THE EFFECTIVENESS OF THE CAPITAL ASSET PRICING MODEL (CAPM) AND FAMA FRENCH 3-FACTOR MODEL - EVIDENCE FROM BURSA MALAYSIA

BY

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRAK

Pasaran saham memainkan peranan penting sebagai saluran yang terkawal diantara perniagaan yang ingin menjana modal dengan pelabur yang ingin berkongsi dalam keuntungan dan risiko perniagaan. Penilaian saran saham global dan Malaysia yang tinggi menjadi galakan untuk para pelabur mencari kaedah yang tepat untuk menilai harga saham supaya dapat memaksimumkan pulangan mereka. Pelbagai teori dan model pernah dicadangkan untuk membantu pelabur menilai harga saham. Teori-teori dan model-model ini mencapai tahap kejayaan yang berbeza semasa diuji di pelbagai negara. Tujuan kajian ini ialah untuk menentukan sama ada model CAPM yang intuitif dan mudah dan model Fama French berfaktor-3 dapat menilai harga saham Bursa Malaysia secara tepat berasaskan data tahunan 2008-2014. Hasil kajian ini menyokong kesahihan model CAPM dan menunjukkan bahawa pulangan berkorelasi positif dengan risiko. Kajian ini juga mendapati bahawa model Fama French berfaktor-3 boleh digunakan dengan berkesan untuk meramal harga saham. Pulangan didapati berkorelasi positif dengan factor prestasi pasaran dan nisbah ‘book-to-price’ firma dan berkorelasi negatif dengan factor saiz firma. Dari segi ketepatan, model CAPM memberikan ketepatan yang kurang baik manakala model Fama French berfaktor-3 memberi ketepatan yang lebih baik. Kajian ini juga menunujukkan bahawa terdapat faktor-faktor yang tidak kenal pasti yang boleh meningkatkan lagi ketepatan model Fama French berfaktor-3.

ABSTRACT

The stock market plays an important role as a well regulated bridge between businesses seeking to raise capital from investors and for investors to share in the gains and risks of the businesses. With the wide swings in valuation of the global and Malaysian stock markets, it has been the holy grail of investors to be able to correctly predict stock prices to maximize their returns. Through time, different theories and models have been proposed to help investors predict stock prices. These models have been tested with varying degrees of success in different parts of the world. This study aims to determine if the intuitively simple CAPM and Fama French 3-Factor models can accurately value stock prices in Bursa Malaysia. Using data from 2008 to 2014, this study demonstrated the validity of the CAPM, showing that returns were positively correlated to risk. The study also found that the Fama French 3-Factor model can be used effectively to value stock prices. It showed that returns were positively correlated to the market premium and book-to-price ratio and negatively correlated to the size of the firm. In terms of model accuracy, it was found that the CAPM gave relatively poor accuracy while the Fama French 3-Factor model was significantly better. The study also identified that there are other factors that can further increase the accuracy of the Fama French 3-Factor model.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Stock markets play an important part in a country's economy, influencing the growth of its commercial and industrial sectors. The health of the stock market is frequently considered the primary indicator of a country's economic strength and development. A rising stock market signals a growing economy, with increasing business investments, affecting household wealth and consumption and vice versa.

Stock markets play two major roles. The first being the place where companies can issue shares to raise capital to finance their business plans. Secondly, it serves as a platform where retail and institutional investors can easily buy and sell stocks, keeping their assets liquid. In developed countries, stock markets have enabled individual investors and households to channel their funds directly into the financial market without going through the traditional bank deposit and lending path. In summary, stock markets form a well regulated bridge between businesses seeking to raise capital and investors seeking to share the gains and associated risks of the businesses.

Stock prices are affected by many factors. At the highest level, stock prices are affected by macro-economic factors like industrial production, inflation rates, interest rates (Chen, Roll and Ross, 1986). These factors systemically affect a large group of stocks at the same time.

At the next level, the fundamental performance of a firm, like its earnings-per-share, price-to-earnings ratio, book-to-price ratio, dividend yield and others determines its stock price. The third factor is market sentiment which refers to the psychology of investors, both individually and collectively. This drives momentum and contrarian trading behaviors. Market sentiment, while subjective has significant impact on the stock market. Cornell (2013) reported that only a minority of the 50 largest price movements in the US stock market in the last 25 years were explained by economic or stock performance factors.

The ability to determine a stock's value helps an investor decide when to buy or sell his or her investments. Investors who buy stocks at prices below their value can earn profits at a later date when the stock's valuation is realized. Similarly, investors who buy over-priced stock may incur losses as the market prices the stock downwards.

These gains or losses can be substantial. As shown in Figure 1, the S&P 500 which represents some of the largest companies in the US stock market, advanced more than 100% between 2009 and 2014 after dipping 50% in 2008. The drop in 2008 represented a loss of $7.9T in market valuation. From a Malaysian perspective, the FTSE-KLCI index has almost doubled since 2009, having dropped 50% in 2008 as shown in Figure 2. Market valuation is estimated at RM1.7T in 2014. With so much at stake, it is no surprise that many researchers have focused on developing models to predict stock prices.

But can stock prices be forecasted? In 1970, Eugene Fama formulated the Efficient Market Hypothesis (EMH) that states that in a perfectly efficient market, stock prices will reflect all known information and investors will not be able to make extraordinary profits by buying undervalued or selling overvalued stocks. The only factor that will affect a stock's price in the long run is the risk of holding the stock. This makes any form of stock price prediction irrelevant.

Critics argue that the EMH does not imply that stock prices cannot deviate from their true value. Indeed they do, but the deviations are random in nature. This means that extraordinary profits and losses are possible in the short run, but not in the long run. It is also argued that not all markets are efficient to all investors at the same time as investors will evaluate information they receive in different ways. Also, to maintain an efficient market, active trading needs to happen and ironically, trading is driven by investors seeking market inefficiencies. As such, the concept of a perfectly efficient market does not exist for any period of time. Markets do operate at different degrees of efficiency but can never be perfectly efficient. This opens the doors to developing methods and models to predict stock prices.

(Source http://finance.yahoo.com/echarts?s=%5Egspc+interactive Viewed: April 17, 2015)

Figure 1: Standard & Poor's 500 Stock Index

(Source: http://finance.yahoo.com/echarts?s=%5EKLSE+Interactive# Viewed: Apr 17, 2015)

Figure 2: FTSE-KLSE Index Performance

1.2 Introduction to Bursa Malaysia

The Malayan Stock Exchange was established in 1960 for public trading of shares. The board had trading rooms in Singapore and Kuala Lumpur, linked by direct telephone lines. In 1964, the Stock Exchange of Malaysia was renamed the Stock Exchange of Malaysia and Singapore. With the secession of Singapore from Malaysia, the Stock Exchange of Malaysia and Singapore was split into the Kuala Lumpur Stock Exchange and the Stock Exchange of Singapore. In 2004, the Kuala Lumpur Stock Exchange took on a new name: Bursa Malaysia

Companies on Bursa Malaysia are listed either in the Main or ACE Markets. There are currently 816 companies split into 12 sectors that are listed on the Main Market with another 105 listed on the ACE Market. Based on information on Bursa Malaysia's webpage (www.bursamalaysia.com), the total market valuation of the Main and ACE Markets is ~RM1.7 trillion and ~RM12 billion respectively in January 2015. Monthly trading volumes range between 26-58 billion shares a month valued between RM36-49 billion on the Main Market and a further 5-15 billion shares a month valued between RM1.2-2.9 billion on the ACE market. Table 1 shows the relative size of Bursa Malaysia in comparison to other stock exchanges in the region and world.

The trading statistics for Bursa Malaysia in January 2015, as reported on their website indicate that local and foreign institutions contribute 41.8% and 27.7% of the trading value respectively. Foreign retail and local nominees and retail trading form the remaining 18.1% and 12.4% of the trading value respectively. From a volume perspective, local and foreign

institutions take up 10.8% and 19.9% respectively. Foreign retail and local nominee and retail traders take up the remaining 47.7% and 21.6% of the trading volume respectively.

Table 1: Comparison of Global and Regional Stock Exchanges

Exchange	Mkt Valuation (Billion USD)	Monthly Turnover (Billion USD)	Number of stocks
New York Stock Exchange	19000	1500	2466
Shanghai Stock Exchange	3871	1258	995
Hong Kong Exchange	3226	155	1752
BSE India	1553	12	5542
Singapore Exchange	756	19	775
Bursa Malaysia	458	12	905
The Stock Exchange of Thailand	426	30	613
Indonesia Stock Exchange	422	9	506
Philippines Stock Exchange	262	4	263

(Source: http://www.world-exchanges.org/statistics/monthly-reports Viewed: March 24, 2015)

1.3 Historical Development of Asset Pricing Models

There is a long history of theoretical and empirical studies on stock pricing theories. Markowitz (1952) introduced the modern portfolio theory which emphasized how diversified portfolios reduce risk versus investing in a single stock. Prior to this work, investors preferred focusing on picking single high yield stocks with little consideration for diversification. Tobin (1958) furthered Markowitz's work by adding a risk-free asset into the analysis. Sharpe (1964), Lintner (1965) and Mossin (1966) proposed the Capital Asset Pricing Model (CAPM) which proposed a method to measure risk (beta) and linked this risk to the expected returns of a stock.

While CAPM was intuitively simple and logical, it was difficult to proof empirically. This could be caused by the many simplifying assumptions used and the difficultly in implementing tests for the model. To improve the accuracy of the model, Blume (1973) and Jensen, Black and Scholes (1972) used portfolios instead of individual stocks to get better accuracy in CAPM. Ross (1976) built on the CAPM and proposed the Arbitrage Pricing Theory (APT) that suggested that the expected returns of an asset is a linear function of many economic factors, and not risk (beta) alone. Fama and French (1992) using APT, expanded on CAPM by adding size and value factors into CAPM after it was found that value and small capital stocks regularly out-performed the market. This was known as the Fama French 3-Factor model.

Subsequent research in different markets identified more variables to improve the model's accuracy. Factors like stock momentum, liquidity, trading volume among others were included as possible influencing factors in the model. Studies in developed markets have shown differing results from emerging markets. Suffice to say, there is sufficient variation in market conditions across the world to cause one model to work more effectively than others.

1.4 Problem Background

Stock investors are perpetually looking for opportunities to get higher returns from their stocks at minimum risk. The problem they face is not having an accurate and simple model to help them maximize returns in a particular market environment. While the empirical validations for the CAPM and Fama French 3-Factor models have been performed in many developed and developing countries, the results have varied. The initial testing of CAPM in the US market by Jensen, et al. (1972), Blume and Friend (1973) and Fama MacBeth (1973) showed good correlation in the 1960's and 1970's. However, researchers in the later years found other models that were more accurate than the CAPM.

One reason for this change is that since the initial empirical studies on CAPM, there have been significant changes in the New York Stock Exchange (NYSE). Between 1958 and 1967, 517 new stocks were listed and an additional 569 stocks listed between 1968 and 1973. The business nature of the listed companies shifted from utilities and transportation in the 1950's to industrial and consumer products and services in the 1960s and 1970s and technology products in the 1980s and beyond. The NYSE daily trading volume has also grown from 4 million shares in 1961 to 100 million in 1982. The number of Americans owning stocks increased to 51million in 1990. Technology had also made more information accessible to all investors.

From a Bursa Malaysia perspective, trading volume had more than doubled from 62 billion shares in 2002 to 137 billion in 2008 and in February 2015 alone, 31.6 billion shares were

traded, indicated a further 3-Fold increase since 2008. The number of Central Depository Service (CDS) accounts have increased from 4 to 4.4 million within the same period indicating an increased number of investors.

Other factors affecting Bursa Malaysia include the advent of on-line trading platforms in Malaysia which had attracted a larger number of investors. There are more than a dozen brokerage houses and banks offering on-line stock trading services with brokerage fees that are significantly lower than trading over-the-counter. These online systems allow investors instant access to stock prices and information and enables them to trade in the comfort of their homes, offices or on the move without the need to contact a remisier. Automated fund transfers for purchase and sales make in convenient for part-time traders. Some on-line traders offer credit facilities to qualified investors, further encouraging investment in stocks. In combination, these changes have changed the demographic and number of investors. These changes have led to the problem statements detailed in section 1.5

1.5 Problem Statements

Problem Statement # 1: Despite the varying results reported in different countries on the effectiveness of traditional stock price forecasting models, there have been limited studies to understand their effectiveness in Bursa Malaysia. There are two known studies published recently. Monfared and Wasiuzzaman (2012) reported that the Fama-French 3-Factor model is more accurate than CAPM based on data from Bursa Malaysia. Foong and Goh (2010) showed that debt-to-equity ratio, earnings per share (EPS) and stock liquidity

affected stock prices, adding that multiple local and global risk factors had higher explanatory power on stock prices versus a single risk factor as suggested by the CAPM. As such, there is a need for more studies to understand prices in Malaysia.

Problem Statement # 2: With the changes sweeping Bursa Malaysia as described in Section 1.4, has the effectiveness of traditional stock price forecasting models changed in Malaysia? Known studies published recently used data from 2006-2009. Here again, there is a need to reassess the models using the latest data.

1.6 Research Objectives

The focus of this study is to empirically test using recent stock price data if the CAPM and Fama French 3-Factor models are applicable to stocks in Bursa Malaysia. If proven applicable, Bursa Malaysia investors can use these models to forecast the value of stocks, based on the companies' performance and the level of risk they are willing to bear. Investors can then systematically (versus arbitrarily or based on hear-say) select the appropriate stocks in their portfolio to enable them to maximize returns for a given level of risk.

1.7 Research Questions

The following research questions will be studied:

1) Is the CAPM which states that stock returns are positively related to the level of risks borne by investors, an effective asset pricing model for Bursa Malaysia? Past studies have shown a weak correlation, but have the recent changes detailed above made the market more form-efficient, and the CAPM more effective?

2) Is the Fama French 3-Factor model which predicts asset pricing using more factors than risk alone provide a better prediction of asset prices in Bursa Malaysia? Past studies in various parts of the world had reported that this model is superior to the CAPM. Does this hold true for Bursa Malaysia too?

3) If both the CAPM and Fama French 3-Factor models are proven effective, which of them would provide a better prediction of asset prices for Bursa Malaysia?

1.8 Significance of study

The significance of this study is to establish the relationship between return and risk as described in the CAPM and to establish the relationship between returns and factors like market premiium, size of firm and book-to-price ratio as described by the Fama French 3-Factor model. The study will use data from 2008-2014 to envelope the period when online stock trading started. Armed with these relationships, investors can optimize their portfolios to maximize their returns based on their desired risk profile.

1.9 Organization of Report

Chapter 1 of this report covered the role of the stock market and why it is important to have an accurate model to forecast stock prices. It summarized the historical development of asset pricing models and discussed growing gaps in these models driven by changes in the market environment. It then proposed areas for investigation and defined research objectives and specific research questions to be studied.

Chapter 2 will review the findings of other researchers and how their findings will guide this study. Chapter 3 will explain the hypotheses, methodology and data used to proof or invalidate these models. Chapter 4 will present the results of the study and Chapter 5 will discuss and draw conclusions from the results. It will also discuss the limitations of the study and suggest areas for future research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the work done by researchers in the development of asset pricing models. Starting with the Capital Asset Pricing Model (CAPM), it will track how asset pricing models were enhanced using the Arbitrage Pricing Theory (APT) which led to the development of the Fama French 3-Factor and other models. This chapter will specifically cover details of the CAPM and Fama French 3-Factor models and the outcome of their empirical testing in different countries.

2.2 Development History of Asset Pricing Models

Researchers have long recognized the need to accurately value stocks and have developed numerous methods and models to accomplish this. Williams (1938) proposed in his book entitled “The Theory of Investment Value” that the value of a stock should equal the present value of its future dividend stream. While this method was simple as it was built on the financial model of loans and bonds predominant during that era, it was soon outmoded as start-up companies began issuing stocks that did not pay dividends during the start-up phase of their business. Dividends were paid only when the company was successful and making a profit, and there was no certainty that the company would achieve it. This was supported by Black and Scholes (1974) who pointed out that dividend yields and dividend policies alone were insufficient to determine the value of a stock.

Markowitz (1952) introduced the portfolio theory which recognized the risk and return of an investment. Prior to his work, investors would spend time picking a single asset to maximize their returns. Markowitz (1952) suggested that investors, could for a given level of risk, maximize their return, by investing in a portfolio of assets versus investing in only a single asset. This gave rise to the concept of an efficient portfolio frontier where a portfolio can be optimized to give maximum returns for a set risk level. Markowitz (1952) identified two types of risks: Non-systemic risks and Systemic risks.

Non-systemic risks are risks that affect a specific stock and can be caused by events like a product recall or impairment of specific assets in a company. By investing in a portfolio of different companies, this risk can be reduced as not all companies are expected to be hit with problems at the same time. Systemic risks on the other hand impact all companies. These risks can come in the form of a market recession or a significant event like the US sub-prime mortgage crisis in 2007, where the performance of every company was affected. Systemic risks cannot be reduced through diversification. Tobin (1958) expanded on Markowitz's work by adding a risk-free asset into the analysis, leading to the concept of super-efficient portfolios through leveraging.

Independent effort by Sharpe (1964), Lintner (1965) and Mossin (1966) built on Markowitz's work on Modern Portfolio Theory to develop the Capital Asset Pricing Model (CAPM). In his landmark work in 1964, Sharpe explained how capital asset prices were

governed by the theory of market equilibrium under conditions of risk. He postulated that a rational, well diversified investor operating at any point of the capital market line can only expect a higher rate of return by incurring additional risk. He described how investors sought to be compensated firstly for the price of time, (as if they had invested in a risk-free investment) and secondly for the price of additional risk in holding an asset. The level of risk, beta (β), is measured by the volatility of an asset's price compared to the overall market.

Earlier studies by Jensen, et al. (1972), Blume and Friend (1973) and Fama and MacBeth (1973) showed empirical support for the CAPM. They demonstrated evidence of mean-variance efficiency which implied that investors sought the best returns for a given risk level. These studies also suggested that the risk (beta) for individual stocks was relatively unstable and varied with time. However, the risk level of a diversified portfolio was more stable as the risk of individual stocks self-cancelled among themselves. While these studies confirmed that returns were positively correlated to the risk level of a stock or portfolio, it was noted that the slope of returns to beta was flatter than expected, meaning that low risk stocks provided slightly higher returns than predicted, while high risk stocks provided slightly lower returns than predicted. (Davis, Fama and French, 2000)

Studies in the 1980s showed less support for the CAPM. Other factors like the characteristic of the stock were found to be better predictors than beta alone. Banz (1981) using data from the New York Stock Exchange (NYSE) reported that small firms provided

higher returns than big firms. Basu (1983) reported that stocks with higher Price to Earning (P/E) ratios provided lower returns. Both observations were related as small firms tended to have lower P/E ratios (Campbell, Lo and MacKinlay, 1997). Rosenberg, Reid and Lanstein (1985) reported a positive relationship between the ratio of book to market value and returns from US stocks.

As the CAPM could not be consistently validated, Ross (1976) proposed the Arbitrage Pricing Theory (APT) which states that the expected return of an asset is a linear function of many economic factors, where the sensitivity of each factor is assigned a specific beta coefficient. The APT suggests that returns are related to multiple risk factors versus the only one risk factor (beta) suggested by CAPM (Campbell, et al., 1997). The CAPM and APT models are not contradictory, but differ in that the CAPM proposes a specific market relationship while the APT explains how market conditions affect returns (Karnosky, 1993). Unlike the CAPM, the APT does not specify the factors that affect returns. These factors are expected to change across different economic environments.

Building on APT, Fama and French (1992) used a firm's size and its value factors to determine asset prices. This was based on their study of returns in the US stock markets for the period between 1963 and 1990 where they found that beta alone does not explain the returns. They found that companies with high book to price ratios, (value stock) and stocks with small market capitalization consistently out-performed stocks with lower book

to price ratios and bigger market capitalization. This was called the Fama French 3-Factor model.

Researchers continued to refine the accuracy of the asset pricing model by including other factors. Bhandari (1988) found that the returns from common stock were positively correlated to a company's debt-to-equity ratio for controlled values of beta and firm size. The study done by Chan, Hamao and Lakonishok (1991) in Japan found stock returns to be correlated to a company's book-to-market ratio and cash-flow yield. Amihud and Mendelson (1986) found that factors like liquidity (the ability to trade large quantity of stocks without undue price fluctuations) affected stock returns. This was confirmed by Brennan and Subrahmanyam (1996) who showed that stock returns would be higher for securities that are less liquid. Parmler and Gonzalez (2007) studied the Swedish market and found that 'momentum' also affected stock returns. The 'momentum' effect is described as the tendency to over-price past winning stocks and to underprice past losing stocks. Foong and Goh (2010) showed that debt-to-equity ratio, earnings per share (EPS) and stock liquidity in Malaysia positively affected stock returns. The list of potential factors affecting stock returns continue to grow and goes beyond the scope of this study which will only evaluate the single factor CAPM and 3-Factor Fama French models.

2.3 The CAPM Model

The CAPM model states that the expected return of a given stock is linearly related to the risk an inventor takes holding the stock. Risks are separated into systemic risks and non-