ASSET PRICING AND VOLATILITY MODELING: THE CASE OF INDONESIA STOCK MARKET

BY

ALDRIN HERWANY

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International Islamic University Malaysia

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ABSTRACT

In determining the rate of return on stocks, many models have been introduced to obtain optimal returns and able to minimize risk. Equilibrium model such as the CAPM, APT and multifactor models have been used in calculating the level of risk and returns through portfolio formation. Since the development initiated by Markowitz who invented portfolio theory, the empirical results of many researchers have produced different points of view relating to stock return and risk relationship. This study aims to look at what factors can be used as a basis to determine returns and at the same time can minimize the risk. As in previous research studies using the CAPM, APT and multifactor models, this study focused on determining the combination of the most significant variables that determine portfolio stock returns in Indonesia. In addition to using the standard in obtaining beta estimates, this study also uses an estimate of volatility models. In obtaining the best model, the first variable that were selected passed through several test models of equilibrium, so that the best model only includes several valid variables. The research was divided into three different economic conditions; full period and two sub periods indicating financial crisis (1998's) and the global crisis (2008's). The results showed that the CAPM is not valid and that market capitalization variable more able to explain changes in the portfolio yield. The model of the APT shows that macroeconomic and market risk premium are significant in explaining changes in portfolio returns, except for the production index. Several fundamental factors of the multifactor models are also found to be significant variables including rating, and that liquidity factor is still an investment benchmark in Indonesia. It is proven that the volume and frequency of trades consistently significant in all test models. Apart from that, the variables showed significant ratings that investors in Indonesia are still passive, traditional and avoid risk. The simulation results of this study indicate that beta is estimated using a standard similar to that estimated using ARCH beta (volatility modeling), and that both methods showed the same conclusion. As such, it can be said to be consistent in terms of portfolio formation. Also, the magnitude and direction of the regression coefficients were tested using several models. In addition, when the establishment of a portfolio simulation was made, it was found that there is an effect of market capitalization. Small-cap portfolios have higher returns than large-cap, and Value at Risk (VaR) value is similar relatively between the two methods of portfolio formation.

خلاصة البحث

قدم العديد من النماذج للحصول على عائدات أفضل قادرة على تقليل الخطر في تحديد معدل العائد على الأسهم. وقد استخدم نموذج التوازن مثل نماذج: CAPM، APT و النماذج المتعددة العوامل في حساب مستوى المخاطرة والعوائد من خلال تشكيل محفظة مالية. منذ التطوير الذي بدأه ماركويتز الذي اخترع نظرية المحفظة المالية، أظهرت النتائج التجريبية للعديد من من الباحثين وجهات نظر مختلفة تتعلق بعلاقة عائدات الأسهم والمخاطر.وتهدف هذه الدراسة إلى ابراز العوامل التي يمكن استخدامها كأساس لتحديد العوائد،مع امكانية تقليل الخطر في الوقت نفسه.و كما هو الحال في الدراسات البحثية السابقة المستخدمة لنماذج CAPM، APT والمتعددة العوامل، فإن هذه الدراسة ركزت على تحديد مجموعة أهم المتغيرات التي تنطوي عليها محفظة عائدات الأسهم المالية في إندونيسيا. بالإضافة إلى استخدام معيار للحصول على تقديرات بيتا، تستخدم هذه الدراسة أيضا تقدير لنماذج التقلب. و للحصول على أفضل نموذج، فالمتغير الأول الذي تم اختياره مرعلى عدة اختبارات لنماذج التوازن، بحيث يشمل أفضل نموذج متغيرات صالحة عدة. وقد قسم البحث إلى ثلاثة شروط اقتصادية مختلفة؛ فترة كاملة و فترتين أدنى تشيران إلى الأزمة المالية (1998) والأزمة العالمية (2008). وأظهرت النتائج أن CAPM غير صالح وأن متغير القيمة السوقية أكثر قدرة على شرح التغيرات في العائد على المحفظة المالية. نموذج للAPT يدل على ان الاقتصاد الكلي وبدل مخاطر السوق لديها دلالة معتبرة في تفسير التغيرات في عوائد المحفظة المالية، باستثناء مؤشر الإنتاج. وظهرأيضا أن العديد من العوامل الأساسية للنماذج المتعددة العوامل متغيرات هامة بما في ذلك التصنيف، وأن عامل السيولة لا يزال معيارا للاستثمار في إندونيسيا.و ثبت أن حجم وتواتر عدد الصفقات معتبر باستمرار في جميع نماذج الاختبار. بغض النظر عن ذلك، أظهرت تقييمات المتغيرات الهامة أن المستثمرين في إندونيسيا لا يزالون سلبيين،و تقليديين ويتجنبون المخاطر. نتائج المحاكاة لهذه الدراسة تشير إلى أن بيتا يقدر باستخدام معيار مماثل لذلك المقدر باستخدام ARCH بيتا (نمذجة التقلب)، و أدت كلتا الطريقتين إلى نفس النتيجة. على هذا النحو، يمكن القول أنها متسقة من حيث تشكيل المحفظة المالية. أيضا، تم اختبار حجم واتجاه معاملات الانحدار باستخدام نماذج عدة. وبالإضافة إلى ذلك، عندما تم إنشاء محاكاة المحفظة ، وجد أن هناك تأثير القيمة السوقية. فالرسملة الصغيرة للمحافظ على العوائد أعلى من الكبيرة ، والقيمة المعرضة للخطر (VaR) قيمة مشابه نسبيا بين الطريقتين في تشكيل المحفظة المالية.

APPROVAL PAGE

The thesis of Aldrin Herwany has been approved by the following:

…..……..……
Mohd. Azmi Omar
Supervisor

……..……
Ahamed Kameel B. Mydin Meera
Supervisor

……..…….
Razali Bin Haron
Internal Examiner

..…….
Fauzias Mat Nor
External Examiner

..…….
Abdul Wahab Bin Abdul Rahman
Chairman

DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

Aldrin Herwany

Signature ……...…… Date ……..……

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Affirmed by Aldrin Herwany

…….. ……
Signature Date

To . Tie, Zahra, Vahra, and my Big Family

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

In their transactions, investors tend to seek for optimum return. Optimum return of an investment may and may not be achievable, as there are a lot of uncertainty factors influencing the viability. The uncertainty factors may come from changes in both the fundamental (internal) condition of an investment, and from the macroeconomic indicator changes (external). As such, investors therefore, adjust their investment goal by choosing an acceptable level of trade-off between risk and return of their investments.

Meanwhile, dynamic changes in the international capital markets have induced many institutions and practitioners to keep developing their facilities and supporting infrastructures to ensure sustainable transactions. On the other side, academicians have been exploring capital markets to develop new theory related to capital markets' products. This study focuses on the portfolio formation strategy under the highly volatile fundamental and economic variables that affect the stock returns in the Indonesian stock market.

Indonesian Stock Exchange (or so called ISX) is one of the most prospective markets in Asia. However, ISX is still categorized as emerging market, as indicated by low liquidity level, poor information dissemination, and organizational and operational ambiguity. ISX is also categorized as microstructure market for its relatively low trading volume. On the other side, ISX index (known as IHSG) is an important factor that gauges the degree of investors' confidence in Indonesian

economic circumstances. Nevertheless, significant capitalization also bears high risk, such as from sharp drop in stock prices leading to the fall of IHSG. Some non-economic variables in fact provide significant impact on the Index movement, e.g., release of macroeconomic policy (regulation), political events, credit rating, etc. In this regards, this research tries to explore the fundamental and macroeconomic risk factors affecting the stock returns.

Fluctuation of the variables results in high volatility of IHSG, which in turn prevent the investors from appropriately estimating stock price. Thus, it is necessary to develop strategies for minimizing loss by identifying dominant factors influencing stock prices. In selecting factors that determine the risk and return tradeoff, existing equilibrium models offer the concept of linearity. If indeed there is truth in these models, then the whole concept of risk factors should have been represented by a single risk factor. However, the empirical results of testing equilibrium models do not show the same results. The concept of non-linearity appears an alternative to investing, because risk can be derived from several factors which together influence the changes in stock returns. Therefore, there is need to re-examine the linearity of risk and return relationship.

Asset Pricing Model

The academicians and practitioners have done such variable identification process since 1960s. Sharpe (1964) developed an asset-pricing model, namely Capital Asset pricing Model (CAPM). This model assesses the relationship between risk and return. Sharpe (1964), Lintner (1965) and Mossin (1966) have further extended studies on Capital Asset pricing Model (CAPM). This theory defines the only risk (beta) as sensitivity of an individual asset movement to the movement of market index. However, this theory is somewhat not applicable, as it incorporates too many

assumptions. For instance, the proposed equilibrium can only be achieved if the efficient portfolio used is the efficient combination of all assets worldwide. This standard is not applicable as calculation of returns of all assets worldwide is almost impossible. Moreover, investors have different utility function, and consequently, the investors' return distribution probability is not the same. In light of these unrealistic assumptions, Ross (1976) introduced Arbitrage Pricing Theory (APT), which tests many variables to calculate stock return.

The APT is developed from a concept on sensitivity degree of variables to asset's return movement. As it proposes fewer assumptions than those in CAPM, it is more acceptable among academicians in finance. This theory is further supported by other academicians, such N. F. Chen, Roll, and Ross (1986), who conducted empirical studies using independent variables (macroeconomic indicators). Unfortunately, these two approaches cannot appropriately answer phenomenon emerging in the stock market.

CAPM is relatively not applicable in a very dynamic economy as beta is not stable. Meanwhile, APT cannot sufficiently define which variables that can consistently be included in the stock price estimation. The two asset pricing models still show some significant weaknesses, especially in dealing with changing economy and different economic characteristics across countries. The difference in economic characteristics may explain variety in the associated research results. For instance, a study may find positive relationship between risk and return in an economy, while similar study done in other country may prove insignificant relationship between the two variables.

In addition, it should also be noted that the volatility of the economic conditions among countries vary in their intensity. Rapid changes of the economic

conditions that influence economic variables and the volatility of the fundamental factors of the stock is high. Therefore, it is necessary that equilibrium models are capture relationships involving risk and return volatility factor. The use of beta cannot fully capture the high volatility (highly fluctuating), in addition to the value of beta is not stable in different periods of time. To explain the high volatility of economic variables movement, Engle and Kroner (1995) introduced volatility modeling, which focuses more on the relationship between volatility of an economic variable and return. This model is able to allocate asset into a low volatility portfolio, which can minimize risk from univariate model to multivariate model.

Meanwhile, in line with the improvement in the associated studies and the advancement in econometric tools, researchers in finance should pay more careful attention on financial time series data. The distribution of financial time series has heavier tails than the normal distribution, highly correlated values for the squared returns, and changes in the returns tend to cluster. It is argued that in this study volatility models are required to overcome such problems. The models will be able to solve different time-varying volatilities resulting from the associated stock price fluctuation. The models include Stochastic Volatility (Variance) model (Taylor, 1986), and GARCH model (Bollerslev, 1986; Engle, 1982); (Nelson, 1991); (Glosten, Jagannathan, & Runkle, 1993). These models are defined as Univariate, and are then developed to be Multivariate Volatility Models, such as BEKK (Engle & Kroner, 1995), which explains direct correlation among returns, and dynamic conditional correlation (DCC), which overcomes asymmetric effects in variances and covariance. In this study, Multivariate models of volatility are used as an alternative to estimate beta and to capture volatility that can not be obtained by standard beta estimation. In this research the whole variable of asset pricing models remain in use, the differences

from previous research is in the process of trying to capture the volatility through a portfolio beta estimation using multivariate ARCH models. In addition, in the process a cross-sectional test is used to see the level of control variable consistency.

This research is different from previous studies in Indonesia. First, the results obtained in this study on the relationship between risk and returns are more comprehensive. This is because unlike in the previous studies that focused only on determinants of stock returns, this present study tests of three different asset pricing models simultaneously. These are the CAPM, APT, and Multifactor model. Second, in this study especially in the multifactor model, combinations of unanticipated factors were used to examine determinants of excess return on portfolio. These are obtained from macroeconomic variables, stock market fundamentals, and liquidity factors. Third, unlike some previous studies, this study compared portfolios formed by two different beta estimates. These are standardized beta and volatility beta. It is envisaged that this should provide additional insight into the risk-return relationship of stocks traded in the Indonesian stock market. Lastly, in addition to the justification above, this study also used an entire period that covers the pre-crisis, during crisis, and post-crisis period. This is unlike previous studies that focused only one of these three different time periods. A further comparison was also made between the moderating effect on the global financial crisis and Asian financial crisis.

Based on the above mentioned advancement in financial management theories, this study tries to combine the two models, that is, asset pricing and volatility models. This is to find the most suitable strategies for portfolio formulation in Indonesian stock market. Unlike previous studies, this study employs multi-stage selection process to find economic variables and fundamental factors that are dominant and consistent in significance. In the first stage, validity of CAPM and APT

is tested to get economic variables that are really proven to influence return, especially in the case of Indonesian stock market. Any non-influencing variables are discarded. In the next stage, the selected variables are included in an assessment using Multi Factor Model. In this process, several non-economic variables are also included. At the final stage, a portfolio is formed based on the results of Multi Factor Model test.

This study has limitations. The number of samples used only just began in 1996. This is due a lot of data is not available (missing variable) in Indonesia Stock Exchange. Other limitations, this study does not include the variable of bond. Especially, the bonds issued by the government, it is caused by the data, which is only available since 2006's. Although many other variables in the claims as determinants of stock returns, the variable factors such as politics, natural disasters, terrorism, and the announcement of government policy as well as other variables. However, these variables are not within the scope of this study. This study was limited to the exploration of fundamental and macroeconomic factors.

1.2 PROBLEM DEFINITION

Based on the above description of research background, this study attempts to address the following problems:

1. Are Asset Pricing models, that is, CAPM and APT, in the context of the trade–off between risk and return valid in Indonesia?
2. Which variables are able to explain stock returns in Indonesia?; and
3. What is the best model for estimating the relationship between risk and return, and what variables consistenly and significantly explain the changes in the excess return of a portfolio?

1.3 RESEARCH AIM AND OBJECTIVE

This research is aimed at investigating the asset pricing and volatility modeling issues on Indonesian Stock Exchange's assets. This is with the intent to reveal factors influencing trade-off between risk and return, and to find the most suitable financial model estimating the relationship between risk and return.

The objectives of this research are:

1. To test the efficacy of CAPM and APT.
2. To identify the factors influencing the trade-off between risk and return and test the identified multifactor model.
3. To construct a simulated model and test the relevancy of the model in the context of Indonesia Stock Market..

1.4 RESEARCH SIGNIFICANCE

In general, the study is expected to contribute to the development of capital market in emerging market, especially in Indonesia. In particular, the research is expected to result in concepts that can improve methods of asset pricing and volatility modeling in Indonesian capital market. This research is expected to provide benefits through both theoretical and practical contributions.

1.5 THEORETICAL CONTRIBUTIONS

In terms of the research's theoretical contributions, it is expected that:

1. The research results may help the development of theory and application of asset pricing and volatility modeling, especially those related to capital market investment;

2. The research results may provide the methodology and the process of finding the best model to explain the relationship between risk and return through asset pricing and volatility modeling theory development.

1.6 PRACTICAL CONTRIBUTIONS

The research is expected to result in inputs that can be of benefit to:

1. The government/regulator. It can use the result to predict future aggregate risk, as well as to anticipate potential shock in the capital market;
2. Securities companies. They can use and adjust the resulting financial model to assess the Indonesian capital market and provide the associated recommendations for their clients;
3. Investors. They can use the result to examine and estimate risk and return of their investment portfolio scenarios.

1.7 ORGANISATION OF DISSERTATION

The remainders of this dissertation as follow. Chapter 2 is the overview of the theory of asset pricing and volatility modeling. This section consists of the study of literature and the empirical results in Indonesia and international. Furthermore, presents hypotheses to be tested in time series regression and cross sectional regression. Chapter 3 describes the overall research methodology. This section consists of data collection techniques, sample selection, as well as all stages of the process in a test of some models of equilibrium. In this section, describes the research design, starting from the stage of forming portfolio up to test the model. Overall, the research described in the research framework model. Chapter 4 presents the results of calculations the entire the study, starting from the results of the sample selection,

calculation of the estimated beta with different methods using the rolling regression, estimated using ARIMA models. Furthermore, hypothesis testing of regression models for time series. Next, is the test of the hypothesis on the cross sectional regression, which includes model CAPM, APT and multifactor model. The whole of the significant variables from the previous model test will be tested again, using multifactor to see a consistently significant variable in explaining portfolio returns. Portfolio simulation results will be calculated by the method of Value at Risk (VaR). This aims to see which method of forming a portfolio that can generate the smallest volatility. The last section is a summary of the results of the entire model. Chapter 5 is a summary of entire of the conclusions, moreover, presented the limitations of the study, implications and recommendations for future research.

CHAPTER 2

LITERATURE REVIEW, THEORETICAL FRAMEWORK, AND HYPOTHESES

2.1 LITERATURE REVIEW

Economic conditions change very quickly and this is unavoidable. The impact of such economic changes will also heighten changes in the level of uncertainty. Many studies have been done to anticipate changes in risk in investing, yet there are limited studies that discuss the overall risk and return where the selection of variables is based on the validity of the financial model. Therefore, this study attempts to fill these gaps, in particular to explain the relationship between risks and return in a comprehensive and simultaneous match by using the concept of asset pricing and volatility modeling

2.1.1 Framework of Asset Pricing

In investing, investors face uncertainty, uncertainty is a risk that is not easy to anticipate. Therefore, investors make predictions in order to minimize the risk. However, the prediction is not easy. While risk cannot be predicted exactly, it nonetheless can be minimized the identification of the components that constitute it. In the science of finance, risk is always associated with the required return of investors if they invest. The concept of risk and return was first introduced by Markowitz (1959). This concept can be analyzed using the approach of mean-variance analysis. Although this concept is widely used in both academic and practitioner research in making investment, but the concept is still very dependent on the assumption of normality of the data which is an obstacle even, the practitioners. If we