PORTFOLIO DIVERSIFICATION IN MALAYSIAN STOCK MARKET

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DECLARATION

We hereby declare that:

(1) This UBFZ 3026 Research Project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the research project.

(4) The word count of this research report is ___**18,675**_________________.

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Thesis group leader

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ABSTRACT

The debate against the performance between Active portfolio strategy and Passive portfolio strategy has been existed for decade. As an investor, the relationship between risk and return plays an important role in constructing portfolio. Active portfolio holder diversifies their portfolio by actively trading and managing portfolio, while passive portfolio holder constructs their portfolio and hold for their desire tenure. Investors are also interesting regarding which strategy perform the best during long term and crisis period. Besides, the reliability of correlation coefficient method that is widely used in constructing Active portfolio has been questioned by many researchers. In this research, all the above statement will bring into Malaysian stock market perspective. The ratios used to measure the risks and returns are Sharpe Ratio, Jensen Index, and Treynor Index. The test used in this research includes GARCH, Unit root and cointegration. This research has included 13 years period of daily data for long run performance comparison, and 2007 crisis period for the performance comparison within crisis period. The findings obtained from this research showed that during both the long run and crisis period Active portfolio strategy does outperformed Passive portfolio strategy. Empirical results also showed that Malaysian stock market is not efficient compared to developed countries as it does not provide significant diversification benefits when simply adding more stocks in a portfolio. While by comparing the performance between correlations based portfolio and cointegration based portfolio, the cointegration based portfolio does outperformed the correlation based portfolio.

CHAPTER 1.0 INTRODUCTION

1.1 Introduction of Research Project

The debate between passive diversification strategy and active diversification strategy over which one is a better strategy has existed long in the stock market. Thus, in this paper, this research aimed at finding out which strategy is more appropriate to be used in Malaysian stock market over the long run and during the crisis as well as determining the level of diversification that can be achieved in Malaysian stock market by randomly selecting a number of stocks ranging from 10 to a maximum of 100 stocks. Besides that, this research will also examine the construction of portfolio based on correlation and cointegration analysis.

In chapter 1, this research will briefly discuss the background of the study. The background started with stock market theory. Then, it is narrowed down to the area of diversification, which includes the types and strategies of diversification, evidence on diversification, how combination of stocks can be done, and finally the factors affecting the portfolio diversification. The background of the study is followed by the problems that exist in literature. Additionally, the research objectives will clearly set to precede purpose of this study in this chapter. Finally, the significance of the study will be discussed.

1.2 Background of the Study

1.2.1 Definition of Diversification

Diversification is a portfolio strategy designed to reduce exposure of risk by combining a variety of investments into one basket of portfolio. The rationale behind this technique contends that a portfolio of different kinds of investments will yield higher returns and pose a lower risk than any individual investment found within the portfolio.

1.2.2 Types of Diversification

There are various types of portfolio diversification, and the below have briefly discuss about the diversification in stock, bond and mutual fund.

i. Diversification in Stock

Diversification in stock can be done by investing in companies with different market capital size. According to Swedroe (2006), small capital stocks tend to have higher return. Besides that, investors can also diversify their investment in growth stocks and value stocks. In addition, stocks investment can further be diversified into stocks with high positive momentum (high 12-months past return) and stocks with low momentum. The easiest of stock diversification is diversifying across industries. A recent research by Shamser, Taufiq Hassan & Zulkarnain (2006) indicated that there is an unstable correlation of return between industries. However, by holding industrial diversified portfolio for a long period, it will still yield some risk reduction benefits. On the other hand, the benefits of international portfolio diversification have always been questioned. Different researches have been done using different methods and different data. According to the study of Giorgio & Bruno (1997), international diversified portfolio still provides larger benefits than domestic diversified portfolio under integrated world markets. While looking at the efforts of Sazali Zainal Abidin, Mohamed Ariffm Annuar Md. Nassir & Shamsher (2004), a study from the perspective of Malaysian proved that domestic diversified portfolio can outperform international diversified portfolio in the long run and crisis period.

ii. Diversification in Bond

Bond diversification is about investing in bond with different maturity and different risk. With different terms of maturity, bond diversification can effectively achieve diversification across time horizons. In addition, diversification in bond can be done by investing in bond with different default risk. Bond with higher yield always comes with higher default risk, and it always depends on the market situation to decide which kind of bond should have bigger weightage in the portfolio.

iii. Diversification in mutual fund

Diversification in mutual fund is the easiest way in varying the risk within securities. If investor are buying mutual fund shares, then investor are effectively diversifying across securities. By buying into a basket of securities via index funds, mutual funds, ETFs, managed funds and such, then you are automatically spreading your risk across the board.

1.2.3 Strategies of Diversification

There are many specified diversification strategies are developed in stock market. Those specified strategies will be discussed in theories of diversification. Instead, this research will categorize the strategy of diversification into two main areas, which are the passive strategy and active strategy.

i. Passive Strategy

Passive strategy is a style of management where a portfolio mirrors a market index. It is also known as indexing the portfolio. Followers of passive strategy believe in the efficient market hypothesis (EMH). It states that at all times markets incorporate and reflect all information, rendering individual stock picking futile. It is nearly impossible to outperform the market. As a result, the best investing strategy is to invest in index funds, or equally invest in every large capital stock. Historical data has proved that passive diversification strategy has outperformed the majority of actively managed fund. Swedroe (2006) has proved that from the year 1927 until 2004, actively managed fund was outperformed by passively managed fund. Another research which is done by Luxenberg (2009) proved that it is still possible to beat the passively managed portfolio using active strategy. However, the chance is nearly impossible.

ii. Active Strategy

Active strategy is the total opposite of passive strategy. In contrast, the concept of active strategy is to actively diversify a fund's portfolio by trading and changing the stocks in portfolio. It relies on analytical research, forecasts, and their own judgment and experience in making investment decisions on what securities to buy, hold and sell. Hence, it incurs a lot of effort and cost in stock selection, market timing, information acquisition, and so on. The followers of active strategy do not believe in the efficient market hypothesis, and it is possible to profit from the stock market through any number of strategies that aim to identify mispriced securities. Despite of all the effort incurred, historical data proves that the return of actively managed fund is outperformed by actively managed fund. However, Stephens (2007) stated that this may have been true during 1980s and 1990s. By evaluating only the return starting from 2000, passively managed fund does not provide such significant return. This is because when the market is corrected, there is a high level of correlation among most market-based financial products.

1.2.4 Factors that affecting Portfolio Diversification

i. Number of assets in the portfolio

In general, the increase in the number of assets in the portfolio will reduce the volatility of the portfolio. How can the lowest volatility be achieved as the number of assets increasing? Barber, Brad, Chip Heath & Terrance (2003) and Goetzmann & Kumar (2002) indicated that diversification is a concept that relates to the portfolio variance. The variance can be reduced by increasing the number of assets in the portfolio. William, Massimo & Andrei (2004) explained that portfolio volatility is reduced when the number of assets in the portfolio increases. Thus, this means that the diversifiable risk of a portfolio can be effectively reduced by increasing the number of stocks held in the portfolio.

ii. Correlation of the assets

To achieve effective diversification, portfolio holdings should not be highly correlated. This is an inverse relationship between correlation and portfolio diversification. When correlation increases, diversification decreases. It shows that the higher the variance, the lower the correlation of risk indicators. Therefore, portfolio diversification with lower correlation tends to have lower portfolio risk.

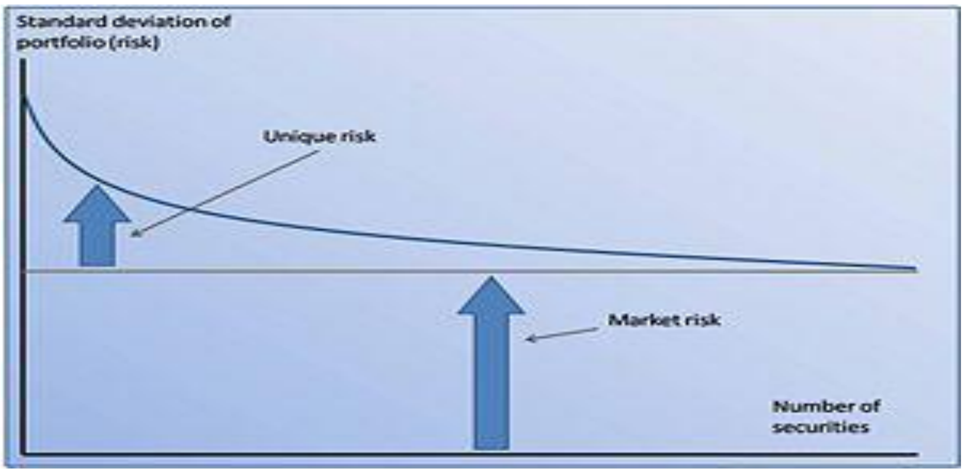
iii. Asymmetric Information

To manage a portfolio of asset, investors should gain the first hand information. Asymmetric information means that different people have different information. Stijn & Laura (2005) explained that whoever can gain the first hand information can achieve effective portfolio diversification. In general equilibrium, investors can specialize by holding different portfolio with different information.

iv. Standard Deviation (Unique risk + Market risk)

In finance, standard deviation represents the total risk in a portfolio. It consists of unique risk and market risk. Unique risk is the firm or industry specific risk that can be diversified away by increasing the number of stocks in a portfolio. On the contrary, market risk is the non-diversifiable risk causing the value of an investment adversely affected by the market movement. As illustrated as below, the number of securities is negatively related to unique risk, and so is the total risk of the portfolio (standard deviation). Since unique risk can be diversified away, the market risk should be the only risk concern for the investors. Market risk is not affected by the number of securities. It is affected by the portfolio beta (β), which will be introduced next.

The relationship between the portfolio risk and number of securities



Source: "Global Equity Strategy" from Dresdner Kleinwort Macro (2007)

v. Beta

Klime & Simonida (2001) proved that diversified portfolios are exposed to variations in the general level of the market. The risk of a well-diversified portfolio depends on how sensitive the portfolio to the general market movement. The measure of the sensitivity is known as beta (β). The market beta (β) is 1.0. A positive beta means that the stock moves in the same direction with the market, while a negative beta means that they move in opposite direction. The greater the beta, the more sensitive the stock is. The standard deviation of a well-diversified portfolio is proportional to its beta as the market risk is the only risk concern.

1.3 Research Problems

From the literature review, the naive portfolio strategy is the strategy which generates the best return with lower risk among all other types of portfolio diversification strategy (Victor, Lorenzo & Raman, January 2007). From Malaysian perspective, this research tries to find out the most suitable portfolio strategy to be used in Malaysian stock market. Instead of using the specific portfolio diversification strategies, this research limits the strategies to the 2 general types of portfolio diversification strategy which is active portfolio diversification and passive portfolio diversification. This research will assess the performance of the 2 portfolio strategies in Malaysian stock market.

According to a research done by Kirt & Domingo (July 2001), said the correlation among stocks is proved to be higher during the time of crisis. The problem exists whether active portfolio diversification and passive portfolio diversification strategy can provide a steady or reasonable return during the time of financial crisis in Malaysian stock market. As proved by Statman (September 1987), a portfolio of 30 stocks can eliminate diversifiable risk in the developed markets, the problem arises is that whether this practice provides consistent result in Malaysian stock market.

Alexander (1999) argued that correlation based analysis is intrinsically a short-run measure. Instead, cointegration based analysis will provide a better performance in the long run. This research will then test the performance between correlation based portfolio and cointegration based portfolio.

1.4 Research Objectives:

i. To compare the performance between active and passive portfolio in Malaysian stock market in the long run and crisis period.
ii. To examine whether diversifiable risk can be significantly reduced with a stock portfolio consists of 30 stocks within Malaysian stock market.
iii. To compare the diversification level between correlation based and cointegration based portfolios in Malaysian stock market in the long run and crisis period.

1.5 Significance of Study

This study is conducted with a primary attempt to provide investors a new understanding towards Malaysia stock market which has never been done in previous research. This study aimed to determine how to achieve portfolio diversification in Malaysian stock market. Thus, this study will be a significant endeavor in promoting good investing decisions among investors in Malaysia, and then leads to a better allocation of fund, and finally improve the overall economy. After the global financial crisis on 2008, it is important to evaluate portfolio return under extreme market conditions. Hence, this study will educate investors in managing their investment to handle the next crisis. Moreover, this research will guide investors on how to eliminate the diversifiable risk in their portfolio.

Essentially, this study will provide directions to future researchers in studying the portfolio diversification strategies in Malaysian stock market with the useful data and methodologies, it will be served as a foundation for future research.

CHAPTER 2.0 LITERATURE REVIEW

2.1 Review of Literature

The chapter outlines the literature review employed in the study. This research consists of review of literature from retrospective part (before year 2000), modern part (after year 2000), Malaysia's literature review, gaps on the literature review and summary of literature review. Start from year 1952, Markowitz proposed his modern portfolio theory. Markowitz described that how the diversifiable risk of a portfolio can be effectively reduced based on correlation analysis. Portfolio diversification can be a valuable stock investing concept for every investor whose ultimate goal is to maximize profit and minimize risk.

2.2 Retrospective Part (before year 2000)

According to George & Thomas (1979) showed that by using Sharpe model, it provides a useful vehicle for portfolio decision making. So, if the marginal cost of unnecessary diversification is considered, it is easy to find out the reason why portfolio managers and investors using the model should reach for indexes which will provide the most parsimonious efficient diversification. Based on research by Andrew (1985), he found that passive management aims to provide positive incremental return through the use of securities analysis and investment research. Instead, passive portfolio is typically stable and constructed to match the long-term performance. The research from Carhart (1997) showed that among others documents the magnitude of active and passive trading costs and notes that actively managed investment funds have tended to be substantially more costly for investors reducing net investment returns. However, there is no attempt to earn incremental rewards from taking advantage of transient asset or market behavior and Statman (1987) explained that commonly 90% diversification will achieved with 15 or above stocks. He also explained that as a portfolio of 30 stocks can significantly reduce diversifiable risk and 400 stocks would fully drive out unsystematic risks.

In year 1987, cointegration was defined and developed by Engle & Granger (1987). Cointegration means that even if two or more data series are non-stationary, there may exist a linear combination of these two series which is stationary. Roll (1992) suggested that choosing the optimization portfolio based on the cointegration analysis. The application of cointegration analysis in practice and finance was limited until around year 1998 because empirical research works has been mainly focus on correlation analysis as introduced by Markowitz (1952). In year 1999, Alexander introduced optimization models being based on cointergration analysis. In the research, he argued that investment strategies merely based on correlation analysis cannot guarantee long-term performance because correlation is intrinsically a short run measure. Instead, cointegration analysis is a better measure for long run investment. He also presented cointegrated international equity portfolios used by EAFE countries. During that time, the application of cointegration analysis in the field of finance was getting popular. However, it was mainly used to analyze the co-movements of stock market indices around the world. This is because international portfolio diversification is of the main concern for the investors during that time. The research from Jing Yang (1999) indicated that market is affected more by the noise factor rather than new information when investors tend to be “noise trader”.

From the international portfolio diversification point of view, Gyongyi, Bugar, Maurer & Raimond (1999) focused on how to narrow the gap in the empirical work in international portfolio diversification from the viewpoint of investors outside the U.S. They found that the lower the elements of the correlation matrix results in the higher potential risk reduction benefits associated with an internationally diversified portfolio. Another subject of much concern is that the study of portfolio diversification whether there is potential benefits from international diversification in the integration market. It was done by Giorgio & Bruno (1997). Considering capital asset pricing model is very important in portfolio diversification, they first tested the conditional capital asset pricing model which is commonly used. It is found that conditional CAPM does provide useful information, however, subject to some limitations. Thus, they extended the multivariate generalized autoregressive conditional heteroskedasticity (GARCH) parameterization which is introduced by Ding & Engle (1994) as an alternative to CAPM. Then it is found that international diversification still benefits investor despite of the market integration.

2.3 Modern Part (after year 2000)

Research done by Victor, Lorenzo & Raman (January 3, 2007) which they compared the naïve portfolio strategy (1/N or equally weighting portfolio) with others portfolio strategies, such as: Sample-based mean-variance portfolio, Bayesian diffuse-prior portfolio, Bayes-Stein shrinkage portfolio, Bayesian portfolio based on belief in an asset-pricing model, Minimum-variance portfolio, Value-weighted portfolio, Portfolio implied by asset-pricing models with unobservable factors, Shortsale-constrained portfolios. It is supported by research of Kan & Zhou (2005) that none of the theories can consistently beat the naive portfolio strategy in terms of the sharp ratio or certainty-equivalent return. From the research of Cremers & Petajisto (2007) introduced the concept of the active share where they found that funds with the highest active share out-performed their associated index. Additionally, they noted that smaller funds are more active and that large funds are closet indexers, which they described as active managers, who maintained the composition of their portfolio closely weighted to the associated benchmark index. Research from Adrangi, Chatrath & Shank (2002) showed further support that actively managed funds could beat the index at least in the short term. They also revisited the EMH as they tested active manager and passive index portfolios against randomly selected dartboard selections.

Based on research by Ronald & Mitchell (2000), they concluded that R-squared and tracking error are the measures that should be used to determine the improvement of diversification since they are measure of diversification as well as a portfolio of 15 stock can only achieved only an average of 75% of diversification benefits where 30 stocks no longer provide full diversification. They argued on the research of Statman (September,1987) that 15 stocks can commonly 90% diversification where they only managed to get 76% of the available diversification based on their empirical results. From the research, George (2006) stated that the objective of his journal is to investigate optimal portfolio size in terms of the number of stocks held in a portfolio. He found that optimal stock holdings in which portfolio return could be effectively maximized and portfolio risk could be efficiently minimized without holding infinite number of assets. A non-linear relationship between portfolio performance and portfolio size is based on the term of the number of stocks. According to Jason (2009), investors have long been told that risk and volatility of portfolio can be reduce by investing in many stock. Volatility of a portfolio can be reduced by 40% just as simple by diversify individual's investment from one single stock to around 20 stocks. This error statement is based on the result that generated from computer that randomly chooses the performance of portfolios. Hence, it leads to an improper portfolio diversification.

In year 2005, Alexander & Dimitriu (2005) used correlation and cointegration analysis as two different approaches in the S&P 500 stock market. There is no evidence of significant advantages or limitations of cointegration based model as compared to correlation based model. Grobys (2010) proved that cointegration based portfolios significantly outperforms correlation based portfolios in Swedish stock market. It is supported by the research from Christopher, David & Francis (2010). They indicated that using correlation as a method of portfolio constructing does not necessary yield the best result. Research from Lima, Leea & Liewb (2003) showed that investors with long run horizons may not benefit from an investment made across the countries in ASEAN region. Concept of integrated markets has strong consequences for international investors as it implies that the benefits of international portfolio diversification would disappear. Cointegration results revealed that all the Asian Newly Industrializing Countries (NIC) of Hong Kong, Singapore, South Korea and Taiwan share long run relationship with the more established market (Japan, U.S., U.K. and Germany).

From the international portfolio diversification point of view, research from Joost & Luc (2006), they indicated that benefits of investing abroad are largest for investors in developing countries, including controlling for currency effects. Most of the benefits are obtained from investing outside the region of home country and remain large when controlling for short sales constraints in developing stock markets. Gains from international portfolio diversification appear to be largest for countries with high country risk. Diversification benefits vary over time as country risk changes. There exist substantial regional and global diversification benefits for domestic investors in both developed and developing countries. Developing countries on average are much less integrated in world financial markets. Research done by three research independently (Kirt & Domingo, July 2001), (Sazali Zainal Abidin, Mohamed Ariff, Annuar Md. Nassir, & Shamsher, March 2004), and (Jenifer, Nitawan & Colin, October 2007) showed that besides diversify portfolio by investing in local stocks, there is an alternative strategy which is the international portfolio diversification where stocks in other country will have lowest correlation compare to local stocks. As a result, it shows that correlations among stocks are higher during the time of economic crisis compared to calm and bullish market period. From a Malaysian perspective it also shows that Malaysia portfolio does beat the international portfolio during the time of economic crisis. From the findings of 3 researches, it showed that to gain the benefits of international portfolio, the study of correlation among each country is the key factor. Investors need to get known the financial integration among the country whether which would impact other the most, in economic downturn, which would get lesser impact or benefits. Furthermore, timing of investment is also an essential element that investors should concern on.

2.4 Malaysia

The research from Sazali Zainal Abidin, Mohamed Ariff, Annuar Md. Nassir & Shamsher (2004) showed that national portfolio does outperform international during time of crisis to outperform international portfolio, so the timing of choosing stock is an important element. Sazali Zainal Abidin

(2006) showed that stocks does have lower correlation during crisis period, hence the offsetting effect of a portfolio does perform well during crisis period. Another research from Shamser, Taufiq Hassan & Zulkarnain (2006) showed that high but unstable correlation of returns between different economic sectors due to global integration. As the process of globalization continues, correlations between country specific fundamentals will increase and reduce the diversification benefits. It examined the issues whether portfolio diversification across industries is more effective than portfolio investment based on naïve strategy. Diversification across industries can only be a supplementary strategy in combination with other diversification strategies.

2.5 Gaps on the Literature

In the literature review, this research found that the naive Portfolio Strategy generates the best return among all other types of portfolio strategy, except the risk and turnover ratio is worse than some of the portfolio strategy (Victor, Lorenzo & Raman, January 2007). In spite of this, in overall, it provides the greater return with a low level of risk. The naive portfolio strategy tends to be a better portfolio strategy in other countries. While in Malaysian stock market, what strategy is more preferable? Previous research used naive diversification strategy to reduce portfolio risk, this research will use passive and active strategy as an alternative strategy to test the reduction of diversifiable risk in Malaysian stock market. Next, findings showed that a portfolio of at least 30 stocks can significantly reduce diversifiable risk in developed markets like United States (Statman, September 1987), the gap from this is that whether it is feasible in Malaysian stock market.

Another gap will be the correlation among stock during time of crisis. In the past research, empirical results showed that correlation among stock tends to be higher during the time of bullish and bearish. Especially in the bearish market, the correlation among each stock will be far higher than the calm period and bullish (Kirt & Domingo, July 2001). Thus, the overall risk will be higher during bearish market and the return for portfolio will be affected. The gap between this is to find any available portfolio diversification strategy that can provide consistent or reasonable return during crisis period and long run.

Finally, due to the trend of international portfolio diversification and the Asian financial crisis from year 1997 to 2002, cointegration analysis was mainly used to examine the linkage among the stock market indices around the world. The application of cointegration to construct a portfolio within a stock market as opposed to correlation analysis advocated by Markowitz (1952) is relatively new in finance field. Alexander & Dimitriu (2005) and Grobys (2010) compared the cointegration based and correlation based models in S&P 500 and Swedish stock market respectively. Such study has yet to be done in Malaysian stock market and the study should be focus on the performance in the crisis period and also the long run.

2.6 Summary of Literature Review

In summary, the body of literature in retrospective part (before year 2000) indicated the status of the active versus passive management debate. Active management tended to be substantially more costly for investors where it would reduce their net investment returns. In United States stock market, a portfolio of 30 stocks can significantly reduce diversifiable risk and 15 or above stocks can commonly achieve 90% diversification. Besides that, there is a debate between the correlation analysis and cointegration analysis. Instead, correlation analysis is intrinsically a short run measure while cointegration analysis is a better measure for long run investment. From the international portfolio diversification point of view, there is a potential benefits from international diversification in the integrated market.

From the body of literature on modern part (after year 2000) indicated that besides portfolio strategy like naive portfolio strategy, active management and others portfolio strategies, the timing of invest and timing of choosing stocks are also an essential element that investors should be concern on. Research by Ronald & Mitchell (2000) argued the previous research by Statman (September 1987) that by using R-squared as a measurement of level of diversification, a portfolio of 30 stocks no longer provide full diversification while 15 stocks can only get 76% of the available diversification. In Swedish stock market, the concept of cointegration based portfolio significantly outperforms correlation based portfolio. From the international portfolio diversification point of view, concept of integrated markets cannot achieve the benefits of international portfolio diversification for international investors. Stocks in other country will have lowest correlation compared to local stocks. However, correlations among stocks are higher during the time of economic crisis compared to calm and bullish market period.

This research is conducted by filling the gap in the previous literature by testing the 13-year period from year 1998 to 2010 and subprime crisis period in the mid of 2007. Since there are many types of portfolio strategies in the world, therefore this research will use passive and active strategy as alternative strategy to imply in Malaysian stock market to see whether which strategy can provide consistent or reasonable return during long run and crisis period. From the gap that stated 30 stocks can significantly reduce diversifiable risk, this research will test on this gap to see whether it is feasible in Malaysian stock market or not. Lastly, this research will compare the correlation based model and cointegration based model to determine which model outperform in the long run and crisis period.

The next section will build on the literature review by identifying the methodology of the study that is used to fill the current gap in the research and illustrate the research process to be conducted.

CHAPTER 3.0 METHODOLOGY

3.1 Data

The population of this study is the listed companies on the main market of Bursa Malaysia Stock Exchange. Malaysian stock market is chosen because of its relevancy and gives direct effect to most of Malaysian investors.

The sample of this study is the 100 stocks with highest earnings in fiscal year end 2009 from Bursa Malaysia Stock Exchange. The closing price data for each company is collected on daily basis for the period time of 13 years from year 1998 until 2010. The data is retrieved from Bursa Station where it is the database center which provides fundamental information, historical record stock prices for all stock listed in Bursa Malaysia. The reason to choose 100 companies with highest earnings at the fiscal year ended 2009 is because, most of the active portfolio manager tend to choose stock based on 2 factors, valuation factors and growth factors. Richard (2009) mentioned that the valuation factors include the price-to-earnings ratio, price-to-book ratio, and dividend yield, while growth factors include earnings improvement and long-term growth prospect. He mentioned that the valuation factors seems to be factors that determined by market demand and supply (price), and company policy (dividend), it is inappropriate to be taken as a measure to pick stock. The fiscal year ended 2009 was the year that the Malaysian stock market recovered from the global financial crisis. Companies that were able to yield high earnings even in the aftermath of global financial crisis showed good earnings ability and earnings growth in long-term. Hence, this research has picked 100 companies in Bursa Malaysian Stock Exchange with highest earnings in the fiscal year ended 2009 as sample data.

As in objectives 1, this research will examine the performance of the active strategy and passive strategy in long run of 13 years period from year 1998 to 2010 and crisis period from 1st July 2007 until 30th September

2009. From literature review, active portfolio strategy involves frequent reconstruction within the portfolio. Hence, by comparing passive portfolio with just a single active portfolio will not give us comprehensive result. The active portfolios are constructed under 5 scenarios based on the correlation coefficient of the stock prices. The active portfolio under scenario 1 consists of the combination of 15 stocks with the lowest correlation coefficient among each other from sample. Next, the same method is used to form the active portfolio under scenario 2 within remaining 85 stocks in sample. Active portfolios under scenario 3, 4 and 5 are constructed based on the same criteria. For the passive portfolio, 10 stocks with the highest market capitalization are selected from sample. This research would then use the stock prices of previous 13 years in calculating portfolio return. The portfolio return is used to calculate the mean return, standard deviation of return, Sharpe ratio, Treynor ratio, Jensen's index, and Generalized Autoregressive Conditionally Heteroskedastic (GARCH) model as the measure of volatilities between the active and passive portfolio.

In objective 2, R^2 will be used to determine the level of diversification of portfolio consists of randomly selected stocks ranging from 10 to 100 stocks where first 10 will be chosen to obtain R^2 result follow by 20,30,40 stocks adding 10 stocks for each portfolio until reaches a portfolio of 100 stocks.

In objective 3, this research will compare the diversification level achieved by correlation based and cointegration based portfolio in the crisis period and long run. The R^2 method mentioned previously is used to measure the level of diversification between the portfolios. This research will use active portfolio under scenario 1 as the correlation based portfolio because it is the combination of stocks in the sample with the lowest correlation. Thus, it is most suitable to represent the correlation based portfolio as this research needs in objective 3. On the other hand, trial and error process is conducted within the sample to construct a portfolio without any cointegration equation among the stock prices movement. To make them comparable, both portfolios consist of 15 stocks. Johansen and Juselius Cointegration Test is used to construct the cointegration based portfolio. Cointegration exists when the combination of the non-stationary data series exhibits a stationary linear combination. Hence, prior to the Johansen and Juselius Cointegration Test, it has to make sure that the data series (the stocks in the portfolio) is non-stationary (has a unit root). This is the prerequisite to conduct cointegration test. This research also looks at the VAR lag order selection criteria to decide the optimal lag length criteria when running the Johansen and Juselius Cointegration Test. The general practice is to choose the optimal lag length based on the AIC. In order to generate a more comprehensive result, optimal lag length are selected base on both AIC and SC.

3.2 Model Design

3.2.1 Descriptive Statistic

3.2.1.1 Arithmetic Mean (AM)

The arithmetic mean is the "standard" average, also called the "mean". The mean is the arithmetic average of a set of values, or distribution. It is the sum of all data values divided by total number of data items. The mean results are use for computations of portfolio returns to obtain the results of Sharpe, Treynor and Jensen ratio.

The arithmetic mean is presented as:

$$\overline{X} = \frac{\sum X}{N}$$

Where:

$\sum X$ = Sum of the data items

N = Number of data items in sample

3.2.1.2 Standard Deviation

Standard deviation is a measure of a set of data from its mean. Standard deviation is also known as historical volatility and is used by investors as a gauge for the amount of expected volatility. Standard deviation is calculated as the square root of variance. The standard deviation results are use for computations of portfolio returns to obtain the results of Sharpe, Treynor and Jensen ratio.

The standard deviation is presented as:

$$\sigma = \sqrt{\frac{1}{N-1}\sum_{i=1}^{n}(R_i - \overline{R})^2}$$

Where:

N = Number of periods

R_i = Return of the investment in daily

$\overline{R}$ =Average daily total return for the investment

A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data are spread out over a large range of values.

3.2.1.3 R-squared as Diversification Measure

R^2 is a measure of the squared correlation between a stock's performance. It measures how reliable the stock's beta is in judging its market sensitivity. R^2 is similar to Beta, but it tells about what proportion of a stock's risk is market-related. A completely diversified portfolio would be perfectly correlated to the market, indicative of an R-Squared figure of 1.0. R^2 equal of 0, on the other hand, indicated that the beta measurement is irrelevant to its actual performance.

$$Y_i = \beta_0 + X_i\beta_i + \varepsilon_i$$

Where Y_i = Portfolio return of stocks

X_i = KLCI Market Return

$$r^2 = \frac{(n\Sigma R_{xi}R_{yi} - \Sigma R_{xi}R_{yi})^2}{[n\Sigma(R_{xi})^2 - (\Sigma R_{xi})^2][n\Sigma(R_{yi})^2 - (\Sigma R_{yi})^2]}$$

Where R_{xi} = Market excess return

R_{yi} = Portfolio excess return (minus risk-free proxy return)

Use EViews to determine KLCI market return as independent variable and portfolio returns of stocks as dependent variable and then run for equation to get the result of R^2. To derive the R^2, a various combination of stocks will be constructed with selection probabilities directly proportional to capitalization size or with careful and purposeful diversification, such as by selecting stocks from a variety of industries and balancing with respect to effects such as style (e.g., value or growth) and size chosen ranging from 10 stocks, 20 stocks, 30 stocks until 100 stocks in order to determine the level of diversification based on the increasing number of stocks in objectives 2.

3.2.2 Risk-Adjusted Performance Indices

Three risk-adjusted performance indicted will be used to test the performance of KLCI market return from Bursa Malaysian stock market as benchmark to make a comparison with active portfolio strategy (scenario 1 until scenario 5) and passive portfolio strategy.

3.2.2.1 Sharpe Ratio

Sharpe ratio is equal to the average return of portfolio minus the average risk-free rate of return (per annum) divided by the standard deviation of portfolio. In order to use the Sharpe ratio, this research should use average return of portfolio, average risk-free rate of return and the standard deviation of the portfolio to calculate it.

The Sharpe ratio is presented as:

$$S_p = \frac{\bar{r}_p - \bar{r}_f}{\sigma_p}$$

Where $\bar{r}_p$ = Average return of the portfolio

$\bar{r}_f$ = Average risk-free rate of return (Interbank deposit rates at the Interbank Money Market in Kuala Lumpur)

σ_p = Standard deviation of the portfolio

The Sharpe ratio tells us whether a portfolio's return is due to smart investment decision or taking excess risk. If a portfolio's Sharpe ratio is higher, it means that a portfolio has better on its risk-adjusted performance. The higher rate of Sharpe ratio indicates a better performance because of each unit of total risk (standard deviation of portfolio) is rewarded with greater excess return.

Result of average return of the portfolio and standard deviation of the portfolio will be achieved using EViews, whereas the average risk-free rate of return will be calculated by using Microsoft Excel. This research have two different average risk-free rate of return which is long run from year 1998 to year 2010 and crisis period from 1st July 2007 to 30th September 2009. Since the result of average return and standard deviation of the portfolio are provided on daily basis, therefore this research needs to annualize average return of the portfolio by multiple 365 days and annualize standard deviation of the portfolio by multiple $\sqrt{365}$ which is 19.1050.

3.2.2.2 Treynor Ratio

Treynor ratio is a risk-adjusted measure the return based on systematic risk. It is quite similar with Sharpe ratio but different in which Treynor ratio is using beta as the measurement of volatility while Sharpe ratio is using standard deviation as the measurement of volatility. Treynor ratio is equal to the expected return of portfolio minus the risk-free rate of return (12-month), divided by the portfolio beta.

The Treynor ratio is presented as:

$$T_p = \frac{\bar{r}_p - \bar{r}_f}{\beta_p}$$

Where

$\bar{r}_p$ = Average return of the portfolio

$\bar{r}_f$ = Average risk-free rate of return (Interbank deposit rates at the Interbank Money Market in Kuala Lumpur)

β_p = portfolio beta

The Treynor ratio is useful for assessing the excess return, evaluating investors to evaluate how the structure of the portfolio to different levels of systematic risk will affect the return. However, it is only useful when a portfolio under consideration is a sub-portfolio of a broader, fully diversified portfolio. The higher the Treynor ratio, tells us that the better the performance of the portfolio under analysis.

By using EViews to obtain the result of average return of the portfolio whereas the average risk-free rate of return and portfolio beta will be calculate by using Microsoft Excel. There will be two different average risk-free rate of return which is long run from year 1998 to year 2010 and another one is crisis period from 1st July 2007 to 30th September 2009. On the other hand, market index will be used as benchmark for market beta, and then calculates the beta using the SLOPE function on Excel. The slope function = SLOPE (range of % change of equity, range of % change of index). Since the result of average return of portfolio is provided on daily basis, therefore this research needs to annualize average return of the portfolio by multiple 365 days.

3.2.2.3 Jensen's Index

In year 1968, Michael Jensen developed an index called Jensen's index also known as Jensen's alpha. It is predicted by the CAPM, given the portfolio's beta and the expected market return. Jensen's index measures the ability of active management to increase returns above those that are purely a reward for bearing market risk.

The Jensen's index is presented as:

$$\alpha_j = \bar{r}_p - [\bar{r}_f + \beta_p(\bar{r}_m - \bar{r}_f)]$$

Where

$\bar{r}_p$ = Average return of the portfolio

$\bar{r}_f$ = Average risk-free rate of return (Interbank deposit rates at the Interbank Money Market in Kuala Lumpur)

β_p = portfolio beta

$\bar{r}_m$ = Average market return

Jensen's index is used to determine the abnormal return of a portfolio of stock over the theoretical expected return. If the Jensen's index is positive, then the portfolio is earning excess returns. In other words, a positive value of Jensen's index means that the investor has "beat the market" with his or her stock picking skills.

Similar to Treynor ratio's methodology in order to achieve the above variable's results and calculating the average market return as well as deriving the SLOPE function and annualizing the average returns.

Results of average return of the portfolio and average market return will be obtained through running EViews whereas the average risk-free rate of return and portfolio beta will be calculated by using Microsoft Excel. Thus research uses two different average risk-free rate of return for long run from year 1998 to year 2010 and crisis period from 1st July 2007 to 30th September 2009. On the other hand, market index will be used as benchmark of market beta, and then calculates the beta using the SLOPE function on Excel. The slope function = SLOPE (range of % change of equity, range of % change of index). Since the result of average return of portfolio and average market return are provided on daily, therefore this research need to annualize average return of the portfolio by multiple 365 days.

3.2.3 Generalized Autoregressive Conditional Heteroscedasticity model (GARCH)

Good investment should generate return in a form of low risk. Hence, investor is trying to find the method which can measure and forecast the volatilities of the portfolio over its holding period in order to develop best strategy to reduce the risk and maximize return. To achieve this, this research uses EViews to estimate the Generalized Autoregressive Conditional Heteroscedasticity model (GARCH) to measure the portfolio volatilities and forecasting. GARCH model is a modified formula from ARCH model. As mentioned earlier, this research has narrowed the strategy to active portfolio strategy and passive portfolio strategy. For active portfolio holder, they will actively trade their shares in the portfolio; hence volatilities measure will be important. While for the passive portfolio, they tend to hold the portfolio until the maturity, hence the volatilities measure will not be equally important. However, as this research is analyzing the volatility to determine which strategy is the best, and has the lowest volatilities, so this research run test on all types of portfolios.

ARCH is a model to test whether the conditional variance are cause by its own lagged term. The model is:

$$h_t = \alpha_0 + \alpha_1 e_{t-1}^2, \qquad \alpha_0 > 0, \qquad 0 \leq \alpha_1 < 1$$

The h_t is the time varying variance, which is a function of a constant term(α_0) plus a lagged once, the square of the error in the previous period ($\alpha_1 e_{t-1}^2$). For the GARCH to be significant, the ARCH model should first be significant. Both the α_0 and α_1 must be positive to ensure a positive variance. The coefficient $\alpha_1$must be less than 1, otherwise $h_t$will continue to increase over time, eventually exploding. Besides that, the Obs*R-squared (LM statistic) and the F-statistics must be significant.

After that, this research will proceed to estimate the GARCH model. The GARCH model is a model which combines the MA (moving average) into ARCH model. Which its final output of coefficient indicates its volatilities whether cause by new information (α) or its own MA (β) effect. The model is: $h_t = \delta + \alpha_1 e_{t-1}^2 + \beta_1 h_{t-1}$

As this research includes one past lag time varying variance as regressor. The coefficient of α represent the ARCH effect; it is the level of volatilities due to the new information. While the coefficient β represent the MA effect, which indicates the volatilities that caused by its own lag moving average effect. For the GARCH model to be valid, both of the coefficient α and β must be significant and have positive value, and sum of these values must below 1. If sum of this 2 value are above 1, it is a so-called integrated GARCH process, or IGARCH. In the IGARCH, it appears because it estimates with using a long time-series of stock return. It can yield a very parsimonious representation of the distribution of an asset's return. In some respect, this constraint forces the conditional variance to act like a process with a unit-root. It is useful in forecasting, where one-step-ahead forecast of the conditional variance is:

$$E_t h_{t+1} = \alpha_0 + h_t$$

And the j-step-ahead forecast is

$$E_t h_{t+j} = j_{\alpha 0} + h_t$$

Moreover, the unconditional variance is clearly infinite, the IGARCH is not perfect. This research will use GARCH model for 4 steps process. Firstly, test the ARCH effect of all types of portfolios, to see whether all portfolios have the problem of ARCH. Second, if there appear to be some portfolios do not show ARCH effect, then will estimate a GARCH variance series graph to check whether there is some potential problem that causes the insignificant effect appeared in step 1. Next, estimate a GARCH model. After checked its validity, then compare their volatilities by using the coefficient to see whether which portfolio strategy does has the lowest volatilities, and its volatilities are mostly cause by what factor, whether new information or its own lag effect (MA). Finally, use the estimated model to forecast the future GARCH variance series. This is because the unconditional forecast has a greater variance than the conditional forecast, hence only forecast for the 10-days-ahead value. This research should also take consideration in the 10-days-ahead forecast with using 13 years period data and 10-days ahead forecast with using crisis period data. Because as mentioned above, unconditional forecast will have greater variance, and this research is using daily data, hence the variance will be far greater than theory mention. However, due to the purpose of getting accurate and discrete result for volatilities comparing between portfolios, this research insists to use daily data in measuring and forecasting.

3.2.4 Unit Root Test

To prove the non-stationarity of the data series, this research deploys Augmented Dickey-Fuller (ADF) (1981), non-parametric Phillips-Perron (PP) (1988), and Kwiatkowski *et al.* (KPSS) (1992) testing principles. This research proceeds the testing of non-stationarity in the presence of intercept and trend. The combining of the three tests should give a consistent and reliable conclusion regarding the non-stationarity of the data.

3.2.4.1 Augmented Dickey-Fuller test (ADF)

ADF test (1981) with intercept and trend is illustrated as follows:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \varepsilon_t$$

Where ε_t is a pure white noise error term and where $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2}), \Delta Y_{t-2} = (Y_{t-2} - Y_{t-3}),$ etc. The number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term in the above equation is serially uncorrelated, so that can obtain an unbiased estimate of $\delta = 0$, the coefficient of lagged Y_{t-1}.

ADF test follows the τ critical values to determine the test result. ADF test takes care of possible serial correlation in the error terms by adding the lagged difference terms of the regressand.

The hypothesis of ADF test:

H_0: The data series has a unit root (non-stationary).

H_1: The data series does not have a unit root (stationary).

Rule of thumb:

Reject the null hypothesis if the ADF test statistic <– τ critical value or ADF test statistic> τ critical value.

3.2.4.2. Non-parametric Phillips-Perron test (PP)

PP test is illustrated as follows:

$$\frac{1}{N}\sum_{t=1}^{N}\hat{\varepsilon}_t^2 + \frac{2}{N}\sum_{t=1}^{N}\varpi(s,l)\sum_{t=s+1}^{N}\hat{\varepsilon}_t\hat{\varepsilon}_{t-s}$$

Where $\int$ is truncation lag parameter; and w(s,l) is a window that is equal to $1-s/(\int+1)$. PP test follows the τ critical values to determine the test result. PP test use non-parametric statistical methods to take care of the serial correlation in the error terms without adding the lagged difference terms.

The hypothesis of PP test:

H_0: The data series has a unit root (non-stationary).

H_1: The data series does not have a unit root (stationary).

Rule of thumb:

Reject the null hypothesis if the PP test statistic <– τ critical value or PP test statistic> τ critical value.

3.2.4.3 Kwiatkowski *et al.* test (KPSS)

The null hypothesis for the KPSS test is stationary (does not have a unit root). KPSS is a semi-parametric procedure tests for stationary against the alternative of a unit root. It uses the LM statistic to determine the test results.

Let e_t, t= 1,2,3 ……, T, be the residuals from the regression of y on an intercept and time trend. Let $\hat{\sigma}_{\varepsilon}^2$ be the estimate of the error variance from this regression (the sum of squared residuals, divided by T). Define the partial sum process of the residuals:

$S_t = \sum_{i=1}^{t} e_i$, t= 1,2,……, T.

Then the LM (and LBI) statistic is

LM = $\sum_{i=1}^{T} S_t^2 / \hat{\sigma}_{\varepsilon}^2$

The hypothesis of KPSS test:

H_0 : The data series is stationary.

H_1 : The data series is non-stationary.

Rule of thumb:

Reject the null hypothesis if the KPSS test statistic > the LM critical value.

3.2.5 VAR Lag Order Selection Criteria

After proving the non-stationarity of the data series, the optimal lag length used to run the cointegration test need to be selected. The criteria includes the sequential modified LR test statistic, Final Prediction and Error, Akaike Information Criterion, Schwarz information critierion, and Hannan-Quinn information criterion. The common practice in financial research has been based on the AIC. To generate a more comprehensive result, this research will determine the optimal lag length based on both AIC and SC. The models with the lowest AIC and SC will be chosen.

3.2.5.1 Akaike's Information Criterion (AIC)

The AIC criterion is defined as:

AIC= $e^{2k/n} \frac{\sum \hat{u}_i^2}{n} = e^{2k/n} \frac{RSS}{n}$

Where k is the number of regressors (including the intercept) and n is the number of the observations. For mathematical convenience, it is written as:

ln AIC= $\left(\frac{2k}{n}\right) + \ln\left(\frac{RSS}{n}\right)$

where ln AIC = natural log of AIC and $2k/n$= penalty factor. The model with the lowest value of AIC will be selected.

3.2.5.2 Schwarz's Information Criterion (SIC)

The SC criterion is defined as:

SC= $n^{k/n} \frac{\sum \hat{u}^2}{n} = n^{k/n} \frac{RSS}{n}$

or in log-form:

ln SC= $\left(\frac{k}{n}\right) \ln n + \ln\left(\frac{RSS}{n}\right)$

where $[(k/n)\ln n]$ is the penalty factor. The model with the lowest value of SC will be selected.

3.2.6 Johansen and Juselius Cointegration Test

Stock prices, which are always known to be non-stationary in nature, with cointegration means that the price series cannot wander off in opposite directions for very long without coming back to a mean distance eventually. Hence, a diversified portfolio should be free from cointegration. Alexander (1999) argued that the cointegration based portfolio is a better model than the correlation based portfolio which was introduced by Markowitz in 1959. The underlying reason is that correlation is intrinsically a short run measure, and thus the figure is misleading because a high negative correlation in a short period can constitute a low correlation to the overall portfolio. Thus, comparison is to be made between a portfolio with lowest correlation (correlation based portfolio) and a portfolio free from any cointegration (cointegration based portfolio). Cointegration based portfolio is constructed using the Johansen and Juselius cointegration test. After proving the non-stationarity of the stock prices series, they can be used to run the Johansen and Juselius cointegration test with the determined optimal lag length.

The Johansen and Juselius (JJ) (1990) multivariate cointegration technique uses maximum likelihood procedure to determine the number of cointegrating vectors among a vector of time series.
Assume that y_t is modeled as a vector autoregression (VAR):

$$y_t = \Pi_1 y_{t-1} + \Pi_2 y_{t-2} + \ldots + \Pi_k y_{t-k} + \mu_t$$

Where:
y_t is a column vector of two endogenous variables.

The estimation of the cointegrating vectors can be determined from the matrix of Π, which is written as:

$$\Pi = \alpha \beta '$$

Where:
$\beta '$ is the (r x p) matrix of cointegrating vectors and α is the (p x r) matrix of error correction parameters that measure the speed of adjustment in Δy_t. Since the rank of Π is related to the number of cointegrating vectors, thus, if the rank of Π equals to p or full rank, then y_t is a stationary process. If the rank of Π is $0 < r < p$, implying that there are r cointegrating vectors and hence the group of time series contain $(p - r)$ common trends. However, if the rank of Π is zero, then the variables in y_t are non-cointegrated. Here, two likelihood ratio (LR) test statistics, namely the trace and maximum eigenvalue statistics are used to determine the number of cointegrating vectors. Critical values for both the trace and maximum eigenvalue tests are tabulated in Osterwald-Lenum (1992)

The trace statistics test the $H_0(r)$ against $H_1(p)$, and is written as:

Trace = $-T\sum_{i=r+1}^{p}\ln(1-\hat{\lambda}_i)$

On the other hand, the maximum eigenvalue statistic tests the $H_0(r)$ against $H_1(r+1)$, which is given by:

Maximum eigenvalue = $-T\ln(1-\hat{\lambda}_{r+1})$

The hypothesis of the JJ test:

H_0: There is no cointegration among the data series.

H_1: There is at least a cointegration among the data series.

Rule of Thumb:

If the Trace statistic and Max-Eigen Statistic are larger than their 0.05 critical values respectively, the null hypothesis is rejected.

3.3 Hypotheses

1.) H_0: There is no significant ARCH effect between past volatile and current volatile.

H_1: There is significant ARCH effect between past volatile and current volatile.

2.) H_0: There is no significant GARCH effect between past volatile and current volatile.

H_1: There is significant GARCH effect between past volatile and current volatile.

3.) H_0: There is no significant of cointegration among the data series.

H_1: There is at least one cointegration among the data series.

3.4 Summary of Methodologies

Data collection is based on sample study of 100 stocks with highest earnings in fiscal year 2009 from Bursa Malaysia with closing price collected on daily basis with a period of 13 years from year 1998 to 2010 where all data are retrieved from Bursa Station. After that, under objective 1 the performances of active and passive strategy in long run of 13 years period and crisis period will be examined. Under objective 2, R^2 will be used to determine the level of diversification of the portfolios where in objective 3 diversification level achieved by correlation based and co-integration based portfolio in the crisis period and long run will be compared.

Model designs involved in examining objective 1 are descriptive statistics which are arithmetic mean and standard deviation to calculate portfolio return where in risk-adjusted indices 3 ratios which are Sharpe ratio, Treynor ratio and Jensen Index will be used to determine which portfolio gives the highest performance in long run as well as during crisis period and next Generalized Autoregressive Conditionally Heteroskedastic (GARCH) is run to measure the volatilities between the active and passive portfolios. For GARCH model, it involves 4 steps of process. The first step is to estimate the ARCH model, which is the requirement of GARCH model. Before estimating the GARCH model, ARCH model should prove to be significant. Then, the second step is to estimate the GARCH variance graph, where the purpose is to detect the outliers or potential issue that cause the model to be insignificant. The next step is the GARCH model estimation, which the coefficients value will be taken into comparison of volatilities between portfolios. Finally, the last step is GARCH forecasting, which aims to test the ability of the model in forecasting.

R^2 will be used to determine the level of diversification of portfolio under objective 2 while in objective 3 correlation based and cointegration based portfolio in the crisis period and long run will be constructed to compare the level of diversification achieved. In the process of constructing cointegration based portfolio, trial and error is conducted. A portfolio of 15 stocks is randomly selected in the sample. First, unit root tests including Augmented Dickey-Fuller test (ADF), Non-parametric Phillips-Perron test (PP), Kwiatkowski et al. test (KPSS) will be used to prove the stock price series within the constructed portfolio is non-stationary. After that, the optimal lag length to run Johansen and Juselius Cointegration Test is determined through VAR Lag Order Selection Criteria based on Akaike's Information Criterion (AIC) and Schwarz's Information Criterion (SC). Finally, Johansen and Juselius Cointegration Test is conducted to determine if there is any cointegration within the portfolio. The portfolio without any cointegration among the stock price movement will be selected as the cointegration based portfolio in this research.

CHAPTER 4.0 DATA RESULTS

Table 1 and 2 show the results of 3 ratios which is the Sharpe, Treynor and Jensen ratio in the long run (13 years) as well as during the crisis period to determine which portfolio has the best performance.

Table 1: Ratio part for 13 years period

	Ratio		
Portfolio Strategy	Sharpe	Treynor	Jensen
Active - Scenario 1	0.7438	0.3240	0.1803
Active - Scenario 2	0.7066	0.2532	0.1175
Active - Scenario 3	0.7505	0.2870	0.1405
Active - Scenario 4	0.7141	0.2512	0.1208
Active - Scenario 5	0.6626	0.2305	0.1230
Passive	0.6092	0.1844	0.0549
KLCI Return	0.4173	0.1164	0

Table 2: Ratio part for crisis period

	Ratio		
Portfolio Strategy	Sharpe	Treynor	Jensen
Active - Scenario 1	0.5465	0.2140	0.2568
Active - Scenario 2	0.2576	0.0795	0.1361
Active - Scenario 3	0.4974	0.1599	0.2034
Active - Scenario 4	-0.0408	-0.0126	0.0559
Active - Scenario 5	0.0982	0.0267	0.1157
Passive	-0.0774	-0.0190	0.0523
KLCI Return	-0.3761	-0.0837	0

Table 3 and 4 show the ARCH outputs which include: coefficients, F-statistic, Probabilities for F-statistic, obs*R-squared, and probabilities for obs*R-squared. The primary usage for these outputs is to check the validity of models.

Table 3: ARCH coefficients, F-statistics and Obs*R-squared for 13 years period

13 years period (Portfolio Strategy)	α0	α1	F-statistic	Prob.	Obs*R-squared	Prob.
Active – scenario 1	0.000338	0.13846	62.585350	0.000000	61.423870	0.000000
Active – scenario 2	0.000134	0.48281	973.276500	0.000000	746.867400	0.000000
Active – scenario 3	0.000169	0.37814	534.229200	0.000000	458.127800	0.000000
Active – scenario 4	0.000103	0.62064	2006.218000	0.000000	1234.188000	0.000000
Active – scenario 5	0.000187	0.51508	1156.312000	0.000000	850.059500	0.000000
Passive	0.000084	0.48230	970.936500	0.000000	745.489500	0.000000
KLCI Return	0.000106	0.50119	1074.575000	0.000000	805.069200	0.000000

Table 4: ARCH coefficients, F-statistics and Obs*R-squared for crisis period

Crisis time (Portfolio Strategy)	α0	α1	F-statistic	Prob.	Obs*R-squared	Prob.
Active – scenario 1	**0.000268**	**0.14251**	**11.504080**	**0.000744**	**11.311080**	**0.000770**
Active – scenario 2	**0.000144**	**0.20846**	**25.215950**	**0.000001**	**24.206990**	**0.000001**
Active – scenario 3	**0.000186**	**0.05913**	**1.946986**	**0.163470**	**1.947171**	**0.162892**
Active – scenario 4	**0.000124**	**0.22855**	**30.585180**	**0.000000**	**29.092180**	**0.000000**
Active – scenario 5	**0.000198**	**0.11260**	**7.125424**	**0.007822**	**7.060455**	**0.007880**
Passive	**0.000094**	**0.11715**	**7.722201**	**0.005639**	**7.643675**	**0.005697**
KLCI Return	**0.000125**	**0.07875**	**3.462697**	**0.063296**	**3.453628**	**0.063113**

Table 5 and 6 show the estimated GARCH outputs which included the coefficient value, z-Statistic, and probabilities for the coefficient. The values of coefficients represent the volatilities due to new market information and its own MA effect, while the z-statistic and probabilities represent the significant level of model.

Table 5: GARCH model coefficient (13 years period)

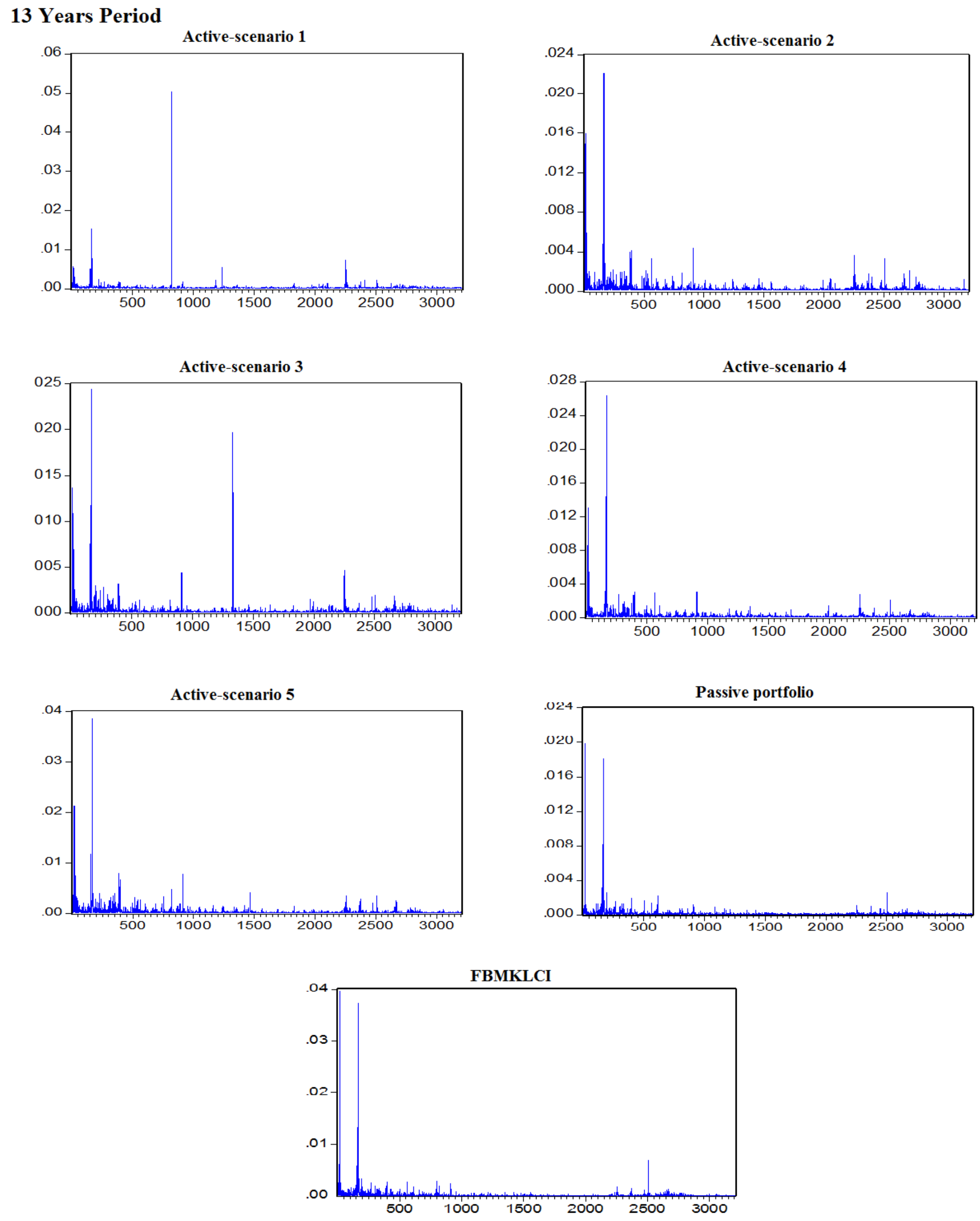
13 years period data (Portfolio Strategy)	**α**	**z**	**Prob.**	**β**	**z**	**Prob.**
Active – scenario 1	**0.215164**	**20.33276**	**0.0000**	**0.787730**	**70.60464**	**0.0000**
Active – scenario 2	**0.159353**	**21.26537**	**0.0000**	**0.831008**	**139.93440**	**0.0000**
Active – scenario 3	**0.219385**	**26.36326**	**0.0000**	**0.752648**	**72.81332**	**0.0000**
Active – scenario 4	**0.130107**	**19.08184**	**0.0000**	**0.856565**	**133.09350**	**0.0000**
Active – scenario 5	**0.138294**	**16.60279**	**0.0000**	**0.858470**	**124.28470**	**0.0000**
Passive	**0.141177**	**18.28669**	**0.0000**	**0.850164**	**121.33330**	**0.0000**
KLCI Return	**0.138588**	**18.48601**	**0.0000**	**0.866065**	**140.18460**	**0.0000**

Table 6: GARCH model coefficient (crisis period)

Crisis Time (Portfolio Strategy)	α	z	Prob.	β	z	Prob.
Active – scenario 1	**0.147411**	**3.32391**	**0.0009**	**0.63714**	**6.59021**	**0.0000**
Active – scenario 2	**0.175042**	**5.20818**	**0.0000**	**0.73332**	**17.42782**	**0.0000**
Active – scenario 3	**0.151056**	**4.63165**	**0.0000**	**0.80757**	**19.20091**	**0.0000**
Active – scenario 4	**0.177119**	**3.87513**	**0.0001**	**0.70015**	**9.05337**	**0.0000**
Active – scenario 5	**0.163714**	**4.99805**	**0.0000**	**0.78457**	**21.32948**	**0.0000**
Passive	**0.171082**	**3.49849**	**0.0005**	**0.69673**	**7.14568**	**0.0000**
KLCI Return	**0.190160**	**4.70922**	**0.0000**	**0.74804**	**11.76569**	**0.0000**

Figure 1 and 2 are the estimated GARCH variance series graphs. They are used to detect the outliers and potential problem that cause the model to be insignificant.

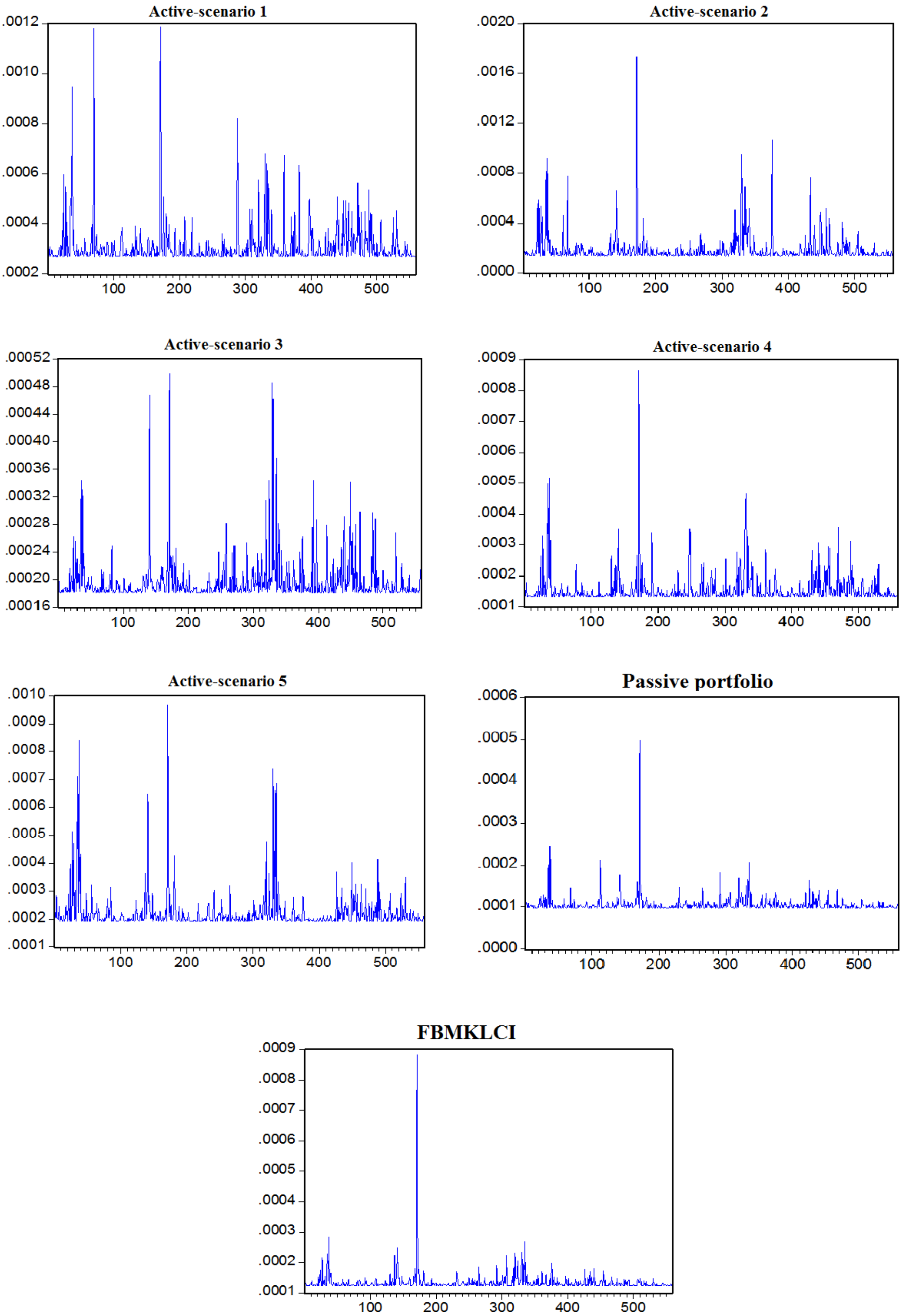
Figure 1: GARCH graph for all types of portfolio (13 years period)



GARCH graph for all types of portfolio (13 years period)

Figure 2: GARCH graph for all types of portfolio (crisis period)

Crisis Period (Mid 2007 - 30 September 2009)



GARCH graph for all types of portfolio (crisis period)

Table 7 and 8 show the forecasted GARCH value and the real GARCH value. The last column is the differences of forecasted value from the real value which the equation is (real value – forecasted value) / real value.

Table 7: GARCH forecasting (by using 13 years period data)

Active scenario 1				**Active scenario 2**		
Forecasted	**Real**	**Difference from real**		**Forecasted**	**Real**	**Difference from real**
0.0003000	**0.0003000**	**0.0000%**		**0.0001450**	**0.0001450**	**0.0000%**
0.0003650	**0.0006300**	**42.0635%**		**0.0002130**	**0.0001980**	**-7.5758%**
0.0003840	**0.0003640**	**-5.4945%**		**0.0002520**	**0.0002200**	**-14.5455%**
0.0003900	**0.0003040**	**-28.2895%**		**0.0002760**	**0.0001410**	**-95.7447%**
0.0003920	**0.0003410**	**-14.9560%**		**0.0002890**	**0.0001270**	**-127.5591%**
0.0003920	**0.0002750**	**-42.5455%**		**0.0002980**	**0.0001710**	**-74.2690%**
0.0003930	**0.0002890**	**-35.9862%**		**0.0003020**	**0.0001560**	**-93.5897%**
0.0003930	**0.0003970**	**1.0076%**		**0.0003050**	**0.0001350**	**-125.9259%**
0.0003930	**0.0002750**	**-42.9091%**		**0.0003070**	**0.0001530**	**-100.6536%**
0.0003930	**0.0003400**	**-15.5882%**		**0.0003080**	**0.0001330**	**-131.5789%**
	Mean	**-14.2698%**			**Mean**	**-77.1442%**

Active scenario 3				**Active scenario 4**		
Forecasted	**Real**	**Difference from real**		**Forecasted**	**Real**	**Difference from real**
0.0001610	**0.0001610**	**0.0000%**		**0.0001560**	**0.0001560**	**0.0000%**
0.0002320	**0.0001950**	**-18.9744%**		**0.0002130**	**0.0001650**	**-29.0909%**
0.0002680	**0.0003730**	**28.1501%**		**0.0002390**	**0.0002420**	**1.2397%**
0.0002860	**0.0001510**	**-89.4040%**		**0.0002500**	**0.0001660**	**-50.6024%**
0.0002950	**0.0001730**	**-70.5202%**		**0.0002560**	**0.0002150**	**-19.0698%**
0.0003000	**0.0001500**	**-100.0000%**		**0.0002580**	**0.0001430**	**-80.4196%**
0.0003020	**0.0001500**	**-101.3333%**		**0.0002590**	**0.0001480**	**-75.0000%**
0.0003030	**0.0001930**	**-56.9948%**		**0.0002600**	**0.0001420**	**-83.0986%**
0.0003040	**0.0001500**	**-102.6667%**		**0.0002600**	**0.0001550**	**-67.7419%**
0.0003040	**0.0003880**	**21.6495%**		**0.0002600**	**0.0002200**	**-18.1818%**
	Mean	**-49.0094%**			**Mean**	**-42.1965%**

Table 7: GARCH forecasting (by using 13 years period data)

Active scenario 5 | **Passive portfolio**

Forecasted	Real	Difference from real		Forecasted	Real	Difference from real
0.0002000	0.0001990	-0.5025%		0.0000781	0.0000788	0.8883%
0.0003140	0.0003080	-1.9481%		0.0001210	0.0008020	84.9127%
0.0003830	0.0002160	-77.3148%		0.0001440	0.0000810	-77.7778%
0.0004240	0.0001940	-118.5567%		0.0001560	0.0000976	-59.8361%
0.0004480	0.0002070	-116.4251%		0.0001630	0.0000862	-89.0951%
0.0004630	0.0001940	-138.6598%		0.0001670	0.0000862	-93.7355%
0.0004710	0.0001940	-142.7835%		0.0001690	0.0000922	-83.2972%
0.0004770	0.0001970	-142.1320%		0.0001700	0.0000943	-80.2757%
0.0004800	0.0002110	-127.4882%		0.0001710	0.0000787	-117.2808%
0.0004820	0.0002680	-79.8507%		0.0001710	0.0000835	-104.7904%
	Mean	-94.5661%			Mean	-62.0288%

KLCI Return

Forecasted	Real	Difference from real
0.0000935	0.0000935	0.0000%
0.0001510	0.0000935	-61.4973%
0.0001930	0.0001420	-35.9155%
0.0002250	0.0001800	-25.0000%
0.0002480	0.0001380	-79.7101%
0.0002650	0.0000819	-223.5653%
0.0002780	0.0000842	-230.1663%
0.0002880	0.0001080	-166.6667%
0.0002950	0.0000818	-260.6357%
0.0003000	0.0000837	-258.4229%
	Mean	-134.1580%

Table 8: GARCH forecasting (by using crisis period data)

Active scenario 1

Forecasted	Real	Difference from real
0.0002700	0.0002720	0.7353%
0.0003060	0.0002730	-12.0879%
0.0003110	0.0002720	-14.3382%
0.0003120	0.0002740	-13.8686%
0.0003120	0.0002930	-6.4846%
0.0003120	0.0005080	38.5827%
0.0003120	0.0002720	-14.7059%
0.0003120	0.0002820	-10.6383%
0.0003120	0.0002840	-9.8592%
0.0003120	0.0004150	24.8193%
	Mean	-1.7845%

Active scenario 2

Forecasted	Real	Difference from real
0.0001780	0.0001770	-0.5650%
0.0001850	0.0001470	-25.8503%
0.0001870	0.0001360	-37.5000%
0.0001870	0.0001370	-36.4964%
0.0001880	0.0001390	-35.2518%
0.0001880	0.0002180	13.7615%
0.0001880	0.0001450	-29.6552%
0.0001880	0.0001470	-27.8912%
0.0001880	0.0001320	-42.4242%
0.0001880	0.0001360	-38.2353%
	Mean	-26.0108%

Active scenario 3

Forecasted	Real	Difference from real
0.0001810	0.0001770	-2.2599%
0.0001960	0.0001780	-10.1124%
0.0001980	0.0001840	-7.6087%
0.0001980	0.0001870	-5.8824%
0.0001980	0.0001820	-8.7912%
0.0001980	0.0001800	-10.0000%
0.0001980	0.0001790	-10.6145%
0.0001980	0.0001780	-11.2360%
0.0001980	0.0001780	-11.2360%
0.0001980	0.0001810	-9.3923%
	Mean	-8.7133%

Active scenario 4

Forecasted	Real	Difference from real
0.0001320	0.0001300	-1.5385%
0.0001540	0.0001300	-18.4615%
0.0001580	0.0001470	-7.4830%
0.0001580	0.0001290	-22.4806%
0.0001580	0.0001310	-20.6107%
0.0001580	0.0001420	-11.2676%
0.0001580	0.0001290	-22.4806%
0.0001580	0.0001290	-22.4806%
0.0001580	0.0001290	-22.4806%
0.0001580	0.0001300	-21.5385%
	Mean	-17.0822%

Table 8: GARCH forecasting (by using crisis period data)

Active scenario 5				Passive portfolio		
Forecasted	**Real**	**Difference from real**		**Forecasted**	**Real**	**Difference from real**
0.0001950	**0.0001920**	**-1.5625%**		**0.0001010**	**0.0001010**	**0.0000%**
0.0002200	**0.0001950**	**-12.8205%**		**0.0001060**	**0.0000999**	**-6.1061%**
0.0002240	**0.0001930**	**-16.0622%**		**0.0001060**	**0.0000984**	**-7.7236%**
0.0002240	**0.0001920**	**-16.6667%**		**0.0001070**	**0.0001590**	**32.7044%**
0.0002240	**0.0001920**	**-16.6667%**		**0.0001070**	**0.0001180**	**9.3220%**
0.0002240	**0.0002010**	**-11.4428%**		**0.0001070**	**0.0001010**	**-5.9406%**
0.0002240	**0.0001960**	**-14.2857%**		**0.0001070**	**0.0000975**	**-9.7436%**
0.0002240	**0.0001900**	**-17.8947%**		**0.0001070**	**0.0000974**	**-9.8563%**
0.0002240	**0.0001900**	**-17.8947%**		**0.0001070**	**0.0000978**	**-9.4070%**
0.0002240	**0.0001920**	**-16.6667%**		**0.0001070**	**0.0000975**	**-9.7436%**
	Mean	**-14.1963%**			**Mean**	**-1.6494%**

KLCI Return

Forecasted	**Real**	**Difference from real**
0.0001260	**0.0001240**	**-1.6129%**
0.0001350	**0.0001240**	**-8.8710%**
0.0001350	**0.0001220**	**-10.6557%**
0.0001350	**0.0001230**	**-9.7561%**
0.0001350	**0.0001220**	**-10.6557%**
0.0001350	**0.0001240**	**-8.8710%**
0.0001350	**0.0001300**	**-3.8462%**
0.0001350	**0.0001230**	**-9.7561%**
0.0001350	**0.0001220**	**-10.6557%**
0.0001350	**0.0001220**	**-10.6557%**
	Mean	**-8.5336%**

Table 9 shows the R-squared results for a portfolio of randomly selected stocks in order to determine the level of diversification.

Table 9: R-squared for each number of stocks

Portfolio Strategy	Number of Stocks				
	10	20	30	40	50
R-squared	57.98%	62.46%	63.01%	66.57%	66.61%
Portfolio Strategy	Number of Stocks				
	60	70	80	90	100
R-squared	67.80%	68.97%	69.17%	69.48%	70.22%

The stationary test results on the 15 stocks by using ADF, PP and KPSS tests are shown in Table 10. Both the ADF and PP tests have the null hypothesis of data series is non-stationary. KPSS has the null hypothesis of data series is stationary. Table 11 indicates the critical values to determine the significance of the tests. ADF and PP follow critical τ value, while KPSS follows LM- Stat critical value.

Table 10: Stationary Tests on the 15 Stocks within the Cointegration based Portfolio at level

Stocks		ADF	PP	KPSS
aji	intercept and trend	-2.047854	-2.030020	0.685535***
bjtoto	intercept and trend	-3.405105*	-3.387044*	0.581280***
carlsbg	intercept and trend	-2.745142	-2.294255	0.224102***
ccb	intercept and trend	-2.194660	-2.169843	0.692892***
gnealy	intercept and trend	-2.514211	-2.434966	1.112411***
kianjoo	intercept and trend	-2.553575	-2.606018	0.566848***
kulim	intercept and trend	-1.185755	-1.065605	0.912681***
maa	intercept and trend	-2.898170	-2.858241	0.700019***
mflour	intercept and trend	-1.127680	-1.069357	0.940947***
mrcb	intercept and trend	-2.664280	-2.615572	0.570300***
pbbank	intercept and trend	-2.147640	-2.431017	0.485827***
rview	intercept and trend	-3.070753	-3.048372	0.367537***
shchan	intercept and trend	-3.323005*	-3.131620*	0.683991***
sime	intercept and trend	-2.842467	-2.645653	0.193438**
umcca	intercept and trend	-0.913605	-1.000442	1.229854***

*(**)[***] denotes rejection of the hypothesis at 10%(5%)[1%] significance level.

Table 11: critical values for the unit root tests

	PP	ADF	KPSS
	Critical τ value		LM-Stat critical value
1% significant level	-3.960904		0.216000
5% significant level	-3.411208		0.146000
10% significant level	-3.127437		0.119000

Table 12 shows the optimal lag length determined by different selection criteria. LR= sequential modified LR test statistic; FPE= Final Prediction and Error; AIC= Akaike Information Criterion; SC= Schwarz information critierion; HQ= Hannan-Quinn information criterion. As mentioned previously, AIC and SC are the chosen criteria in this research.

Table 12: The VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-31964.86	NA	1.58e-10	19.99992	20.02839	20.01012
1	68658.57	200240.0	8.51e-38	-42.78835	-42.3328*	-42.62502*
2	69019.08	714.0237	7.8e-38*	-42.8731*	-41.99045	-42.55664
3	69225.31	406.5430	7.91e-38	-42.86136	-41.55164	-42.39179
4	69416.70	375.4702	8.08e-38	-42.84034	-41.10353	-42.21764

* denotes optimal lag length to be selected

The results of Johansen and Juselius Cointegration Test under lag length 1 and 2 are shown in table 13. The null hypothesis of no cointegration until the null hypothesis of at most 14 cointegration equations are listed in sequence in the first column. A cointegration free portfolio would fail to reject all the null hypothesis listed.

Table 13: Johansen and Juselius Cointegration Test Results

Null Hypothesis	Trace Statistic	5% critical value	Max-Eigen Statistic	5% critical value
Lag Length 1				
None	482.2864	576.2641	82.85964	135.2474
At most 1	399.4268	487.3256	75.02641	104.3697
At most 2	324.4004	398.3685	64.81089	95.4587

At most 3	259.5895	354.9837	49.54621	76.57843
At most 4	210.0433	285.1425	43.49564	70.53513
At most 5	166.5477	239.2354	35.52198	64.50472
At most 6	131.0257	197.3709	29.67099	58.43354
At most 7	101.3547	159.5297	24.69739	52.36261
At most 8	76.6573	125.6154	23.02192	46.23142
At most 9	53.63538	95.75366	17.30877	40.07757
At most 10	36.32661	69.81889	12.85114	33.87687
At most 11	23.47547	47.85613	11.61074	27.58434
At most 12	11.86473	29.79707	6.444337	21.13162
At most 13	5.420012	15.49471	5.381259	14.2646
At most 14	0.039133	3.841466	0.039133	3.841466
Lag length 2				
None	460.0644	574.8402	77.47156	119.0432
At most 1	382.5928	487.2101	70.75548	114.3355
At most 2	311.8373	402.3562	56.86237	89.9541
At most 3	254.975	334.9837	47.56265	76.57843
At most 4	207.4123	285.1425	40.86393	70.53513
At most 5	166.5484	239.2354	34.96367	64.50472
At most 6	131.5847	197.3709	28.46169	58.43354
At most 7	103.123	159.5297	25.38422	52.36261
At most 8	77.73879	125.6154	23.05454	46.23142
At most 9	54.68425	95.75366	18.96617	40.07757
At most 10	35.71809	69.81889	12.92945	33.87687
At most 11	22.78864	47.85613	11.56369	27.58434
At most 12	11.22495	29.79707	6.161161	21.13162
At most 13	5.063786	15.49471	5.063428	14.2646
At most 14	0.000358	3.841466	0.000358	3.841466

* denotes rejection of the hypothesis at 5% significance level.

Comparison between correlation and cointegration based portfolio is shown in Table 14. R-squared is used as the measure to assess the level of diversification achieved by both portfolios. The higher R-squared proves the higher level of diversification, and vice versa.

Table 14: R-squared for Correlation and Cointegration based portfolio

	Long Run		Crisis Period	
	Correlation based protfolio	Cointegration based portfolio	Correlation based protfolio	Cointegration based portfolio
R-squared	41.05%	67.16%	32.28%	55.92%

The stock prices movement within each portfolio in the long run and crisis period is illustrated in Figure 3 to Figure 6.

Figure 3: The Stock Prices Movement within the Correlation based Portfolio in the long run

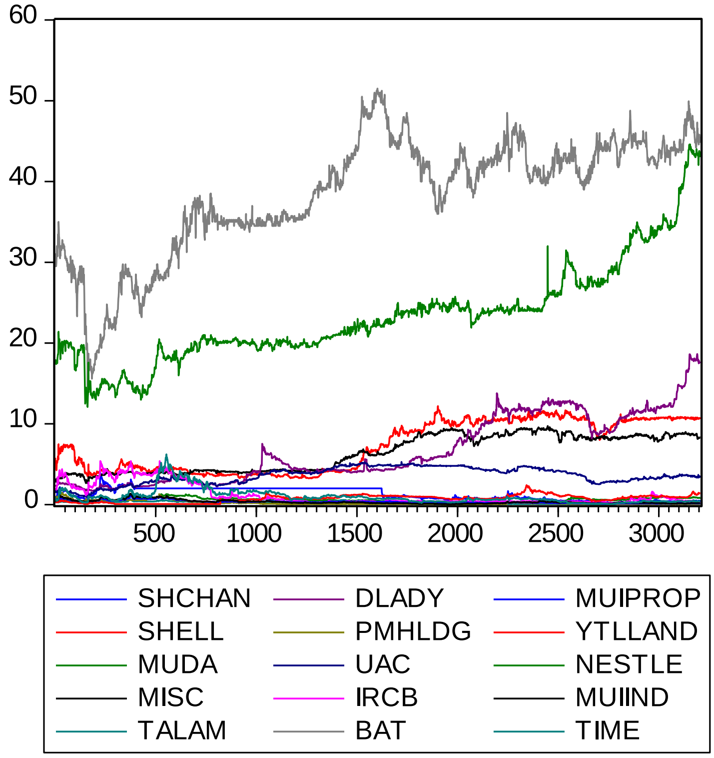


Figure 4: The Stock Prices Movement within the Cointegration based Portfolio in the long run.

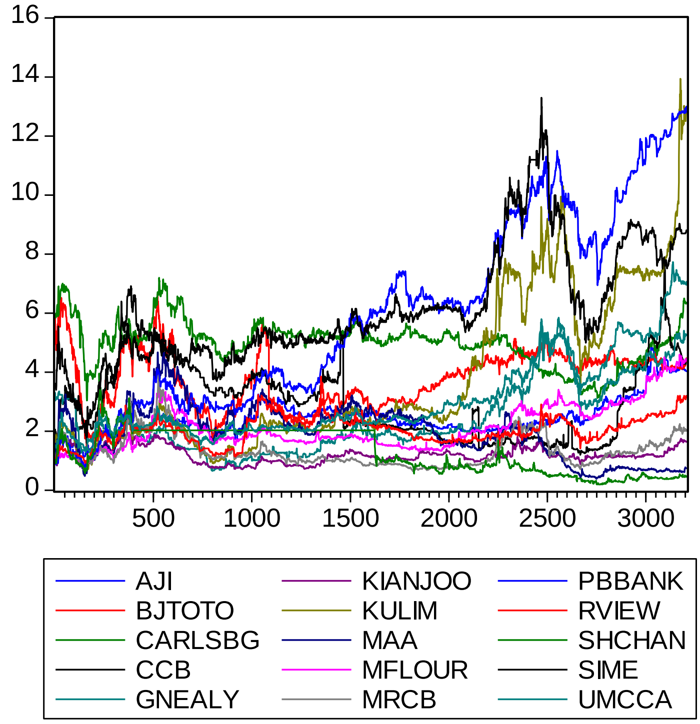


Figure 5: The Stock Prices Movement within the Correlation based Portfolio in the crisis period.

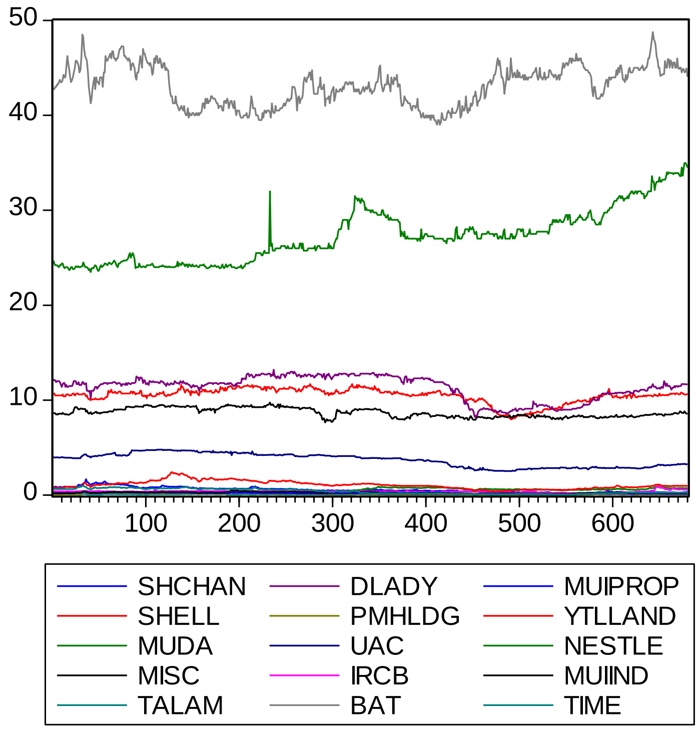
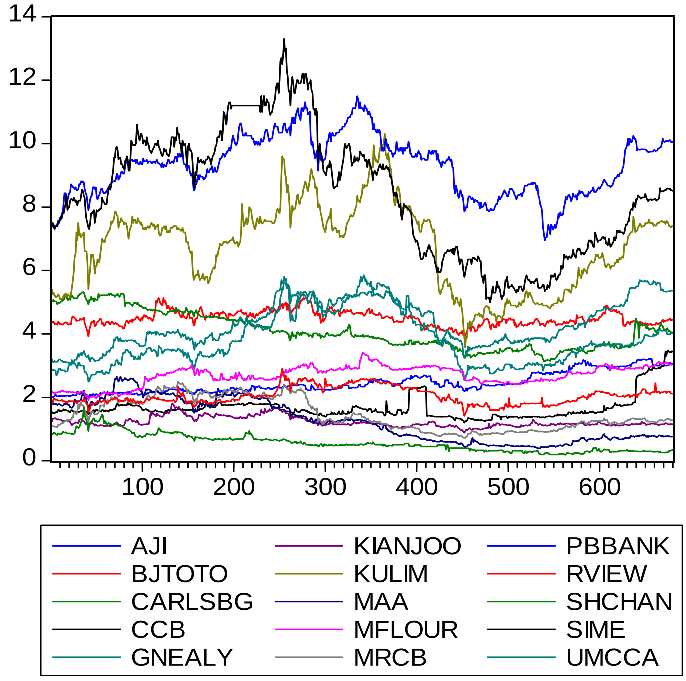


Figure 6: The Stock Prices Movement within the Cointegration based Portfolio in the crisis period.



CHAPTER 5.0 INTERPRETATION OF RESULTS

5.1 Risk-Adjusted Performance Indices (Sharpe, Treynor and Jensen's index)

Table 1 and Table 2 showed the three main ratios which is Sharpe, Treynor and Jensen measures in order to determine the performance of both active and passive portfolios against each other as well as the KLCI market return in 5 different scenarios in the long run period of 13 years and a specific period during the crisis.

In the long run, results in Table 1 showed that active and passive portfolio in all five scenarios consistently outperforming the market return bringing significant positive values in both Sharpe and Treynor ratios. Results indicated that active portfolio in all five scenarios in all 3 of the measures have higher ratios than passive portfolio which means that in long run active portfolio management spurred out higher performance than passive strategies. In terms of choosing the best portfolio, portfolio with the highest performance measure would be chosen as the best portfolio performance. To determine which strategy perform better, the higher the ratio is, the better the performance of the portfolio.

Overall, active portfolio scenario 1 has given the highest performance over the rest of the scenario at a diversification of 15 stocks. Based on Table 1, both active and passive portfolio outperformed the market return which is 0.4173 in Sharpe ratio and a Treynor ratio of 0.1164. However, active portfolio showed higher Sharpe ratio which is 0.7438 compared to passive portfolio of 0.6092. For Treynor measure, both portfolios outperformed the KLCI market return ratio of 0.1164 similar to Sharpe ratio. However, active portfolio once again showed the higher Treynor ratio which is 0.3240 compared to passive portfolio with ratio of 0.1844. For Jensen ratio, the higher the ratio, the better the risk-adjusted return resulted in a positive Alpha value. From Table 1, both portfolios showed positive ratios which reflect that the portfolios performance are relatively superior compared to market return. However, passive portfolio has Jansen ratio of 0.0549 lower than active portfolio with ratio of 0.1803. In overall active portfolio outperformed passive portfolio and KLCI market return in scenario 1. Overall results in Table 1 showed a consistent and stable measure, although Sharpe ratio has a more significant measure among the other 2 ratios, however overall performance of the portfolio is determined with the combined result of the all 3 ratios as a more complete and comprehensive measurement as opposed to Miranti (2009) which chose the strongest performance ratio. Although Sharpe ratio in active portfolio scenario 1 is slightly lower compared to scenario 3 of 0.7505, overall performance of a portfolio is based on the results from the 3 measures. Therefore, active portfolio in scenario 1 gave the highest performance.

Referring to the Table 2, the analysis during the crisis period showed that active portfolio management outperformed both passive portfolio and KLCI market return. Nonetheless, passive portfolio incurred a negative ratio during the crisis which means that passive strategy resulted in lower performance during the crisis period. Due to the inconsistent of ratios showed in the results in all 5 scenarios, it was unable to determine which specific type of ratio performs stronger. Therefore, this research finalized the result by choosing the scenario with highest performance in all 3 ratio measures. Scenario 1 has the highest performance during the crisis period.

Table 2 showed that active portfolio outperformed the KLCI market return during the crisis period which is a ratio of -0.3761 with a significant ratio of 0.5465 while passive portfolio incurred a loss however it is lower than market loss with a Sharpe ratio of -0.0774. Under Treynor ratio, it showed that active portfolio outperformed the KLCI market return ratio of -0.0837 with a significant ratio of 0.2140. However, passive portfolio once again incurred a higher negative Treynor ratio which is -0.0190 compared to market return. For Jensen ratio, both portfolios showed positive ratio which reflect that the portfolios performance is relatively good compared to market return. However, passive portfolio has Jansen ratio of 0.0523 lower than active portfolio with ratio of 0.2568.

All active portfolios have outperformed the market downturn during the crisis however there is an exception with scenario 4 where incurred low performance during the crisis. This could be due to active portfolio in scenario 4 holds a large proportion of property stocks which consists of 7 property stocks out of 15 stocks in a portfolio. This is consistent with the incident of Subprime crisis in year 2008 where during the crisis most of the stocks which were adversely affected are property related stocks. Active portfolio under scenario 1 consists of 5 consumer stocks which hold a large proportion in a portfolio eventually proven to be the best performer during crisis may imply that consumer stocks generally provide protection against downside risk as most of the products sold are necessities. Therefore, there is still a strong demand on consumer products throughout the period including crisis period and it is implied that these stocks are crisis resistant and would generate profit during market downturn. The results showed that the performance of the portfolio could be attributed by the industry of the related stocks.

In overall, active portfolio significantly outperformed passive portfolio and KLCI market return in long run and crisis period. The performance of passive strategy during the crisis period is not as good as it is in the long run. This indicated that diversification under passive portfolio strategy does not provide as much risk reduction in crisis period compared with long run.

5.2 GARCH Model

5.2.1 ARCH output (significance of model)

Based on the Table 3, as required by theory, both the coefficient α_0 and α_1 must be positive, and α_1 must be less than 1. The KLCI market and all the portfolios fulfilled this requirement. Then, all the F-statistic and R^2 are significant at level of 1%. It showed that there is ARCH effect for all the portfolios constructed with 13 years time period. Hence, the null hypothesis of there is no significant ARCH effect between current volatile and past volatile has been rejected.

For the crisis period analysis; based on Table 4, as required by theory, both the coefficient α_0 and α_1 must be positive, and α_1 must be less than 1. All the portfolios fulfilled this requirement. Except for active portfolio scenario 3 and KLCI market return, all portfolio are significant at 1% level with the F-statistic and Obs*R-squared. It could be due to the fact that one of the companies in portfolio, which is AMOLEK has stop its trading for some time and thus led to no movement of price, and flattened the return of the portfolio. Other than that, for KLCI market return is insignificant in 5% level, but significant at 10% level. In overall, all the portfolios are significant.

5.2.2 GARCH Graph

Refer to Figure 1, the active portfolio in scenario 1 showed a high volatility in the days around 800^{th}. It was due to the inactive trading of stock YTLLAND before 9^{th} May 2001, while at 10^{th} May 2001, it started to trade again and the price boosted from RM0.1050 to RM0.7050. While at the days around 500^{th}, all portfolios showed high volatility or large increase in prices. The exact date was 3 September 1998 and 4 September 1998, which KLCI hit historical lowest at point 262.7 at the date 1 September 1998, and at the 2 particular days, the market rebounded. While for active portfolio scenario 3, it also showed a high volatility in days around 1350^{th}. It was also due to the inactive of stock MBFHLDG before 6^{th} June 2003, and the price shot up from RM0.2050 to RM 0.7250 at date 9^{th} June 2003.

5.2.3 GARCH Output

From Table 5, all the coefficients are significant at 1% level, including with high z-stat value, it implied that the GARCH model does fit very well with the data. Hence, the null hypothesis of there is no significant GARCH effect between current volatile and past volatile has been rejected. While for the active portfolio scenario 1 and KLCI market return, the sum of the coefficient are above 1 which are 1.002894 for active portfolio scenario 1 and 1.0046653 for KLCI market return. Therefore, they resulted an IGARCH appearance in the analysis. This indicated that the constraint forces the conditional variance to act like a process with a unit-root. Hence, it is useful for step-ahead forecast.

For the active portfolio scenario 1, its α value is 0.215164, it is the second highest value among all other portfolios. This indicated that the portfolio return's volatility caused by the new market information. While for its β value 0.78773, it showed the second lowest value among all portfolios. This implied that its volatilities caused by its MA effect itself are low compare with other portfolios. The results shown seem to be contradicting with the Harry Markowitz portfolio theory, which uses the correlation analysis to construct portfolio. It is because active portfolio scenario 1 did not earn the lowest conditional variance among all active portfolios under different scenarios. It is align with the research done by Christopher, David & Francis (2010), which indicated that using correlation as a method of portfolio constructing does not necessary yield the best result.

In active portfolio scenario 2, its *α* value of 0.159353 which is far lower than the active portfolio scenario 1. While come to the β value at 0.831008, which is the third lowest value among all portfolio. For the active portfolio scenario 3, its *α* value of 0.219385 seems to be the highest value among all others portfolios, this indicated that its volatilities are mostly affected by the new information among all portfolios. While come to the β value, it has the lowest value of 0.752648. Next, the active portfolio scenario 4, its *α* value of 0.130107 is the lowest value among all portfolios. While come to the β value, it has the third highest value of 0.856565. Come to the active portfolio scenario 5, its value of 0.138294 is the second lowest among all other portfolios. While come to the β value, it has the second highest value of 0.858470.

In passive portfolio, its *α* value of 0.141177, which is the fourth lowest value among all other portfolios. Since the value is lower than the active portfolio scenario 1 value, it showed that, passive portfolio reacted better than active portfolio with regards to the new information. However, it did not outperform all active portfolios; rather it is just better than active portfolio scenario 1. While with the β value of 0.850164, the figure is on the middle point among those of other portfolios. Comparing with the active portfolio scenario 1, it showed poorer performance. By comparing the value of both coefficients, it could not determine which is performing better than the other, and the value seems to be contradicting with Harry Markowitz modern Portfolio Theory which lowest correlation should earn a more stable return.

Looking at the KLCI market return, its *α* value of 0.138588 is lower than passive portfolio and active portfolio scenario 1, which indicated that the market reacts better than this two portfolio with regarding to the new information. However, comparing with other active portfolios scenarios, it has poorer performance. Go to β value, it has the highest value of 0.866065. This indicated that the market does have the highest MA effect.

To summarize it, in the long run, all types of portfolios have its own competitive advantage against each other, which means that the best strategy in long run is indeterminable by using GARCH analysis. Furthermore, in the long run, it was found that portfolio with lower correlation does not necessarily have lower volatilities. Besides that, it is shown that the β value are always far higher than *α* value. This indicated that for the market and all the portfolios, the volatilities are caused more by its MA effect, rather than new market information. This is align with the first research on portfolio return done by Jing Yang (1999) which showed that market is affected more by the noise factor rather than new information when investors tend to be noise trader. In other words, the investors overreact to past information and underreact to new information.

Based on the results of GARCH model in the crisis period, as shown in Table 6, all coefficients for all portfolios seem to be significant at 1% level. All the sum of both α and β are also below 1 as required by theory. Besides that, all the z values are also large enough to indicate that the GARCH fit the data very well. Comparing with the prior ARCH result which showed that active portfolio scenario 3 and market portfolio to be insignificant, it showed significant ARCH effect in GARCH model, this implied that by combining the MA effect into ARCH, ARCH is a significant coefficient to determine the output. There is co-movement of the 2 series since both the coefficient values in GARCH model are significant at 1% level.

For the active portfolio scenario 1, its α value of 0.147411 is the lowest among all the portfolios. Come to the β value, it also has the lowest value of 0.63714 among all other portfolios. It is because active portfolio scenario 1 was constructed using the lowest correlation among stock, it is the core representative of active portfolio. This implied that active portfolio scenario 1 is the best performer during the time of crisis. This is supported by the research done by Sazali Zainal Abidin (2006) which showed that Malaysian stocks tend to have low correlation during the crisis period, but having higher correlation during normal time, and the portfolio constructed using correlation analysis performs well during crisis period rather than long run. The research used the Asian crisis 1997 to represent the crisis period, and comparing with the results of this research which used Subprime crisis 2007, it implied that during both crisis periods, a portfolio constructed by using correlation analysis performed well.

In active portfolio scenario 2, its α value of 0.175042 showed the third highest value. While go to the β value, it is on the middle point among those of other portfolios with 0.73332. Next, go to the active portfolio scenario 3, its α value of 0.151056 was the second lowest among all other portfolios. Then the β value of 0.80757 showed the highest among all portfolios. In active portfolio scenario 4, its α value of 0.177119 seems to be the second highest among all other portfolios, but are still below the market portfolio. While for the β value of 0.70015, it is the third lowest value. In active portfolio scenario 5, its α value of 0.163714 is the third lowest value among all portfolios. While go to the β value, it is the second highest with the value of 0.78457.

For passive portfolio, its α value of 0.171082 represented the middle point among those of other portfolios. Comparing with the market portfolio, it is still lower than it. Then the β value of 0.69673 is the second lowest value that just above the active portfolio scenario 1. Compared with market portfolio, both of the coefficient values are lower than it, which indicated that it shows lesser volatilities than the KLCI market. However, it has poorer performance compared to the active portfolio scenario 1.

Lastly, looking at the KLCI market return, its α value of 0.190160 is the highest value among all portfolios. This indicated that the market reacted more to the new information compared to the active and passive portfolios. Then go to its β value, 0.74804 is the third highest value among all portfolios, and it is above the active portfolio scenario 1 and passive portfolio.

In conclusion, the comparison among portfolios and the market in the crisis period provides clearer results. During the crisis period, active portfolio has the best performance with lowest volatilities compared to passive portfolio and the market. It is again consistent with the research done by Sazali Zainal Abidin (2006) as mentioned earlier. Besides that, it also implied that, Harry Markowitz modern portfolio theory that argued to use correlation to construct portfolio should be categorized as an active portfolio strategy, because it only performs well in short period, but not in the long run. This is because correlation may vary with the market situation and company condition. In other words, the correlation is not fixed by holding a constant portfolio. In the long run, active monitoring and frequent reconstruction is needed so that the correlation of the portfolio can remain low at all the time. Then, in the crisis period, the β value is also found to be far above α value in the market and all portfolios. Again, this indicated that the volatilities of portfolios and market are caused more by the effect of MA (moving average), instead of new market information. Hence, this implied that Malaysia market is inefficient because the volatilities (which caused by share price movement) is not caused by information, but rather a pattern of movement that cause by “noise trader”. (Jing Yang, 1999)

5.2.4 GARCH Forecasting

For the forecasting, by referring to the Table 7, this research has forecasted the future 10 days period GARCH variance series. Referring to the 13 years period forecasting, the percentage differences from real data is large enough. From the lowest of 14.2698% to the highest of 134.1580%, this indicated that the model does not predict the future movement well. However, what can be seen is that, all the 1-day-ahead forecast showed very accurate forecast results. The highest percentage difference between real value and forecasting value is just 0.8883%. Come to the second-day-ahead, the forecasting tends to be too far different from the real data. Besides that, most of the figure is negative with just a few is positive. This implied that, the model tends to over forecast the value in all time.

While come to the forecasting for the crisis period shown in Table 8, the percentage differences between real value and forecasting value are far lower compared to the long run. The lowest value is 1.6494%, and the highest is 26.0108%. This implied that GARCH model can forecast better in the short period compared to 13 years period. Then, by looking at the 1-day-ahead forecast, all the forecasting values are accurate, with the highest percentage difference of 2.2599%. However, looking at the second-day-ahead, the forecasting value is also far deviated from the real data.

In conclusion, the forecast does align with the theory, which stated that unconditional forecast has a greater variance than the conditional variance. Thus, conditional forecast are preferable. By looking at the result, GARCH model forecasts well in short-term period, but not in long term period, thus the percentage differences for crisis period tend to be lower than 13 years period.

5.3 R-squared Diversification Measure

Table 9 showed a randomly chosen 10 to 100 stocks with an assumption of equal weight in all stocks given in a portfolio to interpret R^2. According to Stevenson & Jennings (1984), 8 to 16 stocks would be sufficient enough to construct a well diversified portfolio. However, Ronald & Mitchell (2000) opposed that 15 stocks will only get 76% of the available diversification which denied Statman (September 1987) that commonly 90% diversification will achieved with 15 or above stocks. To testify whether the statement the above statements are applicable in the case of Malaysia, this research used R^2 as the basis of measure of the squared correlation between a stock's performances.

Results in the Table 9 showed that a number of 10 stocks in a portfolio can achieve 57.98% of diversification benefit where it keeps on increasing when gradually adding more number of stocks. When portfolio of stocks reached 100, it achieved a total diversification benefit of 70.22%. Referring back to Ronald & Mitchell (2000), a portfolio of 30 stocks would bring 86% of diversification. However in the case of Malaysia, it brings only about 63% of diversification benefits which is less so effective compared to diversification in developed markets such as United States. According to Statman (September 1987), 400 stocks would fully drive out unsystematic risks therefore in Malaysia this research would imply that it would require more than 400 stocks to fully diversify a portfolio.

The reason where there is a significant differences in the effect of diversification is probably due to various factors such as the size and efficiency of a market where market in developed countries such as United States are far more developed and established compared to Malaysia therefore market is more efficient in these countries. Due to the difference of market efficiency in both markets, the less efficient market in Malaysia may imply that Modern Portfolio Theory of Markowitz (1952) can no longer be plausible to be applied in Malaysia. Modern Portfolio Theory can be limited by the measure of risk that does not represent the realities of the investment markets. Therefore, standard deviation may not be an appropriate measure to effectively assess the risk of a portfolio due to market inefficiency, which in turn R^2 becomes a more essential measure to gauge the level of unsystematic risk.

5.4 Unit Root Test

Table 10 showed the results of the three stationary tests (ADF, PP, KPSS) on each of the stocks within the cointegration based portfolio. The selected stocks included AJI, BJTOTO, CARLSBG, CCB, GNEALY, KIANJOO, KULIM, MAA, MFLOUR, MRCB, PBBANK, RVIEW, SHCHAN, SIME and UMCCA. Compare to the benchmark shown in Table 11, under ADF and PP tests, except for BJTOTO and SHCHAN, which should be rejected only at 10% significance level, all other stocks null hypothesis of non-stationary should not be rejected. For KPSS test, the null hypothesis of stationary for every stock was rejected at 1% significance level, except for *sime* which was only rejected at 5% significance. Thus, the 3 unit root tests consistently indicated that the stocks in the cointegration based portfolio is non-stationary.

5.5 Johansen and Juselius Cointegration Test

The results in Table 10 allowed the Johansen and Juselius Cointegration Test among the stock prices movement in the cointegration based portfolio to proceed. Table 12 showed the VAR lag order selection criteria. This research selected optimal lag length based on AIC and SC. Thus, the lag period of 1 and 2 was chosen as they gave the lowest SC and AIC figure respectively. Table 13 showed the JJ test results. From the table, under the lag 1 and lag 2 periods, the null hypothesis of no cointegration equation was failed to be rejected for both Trace statistic and Max-Eigen statistic at 5% significance level. It proved that the portfolio constructed with the stocks is free from any cointegration equation.

5.6 R-squared for Correlation and Cointegration based Portfolio

After constructing a portfolio which is free from any cointegration, it is compared with the correlation based portfolio. From Figure 3 to 6, it is observable that the stock prices movement within cointegration and correlation portfolio in long run and crisis time. It is obvious that the stock prices movement within cointegration based portfolio (Figure 4 and 6) is more random. On the contrary, as compared to the stock prices movement within correlation based portfolio (Figure 3 and 5), the movement seems to exhibit a trend. In terms of figure, the comparison of the R^2 of correlation based portfolio and cointegration based portfolio as shown in Table 14 is done. The results showed that the R^2 of correlation based portfolio in the long run and crisis period is 41.05% and 32.28% respectively, while the r-square of cointegration based portfolio is 67.16% and 55.92% respectively. In both case, the latter outperformed the former. There is evidence of higher level of diversification in cointegration based portfolio compared to correlation based portfolio in the long run and crisis time.

CHAPTER 6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The performance of the active and passive portfolios in this research was being assessed based on ratio analysis (Sharpe, Treynor and Jansen figure). The ratios are ranking criterion based on risk-adjusted return. It is observed that the active strategy provided higher return than passive strategy in the long run. By looking at the ratio analysis, on the other hand, during the crisis period passive strategy is not as effective as it is in the long run and it did not perform well compared to active strategy which eventually outperformed the KLCI market return at the time of recession. This research explored the performance of the portfolios further by analyzing the GARCH model. The results showed that the diversification effects could not be seen clearly in the 13 years analysis period, and thus it failed to determine which portfolio is better in the long run. However, the results in GARCH model are consistent with those of ratio analysis in crisis period. It showed that the volatilities of active portfolio have significantly been reduced in the crisis period. This is consistent with the recent research done by Sazali Zainal Abidin (2006) which proved that correlation among the stocks tends to be lower in the crisis period. In overall, this research concluded that active portfolio is a better portfolio strategy compared to passive portfolio in Malaysian stock market and its superiority to passive portfolio is especially obvious in the crisis period.

Besides that, GARCH results also showed that correlation may vary with the new market situation and company condition. This concluded that the correlation among the stocks is not fixed by holding a constant portfolio. This finding is consistent with the study done by Alexander (1999). Hence, the correlation based portfolio is relatively better in the short period. In the long run, however, frequent reconstruction of portfolio is necessary to achieve the desired diversification effect. In other words, this research may conclude that Harry Markowitz Modern Portfolio Theory which is based on correlation analysis is more suitable to construct an actively managed portfolio.

Besides that, as indicated by the coefficient result from GARCH model, the coefficients of β are far higher than α value. This implied that stock volatilities were affected more by its own lagged effect rather (noise factor) than the new information. This indicated that Malaysian stock market is inefficient in a way that the stock prices movement affected by its own lagged value, but not due to the new information. This is contradicting with the Efficient Market Hypothesis theory that says that share prices reflect the current information. In other words, this research concluded that the market anomalies in Malaysian stock market are attributed to the investor's behavior. According to the market anomalies argument, the investors are psychological biased in a way that they tend to be overreacted to the past information and underreacted to the new information.

Furthermore, as the results showed that the GARCH model forecasting does provide a very accurate forecast for 1-day-ahead value. However, its accuracy decreased as the forecasting range increases. Besides that, the forecasting of GARCH model is also more accurate in the short period compared to the long run.

The market anomalies in Malaysian stock market as mentioned above have certain effect to the level of diversification. The less efficient market in Malaysia may imply that Modern Portfolio Theory of Markowitz (1952) can no longer be plausible to be applied in Malaysia. This is because Modern Portfolio Theory uses standard deviations of return as the measure of risk. However, under an inefficient market, standard deviation does not represent the realities of risk of the investment, instead R^2 is a better measurement. In terms of R^2, where diversification in Malaysia seems to be not so effective compared to most developed countries like United States. This research showed that in Malaysian stock market, a portfolio with 100 stocks can only achieve the diversification level of

70.22%. In contrast with the study done by Ronald & Mitchell (2000), a portfolio with 30 stocks can already achieve 86% of diversification level. The relationship between number of stocks held in a portfolio and diversification has been clarified. 15 stocks portfolio can achieve only around 60% of available diversification, not the 90% previously believed. Even a portfolio with 60 stocks achieves less than 90% of full diversification. Therefore, in Malaysian stock market, investors can no longer rely on a simple rule of thumb to decide on the number of stocks to include in the portfolio. Diversification is more complex than what the traditional diversification methods that have suggested. Hence, this research concluded that there are only limited diversification benefits in Malaysian stock market.

While in the performance comparing between cointegration based portfolio and correlation based portfolio, the result showed that risk reduction benefits of cointegration based portfolio is superior to the correlation based portfolio in the long run and also the crisis period. The result is consistent with the argument of Alexander (1999), which mentioned that correlation analysis is just a short-term measure and instead cointegration analysis should be used over the long run. The underlying reason is that even a combination of two stocks has low correlation, it does not mean that they move in opposite directions in the long run. This is because correlation changes with the market situation and company conditions. A large opposite movement in the short period can already constitute a low correlation between the two stocks, however, in the long run, the desired diversification level is failed to be achieved because they may still be cointegrated, meaning that the price series cannot wander off in opposite directions for very long without coming back to a mean distance eventually. Hence, the argument is that constructing a portfolio which is free from cointegration is far more realistic than a portfolio with low or negative correlation. This result is also consistent with Alexander & Dimitriu (1995) and Grobys (2010) findings that under the buy and hold strategy, the cointegration based portfolio outperforms the correlation based portfolio. The GARCH analysis in the previous part also proved that correlation varies with new market and company condition and thus is not fixed for long term.

Finally, this research also proved that during the crisis period, the active portfolio under scenario 1 which consists of big proportion of consumer sector stocks has the best performance compared to the other active portfolios and passive portfolio. This showed that consumer sector is more crisis resistant because most of the products sold are the necessities in life. This is consistent with the recent study done by Cahalan, Callaghan & Clarke (2010) on United States market. In addition, active portfolio under scenario 4 has the worst performance among all the portfolios in the crisis period. This is because it consists of a large number of properties sector stocks which are significantly affected during the Subprime crisis 2007. Hence, this research also concluded that stock sectors within a portfolio should be concerned by the investors.

6.2 Limitations

Due to the data limitations, this research assessed the performance of the portfolios using 13 years period from 1998 to 2010 and Subprime crisis period from July of 2007 to September of 2009 to represent the long run and crisis period. Besides that, the return of the portfolio was calculated merely based on daily price changes of stocks.

Furthermore, as comparing active and passive portfolio is one of the main objectives in this research, it is important to clarify that such comparison was done without considering the transaction costs incurred. The transaction costs incurred in active portfolio strategy in reality would exceed those of passive portfolio due to the frequent trading.

Besides that, this research classified the portfolio strategy to the active portfolio strategy and passive portfolio strategy. In fact, there are many types of portfolio strategy were introduced such as Behavioural portfolio theory, Naïve portfolio theory, Markowitz portfolio theory and so on. In addition, it is assumed that all the stocks are equally weighted in every portfolio portfolios in the research. However, in reality, it may not be the case.

As advocated by the traditional portfolio theory, diversification should be made across the different industries in the stock market. However, the diversification based on sectors analysis in this research is very limited.

The use of R^2 of as a measurement in this research is not perfect. For R^2, it is calculated as the square of the correlation coefficient between the original and modeled data values. In this case, R^2 does not tell how good a model is, but instead how diversified a model is. However, if there are too many large positive correlated stocks in a portfolio, R^2 measure may no longer be an effective measure of diversification benefits as the effect of diversification may be distorted.

Besides that, for Sharpe ratio that is used in the research, the returns measured can be of any frequency as long as they are normally distributed, as the returns can always be annualized. If any abnormalities exist, the ratio will no longer be an effective measure as distribution can be problematic to the ratio as returns are not normally distributed. An alternative method of ranking portfolio management for Sharpe and Treynor is Jensen's alpha, which quantifies the added return as the excess return above the security market line in the capital asset pricing model.

Similar to Sharpe ratio, the Treynor ratio (*T*) do not quantify the value added if there is any of active portfolio management. It does not measure the exact return as it is merely a ranking criterion only. A ranking of portfolios based on the Treynor Ratio is only useful if the portfolios under consideration are sub-portfolios of a broader, fully diversified portfolio. If this is not the case, portfolios with identical systematic risk but different total risk, will be rated the same.

The main method of stocks selection in this paper under active portfolio construction is based on the Markowitz portfolio theory (1952) correlation analysis. However, due to the results in objective 1 which somehow seems contradicting to the Markowitz Modern Portfolio Theory, this research conducted a comparison between the portfolios which are constructed using correlation and cointegration analysis. The comparison of diversification level was made on buy-and hold strategy as suggested by Alexander (1999) and the result showed that cointegration based portfolio outperform correlation based portfolio. However, this comparison is not comprehensive because this research earlier proved that correlation based portfolio is more suitable to be used under the active trading strategy.

6.3 Recommendations

Based on the results generated and conclusions made, this research provided some recommendations for Malaysian investors.

First of all, investors are recommended to implement active portfolio strategy in Malaysian stock market in the long run and during crisis period. This is because active portfolio provides higher risk-adjusted return in both situations. Furthermore, for extremely risk-averse investors who are not willing to take any excessive risk, they are still recommended to take active portfolio strategy during the crisis period due to passive portfolio's inability to diversify most of the risk in economic downturn. This recommendation is consistent with the general belief that abnormal profits can be obtained with active portfolio strategy in market anomalies.

The market anomalies in Malaysian stock market are caused by the psychological biased of the investors as proven in the research. Hence, efforts should be made on education in hopes that Malaysian investors can be more rational in response to the past information and new information.

Besides that, due to the limited diversification benefits in Malaysian stock market, Malaysian investors are recommended to go for international investment. It is recommended that implementing international diversification would bring substantial regional global diversification benefits for domestic investors in both developed and developing countries. According to Joost & Luc (2006), investors can largely achieve gains from international diversification benefits with countries that have a well-diversified economy and a well-developed stock market and indicated that potential benefits from investing abroad are still substantial as countries integrated in world financial markets can enjoy larger gains at lower level of risk favor. Thus, the suggestion is to diversify internationally in more developed stock markets. However, due to the present debt crisis happening in Euro zone, investment in the Europe countries should be limited.

Investors who make their investment decision based mostly on correlation analysis are recommended to reconstruct their portfolio more often because correlation is not fixed by holding a constant portfolio. In addition, such reconstruction should make use of the GARCH model given its accuracy in forecasting short term value ahead. Combining the correlation based tactic for picking stocks and analysis of future volatility using GARCH model, it facilitates the construction of high return active trading portfolio in Malaysian stock market.

This research proved that cointegration based portfolio outperforms correlation based portfolio under the buy-and hold strategy. The result is by no means recommending that Markowitz (1952) portfolio theory based on correlation analysis should be abandoned. First, as mentioned by Alexander (1999), correlation measure is focus on short-term analysis. Hence, correlation based portfolio is not suitable for buy-and-hold strategy. This is also consistent with the results generated from GARCH model in this research. However, correlation based analysis is suitable for the investors aim to restructure their portfolio more often because correlation based portfolio could be very profitable in the short-run. Second, the comparison is based on risk reduction (the diversification level), however, in term of expected returns, cointegration based portfolio does not necessary outperform the correlation based portfolio. This result is suggesting that investor who aims to hold the investment for a long period should be more focus on cointegration analysis if risk reduction is of main concern. In objective 3, two portfolios are constructed based merely on the correlation and cointegration analysis respectively just for the sake of comparison. The implementation of correlation and cointegration analysis is not mutually exclusive. In practice, investors are recommended to consider both analyses when constructing their portfolio. For buy-and-hold investment, they should focus more on cointegration strategy while for actively managed investment, they should focus more on correlation strategy.

As a final recommendation for the investors, diversification based on sector analysis should be concerned. Besides that, investors are recommended to focus more on consumer sector stocks in economic downturn due to their crisis resistance nature.

Some recommendations are also made for future researchers with the purpose to provide future directions in order to generate a more comprehensive research. Due to the data available, the range of stock price series in this research is limited. A further hard work in completeness data finding should be concerned. Ideally, in analyzing the performance of portfolios in long run and crisis period, this research should use 20 years period to represent long run period and both the Asian crisis and Subprime crisis period to represent the crisis period. Besides that, in assessing the return of the portfolio, both the daily price changes and dividend returns should be considered. Transaction costs should also be considered. In additions, for future analysis, it is recommended to further classify the portfolio strategy to specific portfolio strategies like Markowitz portfolio strategy, Naïve portfolio strategy, Behavioural portfolio strategy and so on. Future researchers can also construct portfolios with vary weighted in order to produce a more comprehensive view on the diversification effects.

In the future, this research also sees the need to make more comparison between correlation based and cointegration based portfolio rather than risk diversification level alone (expected returns, volatility of returns, and Sharpe ratios). Besides that, such comparison should be made under both buy-and-hold and active trading strategy. Finally, further analysis on stock sectors in related to diversification effects should also be conducted in future research.

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