as well as the means used in data analysis.

Chapter four deal with data presentation, analysis and discussion of findings. Chapter five presents the summary of findings, conclusion and recommendations based on the analysis done in the prior chapter.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

A literature appraisal is an essential and in depth evaluation of previous research.

The goal of the study is to ascertain the risk (standard deviation) and mean returns of some selected companies listed on the Ghana Stock Exchange. Based on the Markowitz meanvariance approach, ten different optimal portfolios will be generated with the aid of Matlab. Essence of diversification will also be dealt with. As such, the literature review examines the risk and return and types of investor attitudes towards risk, Markowitz portfolio selection, diversification and other equally important areas.

2.1 Risk and Return

Risk is considered as a chief component in regards to the decision making procedure of both investors and corporations, so it is significant that the risk related to an investment could be measured. In order to make thorough investment choices, it is imperative to have the capacity to estimate the return and risk of several investment options (Mensah, 2008). Risk is the uncertainty that the anticipated return will be achieved or the possibility of loss, the uncertainty of the future. Most assets (including real and financial) that investors choose to invest in have some exposure to risk**.** The risk that these investors are confronted with can generally be separated into systematic risk and unsystematic risk.

Systematic risk is that constituent of risk that results from the issues that affect the entire market as such; variations in the country's economy or a variation in world energy situation; for example an increase in oil prices or political factors. Systematic risk can therefore be defined as the "variability of return on shares or portfolios related to changes in return on

the market as a whole" (Ibid, p. 103). Investors who hold a well-diversified portfolio are only opened to this kind of risk, as such would be compensated for bearing this risk. The systematic risk of a security is determined by its beta coefficient.

Unsystematic risk as defined by Van Horne and Wachowicz (2005, p. 103) is "the risk constituent that is distinctive to a specific company or industry, as such, it's liberated from economic, political and other factors that impacts all securities in a systematic manner". A typical example is the quality of management of a company. By efficient diversification, this type of risk can be totally eradicated; therefore it is irrelevant when considering the risk of a portfolio. The market does not provide extra compensation for bearing this type of risk.

Returns are the gains or losses from a security in a particular period and are usually quoted as a percentage. The relationship between return and risk as is often defined by the variance or standard deviation is an extensively studied relationship in the works of finance. In reference to the Portfolio Concept (Markowiz, 1952), investors need a higher return from the market portfolio than from the return on a risk free investment. Also according to Samuels et al. (1999), research in both the United Kingdom and the United States of America shows that investors in financial securities demand higher returns from risky investments in equities than from comparatively risk free government securities.

However, a lot of papers reported different relationships between risk and returns based on certain factors. LeBaron (1989) stated that a non-positive risk-return relationship can be a consequence of non-synchronous trading where the market is characterized by illiquidity

.

2.1.1 Investor Attitude to Risk

According to Watson and Head (2007) investor attitudes to risk can be categorized into three. Risk-loving, Risk-neutral and Risk-averse are the three investor attitudes to risk that were identified by them. Risk-loving is where the inclination is for a high return in exchange for a high level of risk. Risk-neutral is where the investor is apathetic to the level of risk encountered. Risk-averse is where the inclination is for low risk, low return investments. The attitude of an investor to different permutations of risk and return is mirrored by the figure of their utility curves (indifferent curves).

a. Risk Neutral

A person is risk neutral relative to an investment if the utility of the expected value of the investment is equal to the expected utility of the investment.

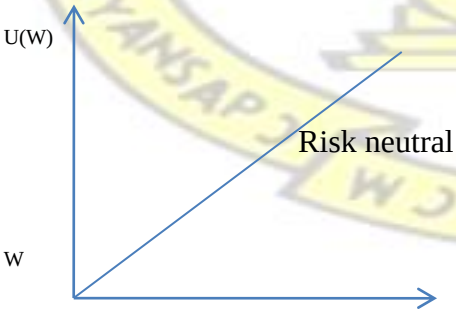
$U [PW_1 + (1-P)W_2]= PU(W_1) + (1-P)U(W_2)$

Such a person is only interested in expected values and is totally oblivious to risk. He is indifferent between investments.

Functions for Risk Neutral

The risk neutral person has a linear utility function of the form

$U(W) = \alpha + \beta W$



b. Risk Averse

A person is a risk averter (averse) relative to an investment if the utility of its expected value is greater than the expected value of its utility.

$U [PW_1 + (1-P)W_2] > PU(W_1) + (1-P)U(W_2)$

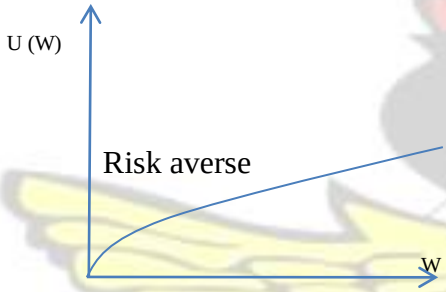
Such a person prefers a certain outcome to an uncertain one with the same expected value.

Functions for Risk Averse

The risk averse has a utility function of the form

$U(W) = \alpha + BW - \gamma W^2$

$$\frac{d^2U}{dW^2} < 0$$

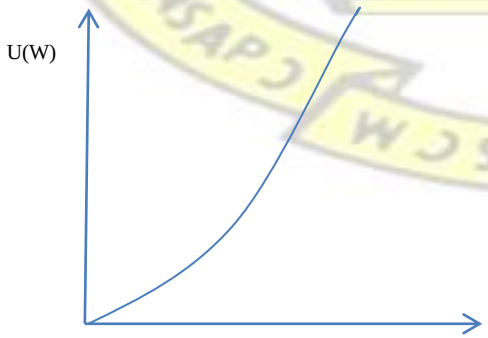


c. Risk Lover

A person is a risk lover relative to an investment if the utility of its expected value is less than the expected values of its utility.

$U [PW_1 + (1-P)W_2] < PU(W_1) + (1-P)U(W_2)$

He would always engage or take a fair bet or gamble.



Risk lover

Functions for Risk Lover

$$\frac{d^2U}{dW^2} > 0$$ It has a utility function of the form

$U(W) = \alpha + \beta W + \gamma W^2$

Therefore any rational investor will expose himself to higher risk given the possibility of higher returns.

2.2 Markowitz Portfolio Selection

Markowitz's ground-breaking study on portfolio optimization in March 1952 in an editorial titled, "portfolio selection" in the paper of finance afforded him to be called the father of modern portfolio theory. He was accordingly awarded the Nobel Prize for Economics in 1990 together with William Sharpe and Merton Miller. Preceding Markowitz study, investors concentrated on evaluating the risk and return of separate securities in creating portfolios. Typical investment policy was to recognize these securities that presented the finest chances for increase with the minimum risk and then create a portfolio from those securities. As a result of this recommendation, an investor could decide that, bank stocks offer worthy risk-return features, and therefore create a portfolio exclusively from them. Instinctively, it will remain inappropriate. Markowitz formalized this perception by proposing that, the worth of a security to an investor is best assessed by its mean, standard deviation/variance, and its correlation to other securities in the portfolio. This daring proposition by Markowitz resulted in overlooking a lot of info about the entity (its earning, dividend policy, capital structure, market and competitor) and computing a limited number of data. He suggested that investors should concentrate on choosing portfolio premised on their entire risk-return features in place of just creating portfolios from securities that every individual has attractive risk-return characteristic. In a nutshell investors must choose portfolio not individual securities.

He concluded that one of the main aims of investors, besides the maximization of the returns of their portfolio is to diversify away as much risk as probable. He maintained that investors choose assets in such a manner that the risk of their portfolio equals with their risk inclinations. In other words, he proposed that, persons who cannot tolerate risk will invest in asset with low risk, while individuals more contented with risk will take investments of

higher risk. The study also recommends that, the trade-off between risk and return is different for every investor. He derived the 'critical line algorithm' which recognizes all possible portfolios from a specified set of assets that minimizes risk for a certain return, and maximizes return for a given level of risk which is known as efficient frontier. To obtain the efficient frontier needs three variables (Markowitz 2000, p.4) namely; (a) the expected return of the asset. (b) the expected variance of the asset and (c) the cross-correlation between the asset categories. Primarily, the method of developing the critical line involved answering for corner portfolio alongside the line. The corner portfolios comprised of the maximum return portfolio, the minimum variance portfolio, and whichever number of portfolios in between. Computing power technology is now able to develop the magnitude of portfolios that constitutes the critical line, otherwise known as the efficient frontier. An investor who can bear more risk could select a portfolio on the higher point of the frontier, whereas a more risk averse investor would be more expected to pick a portfolio at the lowest point on the frontier. A portfolio way below the efficient frontier is thus inefficient, and therefore would need an alteration to the asset apportionment in order for the investor to get close or on the curve, known as strategic asset allocation (Statman, 2001, p.133). Brennan, Schwartz and Lagnado (1997) devised the term "Strategic Asset Allocation" (SAA) to designate optimal asset allocation rebalancing tactics in the face of varying investment chances. SAA portfolios are a blend of two portfolios. The first one is a short-term mean-variance efficient portfolio. It mirrors short-term or parochial concerns, while the second portfolio which Merton (1969, 1971, 1973) termed "inter-temporal hedging portfolio" reveals long-term vigorous hedging consideration.

One could create an enormous quantity of portfolios by coalescing securities and by changing proportions of investment amongst assets. Amongst the portfolio made, a number of them are effective, while several of them are also ineffective. The set of portfolios that

maximize expected return for changing level of risk or minimize risk for a varying level of expected return is known as efficient set. The investor will choose portfolio from these efficient portfolios. The optimal-risk portfolio is typically found to be anywhere in the mid of the curve, since as one goes higher up the curve he/she takes on comparably additional risk for a lower investment return. Nevertheless low risk/ low return portfolio are futile (when one moves down the curve), because he/she can accomplish an analogous return by investing in risk-free return assets such as government securities.

Markowitz formulated the portfolio problem as a select of the mean and variance of a portfolio of securities. He showed the central theorem of mean-variance portfolio concept; that is holding constant variance, maximize expected return, and holding constant expected return and minimized variance. Markowitz established the theory of portfolio select in an uncertain future. He computed the dissimilarity amongst the risk of portfolio assets taken independently and the whole risk of the portfolio. He proved that the portfolio risk came from the co-variances of the asset that constituted the portfolio. The marginal contribution of an asset to the portfolio return variance is consequently quantified by the co-variance between the security's return and the portfolio return, but not by the variance of the security itself. The total risk of a portfolio could be decomposed into systematic risk
(also known as the market risk, which cannot be eradicated, for example, interest rate, wage levels, inflation rate, and foreign exchange) and unsystematic risk (which could be eliminated through diversification) (Statman, 1987).

Although, it is usually correct that, when stocks are selected arbitrarily and combined in equivalent amounts into a portfolio Ferri (2002,p.186), the total risk declines as indicated above, Evans and Archer (1968) noticed that the risk decline consequence reduces quickly as the amount of shares increase. They observed that the financial advantages of

diversification are drained when a portfolio holds ten or more shares. Evans and Archers deduction has been quoted in several text books. For instance, Francis (1986) transcribed; "portfolio managers must not be overenthusiastic and spread their securities over several securities. The maximum benefit of diversification is achieved if ten or fifteen dissimilar securities are chosen for the portfolio. Further spreading of the portfolio's assets is superfluous diversification".

2.3 Assumptions of the Markowitz Model

The Markowitz model has the following assumptions: (1) that an investor is apprehensive with return distribution over a single period. (2) Investors try to maximize the expected return of total wealth. (3) All investors are risk-averse, i.e they will simply take a higher risk if they are rewarded for higher expected return. (4) Investors based their investment judgements on the expected return and risk. (5) All markets are perfectly effective. By a single period we mean that, investors make their portfolio decisions at the start of a period and then wait until the close of the period when the rate of return on their portfolio is realized. Also the investor cannot make any intermediate changes in the composition of his portfolio; and finally the investor makes his choice with the aim of maximizing expected utility of wealth at the end of the period (final wealth). The Markowitz approach is often described as a mean-variance method since; it simply takes those two parameters, mean return and variance of return into consideration to characterize the investor's portfolio. The expected return of the portfolio is quantified by the mean return, while the risk of the portfolio is measured by the variance. The variance facilitates simple modelling, and also is a good measure of risk under the supposition that returns are normally distributed. The concept established by Markowitz is also centred on maximizing the expected utility of the investor's terminal fortune. The utility function is defined according to the expected return and the standard deviation of the wealth. A lot of researches have empirically examined the

capability of the mean-variance analysis to maximize the expected utility of an investor. Though the conclusions of these researches have remained mixed, the broad problems found are correctness in determining the quality of mean-variance efficient solution and how well relying on only mean and variance would work in actual asset allocation problem.

2.4 Criticism of the Markowitz Model and Alternate Models

The mean-variance model of Markowitz has received serious criticism. For instance, Borch (1969) and Feldstein (1969) specified that, the mean variance framework simply points to optimal choices if utility functions are quadratic or investment returns are jointly elliptically (spherically) distributed. Consequently, Bawa and Luenberger (1977) suggested a portfolio technique known as the Mean-Lower Partial Moments (MLPM) portfolio framework founded on the theory of downside risk. This approach gained much popularity among investors in 1990s and seemed to have had superiority to the meanvariance model (Grootveld and Hallerbach, 1999). Even though it is no secret that the Markowitz mean-variance technique has empirical setbacks, it is nonetheless the most extensively used in both academic and real world application (Fama, 2004).

Grootveld and Hallerbach (1999) investigated the dissimilarities and likenesses amongst variance and downside risk measures, and issued an article which confirmed that, just a handful of members of the enormous family of downside risk measures own better theoretical properties in a return-risk structure than does variance. Furthermore, the application of mean-downside risk portfolio model is much more tiresome as there are no shortcuts in calculating portfolio risk (Grootveld and Hallerbach, 1999). Subsequently, the mean-variance technique has persisted to be the most robust portfolio framework in modern times. Several researchers such as Huang and Litzenberger(1988), Elton and Gruber (1995), Elliot and Kopp (1999), Jorion (2003), Ehrgolt*et al* (2004) and Ulucan (2007), have fruitfully continued to study and revised the mean-variance model.

The study by Ulucan (2007) examined the optimal holding period (investment horizon) for the classical mean-variance portfolio technique. He used the historical transaction record of Istanbul Stock Exchange ISE-100 index stock, and Athens Stock Exchange FTSE-40 index stocks data for empirical analysis. The outcome of the study showed that portfolio returns with varying holding period had a convex frame with an optimal holding period.

Hiroshi and Hiroaki (1991) demonstrated that portfolio optimization technique using the mean-variance absolute deviation risk function could eliminate most of the difficulties related to the classical Markowitz technique, whereas upholding its advantages over equilibrium techniques like CAPM, APT etc. In particular, the absolute deviation risk technique points to a linear instead of a quadratic program, so that a large scale optimization problem consisting of more than 1000 stocks may be answered on a real time basis. Numerical experiments using the historical data of NIKKE 1225 stocks showed that the model creates a portfolio fairly comparable to that of the Markowitz technique in a fraction of time necessary to answer the classical Markowitz approach.

Biggs and Kane (2009) dealt with the concern of buy-in thresholds in portfolio optimization using the Markowitz model. Their study suggests that optimal values of invested fraction calculation using for example, the classical minimum-risk problem could be disappointing in practice, as they lead to unrealistically small holding of certain assets. They therefore introduced discrete restrictions on each invested fraction, and used a blend of local and global optimizations to decide reasonable answers.

Paudel (2006) investigated the applications of the Markowitz and Sharpe models in the Nepalese Stock Exchange. His aim for the study was to test whether both models of portfolio selection offer any better investment alternatives to the Nepalese investors. With a sample

of thirty shares traded on the Nepalese stock market, the research found that, the use of those techniques offer superior alternatives for taking decision in the selection of optimal portfolios.

Yang and Hung (2010) suggest a generalized Markowitz portfolio investment technique via adding measures of skewness and peakness into the original Markowitz investment technique. With these third and fourth moments (i.eskewness and peakness) in the objective function, they found that the magnitude of risk and shapes of the efficient frontier differ from that of the classical model of Markowitz; and hence the original work of Markowitz can be seen as special case of the generalized model.

Plessis and Ward (2009) endeavoured to relate the Markowitz concept to the Johannesburg Security Exchange to determine whether an optimal portfolio can be recognized and used as an efficacious trading norm. In their work, weekly data covering eleven years on the top forty JSE corporations were analyzed to create Markowitz mean variance optimized portfolios using ex-ante data. The optimal portfolio was then chosen and rebalanced periodically, and the returns related to JSE ALSI 40 index. The research established that the trading tactic considerably outclassed the market in the period under appraisal.

Mwambi and Mwamba (2010) also investigated an alternate investment tactic to portfolio optimization technique in the frame of the mean variance portfolio selection technique. To distinguish it from the universally applied mean variance technique of Markowitz, which is created on the hypothesis that returns are normally distributed, their technique makes two suppositions; namely, that asset prices follow a geometric Brownian motion, and also assets prices are log-normally distributed (i.e continuously compounded returns are normally distributed). The model was then applied to five randomly selected stocks from JSE and

compared to the Markowitz model. It was observed that while the Markowitz model is static one period plan (buy and hold) and has a fixed time horizon, the log-normal plan was vigorous and can be applied to any rebalancing period such as a year, month, week or a day. They however opined that the classical Markowitz approach was still relevant to the JSE.

Maharakkhaka (2011) evaluated the performance of the mean variance effective estimation to maximize expected utility. Supposing that there are three classes of asset in the portfolio, namely; Security Exchange of Thailand (SET) Index, Thai investment grade corporate bond Index, and Thai government Treasury bill, he used monthly returns of these assets to compare maximum expected utility of the mean variance efficient portfolio to maximum expected utility derived from direct optimization. The results indicate that, though selecting the portfolio on the assumption of the mean variance principles does not result in maximum expected utility, but the mean variance model is still relevant to Thailand Security Market. The performance of the mean variance approximation revealed in the study was not too dissimilar from choosing guileless portfolio where investors simply put equivalent quantity of investment on each asset in their portfolio. Additionally, investors with several utility functions are found to necessitate momentous optimization premium to bring up their welfare to the level attained by holding expected utility maximization portfolio.

Bai, Liu and Wong (2007) demonstrated that, the so called departure of the mean variance optimization model from its theoretical value is a natural phenomenon and the expected optimal return is always bigger than its theoretical parameter. Subsequently, they developed a new bootstrap estimator for the optimal return and its asset allocation, and proved that those bootstrap estimates are steady with their counterpart parameters. Their study approves the reliability; indicating the essence of the portfolio analysis problem which was adequately

captured by their proposed estimates. This greatly enhances the Markowitz mean-variance optimization model as being practically useful.

The next is Tobin (1958) whose model was also based on the Markowitz's mean variance approach which led to the identification of a tangency portfolio, latter known as the market portfolio, along the efficient frontier (see e.g Fama and French, 2004, p.4). Tobin's model had a key assumption that cash was riskless asset (see Tobin, 1958, p.67). Hence when cash is added to the portfolio, the efficient frontier becomes a straight line. Assuming that investors are only concerned with the rate of return and the risk, an optimal portfolio would be somewhere along the straight line (see Campbell and Viceira, 2002, p.3). The point at which the straight line touches the efficient frontier is known as the 'tangency portfolio', and it is the optimal mix of risky assets and riskless asset. Tobin's model is also referred to as the separation theorem, since the allocation of resources amongst risky asset is seen as a separate decision to the level of riskless asset with the portfolio.

However there have been serious criticisms of the Tobin's model, which are largely centred on the assumptions (see e.g Campbell and Viceira, 2002). It was observed that cash was not riskless in the long-run, because interest rate and inflation provide a return variance on cash. This variability indicates risk as quantified by the standard deviation. This would indicate that in the long-run, the investor would choose an optimal portfolio premised on the mean-variance model principles, which could have asset allocation considerably different from the short-run investors 'tangency portfolio'.

Bower and Wentz (2005) also investigated the performance and the comparisons between the Markowitz mean variance model and Mean Absolute Deviation (MAD) model in portfolio optimization. As noted earlier, the computation of the Markowitz mean- variance

approach calls for the use of covariance matrix, which becomes difficult to estimate for large portfolio. Konno and Yamazaki (1992) proposes alternative approach to the meanvariance model called the MAD model, which does not assume normality of the stock return as does the mean-variance of Markowitz. The MAD however minimizes a measure of risk as does the mean-variance, where the measure in this case is the Mean Absolute

Deviation. MAD is easier to compute relative to Markowitz's mean-variance model because it eliminates the need for covariance matrix estimation. Bower and Wentz randomly selected 5 stocks and six-month bond from the S&P 500 for the study. Data covering six-month period were used for both models with a series of parametric and nonparametric test done on the data. They found that neither the mean-variance nor the mean absolute deviation model produced returns that are better than the other. They realized no statistically significant difference between the returns using both methods at the 5% level, but however observed some statistically significant difference at the 10% level. They concluded that with small portfolios, MV is the less complicated approach to use.

However, since both returns using either method is not significantly different, they recommend in general that, it is acceptable to substitute MAD calculations for the MV method for small scale portfolios like 30 stocks. Meanwhile, they maintained that as the size of the portfolio increases, MAD model becomes increasing quicker to use. It is widely accepted that diversified portfolios results in best return while mitigating the risk level, both in the case of stocks and when stocks and bonds are combined (Markowitz, 2000). However, there has been little research into whether the same case applies for pure bond portfolios. Korn and Koziol (2006), Yawitz*et al*., (1976) indicate that diversification benefits exist in the case of pure bond portfolio. Ambrozaite and Sondergaard (2010) studied the Danish mortgage bond market to determine the highest possible return on bond investment for a unit of risk taken (i.e maximizing the Sharpe ratio). Data taken from the Danish bond market was analyzed with the Markowitz mean-variance approach. Sharpe ratios of individual

bonds were compared to portfolios of various types of bond, including callable, non-callable and floating rate bonds. In addition the effect of short sales of bonds within the portfolio was assessed. They found that, combining the three types of bonds- callable, non-callable and the floating rate –in the portfolio yielded higher Sharpe ratios than portfolios consisting of only one or two distinct types of bond. They further concluded that investing in a portfolio of multiple bonds rather than individual bond dramatically reduces the risk (variance) while maintaining return. The diversification benefits were even more pronounced when short-selling of bonds was allowed in the
portfolio.

Cesarone, Scozzari and Tardella (2009) also extended the original model of Markowitz by incorporating some real-world investment constraints into the model. Investment restrictions such as transaction cost, minimum lots dimensions, complexity of administration or strategy of asset managing companies, were termed as quality and cardinality constraints in the new model also known as the Limited Asset Markowitz (LAM) model which they proposed. The addition of these constraints results to a mixed integer quadratic programming problem, which is solve by reformulation of the model as a standard quadratic program. They tested their method with a five data set which consist of covariance matrices and expected return vectors of sizes ranging from tirty-one to two hundred and twenty five built from weekly price data covering a 5 year period for the Hang Seng, DAX, FTSE 100,S&P100, and Nikkei capital market indices. On these data sets, they were able to assess out-of-sample data, the performance of the portfolios obtained from the LAM model, and compared to the classical Markowitz MV portfolio selection, and the market index. Their comparison reveals that, solution obtained with the LAM was a better improvement to the Markowitz model when some real-world
investment constraints were introduced.

Levy and Ritou (2001) also investigated the properties of mean-variance efficient portfolios when the number of securities is large. They analytically and empirically demonstrated that the amount of securities held short converges to 50% as the quantity of assets increases, and the investment quantities are great, with numerous assets held in great positions, the cost of the no-short selling constraint increase dramatically with the number of asset. They also found that, for hundred securities, the Sharpe ratio could be more than doubled with the elimination of this constraint. The outcomes look to be essential properties of mean-variance efficient portfolios in big market.

In a comparable research of the Markowitz technique and Sharpe's technique, AffleckGraves and Money (1976) identified fascinating link among the two techniques. Their research used the expected index portfolio return and standard deviations, and realized that the result attained with the Sharpe's technique turned out to be gradually better with each index that was added. It also noted that whenever extra portfolios are added to the point that every stock was its peculiar portfolios, the technique mimics the Markowitz technique. Once more, they realized that if very low upper boundaries (in terms of percentage holding of whichever one stock) were forced on Markowitz technique, the single-index technique was a close approximation of the optimal portfolio. The research also found that Markowitz model naturally limits the maximum weight invested in any one share to about forty percent (if no upper boundaries were forced) and has in the expanse of six stocks in the efficient portfolio which they believed offered it a usual diversification. Markowitz model in its simplest form states that a portfolio that will give a minimum variance for a target anticipated return can be unambiguously chosen from the pool of assets. In other words, for each possible anticipated portfolio return, there is a distinctive portfolio of assets that will give the necessary return at a minimum variance.

In conclusion, mean-variance optimization has under the banner of modern portfolio theory (see for example, Rudd and Clasing 1982), gained widespread acceptance as a practical tool for portfolio construction. This has occurred over the last decade primarily as a result of the technological advances made in estimating covariance of portfolio return. Many investment advisory firms and pension plan sponsors (and their consultants) today routinely compute mean variance efficient portfolios as part of the portfolio allocation process. Specific applications include asset allocation (allocation across the broad asset classes such as stock and bonds), multiple money managers decisions (allocation across money manager with different strategies and objectives), index matching (finding a portfolio whose returns will closely track those of a predetermined index such as the S&P 500), and active portfolio management (optimizing risk-return trade-off assuming superior judgment).

2.5 Modern Portfolio Theory

A concept of investment that attempts to maximize return and minimize risk by prudently selecting diverse assets is known as Modern Portfolio Theory (MPT). Areas such as behavioural economics in contemporary times have challenged the elementary assumptions of MPT even though it is extensively used in the financial industry.

It is a mathematical formulation of the theory of diversification in investing, with the goal of choosing a pool of investment assets that has collectively lesser risk than any singular asset. In theory this is conceivable since dissimilar kinds of assets often alter in worth in differing ways. For instance, when the prices in the stock market drop, the prices in the bond market often rise, and vice versa. Therefore a pool of both kinds of assets could have lower overall risk than whichever separately.

In principle, MPT models an asset's return as a normally distributed random variable, defines risk as the standard deviation of return, and models a portfolio as a weighted combination of assets so that the return of a portfolio is the weighted combination of the assets' returns. MPT tries to reduce the overall variance of the portfolio by selecting dissimilar assets whose returns are not correlated. MPT furthermore presumes that investors are normal and the market is efficient.

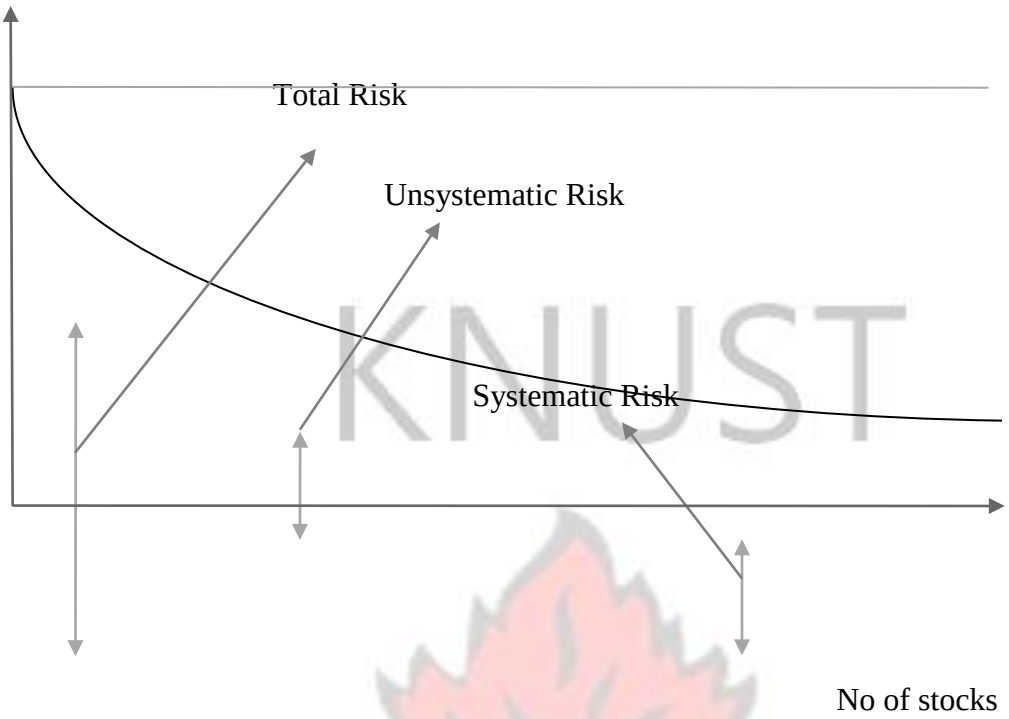
Assets that make up the investment portfolio must not be chosen individually; this is the central theory in MPT. It is vital to study how every asset changes in price comparative to how each other asset in the portfolio changes in price.

Assets with higher returns are generally considered to be riskier. MPT defines how to choose a portfolio with the utmost probable return for a certain quantity of risk. Investing is a trade-off between risk and return or for a certain return. It expounds on how to choose a portfolio with the least probable risk.

2.6 Diversification

A risk management technique in finance known as diversification can be achieved by investing in a wide range of securities within a portfolio. This technique aims at reducing risk as a result of one spreading his investment across many assets. Consequently the fluctuations of a solitary security within the diverse portfolio will have less impact on the diverse portfolio as such diversification reduces risk from any one investment.

Standard Deviation



Owing to business specific events, the worth of an investment would fluctuate if a solitary stock of investment or portfolio is held. On the other hand in holding a diverse large portfolio, the worth of some the stocks may possibly increase while others' value could decline. As a result, the net effect on the whole worth of the portfolio would be moderately less since the positive and negative effects would annul each other out. Consequently by holding a portfolio which is a technique known as diversification, some of the variability associated with individual assets is eliminated. Happenings both positive and negative tend to wash out once assets are combined into a portfolio. Therefore through diversification, a reasonably large portfolio could have its entire unsystematic risk eliminated.

A portfolio containing two stocks is the simplest to consider. The degree to which the unsystematic risk in a two stock portfolio will be eliminated or reduced depends on the correlation between the two assets that constitutes the portfolio. Therefore a statistical measure of the association among any two sets of numbers in place of data is known as correlation. Correlation ranges between negative one and positive one and measures the

extent to which the several assets in a portfolio could be projected to accomplish in a comparable manner or not. It is imperative to note that in order to have a diversified portfolio, the assets selected to be involved in the portfolio should not have a perfect correlation or a correlation of one. If the correlation between two assets is equal to one (1) then it means that no unsystematic risk can be diversified away. On the other hand if the correlation between two assets is negative one (-1) then it means that all unsystematic risk will be diversified away. However if the correlation between the two assets is zero (0) then no correlation exist between the two assets. Perfectly positive or negative correlations between two assets returns are unusual. Most security returns are positively correlated. Nonetheless, when the correlation between two assets is less than perfectly positive, risk reduction can be attained via diversification.

2.6.1 Diversification Strategies

In asset allocation, diversification is the essential principle. A less volatile and less risky portfolios are the results of combining assets with varying correlations and this makes up the entire Modern Portfolio Theory.

Diversification could be enhanced through these tactics:

a. **Spread the portfolio amongst several investment tools**, such as bonds, cash, stocks, mutual funds and so on.
b. **Vary the risk in the securities**. By investing in different mutual funds such as growth funds, index funds, balanced funds, large cap and small cap funds, such a portfolio is diversified. A huge loss in one investment is offset by gains in others because the portfolio contains investments with varied risk levels.
c. **Vary your securities by industry, or by geography**. Industry or location specific risk will be reduced through this process. Investing in a combination of international and local funds

is a practical application of this technique. By selecting funds in numerous countries, happenings in whichever one country's economy have less impact on the whole portfolio.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

The methodology describes the research design and population of the study. It also describes the sampling technique and sample size used. Data collection and data analysis are also covered under the methodology.

3.1 Research Design

The study adopted a descripto-explanatory research design; a mixture of both descriptive and explanatory research design. Descriptive research tries to find an accurate description of observations of a phenomenon while in explanatory research the importance is on learning about circumstances in order to explicate the relationship amongst the variables.

Quantitative data on selected companies on the Ghana Stock Exchange between the years 2011-2013 were analysed to determine their monthly returns, yearly returns as well as the mean returns. The standard deviations spanning the entire duration was also estimated. This was made possible with the help of Microsoft excel. Matlab was used in generating the different portfolios for different risk preference levels.

3.2 Population of the Study

Population refers to the total number of people in a particular area, organization or industry from which the sample would be selected. The population of the study was thirty – four (34) companies listed on the Ghana Stock Exchange.

3.3 Sample Size and Sampling Technique

A sample is a portion of the population selected for analysis. Out of the thirty-four (34) companies listed on the Ghana stock Exchange, thirty-two (32) were selected for the analysis. Five (5) out of the thirty-two (32) were used for the construction of optimal portfolios for different risk preference levels. For the purposes of this study, a purposive sampling technique was used. According to Trochim (2008) a researcher using the purposive sampling method is likely to overweight subgroups in the population that are more readily available.

A list of the sampled companies and their trading names as represented at the Ghana Stock Exchange can be found in appendix one.

3.4 Data Collection

Secondary data which are data that already exist are the data that the researcher relied on. The secondary data was collected from historical trading results of selected companies on the Ghana Stock Exchange. The information comprised of the month end prices of the selected companies as well as the dividend paid over a three year period (20112013).However the month end stock prices and dividend per share for the five selected stocks included the years 2007 and 2008 in addition to the 2011, 2012 and 2013 data.

3.5 Data Analysis

Prior to the analysis, the monthly returns, the yearly returns and mean returns were determined. The standard deviation otherwise known as the risk was also estimated. The monthly expected returns were computed using the formula below:

$$R_i = \frac{(P_i - P_{i-1}) + D}{P_{i-1}}$$

Where:

R_i= the expected returns of the company P_i

= the current share price of the company

P_{i-1} = the previous share price of the company D =

the dividend of the company for the previous year i =

1, 2, 3...n Months

The mean return was also calculated using Microsoft Excel based on the formula below:

$$\bar{R} = \frac{\sum_{i=1}^{n} R_i}{n}$$

Where:

$\bar{R}$ = the mean return R_i

= the yearly returns n =

the number of years

Lastly the standard deviation (risk) was computed using Microsoft Excel based on the formula below:

Standard deviation = $\sqrt{\frac{\sum_{i=1}^{n}(R_i - R)^2}{n}}$

Where:

$\bar{R}$ = the mean return R_i

= the yearly return n =

the number of years

The correlation and covariance of the five carefully selected stocks were also determined with the aid of Microsoft Excel and Matlab. The ten optimal portfolios and the efficient frontier graph were generated based on the Matlab code below:

```
>>returns = [returns of the five selected stocks];

>>STDs = [standard deviations of the five selected stocks];

>>correlations =   [correlations of the five selected stocks];

>>covariances = corr2cov(STDs , correlations);

>>portopt (returns ,covariances , 10)

>>weights = exprnd (1,1000,5);

>>total = sum (weights , 2);

>>total = total (:,ones (5,1));

>>weights = weights./total;

>> [portRisk ,portReturn] = portstats (returns , covariances , weights);

>> hold on

>>plot(portRisk , portReturn , '.r')

>>title('Mean Variance Efficient Frontier and Random Portfolios')

>> [PortRisk, PortReturn, PortWts] = frontcon(returns, covariances, 10)

>> hold off
```

All these were carried out before any table presentations were made. The purpose of using tables was to consolidate and summarize the data set so that it became easier to read and understand.

The relevant data for the construction of the optimal portfolio using the Matlab were sorted and categorized to make for easy analysis. Thereafter the researcher interpreted and summarized the information. This was done in order to draw meaningful conclusions from the data.

3.5.1 Matlab (Matrix Laboratory)

Matlab is a multi-paradigm numerical computing environment and fourth generation programing language. Matlab allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interface, and interfacing with programs written in other languages, including C, C++, Java, Fortran and Python.

In 2004, Matlab had around one million users across industry and academia. Matlab is extensively used in academic and research institutions as well as industrial enterprises.

CHAPTER FOUR

DATA ANALYSIS

4.0 Introduction

Data used in this study were obtained from the Ghana Stock Exchange. The three year period data period spanning from 2011 to 2013 comprise of the stock prices and dividend per share. Based on these data and with the help of Microsoft Excel, the standard deviation (risk) and mean returns of the thirty-two (32) selected stocks were estimated. The correlations between the five carefully selected stocks were also determined using Microsoft Excel. With the aid of Matlab, ten optimal portfolios were generated from the five stocks.

4.1.0 Mean Returns and Standard Deviations (Risk) Analysis

4.1.1 Finance Sector

The finance sector comprises mainly the banks listed on the Ghana Stock Exchange. The mean returns and risks of eight banks were estimated. The best performing company in terms of mean return is the Standard Chartered Bank with a mean return of about eleven percent (11.4336%). CAL Bank Limited was second with a mean return of about nine percent (9.3077%). Ecobank Ghana Limited had a mean return of about six percent (6.4562%). The worst performance in terms of mean return was achieved by Trust Bank Gambia Limited which had a negative mean return of about one percent (-0.8931%).With the exception of Trust Bank Gambia Limited, the rest of the companies in this sector had positive mean returns.

Standard Chartered Bank is the most risky company to invest in with a risk estimation of about seven percent (7.2140%). However Ecobank Ghana Limited was the second most risky company to invest in with a risk estimation of about six percent (5.5678%). CAL Bank Limited came in third with a risk estimation of about five percent (5.4046%). The least most

risk company to invest in is the UT Bank Limited with a risk estimation of about one percent (0.5927%).

Therefore an average sector mean return of 5.6728%means that for every one (1) Ghana cedi that you invest in this sector; your expected mean return will be GH₵ 0.057. The uncertainty that the anticipated average sector mean return will be achieved or not is 3.7283%.

4.1.2 Insurance Sector

The Insurance sector is made up of Enterprise Group Limited and SIC Insurance Company Limited. Enterprise Group Limited is the most risky and also had the higher mean return. It has a mean return of about eight percent (8.0493%) and a risk estimation of about four percent (3.8041%). SIC Insurance Company Limited had a mean return of about three percent (2.9983%) and a risk estimation of about one percent (0.7171%).

Therefore an average sector mean return of 5.5238% means that for every one (1) Ghana cedi that you invest in this sector; your expected mean return will be GH₵ 0.055. The uncertainty that the anticipated average sector mean return will be achieved or not is 2.2606%.

4.1.3 Information and Communication Technology Sector

Clydestone (Ghana) Limited and Transactions Solutions (Ghana) Limited make up this sector. Interestingly both companies had negative mean returns. Clydestone had a negative mean return of about one percent (1.4153%) and Transactions had a negative mean return of about two percent (2.1098%). However Clydestone is the riskier company to invest in with an estimated risk of about two percent (2.0016%).

Consequently an average sector mean return of -1.7626% means that for every one (1) Ghana cedi that you invest in this sector; you will lose GH₵ 0.018. The uncertainty that the anticipated average sector mean return (loss) will be achieved or not is 1.1873%

4.1.4 Mining Sector

Golden Star Resources Limited is the riskier company to invest in with an estimated risk of about two percent (2.2864%).However AngloGold Ashanti Limited had an estimated mean return of about one percent (0.8028%) while Golden Star had a negative mean return of about two percent (-1.6167%).

An average sector mean return of -0.4070% means that for every one (1) Ghana cedi that you invest in this sector; you will lose GH₵ 0.0041. The uncertainty that the anticipated average sector mean return (loss) will be achieved or not is1.5826%.

4.1.5 Agricultural Sector

Benso Oil Palm Plantation is the only company under this sector. It had an estimated mean return of about nine percent (8.7124%) and a risk estimation of about two percent (2.3021%).

Therefore mean return of 8.7124% means that for every one (1) Ghana cedi that you invest in this sector; your expected return will be GH₵ 0.087. The uncertainty that the anticipated mean return will be achieved or not is2.3021%.

4.1.6 Distribution Sector

Mechanical Lloyd Company Limited is the most risky company to invest in this sector yet offered the highest mean return. It had a mean return of about six percent (6.3266%) and a

risk estimation of about four percent (3.6062%). Total Petroleum Ghana Limited also had a good mean return of about six percent (6.3266%). Produce Buying Company Limited was the least risky company in this sector with a risk estimation of about two percent (1.8521%) with a mean return of about four percent (4.2326%). The rest of the companies under this sector generally performed well compared to the other sectors.

An average sector mean return of 5.7786% means that for every one (1) Ghana cedi that you invest in this sector; your expected mean return will be GH₵ 0.058. The uncertainty that the anticipated average sector mean return will be achieved or not is2.4863%.

4.1.7 Food and Beverage Sector

There are three companies under this sector. Fan Milk Limited had the highest mean return yet was the least risky company to invest in. It had a mean return of about five percent (5.0295%) and a risk estimation of about one percent (0.8768%). The most risky company to invest in is the Cocoa Processing Company Limited with a risk estimation of about four percent (3.6454%) and a mean return of about three percent (3.2407%).

An average sector mean return of 4.4285% means that for every one (1) Ghana cedi that you invest in this sector; your expected mean return will be GH¢ 0.044. The uncertainty that the anticipated average sector mean return will be achieved or not is 2.1781%.

4.1.8 Manufacturing Sector

The manufacturing sector is the largest sector in terms of the number of companies. There are ten companies under this sector. Starwin Products Limited had the highest mean return and it is also the most risky company to invest in. It had a mean return of about fourteen percent (13.5185%) and a risk estimation of about nineteen percent (19.3547%). PZ

Cussons Ghana Limited also performed well with a mean return of about eight percent (8.3169%) and a risk estimation of about eleven percent (11.1117%).

Four companies namely African Champion Limited, Aluworks Limited, Pioneer Kitchenware Limited and Golden Web Limited had negative mean returns.

An average sector mean return of 2.8075% means that for every one (1) Ghana cedi that you invest in this sector; your expected mean return will be GH¢ 0.028. The uncertainty that the anticipated average sector mean return will be achieved or not is 4.0633%.

Below are the summary of the mean returns and standard deviations (risk) of the thirty two (32) selected companies presented in graphs and table.

Figure 1: Mean Returns of the 32 Selected Companies

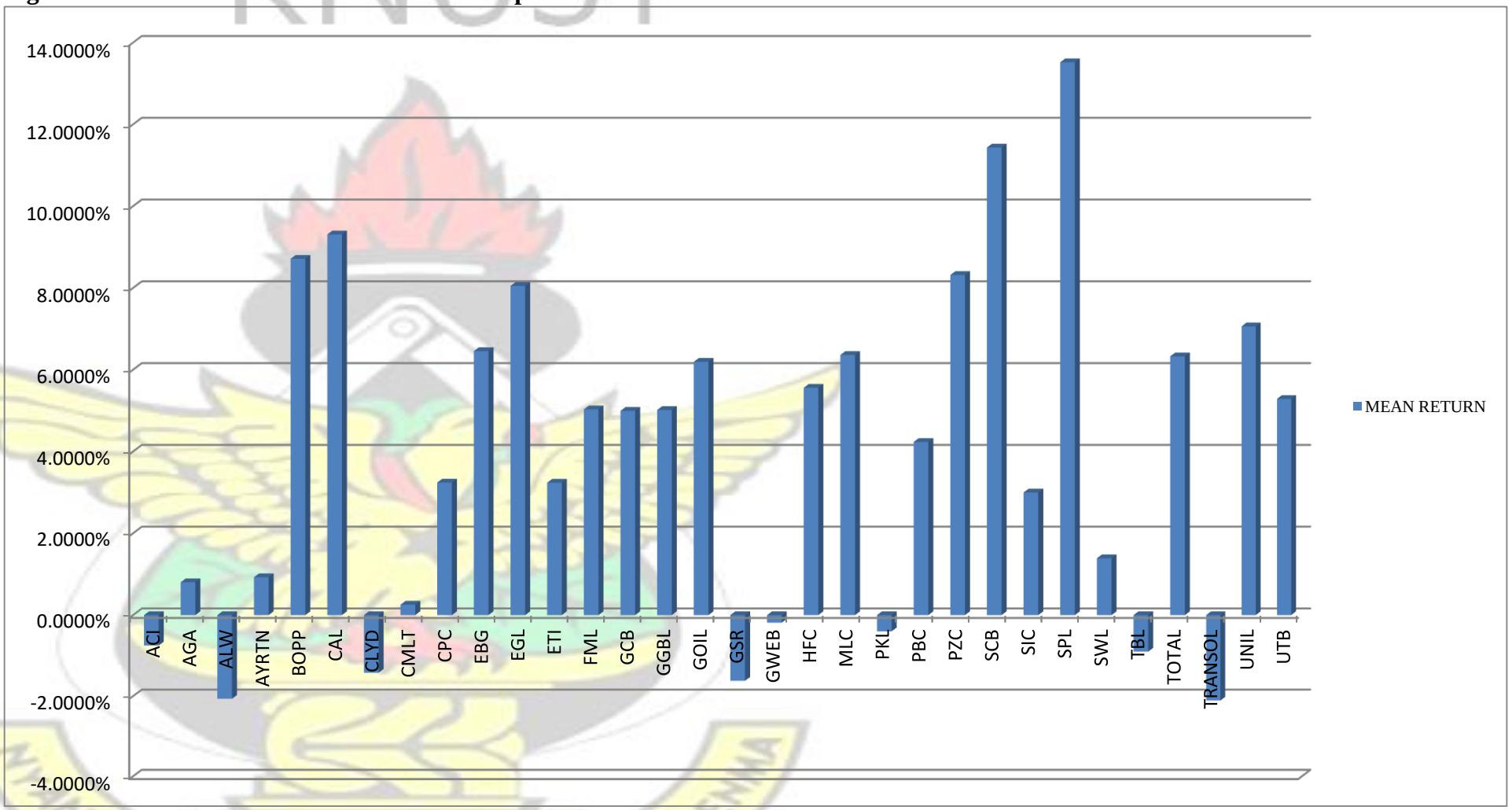


Figure 2: Standard Deviations (Risk) of the 32 Selected Companies

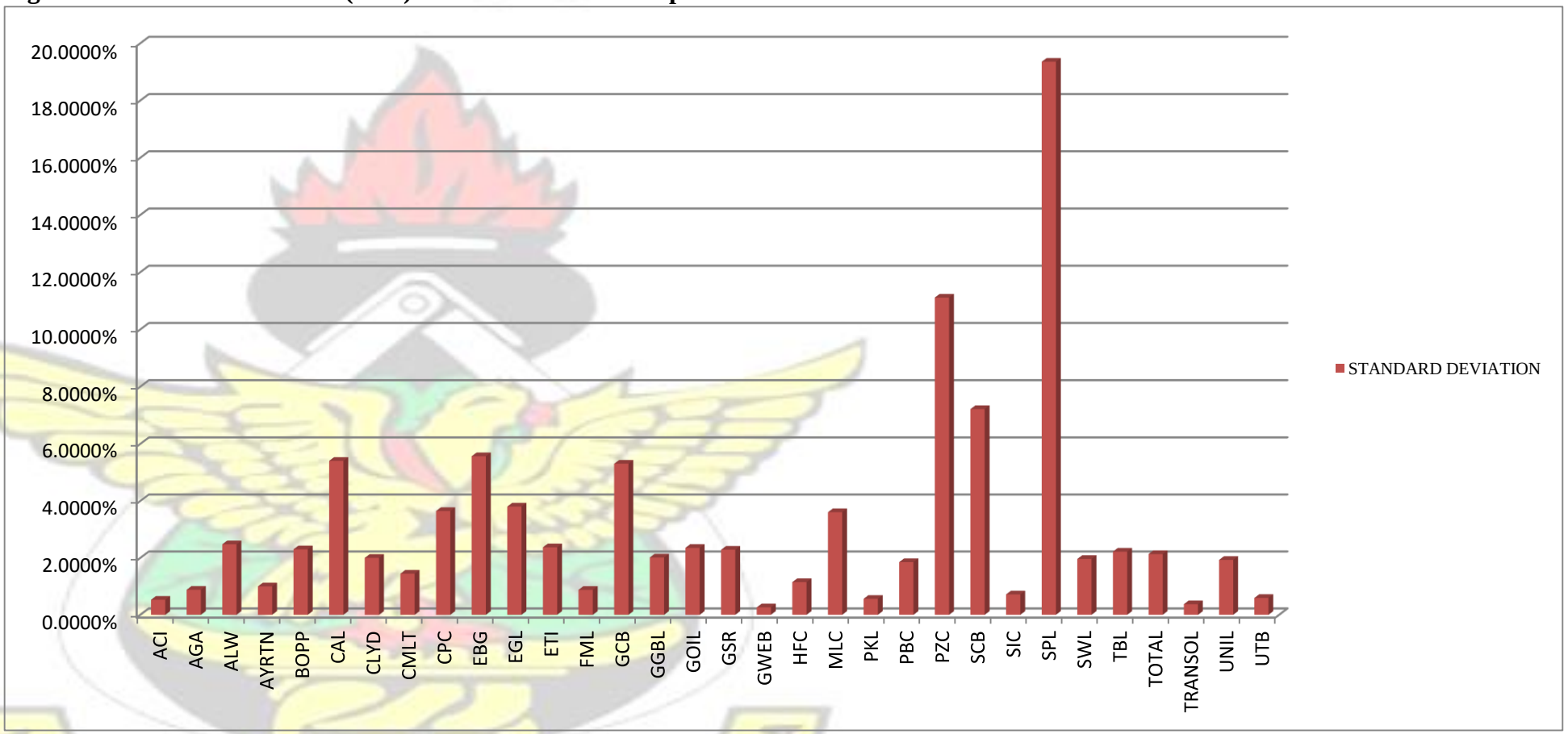


Table 1: Estimated Standard Deviations (Risk) and Mean Returns

SECTOR	MEAN RETURN	STANDARD DEVIATION
FINANCE		
CAL	9.3077%	5.4046%
EBG	6.4562%	5.5678%
ETI	3.2385%	2.3736%
GCB	4.9945%	5.3058%
HFC	5.5595%	1.1488%
UTB	5.2853%	0.5927%
SCB	11.4336%	7.2140%
TBL	-0.8931%	2.2190%
SECTOR AVERAGE	5.6728%	3.7283%
INSURANCE		
EGL	8.0493%	3.8041%
SIC	2.9983%	0.7171%
SECTOR AVERAGE	5.5238%	2.2606%
INFORMATION & COMMUNICATION TECHNOLOGY		
CLYD	-1.4153%	2.0016%
TRANSOL	-2.1098%	0.3731%
SECTOR AVERAGE	-1.7626%	1.1873%
MINING		
AGA	0.8028%	0.8789%
GSR	-1.6167%	2.2864%
SECTOR AVERAGE	-0.4070%	1.5826%
AGRICULTURE		
BOPP	8.7124%	2.3021%
SECTOR AVERAGE	8.7124%	2.3021%
DISTRIBUTION		
GOIL	6.1940%	2.3525%
MLC	6.3613%	3.6062%
PBC	4.2326%	1.8521%
TOTAL	6.3266%	2.1345%
SECTOR AVERAGE	5.7786%	2.4863%
FOOD & BEVERAGE		
CPC	3.2407%	3.6454%

FML	5.0295%	0.8768%
GGBL	5.0152%	2.0121%
SECTOR AVERAGE	4.4285%	2.1781%
MANUFACTURING		
ACI	-0.7740%	0.5296%
ALW	-2.0645%	2.4771%
AYRTN	0.9252%	0.9987%
CMLT	0.2553%	1.4452%
PZC	8.3169%	11.1117%
SPL	13.5185%	19.3547%
UNIL	7.0606%	1.9288%
PKL	-0.3968%	0.5612%
GWEB	-0.1852%	0.2619%
SWL	1.3889%	1.9642%
SECTOR AVERAGE	2.8075%	4.0633%

Generally companies that had higher risk had a higher mean return. For instance out of the thirty two (32) companies analysed, Starwin Products Limited had the highest estimated risk of about nineteen percent (19.3547%) and a corresponding mean return of about fourteen percent (13.5185%). This outcome corroborates research carried out by Samuel et al (1999) in the UK and USA that investors in financial securities demand higher returns from risky investment.

However eight companies namely; Trust Bank Gambia Limited, Clydestone (Ghana) Limited, Transactions Solutions (Ghana) Limited, Golden Star Resources Limited, African Champion Limited, Aluworks Limited, Pioneer Kitchenware Limited and Golden Web Limited had negative mean returns. The non-positive relationship between the risk and return can be a result of non-synchronous trading where the market is characterized by illiquidity as evidenced in the research of (LeBaron, 1989).

4.2 Optimal Portfolios for Different Risk Preference

Evans and Archer (1968) noticed that the risk decline consequence reduces quickly as the amount of shares increase. They observed that the financial advantages of diversification

are drained when a portfolio comprises ten or more shares. As a result, five stocks were selected comprising of BOPP, FML, SCB, SPL and MLC. These stocks were carefully selected based on their correlations. Also one of the strategies in diversification is to vary the stocks by industry or sector. Therefore each of the five selected stocks was selected from different sectors. Below are the yearly returns, mean returns, risk and correlations of the five stocks. Ten optimal portfolios with their corresponding weight, risks and returns are also provided. Additionally the efficient frontier is presented below.

Table 2: Yearly Returns of the Five Selected Stocks

	BOPP	FML	SCB	SPL	MLC
2007	-0.9305%	4.4537%	10.5459%	1.8182%	1.9048%
2008	9.6331%	7.0432%	7.5895%	1.2121%	1.9048%
2011	6.8878%	3.7948%	21.6347%	1.3889%	1.2626%
2012	7.2896%	5.5478%	6.4666%	40.8333%	8.8113%
2013	11.9598%	5.7459%	6.1996%	-1.6667%	9.0098%

Table 3: Mean Returns and Risk of the Five Selected Stocks

	Mean Return	Risk
BOPP	6.9680%	8.6361%
FML	5.3171%	2.4764%
SCB	10.4872%	12.3494%
SPL	8.7172%	34.7942%
MLC	4.5787%	6.8657%

Table 4: Correlation Matrix of the Five Selected Stocks

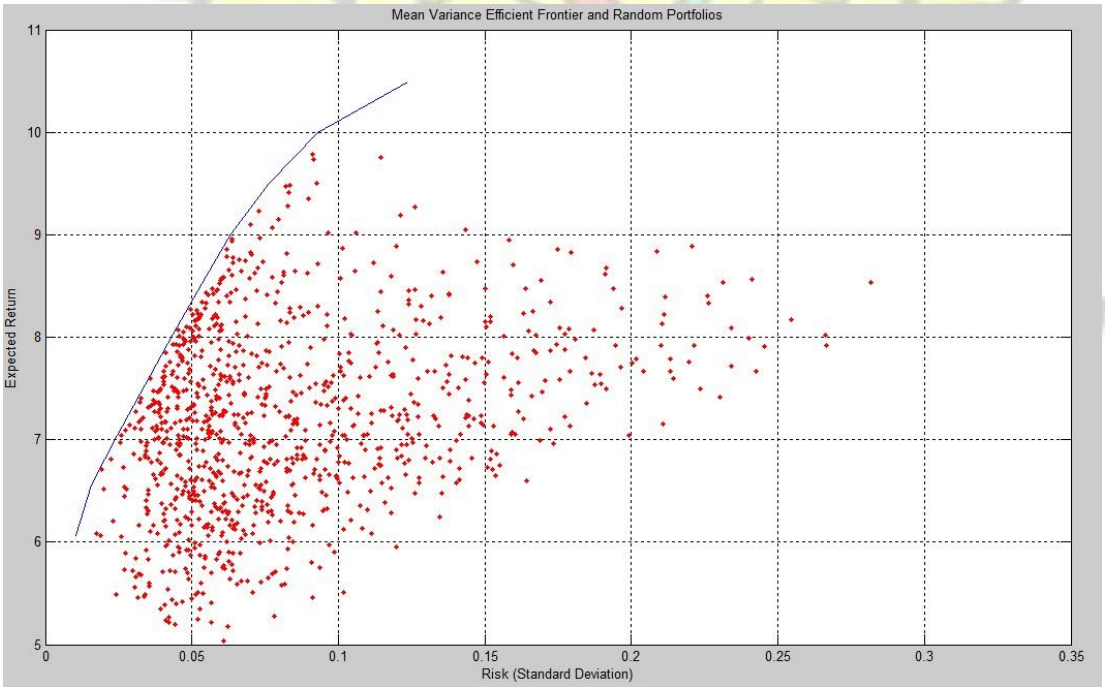
	BOPP	FML	SCB	SPL	MLC
BOPP	1	0.5647	-0.2528	-0.0184	0.4897
FML	0.5647	1	-0.7649	0.0788	0.2828

SCB	-0.2528	-0.7649	1	-0.3113	-0.6379
SPL	-0.0184	0.0788	-0.3113	1	0.5350
MLC	0.4897	0.2828	-0.6379	0.5350	1

Table 5: Portfolio Risks, Portfolio Returns and Portfolio Weights

			Portfolio Weight				
	Risk	**Return**	BOPP	FML	SCB	SPL	MLC
Portfolio 1	1.05%	6.0636%	0.00%	69.60%	16.41%	0.40%	13.96%
Portfolio 2	1.58%	6.5551%	0.00%	65.66%	23.79%	2.07%	8.48%
Portfolio 3	2.47%	7.0466%	8.51%	59.41%	28.15%	3.93%	0.00%
Portfolio 4	3.39%	7.5381%	16.03%	44.34%	34.41%	5.21%	0.00%
Portfolio 5	4.35%	8.0296%	23.56%	29.28%	40.67%	6.49%	0.00%
Portfolio 6	5.33%	8.5212%	31.08%	14.21%	46.94%	7.77%	0.00%
Portfolio 7	6.32%	9.0127%	37.34%	0.00%	53.59%	9.07%	0.00%
Portfolio 8	7.62%	9.5042%	22.53%	0.00%	66.73%	10.74%	0.00%
Portfolio 9	9.30%	9.9957%	7.72%	0.00%	79.86%	12.41%	0.00%
Portfolio 10	12.35%	10.4872%	0.00%	0.00%	100%	0.00%	0.00%

Figure 3: The Efficient Frontier



The combination of risk-return possibilities can be plotted in a risk-return space. The line joining these points is called the efficient frontier. In other words, the permutation of all efficacious portfolios (those that provide the utmost probable return for a certain level of

risk) is identified as the efficient frontier. Every red spot denotes the mean and standard deviation (risk) of a portfolio. The efficient frontier is identified by the blue line. Portfolios on the efficient frontier have highest return for a certain level of risk or, instead, minimum risk for a certain level of return. Any normal investor will choose a portfolio on the efficient frontier. The portopt function in the Matlab determined directly which portfolios of assets lie along the efficient frontier given the mean and covariances of separate asset returns. Therefore through the use of the portopt function, ten optimal portfolios were generated from the Matlab code inputted.

With the aid of Microsoft Excel, the yearly returns, mean returns, risks and correlations of the five stocks were estimated. A Matlab code was formulated to generate the ten optimal portfolios with their corresponding portfolio risk, portfolio return and portfolio weights.

In the literature, the researcher identified three investor attitudes to risk. These are Riskloving, Risk-neutral and Risk-averse. Risk-loving is where the inclination is for a high return in exchange for a high level of risk. Risk-neutral is where the investor is indifferent to the level of risk faced. Risk-averse is where the inclination is for low risk, low return investments.

Therefore based on the definitions above and considering the ten optimal portfolios generated by the Matlab, a risk-loving investor should invest all of his/her funds into buying stocks of SCB. This is because portfolio ten has the highest portfolio risk which is12.35% and a corresponding portfolio return of 10.4872%. Portfolio nine which has a portfolio risk of 9.30% and a portfolio return of 9.9957% would also be appealing to a risk-loving person. In this instance, the investor would be required to invest 7.72%, 79.86% and 12.41% of his/her funds into stocks of BOPP, SCB and SPL respectively. A risk-averse investor has a

preference for low risk, low return. Therefore ideally, a riskaverse investor would pick portfolio one which has a portfolio risk of 1.05% and a portfolio return of 6.0636%. The investor would be required to invest 69.60% of his/ her funds into stock of FML, 16.41% into SCB, 0.40% into SPL and 13.96% into MLC. However a risk-averse might consider portfolio two as well. Portfolio two has a portfolio risk of 1.58% and a portfolio return of 6.5551%. In choosing portfolio two, a risk-averse investor would be required to invest his/her funds into buying 65.66%, 23.79%, 2.07% and 8.48% of stocks of FML, SCB, SPL and MLC in that order. A risk-neutral investor is indifferent to the level of risk faced. Therefore a risk-neutral investor can afford to invest in any of the ten portfolios generated because he/she is indifferent to the risks associated with any of the ten portfolios.

4.3 Diversification

A risk management technique in finance known as diversification can be achieved by investing in a wide range of securities within a portfolio. This technique aims at reducing risk as a result of one spreading his investment across many assets as defined in the literature. Hence, when the correlation between two assets is less than perfectly positive, risk reduction can be attained via diversification.

Therefore inferring from the correlation between the five selected stocks, none of the correlations between any two stocks are perfectly positive. SPL standing alone has a 34.7942% risk. However through diversification by investing in other stocks as generated in portfolio one, the risk (unsystematic) is drastically reduced. Portfolio one has a portfolio risk of 1.05% and a portfolio return of 6.0636%. Even though the return generated by portfolio one is below that of SPL on its own, this is compensated by the drastic reduction in risk (unsystematic).

Therefore one can safely conclude that so long as none of the correlations between any two stocks selected is perfectly positively correlated, risk (unsystematic) has been diversified away. In other words, demonstrably, unsystematic risk has been reduced through diversification.

4.4 Matlab Code Suitable for the Creation of Optimal Portfolios Using any Five Financial Assets

```
>>returns = [returns of the five selected stocks];

>>STDs = [standard deviations of the five selected stocks];

>>correlations =   [correlations of the five selected stocks];

>>covariances = corr2cov(STDs , correlations);

>>portopt (returns ,covariances , 10)

>>weights = exprnd (1,1000,5);

>>total = sum (weights , 2);

>>total = total (:,ones (5,1));

>>weights = weights./total;

>> [portRisk ,portReturn] = portstats (returns , covariances , weights);

>> hold on

>>plot(portRisk , portReturn , '.r')
>>title('Mean Variance Efficient Frontier and Random Portfolios')

>> [PortRisk, PortReturn, PortWts] = frontcon(returns, covariances, 10)

>> hold off
```

Based on the Matlab code provided above, one can generate ten optimal portfolios from any five financial assets. The number of optimal portfolios could even be increased.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter is the concluding chapter of the entire study. The chapter highlights key findings in a summary. Conclusion and recommendations are also carried out in this chapter.

5.1 Summary of Findings

Starwin Products Limited had the highest mean return and it is also the most risky company to invest in. Comparatively, companies such as Benso Oil Palm Plantation, CAL Bank Limited, PZ Cussons Ghana Limited, Enterprise Group Limited and Standard Chartered Bank Limited obtained good mean returns. Some of the most risky companies to invest in are; Starwin Products Limited, PZ Cussons Ghana Limited and Standard Chartered Bank. On the whole, one can conclude that the higher the risk, the higher the mean return. However eight companies namely; Trust Bank Gambia Limited, Clydestone (Ghana) Limited, Transactions Solutions (Ghana) Limited, Golden Star Resources Limited, African Champion Limited, Aluworks Limited, Pioneer Kitchenware Limited and Golden Web Limited had negative mean returns.

Averagely the sector that performed best over the years analysed is the Agriculture sector with an average mean return of 8.7124%. The information and communication technology and mining sector had negative mean returns. The most risky sector to invest in is the manufacturing sector.

Three different investor attitudes towards risk were identified in the literature. The mean returns, standard deviations (risk) and correlations of five carefully selected stocks were used in generating ten optimal portfolio weights with corresponding portfolio risk and return

utilising Matlab. Data used covered a period of five years (2007, 2008, 2011, 2012 and 2013). Based on the optimal portfolios generated, ideally, a risk-lover investor whose inclination is for high returns in exchange for a high level of risk should invest all of his/her funds into buying stocks of SCB which is portfolio ten. Portfolio ten has portfolio risk of 12.35% and a portfolio return of 10.4872%. Nonetheless a risk-lover can also consider investing in portfolio nine which has a portfolio risk of 9.30% and a portfolio return of 9.9957%. Deciding to invest in portfolio nine would require the risk lover to invest 7.72%, 79.86% and 12.41% of his/her funds into buying stocks of BOPP, SCB and SPL respectively. A risk-averse investor whose preference is for low risk, low return should invest in portfolio one. Portfolio one has the least risk which is 1.05% and a return of 6.0636%. The risk-averse investor should invest 69.60%, 16.41%, 0.40% and 13.96% of his/her funds into buying stocks of FML, SCB, SPL and MLC correspondingly. However a risk-averse investor can also invest in portfolio two which has a risk of 1.58% and a return of 6.5551%. A risk-neutral investor who is indifferent to the level of risk encountered can invest in any of the ten optimal portfolios generated.

Demonstrably, diversification has been achieved through selection of stocks that are not perfectly positively correlated. A diversification strategy of selecting stocks from varying industries or sectors was also employed to diversify risk since all the five selected stocks are from different sectors. Furthermore based on the Matlab code presented in chapter four, one can conveniently generate optimal portfolios through the use of Matlab.

5.2 Conclusion

The researcher has been able to estimate the mean returns and standard deviations (risk) of thirty-two (32) selected stocks. The analysis was further carried out based on the individual companies as well as the various sectors on the GSE to determine each sectors average mean

return and average standard deviation (risk). Based on the Markowitz meanvariance analysis and through the use of Matlab, ten optimal portfolios were generated to satisfy the various investor attitudes to risk. We further observed that diversification reduces risk especially the unsystematic risk. However diversification becomes relatively a difficult task when the correlation between assets approaches perfect positive correlation of one (1).

These results and observations contribute significantly to the existing knowledge on the Ghanaian stock market since an average investor can now create optimal portfolios using Matlab. Based on the Markowitz mean-variance model, data on the Ghana Stock Exchange can be utilised in creating optimal portfolios to meet different investor attitudes to risk through the use of Matlab.

5.3 Recommendations

The best performing sector is the Agriculture sector in terms of average mean return. Therefore investors should invest in this sector.

The Markowitz mean variance model should be studied and applied to bond and mutual funds in term of portfolio creation and selection on the Ghanaian capital market.

Further studies should be carried out to determine the applicability of the Markowitz model using Matlab in generating optimal portfolios in comparison to other models to find out which produces better results in the long run.

Since the Matlab model can be used to generate optimal portfolios for any five financial assets, it is recommended that prudent investors develop portfolios with a larger number of stocks.

REFERENCES

Afflec-Grave, J.F and Money, A.H (1976) A Comparison of Two Portfolio Selection Models. The Investment Analyst Journal.7 (4):35-40.

Ambrozaite, R. and Sondergaard, L. (2010) .Danish Mortgage bond portfolio optimization using the mean-variance approach.Master's thesis, Copenhagen Business School.

Bai, .Z. Liu,H. and Wong, W.K (2007), 'Making Markowitz's Portfolio Optimization Theory Practicably Useful'

Bower, B and Wentz, P (2005) Portfolio Optimization Mean-Absolute Deviation vs. Markowitz.

Cesarone,.F., Scozzari,.A. and Tardella, F (2009), Algorithms for constrained portfolio optimization. Master's thesis, Universita di Roma "La sapienza"

Chin, W. Yang, Ken Hung(2010); A generalized Markowitz portfolio selection model with higher moments. Master's thesis

Ehrgott, M., Klamroth, K. and Schwehm, C. (2004) An MCDM Approach to portfolio optimization, European Journal of operational Research, 155,752-70.

Elliot, R.J and Kopp, P.E (1999), Mathematics of financial markets, Springer New York.

Elton, E.J., and Gruber, M.J.,(1997).Journal of Banking and Finance 21(1997):1743-1759.

Elton, E.J and Gruber, M.J (1987) 'Modern Portfolio Theory and Investment Analysis, John Wiley and Sons,3rd edition, New York.

Evans, J. L and Archer, S.H (1968); 'Diversification and the reduction of dispersion: An empirical analysis' Journal of finance 761-767.

Fama, E. F. and French, K. R. (2004) The Capital Asset Pricing Model: Theory and

Evidence. Journal of Economic Perspectives
Fisher, D. E. and Jordan, R. J (1991) Security Analysis and Portfolio Management

Grootveld,.H and Hallerbach, W(1999). Variance versus Downside risk: Is there really much difference? European journal of operational research,114,304-9.

Huang,C.F and Litzenberger, R.H(1988). Foundations for Financial Economics, NorthHolland, New York.

Jorion, P.(2003). Portfolio optimization with tracking error constraints; Financial analyst Journal 59,70-82

Kroll,.Y and Markowitz, H.M (1984). Mean–variance versus direct utility maximization, Journal of finance,39-47-61.

Konno,.H. and Yamazaki,.H.(1991). Mean Absolute deviation portfolio optimization model and its application to Tokyo Stock Exchange, Management Science,37(1991)519531

LeBaron, B (1989), Liquidity Constraints in Production Based Asset Pricing models, National Bureau of Economic Research, Inc.

Li, K (2008), Continuous-Time Mean-Variance Portfolio Selection. Master's thesis, University of Oxford, UK.

Maharakkhaka, B (2011) The Performance of mean variance portfolio selection and its opportunity cost: The case of Thai Securities.

Markowitz, H. (1952). "Portfolio Selection" Journal of Finance, Vol.7 no.1 March: 77-91

Markowitz, H. (1959). "Portfolio Selection": Efficient Diversification of Investment.

Mensah, S. (2008), Securities Markets and Investments. 3rd ed.: Financial Training Institute.

Merton, R. C (1969). “Life time Portfolio Selection Under Uncertainty: The ContinuousTime Case”. Review of Economics and Statistics, Vol.51 no.3 (August): 247-257.

Mwambi.S. and Mwamba.M (2010). An alternative to portfolio selection problem beyond

Natalie, M. (2011), Basics of Modern portfolio

Plesis A.J, and M. Ward(2009). Applying the Markowitz portfolio selection model as a passive investment strategy on the Johannesburg Stock Exchange.Master’s thesis, University of Johannesburge, South Africa.

Samuels, J. M, Wilkes, F. M. and Brayshaw R. E. (1999) Financial Management and Decision Making, Thompson Business Press, UK: London.

Sharpe, W.F (1994). The Sharpe ratio, Journal of portfolio management, 21-49-58.

Statman, M (2001), “How many stocks make a diversified portfolio?” Journal of Finance and Quantitative Analysis.Manuscript, Harvard University, Cambridge, MA.

Trochim, W. (2008) The Evaluation of Large Research Initiatives: A Participatory Integrative Mixed-Methods Approach, American Journal of Evaluation

Ulucan, A.(2007). An analysis of mean variance portfolio selection with varying holding periods, Applied Economics,39,1399-407.

Van Horne, J., & Wachowicz, J. (2005). Fundamentals of Financial Management (12 ed.). England: Pearson Education Limited.and Black – Literman.

Watson, D. and Head, A. (2007) Corporate Finance: Principles and Practice **APPENDICES**

APPENDIX 1

Sampled Companies and their Trading Name

SECTOR	TRADING NAME
FINANCE	
CAL Bank Limited	CAL
Ecobank Ghana Limited	EBG
Ecobank Transnational Incorporated	ETI
Ghana Commercial Bank	GCB
HFC Bank	HFC
UT Bank Limited	UTB
Standard Chartered Bank	SCB
Trust Bank Gambia limited	TBL
INSURANCE	
Enterprise Group Limited	EGL
SIC Insurance Company Limited	SIC
INFORMATION & COMMUNICATION TECHNOLOGY	
Clydestone (Ghana) Limited	CLYD
Transactions Solutions (Ghana) Limited	TRANSOL
MINING	
AngloGold Ashanti Limited	AGA
Golden Star Resources Limited	GSR
AGRICULTURE	
Benso Oil Palm Plantation	BOPP
DISTRIBUTION	
Ghana Oil Company Limited	GOIL
Mechanical Lloyd Company Limited	MLC
Produce Buying Company limited	PBC
Total Petroleum Ghana Limited	TOTAL
FOOD & BEVERAGE	
Cocoa Processing Company Limited	CPC
Fan Milk Limited	FML
Guinness Ghana Breweries Limited	GGBL
MANUFACTURING	
African Champion Limited	ACI
Aluworks Limited	ALW

Aryton Drug Manufacturing Limited	AYRTN
Camelot Ghana Limited	CMLT
PZ Cussons Ghana Limited	PZC
Starwin Products limited	SPL
Unilever Ghana Limited	UNIL
Pioneer kitchenware Limited	PKL
Golden Web Limited	GWEB

APPENDIX 2 MONTHLY STOCK PRICES

Date	ACI	AGA	ALW	AYRTN	BOPP	CAL	CLYD	CMLT	CPC	EBG	EGL
Dec-10	0.08	34	0.18	0.16	0.8	0.39	0.07	0.16	0.03	3.5	0.5
Jan-11	0.08	34	0.19	0.16	0.8	0.39	0.07	0.16	0.03	3.52	0.5
Feb-11	0.08	34	0.22	0.17	0.8	0.35	0.07	0.16	0.02	3.5	0.5
Mar-11	0.08	34	0.22	0.16	0.81	0.27	0.07	0.11	0.03	3.52	0.44
Apr-11	0.08	34	0.22	0.17	0.8	0.3	0.07	0.11	0.02	3.48	0.43
May-11	0.08	34	0.2	0.17	0.83	0.29	0.07	0.12	0.02	3.52	0.46
Jun-11	0.08	34	0.19	0.16	0.83	0.3	0.07	0.12	0.03	3.5	0.47
Jul-11	0.08	34	0.16	0.16	0.8	0.28	0.06	0.11	0.03	3.5	0.51
Aug-11	0.08	34	0.14	0.15	0.81	0.27	0.06	0.11	0.02	3.5	0.55
Sep-11	0.08	34	0.14	0.17	0.82	0.29	0.05	0.11	0.03	3.41	0.49
Oct-11	0.08	34	0.14	0.17	0.83	0.26	0.05	0.11	0.02	3.44	0.49
Nov-11	0.08	34	0.14	0.17	1	0.26	0.05	0.12	0.02	3.43	0.4
Dec-11	0.08	34	0.13	0.17	1.1	0.28	0.04	0.12	0.02	3.19	0.38
Jan-12	0.08	34	0.13	0.17	1.25	0.26	0.04	0.11	0.02	3.2	0.38

Feb-12	0.08	34	0.12	0.17	1.76	0.24	0.04	0.11	0.02	3.2	0.35
Mar-12	0.08	34	0.05	0.18	1.69	0.25	0.04	0.12	0.02	3.13	0.38
Apr-12	0.08	34	0.06	0.17	1.68	0.25	0.04	0.12	0.01	3.04	0.34
May-12	0.08	34	0.06	0.17	1.64	0.23	0.04	0.12	0.02	2.97	0.28
Jun-12	0.08	34	0.05	0.17	1.64	0.29	0.04	0.12	0.02	2.98	0.28
Jul-12	0.08	34	0.06	0.17	1.57	0.31	0.04	0.12	0.02	3	0.29
Aug-12	0.08	37	0.05	0.17	1.49	0.32	0.04	0.12	0.01	3.1	0.31
Sep-12	0.08	37	0.05	0.17	1.49	0.32	0.04	0.12	0.01	3.09	0.3
Oct-12	0.08	37	0.05	0.17	1.6	0.34	0.04	0.12	0.01	3.05	0.3
Nov-12	0.08	37	0.05	0.17	1.5	0.38	0.04	0.13	0.02	3	0.48
Dec-12	0.07	37	0.05	0.18	1.4	0.38	0.04	0.14	0.02	3	0.48
Jan-13	0.06	37	0.06	0.18	1.47	0.47	0.04	0.14	0.02	3	0.5
Feb-13	0.06	37	0.08	0.17	2.49	0.54	0.04	0.15	0.02	3.75	0.55
Mar-13	0.06	37	0.07	0.17	3.26	0.54	0.04	0.16	0.02	4.77	0.7
Apr-13	0.06	37	0.07	0.17	2.76	0.62	0.04	0.16	0.02	4.81	0.85
May-13	0.06	37	0.06	0.17	2.78	0.81	0.04	0.16	0.02	4.4	0.85
Jun-13	0.06	37	0.06	0.17	3	0.82	0.04	0.16	0.02	4.4	1.12
Jul-13	0.06	37	0.05	0.17	3.5	1.12	0.04	0.16	0.02	4.4	1.4

Aug-13	0.06	37	0.05	0.17	3.85	1.14	0.04	0.16	0.02	4.4	1.71
Sep-13	0.06	37	0.06	0.17	3.8	1.09	0.04	0.16	0.02	4.35	1.9
Oct-13	0.06	37	0.06	0.18	3.81	1	0.04	0.16	0.02	5.2	1.85
Nov-13	0.06	37	0.05	0.18	3.2	0.98	0.04	0.16	0.02	5.6	1.9
Dec-13	0.06	37	0.05	0	3.21	0.97	0.04	0.16	0.02	5.61	1.88

Date	**ETI**	**FML**	**GCB**	**GGBL**	**GOIL**	**GSR**	**GWEB**	**HFC**	**MLC**	**PKL**	**PBC**	**PZC**
Dec-10	0.15	2.46	2.7	1.58	0.32	5.2	0.05	0.42	0.1	0.07	0.17	1.2
Jan-11	0.15	2.49	2.69	1.58	0.31	5.2	0.05	0.42	0.1	0.07	0.16	1.2
Feb-11	0.15	2.51	2.4	1.58	0.31	4	0.05	0.43	0.1	0.07	0.18	1.38
Mar-11	0.15	2.45	2.5	1.25	0.3	3.4	0.05	0.4	0.11	0.07	0.25	1.39

Apr-11	0.15	2.56	2.67	1.25	0.31	3	0.05	0.41	0.1	0.07	0.23	1.39
May-11	0.14	3.02	3	1.28	0.32	3	0.05	0.41	0.1	0.07	0.22	1.39
Jun-11	0.15	3.1	3	1.44	0.31	2.99	0.03	0.4	0.09	0.07	0.28	1.39
Jul-11	0.14	3.08	2.97	1.49	0.31	2.99	0.04	0.35	0.1	0.07	0.28	1.39
Aug-11	0.14	2.8	2.88	1.58	0.32	2.99	0.04	0.36	0.11	0.06	0.28	1.39
Sep-11	0.12	2.38	2.51	1.56	0.32	2.75	0.04	0.36	0.1	0.06	0.28	1.4
Oct-11	0.12	2.4	2.02	1.51	0.32	2.75	0.04	0.37	0.1	0.06	0.24	1.4
Nov-11	0.11	2.4	1.9	1.51	0.31	2.75	0.04	0.39	0.09	0.06	0.25	0.24
Dec-11	0.1	2.37	1.85	1.53	0.32	2.75	0.04	0.45	0.11	0.06	0.25	0.24
Jan-12	0.1	2.2	1.86	1.53	0.32	2.75	0.04	0.45	0.1	0.06	0.25	0.24
Feb-12	0.1	2.2	1.85	1.57	0.32	2.75	0.04	0.45	0.1	0.06	0.24	0.24
Mar-12	0.12	2.23	1.85	1.67	0.34	2.75	0.04	0.45	0.11	0.06	0.24	0.24
Apr-12	0.14	2.2	1.9	1.75	0.38	2.75	0.04	0.45	0.1	0.06	0.24	0.24
May-12	0.13	2.09	1.92	1.87	0.47	2.75	0.04	0.45	0.1	0.06	0.24	0.22
Jun-12	0.14	1.93	1.97	2.3	0.49	2.75	0.04	0.45	0.1	0.06	0.24	0.19
Jul-12	0.11	2.42	2	2.35	0.52	2.75	0.04	0.45	0.09	0.06	0.2	0.18

Aug-12	0.1	2.63	2	2.37	0.54	2.75	0.04	0.45	0.1	0.06	0.2	0.19
Sep-12	0.12	2.86	2	2.5	0.55	2.75	0.04	0.45	0.13	0.06	0.17	0.17
Oct-12	0.11	3.5	2.05	2.62	0.6	2.75	0.04	0.45	0.13	0.06	0.17	0.18
Nov-12	0.11	3.53	2.14	2.62	0.62	2.75	0.04	0.45	0.13	0.06	0.18	0.18
Dec-12	0.12	3.55	2.1	2.62	0.62	2.75	0.04	0.45	0.15	0.06	0.18	0.18
Jan-13	0.12	3.77	2.58	2.92	0.68	2.75	0.04	0.41	0.13	0.06	0.18	0.18
Feb-13	0.18	5.23	3.1	3.4	0.89	2.75	0.04	0.51	0.2	0.06	0.21	0.22
Mar-13	0.22	5.45	3.22	3.55	1.04	2.75	0.04	0.52	0.23	0.06	0.22	0.26
Apr-13	0.17	5.63	4.39	3.8	1.34	2.75	0.04	0.54	0.23	0.06	0.16	0.26
May-13	0.19	5.8	5.1	4.3	1.4	2.75	0.04	0.55	0.25	0.06	0.19	0.35
Jun-13	0.19	5.8	4.56	4.42	1.25	2.75	0.04	0.55	0.26	0.06	0.24	0.39
Jul-13	0.19	6	4.92	4.5	0.83	2.75	0.04	0.57	0.26	0.06	0.2	0.4
Aug-13	0.2	6.15	5.38	4.71	0.87	2.75	0.04	0.65	0.29	0.06	0.2	0.57
Sep-13	0.19	6.37	5.3	5.45	0.9	2.75	0.04	0.65	0.31	0.06	0.18	0.91
Oct-13	0.18	6.68	5	6.19	0.9	2.75	0.04	0.69	0.35	0.06	0.17	0.85
Nov-13	0.18	6.6	4.77	6.1	0.93	2.75	0.04	0.96	0.38	0.06	0.17	0.8
Dec-13	0.19	6.62	4.85	6.2	0.89	2.75	0.04	0.96	0.38	0.06	0.17	0.79

Date	SCB	SIC	SPL	SWL	TBL	TOTAL	TRANSOL	UNIL	UTB
Dec-10	45.35	0.5	0.03	0.02	1.33	12.03	0.07	5.85	0.28
Jan-11	45.36	0.5	0.03	0.02	1.33	12.03	0.07	5.86	0.27
Feb-11	46.79	0.48	0.04	0.02	1.33	14	0.07	6.01	0.27
Mar-11	50.02	0.49	0.04	0.02	1.33	15.82	0.07	6.49	0.32
Apr-11	56.75	0.49	0.04	0.02	1.33	16.34	0.07	6.9	0.28
May-11	64.65	0.52	0.04	0.02	1.33	17.31	0.07	7.24	0.31
Jun-11	65	0.52	0.03	0.02	1.33	17.8	0.07	7.44	0.34
Jul-11	60	0.53	0.03	0.02	1.33	21.13	0.06	7.53	0.37
Aug-11	55	0.54	0.04	0.02	1.33	23.13	0.05	7.4	0.38
Sep-11	54.36	0.47	0.04	0.02	0.4	30	0.05	6.7	0.32
Oct-11	44.3	0.41	0.04	0.02	0.4	23	0.05	6.6	0.36
Nov-11	45.48	0.39	0.03	0.02	0.4	19.83	0.05	6.6	0.32
Dec-11	45.48	0.4	0.03	0.02	0.4	19.83	0.05	6.64	0.32
Jan-12	46.06	0.37	0.04	0.02	0.4	21	0.05	6.97	0.32
Feb-12	50	0.37	0.04	0.02	0.4	25	0.05	8	0.32

Mar-12	52.21	0.38	0.04	0.02	0.4	26.5	0.05	8.15	0.31
Apr-12	51.4	0.38	0.04	0.02	0.4	26.14	0.05	8.3	0.32
May-12	48	0.36	0.04	0.02	0.4	20	0.05	8.35	0.32
Jun-12	46.09	0.33	0.04	0.02	0.4	19.23	0.05	8.3	0.32
Jul-12	44.9	0.33	0.04	0.02	0.4	18	0.05	8.3	0.29
Aug-12	43	0.34	0.04	0.02	0.4	18.43	0.05	8.3	0.32
Sep-12	42.5	0.36	0.04	0.02	0.4	18	0.05	8.3	0.33
Oct-12	57	0.36	0.04	0.02	0.4	18.15	0.05	8.42	0.33
Nov-12	8.92	0.36	0.04	0.02	0.4	22.1	0.05	8.45	0.35
Dec-12	11.5	0.34	0.05	0.02	0.4	23.49	0.04	8.52	0.38
Jan-13	11.55	0.31	0.05	0.02	0.4	22.43	0.04	10	0.37
Feb-13	11.36	0.32	0.05	0.02	0.4	25.05	0.04	10.62	0.47
Mar-13	16.01	0.3	0.05	0.02	0.4	28.6	0.04	12.22	0.49
Apr-13	15.94	0.27	0.05	0.02	0.35	29.23	0.04	13.5	0.49
May-13	15.47	0.5	0.05	0.02	0.35	27.55	0.04	14.47	0.52
Jun-13	13.96	0.43	0.05	0.02	0.35	41.66	0.04	15.1	0.52
Jul-13	14.5	0.4	0.05	0.02	0.35	41.9	0.04	15.1	0.51
Aug-13	14.1	0.38	0.05	0.02	0.35	5.22	0.04	15.18	0.49
Sep-13	14.19	0.38	0.05	0.02	0.35	5	0.04	16.78	0.45

Oct-13	14.52	0.39	0.05	0.03	0.35	5	0.04	18	0.44
Nov-13	14.98	0.4	0.04	0.03	0.35	5.03	0.03	18.28	0.44
Dec-13	14.94	0.39	0.04	0.03	0.35	5.06	0.03	18.31	0.45

APPENDIX 3

DIVIDEND PER SHARE

Dividend per share of of 32 selected listed Companies

COMPANY	2010	2011	2012
ACI	0	0	0
AGA	0.13	0.451	0
ALW	0	0	0
AYRTN	0.0021	0.0013	0
BOPP	0.0332	0.069	0.077
CAL	0.012	0.026	0.035
CLYD	0	0	0
CMLT	0	0	0
CPC	0	0	0
EBG	0	0.24	0.29
EGL	0.025	0.016	0
ETI	0.0042	0.0027	0
FML	0.1	0.04	0
GCB	0.0356	0.07	0.14
GGBL	0.0388	0	0
GOIL	0.0104	0.014	0.015
GSR	0	0	0
GWEB	0	0	0
HFC	0.015	0.022	0
MLC	0	0.006	0
PKL	0	0	0
PBC	0.0037	0.0088	0.0088
PZC	0	0.0226	0.0226
SCB	2.47	3.05	0.47
SIC	0.0177	0.0177	0
SPL	0	0.014	0
SWL	0	0	0
TBL	0.0231	0.0171	0
TOTAL	0.7129	0.66	0.69
TRANSOL	0	0	0
UNIL	0.2128	0.48	0.256
UTB	0.0107	0.01	0.02

APPENDIX 4

MONTHLY RETURNS

A TABLE SHOWING THE MONTHLY RETURNS OF 32 LISTED COMPANIES ON THE GSE

Date	ACI	AGA	ALW	AYRTN	BOPP	CAL	CLYD	CMLT	CPC	EBG	EGL
Jan-11	0.0000%	0.3824%	5.5556%	1.3125%	4.1500%	3.0769%	0.0000%	0.0000%	0.0000%	0.5714%	5.0000%
Feb-11	0.0000%	0.3824%	15.7895%	7.5625%	4.1500%	-7.1795%	0.0000%	0.0000%	-33.3333%	-0.5682%	5.0000%
Mar-11	0.0000%	0.3824%	0.0000%	-4.6471%	5.4000%	-19.4286%	0.0000%	-31.2500%	50.0000%	0.5714%	-7.0000%
Apr-11	0.0000%	0.3824%	0.0000%	7.5625%	2.8642%	15.5556%	0.0000%	0.0000%	-33.3333%	-1.1364%	3.4091%
May-11	0.0000%	0.3824%	-9.0909%	1.2353%	7.9000%	0.6667%	0.0000%	9.0909%	0.0000%	1.1494%	12.7907%
Jun-11	0.0000%	0.3824%	-5.0000%	-4.6471%	4.0000%	7.5862%	0.0000%	0.0000%	50.0000%	-0.5682%	7.6087%
Jul-11	0.0000%	0.3824%	-15.7895%	1.3125%	0.3855%	-2.6667%	-14.2857%	-8.3333%	0.0000%	0.0000%	13.8298%
Aug-11	0.0000%	0.3824%	-12.5000%	-4.9375%	5.4000%	0.7143%	0.0000%	0.0000%	-33.3333%	0.0000%	12.7451%
Sep-11	0.0000%	0.3824%	0.0000%	14.7333%	5.3333%	11.8519%	-16.6667%	0.0000%	50.0000%	-2.5714%	-6.3636%
Oct-11	0.0000%	0.3824%	0.0000%	1.2353%	5.2683%	-6.2069%	0.0000%	0.0000%	-33.3333%	0.8798%	5.1020%
Nov-11	0.0000%	0.3824%	0.0000%	1.2353%	24.4819%	4.6154%	0.0000%	9.0909%	0.0000%	-0.2907%	-13.2653%
Dec-11	0.0000%	0.3824%	-7.1429%	1.2353%	13.3200%	12.3077%	-20.0000%	0.0000%	0.0000%	-6.9971%	1.2500%
Jan-12	0.0000%	1.3265%	0.0000%	0.7647%	19.9091%	2.1429%	0.0000%	-8.3333%	0.0000%	7.8370%	4.2105%
Feb-12	0.0000%	1.3265%	-7.6923%	0.7647%	46.3200%	2.3077%	0.0000%	0.0000%	0.0000%	7.5000%	-3.6842%
Mar-12	0.0000%	1.3265%	-58.3333%	6.6471%	-0.0568%	15.0000%	0.0000%	9.0909%	0.0000%	5.3125%	13.1429%
Apr-12	0.0000%	1.3265%	20.0000%	-4.8333%	3.4911%	10.4000%	0.0000%	0.0000%	-50.0000%	4.7923%	-6.3158%
May-12	0.0000%	1.3265%	0.0000%	0.7647%	1.7262%	2.4000%	0.0000%	0.0000%	100.0000%	5.5921%	-12.9412%
Jun-12	0.0000%	1.3265%	-16.6667%	0.7647%	4.2073%	37.3913%	0.0000%	0.0000%	0.0000%	8.4175%	5.7143%
Jul-12	0.0000%	1.3265%	20.0000%	0.7647%	-0.0610%	15.8621%	0.0000%	0.0000%	0.0000%	8.7248%	9.2857%
Aug-12	0.0000%	10.1500%	-16.6667%	0.7647%	-0.7006%	11.6129%	0.0000%	0.0000%	-50.0000%	11.3333%	12.4138%
Sep-12	0.0000%	1.2189%	0.0000%	0.7647%	4.6309%	8.1250%	0.0000%	0.0000%	0.0000%	7.4194%	1.9355%

Oct-12	0.0000%	1.2189%	0.0000%	0.7647%	12.0134%	14.3750%	0.0000%	0.0000%	0.0000%	6.4725%	5.3333%
Nov-12	0.0000%	1.2189%	0.0000%	0.7647%	-1.9375%	19.4118%	0.0000%	8.3333%	100.0000%	6.2295%	65.3333%
Dec-12	-12.5000%	1.2189%	0.0000%	6.6471%	-2.0667%	6.8421%	0.0000%	7.6923%	0.0000%	8.0000%	3.3333%
Jan-13	-14.2857%	0.0000%	20.0000%	0.0000%	10.5000%	32.8947%	0.0000%	0.0000%	0.0000%	9.6667%	4.1667%
Feb-13	0.0000%	0.0000%	33.3333%	-5.5556%	74.6259%	22.3404%	0.0000%	7.1429%	0.0000%	34.6667%	10.0000%
Mar-13	0.0000%	0.0000%	-12.5000%	0.0000%	34.0161%	6.4815%	0.0000%	6.6667%	0.0000%	34.9333%	27.2727%
Apr-13	0.0000%	0.0000%	0.0000%	0.0000%	-12.9755%	21.2963%	0.0000%	0.0000%	0.0000%	6.9182%	21.4286%
May-13	0.0000%	0.0000%	-14.2857%	0.0000%	3.5145%	36.2903%	0.0000%	0.0000%	0.0000%	-2.4948%	0.0000%
Jun-13	0.0000%	0.0000%	0.0000%	0.0000%	10.6835%	5.5556%	0.0000%	0.0000%	0.0000%	6.5909%	31.7647%
Jul-13	0.0000%	0.0000%	-16.6667%	0.0000%	19.2333%	40.8537%	0.0000%	0.0000%	0.0000%	6.5909%	25.0000%
Aug-13	0.0000%	0.0000%	0.0000%	0.0000%	12.2000%	4.9107%	0.0000%	0.0000%	0.0000%	6.5909%	22.1429%
Sep-13	0.0000%	0.0000%	20.0000%	0.0000%	0.7013%	-1.3158%	0.0000%	0.0000%	0.0000%	5.4545%	11.1111%
Oct-13	0.0000%	0.0000%	0.0000%	5.8824%	2.2895%	-5.0459%	0.0000%	0.0000%	0.0000%	26.2069%	-2.6316%
Nov-13	0.0000%	0.0000%	-16.6667%	0.0000%	-13.9895%	1.5000%	0.0000%	0.0000%	0.0000%	13.2692%	2.7027%
Dec-13	0.0000%	0.0000%	0.0000%	-5.5556%	2.7187%	2.5510%	0.0000%	0.0000%	0.0000%	5.3571%	-1.0526%

A table showing the monthly Returns of 32 Listed Companies on the GSE

Date	**ETI**	**FML**	**GCB**	**GGBL**	**GOIL**	**GSR**	**GWEB**	**HFC**	**MLC**	**PKL**	**PBC**	**PZC**
Jan-11	2.800%	5.285%	0.948%	2.456%	0.125%	0.000%	0.000%	3.571%	0.000%	0.000%	-3.706%	0.000%

Feb-11	2.800%	4.819%	-9.457%	2.456%	3.355%	-23.077%	0.000%	5.952%	0.000%	0.000%	14.813%	15.000%
Mar-11	2.800%	1.594%	5.650%	-18.430%	0.129%	-15.000%	0.000%	-3.488%	10.000%	0.000%	40.944%	0.725%
Apr-11	2.800%	8.571%	8.224%	3.104%	6.800%	-11.765%	0.000%	6.250%	-9.091%	0.000%	-6.520%	0.000%
May-11	-3.867%	21.875%	13.693%	5.504%	6.581%	0.000%	0.000%	3.659%	0.000%	0.000%	-2.739%	0.000%
Jun-11	10.143%	5.960%	1.187%	15.531%	0.125%	-0.333%	-40.000%	1.220%	-10.000%	0.000%	28.955%	0.000%
Jul-11	-3.867%	2.581%	0.187%	6.167%	3.355%	0.000%	33.333%	-8.750%	11.111%	0.000%	1.321%	0.000%
Aug-11	3.000%	-5.844%	-1.832%	8.644%	6.581%	0.000%	0.000%	7.143%	10.000%	-14.286%	1.321%	0.000%
Sep-11	-11.286%	-11.429%	-11.611%	1.190%	3.250%	-8.027%	0.000%	4.167%	-9.091%	0.000%	1.321%	0.719%
Oct-11	3.500%	5.042%	-18.104%	-0.718%	3.250%	0.000%	0.000%	6.944%	0.000%	0.000%	-12.964%	0.000%
Nov-11	-4.833%	4.167%	-4.178%	2.570%	0.125%	0.000%	0.000%	9.459%	-10.000%	0.000%	5.708%	-82.857%
Dec-11	-5.273%	2.917%	-0.758%	3.894%	6.581%	0.000%	0.000%	19.231%	22.222%	0.000%	1.480%	0.000%
Jan-12	2.700%	-5.485%	4.324%	0.000%	4.375%	0.000%	0.000%	4.889%	-3.636%	0.000%	3.520%	9.417%
Feb-12	2.700%	1.818%	3.226%	2.614%	4.375%	0.000%	0.000%	4.889%	6.000%	0.000%	-0.480%	9.417%
Mar-12	22.700%	3.182%	3.784%	6.369%	10.625%	0.000%	0.000%	4.889%	16.000%	0.000%	3.667%	9.417%
Apr-12	18.917%	0.448%	6.486%	4.790%	15.882%	0.000%	0.000%	4.889%	-3.636%	0.000%	3.667%	9.417%
May-12	-5.214%	-3.182%	4.737%	6.857%	27.368%	0.000%	0.000%	4.889%	6.000%	0.000%	3.667%	1.083%
Jun-12	9.769%	-5.742%	6.250%	22.995%	7.234%	0.000%	0.000%	4.889%	6.000%	0.000%	3.667%	-3.364%
Jul-12	-19.500%	27.461%	5.076%	2.174%	8.980%	0.000%	0.000%	4.889%	-4.000%	0.000%	-13.000%	6.632%
Aug-12	-6.636%	10.331%	3.500%	0.851%	6.538%	0.000%	0.000%	4.889%	17.778%	0.000%	4.400%	18.111%
Sep-12	22.700%	10.266%	3.500%	5.485%	4.444%	0.000%	0.000%	4.889%	36.000%	0.000%	-10.600%	1.368%
Oct-12	-6.083%	23.776%	6.000%	4.800%	11.636%	0.000%	0.000%	4.889%	4.615%	0.000%	5.176%	19.176%
Nov-12	2.455%	2.000%	7.805%	0.000%	5.667%	0.000%	0.000%	4.889%	4.615%	0.000%	11.059%	12.556%
Dec-12	11.545%	1.700%	1.402%	0.000%	2.258%	0.000%	0.000%	4.889%	20.000%	0.000%	4.889%	12.556%
Jan-13	0.000%	6.197%	29.524%	11.450%	12.097%	0.000%	0.000%	-8.889%	-13.333%	0.000%	4.889%	12.556%
Feb-13	50.000%	38.727%	25.581%	16.438%	33.088%	0.000%	0.000%	24.390%	53.846%	0.000%	21.556%	34.778%
Mar-13	22.222%	4.207%	8.387%	4.412%	18.539%	0.000%	0.000%	1.961%	15.000%	0.000%	8.952%	28.455%
Apr-13	-22.727%	3.303%	40.683%	7.042%	30.288%	0.000%	0.000%	3.846%	0.000%	0.000%	-23.273%	8.692%
May-13	11.765%	3.020%	19.362%	13.158%	5.597%	0.000%	0.000%	1.852%	8.696%	0.000%	24.250%	43.308%
Jun-13	0.000%	0.000%	-7.843%	2.791%	-9.643%	0.000%	0.000%	0.000%	4.000%	0.000%	30.947%	17.886%

Jul-13	0.000%	3.448%	10.965%	1.810%	-32.400%	0.000%	0.000%	3.636%	0.000%	0.000%	-13.000%	8.359%
Aug-13	5.263%	2.500%	12.195%	4.667%	6.627%	0.000%	0.000%	14.035%	11.538%	0.000%	4.400%	48.150%
Sep-13	-5.000%	3.577%	1.115%	15.711%	5.172%	0.000%	0.000%	0.000%	6.897%	0.000%	-5.600%	63.614%
Oct-13	-5.263%	4.867%	-3.019%	13.578%	1.667%	0.000%	0.000%	6.154%	12.903%	0.000%	-0.667%	-4.110%
Nov-13	0.000%	-1.198%	-1.800%	-1.454%	5.000%	0.000%	0.000%	39.130%	8.571%	0.000%	5.176%	-3.224%
Dec-13	5.556%	0.303%	4.612%	1.639%	-2.688%	0.000%	0.000%	0.000%	0.000%	0.000%	5.176%	1.575%

A table showing the monthly Returns of 32 Listed Companies on the GSE

Date	SCB	SIC	SPL	SWL	TBL	TOTAL	TRANSOL	UNIL	UTB
Jan-11	5.469%	3.540%	0.000%	0.000%	1.737%	5.926%	0.000%	3.809%	0.250%
Feb-11	8.598%	-0.460%	33.333%	0.000%	1.737%	22.302%	0.000%	6.191%	3.963%
Mar-11	12.182%	5.771%	0.000%	0.000%	1.737%	18.092%	0.000%	11.527%	22.481%
Apr-11	18.393%	3.612%	0.000%	0.000%	1.737%	7.793%	0.000%	9.596%	-9.156%
May-11	18.273%	9.735%	0.000%	0.000%	1.737%	10.299%	0.000%	8.012%	14.536%

Jun-11	4.362%	3.404%	-25.000%	0.000%	1.737%	6.949%	0.000%	5.702%	13.129%
Jul-11	-3.892%	5.327%	0.000%	0.000%	1.737%	22.713%	-14.286%	4.070%	11.971%
Aug-11	-4.217%	5.226%	33.333%	0.000%	1.737%	12.839%	-16.667%	1.100%	5.595%
Sep-11	3.327%	-9.685%	0.000%	0.000%	-68.188%	32.784%	0.000%	-6.584%	-12.974%
Oct-11	-13.962%	-9.000%	0.000%	0.000%	5.775%	-20.957%	0.000%	1.684%	15.844%
Nov-11	8.239%	-0.561%	-25.000%	0.000%	5.775%	-10.683%	0.000%	3.224%	-8.139%
Dec-11	5.431%	7.103%	0.000%	0.000%	5.775%	3.595%	0.000%	3.830%	3.344%
Jan-12	7.982%	-3.075%	80.000%	0.000%	5.986%	9.228%	0.000%	12.199%	3.125%
Feb-12	15.176%	4.784%	35.000%	0.000%	19.129%	22.190%	0.000%	21.664%	3.125%
Mar-12	10.520%	7.486%	35.000%	0.000%	6.068%	8.640%	0.000%	7.875%	0.000%
Apr-12	4.290%	4.658%	35.000%	0.000%	-1.294%	1.132%	0.000%	7.730%	6.452%
May-12	-0.681%	-0.605%	35.000%	0.000%	-23.423%	-20.964%	0.000%	6.386%	3.125%
Jun-12	2.375%	-3.417%	35.000%	0.000%	-3.765%	-0.550%	0.000%	5.150%	3.125%
Jul-12	4.036%	5.364%	35.000%	0.000%	-6.307%	-2.964%	0.000%	5.783%	-6.250%
Aug-12	2.561%	8.394%	35.000%	0.000%	2.484%	6.056%	0.000%	5.783%	13.793%
Sep-12	5.930%	11.088%	35.000%	0.000%	-2.240%	1.248%	0.000%	5.783%	6.250%
Oct-12	41.294%	4.917%	35.000%	0.000%	0.928%	4.500%	0.000%	7.229%	3.030%
Nov-12	-79.000%	4.917%	35.000%	0.000%	21.857%	25.399%	0.000%	6.057%	9.091%
Dec-12	63.117%	-0.639%	60.000%	0.000%	6.367%	9.276%	-20.000%	6.509%	11.429%
Jan-13	4.522%	-8.824%	0.000%	0.000%	-4.513%	-1.575%	0.000%	20.376%	2.632%
Feb-13	2.424%	3.226%	0.000%	0.000%	11.681%	14.757%	0.000%	8.760%	32.432%
Mar-13	45.070%	-6.250%	0.000%	0.000%	14.172%	16.926%	0.000%	17.476%	8.511%
Apr-13	2.498%	-10.000%	0.000%	0.000%	2.203%	4.615%	0.000%	12.570%	4.082%
May-13	0.000%	85.185%	0.000%	0.000%	-5.748%	-3.387%	0.000%	9.081%	10.204%
Jun-13	-6.723%	-14.000%	0.000%	0.000%	51.216%	53.721%	0.000%	6.123%	3.846%
Jul-13	7.235%	-6.977%	0.000%	0.000%	0.576%	2.232%	0.000%	1.695%	1.923%
Aug-13	0.483%	-5.000%	0.000%	0.000%	-87.542%	-85.895%	0.000%	2.225%	0.000%
Sep-13	3.972%	0.000%	0.000%	0.000%	-4.215%	9.004%	0.000%	12.227%	-4.082%
Oct-13	5.638%	2.632%	0.000%	50.000%	0.000%	13.800%	0.000%	8.796%	2.222%
Nov-13	6.405%	2.564%	-20.000%	0.000%	0.600%	14.400%	-25.000%	2.978%	4.545%
Dec-13	2.870%	-2.500%	0.000%	0.000%	0.596%	14.314%	0.000%	1.565%	6.818%

Monthly stock prices for five selected companies (2007-2008)

Date	BOPP	FML	SCB	SPL	MLC
06-Dec	0.55	1.6002	15.6	0.055	0.21
07-Jan	0.55	1.6014	16	0.055	0.21
07-Feb	0.55	1.9	16.601	0.055	0.21
07-Mar	0.55	1.91	16.6016	0.055	0.21
07-Apr	0.545	1.9251	16.0007	0.055	0.21
07-May	0.545	1.9507	16.0605	0.055	0.21
07-Jun	0.545	1.9601	16.0616	0.055	0.21
07-Jul	0.5	1.9712	16.06	0.055	0.21
07-Jun	0.5	2.1102	20	0.055	0.21
07-Jul	0.5	2.1106	21	0.055	0.21
07-Oct	0.5	2.1501	24.1	0.055	0.21
07-Nov	0.49	2.3751	24.1256	0.055	0.21
07-Dec	0.49	2.39	26	0.055	0.21
08-Jan	0.46	2.6626	26.601	0.055	0.21
08-Feb	0.46	2.7	26.65	0.05	0.21
08-Mar	0.56	2.65	26.77	0.05	0.21
08-Apr	0.71	3.16	26.6	0.05	0.21
08-May	1.29	3.32	27.1	0.05	0.21
08-Aug	1.2	3.6	30.63	0.05	0.21
08-Jul	1.3	3.79	36.12	0.05	0.21
08-Aug	1.3	4.66	36	0.05	0.21
08-Sep	1.3	5	36	0.05	0.21
08-Aug	1.17	5	36	0.05	0.21
08-Nov	1.16	4.5	36	0.05	0.21
08-Dec	0.6	2.46	45.35	0.03	0.1

Dividend for the five selected companies (2006-2007)

COMPANY	2006	2007
BOPP	0	0.0105

FML	0.04	0.046
SCB	1.15	1.3
SPL	0.001	0.001
MLC	0.004	0.004

Monthly returns of the five selected companies (2007-2008)

Date	BOPP	FML	SCB	SPL	MLC
07-Jan	0.0000%	2.2886%	8.5440%	1.8180%	1.9048%
07-Feb	0.0000%	7.6940%	10.9440%	1.8180%	1.9048%
07-Mar	0.0000%	2.6316%	8.1360%	1.8180%	1.9048%
07-Apr	-0.9091%	2.8848%	13.9810%	1.8180%	1.9048%
07-May	0.0000%	3.4076%	6.7210%	1.8180%	1.9048%
07-Jun	0.0000%	2.5324%	6.3740%	1.8180%	1.9048%
07-Jul	-8.2569%	2.6070%	6.4690%	1.8180%	1.9048%
07-Aug	0.0000%	9.0808%	16.9800%	1.8180%	1.9048%
07-Jul	0.0000%	1.9145%	10.7500%	1.8180%	1.9048%
07-Oct	0.0000%	3.7667%	20.2380%	1.8180%	1.9048%
07-Nov	-2.0000%	12.3250%	4.8780%	1.8180%	1.9048%
07-Dec	0.0000%	2.3115%	12.5360%	1.8180%	1.9048%
08-Jan	0.1020%	13.3389%	7.3120%	1.8180%	1.9048%
08-Feb	2.1875%	3.1245%	5.0710%	-7.2730%	1.9048%
08-Mar	18.8542%	7.2593%	5.3280%	2.0000%	1.9048%
08-Apr	28.6607%	13.1930%	4.9680%	2.0000%	1.9048%
08-May	83.1690%	5.8491%	5.9700%	2.0000%	1.9048%
08-Jun	-6.1628%	9.8193%	18.5610%	2.0000%	1.9048%
08-Jul	9.2083%	6.5556%	21.3750%	2.0000%	1.9048%
08-Aug	0.8077%	24.6966%	8.8040%	2.0000%	1.9048%
08-Sep	0.8077%	7.8205%	3.4210%	2.0000%	1.9048%
08-Aug	-9.1923%	0.9200%	3.4210%	2.0000%	1.9050%
08-Nov	0.0427%	-9.0800%	3.4210%	2.0000%	1.9050%
08-Dec	-12.8879%	1.0222%	3.4210%	2.0000%	1.9050%