AN EMPIRICAL TEST OF THE WEAK FORM AND SEMI-STRONG FORM EFFICIENCY OF THE MALAWI STOCK EXCHANGE

MASTER OF ARTS (ECONOMICS) THESIS

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UNIVERSITY OF MALAWI
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JULY, 2014

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MASTER OF ARTS (ECONOMICS) THESIS

By

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UNIVERSITY OF MALAWI
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JULY, 2014

DECLARATION

I, the undersigned, hereby declare that this thesis is my own original work which has not been submitted either in part or whole to any other institution for similar purposes. Where other people's work has been used, acknowledgements have been made.

Whyghtone Mphatso Mweta

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Signature

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Date

CERTIFICATE OF APPROVAL

The undersigned certify that this thesis represents the student's own work and effort and has been submitted with our approval.

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DEDICATION

To Nohakalha and Onivaha.

ACKNOWLEDGEMENTS

My heartfelt gratitude is due to God Almighty for the many possibilities that HE has granted me.

I am sincerely indebted to Professor E. W. Chirwa for his guidance which has helped shape this paper into what it is. He was available for me at short notices despite his many demanding engagements. My gratitude also goes to faculty members in the Department of Economics, Chancellor College, University of Malawi for their dedication during coursework and the thesis presentation seminars. Their comments and suggestions have left indelible marks on this work.

My wife, Kumbukani has been a source of inspiration and I am very grateful for the high moral support. And, a long time friend Hastings Chipungu who unknowingly prodded me on along the way.

ABSTRACT

Stock markets are vital to a country's economic growth on condition that they are efficient. Examination of the efficiency of the stock market is therefore important as it provides a means for understanding the structure and hence the role of the stock market in the economy. This study tests the weak form and the semi-strong form of the Efficient Market Hypothesis (EMH) by employing multiple statistical tests of the Random Walk Model and also by testing one of the market anomalies on the Malawi Stock Exchange (MSE). The empirical findings derived from the statistical tests of the Random walk model conclusively reject the null hypothesis of the existence of a random walk for the Malawi All Share Index (MASI) and therefore it can be concluded that the Malawi Stock Exchange is not weak form efficient. The study also found that there is enough evidence to accept the hypothesis that stock prices do not immediately incorporate earnings announcement information on the Malawi Stock Exchange, which implies that the Malawi Stock Exchange is not semi-strong efficient.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACF	Autocorrelation Function
ACM	Alternative Capital Market
ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
AR	Abnormal Return
ARCH	Autoregressive Conditional Heteroscedasticity
ASEA	African Securities Exchange Association
CAAR	Cumulative Average Abnormal Return
CAR	Cumulative Abnormal Return
EMH	Efficiency Market Hypothesis
FMB	First Merchant Bank
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
GDP	Gross Domestic Product
MASI	Malawi All Share Index
ML	Maximum Likelihood
MSE	Malawi Stock Exchange
NBM	National Bank of Malawi
NITL	National Investment Trust Limited
PIM	Packaging Industries Malawi Ltd
RWH	Random Walk Hypothesis
SBL	Standard Bank Ltd
TVT	Total Value of Trades

CHAPTER 1

INTRODUCTION

1.1 Background

Stock markets play a significant role in ensuring the flow of financial capital to their most productive investment. Thus, they are crucial in the mobilization of savings. Furthermore, stock markets improve the quality and quantity of investment by providing the market with additional financial instruments that better meet the risk and liquidity preference of different individuals (Singh, 1997). Theoretically, good firm management should be reflected in stock performance on the market; hence, the stock market could act as a way of monitoring company performance. In summary, the various roles of the stock market work towards accelerating economic growth. However, this positive relationship is only possible if the market is efficient (Fama, 1970). In fact, an inefficient market becomes a barrier to raising capital in the primary market and reduces the volume of trading in the secondary market (Mensa, 2005).

There have been a growing number of stock markets in Africa[1] but despite the increase in the number, there have been limited studies done on the emerging markets, including the Malawi Stock Exchange. The Malawi Stock Exchange was established with the

[1] According to the United Nations Development Program (UNDP) the number of African stock markets rose from 10 to 18 during the last decade, UNDP (2003).

expectation that it would foster economic growth by boosting domestic savings and quality as well as quantity of investment. Therefore it would be interesting to check whether the Malawi Stock Exchange is efficient and gain insight into its structure and role in the economic growth of the country keeping in mind that only efficient markets add positive values to economic growth.

Not many studies have been done of the Malawi Stock Exchange. Some of the studies done on the Malawi Stock Exchange include Sibweza (2004) and Govati (2009). Govati (2009) examined the effects of macroeconomic variables on stock returns while a direct look at the efficiency of the Malawi Stock Exchange was done over eight (8) years ago and only looked at weak form efficiency using daily stock prices of selected stocks on the bourse (Sibweza, 2004).

The current study sets out to test both the weak form and semi-strong form of the Efficient Market Hypothesis. According to Fama (1991), tests of weak form efficiency are actually tests of return predictability while tests of semi-strong efficiency are event studies. Consequently, the weak form efficiency of the Malawi Stock Exchange was tested by employing multiple statistical tests of the random walk hypothesis while an event study was undertaken to test the semi-strong efficiency of the Malawi Stock Exchange. The study also tested the January Effect based on the fact that it is one of the market anomalies that critics of the Efficient Market Hypothesis commonly point out as a violation of the hypothesis. This test was prompted in order to not only keep the study in check but also as a way of validating the results derived from this study.

1.2 Problem Statement

The Efficient Market Hypothesis has been a subject under protracted debate and investigation in developed and emerging financial markets. Some of the studies done on emerging markets in Africa to test the weak form efficiency of these markets are Olowe (1999) and Kukah, Amoo and Raji (2006) with respect to Nigeria, Mecagni and Sourial (1999) with respect to Egypt and Mollah (2007) with respect to Botswana.

Olowe (1999) showed that the Nigerian Stock Market is weak form efficient. However, Kukah, Amoo and Raji (2006) found inconclusive results for weak form efficiency of the Nigerian Stock Market. Mecagni and Sourial (1999) showed that the Egyptian Stock Market significantly departs from the Efficient Market Hypothesis; and Mollah (2007) found that the Botswana Stock Exchange is not weak form efficient.

On the other hand, studies on African stock markets that examined the semi-strong form of the Efficient Market Hypothesis include Oludoyi (1999) who found that the Nigerian Stock Market is not semi-strong efficient. The semi-strong inefficiency of the Nigerian Stock Market was confirmed by Adelegan (2009) whilst Osei (2002) noted that the Ghana Stock Exchange is not efficient with respect to annual earnings information released to the Ghanaian Stock Market.

A limited number of studies have been done on the Malawi Stock Exchange. Govati (2009) looked at the effects of macroeconomic variables on the Malawi Stock Exchange. It was found that not all macroeconomic variables have influence on stock returns and

volatility and not all macroeconomic variables have asymmetric effects. However, only Sibweza (2004) focused on the efficiency of the Malawi Stock Exchange by examining whether there is presence of the day-of-the-week and turn-of-the-month effects on the Malawi Stock Exchange. The conclusion from this study is that the Malawi Stock Exchange may be weak form efficient since there was no evidence of presence of day-of-the-week and turn-of-the-month effects.

Understanding the efficiency of financial markets is important for a number of reasons. The first being that, investors are interested in holding efficient portfolios and investment analysis provides the basis for selection of such a portfolio (Myers, 2003). The second is that it would help in the determination of appropriate courses of action that may need to be instituted in order to improve the structure of the market so that it achieves its intended functions and objectives effectively.

While duly recognizing the contribution of earlier studies on the Malawi Stock Exchange, the extent to which the Malawi Stock Exchange is efficient has not been fully explored. Consequently, the current study has been necessitated to explore this avenue and also the desire to gauge how investors behave in order to maximize return on their investment if the Malawi Stock Exchange is found to be efficient.

1.3 Significance of the Study

The contributions of the results of the current study are very significant. The first one is that there is limited empirical literature on the efficiency of the Malawi Stock Exchange.

This current study is done to fill this gap by providing evidence of the efficiency of the Malawi Stock Exchange which would give an insight into the structure and therefore its role in the economic growth of the country. The second one is that the study reveals the appropriate adjustments that need to be undertaken so that the Malawi Stock Exchange achieves efficiency levels. Lastly, the study will help in the determination of whether Malawian investment advisors have a basis for seeking to shrewdly gather information about the future in order to help their clients earn higher than average market return.

1.4 Study Objectives

The main aim of the study is to use data on the Malawi Stock Exchange to empirically investigate the efficiency of the market.

The study has the following specific objectives:

1. To examine whether the Malawi Stock Exchange is weak form efficient.
2. To test whether the Malawi Stock Exchange exhibits the January effect.
3. To test whether the Malawi Stock Exchange is informationally efficient with respect to annual earnings announcement information.

1.5 Research hypotheses

In looking to achieve its objectives, the study will be testing the following null hypotheses:

i. The Malawi Stock Exchange is not weak form efficient.

ii. The Malawi Stock Exchange does not exhibit the January effect.

iii. The Malawi Stock Exchange is not informationally efficient with respect to annual earnings announcement information.

1.6 Organisation of the study

The rest of the study proceeds as follows: Chapter Two presents an overview of the Malawi Stock Exchange. Chapter Three is a review of literature giving both the theoretical framework and empirical evidence. Chapter Four discusses the methodology utilized and provides a description of data and its sources. Estimation and results of the study are explained in Chapter Five while Chapter Six summarizes the findings of the study, presents conclusions from the study, provides recommendations for policy making and proposes areas for future research.

CHAPTER 2

THE MALAWI STOCK EXCHANGE

2.0 Introduction

This chapter introduces the context in which the study is being conducted by providing an overview of the Malawi Stock Exchange. The areas covered include its origin and objectives, counters and listing dates, trading system and liquidity among a number of other salient features. The information in this chapter has been sourced from various reports by the Malawi Stock Exchange.

2.1 Background of the Malawi Stock Exchange

The Malawi Stock Exchange (MSE) was instituted in 1994 but it did not start trading in stocks until the listing of NICO Holdings Limited in 1996. It is a member of the African Securities Exchange Association (ASEA) an association of 21 out of 29 stock exchanges in Africa. The exchange's initial main activities were secondary market trading of treasury bills and local registered stock. After Nico Holding's listing, then followed Blantyre Hotels and Illovo in 1997; Press Corporation and Standard Bank in 1998; Old Mutual in 1999; National Bank in 2000; Sunbird in 2002 and then the most notable Initial Public Offering came in 2005 with National Investment Trust Limited (NITL).The underlying functions of the Malawi Stock Exchange include: offering an alternative avenue to raising capital for companies to grow; providing a link between capital raisers

and investors seeking profitable investments, and providing a vessel through which the government could successfully privatise companies into the hands of Malawians. (MSE) The rest of the companies' dates of listing are shown in Table 1. There are now 14 companies listed on the exchange after the delisting of Packaging Industries Malawi Ltd (PIM) in 2011 in an attempt by its minority shareholders to pave way for the injection of private capital to resuscitate the company's operations. Of the 14 listed companies, only one, Old Mutual, is of foreign origin and the rest are local. The exchange is also dominated by financial institutions as can be seen in the following table.

Table 1: Companies Listed on the Malawi Stock Exchange

Company	**Code**	**Sector**	**Listing Date**	**Market Capitalisation**
Nico Holdings	Nico	Insurance & Banking	Nov-96	14,915.45
Blantyre Hotels	BHL	Hospitality	Mar-97	904.36
Illovo Sugar Malawi	Illovo	Manufacturing	Nov-97	190,406.70
Standard Bank	Standardbank	Banking	Jun-98	27,355.83
Press Corporation Ltd	PCL	Conglomerate	Sep-98	22,608.09
Old Mutual	OML	Insurance	Jul-99	4,335,504
National Bank of Mlw	NBM	Banking	Aug-00	25,727.65
Sunbird Tourism Ltd	Sunbird	Hospitality	Dec-00	1,700.29
National Inv. Trust Ltd	NITL	Insurance & Banking	Mar-05	2,295.00
First Merchant Bank	FMB	Banking	Jun-06	19,838.13
NBS Bank Ltd	NBS	Banking	Jun-07	8,004.08
Malawi Prop Inv.Co.Ltd	MPICO	Property	Nov-07	2,757.65
Real Insurance Co. Ltd	REAL	Insurance	Sep-08	300.00
Telekom Networks Mlw	TNM	Communication	Nov-08	14,056.00

Market Capitalisation as at December 2012 (in MK'm)

In order to further encourage more companies to list on the exchange, the MSE also established the Malawi Stock Exchange Alternative Capital Market, MSE ACM. This market is for small to medium companies that are still in their growth phase and as such, they do not meet the full criteria for listing on the exchange's main board. The MSE ACM has less stringent requirements for listing to enable smaller companies to list, and when these companies are fully grown, they graduate to list on the board. Table 2 provides a comparison of the listing requirements for the Main Board and for the ACM.

Table 2: Comparison of MSE Main Board and MSE ACM Listing Requirements

Requirement Description	MSE Main Board Requirements	MSE ACM Requirements
Share Capital	MK100.0 million	MK25.0 million
Equity Shares in Issue	30.0 million	10.0 million
Profit History	3 years	None for venture capital 1 year for existing companies
Free Float to the public	25% of shares in issue	20% of shares in issue
Number of public shareholders	300	100
1. Equity shares 2. Preference shares 3. Debenture	25 10 100 tambala	25 10 50 tambala

Source: MSE, Guidelines to the Listing on the MSE ACM.

2.2 Trading

Trading on the Malawi Stock Exchange is by call over, using an open-cry floor system on a matched bargain basis. Financial instruments traded on the Malawi Stock Exchange are common stock, preference shares, corporate debentures, warrants, government stocks and

fixed interest securities. However, the bulk of trades and listings on the Malawi Stock Exchange are for common stocks. Trading is done once a day from Monday to Friday.

In 2012 the market transacted a total of 667,221,045 shares in 1,041 trades compared to 1,590,006,071 shares in 1,425 trades in 2011. This indicates a decline of 58.04% in terms of share volume. The reported top 5 traded stocks by volume as of December 2012 were MPICO, TNM, NBS, FMB and REAL (see Table 3).

Table 3: Top 5 Traded Stocks by Volume as of December 2012

MSE Code	Shares Traded	% of Total
TNM	302,308,874	45.31
MPICO	280,388,419	42.02
FMB	19,882,978	2.98
NBS	15,577,963	2.33
NBM	15,486,483	2.32

Source: Malawi Stock Exchange, Annual Market Performance Review, 2012

It should be stated that the Malawi Stock Exchange is characterised by thin trading; that is to say, there is large inactivity in some counters where some companies stay for weeks on end without shares being bought or sold. This is one of the major challenges that the Malawi Stock Exchange faces.

The other major issue is that the Malawi Stock Exchange has had to grapple with its small size. It has taken thirteen years to have 15 companies listed. The privatisation process has been the main route through which the listing has slightly accelerated. The

size problem is exacerbated by the fact that the majority of the listed companies are financial institutions; there is no sufficient variety in terms of categories of companies listed. Other sectors like agriculture and manufacturing are not appropriately represented. This limited diversity and depth of the MSE could partly explain why there is a problem of insider trading discussed in the findings below.

2.3 Market Capitalisation and Index

Since 2000, there has been growth in Market Capitalisation due in part to a rise in the number of listed companies as well as increase in share price of previously listed companies. Market Capitalisation rose from K613,751.29 million in 2000 to K3,562,267.61million as of December 2012. In addition, in 2012 the Malawi Stock Exchange registered a positive return on index as reflected in the upward movement of the MASI from 5,369.42 points registered in January to 6,015.15 points registered in December giving a return on index of 10.74 percent. There were reported price gains registered on 8 counters (ILLOVO, NBM, NBS, NICO, NITL PCL, STANDARDBANK and OML) and these were the major drivers of the upward movement of the MASI. The top two decliners in 2012 were MPICO and TNM. Table 4 below is a presentation of total market capitalization since 2000.

Table 4: Market Capitalisation on the MSE since 2000

Year	Mkt Cap MK'm	Mkt Cap MK'm*	Mkt Cap US$'m	Mkt Cap US$'m*
2000	613,751.29	11,224.81	7671.41	140.3
2001	543,218.65	10,517.09	8,067.64	156.195
2002	395,179.35	10,074.25	4,537.72	115.679
2003	584,060.69	10,270.50	5,386.70	94.723
2004	745,271.02	18,321.29	6,485.42	168.214
2005	1,120,358.45	29,921.88	9,051.16	241.733
2006	1,672,124.20	84,295.52	13,508.77	681.007
2007	1,769,228.67	181,399.98	12,610.30	1,292.94
2008	1,839,275.76	251,447.07	13,081.65	1,783.39
2009	1,172,148.07	207,233.12	287,764.21	2,419.57
2010	1,278,529.23	8,478.27	207,233.12	1,374.15
2011	2,681,021.23	16,372.50	226,666.95	1,384.21
2012	3,562,267.61	10,570.53	253,946.93	753.55

* Indicates exclusion of non-Malawi registered Old Mutual plc shares

Source: Malawi Stock Exchange, Various Annual Reports.

2.4 Market Liquidity

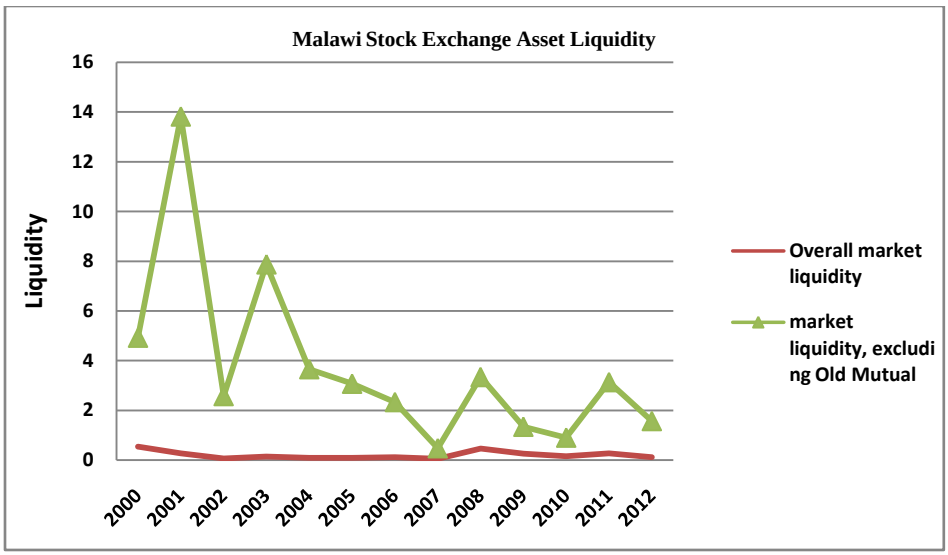
The Malawi Stock Exchange is highly illiquid with daily average value trade averaging approximately US $62,000. Furthermore, liquidity of assets on the Malawi Stock Exchange or turnover velocity as measured by the ratio of Total Value of Trades (TVT) to Market Capitalisation, seem to have been declining over the years. For instance, turnover velocity was recorded at 1.565 percent in 2012 compared to3.131 percent registered in 2011 and the ratio of Total Value of Trades to GDP recorded a liquidity level of 0.11 percent in 2012 compared to 0.26 percent in2011. Table 5 shows the trend in asset liquidity over the years and Figure 1 presents the same information graphically.

Table 5: Malawi Stock Exchange Asset Liquidity

Year	Mkt Cap /GDP %	Mkt Cap/ GDP*%	TVT/Mkt Cap	TVT/Mkt Cap*
2000	591.29	10.81	0.53	4.92
2001	375.89	8.5	0.268	13.82
2002	199.16	6.826	0.066	2.57
2003	354.4	6.232	0.138	7.87
2004	347.406	9.011	0.09	3.652
2005	551.01	14.716	0.0819	3.0673
2006	822.38	41.458	0.11737	2.3282
2007	474.45	48.646	0.04837	0.4717
2008	327.97	44.829	0.456	3.337
2009	208.98	38.443	0.246	1.336
2010	227.94	36.95	0.146	0.899
2011	366.45	30.98	0.263	3.131
2012	279.79	19.95	0.112	1.565

* Indicates exclusion of non-Malawi registered Old Mutual plc shares
Source: Malawi Stock Exchange

Fig 1: Malawi Stock Exchange Asset Liquidity since 2000



The decrease however is much higher when we include data for Old Mutual, which is a foreign company. This may indicate that there is very little or no trading at all on this counter. Such inactivity may be due the high price of the shares, or that the shares are doing so well that no one is willing to sell, hence there are no shares available for those willing to buy.

CHAPTER 3

LITERATURE REVIEW

3.0 Introduction

This chapter will look at models that have been used to look at stock market behaviour under the Efficient Market Hypothesis. After discussing theories of the stock market return behaviour, the chapter also reviews empirical studies that have been done before on the subject under review.

3.1 The Efficient Market Hypothesis

The Efficient Market Hypothesis mainly concerns the behavior of asset prices in a financial market. An efficient market is one in which stock prices reflect all the available information such that no new information could be used by a monopolist to exploit it to his advantage at the expense of other players in the market (Fama, 1970). Stock prices adjust to three information subsets and therefore there are three forms of the Efficient Market Hypothesis namely weak form, semi-strong form and strong form (Fama, 1970).

The weak form of the Efficient Market Hypothesis states that prices incorporate only past information about the asset. An implication of this form of the Efficient Market hypothesis is that one cannot detect mis-priced assets and consistently outperform the market through technical analysis of past prices. The semi-strong form of Efficient

Market Hypothesis asserts that stock prices reflect all historical and available public information. This information includes past prices and returns as well as a company's financial statements, accounting practices, earnings and dividend announcements and competitors' financial situation. The strong form of the Efficient Market Hypothesis states that the current price of a stock incorporates all existing information, both public and private. In this case, one should not expect to systematically outperform the market even if trading on insider information. According to this form of the Efficient Market Hypothesis, the market anticipates future developments and asset prices adjust to incorporate this information (Fama, 1970).

In its summary form, the Efficient Market Hypothesis is the idea that information is quickly and efficiently incorporated into asset prices at any point in time, such that old information cannot be used to predict price movements (Myers, 2003). This characteristic is closely related to the Random Walk Hypothesis. Wooldridge (2002) defines a random walk as a time series process where the next period's value is obtained as this period's value plus an independent (or at least uncorrelated) error term. The error term, therefore, makes the net value unpredictable. The study on the weak form efficiency of the Malawi Stock Exchange is therefore based on the Random Walk Hypothesis because even though the Random walk Hypothesis is not an exact description of the behavior of stock market prices as successive price changes may not be strictly independent, the dependence is negligible (Fama,1965). Thus, the dependence will not enable an investor make abnormal profits from the prediction of prices based on past events as all information will have been incorporated into the current prices.

3.2 Theoretical Framework

If the efficiency of a stock market holds, it is impossible for an investor to outperform the market and earn abnormal returns. Based on this, Fama (1970) suggested three models for testing stock market and these are: the Expected Return Model; the Submartingale Model and the Random Walk Model.

3.2.1 The Expected Return Model

In general, the Expected Return Model states that a stochastic process X_t condition on information set I_t, is a fair game if it has the following property:

$$\varepsilon(x_{t+1}|I_t) = 0 \qquad 3.1$$

Using this property, Fama (1970) introduced a model of the Efficient Market Hypothesis for expected returns and expressed it in the following equations:

$$x_{j,t+1} = p_{j,t+1} - \varepsilon\left(p_{j,t+1}|I_t\right) \qquad 3.2$$

With

$$\varepsilon(X_{t+1}|I_t) = \varepsilon\left[p_{j,t+1} - (p_{j,t+1}|I_t)\right] \qquad 3.3$$

Where $x_{j,t+1}$is the excess market value of security$j$ at time$t+1$, $p_{j,t+1}$ is the actual price of security j at time $t+1$ and $\varepsilon\left(p_{j,t+1}|I_t\right)$ is the expected price of security$j$ that was projected at time$t$, condition on information set I_t or equivalently:

$$z_{j.t+1} = r_{j,t+1} - \varepsilon(r_{j,t+1}|I_t) \qquad 3.4$$

With

$$\varepsilon(r_{t+1}|I_t) = \varepsilon\left[r_{j,t+1} - (r_{j,t+1}|I_t)\right] \qquad 3.5$$

Where $z_{j.t+1}$ is the excess return for security j at time$t+1$, r_{t+1} is the actual return for security j at time $t+1$ and $\varepsilon(r_{j,t+1}|I_t)$ is the equilibrium expected return at time $t+1$ conditional on information set I_t.

This model implies that the excess market value of security j at time$t+1$ is the difference between actual price and expected price conditional on information setI_t. Similarly, the excess return for security j at time$t+1$, is measured by the difference between actual and expected return in that period condition on information setI_t.

According to the Expected Return Model, the excess market value and excess return are zero. In other words, equations 3.3 and 3.5 indicate that excess market value sequence $\{x_{j,t+1}\}$ and $\{z_{j.t+1}\}$ respectively, are fair games with respect to the information set$\{I_t\}$

3.2.2 The Submartingale Model

The Submartingale model is the Expected Return Model with a small adjustment in expected return. In this model, the expected return is considered to be positive instead of zero as in the Expected Return model. This adjustment implies that prices of securities are expected to increase over time. In other word, the returns on investments are projected to be positive due to the risk inherent of capital investment. The Submartingale model can be mathematically written as follows:

$$E(\frac{r_{t-1}}{I_t}) \geq P_{jt}$$

$$E\left(\frac{r_{t-1}}{I_t}\right) = \frac{E\left(\frac{r_{t-1}}{I_t}\right)}{P_{jt}} \geq 0$$

This model states that the expected return sequence $\{r_{t-1}\}$ follows a submartingale, conditional on the information sequence $\{I_t\}$, which is meaningless in forecasting stock prices, except that the expected return, as projected on the basis of the information I_t, is equal to or greater than zero (Fama, 1970). The important empirical implication of the submartingale model is that no trading rule based only on the information set I_t can have greater expected returns than a strategy of always buying and holding the security during the future period in question.

3.2.3 The Random Walk Model

Fama (1970) argues that, in the stock market, the intrinsic value of a stock is equivalently measured by the future discounted value of cash flows that will accrue to investors. And if a stock market is efficient, stock prices must reflect all available information which is relevant for the evaluation of a company's future performance. Therefore the market price of a stock must equal its intrinsic value. Any new information which is expected to change a company's performance must be immediately reflected in the stock price because any delay could be exploited by a monopolist to earn abnormal returns. Thus, in an efficient stock market, price changes must be a response only to new information. Since information arrives randomly, stock prices must also fluctuate unpredictably. The Random Walk Model can be stated in the following equation:

$$P_{t+1} = P_t + e_{t+1} \qquad 3.6$$

Where:

P_{t+1} = Stock price at time $t + 1$

P_t = Stock price at time t

e_{t+1} = Random error with mean zero and constant variance

Equation 3.6 above indicates that stock price at time $t + 1$ is equal to the price at time t plus a value that depends on the new information (unpredictable) arriving between time t and $t + 1$. In other words, change of price, $e_{t+1} = P_{t+1} - P_t$ is independent on past price changes.

Fama (1970) argued that the Random Walk Model is an extension of the Expected Return Model. Specifically, the Expected Return Model indicates that conditions of the market equilibrium can be stated in terms of expected returns while the Random Walk Model gives details of the stochastic process generating returns. Therefore, he concluded that of the three models, empirical tests of the Random Walk Model are more powerful in support of the Efficient Market Hypothesis.

3.3 Empirical Literature Review

3.3.1 Weak Form of the Efficient Market Hypothesis

The weak form of the Efficient Market Hypothesis defines a market as efficient if current prices reflect all available information contained in historical prices. The implication of this is that past prices cannot be used as a predictive tool for future stock price movement. Therefore, it is not possible to earn abnormal returns on the basis of past history of prices only.

The weak form of the efficient market hypothesis implies that current market prices are independent of their past prices. Therefore tests of the weak form efficiency naturally are based on examining the relationship between current and past pries (Fawson, Glover,

Fang and Chang, 1996). A market is said to be efficient in the weak form if stock prices follow a random walk process. Hence, a number of statistical techniques such as runs test, unit root test, serial correlation test and normality test have been used in literature to test weak form efficiency.

Empirical literature on weak form efficiency of African stock markets have been very scanty, due in part to scarcity of data, and in Malawi only one such study has ever been done and that was Sibweza (2004). In this study the focus was on testing the weak form efficiency of the Malawi Stock Exchange by examining the presence of day-of-the-week and turn-of-the-month effect by using the GARCH-in mean (GARCH-M) model. The study concluded that the Malawi Stock Exchange may be weak form efficient on the basis that there was no evidence to support the presence of the day-of-the-week and the turn-of-the-month effects.

Other studies done in Africa include; Olowe (1999), Mecagni and Sourial (1999), Dickinson and Muragu (1994), Amoo and Raji (2006) and Mollah (2007). Olowe (1999) focused on the weak form efficiency of the Nigerian Stock Market. Using correlation analysis on monthly stock returns over the period January 1981 to December 1992, he observed that the Nigerian Stock Market is weak form efficient. The efficiency of the Nigerian Stock Market was also tested by Amoo and Raji (2006) using both parametric and non parametric tests. Their results were inconclusive as the parametric tests showed that the Nigerian Stock Market is weak form efficient while the non parametric tests showed that the market is not weak form efficient.

Mecagni and Sourial (1999) employed the GARCH estimation model to show that the best known four daily indices on the Egyptian Stock Market indicated significant departures from the Efficient Market Hypothesis. Dickinson and Muragu (1994), through serial correlation analysis and runs test, failed to find evidence inconsistent with weak form efficiency in the Nairobi Stock Exchange. Finally, Mollah (2007), conducting both parametric and non parametric tests on daily returns from the Botswana Stock Exchange, had to reject the weak form efficiency hypothesis in this market.

Moving to empirical studies elsewhere, Chan, Gap and Pan (1992) found that Hong Kong, South Korea, Singapore and Taiwan Stock Markets are weak form efficient using unit root tests. Liu, Sony and Romilly (1997) found that both Shangai and Shenzhen Chinese Stock Market indices are characterized by a random walk and are thus weak form efficient.

3.3.2 The Semi-Strong Form of the Efficient Market Hypothesis

The Semi-strong form of the Efficient Market Hypothesis states that current market prices reflect all publicly available information such as information on money supply, announcement of dividends, annual earnings, stock split among others. Studies of the Semi-strong form of the Efficient Market Hypothesis on emerging African markets are relatively few. In fact, according to our knowledge, no such study has ever been carried out on the Malawi Stock Exchange.

Some of the studies done on emerging African markets include: (Olowe, 1998), (Oludoyi ,1999), (Osei, 2002) and (Adelegan, 2003, 2009). Studies examining the information efficiency of the Nigerian Stock Market failed to find evidence of efficiency and therefore concluded that the Nigerian Stock market is not informationally efficient. Using weekly data, Oludoyi (1999) examined the reaction of stock prices in Nigeria to earnings announcement. Evidence from the study suggests that the Nigerian Stock market is not semi-strong efficient as stock prices drift 10 weeks after the corporate earnings results had been released to the public. Adelegan (2009) examined the speed of adjustment of stock prices to dividend announcement. The study reports evidence of significant positive abnormal return for dividend paying firms, 30 days from the date of the announcement. Therefore the study concludes that the Nigerian stock Market is not efficient in the semi-strong form and dividend announcement do not contain relevant information to which stock prices react. Osei (2002) investigated asset pricing characteristics and responsiveness to annual earnings announcements of the Ghana Stock Market. By measuring the abnormal and cumulative abnormal returns of selected securities on the Ghana Stock Market, he concluded that the Ghana Stock Market is not efficient with respect to annual earnings information.

Elsewhere, Sponholtz (2005) using event study analysis examined the information content of annual earnings announcements in the Danish Stock Market. The finding from the study was that there were significant abnormal price reactions in the period surrounding the announcement. Contrary to the efficient market hypothesis, the abnormal price reactions persist several days after the announcement, suggesting that the Danish

Stock market may not be informationally efficient. Sponholtz (2005) attributes the slow post announcement adjustment of prices to the small size of the Danish Stock Market.

The current study benefited theoretically, methodologically and from comparisons of outcomes from the theoretical and empirical literature presented in this chapter. This study will in turn be of use to other researchers by adding to the limited literature on the Malawi Stock Exchange. This is more so considering that the study is the first to look at the semi-strong efficiency of the market and further research can build on this study.

CHAPTER 4

RESEARCH METHODOLOGY

4.0 Introduction

This chapter introduces and discusses the model, tests and data that were used in the study to come up with the results that will be discussed in Chapter 5 below. The Weak Form Efficiency and Semi-strong efficiency tests are introduced separately.

4.1 Testing Weak Form Efficiency

The study adopted the Random Walk Model[2] of security prices as the basis for testing the weak form of the Efficient Market Hypothesis. Since new information is deemed to come in a random manner in an efficient market, price changes that occur as a result of that information will seem random. Thus, price movements in a weak form efficient market occur randomly and successive price changes are independent of one another. (Vitali and Mollah, 2011)

The study estimated the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model to establish the efficiency of the Malawi Stock Exchange. The GARCH model was used to capture the main characteristics of financial time series such as

[2]Excellent reviews on the subject of random walk could be obtained in Annuar and Shamsher (1993) and Campbell, et.al (1997).

stationarity, fat-tails and volatility clustering. In addition, the GARCH model was used to find the presence of non-linear Autoregressive Conditional Heteroscedasticity (ARCH) effects which contradict the random walk concept (Okpara, 2010)

Furthermore, a battery of both parametric and non-parametric tests was conducted to verify the Random Walk Hypothesis. The parametric tests used were: the Autocorrelation Function (ACF) test and the Augmented Dickey Fuller (ADF) test. The Kolmogrov-Smirnov Normality test and the Runs test were the non-parametric tests that were carried out. The January Effect was then tested in order to put the study in check due to the fact that it is one of the commonly cited anomalies that violate the Efficient Market Hypothesis.

4.1.1 The GARCH (1,1) Model

Engle (1982) and Bollerslev (1986) independently introduced the Autoregressive Conditional Heteroscedasticity (ARCH) and the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models, which specifically allow for a time variant conditional variance and nonlinearities in the generating mechanism. The basic GARCH (1,1) model derived below was estimated in the study. According to Brook and Burke (2003), the lag order (1,1) model is sufficient to capture the volatility clustering that is present from the data. The GARCH (1,1) model by Bollerslev (1986) is based on the assumption that forecasts of time varying variance depend on the lagged variance of the asset. An unexpected increase in returns at time *t* will generate an increase in the expected variability in the next period. The basic GARCH (1,1) can be expressed as:

$$MR_t = \mu + \varepsilon_t$$

$$\varepsilon_t | \phi_{t-1} \sim N(0, h_t)$$

$$h_t = \kappa + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} \quad 4.1$$

Where $\kappa > 0, \alpha \geq 0, \beta \geq 0$

MR_t stands for the uncorrelated returns on the Malawi Stock Exchange at time t. ε_t is the normally distributed error term with a conditional heteroscedastic variance (h_t) conditional on the information set ϕ_{t-1}. ε_{t-1}^2 is the news about volatility from the previous period (the ARCH term) and h_{t-1} is the last period forecast variance (the GARCH term). The GARCH model shows that the conditional variance, (volatility) of the error term of time t depends on both the squared error term in the previous period and its conditional variance in the previous period (Gujarati, 2004).

In this study market returns (MR_t) are calculated as:

$$MR_t = ln\left(\frac{P_t}{P_{t-1}}\right) \quad 4.2$$

Where:

MR_t = market return at period t

P_t = market index for period t

P_{t-1} = market index for period $t-1$

ln = natural log

The GARCH (1,1) is weakly stationary if $\alpha + \beta < 1$ but non-negative. If the value of $\alpha + \beta$ is very close to one, it shows high persistence of volatility clustering and implies inefficiency on the market. To determine the efficiency of the stock market, the focus is therefore on: the significance of the conditional mean, that is to say, the constant term in

the mean equation; significance of the ARCH term and the presence of volatility clusters in the variance equation.

4.1.2 Tests to Examine the Assumptions of the Random Walk Hypothesis

After estimating the GARCH (1,1) model, the return series is then subjected to a number of tests[3] both parametric and non-parametric to put to the test the assumptions of the random walk hypothesis.

4.1.2.1 Parametric Tests

The study employed two parametric tests to measure the degree of dependence of the series and these are: the Augmented Dickey Fuller (ADF) Unit Root test and the Autocorrelation Function (ACF) test.

4.1.2.1.1 The Augmented Dickey Fuller (ADF) Unit Root Test

The ADF test is one of the most commonly used tests for stationarity. It tests the null hypothesis that a series contains a unit root. If a time series has a unit root it is said to be non-stationary and a non-stationary time series follows a random walk (Vulić, 2009) Rejection of the hypothesis that a series contain a unit root implies rejection of the weak form Efficient Market Hypothesis.

[3]Detailed specifications for these tests could easily be obtained in most econometrics books. For this study Gujarati (2004) proved to be the most utilized.

4.1.2.1.2 The Autocorrelation Function (ACF) Test

The random walk hypothesis implies independent residuals and a unit root. The ACF test is therefore conducted to measure the correlation between the current and lagged observation of the time series of the stock returns as well as the extent to which current values of the series are related to various lags of the past data. Autocorrelation tests show whether the serial correlation coefficients are significantly different from zero. In an efficient market the null hypothesis of zero autocorrelation will prevail (Simons and Layrea, 2006).

4.1.2.2 Non-Parametric Tests

To confirm the distribution pattern of the returns, the study used the Kolmogrov-Smirnov Normality test. The Runs test was employed to test the independence between successive returns.

4.1.2.2.1 The Runs Test

This test is conducted to test the independence of successive stock return movement. This test was done because non-stationarity of the series, though necessary, is not sufficient condition for a random walk process to exist. A run can be defined as a sequence of return changes of the same sign. The test is carried out by comparing the actual number of runs to the expected number. According to Poshakwale (1996), a lower than expected number of runs indicates a market's overreaction to information while a higher number of runs reflect a lagged response to information. Implicitly, an abnormally high (or low) number of runs indicate evidence against the null hypothesis of a random walk.

4.1.2.2.2 Kolmogrov-Smirnov Normality Test

This test is used to test how well a data series fit a particular distribution. The test here was conducted to compare the cumulative distribution of the returns and the normal distribution to check if they are identical (Simons and Layrea, 2006).

4.2 Testing the January Effect

Having tested the efficiency of the Malawi Stock Exchange in the weak form, the study proceeded to test the presence of the January Effect so as to check the validity of the findings of the study. The January Effect was chosen because it is one of the market anomalies that critics of the Efficient Market Hypothesis most commonly point out as violating the hypothesis (Bodie, Kane, and Marcus, 2003). It is an anomaly where security prices increase in January and create an opportunity for investors to make abnormal returns. Proponents of the Efficient Market Hypothesis argue that three factors could explain this phenomenon. The first explanation being that it could actually be a result of tax-sensitive investors selling at the end of the year in order to reduce their tax liability and repurchase in January the following year (Malkiel, 2003). This could create a discernible pattern which Malkiel (2003) argues could be self-destruct and therefore no longer hold as criticism to the EMH. Another explanation is that, due to high liquidity arising from bonuses, investors bid prices up in the first half of trading in January of the succeeding year. A final possible explanation is that at the end of the year there is above average flow of information by firms as it is the last month of the financial year. This increases noise trading which bids up prices whose effect is depicted in January (Ali and Mustafa, 2001).

To detect the presence of the January effect the following dummy variable regression model was estimated:

$$MR_t = \beta_1 M_{1t} + \cdots + \beta_{12} M_{12t} + \varepsilon_t \qquad 4.3$$

Where MR_t is the monthly average market return andβ_1,…, β_{12} are OLS estimated coefficients.

The study therefore tested the hypothesis that β_1 is equal to zero, which implies that there is no significant January Effect on the Malawi Stock Exchange. The study went further to look at whether there is significant month-of-the-year effect on Malawi Stock Exchange by testing the hypothesis that the coefficients β_1,…,β_{12} are simultaneously equal to zero.

4.3 Testing Semi-strong Efficiency

A stock market is categorized as semi-strong efficient if stock price absorbs not only the historical information but also the information that is publicly available (Fama, 1970). One of the most employed studies of semi-strong efficient market hypothesis is event study analysis. The basic idea in event study analysis is to measure the valuation effects of a corporate event, by examining the responsiveness of the stock price around the announcement of the event. This is done based on the assumption that the market processes information about the event in an efficient and unbiased manner. Thus, event studies are used to connect the presence of a significant event to the market activities. Normally, event studies are designed to detect abnormal price changes in financial assets in the period around an event. (MacKinlay, 1997)

Financial reports of public companies are one of the basic information materials that are available to investors. On the basis of the Efficient Market Hypothesis, it is expected that investors will be cautiously following current companies' reports and that all the unexpected fluctuations in announcements made therein will be reflected accordingly in prices. As a result, there is no scope for anyone to earn abnormal returns. However, in the literature there is proof of the existence of abnormal returns during at least three months after the financial report publication date (Ball and Brown, 1968); (Foster, Olsen and Shelvin, 1984); (Bernard and Thomas, 1990). Presence of abnormal returns is an indication of the delay in investors' reaction to announcements made in financial reports and therefore verification of their presence is a proof of market inefficiency in the semi-strong form. Therefore this part of the study set out to verify whether the anomaly of delayed reaction to earnings announcement is present on the Malawi Stock Exchange which could therefore suggest that earnings announcement information is not fully and correctly incorporated into stock prices such that investors could earn abnormal return by trading on such information.

The study was carried out on the basis of the methodology commonly used in event studies. It was done by collecting a sample of companies in which events of the same kind have occurred in the past and defining precisely the time when information was made public. The next step was to monitor prices right before and after the event occurred. The subject of analysis was therefore the timing and scale of abnormal rates of return that accompanied the event.

4.3.1 Calculation of Abnormal Rates of Return

In order to assess the impact of a specific event on the return from a financial instrument, we must first establish what the return would have been in the absence of the event (the 'normal return'). The study estimated normal returns using the market model since it is conventional to assume that returns are jointly multivariate normal and identically and independently distributed through time (Fama, 1970). The market model presents a linear relationship between the returns on the market portfolio and the returns from a given security. The market model was chosen because it removes the portion of the return that is related to movement in the market hence the variance of any abnormal returns detected should be reduced (Dyckman, Philbrick and Stephan, 1984). Furthermore, use of the market model generally improves the chances of isolating the effects of specific events on stock returns (Odabasi, 1998). The model is specified as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \qquad 4.4$$

where R_{it} and R_{mt} are the period t returns on security i and on the market portfolio respectively, α_i is the intercept, β_i is the OLS regression coefficient between security i and the market portfolio, and ε_{it} is an identically and independently distributed error term with mean zero. Equation 4.4 partitions a rate of return from security i into a systematic component linearly dependent on the market return and an unsystematic component that is uncorrelated with the market. The effect of firm-specific events is understood as fully captured in the unsystematic component, based on the assumption that the information signal concerning an event has no influence on the market return.

The abnormal return (AR_{it}) for security i at time t is the difference between the actual return and the expected return and is calculated as follows:

$$AR_{it} = \varepsilon_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \quad 4.5$$

Parameters of the model above are estimated using a subset of data referred to as the estimation period using the OLS estimation method. The estimation period is an arbitrary period of time chosen to include no security specific events. Event window is also arbitrarily selected to capture ex-ante and ex-post effects of an event on security return. The choice of event window and estimation period varies greatly from study to study, which is unsurprising given the lack of sound evidential basis on which to select these two periods (MacKinlay, 1997).

Generally the event itself should not be included in the estimation period to avoid the event from influencing the parameters of the normal performance model. The length of the estimation period for the current study is 240 trading days which is approximately equal to one calendar year and ends a day prior to the first event being examined. The study examines an event window of 31 days, 15 days before and 15 days after the event. Choice of an event window of 31 days was based on the reasoning that as an emerging market, the Malawi Stock Exchange is characterised by thin trading. The implication of this is that analysis to understanding the full impact of new information on the market must be carried out on longer periods of time. In other words, it will take time for the impact of new information to be felt on thinly traded stock markets, hence the need to have a longer event window.

The study employed the traditional event study methodology which is commonly used to test the announcement effect of earnings (Dennis and McConnell, 1986); (Venkatesh, 1989); (Akhigbe and Madura, 1996). Basically, this method is based on Cumulative Average abnormal returns (CAAR).

The first step therefore is to find cumulative abnormal return (CAR) for security i over the event window of T days, which is estimated as the sum of the abnormal returns (AR) in the event window given by:

$$CAR_{i,T} = \sum_{t=1}^{T} AR_{it} \quad 4.6$$

Where, AR_{it} is abnormal return for security i at time t and $CAR_{i,T}$ is the cumulative abnormal return of security i over the event window of T days.

The cumulative average abnormal return (CAAR) for a sample stock *i* over the event window is:

$$CAAR_{iT} = \frac{\sum CAR_{iT}}{T} \quad 4.7$$

and

$$Var(CAAR_{iT}) = \bar{\sigma}^2 = \frac{\sum_{t=1}^{T} {\sigma_t}^2}{T} \quad 4.8$$

Where, $CAAR_{iT}$ is the cumulative average abnormal return for individual stock *i* over the event window of T. ${\bar{\sigma}_t}^2$ is the variance of abnormal return over the event window of security *i*.

Under the null hypothesis that the event has no impact on the level of returns and the expected value, which implies that the market is semi-strong efficient, $CAAR_{iT}$ equals zero (Campbell, 1997). It is therefore distributed as follows:

$$CAAR_{iT} \sim N(0, \bar{\sigma}^2) \quad 4.9$$

However, in practice the variance $\bar{\sigma}^2$ is unknown and is therefore replaced by its sample estimate $\hat{\bar{\sigma}}^2$ given by:

$$\hat{\bar{\sigma}}^2 = \frac{1}{T}\sum \sigma_t^2 \qquad 4.10$$

Where T is the number of days in the event window.

In this way the zero hypothesis can be verified by means of the following t statistic adopted from Brown and Warner (1985):

$$t = \frac{CAAR_{iT}}{\hat{\bar{\sigma}}/\sqrt{T}} \sim N(0,1) \qquad 4.11$$

4.4 Estimation Technique

The study used the maximum likelihood estimation technique in the estimation of the GARCH model to determine the weak-form efficiency of the Malawi Stock Exchange. It has been established that under this technique, the ML estimators remain consistent under the quasi-maximum likelihood assumptions. Hence ML estimation yields estimators that are asymptotically normally distributed, have asymptotically minimum variance and are asymptotically unbiased. Therefore even if the returns are not normally distributed, they still are efficient under these quasi ML assumptions (Gujarati, 2004).

The dummy model 4.3 testing for the January Effect was estimated using OLS estimation technique.

4.5 Data and its Sources

The market return series was derived from the Malawi All Share Index (MASI). Therefore, in the analysis of the weak form efficiency of the Malawi Stock Exchange, weekly MASI data from 7th January 2000 to 31st December 2012 was utilized and this

was sourced from the Malawi Stock Exchange's weekly trade reports. During this period the Malawi Stock Exchange witnessed tremendous growth in terms of number of companies listed on the bourse and Market Capitalisation. Furthermore, the Malawian investing public became more aware of the activities of the MSE during the privatisation hype of the 2000s.

To test the presence of the January Effect, the study derived monthly average returns from the weekly data for the period January 2000 to December 2012. In terms of the event study, daily data from 2nd June, 2009 to 28th December, 2012 on the four major banks listed on the Malawi Stock Exchange: National Bank of Malawi (NBM), NBS Bank (NBS), First Merchant Bank (FMB) and Standard Bank Limited (SBL) were collected from which daily returns for these individual stocks were derived. Table 6 presents the events reviewed in the event study.

Table 6: Summary of the Events considered in the Study

Number	Event	Date
1	FMB annual earnings announcement	26-Feb-10
2	NBS annual earnings announcement	12-Mar-10
3	SBL annual earnings announcement	22-Mar-11
4	NBS annual earnings announcement	25-Mar-11
5	NBM annual earnings announcement	31-Mar-11
6	FMB annual earnings announcement	22-Mar-12
7	NBM annual earnings announcement	27-Mar-12
8	NBS annual earnings announcement	29-Mar-12

CHAPTER 5

ESTIMATION AND INTERPRETATION

5.0 Introduction

This chapter presents and discusses the results of the analysis of the weak form efficiency of the Malawi Stock Exchange, the presence of the January Effect and the efficiency of the Malawi Stock Exchange in the semi-strong form.

5.1 Estimation Results and Interpretation: Weak Form Efficiency

This part presents the empirical analysis that was undertaken on weak form efficiency of the Malawi Stock Exchange.

Table 7: Summary Statistics for Weekly Malawi Stock Exchange Return Series

Statistic	Value
Mean	0.00432
Standard deviation	0.04049
Minimum	-0.59973
Maximum	0.33952
Range	0.93725
Skewness	-4.16584
Kurtosis	90.3588
Studentised range	23.2434

Table 7 presents the summary statistics of the weekly returns on the Malawi Stock Exchange. The statistics show positive mean value, a negative minimum and positive maximum. This is an indication that investors could make profits or losses on the Malawi Stock Exchange. The statistics also show that returns are skewed to the left and have large kurtosis values of 90.3588 indicating that the Malawi Stock Exchange market return series does not follow a normal distribution. The normal distribution of the market returns on the Malawi Stock Exchange is again refuted on the basis of the Studentised range[4] which Fama (1965) suggested as one of the tests of the degree to which data deviates from normality. The criterion utilized is that the null hypothesis of normal distribution is rejected if the Studentised range is greater than 6 (Simons and Layrea, 2006). Since the value of 23.24 is way above 6, it further suggests that the market Malawi Stock Exchange market return series is not normally distributed.

5.1.1 Estimation of the GARCH Model

The weak form efficiency of the Malawi Stock Exchange was tested by estimating a GARCH (1,1) model using maximum likelihood estimation technique. The results obtained are shown in table 8:

[4]The Studentised range (sr) is calculated as:

$$sr = \frac{maximum - minimum}{standard\ deviation}$$

Table 8: Output for GARCH (1,1) Model

MEAN EQUATION				
Variable	**Coefficient**	**Standard Error**	**Z-statistic**	**Prob**
Constant	-0.00388	0.00066	-5.88	0.000
VARIANCE EQUATION				
arch term	4.6819	0.09233	50.71	0.000
garch term	0.0000593	0.00195	0.23	0.976
constant	0.001515	0.0000293	51.68	0.000
Loglikelihood:1101.138				

From the results in table 8, the conditional mean (μ) parameter, the constant term in the mean equation is significantly different from zero, hence suggesting that we may reject the random walk hypothesis. In the variance equation, the value of $(\alpha + \beta)$ equals 4.682 which is greater than 1 and therefore suggests that the variance is time invariant hence indicating presence of volatility clusters which is an indication of market inefficiency. The significant ARCH term in the variance equation indicates the presence of non-linear ARCH effects. This contradicts the random walk concept. Therefore on the basis of the results of the GARCH (1, 1) model, we may conclude that the Malawi Stock Exchange is not weak form efficient.

5.1.2 Estimation Results and Interpretation of Parametric Tests

This part presents the results of the Augmented Dickey Fuller (ADF) Unit Root test and the Autocorrelations Functions (ACF) test.

5.1.2.1 Augmented Dickey Fuller (ADF) Unit Root test

Phenomenon such as white noise and random walk are greatly connected to the Efficient Market Hypothesis. The random walk hypothesis requires that a series contains a unit root, that is to say, it requires non-stationarity of the series. This argument was used to test whether the market returns on the Malawi Stock Exchange follow a random walk. If the analysed time series follow a random walk they are non-stationary thus it could be concluded that they are unpredictable. The Augmented Dickey-Fuller Test is used to test existence of a unit root in the return series. Using Akaike Information Criterion (AIC), lag length of 5 was chosen for the test. The result of the test is given in the table 9:

Table 9: Augmented Dickey-Fuller test for unit root

Value	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-24.065	-3.43	-2.86	-2.557

Mackinnon approximate p-value for z(t) = 0.000

The results in the table show that the value of the test statistic is significant at 1% significance level and therefore there is sufficient evidence to reject the null hypothesis that the series contains a unit root. The return series on the Malawi Stock Exchange is stationary and does not have a unit root nor does it follow a random walk. This is also pointing to the rejection of the hypothesis that the Malawi Stock Exchange is weak form efficient.

5.1.2.2 Autocorrelation Function Test

The Autocorrelation Function (ACF) test was conducted to identify the degree of autocorrelation in the return series. In a correlogram of a purely white noise series, the

autocorrelations at various lags hover around zero and this is a picture of a stationary time series. Therefore the correlogram of an actual economic series is said to be stationary if it resembles the correlogram of a white noise time series.

In order to determine the length of the lag the study adopted the rule of thumb stated in Gujarati (2004) that one should compute ACF up to one-third or one-quarter of the length of the time series. A lag length of 100 was therefore sufficient for the purposes of this paper.

For a stationary series, its correlogram tapers off rapidly whereas for a non-stationary series it dies gradually. The result in the graph of appendix A1 shows that the market return generated from the Malawi Stock Exchange series follows that of a purely white noise at lag two. This suggests that the series does not follow a random walk process collaborating with the hypothesis that the market under analysis is not weak form efficient.

5.1.3 Estimation Results and Interpretation of Non-Parametric Tests

This part presents the results on the Runs test and the Kolmogrov-Smirnov Normality test.

5.1.3.1 Runs Test

This test has the advantage of ignoring the distributional properties of the data and does not require the normality or constant variance of the data. The Runs test is performed on

the residuals predicted from the regression of the market return on its lagged values. Therefore the first step in executing the runs test is to estimate the following regression:

$$MR_t = \alpha + \beta MR_{t-1} + \mu_t \qquad 5.1$$

The second step is to predict the residuals from regression 5.1 above and then execute the runs test on these predicted residuals.

The results in Table 10 below show a significant Z statistic and behoves us to reject the null hypothesis of random walk at 1% level of significance. The result suggests that since the series does not follow a random walk, the Malawi Stock Exchange may be weak form inefficient.

Table 10: Results of the Runs test

Obs	N(runs)	Z	Prob>| Z |
635	199	-9.49	0.000

5.1.3.2 Kolmogrov-Smirnov Normality Test

This test is used to detect how well a data series fits a particular distribution. In the current study, the test was used to determine if the normal distribution and the distribution of the market return series are identical. The Kolmogrov-Smirnov test was done at the 1 percent level of significance and suggests that the normality assumption is to be rejected. The normality assumption is also rejected at 5 percent level of significance as shown in table 11.

Table 11: Results of the Kolmogrov-Smirnov test

Smaller Group	D	P-Value	Corrected
MR	**0.1587**	**0.000**	
Cumulative	-0.8413	0.000	
Combined K-S	0.8413	0.000	0.000

5.2 Estimation Results and Interpretation of the January Effect

The anomaly of January effect on the Malawi Stock Exchange was tested by examining the statistical significance of stock returns for January and compared it with that of all the other months of the year. Table 12 presents the results of the January effect for the period January 2000 to December 2012. Average monthly returns were used in the analysis.

Table 12: Estimation results for the January effect

Month	**Coefficient**	**t**	**Prob.**
January	0.004	1.13	0.258
February	-0.004	-1.13	0.258
March	0.00267	0.76	0.45
April	0.004	1.13	0.258
May	-0.00333	-1.51	0.132
June	0.002	0.57	0.571
July	-0.002	-0.57	0.571
August	0.00667	1.89	0.06
September	-0.004	-1.13	0.258
October	-0.00667	-1.19	0.85
November	0	0	1
December	-0.00667	-1.19	0.85

The P-value for January, 0.258, is insignificant at 5 percent level of significance; consequently there is enough evidence to accept the hypothesis that there is no significant

January effect on the Malawi Stock Exchange. However, the coefficient for August of 0.060 is significant at 10 percent level of significance which indicates that there could be a month-of-the-year effect on the Malawi Stock Exchange. In such a case, it is expected that the returns of the month of August will be higher than the returns from the other months. This observation could be attributed to a number of factors, one of which is the fact that by August the national budget would have been passed and therefore the government could have at least paid most of its debts from the previous financial year and therefore investors will have money with which they would invests on the Malawi Stock Exchange. The other factor is that by August, commercial farmers in tobacco and maize farming will have sold most of their produce and therefore there is money to invest on the Malawi Stock Exchange.

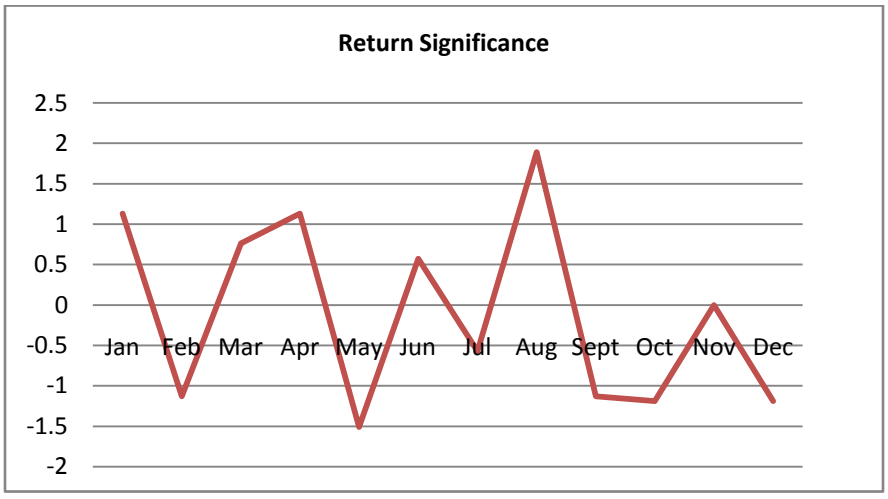


Fig 2: Behaviour of Average Return in January Effect Analysis

Graphical presentation of table 12 is used to show the behaviour of the average return in the January Effect analysis.

Nevertheless, the results of the joint *F-test* on whether the monthly coefficients simultaneously equal to zero indicate that we do not have enough evidence to reject the hypothesis that there is no significant month-of-the-year effect on the Malawi Stock Exchange. Specifically, an *F-statistic* of 1.03 is statistically insignificant at 5 percent level of significance, hence it points to the conclusion that there is no significant month-of-the-year effect.

5.3 Estimation Results and Interpretation: Semi-strong Form Efficiency

After establishing that the Malawi Stock Exchange is not weak form efficient, and that neither are there significant January Effect nor month-of-the-year effect, the study proceeded to test whether the Malawi Stock Exchange is semi-strong efficient by conducting an event study on whether the Malawi Stock Exchange is informationally efficient with respect to annual earnings announcement information. In a nutshell, the event study was done to test whether investors in stocks of the four major banks listed on the Malawi Stock Exchange could earn significant abnormal returns on the basis of trading on annual earnings announcement information released by these banks.

The hypothesis of zero average abnormal return was tested based on the test statistic that is developed from the cumulative average abnormal return. The tables from appendix A2 to appendix A9 show the results of the event study of the different annual earnings announcements that were made during the period under investigation. We first considered how individual stocks behaved around the event day before proceeding to analyse the

overall average behaviours during the event windows. This analysis is based on how the annual earnings announcements of a firm affect the returns of that particular firm.

Table 13 summarises the results of the event studies as presented in the appendices A2 to A9.

Table 13: Summary Results of the Event Study

Stock	Event	No. of statistically significant statistics	Accept or Reject Ho
FMB	Event 1	0	Accept
	Event 2	31	Reject
NBM	Event 1	0	Accept
	Event 2	31	Reject
NBS	Event 1	31	Reject
	Event 2	31	Reject
	Event 3	31	Reject
SBL	Event 1	31	Reject

Results from the table above, we cannot reject the null hypothesis that the earnings announcement did not have an impact on the stock returns in 2 out of the 8 events considered in the study. This implies that the market would be considered efficient based on these results. On the other hand, from the results, we cannot accept the null hypothesis that there was no impact from the earnings announcement on the stock returns in out of the 8 events in the study. This implies that the market cannot be considered to be semi-strong efficient based on the rejection of the null hypothesis in the events studied.

For all events with statistically significant CAAR values, it means investors could earn abnormal (excess) returns during the 30-day event window (Adelegan, 2009). Therefore, share prices do not fully incorporate earnings announcements information on the MSE.

According to Fama (1965), there are observable lags in complete adjustment of actual prices to new equilibrium values.. This would happen if the event is anticipated by the market before it actually happens. However, it is generally expected that the price adjustment takes place on the event day if the results are to be consistent with the prediction that the earnings announcement possess informational value (Kadioglu, 2008); (Odabasi, 1998). For the MSE, the results in the appendices show that this is not the case. This result is consistent with results obtained in other emerging and inefficient stock markets (Odabasi, 1998); (Aga and Kocaman, 2008); (Iqbal and Farooqi, 2011). In fact, systematically nonzero abnormal security returns that persist after a particular corporate event (and it is argued here, for any particular period of time for that matter) are inconsistent with market efficiency (Fama, 1991).

Overall analysis of the average behaviours of the stocks during the event windows indicate that the greatest magnitude of earnings reactions (in absolute terms) takes place in the post-event period than in the pre-event period. Figure 3 is a graphical presentation of the mean CAARs in the pre-event and post-event section of the event window. The reason for such observation could be the fact that financial information flow on the market is slow and so leads to delayed reaction by investors. During most of the times,

the banks considered in the study delayed in the release of their annual earnings which might have led to speculation before appropriate reaction to the news.

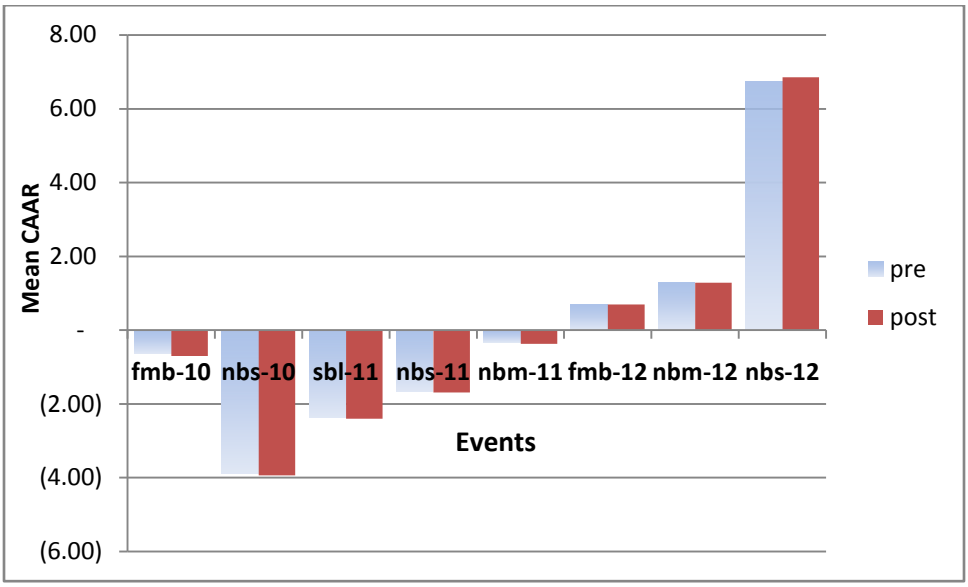


Fig 3: Mean CAARs in the pre- and post-event periods

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter summaries the results obtained from the study, provides recommendations for policy making and finally stipulates the limitations to the study and possible areas for future research.

6.1 Summary of the Study

The study set out to examine both the weak form and the semi-strong form of the Efficient Market Hypothesis on the Malawi Stock Exchange by employing multiple statistical tests of the Random Walk Hypothesis and by testing market anomalies on the Malawi Stock Exchange. The period of analysis and data utilised changed depending on what was being examined. However, data on the Malawi All Share Index (MASI) was collected from which market returns were derived where as stock indices for specific securities were also collected from which stock returns for those securities were derived.

Estimation results from the GARCH (1,1) model which was used to test weak form efficiency of the Malawi Stock Exchange, showed that the Malawi Stock Exchange return series had a statistically significant constant term in the mean equation and a time invariant variance which indicated persistence of volatility clusters and presence of

ARCH effects in the variance equation. These observations led to the conclusion that the Malawi Stock Exchange may be inefficient in the weak form.

To ascertain this initial finding the study tested the characteristics of the Random Walk Model by using parametric and non parametric tests. The Augmented Dickey-Fuller (ADF) and the Autocorrelations Function tests were the two parametric tests that were considered while the Runs test and the Kolmogrov-Smirnov test were the two non-parametric tests that were conducted.

On the basis of the ADF test, the results showed that the Malawi Stock Exchange return series does not contain a unit root which signifies that the series is stationary. According to the Random Walk Model, a stationary series is non random and is therefore inconsistent with the Efficient Market Hypothesis. The ACF test was then conducted to determine if there was autocorrelation in the return series. Presence of autocorrelation was confirmed given that the correlogram of Malawi Stock Exchange return series resembled that of a white noise and the partial ACF quickly died away at lag 5. The Malawi Stock Exchange return series could not be characterised as a random walk, again suggesting inefficiency of the Malawi Stock Exchange. Therefore, these parametric tests led to the conclusion that the Malawi Stock Exchange is not efficient in the weak form of the Efficient Market Hypothesis.

The results of the Kolmogrov-Smirnov Normality test showed that the Malawi Stock Exchange return series is not normally distributed. Since the Random Walk Model assumes that the random walk process follows a normal distribution, the conclusion is

that the Malawi Stock Exchange return series is not a random walk and therefore the Malawi Stock Exchange is not efficient. Furthermore, the results of the Runs test showed the Malawi Stock Exchange return series does not have independent successive price changes. This is a violation of one of the fundamental assumptions upon which the Random Walk Model is built on and that is, independence of successive price changes. Consequently, these two non parametric tests led to the conclusion that the Malawi Stock exchange is not weak form efficient.

The Efficient Market Hypothesis has been subjected to a number of criticisms based on the fact that discernible patterns are existent on most stock markets. The study therefore went further to examine one of the most referred to and studied anomalies in stock markets: the January effect. However, the Month-of- the-year effect was also tested as a by product of the test of the January effect. The tests of the January as well as the Month of the Year effect on the Malawi Stock Exchange indicated insignificant coefficient for the month of January over the study period. This therefore indicates that there are no January effects on the Malawi Stock Exchange.

The study did also examine the efficiency of the Malawi Stock Exchange in the semi-strong form by examining the nature and extent of market's responsiveness to companies' annual earnings announcement information. Specifically, the study assessed whether the stock prices failed to fully incorporate to earnings announcement information on the Malawi Stock Exchange, to which end we could categorize the Malawi Stock Exchange

as inefficient in the semi-strong form of the Efficient Market Hypothesis. An event study analysis was used to examine the semi-strong efficiency of the Malawi Stock Exchange.

The results of the event study indicated that abnormal returns could be earned on stocks of the four major banks listed on the Malawi Stock Exchange during the event windows of the annual earnings announcement by these banks. This implies that on the basis of the events considered in the study, the Malawi Stock Exchange did not quickly and fully incorporate annual earnings information into stock prices. Appendix 10 shows comparison of stock price reactions to new information in efficient markets and inefficient markets. Appendix 11 shows how the prices on the MSE (proxied by the CAARs) behaved. In other words, the market misreacted to annual earnings information. Overall, the findings from the event study contradicted the Efficient Market Hypothesis and therefore the hypothesis that Malawi Stock Exchange is not semi-strong efficient could not be rejected.

6.2 Recommendations

Two major issues were observed from the results of the study that lead to the two recommendations that will be made. The first issue is that in general, the results of the event study indicate that the greatest magnitude of earnings reaction takes place in the pre-event period. The implication is that the recorded significant abnormal returns in this period could be as a result of insider dealings and not necessarily the information content of earnings announcement. This could therefore be attributed to weak regulations and institutions, poor infrastructure as well as poor corporate governance.

The second issue is that during the period under analysis, the Malawi Stock Exchange recorded impressive MASI growth and positive earnings were reported by most firms considered in the study as such a general negative market reaction in the event window is contrary to prior expectation. One possible explanation for such negative reaction is that most of the firms considered in the study delayed in the release of their annual earnings. According to Chambers and Penman (1984), firms that do not announce earnings early send signals of negative news and thus earn negative pre-announcement and post-announcement abnormal returns. Therefore this argument may provide some explanation for the findings of the study.

The study therefore makes a number of recommendations. Firstly, the regulatory authorities should intensify efforts to ensure compliance to insider trading laws by market participants. To do this, capacity should be built within the relevant authorities such that appropriate measures are taken against any offending market players. Secondly, listed companies should be encouraged to ensure timely release of financial reports. This will help the companies in that their stock will attain true value by avoiding the market's overreaction or underreaction to the impending announcement. Lastly and related to the second recommendation above, market regulators and policy makers need to shorten the deadlines for the release of financial statements and impose penalties on companies that delay in the release of their results. Timely release of financial information is expected to help discourage unnecessary speculations by investors while at the same time attract new investors and improve information efficiency of the Malawi Stock Exchange.

6.3 Limitations of the Study and Assumptions

The first limitation of the study was that the period under analysis was rather short to give a more insightful and clear picture of the market under study. This limitation emanates from the fact that the Malawi Stock Exchange is an emerging market, having only been in existence since 1994 and stock trading did not commerce until 1996. The second limitation was the unavailability of data on other companies listed on the Malawi Stock Exchange. Such data could have helped in drawing a better conclusion. Furthermore, the study was carried out on the *ceteris paribus* assumption with respect to the impact of gradual entry to the market of companies over the years under study. Given these limitations and assumptions, the results of this study may be the basis for further research. The proposed areas of further research are presented in the next section.

6.4 Areas for Future Research

Future research on the Malawi Stock Exchange may focus on a number of areas. First, future studies could be done on the strong form of the Efficient Market Hypothesis in order to complete the analysis of the efficiency of the Malawi Stock Exchange. Second, since the number of counters on the Malawi Stock Exchange has varied over the period under review, it would be interesting to test the evolving efficiency of the stock market. Jefferis and Smith (2005) conducted such a study on 10 African stock markets. Finally, future research could be of the same study as the current one with a larger sample of firms and events, depending on the availability of data.

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APPENDICES

Appendix A1: Autocorrelation Function Test

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. corrgram MR, lags(100)
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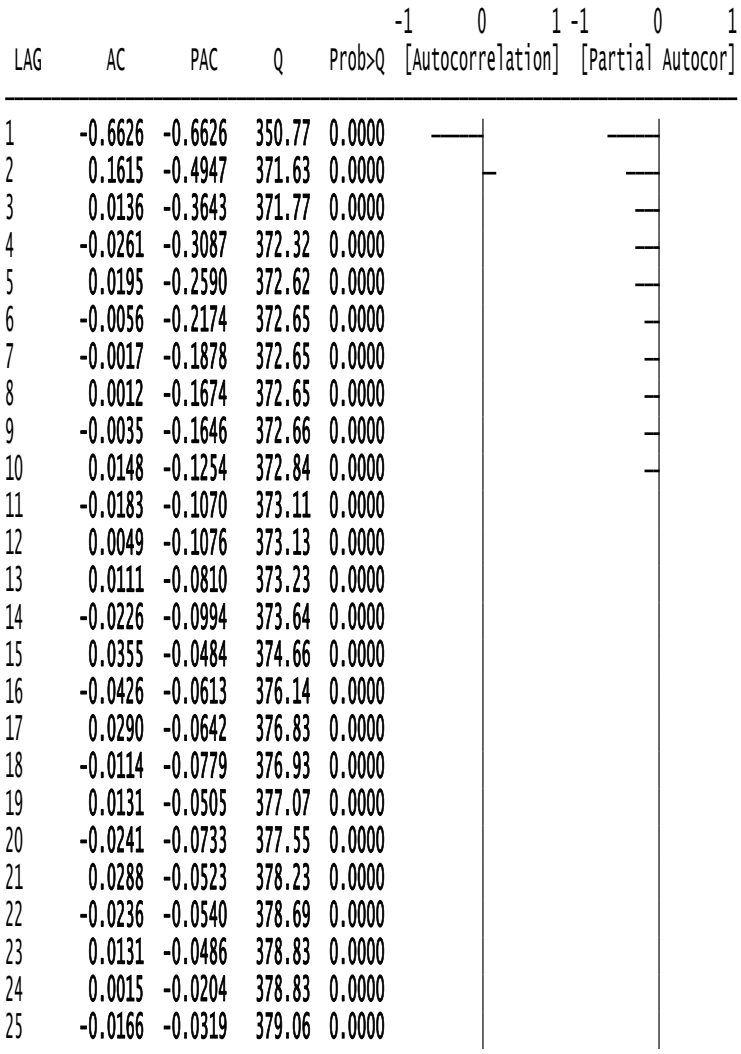


LAG	AC	PAC	Q	Prob>Q	[Autocorrelation]	[Partial Autocor]
1	-0.6626	-0.6626	350.77	0.0000		
2	0.1615	-0.4947	371.63	0.0000		
3	0.0136	-0.3643	371.77	0.0000		
4	-0.0261	-0.3087	372.32	0.0000		
5	0.0195	-0.2590	372.62	0.0000		
6	-0.0056	-0.2174	372.65	0.0000		
7	-0.0017	-0.1878	372.65	0.0000		
8	0.0012	-0.1674	372.65	0.0000		
9	-0.0035	-0.1646	372.66	0.0000		
10	0.0148	-0.1254	372.84	0.0000		
11	-0.0183	-0.1070	373.11	0.0000		
12	0.0049	-0.1076	373.13	0.0000		
13	0.0111	-0.0810	373.23	0.0000		
14	-0.0226	-0.0994	373.64	0.0000		
15	0.0355	-0.0484	374.66	0.0000		
16	-0.0426	-0.0613	376.14	0.0000		
17	0.0290	-0.0642	376.83	0.0000		
18	-0.0114	-0.0779	376.93	0.0000		
19	0.0131	-0.0505	377.07	0.0000		
20	-0.0241	-0.0733	377.55	0.0000		
21	0.0288	-0.0523	378.23	0.0000		
22	-0.0236	-0.0540	378.69	0.0000		
23	0.0131	-0.0486	378.83	0.0000		
24	0.0015	-0.0204	378.83	0.0000		
25	-0.0166	-0.0319	379.06	0.0000		

Appendix A2: Reaction of FMB stock return to FMB earnings announcement on 26-Feb-2010

company	dif	caar	t-stat
1	-15	-0.615	-1.342
1	-14	-0.618	-1.349
1	-13	-0.622	-1.357
1	-12	-0.625	-1.365
1	-11	-0.629	-1.373
1	-10	-0.632	-1.38
1	-9	-0.636	-1.388
1	-8	-0.64	-1.396
1	-7	-0.643	-1.403
1	-6	-0.647	-1.411
1	-5	-0.65	-1.419
1	-4	-0.654	-1.427
1	-3	-0.657	-1.434
1	-2	-0.661	-1.442
1	-1	-0.664	-1.45
1	0	-0.668	-1.457
1	1	-0.671	-1.465
1	2	-0.675	-1.473
1	3	-0.678	-1.48
1	4	-0.682	-1.488
1	5	-0.685	-1.496
1	6	-0.689	-1.504
1	7	-0.693	-1.511
1	8	-0.696	-1.519
1	9	-0.7	-1.527
1	10	-0.703	-1.534
1	11	-0.707	-1.542
1	12	-0.71	-1.55
1	13	-0.714	-1.558
1	14	-0.717	-1.565
1	15	-0.721	-1.573

Appendix A3: Reaction of NBS stock return to NBS earnings announcement on 12-March- 2010

company	dif	caar	t-stat
3	-15	-3.854	-8.129
3	-14	-3.858	-8.137
3	-13	-3.861	-8.145
3	-12	-3.865	-8.152
3	-11	-3.869	-8.16
3	-10	-3.872	-8.168
3	-9	-3.876	-8.176
3	-8	-3.88	-8.183
3	-7	-3.883	-8.191
3	-6	-3.887	-8.199
3	-5	-3.891	-8.206
3	-4	-3.894	-8.214
3	-3	-3.898	-8.222
3	-2	-3.902	-8.23
3	-1	-3.905	-8.237
3	0	-3.909	-8.245
3	1	-3.913	-8.253
3	2	-3.916	-8.26
3	3	-3.92	-8.268
3	4	-3.924	-8.276
3	5	-3.927	-8.283
3	6	-3.931	-8.291
3	7	-3.935	-8.299
3	8	-3.938	-8.307
3	9	-3.942	-8.314
3	10	-3.946	-8.322
3	11	-3.949	-8.33
3	12	-3.953	-8.337
3	13	-3.956	-8.345
3	14	-3.96	-8.353
3	15	-3.964	-8.361

Appendix A4: Reaction of SBL stock return to STD Bank earnings announcement on 22-March- 2011

day	CAAR	t-stat
-15	-2.372	-14.421
-14	-2.373	-14.429
-13	-2.375	-14.437
-12	-2.376	-14.444
-11	-2.377	-14.452
-10	-2.378	-14.46
-9	-2.38	-14.468
-8	-2.381	-14.475
-7	-2.382	-14.483
-6	-2.384	-14.491
-5	-2.385	-14.498
-4	-2.386	-14.506
-3	-2.387	-14.514
-2	-2.389	-14.522
-1	-2.39	-14.529
0	-2.391	-14.537
1	-2.392	-14.545
2	-2.394	-14.552
3	-2.395	-14.56
4	-2.396	-14.568
5	-2.398	-14.576
6	-2.399	-14.583
7	-2.4	-14.591
8	-2.401	-14.599
9	-2.403	-14.606
10	-2.404	-14.614
11	-2.405	-14.622
12	-2.406	-14.63
13	-2.408	-14.637
14	-2.409	-14.645
15	-2.41	-14.653

Appendix A5: Reaction of NBS stock return to NBS earnings announcement on 25-March-2011

day	CAAR	t-test
-15	-1.655	-8.995
-14	-1.656	-9.003
-13	-1.658	-9.011
-12	-1.659	-9.019
-11	-1.661	-9.026
-10	-1.662	-9.034
-9	-1.663	-9.042
-8	-1.665	-9.049
-7	-1.666	-9.057
-6	-1.668	-9.065
-5	-1.669	-9.073
-4	-1.67	-9.08
-3	-1.672	-9.088
-2	-1.673	-9.096
-1	-1.675	-9.103
0	-1.676	-9.111
1	-1.678	-9.119
2	-1.679	-9.127
3	-1.68	-9.134
4	-1.682	-9.142
5	-1.683	-9.15
6	-1.685	-9.157
7	-1.686	-9.165
8	-1.687	-9.173
9	-1.689	-9.181
10	-1.69	-9.188
11	-1.692	-9.196
12	-1.693	-9.204
13	-1.695	-9.211
14	-1.696	-9.219
15	-1.697	-9.227

Appendix A6: Reaction of NBM stock return to NBM earnings announcement on 31-March-2011

day	CAAR	t-stat
-15	-0.31	-0.897
-14	-0.313	-0.905
-13	-0.316	-0.913
-12	-0.318	-0.92
-11	-0.321	-0.928
-10	-0.324	-0.936
-9	-0.326	-0.944
-8	-0.329	-0.951
-7	-0.332	-0.959
-6	-0.334	-0.967
-5	-0.337	-0.974
-4	-0.34	-0.982
-3	-0.342	-0.99
-2	-0.345	-0.997
-1	-0.348	-1.005
0	-0.35	-1.013
1	-0.353	-1.021
2	-0.356	-1.028
3	-0.358	-1.036
4	-0.361	-1.044
5	-0.364	-1.051
6	-0.366	-1.059
7	-0.369	-1.067
8	-0.372	-1.075
9	-0.374	-1.082
10	-0.377	-1.09
11	-0.38	-1.098
12	-0.383	-1.105
13	-0.385	-1.113
14	-0.388	-1.121
15	-0.391	-1.129

Appendix A7: Reaction of FMB stock return to FMB earnings announcement on 22-March- 2012

day	CAAR	t-stat
-15	0.677	5.328
-14	0.678	5.336
-13	0.679	5.344
-12	0.68	5.351
-11	0.681	5.359
-10	0.682	5.367
-9	0.683	5.374
-8	0.684	5.382
-7	0.685	5.39
-6	0.686	5.398
-5	0.687	5.405
-4	0.688	5.413
-3	0.688	5.421
-2	0.689	5.428
-1	0.69	5.436
0	0.691	5.444
1	0.692	5.452
2	0.693	5.459
3	0.694	5.467
4	0.695	5.475
5	0.696	5.482
6	0.697	5.49
7	0.698	5.498
8	0.699	5.506
9	0.7	5.513
10	0.701	5.521
11	0.702	5.529
12	0.703	5.536
13	0.704	5.544
14	0.705	5.552
15	0.706	5.56

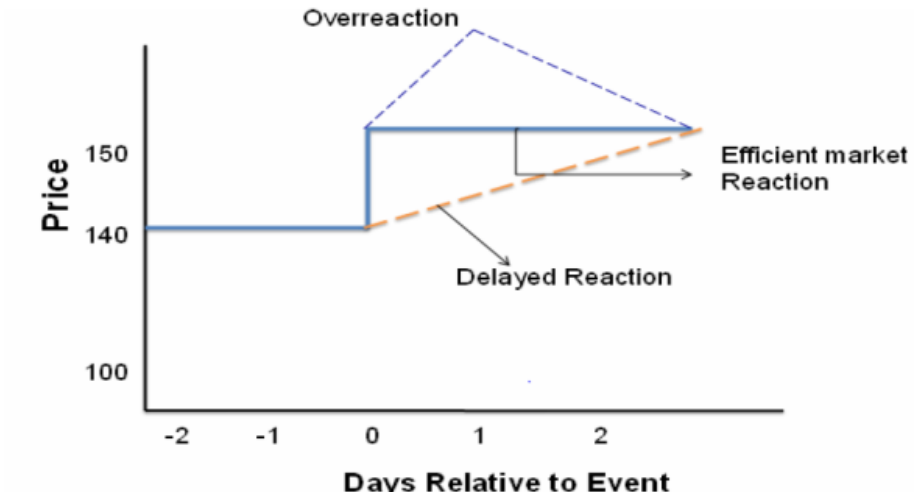
Appendix A8: Reaction of NBM stock return to NBM earnings announcement on 27-March- 2012

day	CAAR	t-stat
-15	1.273	17.325
-14	1.273	17.333
-13	1.274	17.341
-12	1.274	17.348
-11	1.275	17.356
-10	1.275	17.364
-9	1.276	17.372
-8	1.277	17.379
-7	1.277	17.387
-6	1.278	17.395
-5	1.278	17.402
-4	1.279	17.41
-3	1.279	17.418
-2	1.28	17.426
-1	1.281	17.433
0	1.281	17.441
1	1.282	17.449
2	1.282	17.456
3	1.283	17.464
4	1.283	17.472
5	1.284	17.48
6	1.285	17.487
7	1.285	17.495
8	1.286	17.503
9	1.286	17.51
10	1.287	17.518
11	1.287	17.526
12	1.288	17.534
13	1.289	17.541
14	1.289	17.549
15	1.29	17.557

Appendix A9: Reaction of NBS stock return to NBS earnings announcement on 29-March- 2012

day	CAAR	t-stat
-15	6.679	6.695
-14	6.687	6.703
-13	6.694	6.711
-12	6.702	6.718
-11	6.71	6.726
-10	6.717	6.734
-9	6.725	6.741
-8	6.733	6.749
-7	6.74	6.757
-6	6.748	6.765
-5	6.756	6.772
-4	6.763	6.78
-3	6.771	6.788
-2	6.779	6.795
-1	6.787	6.803
0	6.794	6.811
1	6.802	6.819
2	6.81	6.826
3	6.817	6.834
4	6.825	6.842
5	6.833	6.849
6	6.84	6.857
7	6.848	6.865
8	6.856	6.872
9	6.863	6.88
10	6.871	6.888
11	6.879	6.896
12	6.887	6.903
13	6.894	6.911
14	6.902	0.919
15	6.91	6.926

Appendix 10: Price Reactions to New Information in Efficient Markets and Inefficient Markets



Source: Ross eta al (1999)

Appendix 11: Trends of CAARs under the Event Study