ASSET PRICING IN MALAYSIA:

A COMPARATIVE STUDY OF CONSUMPTION-BASED CAPM AND FAMA-FRENCH FACTOR MODELS

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ABSTRACT

This thesis is aimed to carry out a comparative study between Consumption-oriented CAPM and Fama-French factor models in the stock market of Malaysia. Specifically, factor patterns of expected returns in the Malaysian market are investigated. Eventually, we find the effects observed from the US market do not perfectly repeat with the Malaysian data; for instance, the value effect which even exhibits a totally contradictory result. Gibbons, Ross, and Shanken (1989) test and Fama-Macbeth (1973) two-pass regression are performed to compare the selected models. This study finds that FF factor models perform empirically much better than CCAPM does though all of them are not perfect in explaining Malaysia stock market. FF five-factor model does not show a significant improvement from the FF three-factor model in explaining time series excess returns while working better in cross-sectional tests. For time-series testing, the redundancies of size and profitability factors appearing in the Malaysian stock market suggests an interesting point that the combination of four factors which are market, value and investment factors show a better results than both original FF three-factor and five-factor models do.

Keywords: Emerging market, Asset pricing, Fama-French factor models, Consumption CAPM

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LIST OF ABBREVIATIONS

B/M	Book-to-Market Ratio
BE	Book Value of Equity
CAPM	Capital Asset Pricing Model
CMA	Conservative-minus-Aggressive (Investment Factor)
FF	Fama-French
GRS Test	Gibbons, Ross, Shanken Test
HML	High-minus-Low (Value Factor)
ME	Market Value of Equity
NASDAQ	National Association of Securities Dealers Automated Quotation System
NYSE	The New York Stock Exchange
OLS	Ordinary Least Squares
OP	Operating Profit
P/E	Price/Earnings Ratio
RMW	Robust-minus-Weak (Profitability Factor)
SMB	Small-minus-Big (Size Factor)
UMD	Up-minus-Down (Momentum Factor)

CHAPTER 1. INTRODUCTION

1.1. Background and motivation

Asset pricing is an appealing issue in both academic area and everyday life of people. The method of pricing asset and the properties asset price owns attract attentions of many researches. There are different approaches people think about and conduct the process of asset pricing.

Since the introduction of CAPM in 1960s by Sharpe (1964), Lintner (1965) and Mossin (1966), it has become one of the most important asset pricing models in the world of finance, attracting attention and efforts of researchers across the world to test its validity. However, its limitations are also widely indicated by many studies, its static assumption is far different from the realistic world (Merton, 1971), for example.

Optimizing the static assumption to a dynamic process, Consumption-based CAPM is regarded as a standard of asset pricing theory. Assuming there is no chance of arbitrage, Consumption CAPM is an intertemporal model that chases the optimization of consumptions an individual investor does across periods (Rubinstein, 1976). In this dynamic process, the risk preference of a representative agent varied across time, which might be due to consumption level and changes in wealth (Lucas, 1978 & Breeden, 1979). However, despite its compelling theoretical background, Consumption-based CAPM is always suggested showing a poor performance (Hansen & Singleton, 1982 for example). To overcome this poor performance of Consumption CAPM, some extension models of it are proposed by researchers. In addition, there are also some theories coming out in the areas of behavior finance (Shiller, 1981). These two different approaches are regarded as two possible improvements of Consumption-based CAPM.

Besides the static assumption of CAPM, it is also criticized by poor empirical performance (Rosenberg, Reid & Lanstein, 1985) for example. These studies proposed there are some anomalies in CAPM, which lasted in discussions for a long time. These discussions are summarized to an empirically robust model, Fama-French three-factor model (Fama & French, 1993). Adding the factors of size and value, FF three-factor model is believed to shows better empirical performance than the original CAPM. Despite its great influence, researchers later have continued to find the deficiencies of CAPM and provide revised models with addition of other factors or variables. Some other factors are therefore widely proposed and tested by others. For example, FF five-factor model

that adds profitability and investment factors are believed to make a significant improvement from FF three-factor model (Fama & French, 2015). Besides, factors like momentum are also discussed (Cahart, 1997). These empirical models are popular in not only academic studies, empirical testing and event study area but also industries.

Having a relatively satisfied practical results, however, these empirical models are criticized for lacking theoretical intuition. Different from the Consumption-based CAPM that is based on a comprehensive theoretical intuition, FF factor models are purely proposed by empirical goods and practical preferences. It seems these two kinds of model driving asset pricing issue to two different sides, theoretical or empirical? Though researchers never stop their steps in moving on.

Nonetheless, it is common in the financial research that models are tested individually on specific markets, among which the US or European ones are most popular. It is lack of a complete study that theoretically and practically compares both models that we are interested in as mentioned, says Consumption-based CAPM and FF factor models. Therefore, we are inspired to do such a research to explore how models work in a selected market. With the single market as the baseline, we can easily make direct comparison of how effective each model is.

Even though interested models are test repeatedly by researchers, the developed or major emerging markets are on the spotlight. Thus, the small and average emerging markets receive less or no attention at all. We understand that such small markets are also part of the world financial markets and models that work in major ones might not be effective in explaining the pattens of stock returns in small-sized counterparts. Do these classical models that were born in US and other well-developed markets hold in an emerging market? What is the pattern these different models show compared to each other? Answering these questions, we intend to test these models on small markets and suppose this might help further confirm the appropriateness of results from big markets. That is why we select Bursa Malaysia as the testing market among emerging stock markets. This stock market is originated from 1930 and old enough for us to obtain sufficient data and historical events which serve as input for our research. In addition, compared to other markets such as Vietnam and China, besides it owns a longer history, the Malaysian one is relatively transparent and internationally integrated. Besides, compared to South Korean and Indian counterparts, Bursa Malaysia is relatively inferior in terms of size. In addition, not many research projects that test our concerned models on the Malaysian market have been conducted. Therefore, it perfectly matches our intentions.

Different from a single model testing in a selected market, we are more interested in how both these empirical models and theoretical intuitions perform compared to each other. Therefore, we ended up testing and comparing the Consumption-based CAPM and FF factor models in the stock market of Malaysia. After having the main findings, we will also compare these patterns to these evidence in US market confirmed by sufficient previous studies. This way, we can draw a more comprehensive conclusion in how these models perform in emerging market.

1.2. Research delimitations

In the previous section, we introduced the history and development of modern asset pricing models. After both these theoretical and empirical models being introduced, they are extensively tested in US and other European markets. However, the empirical studies based on emerging markets are not abundant so far. In addition, according to Credit Suisse (2014), the emerging market share of global equities will increase to 39% in 2030, which shows the great potential development these developing markets possess. Therefore, this great gap between the fact emerging markets are advancing in an extremely rapid pace and the dilemma that robust academic studies relating to asset pricing of emerging market are scarce draws our attention. As a result, it is both significant and relevant to perform this empirical analysis and comparisons in an emerging market.

Therefore, we would like to conduct research on whether these empirical and theoretical models hold in emerging markets, what are the patterns they perform in emerging market compared to each other and their implications behind the empirical results. Also, we will compare these empirical findings to the US market that is frequently tested in previous studies.

To be specific, we ended up choosing the stock market of Malaysia as explained in last section. Empirical tests of FF factor models and Consumption-based model will be conducted and the results will be compared to each other.

1.3. Research question

To test the performance of both theoretical and empirical asset pricing models in an emerging market which is the Malaysian market, we will conduct empirical tests on both Consumption-based CAPM and different FF factor models. In addition, comparisons based on the performance among these models will also be applied.

The research question we will explore across this thesis is the efficiency of both empirical models and theoretical intuitions, as well as the practical comparisons among them in the stock market of Malaysia.

To what extent the Consumption-based CAPM and FF factor models can explain the excess return of stocks in the Malaysia market? Which one of them performs better?

In addition, we wonder if these empirical findings in Malaysia are consistent with those from the US market. Therefore, we will also compare the results we will have to those of the US market.

1.4. Hypotheses

Following the research question, we then convert it into some testable and comparable hypotheses. As we will conduct both time series tests and additional two-stage cross-sectional regressions following Fama-Macbeth for all selected models, our hypotheses will mainly focus on the result of these tests.

The first hypothesis we propose is which model owns a stronger power in explaining the expected returns. As previous studies suggest failures of both FF factors and Consumption-based CAPM in description of expected returns, we expect these models will also leave unexplained excess return in our data of Malaysia market, and even larger compared to developed stock market, US for example.

We will therefore study whether there is unexplained excess return left for each of tested models and compare the capability of them, which will be discussed based on the time series regression results of intercepts. Specifically, we will conduct OLS regression and check if the intercept is statistically significant. In addition, a GRS test will be conducted to test if all intercepts are jointly statistically different from zero. From the previous critics of poor performance of Consumption-based CAPM, we expect the it will leave more unexplained excess returns than FF factor models.

H_0: There are more unexplained excess returns left for Consumption-based CAPM than FF factor models.

H_A: There are less unexplained excess returns left for Consumption-based CAPM than FF factor models.

Our second hypothesis about time series regression is whether the coefficients of selected models are statistically significant. For both Consumption-based CAPM and FF factor models, they both suggest there is linear relationship between excess returns and consumption growth or risk factors.

When it comes to empirical tests, we expect to receive statistically significant coefficients for both Consumption CAPM and FF factor models. In addition, we wonder how the pattern of coefficients changes with different double-sorted portfolios, that is, size-BM, size-OP and size-INV portfolios. This indicates how the sensitivity of returns reacts to certain factor varies in different portfolios. For example, in the size-BM sorted portfolios, we can test specifically how returns of an extreme small-size portfolio reacts to the size factor. For FF factor models, from previous research (for example, Fama & French, 2015) we can learn the coefficients show different patterns for different sorted portfolios, we therefore expect this to repeat in our data. For the Consumption-based CAPM, we do not find any study about testing it with different sorted-method portfolios. However, we infer it will be consistent to different portfolio sorting-style as the consumption growth rate will not be considered as a sorting indicator and the returns should therefore not be sensitive to it.

H_0: The coefficients of both CCAPM and FF factor models are statistically significant.

H_A: The coefficients of both CCAPM and FF factor models are not statistically significant.

The third hypothesis is solely about FF factor model that if there is any redundant factor. That is, a certain factor can be explained by other factors and therefore the explanatory power of it is redundant. Fama & French (2015) indicated the value factor cannot improve performance of FF five-factor model from four-factor model with the U.S. data, suggesting the value factor will be a redundant if profitability and investment factors are taken into consideration. Therefore, we propose there might also be one or more factors that cannot help improving model performance.

H_0: There is redundant factor in FF factor models for the Malaysia data.

H_A: There is no redundant factor in FF factor models for the Malaysia data.

Our fourth hypothesis focuses on cross-sectional OLS regression, as we will test whether the risk premia are statistically significant for selected models. When we follow the two-stage regression of Fama-Macbeth, we will study the coefficients of factor loadings. This risk premium helps us test the sensitivity how expected returns react to certain risk factor. That is, when the risk factor changes 1 unit, how much will the excess return vary. We expect there is significant linear relationship between excess return and specified factor loadings for FF factor models, while Consumption-based CAPM will not present any significant linear relationship between returns and consumption beta as its poor performance suggested by previous studies.

H_0: Risk premium is indistinguishable from zero

H_A: Risk premium is distinguishable from zero.

1.5. Thesis structure

We study how different asset pricing models work in the Malaysia stock market and conduct comparisons among models in this thesis. Our thesis will be structured in the way that aligns with an ordinary research paper and can communicate our expectation when we decided to pursue this topic.

In the Chapter 2, we try to provide the comprehensive review of literatures, which are theoretical bases for all models we want to test in this thesis. Past research on all concerned models which are namely CAPM, the Fama-French three-factor model and the Fama-French five-factor model, Consumption-based CAPM are deliberately mentioned and discussed to make sure that our tested models have sufficient theoretical supports.

After reviewing the previous papers and theories for both Consumption-based CAPM and Fama-French factor models, we then introduce the data, variables, portfolios we will use as well as the methods we will perform in Chapter 3. Specifically, we will describe our data set used in analysis and what methods we employ to analyze the models. Specifically, we give the reasons why the Malaysian market is selected and the period of the testing data. In addition, we mention hypotheses that will be tested against. Since portfolios will be organized differently to meet the testing objectives so that we also explain how we construct different portfolios based on factors. Finally, we specify regressions that underlie the empirical studies.

In the Chapter 4, we present the all empirical results and compositions after analyzing the data set and provide discussions on all parts. Since both time-series and cross-sectional regressions are run, we provide the regression outputs of both testing methods in this chapter.

In the Chapter 5, we detail the conclusion we obtain from the regressions. The conclusions will include how effectively each model performs in explaining the expected returns. We also do comparison to see if our results are in line with research results obtained by other researchers across the world.

CHAPTER 2. LITERATURE REVIEW

2.1. The Modern Portfolio Theory

First introduced by Markowitz (1959), the Modern Portfolio Theory encourages the investors to diversify their investment portfolios. Through diversification, investors can reduce risks that affect the portfolio's expected rate of return.

Additionally, Markowitz (1959) proposed a principle in portfolio selection. There is a prevalent sentence to briefly describe this principle, which is "don't put all your eggs in one basket". A portfolio is considered effective when its expected return is maximized given a level of risk. However, achieving this efficiency is not easy because systematic risks and specific risks are visible in all securities. If all risks are not considered carefully and properly, it is impossible for a portfolio to deliver returns. Therefore, before making decisions, investors need to consider following factors

- What are investors' goals?
- What is investors' risk appetite?
- Invest in what investors are knowledgeable of
- Trade at the right time

By re-balancing the holding securities to prevent the effects from market volatility, investors can hold a stable portfolio, even with highly volatile securities.

2.2. The Capital Asset Pricing Model (CAPM)

2.2.1. Overview of CAPM

The Capital Asset Pricing Model (CAPM) is proposed by Sharpe (1964), Lintner (1965), and Black (1972). The CAPM is developed based on the Modern Portfolio Theory by Markowitz (1959). This model describes the relationship between securities' expected return and market risks.

FORMULA

$$E(R_i) = R_f + \beta * E(R_m - R_f)$$

$E(R_i)$: Expected return of stock

β: the sensitivity of the stock expected return to the market risk. This beta can be obtained from the historical data

R_f: Risk-free rate. Government bond rate is often used as the rate due its having no default risk.

R_m: Expected market return over a period

$(R_m - R_f)$: Market risk premium

The CAPM holds that expected return of individual asset or a portfolio of assets will be the combination of risk-free rate and market risk premium. If the expected return is below such an amount, investors will not invest. The Security Market Line represents the results of CAPM.

2.2.2. Assumptions of CAPM

Constructed based on the Modern Portfolio Theory (Markowitz, 1959), CAPM inherits all assumptions from the Modern Portfolio Theory. In addition, Sharpe (1964) and Lintner (1965) also proposed two additional assumptions for CAPM.

- All investors are risk adverse: to compensate for higher level of risks, investors demand higher expected returns. Investors select assets to invest in based on their personal preferences with an aim to minimize risks and maximize returns.

- Market is perfect: there is no transaction costs, taxes, short-selling available in the market. Also, investors can lend and borrow at risk-free rate.

- Investors have the same holding period: CAPM is a single-period model and all investment decisions are made on the period.

- Investors have the homogeneous views about investment options.

- Investment amount can be as small as possible: an individual investor can make big or small investment in a single asset based on his or her preferences. This assumption allows the model to use continuous data instead of discrete data. At the end, this assumption has little to no effect on the ultimate results and conclusions drawn from the model.

- There is no single investor who is powerful enough to exert significant influence on the market. Investors have equal access to all information.

2.2.3. Advantages and disadvantages of CAPM

One of the most outstanding advantages of CAPM is that it is extremely easy to understand and apply in the real contexts. However, because it only considers the market factor in the relationship between risks and returns, there would be deficiencies associated with the model. It is reported by many managers and scholars that CAPM delivers flawed results in many real-world situations.

Impact of company size on stock returns: Banz (1981) found that during the period from 1926 to 1975, stock returns of small firms listed on NYSE on average outperformed those of large firms (firm size = market capitalization = price per share x number of share), holding all other things constant.

Impact of Market value ratio (P/E and M/B) on stock returns: P/E, M/B. Basu (1977) examined over 1400 companies whose stocks were traded in NYSE from December 1956 to August 1977. He came to conclusion that “prices of securities are biased, and the P/E ratio is an indicator of this bias”. The research confirmed that stock returns of companies whose P/E ratios are low are higher than those of companies with high P/E ratios. Even after many other factors such as transaction costs, differential taxes were accounted, this finding persisted. This phenomenon means a violation to the efficient market hypothesis. The Capital Asset Pricing Model (CAPM) proposed by Sharpe, Lintnet, and Treynor failed to explain this phenomenon.

Meanwhile, Rosenberg, Reid, and Lanstein (1985) studied two separate strategies with an aim to investigate any abnormal performances. Under such paper, 1400 largest companies whose stocks were traded in three different exchanges which are NYSE, ASE, and NASDAQ between 1980 to 1984 were used in the empirical investigation. Ultimately, the research concludes that big firms whose Book-to-Market ratios are low provide stock returns lower than what high book-to-market ratio companies can offer.

Prior to Rosenberg et al. (1985), Stattman (1980) also notices a positive relationship between book-to-market value ratio and stock returns after empirically testing stocks of companies listen on the NYSE.

January effect was first documented by Rozeff and Kinney (1976). The research results show that the average returns of stocks on the NYSE are higher than those of other months. The phenomenon also exists in the Australian stock market. Keim (1983) provides further review on January effect by testing data in the period between 1963 and 1979. The research supports that finding of Rozeff and Kinney (1976) that average returns in January are higher than returns in other eleven months. This phenomenon is particularly outstanding among smaller firms. Reinganum (1983) provides another view on January effect. The paper finds that "small firms experience large returns in January and exceptionally large returns during the first few trading days of January" (ibid.).

2.2.4. Empirical studies of CAPM

Modigliani, Pogue, and Solnik (1973) investigate the validity of CAPM over eight European stock markets. The research results confirm "the positive relationship between realized return and risk" in all markets except Germany.

Nikolaos (2009) tests the validity of CAPM on the British stock market, using the stock prices of 39 companies listed on the London Stock Exchange. The study indicates that there is a linear relationship between the regression betas and cross-section of average return.

Yonezawa (1992) tests data from Tokyo Stock Exchange in the period from January 1952 to December 1986 to see if the CAPM holds in the Japanese market. The author documents the invalidity of CAPM in the Japanese Market which attributes the lack of diversification as the reason.

Rui, Rasiah, Yen, Ramasamy, Pillay (2018) conduct investigation into the validity of CAPM on the Malaysian market, using data of 24 companies in the period from 2007 to 2015. The group of authors ultimately document the inapplicability of the CAPM in the Malaysian context. Some reasons are documented to justify this failure of CAPM, including time frame, sample size and others.

Pham and Bui (2015) attempt a test of CAPM on the Vietnamese market to see if this model can explain the returns of stocks listed on Ho Chi Minh Stock Exchange. By using the stock prices data

from January 2007 until June 2015, the research result show that CAPM is not efficient in explaining the stock returns of the tested data set. Between the two approaches used by the research, the conditional approach produces results consistent with what CAPM proposes.

2.2.5. Several extensions of CAPM

Since the introduction of CAPM, many extensions are proposed by various researchers across the world with a view to improving the effectiveness of CAPM in explaining the stock returns on specific conditions.

Solnik (1974) notices in increasingly concentrated world capital markets illustrated by cross-border investments. Thus, the traditional CAPM which considers only investments made within a single country can no longer be effective in describing the stock returns in the international markets. The research documents that not only global but also local factors have impact on returns of securities. Agmon (1972) and Lessard (1974) also come to the similar conclusion.

Merton (1973) proposes another version of CAPM which is Intertemporal CAPM. This version of CAPM is built on "the portfolio selection behavior by an arbitrary number of investors who aot so as to maximize the expected utility of lifetime consumption and who can trade continuously in time". The research results demonstrate that "expected returns on risky assets may differ from the riskless rate even when they have no systematic or market risk".

Cochrane (1991) examines the production-based CAPM which is constructed in a similar way as the Consumption-based CAPM, however, with the consideration of the production factor. In this model, stock returns are linked to investments returns "which are inferred from investment data via a production function". It is proved that the model is particularly effective in predicting stock returns when business-cycle and economics activities are considered.

Acharya & Pedersen (2005) describes the liquidy-adjusted CAPM. In this model, the expected liquidity of stocks is believed to impact the expected stock returns. The model also documents that "a persistent negative shock to a security's liquidity results in low contemporaneous returns and high predicted future returns"

Jagannathan and Wang (1996) give that static CAPM which requires beta to be constant over time and value-weighted portfolio proxies returns on total wealth is not effective in explaining the cross-section of stock returns. Therefore, "CAPM holds in a conditional sense" which means "betas and market risk premium vary over time". Also, returns on human capital when "measuring returns on aggregate wealth" is considered. It is proved that Conditional CAPM performs well empirically to describe the cross-section of stock returns.

2.3. Fama-French 3 factor model

2.3.1. Theoretical background of the Fama-French three-factor model

Getting inspired by various research regarding size effects and value effects done by Stattman (1980), Rosenberg, Reid, and Lanstein (1985), Basu (1983) et el., Fama and French (1992) conduct testing on stocks in the period from 1963 to 1990 and find that beta or market factor is not the only factor affecting stock returns or portfolio returns.

The research results demonstrate that there are factors other than market factor such as size, leverage, E/P, and book-to-market equity affecting stock returns. Among those factors, size and BE/ME show the strongest relations to average return. Especially, when these two factors are added to the model, the other factors' roles seem shrinking (ibid.).

Fama and French (1992) focus the research on two group of stocks that provide above abnormal returns. One group consists of companies with small market capitalization (Small caps) and the other comprises companies with high BE/ME ratio (also known as value stock). Then, these two factors are integrated into the CAPM model. Initially, market factor is excluded from the model and only size and value factors are considered. This try shows that these two factors strongly influence stock returns or portfolio returns. In the second try, market factor is included into the model through the beta coefficient. The results give that the effects of the market factor are interior to those of the size and value factors when it comes to stock or portfolio returns (ibid.).

Therefore, Fama and French (1992) come to conclusion that the CAPM is no longer robust.

2.3.2. Fama French Three-Factor Model

As afore-mentioned, the Fama-French factor model is developed to overcome deficiencies associated with the Capital Asset Pricing Model. Inspired by CAPM, Fama and French (1993) introduce two new variables, which are size of company measured by the market capitalization and value of company measured by the book value divided by market value, into the CAPM to explain the returns. This model is later regarded as the Fama and French three-factor model.

FORMULA

$$E(R_i) - R_f = \alpha + \beta_i * [E(R_m) - R_f] + s_i * SMB + h_i * HML$$

$E(R_i)$: expected return of the portfolio

R_f: Risk-free rate

$E(R_m)$: Market risk premium

β_i: the sensitivity of the stock expected return to the market risk. This beta can be obtained from the historical data

s_i: measures the effects of the size factor

h_i: measures the effects of the value factor

SMB (small minus big): Size factor

HML (high minus low): Value factor

In this model, the high expected return of a portfolio compensates for the high risks that investors have to assume. The coefficients si and hi in the model represent the effect of variable SMB and HML on returns of the portfolio i. The portfolio i comprising stocks of value companies would have high hi and vice versus. Similarly, the portfolio i comprising of stocks of large market capitalization companies will have low si and vice versus.

Compared to CAPM by Sharpe (1964) and Lintner (1965), Fama French three factor model introduces two new factors which are SMB and HML. SMB (Small minus Big) is the excess returns in which the investors will receive if they invest in stocks of small companies. This return is calculated by subtracting the returns of big company stocks from the returns of small company stocks. This factor is referred to as the small firm effect because this excess return is made by size effects. In the reality, SMB numbers are calculated by subtracting returns of portfolio comprising of 33% biggest

listed companies from the returns of portfolio comprising of 33% smallest listed companies. If the SMB is positive, it indicates that returns of small companies are higher those of big companies. If SMB is negative, it means that returns of small companies are interior to those of big companies.

HML measures the excess return in which investors would receive if they invested in companies who book-to-market ratio are high or value companies. Put it differently, HML may be called as firm value returns which are made by the value of the companies. The HML factor is calculated by subtracting the returns of portfolio comprising of 50% listed companies with highest book-to-market ratio from the returns of portfolio comprising of 50% companies with lowest book-to-market ratio.

2.3.3. Criticisms of the Fama French three-factor model

Even though Fama and French (1992) does great jobs to detect and improve deficiencies of CAPM. However, there are criticisms from academic researchers on the imperfection inherent in the model.

Black (1993) casts doubt on the results from Fama and French (1992) and believes the statistical analysis might be the result of data mining. Black (1993) criticizes for Fama and French (1992)'s lack of explanation for the relationship between size effects and expected returns. Data mining would be a reason why Fama and French (1992)'s failure to provide any sufficient explanation.

Shanken and Sloan (1995) find the tie between book-to-market ratio and stock returns weaker than what have been reported by Fama and French (1992). Specifically, "FF results are influenced by a combination of survivorship bias in the COMPUSTAT database affecting the high B/M stocks' performance and period-specific performance of both low B/M, past "winner" stocks, and high B/M, past "losers" stocks". By analyzing another data set, Shanken and Sloan (1994) believe the B/M ratio weakly affect the expected returns.

2.3.4. Empirical studies of the Fama-French three-factor model

Xu and Zhang (2014) run a testing of the Fama-French three-factor model on the Chinese stock markets with the data set comprising stock prices of companies listed on both Shanghai and Shenzhen Stock Exchanges from 1992 to 2012. The research shows interesting results when the authors find that the factor specific to the Chinese market such as state-owned feature, multiple class shares, among others do affect the performance of Fama-French three-factor model. Especially, the

regression R-squared is relatively high at 93% confirming the powerful performance of the Fama-French 3 factor model compared to the market model.

Pham (2007) provides the comprehensive testing of the well-known Fama-French three-factor model over the Japanese market. Running the regression using the data set containing 33 industry indices over the period from 1984 to 2004, the author concludes that the Fama-French three-factor model cannot be rejected in the case of the Japanese market. However, the research finds that when considering the Fama-French risk premium, the performance of the model deteriorates.

Faff (2004) examines the performance of Fama-French three-factor model on the Australian market, using the daily data. The sample data comprises 24 industry indices returns covering the period from May 1996 to April 1999, leading to 762 obersvations. The research results document the effectiveness of the model in explaining the returns of tested indices. However, the phenomenon that size premium is negative consistenly arises, casting more doubts to the factor's existence.

Al-Mwalla and Karasneh (2011) conducts empirical tests of the Fama-French three-factor model over the Kenyan market. By using the data set dated from July 2004 to June 2017 in the Nairobi Securities Exchange, the research documents the effectiveness of the Fama-French three-factor model in explaining the stock returns. However, the research also finds that companies which have high trade concentration can deliver returns higher than those which have low trade concentration.

Canbas and Arioglu (2008) examines the validity of the Fama-French three-factor model on the Turkish market. By employing data of financial firms listed on the Istanbul Stock Exchange from 1993 to 2004, the Fama-French three-factor model find the results favorable to what have been found my Fama and French (1993) in the US market. However, the research reveals that the Fama French factor while effective cannot capture full variation of stock returns, suggesting that there should be some other factors that are missed by the model to explain the stock returns, specifically in the Istanbul Stock Exchange.

2.4. Fama and French 5 factor model

2.4.1. Theoretical background

Since the introduction of the Fama and French three factor model was introduced in 1992, it has become one of the most popular asset pricing models that finance students across the world have to learn and do research on. Along with that, finance academic community has also conducted comprehensive research on Fama and French three-factor model with an aim to improve and revise the model. In such research, many authors have found out many anomalies in addition to what have been introduced in the three-factor model. Importantly, they found a robust relationship between such anomalies with the expected returns of a portfolio.

Ang, Hodrick, Xing, and Zhang (2006) conducted investigation into a set of stocks that are "sorted by the idiosyncratic volatility relative to the Fama-French three factor model". The research results uncover that "assets whose idiosyncratic volatility relative to Fama and French (1993) model have abysmally volatility risk". Importantly, factors such as "size, book-to-market, momentum, and liquidity effects cannot account for either the low average returns earned by stocks with high exposure to systematic volatility risk or for the low average returns of stocks with high idiosyncratic volatility" (ibid.).

Pastor and Stambaugh (2003) by running analysis on stocks listed on NYSE from 1966 to 1999 find a significant relation between stock returns and the stocks' sensitivity of returns to fluctuation in market liquidity. The research results show that returns of stocks which have high liquidity betas often exceed those of stocks with low liquidity betas. Put it differently, stocks which are highly sensitive to the market liquidity often offer returns higher than those of stocks which are less sensitive to the aggregate liquidity. This phenomenon holds even if exposures to market returns, size, value, and momentum factors are considered (ibid.).

Fama and French (2006) do investigation into if variables of valuation theories predict the expected returns of stocks. By analyzing stock prices from 1963 to 2003, Fama and French (2006) find a relation between a firm stock's expected returns and the company's investment level. To be specific, Holding constant the levels of book-to-market ratio and expected profitability, companies with higher expected investment growth will deliver lower expected returns for their stocks. Meanwhile, companies with lower expected investment growth will result in high expected stock returns (ibid.).

Novy-Marx (2013) studies companies listed in the NYSE from 1963 to 2010 to investigate the explanatory power of firm's profitability to the stock returns. The research results demonstrate that "Profitability, measured by gross profits-to-assets, has roughly the same power as book-to-market predicting the cross-section of average returns". Specifically, highly profitable firms often have high stock returns. Meanwhile, unprofitable firms often come with low expected returns.

Aharoni, Grundy, and Zeng (2013) revisit Fama and French (2006)'s findings document a that there is a negative relationship between "expected investment and stock returns after controlling for the other two variables". The researchers argue that Fama and French (2006) fail to describe this reverse relation because "their tests examined per share measures of expected investment and expected profitability and the valuation formula does not necessarily hold in per share analysis

2.4.2. Fama and French 5 factor model

To acknowledge new anomalies and improve the efficiency of the three-factor model, Fama and French (2015) introduce a new pricing model accounting for the effects of size, value, profitability, and investments on stock returns.

FORMULA

$$R_i - R_f = \alpha_i + \beta_i * (R_m - R_f) + s_i * SMB + h_i * HML + r_i * RMW + c_i * CMA$$

R_i: Expected stock return

R_f: Risk-free rate

R_m: Market returns

SMB (small minus big): Size factor

HML (high minus low): Value factor

RMW (robust minus weak): Profitability factor

CMA (conservative minus aggressive): Investment factor

α_i: Regression intercept

β_i: measures the effects of market risk to expected returns

s_i: measures the effects of the size factor

h_i: measures the effects of the value factor

r_i: measures the effects of the profitability factor

c_i: measures the effects of the investment factor

Compared to the Fama and French three-factor model, this five-factor model considers additional two factors that are believed to capture the variation of a stock return. According to the Fama and French (2015) "RMW is the difference between the returns on diversified portfolios of stocks with robust and weak profitability, and CMA is the difference between the returns on diversified portfolios of the stocks of low and high investment firms, which we call conservative and aggressive".

Though the Fama and French five-factor model in most cases shows improvement in capturing the variation of the expected returns. However, there are still issues associated with the application of the model. On the one hand, the model fails to explain the "low average returns on small stocks whose returns behave like those of firms that invest a lot despite low profitability". On the other hand, the results show that in some cases the value factor loses its contribution to explaining the expected returns. In such cases, the model of four factors and excluding the value factor is recommended.

2.4.3. Empirical studies

Since the introduction of the Fama and French five-factor model in 2015, there are various empirical studies which have been conducted to test the validity of the model in various markets.

Fama and French (2017) conduct a research on the international applicability of the five-factor mode. By analyzing stock prices for the period between July 1990 to December 2015 from 23 developed markets, the author finds the expected returns are positively related to the value factor and profitability factor. Meanwhile, investment factor is negatively related to the expected returns. However, particularly in the Japanese market, the relation between the average return and value factor is strong and robust while the other two factors is loosely related to the average returns. Ultimately, the research documents the superiority of the five-factor model compared to the three-factor version (ibid.).

Lin (2017) investigates the performance of the Fama and French five-factor model in the Chinese market, using a sample data set for the period from 1997 to 2015. The research indicates that the five-

factor model is better than the three-factor version at capturing the variation of the equity returns. However, a notable phenomenon is reported contradictory to results of Fama and French (2015) that value factor and profitability factor are highly important in explaining the average returns. In the meantime, investment factor plays minimal roles in describing the returns of the Chinese equity market (ibid.).

Sundqvist (2017) evaluates the performance of the five-factor model exclusively in the Nordic markets. The research discovers that the five-factor model cannot effectively explain the average returns of the Nordic markets, using the sample data set. However, the model is relatively good at capturing the average returns when either the portfolio is sorted by size and book-to-market ratio, and the portfolio is sorted by size and investment. In contrast, the average returns are not effectively explained by the model when the portfolio is sorted by size and profitability. Noticeably, the research results show that the five-factor is not better than the three-factor model in improving the regression intercepts (ibid.).

Foye (2018) tests the validity of the Fama and French five-factor model on the emerging markets. This research delivers interesting results when it comes to different regions and factors. In the Eastern European and Latin American regions, the five-factor model proves more efficient than the three-factor version in capturing the variation of the average returns. Meanwhile, in the Asian region, the five-factor model is not superior to the three-factor counterpart in explaining the average returns. Especially, “a profitability or investment premium cannot be distinguished in the Asian factors” (ibid.).

2.5. The 6-factor asset pricing model

2.5.1. Theoretical background

Harvey, Liu, and Zhu (2015) provide extensive search for anomalies and appropriate testing frameworks recorded by research papers on asset pricing models. The research results document over 316 new factors that can potentially explain the cross-section of returns.

Fama and French (2018) provide insights into how to choose the best factors among many available to achieve the maximum squared Sharpe ratio. To conduct this study, both nested and non-nested models are tested to and compared. Among nested models, in addition to regularly tested ones such

as CAPM, Fama and French 3 factor model, Fama and French 5 factor model, the authors introduce a new model which considers the momentum factor. However, the Fama and French (2018) confirm that the inclusion of the momentum factor into the five-factor model is "lack of theoretical justification".

2.5.2. The Fama and French 6 factor model

$$R_i - R_f = \alpha_i + \beta_i * (R_m - R_f) + s_i * SMB + h_i * HML + r_i * RMW + c_i * CMA + m_i * UMD$$

R_i: Expected stock return

R_f: Risk-free rate

R_m: Market returns

SMB (small minus big): Size factor

HML (high minus low): Value factor

RMW (robust minus weak): Profitability factor

CMA (conservative minus aggressive): Investment factor

UMD (up minus down): Momentum factor

α_i: Regression intercept

β_i: measures the effects of market risk to expected returns

s_i: measures the effects of the size factor

h_i: measures the effects of the value factor

r_i: measures the effects of the profitability factor

c_i: measures the effects of the investment factor

m_i: measures the effective of the momentum factir

2.6. Consumption-based CAPM

2.6.1. From CAPM to Consumption-based CAPM

The mean-variance market portfolio introduced by Markowitz (1959) as well as other researches only illustrate the portfolio selection situation that plays one period. However, Merton (1971) pointed out it is not a realistic case as investors usually have to face changing investment opportunities through lifetime. Therefore, Samuelson (1969) firstly showed many-period discrete portfolio selection

process inspiring us to think about the lifetime consumption by dynamic stochastic process. In addition, Merton (1969) extended this case to continuous multi-period model where one's incomes are from returns of his assets and its simulated growth rate are a stochastic process.

As we mentioned before, due to its homogeneous expectations and only one-period assumption (Merton, 1973), static CAPM are criticized by both theoretical and empirical objections. Relaxing the restricted assumptions of CAPM, Merton (1973) therefore introduced an intertemporal equilibrium model based on the preference structure provided by Merton (1971). This model maximizes the expected utility and restricts the liability scale (fulfil the perfect market), which suggested empirically performs better than the traditional CAPM though is still not tractable as the excess return are explained by asset beta as well as many investment state variables that are difficult to identify (Breeden, 1979). This model is called Intertemporal CAPM by following researches.

To overcome the theoretical limitation of traditional CAPM, Rubinstein (1976), Lucas (1978) and Breeden (1979) have invented the consumption beta and the consumption based CAPM (CCAPM) that derived from theoretical optimization problems. Specifically, following rational risk averse investor behavior, Rubinstein (1976) developed an equilibrium model based on stochastic income streams rather than simply extend the one-period model into a multi-period extent. In this framework of equilibrium, the author also introduced a stream of uncertain income that follow the rational risk aversion. Meanwhile, starting from the situation that an individual consumes single good in a pure exchange economy and maximum his expected utility, Lucas (1978) introduced a stochastic equilibrium model for asset pricing. In the economy situation of the research, similarly, consumers are assumed to optimize their consumption and investment choices and a representative agent tends to make a decision at an infinite horizon, in other words, through his lifetime, to maximize expectation of his utility,

$$max\ E\left\{\sum_{t=0}^{\infty}\beta^{t}U(C_{t})\right\}$$

where $\beta \in (0,1)$ is a discount factor, standing for the time preference of the representative agent, while C_t is the order of consumption situation representing the stochastic consumption at period t and U stands for selected utility function. Then combining the condition of market equilibrium, one can have,

$$\left(\mathbb{E}_t\tilde{R}_{t+1} - R^f_{t+1}\right) = -Cov\left(\tilde{R}_t, \beta\frac{u'(C_{t+1})}{u'(C_t)}\right)R^f_{t+1}$$

Besides, this research assumes the utility function follows Constant Relative Risk Aversion (CRRA),

$$U(C_t) = \frac{{C_t}^{1-\gamma} - 1}{1-\gamma}, \gamma > 0$$

where γ is the order of Relative Risk Aversion. And we have $U'(C_t) = {C_t}^{-\gamma}$. In addition, assuming the returns of stock and the growth rate of consumption x both follow log-normal distribution, one can have the core equation of consumption-based CAPM,

$$\tilde{r}_{t+1} - r^f_{t+1} = \gamma Cov\left(\tilde{R}_t, x\right)$$

where $\tilde{r}_{t+1} = log\mathbb{E}_t\tilde{R}_{t+1}$, $r^f_t = logR^f_t$. This is the initial version of Consumption-based CAPM, which is regarded as a standard of academic intuition in the area of asset pricing.

Subsequently, following the continuous extension version of asset pricing model (single good) invented by Merton (1973), Breeden (1979) stated a consumption based single-beta model in a multi-goods and multi-period (continuous) situation with stochastic consumption and investment opportunities. Different from Merton's (1973) model that the excess return is explained by asset beta and many investment opportunities respectively, Breeden (1979) pointed out that one can use only one beta that contains all states mentioned by Merton (1973), which is aggregate consumption growth rate in this case. In other words, asset beta in this model depends on the covariance of asset's return and marginal utility of consumption. That is,

$$\beta_{jC} = \frac{cov(r_j, dlnC)}{var(dlnC)}$$

Breeden (1979) also provided a linear version of CCAPM that under the assumption of the asset's return μ_a is perfectly correlated with the changes in consumption,

$$\mu_a - r = \beta_{jC}(\mu_C^* - r)$$

where $\mu_C^* - r$ is the excess return on the asset. This formula provides us with a linearly testable CCAPM.

2.6.2. Test CCAPM

Introducing the consumption-based asset pricing model, Lucas (1978) indicated this model shows a potential to be test empirically. After that, many researches tried to find a tractable approach to test this nonlinear model. For example, Grossman & Shiller (1981), Hansen & Singleton (1983) and Wheatley (1987) conducted tests on discrete consumption-based asset pricing model. The test performed on U.S. consumption data from the period of 1890-1979 by Grossman & Shiller (1981) is the first try to test consumption-based asset pricing model. Under the power utility assumption, they calculated $\beta u'(c_{t+1})/u'(c_t)$ under each level of certain risk aversion. However, in their research, consumption CAPM describes the pattern of stock price only when the marginal utility of consumption is sensitive to the changes of consumption, in other words, only when the investors are extremely risk averse. Grossman & Shiller's (1981) finding inspires Hansen & Singleton (1982) to work on this technique-difficult stochastic Euler equation. Hansen & Singleton (1982) introduced a brand-new method named Generalized Method of Moments (GMM) estimators to solve this dynamic equation. They proposed a log linear CCAPM under the assumption that error term follows normal distribution,

$$E\left[ln\left(1 + R_{i,t+1}\right)\right] = -ln\beta - \gamma E_t[\Delta lnc_{t+1}] + [\sigma_i + \gamma^2\sigma_c - 2\gamma\sigma_{ic}]/2$$

where γ is the rate of risk aversion while the third term depends on the variance and co-variance. In GMM estimators, one can regard the dynamic optimum problem as many subsequent Euler equations, corresponding many orthogonality conditions equals to zero. Variables in these nonlinear conditions can be preferences function, returns etc. After showing this approach of estimating, Hansen & Singleton (1982) also applied it in both nondurable plus services and nondurable real consumption per capita. However, the empirical result against the asset pricing model with CRRA. The classic power utility function of Hansen & Singleton (1982) is also widely characterised. Hansen (1982) also extend the large sample properties of GMM later, which made GMM as an important estimator for

dynamic model testing in modern econometric. However, Hansen & Singleton (1996) indicated that this GMM method is not sufficient and provided an optimal estimator of preference parameter γ_0.

Subsequently, Hansen & Singleton (1983) conducted a time series test on consumption-based asset pricing model with both CRRA and CRRA-lognormal model. Performing maximum likelihood estimations to get the coefficients, this test led to a result against consumption based CAPM. In addition, in their test of equity premium puzzle, Mehra & Prescott (1985) also performed a robust test on the growth rate of aggregate consumption and concluded that the result is not sensitive to changes in consumption growth rate. They pointed out the heterogeneity among agents, or consumption risk might imply the so-called equity premium puzzle. Similarly, Wheatley (1987) performance simulation tests to exam the discrete version of model with CRRA and the covariance of consumption with asset return. Rejecting the consumption model, Wheatley's (1987) tests also suggested implausible high degree of relative risk averse existing. In the comparative cross-sectional test of Mankiw & Shapiro (1986), they also concluded that consumption beta cannot empirically explain the excess return as well as the theory suggests, and they explained this might because there might be only a small fraction of consumers takes part in the stock market. In addition, Mankiw & Zeldes (1991) conducted further tests to stockholders and non-stockholders separately and found that stockholders own a higher volatility of consumption than those family who do not buy stocks, also, the excess return show a higher correlation with the consumption of stockholders. They suggested this might help illustrate the equity premium puzzle though it still fails to conform the CCAPM empirically.

When Grossman, Melino & Shiller (1987) examined the continuous version of consumption CAPM, the approach they processed consumption data is impressive. They pointed out that it would be difficult to bring the instantaneous consumption into their model, therefore they suggested using the time averaged covariance though this method might reduce the relative risk aversion. Consistent with the previous studies, empirical test of Grossman, Melino & Shiller (1987) also rejected the consumption model by implausible estimator and high relative risk aversion, while they explained this failure to their way of processing consumption data as the covariance is state dependent. Besides, conducting test on CCAPM, Singleton (1990) also stated that the relationship between asset return and consumption is not well fetched by consumption oriented CAPM. Singleton (1990) explained this as, firstly, the consumption growth rate is much higher than asset returns in the postwar period this research used to fit with the model. In addition, the heteroscedasticity stock return itself is proved

to be volatile that is difficult to fetch preciously. Finally, the CCAPM cannot describe the covariance between asset return and aggregate consumption that is relatively less variable compared to the autocorrelated returns.

Testing a linear version of CCAPM and also comparing it with the market oriented CAPM during the period of 1926-1982, Breeden, Gibbons & Litzenberger (1989) used the aggregate instantaneous consumption rate rather than the last-day consumption of each quarter, while their tests rejected the models with both value weighted index and maximum correlation with consumption (MCP) portfolio.

Theoretically, Breeden, Gibbons & Litzenberger (1989) started from the first order condition of consumption optimization,

$$E_t\left[\beta_{ci}\frac{U'(C_{t+1})}{U'(C_t)}\left(R_{i,t+1}-R_{Z,t+1}\right)\right]=0$$

where $\widetilde{\mathrm{R}}_{\mathrm{zt}}$ is the expected return of zero-beta asset. Let $\mathrm{f(C_t)}=\mathrm{U'(C_t)}$ and we can have $\frac{\mathrm{f(C_{t+1})}}{\mathrm{f(C_t)}}=\frac{\mathrm{U\prime(C_{t+1})}}{\mathrm{U\prime(C_t)}}$. Then, according to Taylor first-order expansion and the assumption of CRRA utility, they have the unconditional expectation,

$$E\left[\beta_{ci}(1-\gamma\Delta C_{t+1})\left(R_{i,t+1}-R_{Z,t+1}\right)\right]=0$$

Breeden, Gibbons & Litzenberger (1989) also indicated the expected return of a selected asset i can be rewritten as a linear version,

$$R_{i,t+1}=\ \alpha_i+\beta_{c,i}\Delta C_{t+1}+\varepsilon_{i,t+1}$$

where $\alpha_{\mathrm{ci}}=\mathrm{E}\left[\mathrm{R_{i,t+1}}\right]+\beta_{\mathrm{ci}}\mathrm{E}[\Delta\mathrm{C_{t+1}}]$. This linear version of CCAPM provides us with a testable content of CCAPM and a possibility of comparing with FF factor models in a time series framework. In addition, including the expected return of zero-beta asset, they proposed,

$$E\left[R_{i,t+1}\right]=\ \lambda_0+\beta_{c,i}\lambda_1$$

where $\lambda_1 = \gamma \frac{\mathrm{Var}(\Delta C_{t+1})}{1-\gamma E[\Delta C_{t+1}]}$, and they indicated the λ_1 should be positive and significant, which is interesting to test in the cross-sectional content.

However, Breeden, Gibbons & Litzenberger (1989) also mentioned that the usage of monthly consumption data rather than lower frequency increases the power of observations to reject the null model, and therefore the MCP portfolio might be over tested. Their linear CCAPM was rejected at the level of 5% though they suggested the poor quality of consumption data should be the main reason.

2.6.3. Preference and utility

Trying to upgrade the preferences to resolve the equity premium puzzle pointed out by Mehra & Prescott (1985) in over decades, relevant researches can be regarded as two type, modifying time-and-state-separable utility and introducing habit formation (Mehra, 2003). Initially, Hall (1978) suggested consumption is a random walk, however, this is contradictory with the fact that stock prices and future consumption vary a lot with current level (Grossman & Shiller, 1981). To test Hall's (1978) statements, Grossman & Shiller (1981) examined U.S. consumption per capita in the period of 1890-1979 and their conclusion is consistent with Hall's (1978), saying that consumption is a random walk under certain assumptions and income is relevant to lag consumption. They explained the puzzle from Hall's (1978) research as the future consumption contains more information than current consumption, and therefore the discounted factor (real interest rate) varies with new information. They also conclude the variability of stock price attributes to this. Testing the three-moment consumption oriented CAPM, Kraus & Litzenberger (1983) suggested that for individuals in efficient market, this should be a potential aggregate preference function for expected return and risk aversion due to the increasing concave utility function and nonincreasing absolute risk aversion.

Hall (1988) indicated that the elasticity of intertemporal substitution is determined by the covariance of consumption growth rate and changes in expected real interest rate, and the empirical test showed this elasticity is positive in U.S. sample. Hall (1988) also agreed with other researchers that the higher stock returns do not imply a rapid growth rate of consumption.

Impressively, Epstein & Zin (1989) formulated an intertemporal utility function that is capable to separate the intertemporal substitution and the risk aversion properly. In addition, they describe the implying pattern of temporal behavior of consumption and expected returns. Epstein & Zin (1989) also suggested to bring this Kreps-Porteus utility function into the consumption model introduced by Lucas (1978) and Breeden (1979).

However, Weil (1989) indicated that simply de-composite the risk aversion from the intertemporal substitution cannot solve the equity premium puzzle. Weil (1989) supported Mehra & Prescott (1985) that the heterogeneity among consumers, might be the main reason to both equity premium puzzle and riskless rate puzzle. That is, when the consumption risk of an individual is higher than that of the aggregate consumption, this consumer might buy safer goods later, leading a lower risk-free rate. Kandel, Shmuel, Stambaugh & Robert (1991) agreed that intertemporal substitution is more significant than risk aversion in determining the equity returns.

Vissing-Jørgensen & Attanasio (2003) also suggested that the empirical failure of consumption CAPM can be explained by the marginal substitution of intertemporal consumption. From their empirical evidence that the elasticity of substitution is over 1 though the risk aversions are lower than 10, they concluded this might weaken the relationship between substitution and risk aversion.

By contrast, bring 'resolution' of the equity premium puzzle and riskless rate puzzle, Constantinides (1990) firstly raised the 'habit persistence' that supported by the positive subsistence rate of consumption (the consumption is positively autocorrelated with asset return). Taking habit persistence into account in the utility, their test showed a low degree of volatility in consumption growth. Furthermore, Campbell & Cochrane (1999) developed a consumption-oriented model (however, assuming the consumption is random walk and negatively autocorrelated with stock return) with habit formation that showed a plausible pattern in long horizons as well as consistent with economic intuition.

Campbell (2003) suggested the Campbell-Cochrane model demonstrates a risk aversion with the different level of consumption. Engsted & Moller (2010) tested the Campbell-Cochrane model by a GMM estimator and suggested the empirical results vary across different countries. In majority countries, the model provided a plausible evidence for preferences, risk-less rate and risk aversion.

In addition, Otrok, Ravikumar & Whiteman (2002) provided the habit preference and suggested to apply it in the intertemporal consumption CAPM. They stated that consumers care about both intertemporal and temporal volatility. Furthermore, individuals are more averse to high-frequency volatility than that of low-frequency. Besides, Wachter (2002) suggested the excess returns are not only depend on the future consumption growth rate but also determined by the past consumption level.

The spectral utility function provided by Otrok, Ravikumar & Whiteman (2002) describes consumer's preference to volatility of consumption during each temporal period and assume the intertemporal consumption can be aggregated by consumption among each period to solve the equity premium puzzle. In addition, Different from Mehra & Prescott's (1985) explanation, Kocherlakota (1996) suggested agents have more methods to increase saving demands than previous researches considered. This might explain the phenomenon that the consumption growths rate is higher than risk-free rate.

Also, Kocherlakota (1996) illustrated the equity premium puzzle is caused by the different trading expenses between stock market and bond market. However, Mehra (2003) indicated that both these two main preference modifications can only explain the riskless rate puzzle though are unable to illustrate the equity premium puzzle properly. Mehra (2003) therefore introduced the life-cycle features of agents, saying that for young people the correlation between consumption and equity income is not high whereas for middle-aged people they are highly correlated.

Taking income level of agents into consideration, Smoluk & Neveu (2002) tested whether different income groups have the different reaction to the consumption CAPM. However, they cannot find any plausible difference between different income groups. After that, trying to resolve the equity premium puzzle, Bansal & Yaron (2004) proposed a model of consumption with price-dividend ratio that based on the preferences of Epstein & Zin (1989).

In addition, Bansal & Yaron (2004) documented that the price-dividend ratio shows a negatively correlation with the volatility of consumption, that is, the variation of consumption decreases the stock price. However, Santos & Veronesi (2006) documented that the labor income to consumption ratio shows a better performance than price-dividend ratio in explaining the stock returns. In addition,

Martin (2013) stated that the variation in price-dividend ratio is attributed to variation in risk premium to a large extent.

Semenov (2007) presented a consumption model based on a discounted factor that is intertemporal marginal rate of substitution weighted by the possibility one might hold it, where the weight is the conditional probability on imperfect sample information.

Cochrane & Hansen (1992) improved the stochastic discount factor (SDF) applied in consumption asset pricing model as they suggested one can use SDF that is more consistent with the preference and behaviors of consumers. Taking correlation between asset returns and SDF into consideration, Cochrane & Hansen (1992) encouraged more later researches to find a more suitable SDF for macroeconomic models. Nieto & Rubio (2011) proposed the volatility of consumption SDF and applied it in both nontemporal and ultimate consumption with durable and non-durable consumption data. Empirical findings suggested the volatility of consumption based SDF is capable to predict future stock returns. Pointing out that researchers tend to normalize the SDF in the previous studies whereas these normalizations vary in both population and finite samples, Burnside (2016) proposed the failure of rank conditions is capable to influence inference.

Yogo (2006) suggested that the covariance between durable consumption growth rate and asset returns is high when the growth rate of durable consumption lower than that of non-durable consumption.

Hansen, Heaton & Li (2008) studied a plausible measurement of long-run risk-return in consumption growth and cash flow. They pointed out these portfolios own high book-to-market ratios show a positive covariance with consumption whereas these low book-to-market portfolios have negative covariance.

However, Auer (2011) estimated both power utility and habit formation model in investment funds returns and indicated both of these two models are not rejected though a high degree of risk aversion is required. In addition, the classic risk-free rate puzzle only appears in the power utility model.

2.6.4. Consumption data measurement

In this developments and discussions of theoretical asset pricing models, the approach researches describing and measuring consumption varied a lot. Breeden, Gibbons & Litzenberger (1989) used the aggregate instantaneous consumption rate rather than the last-day consumption of each quarter, although they suggested that the rejection of CCAPM model might be due to the monthly consumption data used.

Mankiw & Zeldes (1991) suggested research can split the consumption between stockholders and non-stockholders as consumers who own stocks might face a riskier level of consumption.
Wilcox (1992) pointed out that the rejection to consumption CAPM might due to consumption data itself, as there are two main error showed in previous work. First error is a sample error happened in the estimation of retail sales and personal consumption expenditure (PCE). Secondly, the time interval retail sales used might be imperfection. In addition, Wilcox (1992) suggested a more proper way to construct consumption data. Bell & Wilcox (1993) also supported the sampling error in estimating retail sales from Census Bureau's Monthly Retail Trade Survey that might influence model estimation.

Lynch (1996) provided a new idea in consumption measurement as suggesting assuming consumer makes decisions in a fixed frequency (unsynchronized for individuals). From Lynch's (1996) test on U.S. data, it showed low volatility of consumption and it showed the consumption lowly correlated with asset return due to this assumption.

Studying both intertemporal consumption model with discrete utility and habit consumption utility introduced by Constantinides (1990) in different horizons, Daniel & Marshall (1997) found a significant evidence for Constantinides's (1990) model in long horizons that describes the mean and variance of equity premium generally as well as the risk-free rate. Therefore, Daniel & Marshall (1997) suggested long horizons might improve the model performance.

Analyzing the scenario that consumers mark their consumption each D (delay) periods, Gabaix & Laibson (2001) found the 6D bias that the consumption Euler equation fails to reject the consumption based CAPM model.

Bringing housing expenditure into content, Piazzesi, Schneider & Tuzel (2007) separate consumption into two parts, housing and numeraire good (non-housing). They concluded that non-housing good expenditure shows a better potential in predicting excess return than dividend yield. In addition, Lustig & Nieuwerburgh (2005) presented a consumption model take housing collateral ratio into consideration. Concluding the collateral house model performs better than the traditional consumption model, they explained the risk-sharing is not always optimal in the real world. That is, the capability of risk-sharing varies among agents.

Ait-Sahalia, Yacine, Parker & Yogo (2004) formulated utility functions of both luxury goods and ordinary good, finding that the covariance of regular consumption and excess returns is relatively low. That is, the degree of risk aversion is implausible high, refer to the equity premium puzzle.
Parker & Julliard (2005) processed the systematic risk as the covariance with excess return and contemporaneous consumption as well as future growth rate over many quarters, concluding the risk of ultimate consumption is positively correlated while that of contemporaneous consumption is negatively related.

In addition, Jagannathan & Wang (2007) also stated that long horizons can improve the performance of consumption CAPM. They suggested using the end of year consumption data helps the CCAPM shows a relatively equal outcome as the Fama-French three factors model whereas it shows a poor performance when it comes to quarterly data.

Kolev (2013) applied the power utility CCAPM with monthly, quarterly and yearly consumption data respectively. Having difference level of risk aversion with these different time horizons, Kolev (2013) suggesting the failure estimations in previous studies owing the bad data selected rather than the bad model as the CCAPM with power utility is capable to explain equity premium. Meanwhile, Bin Li (2010) indicated that the quarterly-recorded consumption data only provides a very limited and late indicator for investors to make their decisions.

Savov (2011) proposed a new measurement of consumption, garbage. Instead of using the traditional consumption data, National Income and Product Accounts (NIPA), Savov (2011) estimate the consumption model based on the more volatile garbage data and reported it is highly correlated with stock returns in U.S. stock market. Savov (2011) explained the failure of NIPA data as the limited

measurement of it. In addition, Kroencke (2017) also supported that the garbage data owns a much lower risk aversion than NIPA consumption and suggested this difference attributes to the filtered mitigate measurement error of NIPA data. Estimating the model with unfiltered NIPA consumption, Kroencke (2017) concluded it works well in explaining cross-sectional returns with a lower risk aversion.

2.6.5. Extension models of CCAPM

To resolve the complexity of nonlinear property of the intertemporal consumption CAPM, Campbell (1993) formulated a loglinear approximation with the utility function provided by Epstein & Zin (1989) and Weil (1989). Consisting with Hall (1988), this loglinear model indicated that the consumption-wealth ratio is determined by the elasticity of intertemporal substitution in consumption, whereas the risk premium is depend on the covariance between asset returns and market returns (consistent with static CAPM), as well as the covariance with information about discounted factor, in accordance with Grossman & Shiller (1981).

Suggesting the log consumption-aggregate wealth ratio is a better predictor for future asset returns in both short and intermediate horizons, Lettau & Ludvigson (2001) investigated a conditional version of consumption model. They introduced a conditional variable cay representing the consumption-aggregate wealth ratio to constrain the linear consumption model. This conditional consumption CAPM is also called CC-CAY model by others. The evidence of Santos & Veronesi (2006) also support how the asset return is influenced by cyclical variation of consumption to wealth ratio.

As we described above, Parker & Julliard (2005) suggested studying the consumption risk of future consumption and contemporaneous consumption separately, they proposed an ultimate version of consumption CAPM measuring risk as the covariance between contemporaneous consumption and asset returns. This adjustment in consumption allows the excess returns reflect the future information in three years. This model is reported to confirm that asset returns are determined by the consumption risk.

Assuming the utility of durable consumption and non-durable consumption is inseparable, Yogo (2006) proposed a durable consumption model with constant elasticity of substitution (CES) different from the original consumption model based on the non-durable consumption. Yogo (2006) suggested

this model is capable to explain both cross-sectional return and variation of time series equity premium though the risk aversion is very high.

2.6.6. Comparisons of CAPM and CCAPM

Mankiw & Shapiro (1986) firstly empirically compared the traditional CAPM to the 'newly popular' consumption CAPM and the cross-sectional result led to the conclusion that the excess returns are more closely related to the market return than with consumption growth rate, while Breeden, Gibbons & Litzenberger (1989) compared the linear version of consumption CAPM with the static CAPM empirically and suggested they generally have a similar poor result.

Epstein & Zin (1989) pointed out the excess return is explained by covariance with both market return and consumption growth rate. In addition, they indicated that when it comes to infinite horizons, the static CAPM and the intertemporal CCAPM are nested, in other words, the traditional CAPM is a special case of consumption-based asset pricing model. Cochrane (2001) also support this. In the assumption under CAPM, market portfolio is regarded as the only one kind of consumption as it is the only good that make returns in the market. Therefore, the market equilibrium happens only when the growth rate of consumption equals to the return of market portfolio. In addition, for utility of the representative agent, assuming γ is the same for all individual representative agents, for example, let every agent fulfill the condition of $\gamma = 1$. This assumption indicates that the single representative agent is not sensitive to time horizons, in other words, they do not show any time preference for when they consume the certain good. Then, one can consider a static situation for Consumption-based CAPM, that is, the consumption growth rate and returns do not vary across time. The Consumption CAPM can therefore be rewritten as,

$$\tilde{r} - r^f = Cov(r^M, \tilde{r})$$

For market portfolio, one has,

$$r^M - r^f = Cov(r^M, r^M) = Var(r^M)$$

Subtracting these two equations, one can get,

$$\tilde{r} - r^f = \frac{Cov(r^M, \tilde{r})}{Var(r^M)}(r^M - r^f) = \beta(r^M - r^f)$$

This is the equation of static CAPM. Therefore, one might conclude that CAPM is a special case of Consumption-based CAPM.

Kan, Robotti and Shanken (2013) provided some evidences in the respect of two-pass cross-sectional study. They compared seven different asset pricing models including CAPM, FF three-factor and CCAPM. After comparing R^2 and significance of each risk premiums, they suggested a five-factor specification version of ICAPM (Intertemporal CAPM) proposed by Petkova (2006) showed the best performance, while FF three-factor model generally held a second position. Similarly, CCAPM always shows the less power in explaining excess returns.

Some international empirical tests also provide some comparisons that also show similar patterns. For example, comparing CCAPM, static CAPM and FF three-factor model in the stock market of Australia, Bin Li (2010) indicated that the CCAPM owns the lowest power of explaining excess returns in both time series and cross-sectional regressions. In addition, the comparative study between CCAPM and traditional CAPM in Nigerian market conducted by Eseoghene (2014) suggested that both CCAPM and CAPM can be applied in Nigerian stock market, while CCAPM does not show a better performance than conventional CAPM.

2.7. Asset pricing models in emerging markets

The empirical test of asset pricing models in emerging market started far latter than those in US and European markets. However, the different patterns and varied performance emerging stock markets show draw more attention from the last thirty years.

Is model of US market also available in emerging market? Pereiro (2010) stated that, theoretically, although these asset pricing models should also be similarly applied in emerging market, but it is not that case in the realistic practice as 'beta dilemma' raised. That is, less available data due to a relatively shorter history of capital market makes the risk beta not reliable. As a result, they suggested one can consider using the industry beta calculated with US data. However, new problem raised in this way as the statistical characters of US and emerging markets are not identical. To tackle this

equivalent problem, the author suggested adding the merging data as a single asset when it comes to the industry beta calculation.

Performing a rolling window regression between emerging markets and developed markets, Coudert, Herve and Mabille (2015) suggested the emerging markets are more correlated with the developed market due to the globalizations. Therefore, the performance different asset pricing models present in developed and emerging markets should be also correlated to each other. However, Hanauer and Linhart (2015) suggested the emerging markets and developed markets are not integrated from their empirical studies.

Hwang and Satchell (1999) indicated that emerging markets are usually more volatile having higher skewness and kurtosis. They therefore suggested taking a higher moment in the GMM test when it comes to the CAPM testing issue in emerging market, and from their empirical findings, adding extra systematic risk makes the CAPM explained emerging markets better. Similarly, Neslihanoglu, Sogiakas, McColl and Lee (2017) take the co-skewness and co-kurtosis to increase the moment in GMM method when they tested CAPM in emerging market. In addition, conducting the similar work previous researches have done for risk factors in US market, Hearn (2016) proposed that the CAPM do not hold in Asian market, while CAPM with an additional liquidity factor show a better performance. The liquidity factor was introduced by Liu (2006). In addition, momentum factor is also inefficient in Asian market. Examining different factors and empirical models in emerging markets, Hanauer and Linhart (2015) indicated that they captured a strong and highly significant value effect, and it is even stronger than in developed countries. The momentum factor is also strong but less significant. They also documented that the combinations of market factor, size, value and momentum factors show an overall better performance in explaining excess returns in emerging markets.

In addition to CAPM and FF factor models, CCAPM is also widely tested in emerging market. For example, Cashin and McDermott (1998) examined CCAPM for stock data in Jordan, Turkey and Pakistan from 1986 to 1993. The empirical results also rejected CCAPM, which is consistent with evidences from US.

Wondering if all emerging market show similar reactions to these asset pricing models, Mohanty (2019) conducted a comparative study for 21 emerging markets along with 22 developed market from

1991 to 2016. The results suggested that different markets usually have unique properties and therefore have different qualities of model specifications. That is, it is hard to summarize one standard market characteristic for all emerging markets. Specifically, some studies on certain emerging market also provide useful insights. For example, Gonenc and Karan (2003) conducted empirical tests of risk factors and asset pricing models in the market of Istanbul Stock Exchange. They suggested that FF three-factor model shows a satisfied performance for value and growth portfolios.

When it comes to the Malaysian stock market, the empirical test of asset pricing model is very scarce and old. Drew and Veeraraghavan (2002) tested the FF three-factor model in Malaysia stock market and suggested it does not show a satisfied performance in explaining excess return of Malaysia, while they indicate the existences of both size premium and value premium in Malaysia.

CHAPTER 3. METHODOLOGY

In this chapter, we will introduce the securities prices, accounting data and consumption data we use, how we construct variables, factors and portfolios. We finally introduce the method we test the models, including time series regressions and cross-sectional regressions.

3.1. Data

3.1.1. Stock prices and accounting information

In this study, we intend to analyze and compare several asset pricing models such as Consumption-based Capital Asset Pricing Model (CCAPM), Fama and French three-factor model, Fama-French five-factor model over the Malaysia market. In order to perform the testing of various models in this thesis, we attempted to use data from various sources, including the COMPUSTAT which is available through the Wharton Research Data Services (WRDS). For the data set we obtained, both securities prices and accounting data of 1,321 companies are included with their sedol code, from which different portfolios are constructed. All company information is showed in **APPENDIX A**. To be specific, for the stock prices of companies listed in Bursa Malaysia which is the Malaysia's stock exchange, the monthly interval applies in this case, starting from January 1992 until December 2019, equivalent to 336 months in total. Even though past research on this topic had usually been conducted using a longer range data, for example, Fama & French (2015) chose the period from July 1963 to December 2013 in US market, 606 months in total, we find that some accounting data of Malaysia before 1992 is not available for constructing variables and testing all interested models. Therefore, we come up with the idea to obtain needed data in the mentioned period to produce the most transparent, unbiased, and comparable analyses. For the accounting data, the annual data is used and available in the COMPUSTAT data source.

3.1.2. Consumption data

Since the Consumption-based Capital Asset Pricing Model (CCAPM) is one of the models going into the comparison, the information about the private consumption is therefore employed. We obtained the Households and NPISHs Final consumption expenditure per capita growth (annual %) of Malaysia from the World Bank national accounts data. This data set comprises both the consumption for non-durable goods and the expenditures of nonprofit institutions serving households. Even though

the data on the consumption for non-durable goods in testing the CCAPM is preferable as it is more consistent with the original theory, the expenditures of nonprofit institutions serving households in this case are too minimal to be neglected.

3.1.3. Risk-free rate

One of the key factors shared by interested models is the risk-free rate from which market excess returns are derived. In this study, reference rates are provided by various sources, among which the one from the International Financial Statistics (IFS) is selected. Considering the time interval of the stock prices and accounting data, we have decided to use Malaysia's 1-year government bond yield as the input. In order to calculate the excess return of each portfolio and the market portfolio which are in the monthly frequency, the annual government bond yield is divided by 12 to obtain the relevant risk-free rate.

3.2. Variables

After having the original data, we will then define all variables we need for the models.

We firstly calculate monthly returns $R_{i,t}$ from the monthly stock price for each company at the end of each month, where i represents a company and t is the time-period. While choosing the close stock price ($P_{i,t}$), the total return factor ($TRF_{i,t}$) provided by Compustat will help us improve the accuracy of security data. The calculation of $R_{i,t}$ is provided in Table 2.1. Monthly returns are prepared for portfolio and factor constructions.

When it comes to consumption beta, we take the yearly growth rate ($r_{c,t}$) of consumption variable (C_t). Table 2.1 presents the calculation.

Thirdly, we get the market equity $ME_{i,t}$ for each company at each month end by multiplying the close stock price by total shares outstanding ($N_{i,t}$). The formula is shown in Table 2.1. This market capitalization is used as the size indicator in both factor and portfolio constructions.

Then, we calculate the book-to-market ratio $B/M_{i,t}$ by diving the book equity of each company ($BE_{i,t}$) by its market capitalization (Table 2.1), where book equity is the book value of total equity from accounting data. This book-to-market ratio stands for value of company, which is processed for value factor construction.

When preparing the operating profitability ($OP_{i,t}$), we take a method that is slightly different from the process conducted by Fama & French (2015) due to the limited accounting data of Malaysia companies. We calculate the operating profitability by annually accounting data, using the earnings before interest and tax ($EBIT_{i,t}$) minus interest expenses and then divide the difference by book value of equity, while Fama & French (2015) usd the revenue minus cost of goods sold, minus sell, general and administrative expenses, minus interest expenses and then divided by the book equity. The formula of ours showed below, and this $OP_{i,t}$ used as operating profitability factor later.

Finally, we define the investment variable ($INV_{i,t}$) as total assets of year t minus total assets of year $t-1$ and then divide these changes by the total asset of year $t-1$ (Table 3.1). We will use it to construct the investment factor and portfolios.

Table 3.1: Formulas of Variables Construction

Variable definitions
$R_{i,t} = \frac{P_{i,t} \times TRF_{i,t}}{P_{i,t-1} \times TRF_{i,t-1}} - 1$
$r_{c,t} = \frac{C_t}{C_{t-1}} - 1$
$ME_{i,t} = P_{i,t} \times N_{i,t}$
$B/M_{i,t} = \frac{BE_{i,t}}{ME_{i,t}}$
$OP_{i,t} = \frac{EBIT_{i,t} - Interest_{i,t}}{BE_{i,t}}$
$INV_{i,t} = \frac{Asset_{i,t} - Asset_{i,t-1}}{Asset_{i,t-1}}$

3.3. Factors

We will then construct all six factors by following the method proposed by Fama & French (2015) after defining variables above.

The first factor we create is excess market return $RM_t - RF_t$, where monthly market return R_M is calculated as value weighted ($ME_{i,t}$)average return of all companies in each month, and R_F is risk-free rate. The formula is showed in Table 3.2.

We secondly generate the value factor HML_t by a 2×3 double sorted method. We sort all returns and split them into two groups, B ('Big') and S ('Small'), by stocks with the median size ($ME_{i,t}$ variable). And then, in each size group, we again divide returns into three group by 30^{th} and 70^{th} percentile of value variable $B/M_{i,t}$, B ('High'), M ('Middle') and L ('Low'). We therefore split all these returns into six groups and can have average return for each group. To get the time series of HML_t factor, we can then use the average return of group SH_t and BH_t minus average return of group SL_t and BL_t in each month. The calculation shows in Table 3.2.

To construct RMW_t and CMA_t factors, we then follow a similar 2×3 double sorted process as above. we sort returns by size and $OP_{i,t}$ variables for RMW_t, by size and $INV_{i,t}$ variables for CMA_t, we then get all these factors following the calculations in Table 3.2.

Finally, we construct the SMB_t factor in two steps. After sorting each 2×3 group above, we can get the SMB_t for each factor portfolio by subtract the average return of BH_t, BM_t and BL_t from the average return of SH_t, SM_t and SL_t. Next, we take the average value of all these SMB_t factors to have the final SMB_t. Table 3.2 provides the details.

Table 3.2: Formulas of Factors Construction

Factors construction
$$RM_t - RF_t = \frac{\sum_{i=1}^{n} ME_{i,t} \times R_{i,t}}{\sum_{i=1}^{n} ME_{i,t}} - RF_t$$
$$HML_t = \frac{SH_t + BH_t}{2} + \frac{SL_t + BL_t}{2}$$
$$RMW_t = \frac{SR_t + BR_t}{2} + \frac{SW_t + BW_t}{2}$$
$$CMA_t = \frac{SC_t + BC_t}{2} + \frac{SA_t + BA_t}{2}$$
$$SMB_{t,B/M} = \frac{SH_t + SM_t + SL_t}{3} - \frac{BH_t + BM_t + BL_t}{3}$$
$$SMB_{t,OP} = \frac{SR_t + SM_t + SW_t}{3} - \frac{BR_t + BM_t + BW_t}{3}$$
$$SMB_{t,INV} = \frac{SC_t + SM_t + SA_t}{3} - \frac{BC_t + BM_t + BA_t}{3}$$
$$SMB_t = \frac{SMB_{t,B/M} + SMB_{t,OP} + SMB_{t,INV}}{3}$$

3.4. Portfolio constructions

To increase the effect of each factor on portfolios and therefore study the sensitivity returns show to different factors, we follow the method of Fama & French (2015) to construct portfolios on different factor loadings. The 5×5 double sorted methods are similar to the factor construction while we take each 30^{th} percentile as breakpoints to sort returns. Sorting portfolios on size and one of other variables, $B/M_{i,t}$, $OP_{i,t}$ and $INV_{i,t}$, we finally have 25 portfolios for size-B/M, size-OP and size-INV, respectively.

3.5. Model testing

To test the performance of all these factor models with CCAPM, we will conduct both time series regressions and Fama-Macbeth two-pass regressions. To make the CCAPM easier to be tested and compared with factor models, we also treat it as a 'one-factor' model with consumption growth rate being the only factor.

3.5.1. Time series regressions

Since this study is intended to compare the performance of various models which are Consumption-based CAPM, Fama-French three factor model, Fama-French five factor model in the Malaysian Market, multiple time-series regressions will be conducted. For each double-sorted portfolio, we run the Ordinary Least Squares Method (OLS) time series regression on the period from January 1992 to December 2019 for all models. The intercepts and slopes are checked to assess model performance, as a zero intercept and significant slopes are an indicator for model well-fitting. In the Table 3.3, equations for testing respective models are presented.

Table 3.3: Model Equations for Consumption CAPM, static CAPM, FF three-factor and FF five-factor models. β_{c_t} is the consumption beta while C_t is the growth rate of consumption. $\varepsilon_{i,t}$ is the residuals.

Model	Equation
Consumption-based CAPM	$R_{i,t} - RF_t = \alpha_i + \beta_{c_t} C_t + \varepsilon_{i,t}$
CAPM	$R_{i,t} - RF_t = \alpha_i + \beta_i (RM_t - RF_t) + \varepsilon_{i,t}$
FF three-factor model	$R_{i,t} - RF_t = \alpha_i + \beta_i (RM_t - RF_t) + s_i SMB_t + h_i HML_t + \varepsilon_{i,t}$
FF five-factor model	$R_{i,t} - RF_t = \alpha_i + \beta_i (RM_t - RF_t) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + \varepsilon_{i,t}$

To study the intercept further, we will then conduct GRS test that is pioneered by Gibbons, Ross, & Shanken (1989) and is one of the most important means to test the validity of factor models. Showed the calculating formula below, GRS is used to test whether all intercepts of the time series regression are jointly equal to zero. The null hypothesis of GRS test dictates that "terms of an empirical asset-pricing equation for a range of assets or portfolios are jointly equal to zero." "A failure to reject the null hypothesis represents statistical evidence that the model adequately captures the systematic variation of asset or portfolio returns" (Kim & Shamsuddin, 2018).

In its formula, T is the total time interval, N is the number of assets to be tested and K is the number of factors. $\hat{\alpha}' \hat{\Sigma}^{-1} \hat{\alpha}$ stands for the unexplained excess return, where $\hat{\alpha}$ is the vector of intercepts and $\hat{\Sigma}$

is the covariance matrix of regression residuals. The nominator is excess returns explained by model, where $\hat{\mu}$ is the vector of factors and $\widehat{\Omega}$ is the covariance matrix of factor returns.

$$GRS = \left(\frac{T}{N}\right)\left(\frac{T-N-K}{T-K-1}\right)\left(\frac{\hat{\alpha}'\hat{\Sigma}^{-1}\hat{\alpha}}{1+\hat{\mu}'\widehat{\Omega}^{-1}\hat{\mu}}\right) \sim F(N, T-N-K)$$

In addition, proposed by Fama-French (2015), the value factor's role in capturing the variation of the expected stock returns might erode in the US data when the investment factor is considered in the FF five-factor model. They found it in the GRS test results and provided evidence with factor regressions. Therefore, we will also perform factor regressions among different factors to test if there are any factor becoming redundant when other factors are included with the Malaysia market data. That is, we regress each factor against all other factors to see if one factor can be explained by others.

To sum up, we will conduct time series regressions, GRS test for each model and then factor regressions for different FF factors.

3.5.2. Fama-Macbeth regressions

In order to obtain the premium exposure to included factors, Fama and Macbeth (1973) propose a two-step regression that aims to test how concerned factors impact the portfolio returns.

In the first regression, portfolio returns of N assets will be regressed against relevant factors (K factors) such as market excess returns, HML, SMB and so on, depending on the models, using the time-series data points as what we did in the time series regression part. The objective of this process is to measure the impact of each factor on the portfolio returns, which is represented by one of regression coefficients. We take FF five-factor as an example and the process showed below. We run 25 time series regressions on all of 25 portfolios in each sorting method.

$$\begin{aligned}
R_{1,t} - RF_t &= \alpha_1 + \beta_1(RM_t - RF_t) + s_1 SMB_t + h_1 HML_t + r_1 RMW_t + c_1 CMA_t + \varepsilon_{1,t} \\
R_{2,t} - RF_t &= \alpha_2 + \beta_2(RM_t - RF_t) + s_2 SMB_t + h_2 HML_t + r_2 RMW_t + c_2 CMA_t + \varepsilon_{2,t} \\
&\vdots \\
R_{25,t} - RF_t &= \alpha_{25} + \beta_{25}(RM_t - RF_t) + s_{25} SMB_t + h_{25} HML_t + r_{25} RMW_t + c_{25} CMA_t + \varepsilon_{25,t}
\end{aligned}$$

In the second step, the cross-sectional portfolio returns will be regressed against factor loadings (regression coefficients) obtained from the time-series regressions. We run $T = 336$ cross-sectional regressions in each month. The results of this second step are the time-series risk premia coefficients γ for individual factors.

$$R_{i,1} - RF_1 = \gamma_{0,1} + \beta_i\gamma_{1,1} + s_i\gamma_{2,1} + h_i\gamma_{3,1} + r_i\gamma_{4,1} + c_i\gamma_{5,1} + \varepsilon_{i,1}$$
$$R_{i,2} - RF_2 = \gamma_{0,2} + \beta_i\gamma_{1,2} + s_i\gamma_{2,2} + h_i\gamma_{3,2} + r_i\gamma_{4,2} + c_i\gamma_{5,2} + \varepsilon_{i,2}$$
$$\vdots$$
$$R_{i,T} - RF_T = \gamma_{0,T} + \beta_i\gamma_{1,T} + s_i\gamma_{2,T} + h_i\gamma_{3,T} + r_i\gamma_{4,T} + c_i\gamma_{5,T} + \varepsilon_{i,T}$$

We finally take the average of risk premia cross different time periods. Take γ_0 as an example,

$$\overline{\gamma_0} = \frac{\gamma_{0,1} + \gamma_{0,2} + \cdots + \gamma_{0,T}}{T}$$

We will repeat this process of cross-sectional regression for each selected model in the equivalent period, and then the average risk premium for each risk factor is calculated. Table 3.4 presents all models in the cross-sectional equation.

Table 3.4: Model equations for cross-sectional regressions. Cross-sectional regressions of consumption CAPM, static CAPM, FF three-factor and FF five-factor models are provided. γ stands for risk premiums for each risk factor.

Model	Equation
Consumption-based CAPM	$R - RF = \gamma_0 + \gamma_1\beta_c$
CAPM	$R - RF = \gamma_0 + \gamma_1\beta$
FF three-factor model	$R - RF = \gamma_0 + \gamma_1\beta + \gamma_2 s + \gamma_3 h$
FF five-factor model	$R - RF = \gamma_0 + \gamma_1\beta + \gamma_2 s + \gamma_3 h + \gamma_4 r + \gamma_5 c$

Following two regressions, there will be a N number of risk premia γ over the whole time T for each factor, including the series of regression intercepts γ_0. Then, Fama and Macbeth (1973) proposed to average the series of premia of each factor and have $\overline{\gamma_K}$, calculate the standard deviation of the average risk premium σ_{γ_K}, and compute the t-statistics for each risk premium obtained. Below is the formula for t-ratio of each risk premium.

$$t = \frac{\gamma_K}{\sigma_{\gamma_K}/\sqrt{T}}$$

CHAPTER 4. EMPIRICAL RESULTS

4.1. The playing fields

Table 4.1 shows the monthly average excess returns of each portfolio sorting on all size-B/M, size-OP and size-INV, we will exam if there is any obvious pattern as well as compare it to the US market of Fama & French (2015).

Panel A shows the excess return of 25 portfolios sorted on size and B/M, where we use the return of each portfolio minus the Malaysia government bond yield. For most B/M column of Panel A, we do not find a clear pattern when the size change from small to big while Fama & French (2015) indicated there is a size effect in 4 of 5 groups of their US data that excess returns fall with size increasing. They also fail to find any relationship between excess return and size in the lowest value column. Surprisingly, the 4^{th} B/M column of ours shows a definitely different pattern that excess returns increase when size increasing, changing from -0.63% to 0.63% per month. In addition, for all value columns, we find that the smallest group always own the lowest excess return, which is different from 4 of 5 data in US market (Fama & French, 2015) where small returns happened in big size in most cases. Therefore, we fail to find any evidence of size effect in Malaysia market, and we even find an obvious opposite phenomenon.

For each size row, we again fail to seek the value effect. Fama & French (2015) found value effect that excess returns increase with B/M ratio and it shows a stronger effect with those with small size. However, our data shows an extremely opposite pattern that returns fall when value increasing, and low B/M groups always have the highest excess returns, ranging from 1.58% to 3.23%. That is, we find an opposite pattern of value effect in Malaysia market.

Panel B shows the excess returns of size-OP portfolios. For each profitability column, we also cannot find any clear relation between return and size, rejecting the size effect. For every size row, we cannot point out a clear pattern of returns with profitability increasing though those with the highest profitability always have the highest excess returns, ranging from 0.57% to 1.79% per month. Novy-Marx (2013) introduced the profitability effect that portfolios with the highest profitability is more likely to have the highest returns. Therefore, although we fail to find any clear relation between profitability and excess return, we can say the highest profitability groups always hold the highest returns in our Malaysia data.

The excess returns of size and investment portfolios shows in Panel C of Table 4.1. We also fail to find any evidence of size effect in every investment column, and we again find an opposite trend that returns increase with size in the middle investment group. For each size quintile, we cannot find relation between excess returns and investment in our Malaysia market, while Fama&French (2015) find that small investment is associated with high returns.

Table 4.1: Monthly average excess returns of each portfolio from January 1992 to December 2019, 336 months in total. Panel A, Panel B and Panel C respectively show excess returns of portfolios sorted on size-B/M, size-OP and size-INV. The excess returns subtract the Malaysia government bond rate from returns each month. These mean returns of each portfolio show in percentage after multiplying 100.

	Low	2	3	4	High
Panel A: Size-B/M					
Small size	1.58	0.04	-0.22	-0.63	-1.12
2	3.09	1.19	0.06	-0.27	-0.93
3	2.26	0.83	0.74	0.15	-0.04
4	3.23	1.89	0.86	0.44	-0.05
Big size	1.82	0.80	0.38	0.63	0.06
Panel B: Size-OP					
Small size	-0.19	-0.25	-0.46	-0.31	0.57
2	0.87	0.59	0.43	0.27	1.04
3	0.81	0.37	0.51	0.94	1.37
4	1.11	0.91	1.88	0.76	1.79
Big size	0.47	1.24	0.70	0.57	1.31
Panel C: Size-INV					
Small size	-0.44	-0.20	-0.33	-0.39	0.64
2	0.72	0.44	0.19	0.26	1.53
3	0.54	0.83	0.58	0.89	1.14
4	2.21	1.01	0.62	1.22	1.62
Big size	0.58	0.89	0.67	0.89	1.39

4.2. Descriptive statistics of factors

We then study the descriptive statistic of all factors in Table 4.2, including mean returns, standard deviations and p-value of t-test in Panel A and correlations between each pairs of factors in Panel B. Excess market return shows the highest monthly average return (0.86%) among these five factors, while HML owns the smallest average return at -1.96% (the most negative). The mean returns of size and value are negative, which is consistent with the fact we find in excess returns of each portfolio that differ from size effect and value effect. However, although we fail to find evidence of investment factor, the mean return of CMA factor is still positive (0.38%). When it comes to the standard deviation, excess market return is the most volatile one with 7.07% while others remain a stable level ranging from 4.45% to 5.99%.

From the p-value of t-test for each factor, only the excess market return and value factor are statistically significant whereas SMB, RMW and CMA factors are not statistically different from zero at the significance level of 5%.

Table 4.2: Descriptive statistics of five risk factors in Malaysia market from January 1992 to December 2019, 336 months in total. Panel A shows the monthly average returns, standard deviation and p-value of t-test for all five factors. Panel A shows in percentage after multiplying 100. Panel B shows correlations between each pairs of risk factors, the duplicate correlations are omitted to save space and show results clearly.

	RM-RF	SMB	HML	RMW	CMA
Panel A: Descriptive statistics					
Mean	0.86	-0.13	-1.96	0.26	0.38
Std.dev.	7.07	5.99	4.45	5.07	5.08
p-value	0.03	0.70	0.00	0.35	0.17
Panel B: Correlations					
RM-RF	1.00				
SMB	0.31	1.00			
HML	0.00	-0.04	1.00		
RMW	-0.48	-0.46	0.11	1.00	
CMA	-0.32	-0.26	0.20	0.45	1.00

In Panel B of Table 4.2, the correlations between two different factors provide us with information about how returns distribute among these factors. For example, the highest positive correlation 0.45 appears between RMW and CMA, suggesting there are more big returns happen in these profitable companies who invest much. By contrast, a negative correlation -0.46 happens between SMB and RMW suggests there are fewer high returns in profitable macro-cap companies.

In addition, we find two different patterns of correlation with the fact from Fama & French (2015) in US market. Firstly, excess market return and value factor are almost not correlated (0) while they found a negative correlation (-0.30). Secondly, the correlation of RMW and CMA of our case is positive while they got a negative one, which might indicate a higher level of investment is more associated with a higher level of profitability.

Additionally, to compare with Fama & French (2015) works of US market, we also make a correlation table between factors of Malaysia and US shown in Table 4.3. We can find that only market factor shows a relatively higher correlation at 0.36, while size factor owns a 0.16 correlation with US market. Other factors show very low level of correlations. This might suggest there is a huge development gap between emerging market like Malaysia and US market.

Table 4.3: Correlations between five risk factors of Malaysia market and US market from January 1992 to December 2019, 336 months in total. The US risk factors data is from Data Library of Kenneth R. French.

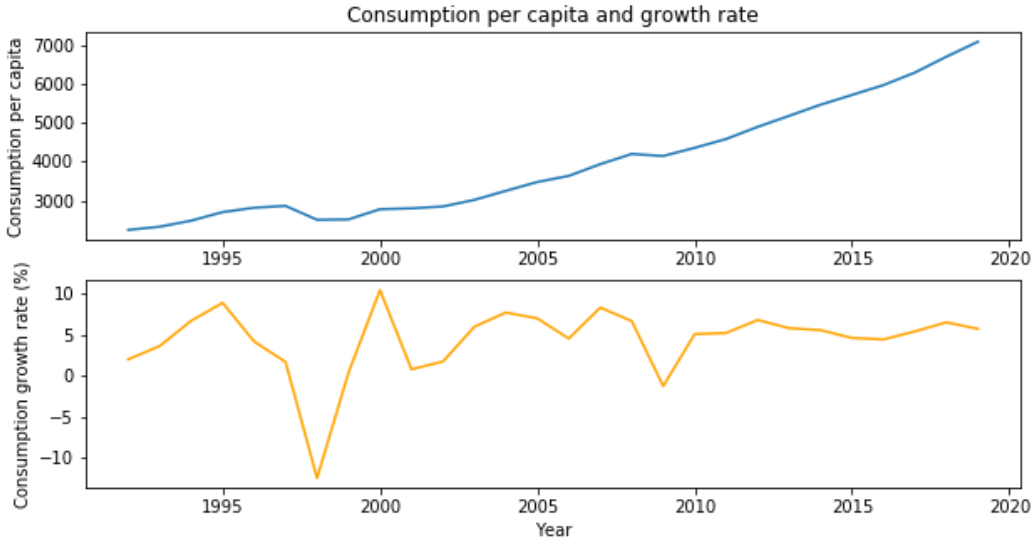
RM-RF	SMB	HML	RMW	CMA
0.36	0.16	0.04	0.09	0.08

For consumption data, we plot both consumption data and consumption growth rate of Malaysia during the period from 1992 to 2019 in Figure 3.1.

From the first figure we can notice that the consumption per capita show an increasing trend during the selected period though some fluctuations happened during Asian financial crisis and global financial crisis. From the second figure of consumption growth rate we can know the consumption growth rate fluctuate around 5% and the volatile of consumption growth rate gradually decreased

from 2000, which meaning the consumption level of Malaysia becomes more and more stable after Asian financial crisis.

Figure 4.1: Households and NPISHs Final consumption expenditure per capita and its growth (annual %) of Malaysia from 1992 to 2019. The data is from the World Bank national accounts data.



4.3. Time series regressions

Running time series regressions of excess return on CAPM, FF three-factor, five-factor and CCAPM models for each size-BM, size-OP and size-INV portfolios, we get the results in Tables 4.4 – 4.10.

4.3.1. Time series results for size-BM portfolio

Time series regressions of size-BM portfolio shows in Table 4.4. The intercepts of all factor models are close to zero, while some strong negative values happen in right top corner (extreme small size with high value). The lowest value showed in both FF three-factor and five-factor models are equally -0.01%, t-statistics are -2.82 and -3.08 respectively. Reasonably, CAPM owns the most negative value, while FF five-factor and three-factor have both 3 of 25 negatives, suggesting FF five-factor do not improve the explaining capability than three-factor model. This pattern of intercept is contradiction to Fama & French (2015) where they found 'negative problem' in the left top corner, though we both find in smallest size row.

When it comes to market factor, all slopes are close to 1. In addition, we can find that FF three-factor and five-factor model are closer to 1 than CAPM. This is consistent with Fama & French (2015).

Slopes of SMB are generally significantly positive, while some negative slopes appear in extreme big size quantile with growth (left bottom norner). Only one slope is insignificant in both FF three and five factors. This is also similar to Fama & French (2015).

Table 4.4: Results of time series regressions on size-BM sorted portfolios. Coefficients and t-statistics are showed together.

B/M	Low	2	3	4	High	Low	2	3	4	High
Panel A: CAPM										
			a					t(a)		
Small	0.00	-0.01	-0.01	-0.02	-0.02	0.37	-2.33	-3.13	-2.65	-4.81
2	0.02	0.00	-0.01	-0.01	-0.02	3.48	0.58	-2.63	-3.33	-6.10
3	0.01	0.00	0.00	-0.01	-0.01	1.95	-0.21	-0.60	-3.00	-3.10
4	0.02	0.01	0.00	0.00	-0.01	2.12	2.42	-0.43	-1.76	-3.29
Big	0.01	0.00	0.00	0.00	-0.01	4.63	0.40	-2.16	-0.97	-3.81
			b					t(b)		
Small	1.57	1.21	1.18	1.14	1.34	18.54	19.99	21.24	13.33	20.16
2	1.64	1.09	1.07	1.13	1.24	24.33	18.16	23.16	21.59	26.89
3	1.43	1.03	1.10	1.13	1.26	19.31	25.50	21.91	29.04	24.61
4	1.36	1.24	1.15	1.07	1.28	9.96	26.04	26.13	27.75	26.00
Big	0.86	0.84	0.90	0.96	1.14	26.57	32.44	35.22	32.68	33.37
Panel B: FF three-factor										
			a					t(a)		
Small	0.01	0.00	0.00	-0.01	-0.01	1.11	-0.71	-0.69	-1.22	-2.82
2	0.02	0.01	0.00	0.00	-0.01	5.38	2.63	0.78	-0.22	-3.02
3	0.01	0.01	0.01	0.00	0.00	2.98	2.56	3.25	1.10	0.24
4	0.02	0.02	0.01	0.01	0.00	1.81	6.04	2.15	2.77	0.48
Big	0.00	0.00	0.00	0.00	0.00	2.17	-1.69	-1.81	2.18	1.46
			b					t(b)		
Small	1.24	0.97	0.95	0.89	1.05	18.89	20.96	24.08	11.46	24.32
2	1.37	0.86	0.89	0.94	1.05	26.76	17.81	26.50	23.11	35.10
3	1.21	0.89	0.93	1.00	1.07	18.02	26.68	23.17	33.77	27.63
4	1.30	1.11	1.06	0.96	1.16	9.12	26.52	25.36	30.58	27.03
Big	0.94	0.86	0.93	0.94	1.07	30.76	33.44	35.86	32.93	39.83
			s					t(s)		
Small	1.31	0.94	0.90	0.96	1.14	16.88	17.22	19.37	10.40	22.49
2	1.06	0.86	0.70	0.73	0.72	17.60	14.92	17.70	15.07	20.31
3	0.86	0.54	0.65	0.52	0.73	10.81	13.73	13.73	14.78	15.99
4	0.20	0.49	0.35	0.40	0.43	1.20	9.94	7.14	10.67	8.48
Big	-0.29	-0.11	-0.14	0.09	0.29	-7.90	-3.64	-4.44	2.77	9.13
			h					t(h)		
Small	-0.07	0.22	0.37	0.29	0.50	-0.71	3.16	6.17	2.48	7.71
2	0.00	0.20	0.42	0.47	0.55	-0.02	2.78	8.19	7.63	12.14
3	0.08	0.26	0.49	0.46	0.48	0.77	5.09	8.02	10.18	8.20
4	-0.11	0.45	0.35	0.51	0.59	-0.49	7.11	5.47	10.61	9.03
Big	-0.25	-0.18	0.05	0.32	0.57	-5.32	-4.68	1.17	7.48	14.06
Panel C: FF five-factor										
			a					t(a)		
Small	0.01	0.00	0.00	-0.01	-0.01	1.86	-0.48	-0.57	-1.54	-3.08
2	0.02	0.01	0.00	0.00	-0.01	4.59	2.74	1.22	-0.37	-2.68

3	0.02	0.01	0.01	0.00	0.00	3.42	2.76	3.46	1.59	0.66
4	0.02	0.02	0.01	0.01	0.00	2.33	6.65	3.56	3.57	1.12
Big	0.00	0.00	0.00	0.01	0.00	1.60	-1.82	-1.05	2.97	1.51
			b					t(b)		
Small	1.14	0.95	0.94	0.97	1.10	16.05	18.64	21.43	11.37	23.66
2	1.45	0.86	0.87	0.96	1.03	26.08	15.95	23.56	21.29	31.21
3	1.28	0.89	0.89	0.97	1.01	18.82	24.28	20.20	29.96	24.08
4	1.22	1.05	0.96	0.92	1.08	7.82	23.07	21.98	26.92	23.33
Big	0.97	0.87	0.88	0.89	1.06	29.05	30.56	31.42	28.73	35.86
			s					t(s)		
Small	1.23	0.93	0.89	1.04	1.21	14.96	15.78	17.67	10.57	22.55
2	1.14	0.85	0.69	0.75	0.70	17.77	13.80	16.22	14.36	18.44
3	0.97	0.55	0.61	0.50	0.67	12.39	13.01	11.95	13.26	13.80
4	0.16	0.44	0.27	0.36	0.34	0.89	8.42	5.32	9.19	6.43
Big	-0.25	-0.10	-0.18	0.04	0.29	-6.59	-3.06	-5.63	1.23	8.43
			h					t(h)		
Small	0.01	0.24	0.37	0.26	0.50	0.08	3.33	6.09	2.17	7.58
2	-0.06	0.22	0.44	0.46	0.56	-0.79	2.93	8.56	7.31	12.12
3	0.14	0.28	0.50	0.48	0.50	1.44	5.35	8.04	10.56	8.44
4	0.04	0.49	0.43	0.55	0.62	0.17	7.71	7.04	11.43	9.55
Big	-0.27	-0.19	0.07	0.36	0.57	-5.76	-4.72	1.87	8.21	13.79
			r					t(r)		
Small	-0.15	0.00	-0.05	0.30	0.29	-1.35	-0.04	-0.76	2.23	3.92
2	0.16	0.03	0.01	0.07	-0.04	1.83	0.39	0.18	0.93	-0.73
3	0.70	0.09	-0.19	-0.02	-0.26	6.55	1.48	-2.75	-0.48	-3.96
4	0.22	-0.10	-0.15	-0.05	-0.32	0.89	-1.42	-2.17	-0.94	-4.44
Big	0.07	0.03	-0.13	-0.13	0.01	1.34	0.64	-3.00	-2.78	0.13
			c					t(c)		
Small	-0.28	-0.08	0.00	0.00	-0.11	-2.83	-1.07	0.06	-0.02	-1.68
2	0.19	-0.09	-0.12	0.01	-0.04	2.51	-1.20	-2.42	0.08	-0.82
3	-0.60	-0.12	0.05	-0.10	0.05	-6.40	-2.39	0.86	-2.22	0.93
4	-0.75	-0.15	-0.31	-0.16	0.02	-3.47	-2.31	-5.11	-3.38	0.24
Big	0.08	0.01	-0.06	-0.08	-0.02	1.69	0.37	-1.55	-1.89	-0.52
Panel D: CCAPM										
			a					t(a)		
Small	0.03	0.01	0.01	0.01	0.01	2.67	1.59	0.83	1.02	0.88
2	0.05	0.02	0.01	0.01	0.00	4.84	2.77	1.54	1.01	0.25
3	0.03	0.02	0.02	0.01	0.01	2.80	2.98	2.50	1.84	1.05
4	0.03	0.03	0.02	0.02	0.01	2.06	4.08	2.63	2.36	0.74
Big	0.03	0.02	0.01	0.02	0.02	4.34	4.11	2.67	3.16	2.35
			β_{c_t}					t(β_{c_t})		
Small	-0.39	-0.32	-0.22	-0.40	-0.46	-1.91	-2.14	-1.49	-2.23	-2.77
2	-0.55	-0.27	-0.25	-0.25	-0.26	-2.93	-1.92	-2.03	-1.85	-1.89
3	-0.19	-0.29	-0.29	-0.28	-0.22	-1.03	-2.49	-2.18	-2.28	-1.52
4	-0.01	-0.35	-0.28	-0.28	-0.16	-0.03	-2.53	-2.12	-2.41	-1.10
Big	-0.16	-0.31	-0.25	-0.30	-0.37	-1.69	-3.60	-2.74	-2.95	-3.13

The negative slopes of HML all show in the growth B/M column, which follows Fama & French (2015). However, they find all negative values are at a similar level while our slopes range from -0.25 to 0.08 for FF three-factor and from -0.27 to 0.14 for FF five-factor model. The minimum shows in macro-cap (-0.25 for FF three-factor and -0.27 for five-factor).

In Panel C, there are only 9 of 25 significant slopes for RMW. Most slopes of lower value (the first two columns) are positive while higher value tends to own more negative slopes. This pattern is contradiction to Fama & French (2015) as their negative slopes are more likely to show in lowest HML. Both of our work has the lowest slope in the growth micro-cap portfolio (left top corner).
Most slopes of CMA are insignificant (15 of 25). In addition, we cannot point out a clear pattern whether slopes are positive or negative, as negatives and insignificance appear in each row and column while most of coefficients are negative. By contrast, Fama & French (2015) found negative slope are more often showed in lowest HML and stay a similar level for different size.

For the negative intercept -0.01% showed in the smallest size with highest value portfolio, the slopes of RMW and CMA are 0.29 and -0.11 counterpart. This demonstrates that we do not meet the 'micro-cap problem' introduced by Fama & French (2015).

For CCAPM model, most of intercepts are significantly different from zero and left larger unexplained excess returns than FF models. The slopes of our CCAPM are strongly negative that is contradiction to theory as well as some previous empirical tests (Breeden, Gibbons & Litzenberger, 1989, for example).

The R^2 of each model for size-BM sorted portfolios are showed in Table 4.5. We can find that FF five-factor model always owns the highest R^2 for all portfolios ranging from 0.26 to 0.88 while most R^2 are larger than 0.7, suggesting it shows a higher quality of explaining the time series excess returns. Followed by FF three-factor model and CAPM, while CCAPM shows the least R^2 for all portfolios ranging from 0 to 0.04. This suggests us the CCAPM shows a very poor quality of explaining time series of excess return, which is consistent with our expectations.

Table 4.5: R-squared of time series regressions on size-BM sorted portfolios

B/M	Low	2	3	4	High
Panel A: CAPM					
Small	0.51	0.54	0.57	0.35	0.55
2	0.64	0.50	0.62	0.58	0.68
3	0.53	0.66	0.59	0.72	0.64
4	0.23	0.67	0.67	0.70	0.67
Big	0.68	0.76	0.79	0.76	0.77
Panel B: FF three-factor					
Small	0.74	0.76	0.81	0.51	0.83
2	0.81	0.70	0.82	0.77	0.88
3	0.65	0.79	0.76	0.85	0.82
4	0.23	0.77	0.73	0.82	0.77
Big	0.75	0.78	0.80	0.80	0.87
Panel C: FF five-factor					
Small	0.75	0.76	0.81	0.52	0.84
2	0.82	0.70	0.82	0.77	0.88
3	0.71	0.80	0.77	0.86	0.83
4	0.26	0.78	0.76	0.83	0.78
Big	0.75	0.78	0.81	0.81	0.87
Panel D: CCAPM					
Small	0.01	0.01	0.01	0.01	0.02
2	0.02	0.01	0.01	0.01	0.01
3	0.00	0.02	0.01	0.02	0.01
4	0.00	0.02	0.01	0.02	0.00
Big	0.01	0.04	0.02	0.03	0.03

4.3.2. Time series results for size-OP portfolio

Table 4.6 shows the results of time series regression for size-OP portfolio. The negative intercepts of CAPM generally concentrates on small size portfolio, while FF three-factor and five-factor models own the most zero intercepts. However, the negative values appear in smallest size portfolio with lowest profitability (left top corner), which is different from the size-BM portfolio. The intercepts of FF three-factor and five-factor models are at a similar level, demonstrating five-factor model do not show any improvement than three-factor model. Again, the many negative intercepts of CAPM suggests it does not fit well. From Fama & French (2015), they could not find any clear pattern of intercepts while most of them are close to zero.

Market and size factor show a similar pattern to size-BM portfolio. The slopes of RMRF are around 1. Most slopes of SMB are positive though there are some strong negatives show in the macro-cap portfolios.

Table 4.6: Results of time series regressions on size-OP sorted portfolios. Coefficients and t-statistics are showed together.

B/M	Low	2	3	4	High	Low	2	3	4	High
Panel A: CAPM										
	a					t(a)				
Small	-0.01	-0.01	-0.02	-0.01	-0.01	-2.82	-2.97	-4.11	-3.11	-0.87
2	0.00	-0.01	-0.01	-0.01	0.00	-0.89	-1.28	-1.46	-2.02	-0.11
3	0.00	-0.01	0.00	0.00	0.00	-1.03	-2.25	-0.98	0.21	0.81
4	0.00	0.00	0.01	0.00	0.01	-0.43	-0.68	0.88	0.02	2.47
Big	-0.01	0.00	0.00	0.00	0.01	-2.33	1.07	-0.29	-0.36	3.23
	b					t(b)				
Small	1.46	1.27	1.26	1.08	1.35	20.30	19.97	23.75	19.19	14.15
2	1.48	1.27	1.14	1.05	1.25	22.95	22.89	21.15	23.68	25.01
3	1.45	1.26	1.04	1.01	1.20	23.48	28.11	18.60	23.38	20.86
4	1.52	1.31	1.24	0.87	1.15	22.80	28.05	9.69	26.39	25.31
Big	1.18	1.13	0.87	0.74	0.77	35.34	33.08	33.05	28.39	27.10
Panel B: FF three- factor										
	a					t(a)				
Small	-0.01	0.00	0.00	0.00	0.00	-2.58	-0.87	-1.72	-1.11	0.53
2	0.01	0.00	0.01	0.00	0.01	1.69	1.50	1.93	0.45	2.77
3	0.01	0.00	0.00	0.01	0.01	1.97	0.90	0.52	3.39	3.65
4	0.01	0.01	0.01	0.01	0.01	1.91	3.93	1.26	3.13	4.44
Big	0.00	0.01	0.00	0.00	0.00	-1.72	2.27	-0.72	-1.25	2.23
	b					t(b)				
Small	1.15	1.00	1.03	0.85	1.03	22.26	21.88	29.46	20.55	12.50
2	1.23	1.06	0.94	0.87	1.03	24.58	24.62	22.82	25.93	29.70
3	1.21	1.10	0.88	0.86	1.06	25.94	30.98	17.26	24.23	20.05
4	1.39	1.18	1.21	0.79	1.04	21.65	30.99	9.01	26.57	24.24
Big	1.21	1.13	0.90	0.77	0.79	34.50	31.85	33.34	28.60	26.66
	s					t(s)				
Small	1.19	1.02	0.90	0.90	1.22	19.45	18.88	21.82	18.36	12.40
2	0.96	0.82	0.79	0.67	0.84	16.19	16.09	16.19	16.84	20.39
3	0.94	0.62	0.63	0.57	0.54	17.07	14.62	10.54	13.41	8.66
4	0.50	0.52	0.11	0.34	0.43	6.66	11.48	0.67	9.67	8.41
Big	-0.09	0.00	-0.13	-0.11	-0.08	-2.08	0.08	-3.98	-3.45	-2.18
	h					t(h)				
Small	0.02	0.35	0.40	0.30	0.25	0.27	5.06	7.66	4.84	2.01
2	0.36	0.36	0.45	0.26	0.24	4.71	5.49	7.18	5.16	4.48
3	0.41	0.38	0.19	0.32	0.46	5.82	7.01	2.41	6.01	5.81
4	0.48	0.59	0.21	0.29	0.24	4.94	10.22	1.03	6.43	3.66
Big	0.07	0.17	-0.02	-0.07	-0.07	1.34	3.19	-0.57	-1.81	-1.55
Panel C: FF five-factor										
	a					t(a)				
Small	-0.01	0.00	0.00	0.00	0.00	-1.86	-0.23	-1.64	-1.01	0.00
2	0.01	0.01	0.00	0.00	0.01	1.54	1.92	1.60	0.53	2.37

3	0.01	0.00	0.00	0.01	0.01	3.36	1.89	0.53	3.33	3.16
4	0.02	0.01	0.02	0.01	0.01	3.96	5.26	1.94	2.96	3.72
Big	0.00	0.01	0.00	0.00	0.00	-0.82	3.07	-0.65	-1.91	1.26
			b					t(b)		
Small	1.06	0.94	1.02	0.85	1.19	18.87	18.84	26.55	18.69	13.45
2	1.21	1.02	0.96	0.90	1.09	22.20	21.58	21.12	24.59	29.41
3	1.07	1.04	0.90	0.89	1.15	22.09	27.25	16.19	22.67	20.37
4	1.15	1.07	1.10	0.80	1.09	18.14	26.94	7.56	24.72	23.38
Big	1.10	1.06	0.91	0.82	0.87	30.76	27.71	30.14	28.36	27.88
			s					t(s)		
Small	1.10	0.97	0.90	0.91	1.39	16.99	16.84	20.21	17.23	13.59
2	0.92	0.79	0.81	0.70	0.91	14.69	14.43	15.38	16.78	21.20
3	0.81	0.56	0.67	0.60	0.65	14.44	12.81	10.43	13.21	9.90
4	0.29	0.42	0.04	0.36	0.47	3.93	9.14	0.23	9.64	8.77
Big	-0.20	-0.06	-0.12	-0.06	0.00	-4.83	-1.40	-3.60	-1.66	0.10
			h					t(h)		
Small	0.07	0.40	0.41	0.31	0.21	0.90	5.64	7.50	4.86	1.68
2	0.33	0.39	0.43	0.28	0.22	4.36	5.85	6.69	5.42	4.28
3	0.49	0.43	0.20	0.33	0.44	7.25	8.10	2.51	6.03	5.50
4	0.64	0.65	0.38	0.29	0.19	7.21	11.66	1.85	6.29	2.90
Big	0.11	0.21	-0.02	-0.09	-0.11	2.16	3.93	-0.47	-2.33	-2.49
			r					t(r)		
Small	-0.29	-0.11	0.01	0.07	0.68	-3.29	-1.38	0.13	0.98	4.88
2	-0.25	-0.06	0.02	0.20	0.29	-2.93	-0.76	0.33	3.44	4.92
3	-0.40	-0.08	0.20	0.15	0.41	-5.33	-1.40	2.29	2.52	4.64
4	-0.53	-0.25	0.17	0.11	0.07	-5.38	-4.02	0.75	2.09	1.02
Big	-0.41	-0.19	0.03	0.19	0.25	-7.39	-3.11	0.54	4.20	5.25
			c					t(c)		
Small	-0.08	-0.15	-0.02	-0.07	-0.13	-1.04	-2.17	-0.28	-1.17	-1.09
2	0.23	-0.11	0.08	-0.16	-0.08	3.05	-1.68	1.26	-3.14	-1.63
3	-0.17	-0.21	-0.15	-0.10	-0.08	-2.52	-3.94	-1.90	-1.90	-1.01
4	-0.47	-0.17	-0.82	-0.05	0.17	-5.38	-3.11	-4.10	-1.10	2.70
Big	0.03	-0.09	-0.03	0.00	0.05	0.64	-1.66	-0.68	0.07	1.19
Panel D: CCAPM										
			a					t(a)		
Small	0.01	0.01	0.01	0.01	0.03	0.98	1.21	1.16	1.01	2.50
2	0.03	0.02	0.01	0.01	0.02	3.08	1.96	1.61	1.88	2.82
3	0.01	0.02	0.02	0.02	0.03	1.35	2.26	1.98	2.65	3.15
4	0.02	0.02	0.03	0.02	0.03	1.84	2.80	1.77	2.73	3.20
Big	0.02	0.03	0.02	0.02	0.02	2.09	4.35	4.05	3.11	3.95
			β_{c_t}					t(β_{c_t})		
Small	-0.29	-0.32	-0.34	-0.26	-0.57	-1.59	-2.04	-2.33	-1.92	-2.81
2	-0.54	-0.27	-0.21	-0.26	-0.32	-3.11	-1.82	-1.53	-2.09	-2.22
3	-0.13	-0.35	-0.25	-0.22	-0.33	-0.79	-2.51	-1.87	-1.85	-2.22
4	-0.20	-0.35	-0.17	-0.20	-0.17	-1.13	-2.43	-0.70	-2.00	-1.30
Big	-0.25	-0.42	-0.35	-0.22	-0.16	-2.02	-3.60	-3.83	-2.68	-1.93

Different from our findings in size-BM portfolio, the negative slopes of HML are in the extreme biggest size. RMW factor has all negative slopes in the first two lower profitability columns, and it decreases with size increasing that is consistent with Fama & French (2015). Besides, we again cannot point out any pattern of CMA while most of them are negative.

Panel D presents the results of CCAPM, the intercepts of whose are again significant and larger than that of FF models. The slopes of consumption are also all negative, suggesting this model show a poor performance in our Malaysia data.

Table 4.7 showed the R^2 of each model for size-OP sorted portfolios. We can clearly find that FF five-factor model always has the highest R^2 for all portfolios in this sorted way ranging from 0.26 to 0.86 while most R^2 are larger than 0.7, suggesting it shows a higher quality of explaining the time series excess returns. FF three-factor model and CAPM hold the middle positions, while CCAPM shows the least R^2 for all portfolios ranging from 0 to 0.04. This suggests us the CCAPM shows a very poor quality of explaining time series of excess return, which is consistent with our expectations.

Table 4.7: R-squared of time series regressions on size-OP sorted portfolios

B/M	Low	2	3	4	High
Panel A: CAPM					
Small	0.55	0.54	0.63	0.52	0.37
2	0.61	0.61	0.57	0.63	0.65
3	0.62	0.70	0.51	0.62	0.57
4	0.61	0.70	0.22	0.68	0.66
Big	0.79	0.77	0.77	0.71	0.69
Panel B: FF three-factor					
Small	0.79	0.79	0.86	0.77	0.57
2	0.79	0.79	0.78	0.80	0.85
3	0.81	0.83	0.64	0.77	0.67
4	0.67	0.82	0.22	0.77	0.72
Big	0.79	0.77	0.78	0.72	0.69
Panel C: FF five-factor					
Small	0.80	0.79	0.86	0.77	0.60
2	0.80	0.79	0.78	0.81	0.86
3	0.83	0.84	0.64	0.77	0.69
4	0.74	0.84	0.26	0.77	0.73
Big	0.82	0.78	0.78	0.74	0.72
Panel D: CCAPM					
Small	0.01	0.01	0.02	0.01	0.02
2	0.03	0.01	0.01	0.01	0.01
3	0.00	0.02	0.01	0.01	0.01
4	0.00	0.02	0.00	0.01	0.01
Big	0.01	0.04	0.04	0.02	0.01

4.3.3. Time series results for size-INV portfolio

Table 4.8 are results of size-INV portfolios. The pattern of intercepts is similar to size-OP as most of values are close to zero, while there are some negative intercepts for both FF three and five factor models happen in micro-cap portfolios with low investment. Similarly, CAPM again holds larger constants.

Table 4.8: Results of time series regressions on size-INV sorted portfolios. Coefficients and t-statistics are showed together.

B/M	Low	2	3	4	High	Low	2	3	4	High
Panel A: CAPM										
			a					t(a)		
Small	-0.02	-0.01	-0.01	-0.01	0.00	-3.19	-3.02	-3.57	-3.27	-0.71
2	-0.01	-0.01	-0.01	-0.01	0.00	-1.44	-1.49	-2.21	-2.23	1.15
3	-0.01	0.00	0.00	0.00	0.00	-1.36	-0.65	-1.25	-0.16	0.22
4	0.01	0.00	0.00	0.00	0.01	0.71	-0.14	-0.89	1.20	1.56
Big	0.00	0.00	0.00	0.00	0.01	-1.78	0.59	-0.33	0.41	2.40
			b					t(b)		
Small	1.48	1.30	1.28	1.15	1.22	19.52	21.08	22.56	19.36	14.71
2	1.53	1.19	1.12	1.14	1.19	25.94	21.54	22.63	24.86	19.63
3	1.36	1.21	1.11	1.09	1.20	20.74	25.06	26.00	24.74	20.25
4	1.62	1.22	1.05	1.04	1.20	10.19	27.08	23.13	27.53	23.02
Big	1.06	0.89	0.85	0.93	0.86	39.42	30.69	29.65	33.37	22.68
Panel B: FF three-factor										
			a					t(a)		
Small	-0.01	0.00	0.00	0.00	0.00	-2.34	-1.07	-1.46	-1.19	0.51
2	0.00	0.00	0.00	0.00	0.02	1.22	0.96	-0.02	0.26	4.80
3	0.00	0.01	0.01	0.01	0.01	0.67	1.96	2.64	3.29	2.84
4	0.01	0.01	0.01	0.01	0.01	0.76	3.40	2.54	5.56	3.94
Big	0.00	0.00	0.00	0.00	0.01	-1.03	1.21	-1.96	0.26	3.04
			b					t(b)		
Small	1.14	1.05	1.03	0.92	0.94	22.18	22.75	27.04	19.92	13.22
2	1.29	1.00	0.92	0.96	0.95	29.63	21.86	24.87	27.20	20.86
3	1.18	1.06	0.96	0.92	1.00	19.62	25.46	29.18	27.27	20.14
4	1.62	1.12	0.91	0.93	1.08	9.67	27.51	23.64	29.65	22.01
Big	1.04	0.90	0.90	0.97	0.86	37.10	29.65	32.07	33.65	21.67
			s					t(s)		
Small	1.31	0.96	0.96	0.88	1.10	21.60	17.63	21.40	16.01	13.16
2	0.93	0.74	0.78	0.68	0.93	18.00	13.78	17.72	16.24	17.11
3	0.68	0.60	0.60	0.64	0.79	9.57	12.15	15.32	16.08	13.46
4	0.00	0.39	0.52	0.43	0.47	0.01	8.14	11.37	11.72	8.15
Big	0.07	-0.04	-0.21	-0.14	0.00	2.12	-1.04	-6.30	-3.97	-0.01

	h					t(h)				
Small	0.19	0.32	0.35	0.34	0.15	2.45	4.56	6.11	4.85	1.42
2	0.35	0.33	0.26	0.28	0.41	5.24	4.83	4.60	5.32	5.94
3	0.35	0.32	0.42	0.33	0.35	3.89	5.03	8.37	6.49	4.59
4	0.07	0.48	0.42	0.42	0.35	0.27	7.73	7.27	8.78	4.73
Big	0.05	0.08	-0.14	0.01	0.13	1.24	1.80	-3.24	0.24	2.09

Panel C: FF five-factor

	a					t(a)				
Small	-0.01	0.00	0.00	0.00	0.00	-1.80	-0.30	-1.46	-0.96	-0.11
2	0.01	0.01	0.00	0.00	0.01	1.94	1.61	-0.12	0.21	3.56
3	0.01	0.01	0.01	0.01	0.01	2.25	2.59	3.15	3.39	1.67
4	0.02	0.01	0.01	0.01	0.01	1.78	5.12	2.20	5.92	3.87
Big	0.00	0.00	0.00	0.00	0.00	0.20	2.14	-1.62	0.10	1.48
	b					t(b)				
Small	1.12	0.99	1.04	0.90	1.02	20.45	19.85	24.82	17.55	13.21
2	1.27	0.94	0.94	0.96	1.06	27.31	18.95	23.01	24.51	23.05
3	1.11	1.03	0.93	0.91	1.09	19.28	22.68	25.82	24.24	21.32
4	1.40	1.00	0.90	0.90	1.07	7.89	23.94	21.85	26.14	19.76
Big	0.99	0.85	0.88	0.97	0.96	33.76	26.25	28.38	30.50	25.08
	s					t(s)				
Small	1.32	0.92	0.98	0.85	1.18	20.83	15.93	20.29	14.48	13.22
2	0.93	0.70	0.80	0.68	1.00	17.29	12.20	16.98	14.97	18.97
3	0.66	0.58	0.57	0.63	0.85	9.96	11.08	13.81	14.61	14.46
4	-0.15	0.28	0.50	0.41	0.47	-0.71	5.92	10.40	10.34	7.46
Big	0.03	-0.07	-0.23	-0.14	0.08	0.88	-1.94	-6.39	-3.72	1.78
	h					t(h)				
Small	0.25	0.38	0.35	0.35	0.09	3.23	5.39	6.01	4.92	0.78
2	0.41	0.38	0.26	0.28	0.30	6.21	5.47	4.47	5.10	4.59
3	0.51	0.36	0.45	0.34	0.24	6.28	5.75	8.84	6.50	3.31
4	0.36	0.57	0.39	0.44	0.35	1.45	9.69	6.74	9.08	4.61
Big	0.11	0.13	-0.13	0.00	0.01	2.68	2.83	-2.87	0.04	0.19
	r					t(r)				
Small	0.21	-0.04	0.10	-0.06	0.17	2.39	-0.45	1.45	-0.78	1.37
2	0.15	-0.06	0.10	-0.03	0.02	2.11	-0.81	1.62	-0.48	0.35
3	0.34	0.04	-0.02	-0.03	-0.04	3.81	0.53	-0.29	-0.58	-0.55
4	0.17	-0.23	-0.20	-0.04	-0.03	0.60	-3.52	-3.11	-0.81	-0.30
Big	-0.02	-0.03	-0.05	-0.03	0.03	-0.47	-0.54	-1.07	-0.62	0.56
	c					t(c)				
Small	-0.36	-0.25	-0.06	-0.03	0.22	-4.75	-3.59	-0.98	-0.42	2.07
2	-0.34	-0.19	-0.04	0.03	0.51	-5.25	-2.71	-0.76	0.62	7.96
3	-0.85	-0.23	-0.13	-0.03	0.51	-10.65	-3.67	-2.56	-0.49	7.20
4	-1.38	-0.30	0.25	-0.08	0.01	-5.65	-5.14	4.29	-1.71	0.13
Big	-0.25	-0.19	-0.03	0.06	0.50	-6.10	-4.33	-0.73	1.25	9.37

Panel D: CCAPM

	a					t(a)				
Small	0.02	0.01	0.01	0.01	0.03	1.35	1.31	0.90	1.00	2.36
2	0.02	0.01	0.01	0.02	0.03	2.14	1.39	1.83	2.16	3.84

3	0.02	0.02	0.02	0.02	0.02	1.62	2.42	2.06	2.76	2.51
4	0.02	0.03	0.02	0.02	0.02	1.30	3.25	2.26	3.27	2.62
Big	0.02	0.02	0.02	0.02	0.02	3.44	3.87	3.10	3.68	3.33
			β_{c_t}					$t(\beta_{c_t})$		
Small	-0.45	-0.33	-0.27	-0.29	-0.44	-2.41	-2.11	-1.76	-2.00	-2.45
2	-0.35	-0.18	-0.29	-0.33	-0.44	-2.01	-1.23	-2.21	-2.53	-2.96
3	-0.25	-0.28	-0.23	-0.27	-0.26	-1.50	-1.99	-1.79	-2.19	-1.74
4	-0.05	-0.37	-0.24	-0.24	-0.14	-0.16	-2.78	-1.98	-2.09	-1.00
Big	-0.38	-0.30	-0.24	-0.29	-0.15	-3.52	-3.19	-2.62	-3.00	-1.49

The RMRF and SMB maintain the similar pattern with the previous sorted portfolios. RMRF owns slopes close to 1 and negative slopes of SMB appear in the biggest size while most coefficients of SMB are significantly positive. The slopes of HML are generally positive with an only negative (-0.13) for FF five-factor in macro-cap portfolio. Besides, negative slopes of RMW does not show a clear pattern as the number of positive and negative coefficients seem to be equal. For CMA factor, there are only positive slopes in the highest investment column while other investment columns are all negative, which is definitely opposite to Fama & French (2015) that they only found negatives in the most aggressive investment.

When it comes to the CCAPM model, we find it also shows a poor quality that significant intercepts with all negative consumption slopes. This suggests CCAPM is not sensitive to these three methods of portfolio sorting and always show a poor performance.

The R^2 of each model for size-INV sorted portfolios are showed in Table 4.9. We can find that FF five-factor model always owns the highest R^2 for all portfolios ranging from 0.31 to 0.85 while most R^2 are larger than 0.7, suggesting it shows a higher quality of explaining the time series excess returns. Followed by FF three-factor model and CAPM, while CCAPM shows the least R^2 for all portfolios ranging from 0 to 0.04. This suggests us the CCAPM shows a very poor quality of explaining time series of excess return, which is consistent with our expectations.

Table 4.9: R-squared of time series regressions on size-INV sorted portfolios.

B/M	Low	2	3	4	High
Panel A: CAPM					
Small	0.53	0.57	0.60	0.53	0.39
2	0.67	0.58	0.61	0.65	0.54
3	0.56	0.65	0.67	0.65	0.55
4	0.24	0.69	0.62	0.69	0.61
Big	0.82	0.74	0.72	0.77	0.61
Panel B: FF three-factor					
Small	0.81	0.78	0.84	0.74	0.60
2	0.84	0.74	0.80	0.81	0.76
3	0.67	0.77	0.82	0.81	0.72
4	0.24	0.77	0.75	0.81	0.69
Big	0.83	0.74	0.76	0.78	0.61
Panel C: FF five-factor					
Small	0.82	0.79	0.84	0.74	0.61
2	0.85	0.75	0.80	0.81	0.81
3	0.75	0.78	0.83	0.81	0.76
4	0.31	0.80	0.76	0.81	0.69
Big	0.85	0.76	0.76	0.78	0.70
Panel D: CCAPM					
Small	0.02	0.01	0.01	0.01	0.02
2	0.01	0.00	0.01	0.02	0.03
3	0.01	0.01	0.01	0.01	0.01
4	0.00	0.02	0.01	0.01	0.00
Big	0.04	0.03	0.02	0.03	0.01

This comparison tells us the time series regressions of FF models are far better than CCAPM for all three double-sorted portfolios, while FF five-factor do not improve significantly from three-factor model in our data. For the quality of time series regressions, FF five-factor always shows the best while CCAPM have the least R^2 that even close to zero.

4.4. GRS tests

To dive deeper to the capability these models explaining the excess return, we then test whether these intercepts of different portfolios jointly equal to zero by conducting the GRS tests and results are showed in Table 4.10.

GRS value is the F-statistic of joint test that a higher GRS leads to reject the hypothesis that intercepts jointly equal to zero, a lower GRS therefore stands for a better performance of model to explain the excess expected return. From the results below, we conclude all of the models fail to explain the expected return properly from GRS test. In addition, we can find that size-INV portfolios generally have a lowest level of GRS (ranging from 2.57 to 4.68 and have the most value between 2 and 3) while size-BM have the highest GRS and some are even higher than 10. Differently, Fama & French (2015) showed the best performance in their size-OP portfolios.

For the size-B/M portfolio, FF three-factor model owns the best GRS (6.10). Having a GRS level of 6.27, FF five-factor model cannot even outperform than the easy combination of RMRF and HML factors as well as some four-factor model. Comparing GRS of all these models in this portfolio set, we can judge that HML factor is the 'core factor' in these tests. That is, whenever we include HML factor in the model, the performance in explaining the intercept will improve significantly.

In addition to the fact that five-factor model have a lower GRS than the four-factor without HML, we can conclude HML is not redundant in our data that is in contradiction to Fama & French (2015). By contrast, our results for size-B/M portfolio is very sensitive to HML factor. In terms of the absolute intercept A|a|, we also find a similar pattern that HML leads to a better power of excess return description.

When it comes to Panel B of size-OP portfolio, 'two-factor model' of market and profitability factors shows the lowest GRS at 3.07. Although FF five-factor (4.13) shows a better performance than FF three-factor model (4.21), there are still many other combinations have lower GRS. Also, we find the

RMW factor is the 'core factor' to decrease the GRS, suggesting this size-OP portfolio is sensitive to profitability factor. This set also owns a lower level of absolute intercept than last sort and the pattern is consistent with the GRS results.

Table 4.10: Results of GRS test for different combinations of factors. GRS stands for the GRS stat and p-value of GRS test presented together. A|a| is the average absolute intercept that is calculated by adding all intercepts. R^2 is showed to assess the quality of each test.

	GRS	p-value	A|a|	R^2
Panel A: size-B/M				
RMRF	9.60	3.58E-26	0.009	0.61
HML	6.38	9.57E-17	0.012	0.02
RMRF, SMB	9.69	2.15E-26	0.009	0.72
RMRF, HML	6.13	5.91E-16	0.006	0.64
RMRF, SMB, HML	6.10	7.37E-16	0.007	0.75
RMRF, SMB, RMW	9.92	5.34E-27	0.009	0.73
RMRF, SMB, CMA	10.40	2.67E-28	0.009	0.73
RMRF, SMB, HML, RMW	6.13	6.12E-16	0.007	0.75
RMRF, SMB, HML, CMA	6.28	2.12E-16	0.008	0.76
RMRF, SMB, RMW, CMA	10.41	2.68E-28	0.009	0.73
RMRF, SMB, HML, RMW, CMA	6.27	2.26E-16	0.008	0.76
Consumption growth rate	5.89	3.14E-15	0.019	0.01
Panel B: size-OP				
RMRF	3.31	4.88E-07	0.006	0.61
RMW	3.43	1.96E-07	0.010	0.21
RMRF, SMB	3.38	2.82E-07	0.004	0.72
RMRF, RMW	3.07	2.69E-06	0.004	0.63
RMRF, SMB, HML	4.21	6.97E-10	0.006	0.74
RMRF, SMB, RMW	3.18	1.27E-06	0.004	0.73
RMRF, SMB, CMA	3.30	5.22E-07	0.004	0.72
RMRF, SMB, HML, RMW	4.01	3.02E-09	0.006	0.75
RMRF, SMB, HML, CMA	4.19	8.09E-10	0.007	0.74
RMRF, SMB, RMW, CMA	3.19	1.18E-06	0.004	0.73
RMRF, SMB, HML, RMW, CMA	4.13	1.22E-09	0.007	0.75
Consumption growth rate	2.61	6.66E-05	0.019	0.01

Panel C: size-INV				
RMRF	2.74	2.71E-05	0.006	0.61
CMA	2.84	1.37E-05	0.010	0.10
RMRF, SMB	2.98	5.30E-06	0.005	0.72
RMRF, CMA	2.57	8.97E-05	0.005	0.63
RMRF, SMB, HML	4.68	2.13E-11	0.006	0.74
RMRF, SMB, RMW	2.96	5.74E-06	0.005	0.72
RMRF, SMB, CMA	2.78	2.16E-05	0.004	0.74
RMRF, SMB, HML, RMW	4.59	4.14E-11	0.006	0.74
RMRF, SMB, HML, CMA	4.29	3.68E-10	0.006	0.75
RMRF, SMB, RMW, CMA	2.87	1.09E-05	0.004	0.74
RMRF, SMB, HML, RMW, CMA	4.32	3.06E-10	0.007	0.76
Consumption growth rate	2.23	8.87E-04	0.019	0.01

For the size-INV portfolio in Panel C, again, the joint of market factor and investment factor itself shows the best performance at 2.57. FF five-factor model outperform than the FF three-factor model, however, there are still other models have lower GRS. In this set, CMA becomes the 'core factor' in explaining the intercept.

We also run the GRS test to assess how CCAPM works in explaining the excess return.

Reasonably, the R^2 of all three tests are only 0.01, suggesting a very poor quality.

To sum up, all our models are rejected by the GRS test. Specifically, these factor models with the specified sorted-factor show a better performance, suggesting our portfolios are extremely sensitive to the sorted-indicator. This might because we have less companies and stock data in each selected period compare to Fama & French (2015). In addition, our CCAPM model has very poor quality even though it always owns lower GRS statistics.

From the GRS test results, we can find it does not follow the pattern like adding a factor makes the model fit better, so we wonder if there are any factors that is redundant. Following the process of factor regressions by Fama & French (2015) to test if HML is redundant in their work, we also do the same job to check if one factor can be construct by others in explaining expected return. The result shows in Table 4.11.

Table 4.11: Results of factor regressions. Each row represents regressing one factor by the others. Each coefficient is showed with their level of t-statistic. R^2 is showed to assess the quality of regression.

		Constant	RM-RF	SMB	HML	RMW	CMA	R^2
RM-RF	coefficients	0.01		0.12	0.12	-0.53	-0.19	0.26
	t-stat	3.58		1.87	1.56	-6.62	-2.50	
SMB	coefficients	0.00	0.09		0.01	-0.45	-0.06	0.22
	t-stat	-0.12	1.87		0.17	-6.43	-0.89	
HML	coefficients	-0.02	0.06	0.01		0.06	0.18	0.05
	t-stat	-8.62	1.56	0.17		0.95	3.39	
RMW	coefficients	0.00	-0.22	-0.25	0.05		0.27	0.41
	t-stat	1.70	-6.62	-6.43	0.95		5.93	
CMA	coefficients	0.01	-0.10	-0.04	0.19	0.35		0.25
	t-stat	2.71	-2.50	-0.89	3.39	5.93		

For factor regressions of market factor, value factor and investment factors, the constants are statistically significant with t statistics are 3.58, -8.62 and 2.71 respectively. To be noticed, the intercept of HML is the strongest significant, which is consistent with the fact that HML shows the best capability of return description in GRS test while is contradiction to Fama & French (2015) as they suggested the HML factor is redundant in U.S. during the period from July 1963 to December 2013. However, the constants of regressions on SMB and RMW factors are both not significant (t = -0.12 and t = 1.70, respectively), suggesting these two factors can be explained by all other factors without significant intercepts left.

In the regression of SMB, only the slope of RMW factor owns statistically significant and a dominant position (-0.45, with t stat equals to -6.43) in explaining SMB, however, RMW is also redundant as we discussed. Therefore, we still leave part of excess returns not be explained. Besides, when it comes to RMW regression, RMRF, SMB and CMA all account for big positions with significantly absolute values ranging from 0.22 to 0.27. That is, the excess return of RMW factor is almost equally absorbed by RMRF, SMB and CMA factors.

We can find that both SMB and RMW are redundant and inter-explained by each other, suggesting we will still leave some unexplained excess return even by excluding SMB and RMW.

Additionally, excluding two redundant factors, SMB and RMW, we construct a new three-factor model that only include RMRF, HML and CMA factors and GRS test results for different sorted portfolios showed in Table 4.12. We get a GRS of 6.21 for size-BM portfolios, where the FF three-factor is 6.10 while the FF five-factor is 6.27. This means the performance of our combination of RMRF, HML and CMA factors in explaining excess return is better than FF five-factor model though is worse than FF three-factor for size-BM portfolios. For size-OP portfolios, the GRS of our model is 4.03 while FF three-factor and FF five-factor is 4.21 and 4.13 respectively.

This suggests our three-factor model shows a better performance than FF models in size-OP portfolios. Finally, we get a GRS of 3.91 for size-INV portfolio, where FF three-factor and FF five-factor model own GRS of 4.68 and 4.32 respectively. That is, our combination of market, value and investment factors is better than both FF three-factor and five-factor models.

Table 4.12: Results of GRS test for combination of RMRF, HML, CMA factors. GRS stands for the GRS stat and p-value of GRS test presented together. A|a| is the average absolute intercept that is calculated by adding all intercepts. R^2 is showed to assess the quality of each test.

	GRS	p-value	A|a|	R^2
Panel A: size-B/M				
RMRF, HML, CMA	6.21	3.27E-16	0.007	0.65
Panel B: size-OP				
RMRF, HML, CMA	4.03	2.60E-9	0.006	0.63
Panel C: size-INV				
RMRF, HML, CMA	3.91	6.16E-9	0.006	0.64

To sum up, our model that combines RMRF, HML and CMA factors generally shows a better performance than FF three-factor and FF five-factor models in explaining excess expected returns though it still cannot pass the GRS test. We can therefore conclude the SMB and RMW factors are redundant in Malaysia stock market. However, the three-factor model exclude size and profitability still leaves some unexplained excess returns.

4.5. Fama-Macbeth tests

If all the models that are research objects of this study hold in the reality, the intercept of regression of each model should be equal to zero. However, the zero intercept is not the sole implication of such models. Rather, all models also imply that there are linear relationships between average returns and relevant betas (regression coefficients). For example, in the Capital Asset Pricing Model (CAPM), it is implied that the average returns are linearly related to the market beta. For the Fama and French three-factor model, it can be drawn that there is a linear relation between average returns and three distinctive betas which are beta of value factor, beta of size factor, and beta of the market factor. For the Fama and French five factor model, it can be easily concluded that the average returns are linearly related to four respective betas which are beta of value factor, beta of size factor, beta of investment factor, beta of profitability factor, and beta of the market factor. Similarly, for the Consumption-based CAPM, it implies a linear relation between average returns and consumption beta. With the Fama-Macbeth method, one can use it to estimate the risk premia of relevant factors in each model.

After running the cross-sectional regressions (Fama-Macbeth regression) using 5x5 portfolios double sorted by size-B/M, size-Inv, size-OP, we report the regression outputs as follows, from Tables 4.13 – 4.18.

4.5.1. For portfolios double-sorted by size-B/M

Table 4.13: Results of cross-sectional OLS regressions for portfolios sorted in size-BM. R^2 and risk premiums of different risk factors are provided.

Model	R^2	γ_0	γ_1	γ_2	γ_3	γ_4	γ_5
CAPM	0.103	-0.015	0.018				
CCAPM	0.022	0.011	0.016				
FF3	0.683	-0.028	0.043	-0.004	-0.024		
FF5	0.695	-0.025	0.039	-0.004	-0.023	-0.012	-0.019

Table 4.14: Results of cross-sectional OLS regressions for portfolios sorted in size-BM (T-Statistics)

Model	γ_0	γ_1	γ_2	γ_3	γ_4	γ_5
CAPM	-2.654	2.555				
CCAPM	2.097	1.274				
FF3	-3.726	4.690	-1.119	-6.484		
FF5	-3.865	5.040	-1.034	-6.128	-2.156	-2.641

As we can see from the R-squared information, CCAPM is the least efficient model in explaining the cross-section of average returns since the associated R-squared is only 2 percent. The CAPM model can explain only 10.3% of the cross-section of the average returns. Meanwhile, FF3 and FF5 models show the most impressive results when the models can explain 68.3% and 69.5% the cross-sections of average returns. Put it differently, the concerned factors in both models are effective in capturing the variation of average returns cross-sectionally. However, considering the difference between the R-squared of cross-sectional regression output of the two model, it is noticed that the one of the FF5 is just slightly larger than that of the FF3 model. It means that the addition of two more variables which are investment and profitability does not improve the situation much.

Considering the intercept, if the models hold, the intercept of each model should be equal to zero. Regarding the intercept of the CCAPM, the absolute value of is relatively huge, amounting to 1.1

percent. Since the t-statistics of the intercept smaller than -1.96, we can reject the hypothesis that the intercept is equal to zero. In other words, the intercept for the CCAPM model is statistically different from zero. Regarding the intercept of CAPM, the absolute value is -0.015 or negatively contributed to the average returns of 1.5%. this number is quite big. This phenomenon is confirmed when the t-stat of the intercept is 2.555 which is bigger than 1.96. We can reject the hypothesis that the intercept of the CAPM model is equal to zero. For the FF3 model, the intercept equals -0.028, equivalent to 2.8% negative contribution to the average returns. This intercept is quite big. The phenomenon is supported by the t-stat being -3.726 which is smaller than -1.96, meaning that we can reject the hypothesis that the intercept is equal to zero. Last, for the FF5 model, the intercept is -0.025 which is equivalent to the -2.5% contribution towards the average returns. The t-stat for this intercept is -3.865 which is smaller than -1.96, meaning that we can reject the hypothesis that the intercept is equal to zero. From all information, we can easily see that all models do not hold in the reality with the cross-sectional data. In other words, all tested models are invalid.

For the CAPM model, the beta 1 has the risk premium of 0.018. Put it differently, if the beta increases by 1, the average returns would increase by 1.8%. However, the t-stat of this risk premium (gamma) is 2.555 which is greater than 1.645, meaning that we can reject the hypothesis that there the true gamma or risk premium is equal to zero. So, it indicates that there is a linear relation between the market beta and average returns as what believed by the CAPM. For the CCAPM, the gamma 1 is 0.011 which is equivalent to 1.1%. This can be explained that if market beta increase by 1 unit, the average returns increase by 1.1%. Considering that t-stat which numbers 1.274 and small than 1.645, we cannot reject the hypothesis that the true gamma or market risk premium is equal to zero. Therefore, it comes to conclusion that there is a no linear relationship between the market beta and the average returns. For the FF3 model, the gamma 1 numbers at 0.043. This means that if the market beta increases by 1 unit, the average returns would go up by 4.3%. However, that the t-stat is 4.69 and greater than 1.645 means that we can reject the hypothesis that the true gamma is equal to zero. In this case, there is a positive linear relation between average returns and market beta. For the FF5 model, the gamma 1 is 0.039 which can be explained that if the market beta increases by 1 unit, the average return would climb by 3.9%. Taking into account its t-stat which is at 5.040 and greater than 1.645, we can reject the hypothesis that the true gamma 1 is zero. Put it differently, the market beta is linearly related to the average returns.

Regarding the gamma 2 of the FF3 model, we can see that it is relatively small at -0.004. To explain this number, if the size beta increases by 1 unit, the average returns would go down by -0.4%, implying the negative relation between the average returns and size beta. Looking into the t-stat which numbers at -1.119 and greater than -1.645, we cannot reject the hypothesis that the true gamma 2 is equal to zero. In other words, it declines a linear relation between the average returns and size beta. Regarding the FF5 model, the gamma 2 is -0.004 which is quite small. The explanation for this number is that if size beta increases by 1 unit, the average returns would decline by 0.4%. We found that the linear relation between the average returns and size beta is statistically insignificant. Since the t-stat is -1.034 which is much greater than -1.645, we cannot reject the hypothesis that the true gamma 2 is equal to zero.

Regarding the gamma 3 of the FF3 model, the value is -0.024, meaning that if the value beta increases by 1 unit, the average returns would decline by 2.4%. This shows a negative relation between average returns and value factor. The t-stat for the value of gamma 3 is only -6.484 which is smaller than -1.645, so we can reject the hypothesis that gamma 3 is equal to zero. Put it differently, there is a linear relationship between the average return and gamma 3 of the FF3 model. Meanwhile, the gamma 3 of the FF5 model is -0.023 which means that if the value beta rises by 1 unit, the average return would reduce by 2.3%. The t-stat for this gamma is -6.128 which is smaller than the critical value -1.645 so that we can reject the hypothesis that the gamma 3 of the FF5 model is equal to zero. In other words, the linear relation between the average returns and the value factor is robust, considering the cross-sectional data sets.

When it comes to the gamma 4, its value is -0.012 and indicates a negative impact on the average returns. To interpret this number, we can observe the 1.2% decrease in average returns if the profitability beta increases by 1 unit. The t-stat for gamma 4 is -2.156 and smaller than the critical value of -1.645, meaning that we can reject the hypothesis that the profitability beta is indifferent from zero. In short, the relation between the average return and the profitability beta is statistically significant.

For the final gamma, the regression output shows the negative relationship between investment beta and the average return, numbering at -0.019. This can be explained that when investment beta increases by 1 unit, the average returns would go down by 1.9%. The t-stat of this gamma 5 is -2.641

which is smaller than the critical value of -1.645. From this point, we can reject the hypothesis that the investment beta is zero. In other words, it has a linear relation to the average return.

4.5.2. For portfolios double-sorted by size-OP

Table 4.15: Results of cross-sectional OLS regressions for portfolios sorted in size-OP. R^2 and risk premiums of different risk factors are provided.

Model	R^2	γ_0	γ_1	γ_2	γ_3	γ_4	γ_5
CAPM	0.007	0.010	-0.002				
CCAPM	0.041	0.010	0.011				
FF3	0.373	0.000	0.010	-0.009	0.007		
FF5	0.602	-0.016	0.026	-0.011	0.008	0.011	0.001

Table 4.16: Results of cross-sectional OLS regressions for portfolios sorted in size-OP (T-statistics)

Model	γ_0	γ_1	γ_2	γ_3	γ_4	γ_5
CAPM	2.060	-0.359				
CCAPM	2.137	1.176				
FF3	0.089	1.405	-2.374	1.208		
FF5	-2.129	3.094	-2.878	1.359	2.635	0.141

Comparing the R-squared values of different regression output, we can see the vast gaps. For the CAPM, this model can explain only 0.7% of the variation of the average returns which is significantly smaller than the R-squared of the regression over the size-B/M portfolios. The CCAPM in this case can explain 4.1% of the variation of the average returns. This result is inferior to what have been obtained using the size-B/M sorted portfolios. For the FF3 model, the R-squared is 37.3% which is a significant improvement over the CAPM and CCAPM. However, with this R-squared, the FF3 model seems to be less effective in describing the variation of the average returns than itself when using the size-B/M portfolios. For the FF5 model, the R-squared value is a huge improvement to both the FF3 model, however, inferior to itself when regressing using the size-B/M portfolios. In this case, the FF5 model can explain around 60.5% of the variation of the portfolio average returns.

As one of the requirements for all the models to be valid is having zero intercept, we can easily notice that only the FF3 model satisfies this criterion, taking into account its regression output. For the CAPM model, the intercept of the regression output is 0.01 which will contribute 1% towards the average returns. Since the t-stat for the intercept of CAPM is 2.060 which is higher than the critical value of 1.96, we can reject the hypothesis that the intercept is equal to zero. Put it differently, the CAPM does not hold with the size-OP sorted portfolios. For the CCAPM model, the regression intercept is 0.01 as well. Considering the intercept's t-stat which is 2.137 and greater than the critical value of 1.96, we can reject the hypothesis that the intercept is zero. This means that the CCAPM also does not hold with the size-OP sorted portfolios. For the FF3 model, the regression intercept is 0.000 and becomes the only zero regression intercept that meets the validity requirement. Because the t-stat in this case is 0.089 which is smaller than the critical value of 1.96, we cannot reject the hypothesis that the intercept is zero. Therefore, the intercept of FF3 model is valid. The FF3 model is valid in case of size-OP sorted portfolios. For the FF5 model, the intercept is -0.016 which dictates a negative impact on the average returns created by the profitability beta. However, the t-stat for this intercept is -2.129 which is smaller than the critical value of -1.96, so we can reject the hypothesis that the intercept of the FF5 model is zero. In other words, the FF5 model does not hold in this case.

Regarding the gamma 1 of the CAPM, the value is -0.002, meaning that the size beta increases by 1 unit, the average returns would go down by -0.2 percent. Considering the t-stat which is -0.359 and is bigger than the critical value of -1.645, we cannot reject the hypothesis that the true gamma 1 is equal to zero. Put it differently, there is no negative linear relation between the average returns and the market beta. For the CCAPM, the gamma 1 is 0.011, meaning that if the market beta increases by 1 unit, the average returns would go up by 1.1%. As the t-stat for this gamma 1 is 1.176 which is smaller than the critical value of 1.645. we cannot reject the hypothesis that the true gamma 1 is zero. To explain it differently, the average return is not linearly related to the market beta. For the FF3 model, the regression gamma 1 is 0.01 or the average return would go up by 1% if the market beta increases by 0.01. Since the t-stat for this number is 1.405 which is smaller than the critical value of 1.645, we cannot reject the hypothesis that the true gamma 1 for FF3 model is equal to zero. Differently speaking, there is no positive linear relation between the average return and the market beta. This result is opposite to what have been obtained by double sorting the portfolios by size and B/M. Thus, it means that sorting the portfolios differently can expose the impact of the market beta on average return. For the FF5 model, the gamma 1 is 0.026, dictating that if the market beta increases

by 1 unit, the average return would improve by 2.6%. The t-stat of this gamma is 3.094 which is bigger than the critical value of 1.645. Therefore, we reject the hypothesis that the true gamma 1 of the FF5 model is equal to zero. Put it differently, there is a statistically significant linear relation between the average return and the market beta in this selection of portfolios.

Regarding the gamma 2 of the FF3 model, it is only -0.009. This can be interpreted as if the size beta increases by 1 unit, the average return would decrease by 0.9%. However, when looking at the t-stat of this gamma 2, we can see that the value is -2.374 and smaller than the critical value of -1.645. Thus, we can reject the hypothesis that the true gamma 2 is equal zero, meaning that the average return is linearly related to the size beta. This result is contradictory to what have been found by sorting the portfolio by size and B/M which indicates a statistically insignificant size risk premium. For the FF5 model, the gamma 2 is -0.011, meaning that the average return would decline by 1.1% if the size beta increase by 1 unit. Since the t-stat of this gamma 2 is -2.878 and smaller than the critical value of -1.645, we can reject the hypothesis that the true gamma 2 is equal to zero. Thus, there is a negative linear relation between average return and the size beta if we use the double-sorted size-OP portfolios for the regression. Compared to what have been found by sorting the portfolios by size-B/M, we see a contradiction since the latter case results in no impact of the size beta and average returns.

Regarding the gamma 3 of the FF3 model, it is only 0.007 which means that the average return will be going up by 0.7% if the value beta is increasing by 1 unit. This impact is relatively small. With the t-stat of this gamma 3 is 1.208 and smaller than the critical value of 1.645. we cannot reject the hypothesis that the true gamma 3 is distinguishable from zero. This turns down the linear relation between the average return and the value beta. However, this result is opposite to the results obtained by sorting the portfolios by size-B/M which presents such a relation. Meanwhile, the gamma 3 of the FF5 model is 0.008 and means that if the value beta increases by 1 unit, the average return would climb up by 0.8%. Not only is the gamma's absolute value small but also it is statistically insignificant. Considering the t-stat of this gamma 3 is 1.359 that is smaller than the critical value of 1.645, we cannot reject the hypothesis that the true gamma 3 of the FF5 model is indifferent from zero. Thus, there is not a linear relation between the average return and the value beta. This result is also contradictory to what we have found by sorting the portfolios by size-B/M which insists such a relation.

For the gamma 4 of the FF5 model, we do see the impact is 0.011 that means that the average return will increase by 1.1% if we increase the profitability beta by 1 unit. Considering the t-stat of this gamma 4, we notice that the value is 2.635 which is bigger than the critical value of 1.645, we can reject the hypothesis that the true gamma 4 is statistically insignificant. This leads to the conclusion that the average return is linearly related to the profitability beta. This result is also consistent with what have been found by sorting the portfolios by size-B/M. Switching between the portfolio construction methods does not affect the impact of the profitability beta.

For the gamma 5 of the FF5 factor, the regression output gives the value of 0.001, meaning that the average return increases by only 0.1% if we increase the investment beta by 1 unit. The t-stat of this gamma 5 is 0.141 and smaller than the critical value of 1.645, we cannot reject the hypothesis that the true gamma 5 is equal to zero. This means that a positive linear relation between the average return and the investment beta is declined. This phenomenon conflicts with what have been obtained by sorting the portfolio by size-B/M. Therefore, changing the portfolio construction method can demonstrate the impact of the investment beta on the average returns.

4.5.3. For portfolios double-sorted by size-INV

Table 4.17: Results of cross-sectional OLS regressions for portfolios sorted in size-INV. R^2 and risk premiums of different risk factors are provided.

Model	R^2	γ_0	γ_1	γ_2	γ_3	γ_4	γ_5
CAPM	0.002	0.009	-0.002				
CCAPM	0.209	0.016	0.031				
FF3	0.465	-0.003	0.013	-0.012	0.015		
FF5	0.714	-0.025	0.036	-0.017	0.021	0.015	0.014

Table 4.18: Results of cross-sectional OLS regressions for portfolios sorted in size-INV (T-Statistics)

Model	γ_0	γ_1	γ_2	γ_3	γ_4	γ_5
CAPM	1.180	-0.187				
CCAPM	2.524	2.042				
FF3	-0.337	1.065	-2.927	2.539		
FF5	-2.147	2.727	-3.839	2.954	1.417	3.244

Looking into the R-squared values of all the regression outputs, we see a sign of an upward trend. That means, the more factors a model can include, the more variation of the average returns that model can capture. For the CAPM model, the R-squared value is relatively small since it can only explain 0.2% the variation of the average return. This R-squared value is the lowest among those from three portfolio construction methods. That is being said, the CAPM is the least efficient model in explaining the average returns of size-INV sorted portfolios. For the CCAPM, this model can capture 20.9% of the variation of the average return. This R-squared is much higher than that of the CAPM, meaning that the CCAPM is much more effective than CAPM in explaining the cross-section of average returns. Compared to the CCAPM's R-squared values when we sort the portfolios by size-B/M and size-OP, the R-squared in this case is a huge improvement. For the FF3 model, the R-squared value is 46.5%, meaning that the FF3 model can describe 46.5% variation of the average return. This R-squared value is better than that from the regression of size-OP sorted portfolios, but less effective than that from the regression of size-B/M sorted portfolios. For the FF5 model, the R-squared value sees a significant improvement to explain 71.4% variation of the average returns. The R-squared for the size-INV sorted portfolio is better than those from the other two portfolio construction methods.

Regarding the intercept of the CAPM, it is 0.009 and relatively small. This will contribute a positive amount of 0.9% towards the average return. Since t-stat of the CAPM's intercept is 1.18 which is smaller than 1.96, we cannot reject the hypothesis that the intercept is zero. This means the CAPM holds with the size-INV sorted portfolios. This is different from what we have found with the other two portfolio construction methods which say that CAPM is an invalid model. For the CCAPM, the regression intercept is 0.016, meaning that the average return has 1.6% contributed by the intercept. However, the t-stat of CCAPM's intercept is 2.524 which is bigger than the critical value of 1.96, we can reject the hypothesis that the intercept is equal to zero. In other words, the CCAPM does not hold

with portfolios double sorted by size-INV. This result is in line with what have been found with portfolios sorted by size-B/M and size-OP. For the FF3 model, the intercept is -0.003 that contributes an equivalent negative amount of 0.3% to the average return. The t-stat of the FF3's intercept is -0.337 which is bigger than the critical value of -1.96 so that we cannot reject the hypothesis that the intercept is zero. It also means that the FF3 model is valid with this method of portfolio construction. This result is in line with what has been found when double sorting the portfolios by size-OP. For the FF5 model, the intercept is -0.025, meaning that this intercept contributes negatively towards the average return with an amount of 2.5%. The t-stat for the FF5's intercept is -2.147 which is smaller than the critical value of -1.96. Thus, we can reject the hypothesis that the intercept is zero or statistically insignificant. This means the FF5 model does not hold true when the portfolios are double sorted by size and investment factors. For other two methods of portfolio construction, the FF5 is not a valid model as well, meaning there exists other factor in addition to those in the FF5 model that can describe the variation of the average return.

Regarding the CAPM's gamma 1 or the market risk premium, its value is -0.002 that means the market beta has a negative impact on the average return with an amount of 0.2% for each unit increase in the market beta. The t-stat for this gamma 1 is -0.187 and bigger than the critical value of -1.645. Thus, we cannot reject the hypothesis that the true gamma 1 is equal to zero. This means that there exists no negative linear relation between the average return and the market beta. This phenomenon is similar with what has been given when portfolios are sorted by size-OP. For the CCAPM's gamma 1, the value is 0.031. To explain it, the average return will increase by 3.1% if the consumption beta increases by 1 unit. The t-stat for this gamma is 2.042 which is greater than the critical value of 1.96. Therefore, we can reject the hypothesis that the true gamma 1 is zero. Put it differently, the consumption beta of the CCAPM has an impact on the average return. This is inconsistent with the regression output of the portfolios sorted by size-B/M and size-OP. For the FF3's gamma 1, its value is 0.013. Theoretically, it can be explained as for each unit increase in the market beta, the average return increases by 1.3%. The t-stat of this gamma 1 is 1.065 which is smaller than the critical value of 1.96. We cannot reject the hypothesis that the true gamma 1 of the FF3 model is indifferent from zero. There exists no statistically significant linear relation between the average return and the market beta of the FF3 model. This is consistent with the regression results when portfolio is double sorted by size-OP. For the FF5 model, the gamma 1 value is 0.036. The t-stat for this gamma is 2.727 which is greater than the critical value of 1.96. We can reject the hypothesis that the true gamma 1 of the

FF5 model is zero. Put it differently, we can conclude that there exists a robust linear relation between the average return and the market beta of the FF5 model. With the portfolios sorted by the other two methods, the same results are given.

With respect to the gamma 2 of the FF3 model, its value is -0.012, foreseeing a negative relation between the average return and the size beta. When the size beta increases by 1 unit, the average return would reduce by 1.2%. The t-stat of this gamma 2 is -2.927 which is smaller than the critical value of -1.645. Therefore, we can reject the hypothesis that the true gamma is equal to zero. In other words, there exists a linear relation between the average return and size beta. This is in line with what is found when sorting the portfolios by size-OP but contradictory to the results obtained by sorting the portfolios by size-B/M. For the FF5 model, the gamma 2 is -0.017 that can be explained as if the size beta increases by 1 unit, the average returns would go down by 1.7%. The t-stat of this gamma 2 is -3.839 which is smaller than the critical value of -1.645. Thus, we reject the hypothesis that the true gamma 2 is indistinguishable from zero. Put it differently, the average return is linearly related to the size beta. This phenomenon is consistent with the result of sorting the portfolios by size-OP

With regard to the gamma 3 of the FF3 model, it is 0.015, telling that the average return would increase by 1.5% if the value beta increases by 1 unit. Considering the t-stat of this gamma 3, the value is 2.539 which is bigger than the critical value of 1.645. Thus, we can reject the hypothesis that the true gamma 3 is zero or there is a linear relationship between the average return and the value beta. This result is similar with the conclusion from regression of portfolios sorting by size-B/M, but contradictory to stories told by sorting the portfolios by size-OP. For the FF5 model, the gamma 3 is 0.021, meaning that for each unit increase in the value beta, the average return would increase by 2.1%. The t-stat for this gamma 3 is 2.954 which is much bigger than the critical value of 1.645. Therefore, we reject the hypothesis that the true gamma 3 is equal to zero. For this reason, we can conclude there is a robust linear relationship between the average return and the value beta with this portfolio construction method. However, for another method which is sorting the portfolios by size-OP, the value beta is statistically insignificant.

With respect to the gamma 4 of the FF5 model, the value of it is 0.015 which means that if the profitability beta increases by 1 unit, the average return would increase by 1.5%. Since the t-stat of this gamma 4 is 1.417 which is smaller than the critical value of 1.645, we cannot reject the hypothesis

that the true gamma 4 is equal to zero. It reaffirms there is no linear relationship between the average return and the profitability beta. This totally contradicts to the regression results when sorting the portfolios by size-B/M and size-OP.

Regarding the gamma 5 of the FF5 model, its value is 0.014 that describes that the average return would increase by 1.4% in case the investment beta goes up by 1 unit. However, the t-stat for this gamma 5 is 3.244 and is bigger than the critical value of 1.645, so we can reject the hypothesis that the true gamma 5 is equal to zero. Thus, we find a statistically significant linear relation between the average return and the investment beta. This conclusion agrees upon with the regression outputs with portfolios sorted by size-B/M and size-OP.

To sum up, for CCAPM, the R^2 is always at a relatively lower level ranging from 0.022 to 0.209, suggesting CCAPM is not satisfied in explaining cross-sectional excess return. Also, the significance of consumption risk premium only shows in the size-INV portfolio whereas we cannot find any significant coefficient in size-BM and size-OP portfolios.

When it comes to CAPM and FF factor model, we find that FF five-factor model always owns the highest R^2 while followed by FF three-factor and CAPM, suggesting FF five-factor model has the best performance in explaining cross-sectional excess return. For risk premia, we have found varying impact of factor loadings on the average returns. For market factor, it is found to have no significant linear relationship with average returns of CAPM when portfolios sorted by size-OP and size-Inv; not to be linearly related to average returns of CCAPM when portfolio are sorted by size-B/M and size-OP; and not to be linearly related to average returns of FF3 model when portfolios sorted by size-OP and size-Inv. For the size factor, it is noted to have no linear relation to average returns of both FF3 and FF5 models for size-B/M sorted portfolios. Meanwhile, the value factor is proved to be not related to average returns of both FF3 and FF5 models for size-OP sorted portfolios. The profitability is found to have no linear relation with average return of FF5 model when portfolios are sorted by size-Inv. Finally, the investment factor has no relation to average return of FF5 model when portfolios are sorted by size-OP. For all other cases, risk factors are believed to be linearly related to the average returns derived from tested models.

CHAPTER 5. CONCLUSION

In this chapter, we will answer the research question and related hypotheses in 5.1, while some limitations of this study and suggestions for further research are given in 5.2.

5.1. Main findings

This study aims to answer the research question and compare the results to developed market, the question is, Do CCAPM and FF factor models hold in Malaysia stock market? Which model of them performs better? To answer this question, we firstly need to response to certain tested hypotheses.

Before studying the performance of selected models, we firstly observe if our excess returns of Malaysia show any classic pattern that is found in US data. Specifically, we fail to find size effect across different sorted portfolios in Malaysia market during the period from 1992 to 2019, and we even find an opposite pattern in some portfolios. Similarly, we find an extreme opposite pattern of value effect. That is, the excess returns decrease with value increasing in Malaysia market, which is contradictory to US market. And this pattern is more pronounced than the value effect in US market. This effect suggests that growth stocks in Malaysian stock market are more likely to have higher returns than value stocks. For profitability, the portfolios with highest profitability always own the highest returns though we cannot find a clear pattern of profitability effect. When it comes to investment, we again fail to find evidence of investment effect. Therefore, we cannot find the effect observed from US market in Malaysia data and sometimes we even find an opposite pattern.

First hypothesis we test is whether the FF factor model owns a better power in explaining excess return. From the results of both time series regressions and GRS test, we can conclude the FF factor models always have a far better capability in explaining excess return than CCAPM though all of these models cannot pass the GRS test. However, for FF factor models, the FF five-factor model do not show a very significant improvement from three-factor model for both tests in Malaysia market. In addition, our portfolios are extremely sensitive to the factor that our portfolios sorted with, we suggest this might because our stock data of Malaysia is in a relatively limited scale in each selected month.

When it comes to the significance of model coefficients, the coefficients of FF three-factor models are strong statistically significant in most portfolios. When we add the profitability and investment factors, the coefficients of these two factors are mostly significant though are not as strongly as those of the three-factor models. This again suggests us the FF five-factor model cannot make significant improvements from FF three-factor model, which correspond to the intercept tests. However, the poor quality of CCAPM time series regression suggests us the significance of CCAPM coefficients is not persuasive.

In addition, each coefficient shows a specified pattern though some of them are contradiction to the US data of Fama & French (2015). The slopes of market factor are strongly significant and generally equals to one in all sorted portfolios. Most coefficients of size factor show significantly positive for all size-BM, size-OP and size-INV sorted portfolios while some negatives happen in big size, which is consistent with US market. Also following a similar pattern of US, value factor has most strong positive coefficients for all sorted portfolios while some negatives appear mainly in small BM for size-BM portfolios and big BM for size-OP, size-INV portfolios. When it comes to profitability factor, for size-BM portfolio, most coefficients of RMW is insignificant while some negatives happen in big BM that is contradiction to US data. For size-OP and size-INV portfolios, most coefficients of profitability factor are significantly positive whereas some negatives appear in low OP for size-OP and no clear pattern can be stated for size-INV. Besides, most coefficients of investment factor are negative that is different from US market. Specifically, most slopes are insignificant for size-BM and size-OP portfolio while coefficients are strongly negative for size-INV despite of some negatives appear in high investment. In addition, for CCAPM, the coefficients of consumption growth rate are all significantly negative, which is contradiction to the previous studies (Breeden, Gibbons & Litzenberger, 1989, for example).

The third hypothesis we test is whether there is any redundant factor in FF factor models. From the process of factor regressions and GRS tests, we find the factors of size and profitability are redundant in Malaysia stock market. That is, in the regression of size factor, both SMB and RMW factors do not have significant intercepts, indicating they are totally explained by other factors. To be specific, SMB can be explained by RMW factor. Also, the excess return of RMW factor is absorbed by RMRF, HML and CMA factors. The better performance that model combines only market, value and

investment factors shows in GRS test suggests this three-factor model is better than FF models in explaining excess returns.

Last hypothesis we test is from the aspect of cross-sectional regression. In respect of the cross-sectional regression quality, we find that FF five-factor model is always the best in explaining cross-sectional excess returns while the qualities of CAPM and CCAPM are not satisfied. For risk premiums of risk factors, almost all factors of FF five-factor model show its robustness across size-BM, size-OP and size-INV portfolios. This is in line with many findings observed from other markets.

To sum up, we can conclude that the FF factor models are empirically far better than CCAPM though all of them are not at a satisfied level in explaining Malaysia stock market in respect of intercept explanation, coefficient significance and risk premiums.

For FF factor models, the FF five-factor model does not show significant improvement from the FF three-factor model in explaining time series excess returns while it is crucial in cross-sectional aspect. In addition, the redundancies of size and profitability factors appeared in Malaysia stock market suggests us the combination of only market, value and investment factors show a better performance than both FF three-factor and five-factor models in explaining expected returns.

5.2. Further research

From the process of comparing CCAPM and FF factor models in Malaysia market, we find some limitations our study has and therefore provide some suggestions for further research.

Firstly, the sample we used in Malaysia market is from January 1992 to December 2019, 336 months in total. However, studies in the US or other developed markets usually use longer period. For example, Kan, Robotti & Shanken (2013), Fama & French (2015), Fama & French (2018) used 582 months, 606 months and 636 months respectively. In addition, the number of companies of Malaysia considered in each month is far less than that of the US market. That is, the data from emerging market usually contains less periods as their stock markets started later than the developed counterparts, and they usually have less companies in each selected period. Therefore, one can include more countries when they want to study emerging markets. However, it is advised to consider further on how to balance the influence of each selected country.

Secondly, the consumption data is usually reported in a quarterly or annually basis, indicating the time interval might be too large and thus insufficient to describe the excess returns. This fact is also criticized by previous studies (Kolev, 2013 and Kroencke, 2017 for example). One might study further on the consumption measurement issues.

Thirdly, all size effect, value effect, profitability effect and investment effect captured in US market fail in Malaysia market. One might study other developing markets to see if these effects are also rejected. In addition, we find the SMB and RMW factors are redundant in Malaysia market. One might conduct further research on this in other emerging markets to study if it only appears in Malaysia or it is a common phenomenon across emerging markets.

Fourthly, in this thesis, we only focus on how excess returns of Malaysia react to the local factors. Considering the development and integration of the global economy, one might test if expected returns of emerging market are integrated to US market or developed markets. That is, one can conduct empirical study to emerging market on US factors or developed factors.

Finally, the CCAPM, FF factor models and our combinations of market, value and investment factors all fail to show a satisfied performance in explaining excess return as they all leave some unexplained expected returns. One can try to find if there are other factors that work in emerging market and conduct tests to confirm the new factors' robustness. For example, Nguyen, Ulku & Zhang (2015) study the different appearance state-owned and other companies in Vietnam.

However, suggested by Fama & French (2018), researchers should be cautious to these factors that are empirically robust but lack of theoretical background.

APPENDICES

APPENDIX A: Companies in Portfolio Constructions

Sedol	Company Name	Sedol	Company Name	Sedol	Company Name
6683364	PETALING GARDEN BHD	6290924	DELLOYD VENTURES BHD	B1Q2KS4	GHL SYSTEMS BHD
B0FLMF6	OYL INDUSTRIES BHD	B6ZS981	METROD HOLDINGS BHD	6586441	KARENSOFT TECHNOLOGY BHD
6812328	COSWAY CORP BHD	6485537	KIA LIM BHD	6725631	MARINE & GENERAL BERHAD
6504960	LANDMARKS BHD	6478816	JERNEH ASIA BHD	6606565	HARN LEN CORP BHD
6556552	SAPURA RESOURCES BHD	6478399	JOHOR PORT BHD	6710723	JOHORE TIN
6159906	CI HOLDINGS BHD	6553542	MALPAC HLDGS BHD	6720238	JSPC I-SOLUTIONS
6303617	EON-EDARAN OTOMOB NASION BHD	6536510	LOH & LOH CORP BHD	6714402	EBWORX BHD
6050935	ASIA PACIFIC LAND BHD	6905477	TRANSMILE GROUP BHD	6731036	RGB INTERNATIONAL BHD
6209630	CSM CORP BHD	6525790	MAGNA PRIMA BHD	6725653	TPC PLUS BHD
6145325	LIEN HOE CORP BHD	6354444	FORESWOOD GROUP BHD	6724360	MANGOTONE GROUP BERHAD
6436126	YTL CORP BHD	6750729	REX INDUSTRY BHD	6740281	SERN KOU RESOURCES BHD
B1DNFN0	E & O PROPERTY DEVT	6100294	SETEGAP BHD	6729053	LCL CORP BHD
B12GMF1	PILECON ENGINEERING BHD	6841571	STAR MEDIA GROUP BHD	6729525	REDTONE INTL BHD
6556325	MALAYAN BANKING BHD	B11M0Q7	TRADEWINDS PLANTATION BHD	B0M9M97	KEJURUTERAAN SAMUDRA TIMUR
6868398	TELEKOM MALAYSIA BHD	6580391	MESB BHD	6740236	ARB BHD
6244675	RHB BANK BHD	6686437	POWERTEK BHD	6742135	EKA NOODLES BERHAD
6918516	LEADER UNIVERSAL HLDGS BHD	6137311	MANULIFE HOLDINGS BHD	6739869	DBE GURNEY RESOURCES BHD
6182827	CEMENT INDS OF MALAYSIA BHD	6441669	HUA JOO SENG ENTERPRISE GRP	B00XVN8	MAHAJAYA BHD
6444754	HUME INDUSTRIES (MALAYS) BHD	BF0J5S4	PRESS METAL ALUMNIUM HLD BHD	B00H4X1	CYMAO HLDGS BHD
B01RN99	COMFORT GLOVES BHD	6868592	KURNIA SETIA BHD	6735931	OPENSYS (M) BHD
6644372	HEXZA CORP BHD	6522672	LPI CAPITAL BHD	6731382	PLASTRADE TECHNOLOGY
6286536	SIME ENGINEERING SERVICES	6044370	ANN JOO RESOURCES BHD	6728287	KEY ALLIANCE GROUP BHD
6556864	ANN JOO STEEL BHD	6302852	EP MFG BHD	6725813	POLY TOWER VENTURES BHD
B6VGS93	SUNWAY BHD	6005753	ACF HOLDINGS BHD	B00CQY1	ESTHETICS INTL GROUP BHD
6728782	HARBOUR-LINK GROUP BHD	6707372	FOUNTAIN VIEW DEVELOPMENT	6740957	MMAG HOLDINGS BHD
6891833	DAGANG NEXCHANGE BHD	6100562	BINA DARULAMAN BHD	6728232	ASIAEP RESOURCES BHD
6557997	MISC BERHAD	6193012	CHOO BEE METAL INDUSTRIES	6729837	Y.S.P. SOUTHEAST ASIA HLDG
9090121	MP TECHNOLOGY RESOURCES BHD	6693266	PINTARAS JAYA BHD	B00NLX8	CHIN HIN GROUP PROPERTY BHD
6556518	MALAYAN CEMENT BHD	6689339	PICA (M) CORP BHD	B00VZW9	PELANGI PUBLISHING GROUP BHD
6556927	MALAYSIAN OXYGEN BHD	6430496	HHB HOLDINGS BHD	B01JK05	MYCRON STEEL BHD
6009454	AFFIN BANK BHD	6353474	FSBM HOLDINGS BHD	B16TVC6	ADVENTA BERHAD
6668918	PMC-PAN MALAYSIA CORP BHD	6472818	TANCO HOLDINGS BHD	B015P42	DK LEATHER CORP BHD
6279934	WING TAI MALAYSIA BHD	6045942	APEX EQUITY HLDGS BHD	B00STN9	MSCM HOLDINGS BHD
6084707	ADVANCE SYNERGY BHD	6013002	AJIYA BHD	B0166B9	METRONIC GLOBAL BHD
6411929	GOLDEN HOPE PLANTATIONS BHD	6379298	GOLDEN PHAROS BHD	B012521	MUDAJAYA GROUP BHD
6497446	KUALA LUMPUR KEPONG BHD	6688240	MANCON BHD	B01H3N3	IBRACO BHD
6910824	UMW HOLDINGS BHD	6414199	ANZO HOLDINGS BHD	B01VPM8	GOODWAY INTEGRATED INDS BHD
6986223	YEO HIAP SENG (MALAYSIA) BHD	6892160	PEGASUS HEIGHTS BHD	B0L2MN1	OSK VENTURES INTL BHD
6242301	CYCLE & CARRIAGE BINTANG BHD	6637532	NGIU KEE CORP (M) BHD	B67GVX2	SYSTECH BHD
6556701	MEASAT GLOBAL BHD	6374646	BERJAYA ASSETS BHD	B01ZS76	CUSCAPI BERHAD
6497628	KULIM (MALAYSIA) BHD	6364874	MAXTRAL INDUSTRY BHD	B01YCH1	LIMAHSOON BERHAD
6661434	ORIENTAL HOLDINGS BHD	6389651	ENCORP BHD	B033KT4	KEIN HING INTL BHD
6584683	METROPLEX BHD	6428877	HIROTAKO HOLDINGS BHD	B02SBM0	GE-SHEN CORP BHD
6812555	MEDIA PRIMA BHD	B01T3D9	INDUSTRONICS BHD	6712406	MGB BHD
B28RHW7	OPUS GROUP BHD	B1W58N8	LB ALUMINIUM BHD	B01SF96	ANCOM LOGISTICS BHD
6554006	MAGNUM CORP BHD	6070676	BHL VENTURE BHD	B03TJ28	LCTH CORP BHD
B0W1VM9	BERJAYA CORP BHD	6595652	MINHO (M) BHD	B03P5P1	GRAND-FLO BHD
6189806	CHEMICAL CO OF MALAYSIA BHD	6225551	EASTERN PACIFIC INDL CORP	B030D96	SERSOL BERHAD
6436450	HONG LEONG FINANCIAL GP BHD	6283708	ANSON PERDANA BHD	B03JK70	WCT LAND BHD
B1VXJL8	GENTING BHD	6086509	BCB BHD	B02TM19	KARYON INDUSTRIES BHD
6114659	BOUSTEAD HOLDINGS BHD	6518262	SAND NISKO CAPITAL BERHAD	B92NSW7	KLCC PROPERTY HOLDINGS BHD
6620015	MWE HOLDINGS BHD	6498212	NEGARA PROPERTIES (M) BHD	B039VT9	SIN CHEW MEDIA CORP BHD
6425856	HIGHLANDS & LOWLANDS BHD	6117551	KUMPULAN HARTANAH SELANGOR	6741701	IQZAN HOLDING BERHAD
B1TSHV1	SINO HUA-AN INTL BHD	6004266	SAFEGUARDS CORP BHD	B00FQS4	SWS CAPITAL BHD
6772820	FA PENINSULAR BHD	6965909	POS MALAYSIA BERHAD	B01S2P1	PERISAI PETROLEUM TEKNOLOGI
6397803	HEINEKEN MALAYSIA BHD	6819095	SUNWAY CITY BHD	B0507J2	TRICUBES BHD
B1Y3WG1	IOI CORP BHD	6068778	AIC CORP BHD	B03NG52	TEK SENG HLDGS BHD
6556875	NALURI CORP BHD	6535186	SAM ENGINEER & EQUIP BHD	B01BTP9	G NEPTUNE BHD
6555281	MECHMAR CORP BHD	B010Q22	APB RESOURCES	B03TJ06	EKOWOOD INTL BHD
6794040	SELANGOR PROPERTIES BHD	6045179	PERAK CORP BHD	B03WCK6	MODULAR TECHCORP HLDGS
6498933	KUMPULAN GUTHRIE BHD	6697086	WAWASAN TKH HLDGS BHD	B05KKN7	ASDION BHD
6502458	IOI PROPERTIES BHD	6410391	PACIFICMAS BHD	B05DZD1	CSC STEEL HOLDINGS BHD
6668446	IOI OLEOCHEMICAL INDUSTRIES	6310888	ESPRIT GROUP BHD	B01XZR9	OCEANCASH PACIFIC BHD
B1L0JB9	KIAN JOO CAN FACTORY BHD	6862709	SUNRISE BHD	B05DWZ2	D&O GREEN TECHNOLOGIES BHD
B1G3B62	MALAYSIAN MOSAICS BHD	B1W2P83	BONIA CORP BHD	B05J818	EFFICIENT E-SOLUTIONS
6577401	MENANG CORP (MALAYSIA) BHD	6864653	SUNWAY CONSTRUCTION BHD	B0149D6	MOBIF BHD
6436308	HONG LEONG INDUSTRIES BHD	6556563	CRIMSON LAND BHD	B01XPF7	BIOSIS GROUP BHD
B29TTR1	SIME DARBY BHD	6504283	KWANTAS CORP BHD	6742232	G3 GLOBAL BHD
6143084	MBF HOLDINGS BHD	6005991	UEM BUILDERS BHD	6740979	POH KONG HLDGS
6724735	RASHID HUSSAIN BHD	6602938	EON CAPITAL BHD	B02HJ67	MEMS TECHNOLOGY BHD
B012W42	PUBLIC BANK BHD	B01GQS6	YTL POWER INTERNATIONAL BHD	B063H67	FREIGHT MANAGEMENT HLDGS
6569679	MELEWAR INDUSTRIAL GROUP BHD	B05KKM6	AMVERTON BERHAD	B03P5N9	CLASSIC SCENIC BHD
6114488	PROMET BHD	6305840	PARK MAY BHD	B033B13	PECD BHD
6870230	AMCORP PROPERTIES BHD	6920878	UPA CORP BHD	B064179	TAFI INDUSTRIES BHD
B1VXKN7	GENTING MALAYSIA BHD	6990622	ZAITUN BHD	B02JHS1	COMINTEL CORP BHD
6075745	CIMB GROUP HOLDINGS BERHAD	6989200	HONG LEONG CAPITAL BHD	B05JS85	ECOFUTURE BHD
6089360	GUOCOLAND (MALAYSIA) BHD	6573335	MTD CAPITAL BHD	B06B9D2	BP PLASTICS HLDGS
6679352	PELANGI BHD	6489045	KHEE SAN BHD	B05MYX1	MQ TECHNOLOGY BHD
6490092	GEORGE KENT (MALAYSIA) BHD	6226435	COMPUTER SYSTEMS ADVISERS	B02HY95	DPS RESOURCES BHD
6592794	AMSTEEL CORP BHD	6461247	INTEGRATED LOGISTICS BHD	B05MXJ0	EURO HLDGS BHD
6047023	AMMB HOLDINGS BHD	6690290	AWC BHD	B05LVY8	SUCCESS TRANSFORMER CORP
6289160	DUTCH LADY MILK INDUSTRIES	6987839	YE CHIU METAL SMELTING BHD	B064DY0	MALAYSIA STEEL WORKS
6297743	HAP SENG CONSOLIDATED BHD	6100379	BIMB HOLDINGS BHD	B05JTL5	FOTRONICS CORP BHD
6255826	DKH- DATUK KERAMAT HLDGS BHD	6223287	OMEGA HOLDINGS BHD	B03FFT5	PROGRESSIVE IMPACT CORP
6681669	PPB GROUP BHD	6474137	TROPICANA CORP BHD	B04QXQ0	ECOBUILT HOLDINGS BHD
6592921	LION INDUSTRIES CORP BHD	6493585	KPJ HEALTHCARE BHD	B04BNH6	IMPRESSIVE EDGE GROUP BHD
6552538	CELCOM (MYS) BHD	6730594	ROHAS TECNIC BERHAD	B03HJ88	JCBNEXT BHD
6710745	UEM WORLD BERHAD	6791870	BOUSTEAD HEAVY INDS CORP	B05KCS6	HEVEABOARD BHD
6592749	LION CORP BHD	6505491	LINGKARAN TRANS KOTA HLDGS	B04BNJ8	VORTEX CONSOLIDATED BHD
6915250	SIME UEP PROPERTIES BHD	6034155	AHB HLDGS BHD	B055ZL5	EXCEL FORCE MSC BHD
6720926	IJM PLANTATIONS BHD	6159069	RHB SAKURA MERCHANT BANKERS	B05F1C8	COCOALAND HLDGS
6629335	NESTLE (MALAYSIA) BHD	6673945	NILAI RES GROUP BERHAD	B058J67	VSOLAR GROUP BHD
6668781	PMI-PAN MALAYSIAN INDS BHD	6439932	PANTAI HOLDINGS BHD	B05R232	TH HEAVY ENGINEERING BHD
B036QH3	JAVA BERHAD	6371658	GLENEALY PLANTATIONS (MALAY)	B052130	DIS TECHNOLOGY HLDGS BHD

6904612	TENAGA NASIONAL BHD
6399111	GUTHRIE ROPEL BHD
6556693	MALAYSIAN PACIFIC INDUS BHD
6455217	IJM CORP BHD
6609230	MUDA HOLDINGS BHD
6487890	KEMAYAN CORP BHD
6557867	MALAYSIAN RESOURCES CORP
6218937	CONSTRUCTION & SUPPLIES HOUS
6518648	LINGUI DEVELOPMENTS BHD
6192859	LION DIVERSIFIED HOLDINGS
6084622	BATU KAWAN BHD
6057680	GENTING PLANTATIONS BHD
6333120	FFM BHD
6556938	ALLIANCE BANK MALAYSIA BHD
6551278	MBF CORPORATION BHD
6500678	NCB HOLDINGS BHD
6021953	ALUMINIUM CO OF MALAYSIA
B00ML91	PROTON HLDGS BHD
6480112	KFC HOLDINGS (MALAYSIA) BHD
B09FGC9	CARLSBERG BREWERY MALAYSIA
6378596	GOPENG BHD
B04ZNB2	MARCO HOLDINGS BHD
6872032	TA ENTERPRISE BHD
6655040	OSK HOLDINGS BHD
B0B8SB9	TANJONG PLC
6038254	AYER HITAM TIN DREDGING
6483520	PUTERA CAPITAL BHD
6556585	MALAYAN FLOUR MILLS BHD
6252195	DAIBOCHI BERHAD
6669386	PANGLOBAL BHD
B01GQR5	YTL LAND & DEVELOPMENT BHD
6269816	DRB-HICOM BHD
6904690	ZELAN BHD
6555924	MALAKOFF BHD
6812599	TURIYA BHD
6900814	TRADEWINDS (M) BHD
6556723	SUNSURIA BERHAD
B0RY9Y1	BERJAYA LAND BHD
6373171	GEORGE TOWN HOLDINGS BHD
6665577	PANSAR BERHAD
6031758	ANCOM BHD
6777535	SATERAS RESOURCES (MALAYSIA)
6810883	SIN HENG CHAN (MALAYA) BH
6870586	TALAM TRANSFORM BHD
6093509	REKAPACIFIC BHD
6694247	POLY GLASS FIBRE (M) BHD
6632968	HICOM HOLDINGS BHD
6542818	MMC ENGINEERING GROUP BHD
6577887	MENTAKAB RUBBER CO (MALAYA)
B0225T7	LEE SWEE KIAT GROUP BHD
6006659	ACTACORP HOLDING BHD
6948609	WEMBLEY INDUSTRIES HLDGS BHD
6556778	MUI PROPERTIES BHD
6666592	TADMAX RESOURCES BHD
6219082	CONCRETE ENGINEERING PRODCTS
6308010	EKOVEST BHD
6306984	EKRAN BHD
6486712	KECK SENG (MALAYSIA) BHD
6331931	FAR EAST HOLDINGS BHD
6068938	AUTOWAYS HOLDINGS BHD
6559573	MAMEE-DOUBLE DECKER (M) BHD
6904021	TDM BHD
6592802	SILVERSTONE CORP BHD
B1VZ5G1	SCIENTEX BHD
6481137	KAI PENG BHD
B01R1Y0	JAKS RESOURCES BHD
6359881	GAMUDA BHD
6621159	NAM FATT CORPORATION BHD
6825423	SOUTH MALAYSIA INDUSTRIES
6198073	CHG INDUSTRIES BHD
6801519	SHANGRI-LA HOTELS (MALAYSIA)
6513159	MAGNUM 4D BHD
6286439	SARAWAK ENERGY BHD
6491448	KIM HIN INDUSTRY BHD
6987442	YEE LEE CORP BHD
B01KLG1	NYLEX (MALAYSIA) GROUP
6358457	GADEK (MALAYSIA) BHD
6796778	HALIFAX CAPITAL BHD
6904504	M3NERGY BERHAD
B0217L0	PUBLIC PACKAGES HOLDINGS BHD
6980203	WOO HING BROTHERS (MAL) BHD
6670236	PARAMOUNT CORP BHD
6490456	DAMANSARA REALTY BHD
6914558	UNIPHOENIX CORP BHD
6379652	PARAGON GLOBE BHD
6981466	WORLDWIDE HOLDINGS BHD
6436717	HO HUP CONSTRUCTION CO BHD
6712365	YNH PROPERTY BHD
6069102	AYER MOLEK RUBBER CO BHD
6400240	JOHAN CERAMICS BHD
6628150	NEGRI SEMBILAN OIL PALMS BHD
6557760	MALAYSIA PACKAGING INDUSTRY
B1V74R1	OLYMPIA INDUSTRIES BHD
6110668	SYMPHONY LIFE BERHAD
6742652	REPCO HOLDINGS BHD
6083748	FCW HOLDINGS BHD
6331566	BERJAYA SPORTS TOTO BHD
6799971	PELIKAN INTL CORP BHD
6745286	ROAD BUILDER (M) HOLDINGS BH
6825531	JAYA TIASA HOLDINGS BHD
6314653	PJ DEVELOPMENT HOLDINGS BHD
6024565	AMALGAMATED INDUST STEEL BHD
6695938	PETRONAS DAGANGAN
BDGJCX8	NATIONWIDE EXPRESS HLDG
6744216	LEBTECH BHD
6882729	TGL-TEO GUAN LEE CORP BHD
6860684	SUNGEI BAGAN RUBBER CO (MAL)
6495633	KLUANG RUBBER CO (MALAY) BHD
6419064	HWA TAI INDUSTRIES BHD
6703433	PPB OIL PALMS BHD
6543101	MNRB HOLDINGS BHD
B00MRS2	DIALOG GROUP BHD
6486615	K & N KENANGA HLDGS BHD
6909093	TECK GUAN PERDANA BHD
6489614	KEN HOLDINGS BHD
6502124	K.P.KENINGAU
6820901	ECM LIBRA BHD
6808123	SYARIKAT TAKAFUL MALAYSIA KE
B00QBW6	PESONA METRO HOLDINGS
6794062	BOUSTEAD PROPERTIES BHD
6834560	SPK-SENTOSA CORP BHD
6456221	INSAS BHD
6670797	LIQUA HEALTH CORP
6499754	KUMPULAN BELTON BHD
6249034	DAI HWA HLDGS (M) BHD
6498717	KRETAM HOLDINGS BHD
6483047	ECM LIBRA GRP BERHAD
6674368	PREMIER NALFIN BERHAD
6151786	BUKIT KATIL RESOURCES BHD
6868774	S P SETIA BHD
6786757	SEAL INC BHD
6053633	TECHVENTURE BHD
6028471	Y&G CORP BHD
B00NYQ2	GTB-GLOBETRONICS TECHNOL BHD
6097868	MANGIUM INDUSTRIES BHD
6085380	BORNEO OIL BERHAD
6040947	KOMARKCORP BHD
6507550	LATITUDE TREE HOLDINGS BHD
6086190	BINTAI KINDEN CORP BHD
6183916	CENTRAL GLOBAL BERHAD
6081731	ZECON BERHAD
6283322	PDZ HLDGS BERHAD
6019420	NIOI-NISSAN-IND OXYGEN INC
6013295	TT RESOURCES BHD
6693589	KYM HOLDINGS BHD
6683502	PETALING TIN BHD
6889612	MILUX CORP BHD
6019312	GRAND HOOVER BHD
B1SC1H8	PUNCAK NIAGA HLDGS BHD
6015611	PADIBERAS NASIONAL
6981961	WONDERFUL WIRE & CABLE BHD
6452843	JOHOR LAND BHD
6017327	MCE HOLDINGS BHD
6056717	ASIA BRANDS CORP BHD
6114701	BOX PAK (MALAYSIA) BHD
6073835	MASTER-PACK GROUP BERHAD
6086242	DIGI.COM BHD
6039514	KUB MALAYSIA BHD
6053990	CME GROUP BHD
6013400	OCEAN CAPITAL BHD
6206556	CN ASIA CORP BHD
6073813	FIAMMA HOLDINGS BHD
6907440	TIEN WAH PRESS HLDGS BHD
B1KZV19	PATIMAS COMPUTERS BHD
6320661	EUPE CORP BHD
6092904	SEE HUP CONSOLIDATED BHD
B016FP6	JADE MARVEL GRP BERHAD
6016829	YLI HLDGS BHD
6556682	MALAYSIAN AIRLINE SYSTEM BHD
6874704	TASEK CORP BHD
6368995	GOLD BRIDGE ENGRG & CONSTR
6900944	TRACTORS MALAYSIA HLDGS BHD
6552464	ALLIANZ MALAYSIA BERHAD
6005311	INTAN UTILITIES BHD
6301503	HUBLINE BHD
6773737	ECO WORLD DEV GROUP BHD
6633002	NEW STRAITS TIMES PRESS (M)
6917717	UNITED ENGINEERS (MALAY) BHD
6871125	TAN CHONG MOTOR HOLDINGS BHD
6506007	KRISASSECTS HLDGS BHD
6467148	ISLAND & PENINSULAR BHD
6917148	UNITED PLANTATIONS BHD
6310985	UEM EDGENTA BHD
6609627	MAGNUM BHD
6861319	SUNCHIRIN INDUSTRIES (MALAY)
6752349	BRITISH AMER TOB (MALAYSIA)
6914428	UAC BHD
6798150	SHH RESOURCES HLDGS BHD
6803504	HENGYUAN REFINING CO BHD
6556648	MMC CORPORATION BHD
6041940	WOODLANDOR HOLDINGS BHD
6541086	MALAYSIA PACIFIC CORP BHD
6644435	NORTH BORNEO CORP BHD
6074902	BANDAR RAYA DEVELOPMENTS BHD
6154376	KERJAYA PROSPEK PROPERTY
6700456	YCS CORP BHD
6188193	MALAYSIA AIRPORTS HLDGS BHD
B05MGY6	UNISEM (M) BHD
6696760	POLYMATE HLDGS BHD
6599438	MIECO CHIPBOARD BHD
6306177	HEITECH PADU BHD
6183499	TA ANN HOLDINGS BHD
6120355	AKN TECHNOLOGY BHD
6113429	VS INDUSTRY BHD
6183563	UDA HOLDINGS BHD
6909888	UTAMA BANKING GROUP BHD
6202792	APM AUTOMOTIVE HOLDINGS BHD
6180746	MESINIAGA BHD
6137117	ABRIC BHD
6856865	SUBUR TIASA HOLDINGS BHD
6206028	NIKKO ELECTRONICS BHD
6513568	LADANG PERBADANAN-FIMA BHD
B06FV38	BURSA MALAYSIA BHD
B06KJ28	DESTINI BHD
B1LYZG8	HOVID BHD
B06N262	GREEN OCEAN CORP BHD
B09MBH0	T7 GLOBAL BERHAD
B08TZP8	GD EXPRESS CARRIER BHD
B08BFM1	ORION IXL BHD
B06WMC5	LYC HEALTHCARE BHD
B063789	AT SYSTEMATIZATION BHD
B08YDJ3	AMINVESTMENT GROUP BHD
B0984H9	MEGA SUN CITY HOLDINGS BHD
B08GQF6	A-RANK BHD
B07DXK2	KANNALTEC BHD
B09XV17	TECHFAST HOLDINGS BHD
B081SH7	STRAITS INTER LGSTCS BERHAD
B0CGYN6	CNI HOLDINGS BHD
B0C8KK1	EB CAPITAL BHD
B09RBP3	MLABS SYSTEMS BHD
B0HWY40	XINGHE HOLDINGS BHD
B0CMD04	DAYA MATERIALS BHD
B0CKSF8	KOSMO TECH INDUSTRIAL BHD
B0CGYL4	INS BIOSCIENCE BHD
B0CL691	ELSOFT RESEARCH BHD
B0CSZS4	IRM GROUP BHD
B0CSZR3	CAN-ONE BHD
6574877	JERASIA CAPITAL BERHAD
B0CMCM9	MINETECH RESOURCES BHD
B0FGN81	NI HSIN RESOURCES BERHAD
B0CMD48	MTOUCHE TECHNOLOGY BHD
B0CMCW9	EONMETALL GROUP BHD
B0F1KV8	TEX CYCLE TECH MALAYSIA BHD
B0JFQZ2	INIX TECHNOLOGIES HLDG BHD
B0K4GS1	SCICOM MSC BHD
B0CMCS5	SOLUTION GROUP BERHAD
B0KLDR0	VITROX CORP BHD
B0F1NS6	KAWAN FOOD BHD
B0L7ML4	IQ GROUP HOLDINGS BHD
B0MT2N1	CONNECTCOUNTY HOLDINGS BHD
B0RGG02	R&A TELECOMMUNICATION GRP BH
B0NJDV5	EDUSPEC HLDGS BERHAD
B0Q0VH7	REXIT BHD
B0NLT57	GENETEC TECHNOLOGY BHD
B0RYB12	SC ESTATE BUILDER BHD
B0RGJD6	N2N CONNECT BHD
B0V4FT4	MMS VENTURES BERHAD
B0LNJK0	BSL CORP BHD
B0742L9	GUAN CHONG BHD
B0JVKJ2	YTL HOSPITALITY REIT
B1V7KX9	DUTALAND BERHAD
B0LSTW7	TMC LIFE SCIENCES BHD
B0L2K37	STEPPE CEMENT LTD
B0984J1	GREEN PACKET BHD
6455273	IGB CORP BHD
B0JT319	BAHVEST RESOURCES BERHAD
B09YCC8	NOTION VTEC BHD
B05LHT5	VIVOCOM INTL HOLDINGS BHD
B07DQ69	CAROTECH BHD
B03J9L7	AIRASIA GROUP BERHAD
B06HC42	EVERGREEN FIBREBOARD BHD
B05Q488	KSK GROUP BHD
B0LKYL7	ES CERAMICS TECHNOLOGY BHD
B0W5KG8	K-ONE TECHNOLOGY SDN BHD
B05LVV5	CHEETAH HLDGS BHD
B0VCDT4	MIKRO BHD
B03DHS2	WANG-ZHENG BHD
B0WJ4L3	FOCUS DYNAMICS GROUP BHD
B123VH7	TRIVE PROPERTY GROUP BHD
B13JSP1	TH PLANTATIONS BERHAD
B134VQ8	JADI IMAGING HOLDINGS BHD
B12SNB0	VISDYNAMICS HOLDINGS BHD
B13P2T1	PRIVASIA TECHNOLOGY BHD
B131M00	PA RESOURCES BERHAD
B13WDL1	UMS-NEIKEN GROUP BHD
B13C4D0	HDM-CARLAW CORPORATION BHD
B16FQW9	MICROLINK SOLUTIONS BHD
B11FKB1	RIMBUNAN SAWIT BHD
B18YC59	TOMEI CONSOLIDATED BERHAD
B19VV63	TECHNODEX BHD
B188WD9	FAVELLE FAVCO BHD
B19VC48	DIVERSIFIED GATEWAY SOLUTION
B17ZLB2	SILVER RIDGE HOLDINGS BERHAD
B18Z0F8	JHM CONSOLIDATION BERHAD
B19DF89	BCT TECHNOLOGY BERHAD
B0WW490	IMASPRO CORP BERHAD
B18TLC4	FRONTKEN CORPORATION
B1G3BD9	PUTRAJAYA PERDANA BHD
B1FS4T2	SCAN ASSOCIATES BHD
B1G2H38	STEMLIFE BHD
B06K0B4	ALIRAN IHSAN RESOURCES BHD
B1L72X3	KENCANA PETROLEUM BHD
B1LDQV7	RESINTECH BERHAD
B1G2H05	SWEE JOO BHD
B05KY68	GROMUTUAL BERHAD
B11YC23	TOWER REAL ESTATE BHD
B0CMCL8	AXIS REIT MANAGERS BHD
B1KKH50	HEKTAR REAL ESTATE INV TRUST
B0W3DK7	WIMEMS CORP BHD
B131M11	ADVANCE INFORMATION MKTG BHD
B1BL6J9	AL-AQAR HEALTHCARE REIT
B0BV3F7	YGL CONVERGENCE BHD
6794017	SELANGOR DREDGING BHD
B0VY4Z3	UOA REAL ESTATE INVT TR
B19CNZ9	ALAM MARITIM RESOURCES BHD
6303316	IJM LAND BERHAD
6497736	ECOFIRST CONSOLIDATED BERHAD
B1DQBZ3	SANICHI TECHNOLOGY BERHAD

6331652	FARLIM GROUP (MALAYSIA) BHD
6838487	STAMFORD COLLEGE BHD
6772325	SAAG CONSOLIDATED (M) BHD
6520234	THETA EDGE BERHAD
6660840	ORIENTAL INTEREST BHD
6573175	OMESTI BHD
6801133	SARAWAK CONS IND BERHAD
6703972	PETRONAS GAS
6707606	PUBLIC FINANCE BHD
6210814	ENRA GROUP BHD
6253154	EG INDUSTRIES BHD
9000091	TRIPLC BERHAD
6696726	LION POSIM BERHAD
6621621	NANYANG PRESS (MALAYA) BHD
6916598	UMLAND-UNITED MALAYAN LAND
6677215	PACIFIC & ORIENT BHD
6191157	CHIN TECK PLANTATIONS BHD
6711469	VERSATILE CREATIVE BHD
6100517	BINA PURI HOLDINGS
6673699	PROLEXUS BHD
6308173	ENG TEKNOLOGI HOLDINGS BHD
6176518	CONSOLIDATED FARMS BHD
6491374	KILLINGHALL (MALAYSIA) BHD
6339247	
6701909	IDAMAN UNGGUL
6479994	JT INTERNATIONAL BHD
6214106	PERSTIMA BHD
6682264	TRADEWINDS CORP BHD
B01GQT7	YTL CEMENT BHD
6489755	KESM INDUSTRIES BHD
6030409	PARKSON HOLDINGS BHD
6579678	MKH BHD
6460329	INSTANGREEN CORP BHD
6493488	KKB ENGINEERING BHD
B012W31	RCE CAPITAL BHD
B037FP7	MAXBIZ CORP BHD
6809137	SINMAH CAPITAL BERHAD
6506104	WCE HOLDINGS BHD
6776598	I-BERHAD
6862077	SUIWAH CORP
6622947	NEPLINE BHD
6069061	AYER HOLDINGS BHD
6572600	PANASONIC MFG MALAYSIA
6228163	COUNTRY HEIGHTS HLDGS BHD
6986858	AKTIF LIFESTYLE CORP BHD
6398011	GULA PERAK BHD
6511603	LBI CAPITAL BHD
6777386	SAPURA TECHNOLOGY BHD
6365491	LAND & GENERAL BHD
6007919	ADVANCE PACKAGING TECHNOLOGY
6667261	RGT BHD
B0684B6	PRESTAR RESOURCES BHD
6916684	UNITED MALACCA BHD
6495150	LOTUS KFM BERHAD
9000059	TECNIC GROUP BERHAD
6556756	MALAYAN UTD INDS BHD
6240413	SYCAL VENTURES BERHAD
6494953	KUMPULAN JETSON
6889827	TRU-TECH HOLDINGS
BYYDJQ1	MINTYE BERHAD
6258739	GOLDEN PLUS HOLDINGS BHD
B01WHW5	HIL INDUSTRIES BHD
6898403	TOMYPAK HLDGS
6862323	SUPER ENTERPRISE
6863865	SUREMAX GROUP BHD
6912961	KERJAYA PROSPEK GROUP BHD
6583486	FIMA CORP BHD
6668963	ASIAN PAC HOLDINGS BHD
6731371	AVILLION BERHAD
6679932	PAN MALAYSIA HOLDINGS BHD
6508520	LAY HONG
6824260	SOUTHERN ACIDS (M) BHD
6215626	COMPUTER FORMS (MALAYSIA)
6787590	SHL CONSOLIDATED BHD
6149792	BTM RESOURCES BHD
6253176	DKSH HLDGS (MALAYSIA) BHD
6853048	STORE CORP BHD
6771429	WTK HOLDINGS BHD
6697644	PCCS GROUP BHD
6921398	UMS HOLDINGS
6059288	ASAS DUNIA BHD
6185796	JIANKUN INTERNATIONAL BHD
6038210	ATLAN HOLDINGS
6145347	EKSONS CORP BHD
6299910	HO WAH GENTING BHD
B053CZ2	TSH RESOURCES BHD
6524151	LYSAGHT GALVANIZED
6436892	HONG LEONG BANK BHD
6468754	EASTERN & ORIENTAL BHD
6913298	UNZA HOLDINGS BHD
6730011	ATA IMS BERHAD
6475806	SINOTOP HLDGS BHD
6882097	TRANSOCEAN HLDGS
6333153	FEDERAL INTL HLDG BHD
6868536	SYARIKAT KAYU WANGI BHD
6256948	MTD INFRAPERDANA BHD
6136415	BRIGHT PACKAGING IND BHD
B00LVN2	QSR BRANDS BHD
6467030	IREKA CORP BHD
6047465	ASIA FILE CORP BHD
6565019	MULTI-USAGE HLDGS BHD
6567071	MALAYSIAN INDL DEV FINANCE
6571328	ADVANCE SYNERGY CAPITAL BHD
6358598	MALTON BHD
6130923	BREM HOLDING BHD
6479585	TSM GLOBAL BERHAD
6248183	ANALABS RESOURCES BHD
6293387	COURTS MAMMOTH BHD
6175407	WHITE HORSE BHD
B00PSW2	UCHI TECHNOLOGIES BHD
6874544	IGB BERHAD
6336538	TIME DOTCOM BHD
B014958	NV MULTI CORP BHD
6180865	PHARMANIAGA BHD
6692326	PLS PLANTATIONS BHD
6370440	AIKBEE RESOURCES BHD
6363763	CJ CENTURY LOGISTICS HOLDING
6130020	COMSA FARMS BHD
6367743	EDARAN BHD
6225841	MAGNI-TECH INDUSTRIES BHD
6336817	INGRESS CORP BHD
6264996	PIE INDUSTRIAL BHD
6013671	KOBAY TECHNOLOGY BHD
6341651	SKB SHUTTERS CORP BHD
6093145	OCI BHD
6202963	WARISAN TC HOLDINGS BHD
6108317	PLB ENGINEERING BHD
6280390	HOCK LOK SIEW CORP BHD
B01LS29	PERDANA PETROLEUM BHD
6084086	AMTEL HOLDINGS BHD
6281456	MEGAN MEDIA HOLDINGS BHD
6093372	NOMAD GROUP BHD
6431950	HOCK SENG LEE
6017424	ARK RESOURCES BERHAD
6091462	YONG TAI BHD
6345697	BINTULU PORT HOLDINGS BHD
6575342	PAXELENT CORP BHD
6074269	KENMARK INDUSTRIAL CO BHD
6106195	ASTRAL ASIA BHD
6282114	ORIENTAL FOOD INDS HLDGS BHD
B09G428	WONG ENGINEERING CORP BHD
6178042	TIGER SYNERGY BHD
6111810	KHIND HOLDINGS BHD
6219822	LTKM BHD
6096166	KUMPULAN H & L HIGH TECH BHD
6296900	HUP SENG INDUSTRIES BHD
6566993	AMANAH HARTA TANAH PNB 2
6081593	SCOMI ENERGY SERVICES BHD
6311148	KIM LOONG RESOURCES BHD
6113043	NEW HOONG FATT HOLDINGS BHD
B0B7W58	INDUSTRIAL CONCRETE PRODUCTS
6344962	D'NONCE TECHNOLOGY BHD
6352211	MERGE HOUSING BHD
B05L892	TOP GLOVE CORP BHD
6173683	HARRISONS HOLDINGS BHD
B00NLW7	NWP HOLDINGS BHD
6353894	KNUSFORD BHD
B01LS18	CHIN WELL HOLDINGS BHD
6328717	RANHILL BHD
B00G234	QL RESOURCES BHD
6047142	AMFB HOLDINGS BHD
6321590	PETRON MALAYSIA REFINING
6481858	KOA DENKO (MALAYSIA) BHD
6312033	MHC PLANTATIONS BHD
6179551	TONG HERR RESOURCES BHD
B04NN83	PAOS HOLDINGS BHD
B01Y2Y8	UNICO-DESA PLANTATIONS BHD
6130019	STELLA HOLDINGS BERHAD
6764656	SAUJANA CONSOLIDATED BHD
6261652	GLOMAC BHD
6431284	LBS BINA GROUP BHD
6100863	HUME INDUSTRIES BHD
6219145	HUNZA PROPERTIES BHD
B03KZT0	GPA HOLDINGS BHD
6286893	LII HEN INDUSTRIES BHD
B0DD1J1	OCTAGON CONSOLIDATED BHD
6419945	XIAN LENG HOLDINGS LTD
B09SYR9	CB INDUSTRIAL PRODUCT HLDG
6510354	PBA HOLDINGS BHD
6433019	KSL HOLDINGS BHD
6086231	CCK CONSOLIDATED HOLDINGS
B01VG70	DEGEM BHD
B01VG47	UNIMECH GROUP BHD
6087375	THONG GUAN INDUSTRIES BHD
6093167	PADINI HOLDINGS BHD
6095969	FAJARBARU BUILDER GROUP BHD
6153630	MALAYSIAN AE MODELS HLDG BHD
6055145	PETROL ONE RESOURCES BHD
6222262	POH HUAT RESOURCES HOLDINGS
6286398	SPRITZER BHD
6254265	JPK HOLDINGS BHD
6141635	OCR GROUP BHD
6084837	BINA GOODYEAR BHD
6523589	COUNTRY VIEW BHD
6150460	SEACERA GROUP BHD
6115265	FW INDUSTRIES BHD
6248826	APEX HEALTHCARE BHD
6086479	CNLT (FAR EAST) BHD
6453426	UNITED KOTAK BHD
6284950	TA WIN HOLDINGS BHD
6085272	MALAYSIAN MERCHANT MARINE
6080567	TOYOCHEM CORP BHD
6153362	AHMAD ZAKI RESOURCES BHD
6017123	YKGI HOLDINGS BHD
6721413	RALCO CORP BHD
B1JH042	JOTECH HOLDINGS BHD
6211925	SYF RESOURCES BHD
6140568	VIZIONE HOLDINGS BHD
6122232	AVANGARDE RESOURCES BHD
6092915	WWE HOLDINGS BHD
6180360	CHIN FOH BHD
B1GJ8D6	ABLEGROUP BHD
B1KL2D6	MY EG SERVICES BHD
B1G49R2	GREENYIELD BERHAD
B1RM6F2	PANTECH GROUP HLDGS BHD
B10SMR1	SMRT HOLDINGS BHD
B1VJC39	MELATI EHSAN HOLDINGS
B1QZ9F3	H-DISPLAYS (MSC) BHD
B1SVX57	DUFU TECHNOLOGY CORP BHD
B1LJQ04	AMANAHRAYA REIT
B1SF2F2	MACPIE BERHAD
B1W4727	OGAWA WORLD BERHAD
B1TDTF4	ATRIUM REAL ESTATE INV TRUST
B1WD8F4	ZHULIAN CORP BERHAD
B14L2Q5	MAJUPERAK HOLDINGS BERHAD
B1XFDH6	POWER ROOT BHD
B1W8S37	SUPERLON HOLDINGS BHD
B1XL5X4	HELP INTL CORP BHD
B1Y9MF8	DELEUM BERHAD
B0VY431	COMPUGATES HLDGS BHD
B2369M3	PETRA ENERGY BHD
B1YY2W0	KONSORTIUM TRANSNASIONAL
B23WT10	SARAWAK PLANTATION
B23C352	SCANWOLF CORP
B2477M1	COMPLETE LOGISTIC SERVICE
B28SPM6	VERTICE BHD
B28VNR6	HAP SENG PLANTATIONS HLDG
B29H5B1	NEXTGREEN GLOBAL BHD
9000160	IMPIANA HOTELS BERHAD - OLD
B29H4P8	AEON CREDIT SERVICES M BHD
6834601	SURIA CAPITAL HLDGS BHD
6449425	MERIDIAN BHD
6692768	GLOBAL ORIENTAL BHD
B2NB597	TASCO BERHAD
B1LB9J0	AMFIRST REAL ESTATE INVEST
B197XV0	WELLCALL HOLDINGS BERHAD
B1QSFL0	AL-HADHARAH BOUSTEAD REIT
6680116	MK LAND HOLDINGS BHD
6036322	PASDEC HOLDINGS BHD
B2NPQ18	KEY ASIC BERHAD
6474773	JOHAN HLDGS BHD
6381356	ISKANDAR WATERFRONT CITY BHD
B2NRG03	SIGNATURE INTL BHD
B1M32W9	MRCB-QUILL REIT
B2Q1KT9	SLP RESOURCES BHD
B142NG5	DAYANG ENTERPRISE HOLDINGS
B2QG5C2	EWEIN BHD
B2QZGV5	AXIATA GROUP BHD
B39XB07	INNITY CORP BHD
B2NFGB8	WINTONI GROUP BHD
B2QPJK5	HARTALEGA HOLDINGS BHD
B2PJYS1	TFP SOLUTIONS BHD
B2PFKX6	SCGM BHD
B39XYQ4	LUXCHEM CORP BHD
B3B1WB7	PERWAJA HOLDINGS BHD
B3D2FW0	BARAKAH OFFSHORE PETRO
B3FKMY3	UEM SUNRISE BHD
B3D64D6	SUNZEN BIOTECH BHD
B2QPF74	JF TECHNOLOGY BHD
B1VP2N7	TEO SENG CAPITAL BHD
B3KB661	FINTEC GLOBAL BERHAD
B3KG7D0	FIBON BERHAD
B3BPBW3	SEALINK INTL BERHAD
B602XT7	SAMCHEM HLDGS BHD
B3BP9Y1	UZMA BHD
B3XVSZ1	HANDAL ENERGY BERHAD
B41RS03	TAS OFFSHORE BHD
9000151	HALEX HOLDINGS BHD
B59L2D5	SAUDEE GROUP BHD
B56NX86	MUAR BAN LEE GROUP BHD
B5387L5	MAXIS BHD
B3X17H6	TA GLOBAL BHD
B59L1C7	KELINGTON GROUP BHD
B549KB8	YOONG ONN CORP BHD
B4572F2	DGB ASIA BHD
B63DFW4	HOMERITZ CORP
B06Y599	KAMDAR GROUP (M) BHD
B653522	HOCK HENG STONE IND
B62JK51	JCY INTERNATIONAL BHD
B4TKFV4	VSTECS BHD
B4N0101	OVERSEA ENTERPRISE BHD
B5Q6WR7	SEREMBAN ENGINEERING BHD
B3P45R9	MINDA GLOBAL BHD
B3X8MB6	SARAWAK CABLE BHD
B5TVT01	TURBO-MECH BERHAD
B56H333	SHIN YANG SHIPPINGCORP BHD
B60JFL4	KIMLUN CORP BHD
B3W45N8	EA HOLDINGS BHD
B3ZB1D8	IVORY PROPERTIES GROUP BHD
B3Y3BC4	DYNACIATE GROUP BERHAD
B4VXJ31	SOUTHERN INDUSTRIAL GAS SDN
B3XH2W4	SCC HOLDINGS BHD
B42SX77	BERJAYA RETAIL SDN BHD
B3WMH69	FOCUS POINT HOLDINGS BHD
B3ZKH48	MCT BHD
B67YS79	MALAYSIAN GENOMICS RES
B3W5NN7	MALAYSIA MARINE & HEAVY
B3ZH2K0	CYPARK RESOURCES BERHAD
B5KQGT3	PETRONAS CHEMICALS GROUP
B3WLCQ1	CAREPLUS GROUP BHD
B65MJQ1	BENALEC HOLDINGS BHD
B3RZ1Q1	CAPITALAND MALAYSIA MALL TR
B67M549	K.SENG SENG CORP BHD
B68KD60	ASIA MEDIA GROUP BHD
B3SQ4Z3	CENSOF HOLDINGS BERHAD
B63F348	MAXWELL INTL HLDG BERHAD
B64J4Y6	TAMBUN INDAH LAND BHD
B58PZN9	BERJAYA FOOD BHD

6516448	MOL.COM BHD
6361875	INTEGRAX BHD
6868945	SOUTHERN PLASTIC HLDGS BHD
B03HDQ4	JASA KITA BHD
6584393	METROJAYA BHD
6915603	IDEAL UNITED BINTANG INTERNA
6502005	KONSORTIUM LOGISTIK BHD
6878728	YOKOHAMA INDUSTRIES BHD
BBP6LY0	WCT HOLDINGS BHD
6891576	MNI HOLDINGS BHD
B03KZV2	LEADER STEEL HOLDINGS BHD
6876960	TEXCHEM RESOURCES BHD
6477341	JASATERA
6577898	MENTIGA CP BHD
6004835	MTD ACPI ENGINEERING BHD
6797351	SCK GROUP BHD
6892063	TIONG NAM LOGISTICS HLDGS
6364131	BERJAYA MEDIA BHD
6735061	RANHILL POWER BHD
6690104	PARAGON UNION BHD
6364302	GENERAL CORP BHD
6782540	ATTA GLOBAL GROUP BHD
6182861	CAHYA MATA SARAWAK BHD
6303156	ICONIC WORLDWIDE BERHAD
6445285	OILCORP BHD
B04SKF4	PENSONIC HOLDINGS BHD
B0D0FG7	ENERGREEN CORP BHD
6499798	TENGGARA OIL BHD
6067827	AUSTRAL ENTERPRISES BHD
6776305	KAF-SEAGROATT & CAMPBELL BHD
6308515	EMICO HLDGS BHD
6549842	MCSB SYSTEMS (M) BHD
B0DQSM2	TALIWORKS CORP BHD
B0S5CY4	BERJAYA CAPITAL BHD
6348395	FORMOSA PROSONIC INDUSTRIES
6807272	SBC CORPORATION BHD
6488183	KEJORA HARTA BHD
6868815	SEG INTERNATIONAL BHD
6904991	TRIUMPHAL ASSOCIATES BHD
6807937	PRIME UTILITIES BHD
6795322	SENI JAYA CORP BHD
6884048	AMCORPGROUP BHD
6868956	BRAHIM'S HOLDINGS BHD
6984409	YA HORNG ELECTRONIC (M) BHD
6417176	CEPATWAWASAN GROUP BHD
6825274	SOUTH JOHORE AMALG HLDGS BHD
B1YYNJ4	MAH SING GROUP BHD
6908380	DUNHAM-BUSH (MALAYSIA) BHD
6500388	GADANG HOLDINGS BHD
6512598	LEONG HUP HLDGS BHD
6497725	KUCHAI DEVEL BHD
6232777	CRESCENDO CORP BHD
6045470	APOLLO FOOD HLDGS BHD
6485720	MAJOR TEAM HLDGS
6783178	SAPURA INDUSTRIAL BHD
6964810	WIDETECH (MALAYSIA) BHD
6505587	JKG LAND BHD
6407122	HAI-O ENTERPRISE BHD
6327952	HPI RESOURCES BHD
6567929	EDEN INC BERHAD
6422534	HEXAGON HLDGS BHD
B00SGF0	AXIS INCORP BHD
6100324	BIG INDUSTRIES BHD
6742715	RAPID SYNERGY BHD
6710358	QUALITY CONCRETE HLDGS BHD
6986717	YINSON HLDGS
6324629	EVERMASTER GROUP BHD
6910891	BERTAM ALLIANCE BHD
6504368	KUMPULAN FIMA BHD
6902014	WMG HOLDINGS
6720670	RAMATEX BHD
6275567	DKLS INDUSTRIES BHD
6098452	SCOMI ENGINEERING
6903675	HYUNDAI SIME DARBY BHD
6809148	METECH GROUP BHD
6825252	SRII BHD
6812771	KUMPULAN PERANGSANG SELANGOR
6377452	GOLDEN FRONTIER BHD
6618850	CHASE PERDANA BHD
6492333	PAN MALAYSIA CAPITAL
6632300	CREST BUILDER HLDGS BHD
B1HMM21	WATTA HLDGS BHD
6708096	PNE PCB BHD
6153414	MAA GROUP BERHAD
6408084	KPS CONSORTIUM BHD
6914451	UTUSAN MELAYU (MALAY) BHD
6704533	PROJEK PENYELENGGA LEBUHRAYA
6555946	FRASER & NEAVE HOLDINGS BHD
6825337	SOUTHERN STEEL BHD
6905563	TIMBERWELL BHD
6788678	SELOGA HLDGS
6506580	LATEXX PARTNERS BHD
6770556	SARAWAK OIL PALMS BHD
6980173	SCIENTEX PACKAGING BHD
6599074	MITRAJAYA HLDGS BHD
6609304	MUHIBBAH ENGINEERING (M) BHD
6449179	HWANG CAPITAL (MALAYSIA) BHD
6380825	GRAND CENTRAL ENTERPRISES
6575740	MEGA FIRST CORP BHD
6381970	GRAND UNITED HLDGS BHD
6780685	AMANAH MILLENIA FUND
6207731	DATAPREP HOLDINGS BHD
6459491	INNOVEST BHD
6759254	RUBBEREX CORP (M) BHD
6820796	INNOPRISE PLANTATIONS BERHAD
6005366	SBBS CONSORTIUM BERHAD
6111627	AMTEK HOLDINGS BHD
6281360	INTELLIGENT EDGE TECHNOLOGIE
B01H151	YTL E-SOLUTIONS BHD
6018375	CHUAN HUAT RESOURCES BHD
6520579	NADAYU PROPERTIES BHD
B051DW0	HAISAN RESOURCES BHD
6518875	WILLOWGLEN (MSC) BHD
6175979	NAKAMICHI CORP BHD
B03SLP2	WEIDA (M) BHD
6525983	OKA CORP BHD
6284109	HCK CAPITAL GROUP BHD
6520427	YI-LAI BHD
6017394	ELBA HOLDINGS BHD
B05F2W5	ACOUSTECH BHD
6449414	KUMPULAN POWERNET BHD
6016681	AUTOV CORPORATION BERHAD
6878074	OSK PROPERTY HLDGS BHD
6877736	GUNUNG CAPITAL BHD
B02ZDM5	EMIVEST BHD
6095174	AUTOAIR HOLDINGS BHD
6180854	PERMAJU INDUSTRIES BHD
6457570	GOLDEN LAND BHD
6427227	ASIA BRANDS BERHAD
6084990	TAP RESOURCES BHD
6093424	RHYTHM CONSOLIDATED BHD
B1V7L36	SUPERMAX CORP BHD
6265007	EUROSPAN HOLDINGS BHD
6509891	TSR CAPITAL BHD
6528692	RANHILL UTILITIES BHD
6531775	PLUS EXPRESSWAYS BHD
6532701	IRIS CORP BHD
B0519F5	CAM RESOURCES BHD
6530523	MAXIS COMMUNICATIONS BHD
6429751	LONDON BISCUITS BHD
6531377	AE MULTI HOLDINGS BHD
6520580	NPC RESOURCES
6507204	ACME HOLDINGS BHD
6526027	HIGH-5 CONGLOMERATE BHD
6519801	HOCK SIN LEONG GROUP LTD
6535465	WAH SEONG CORP BHD
6516910	SMIS CORP BHD
6139823	EASTLAND EQUITY BHD
6524571	PWF CORPORATION BHD
6506160	AEON CO. (M) BHD
6449254	BANENG HOLDINGS BHD
6411662	LIPO CORP BHD
B01QKV7	DUOPHARMA BIOTECH BHD
6513911	PUC BERHAD
6530512	STONE MASTER CORP BHD
6525574	BSA INTERNATIONAL BHD
6424541	PRICEWORTH INTERNATIONAL BHD
6742469	RIVERVIEW RUBBER ESTATES BHD
6524883	NICHE CAPITAL EMAS HLDGS BHD
6726117	APL INDUSTRY BHD
B01RWK3	YFG BHD
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6534666	BINAIK EQUITY BHD
6010973	AJINOMOTO MALAYSIA BHD
6582007	CIMB BHD
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6587347	ORNAPAPER BHD
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B01J599	METACORP BHD
6534592	TRC SYNERGY BHD
6587121	LAMBO GROUP BHD
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6608798	CYL CORP BHD
6534451	ENGTEX GROUP BHD
6534600	VADS BHD
6532831	TRACOMA HOLDINGS BHD
6563778	UCREST BHD
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6534945	THREE-A RESOURCES BHD
6563790	DISCCOMP BHD
6534644	ATIS CORP BHD
6610469	KL INFRASTRUCTURE GROUP BHD
6115038	METAL RECLAMATION BHD
6548742	PULAI SPRINGS BHD
6791427	SALCON BHD
6548720	HYTEX INTEGRATED BHD
B02JPH6	SUPERCOMNET TECHNO
6715171	SCOPE INDUSTRIES BHD
6714800	PLENITUDE BHD
6680310	NOVA MSC BERHAD
6671273	ASTINO BHD
6658458	PARLO BHD
B03GWH5	COASTAL CONTRACTS
6372479	GLOBAL CARRIERS BHD
B09SYT1	CENTURY BOND BHD
6685081	HIAP TECK VENTURE BHD
6613491	ORISOFT TECHNOLOGY LTD
6546605	JAYCORP BERHAD
6716055	LEWEKO RESOURCES
6697666	DXN HLDGS BHD
6707350	DOMINANT ENTERPRISE BHD
6613479	PARADE SEASON BHD
6677442	PJBUMI BHD
B5M4SH7	MANAGEPAY SYSTEMS BHD
B67G9Q1	APFT BHD
B3ZN6B7	SMTRACK BERHAD
B5L7640	FOCUS LUMBER BERHAD
9000094	IDEAL JACOBS (MALAYSIA)- OLD
B4Y8MQ7	MCLEAN TECHNOLOGIES BHD
B65XBS0	BOILERMECH HOLDINGS BHD
B41LHL9	UOA DEVELOPMENT BHD
B40GYF8	MSM MALAYSIA HOLDINGS BHD
B4QGNB1	EVERSENDAI CORP BERHAD
B54JP79	INARI AMERTRON BHD
B6WFG06	PRESTARIANG BERHAD
B3YX6Q3	BUMI ARMADA BHD
B58PQ81	REV ASIA BERHAD
B5VN637	HIBISCUS PETROLEUM BHD
B607KN5	OLDTOWN BHD
B0J2LF8	NEXGRAM HOLDINGS BHD
B0LX4J4	ICAPITAL.BIZ BHD
B2ND8F0	WZ SATU BHD
B6WC5H7	PETERLABS HOLDINGS BHD
B0MYNT9	MNC WIRELESS BHD
B11L7D0	APPASIA BERHAD
B4Z0Z18	IDIMENSION CONSOLIDATED BHD
B4VRBJ3	XOX BERHAD
B62QFR9	SUNWAY REIT
B6ZRLP9	SENTORIA GROUP BHD
B7Z7KV5	EITA RESOURCES BERHAD
B7GJ601	SAPURA ENERGY BHD
B8095F2	PESTECH INTERNATIONAL BERHAD
B8F0GN5	TEMASEK FORMATION SDN BHD
B8L1DR5	FELDA GLOBAL VENTURES HOLD
B8FL1M2	GAS MALAYSIA BHD
B7RKJT3	GABUNGAN AQRS BERHAD
B83X6P8	IHH HEALTHCARE BERHAD
B8DB3R3	OCK GROUP BERHAD
B710SK3	PASUKHAS GROUP BHD
B7W5GK3	ASTRO MALAYSIA HOLDINGS BHD
B8HNYQ1	DATASONIC GROUP BERHAD
B8FZ8H8	HIAP HUAT HOLDINGS BERHAD
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B79YDV3	PAVILION REAL ESTATE INV
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B9XQDY2	MPHB CAPITAL BERHAD
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BB36C61	AIRASIA X BERHAD
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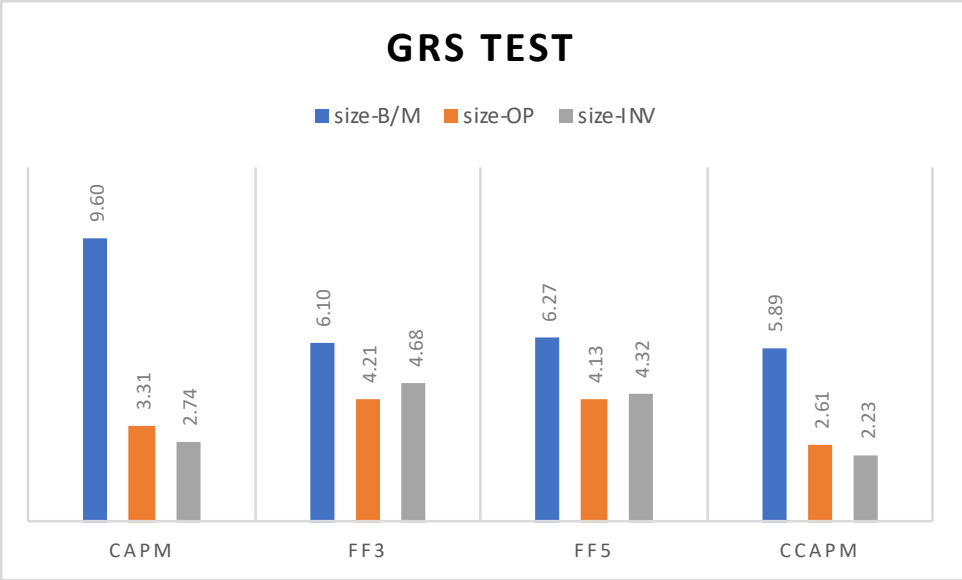
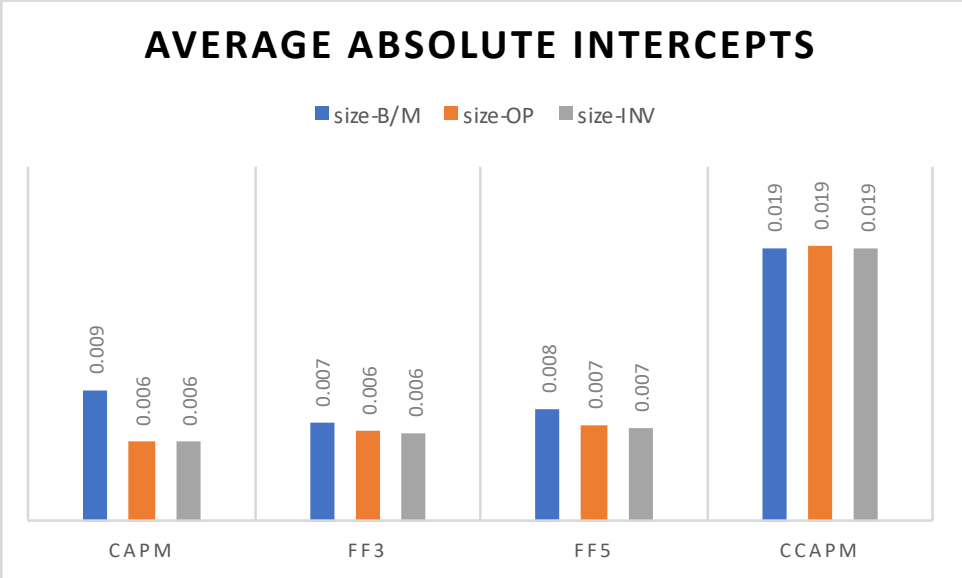
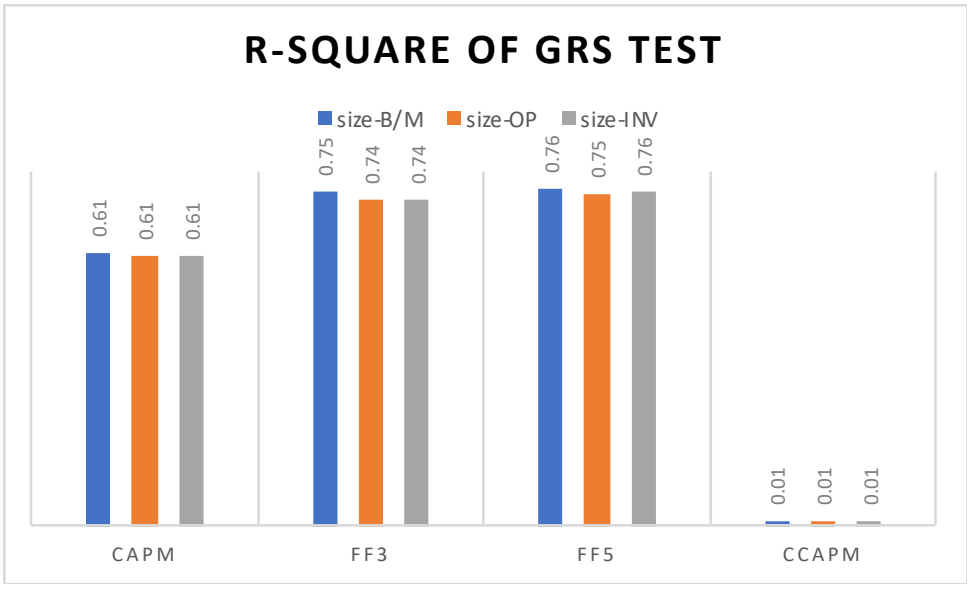
BDFM1K8	WESTPORTS HOLDINGS BHD
BGFB463	CARING PHARMACY GROUP BHD
BGCB7B2	KAREX BERHAD
BGLC5P6	TITIJAYA LAND BHD
BGLKMM6	BERMAZ AUTO BHD
BDFM6W5	VELESTO ENERGY BERHAD
BHC8B29	KANGER INTERNATIONAL BHD
B89JCF2	IGB REIT
BH7JFJ2	IOI PROPERTIES GROUP BHD
BJTMRP3	SCH GROUP BERHAD
BMN9S81	7-ELEVEN MALAYSIA HOLDINGS
BNH7MH5	BOUSTEAD PLANTATIONS BERHAD
BNG7Y25	ECONPILE HLDGS BHD
BNBNPL4	ICON OFFSHORE BERHAD
BPCWYL7	HENG HUAT RESOURCES GROUP
BP9DM08	SASBADI HOLDINGS BERHAD
BP4VKK3	TANAH MAKMUR BERHAD
BQ1K390	REACH ENERGY BHD
BSFV199	ZICO HOLDINGS INC
BSL6X92	CARIMIN PETROLEUM BHD
BTG8635	KRONOLOGI ASIA BHD
BTF7ZK3	E.A. TECHNIQUE (M)
BTGQB89	ONLY WORLD GROUP HOLDINGS
BWSW131	BIOALPHA HOLDINGS BHD
BWXN162	MALAKOFF CORPORATION BHD
BYNXPS6	XIN HWA HOLDINGS BHD
BY5VR82	DOLPHIN INTERNATIONAL BHD
BYP72D0	SEDANIA INNOVATOR BHD
BYMVQ00	IKHMAS JAYA GROUP BHD
BX909K4	SUNWAY CONSTRUCTION GROUP
BYWQH24	AL-SALAM REIT
BYNQJ27	AEMULUS HOLDINGS BERHAD
BYM8DL1	AXCELASIA INC
BYSRH65	KIM TECK CHEONG CONSOLIDATED
BD977N4	RED SENA BERHAD
BYXBL71	CHIN HIN GROUP BHD
BDG1T00	MYNEWS HOLDINGS BHD
BD0CP78	RANHILL HOLDINGS BHD
BYPD8G3	PECCA GROUP BHD
BYYSTZ5	LKL INTERNATIONAL BHD
BYMJ734	SALUTICA BHD
BD0FHK4	DANCOMECH HOLDINGS BHD
BYZKLK9	HSS ENGINEERS BHD
BDGJPP1	PERAK TRANSIT BHD
BYX39S4	BCM ALLIANCE BERHAD
BD8DKF6	RHONE MA HOLDINGS BHD
BY9C4F7	FOUNDPAC GROUP BHD
BYYQB53	MATANG BERHAD
BZ6T4Z8	GFM SERVICES BHD
BDBD6H7	HLT GLOBAL BERHAD
BYVNW76	SERBA DINAMIK HOLDINGS BERHA
BYQC201	EVERSAFE RUBBER BERHAD
BD9GJH9	ECO WORLD INTL BHD
BDVJR61	INTA BINA GRP BHD
BD45QM5	CABNET HOLDINGS BERHAD

6246626	DAIMAN DEVELOPMENT BHD	B00PKJ3	SCOMI GROUP BHD	BZ982W5	ADVANCECON HOLDING BERHAD
6092391	PINEHILL PACIFIC BHD	6726827	GETS GLOBAL BHD	BF3N1G3	LOTTE CHEMICAL TITAN HOLDING
6550327	MBM RESOURCES BHD	6719128	MALAYSIAN BULK CARRIERS BHD	BDFFZK5	CWG HOLDINGS BHD
6705428	PROMTO BHD	6604019	UBS CORP BHD	BD9FP12	CLOUDARON GROUP BH
6745673	ROCK CHEM INDUSTRIES (MALAY)	6711641	PMB TECHNOLOGY BHD	BD2Z8V0	KENANGA INVESTMENT
6491631	KIG GLASS INDUSTRIAL BHD	6673268	IFCA MSC BHD	BF6RHY2	SIME DARBY PLANTAT
6650733	DOLMITE CORP BHD	6654898	BLD PLANTATION BHD	BYWV8V5	RED IDEAS HOLDINGS
6280174	FACB INDUSTRIES INC BHD	6726515	CAB CAKARAN CORP BHD	BF6RHX1	SIME DARBY PROPERT
6024996	AMWAY (MALAYSIA) HLDGS BHD	6711793	DIGISTAR CORP BHD	BD254N4	BINASAT COMMUNICAT
6516675	LINEAR CORP BHD	6708739	LFE CORP BHD	BYZLX84	KIP REAL ESTATE
6558194	CAMERLIN GROUP BHD	B07WT12	ENGLOTECHS HLDG BHD	BF2PY16	JM EDUCATION GROUP
6913384	TH GROUP BHD	6674904	PROTASCO BERHAD	BDSCT90	WEGMANS HOLDINGS
6552282	MALAYSIA SMELTING CORP	6564588	ISYODA CORP BHD	BG00JS2	QES GROUP BERHAD
6828949	SOUTHERN BANK BHD	6654928	CAELY HLDGS BHD	BFMN647	GDB HOLDINGS BHD
6655200	OCB BHD	6726861	OPCOM HOLDINGS BHD	BYZQTY7	NOVA PHARMA SOL
6580465	MERCURY INDUSTRIES BHD	6726612	MOL ACCESSPORTAL BHD	BYVPS30	POLYMER LINK HOLDI
6458294	IPMUDA BHD	6673053	YBS INTERNATIONAL BHD	BD1KFK4	METRO HEALTHCARE B
6703325	POHMAY HLDGS BHD	6705439	PRG HOLDINGS BHD	BFM6T47	TRI-MODE SYSTEM (M
6556789	MALAYSIA BUILDING SOCIETY	6557674	SUMATEC RESOURCES	BF2Q9Q9	JAWALA INC
6799056	SINDORA BHD	6712417	TOYO INK GROUP BHD	BZ57CS2	MI TECHNOVATION BHD
6581844	THRIVEN GLOBAL BHD	6654984	JAG BHD	B63NKB8	WIDAD GROUP BERHAD
6052287	AMANAH HARTA TANAH PNB	6724122	AGESON BHD	BDRTXM3	REVENUE GROUP BERHAD
B03XKB6	DFZ CAPITAL BHD	6586786	M3 TECHNOLOGIES (ASIA) BHD	BFX3K33	AMLEX HOLDINGS BERHAD
B1C3ZB9	FITTERS DIVERSIFIED BHD	6691464	NAIM HLDGS BERHAD	BGSYZQ6	CRG INCORPORATED BHD
6609597	MULPHA INTERNATIONAL BHD	6608453	NETX HOLDINGS BHD	BHNC6X6	LEONG HUP INTERNATIONAL BHD
6681788	PARACORP BHD	6674711	DWL RESOURCES BHD	BK0Q1M6	GREATECH TECHNOLOGY BHD
B03L2M5	HALIM MAZMIN BHD	6691077	LUSTER INDUSTRIES	BJ17CJ5	UWC BHD
B019JL9	INTI UNIVERSAL HLDGS BHD	6658317	PENTAMASTER CORP		
B0DD1H9	KOSSAN RUBBER INDUSTRIES BHD	B02JY46	KNM GROUP BHD		

APPENDIX B: Empirical Result Visualizations






R-SQUARE OF GRS TEST
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size-OP
size-INV
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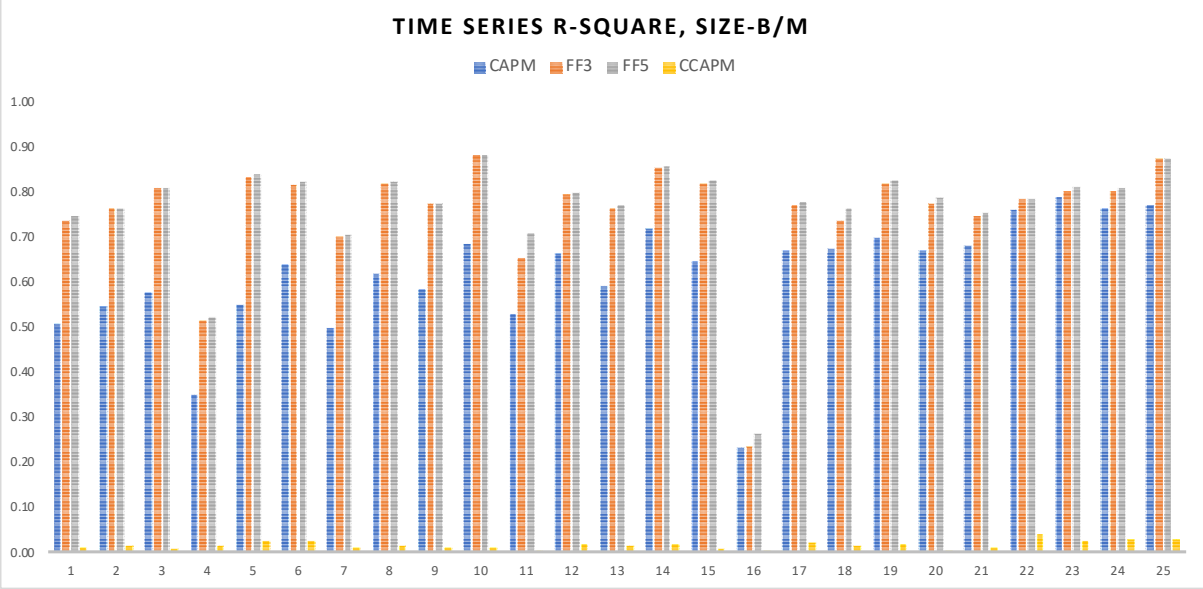
0.75
0.76
0.01
0.01
0.01
CAPM
FF3
FF5
CCAPM


TIME SERIES R-SQUARE, SIZE-B/M
CAPM
FF3
FF5
CCAPM
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0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
2
3
4
5
6
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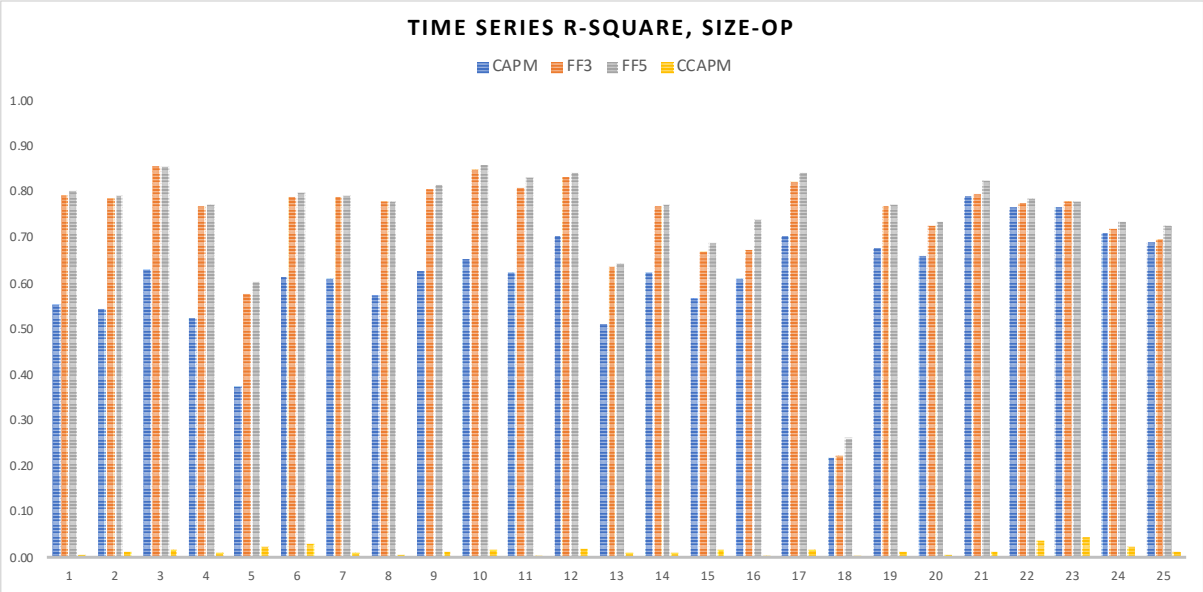
TIME SERIES R-SQUARE, SIZE-OP
CAPM
FF3
FF5
CCAPM
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0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
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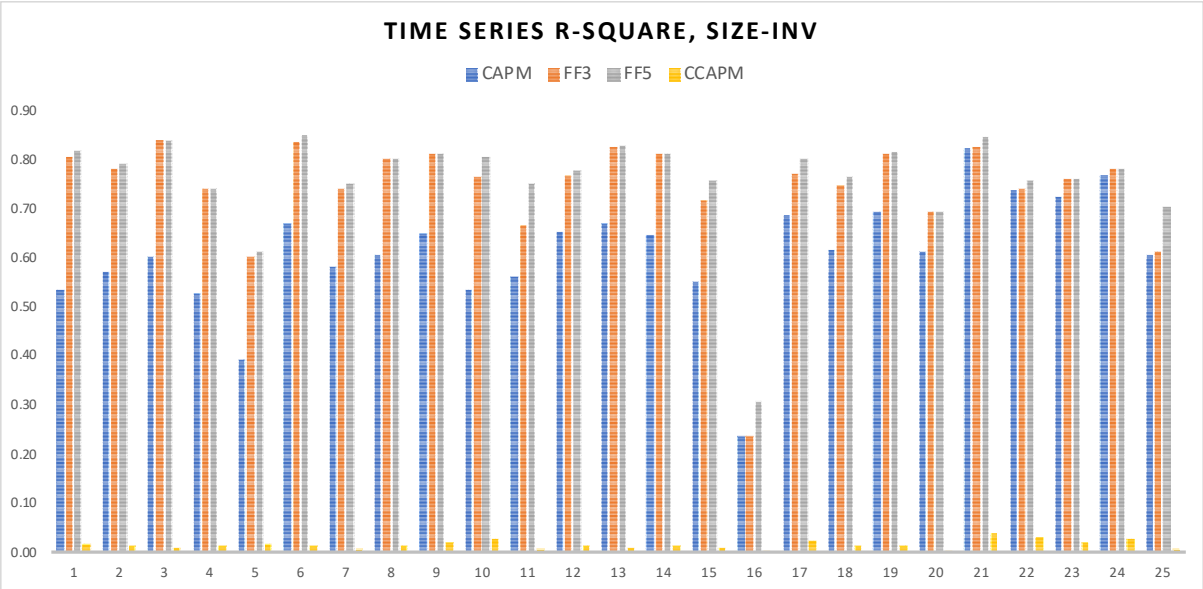
TIME SERIES R-SQUARE, SIZE-INV
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FF5
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0.30
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0.10
0.00
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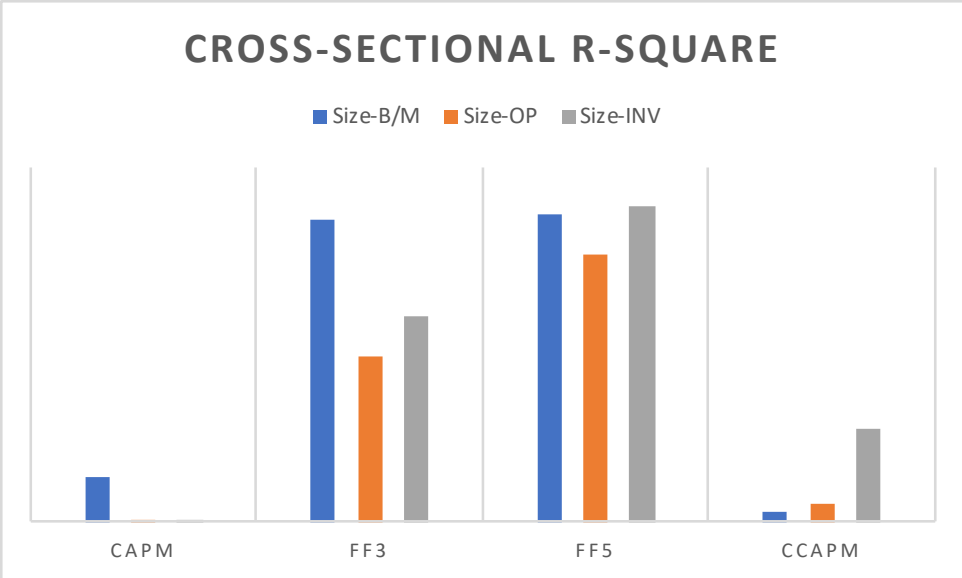
CROSS-SECTIONAL R-SQUARE
Size-B/M
Size-OP
Size-INV
CAPM
FF3
FF5
CCAPM

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