A Study on Investment Returns of Industry Groups in the Stock Exchange of Thailand Using Five-Factor Model

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Abstract

This research aims to examine the rate of return in eight industry groups on the Stock Exchange of Thailand (SET). Our data was collected from the monthly closing price of common stocks in the SET from January 2013 to December 2019, a total of 84 months, using a five-factor model. The five-factor model or the five-risk premiums factor is comprised of: (1) market risk premium, (2) size premium, (3) value premium, (4) profitability premium, and (5) investment premium. The above factors exert an effect on the increases and decreases of stock returns. Thus, to determine the rate of return, the premia factors must be included. In addition, a constant must be calculated to measure the excess return.

The study reflects that the five-factor model can explain the rate of return of industry groups well, especially in the industrials industry, financials industry, property and construction industry, service industry, and technology industry. Furthermore, the research investigates the excess return using the five-factor model to calculate the constant variable according to the Jensen method, with 0.05 statistical significance. The test shows that all eight industry groups do not have abnormal returns. It summarizes that the five-factor model can be efficiently and extensively used to explain the rate of return, hence no excess return.

Keywords: 1) five-factor model 2) rate of return 3) excess return

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Introduction

The SET index is highly volatile. It swings all around the year until closing at the highest point at 1,753.71, only .02 lower than the lowest point of 2017. The supporting factors are from the global and Thai economies, such as the US tax reforms resulting in better investment in various industries and the stimulation of the Thai government's economy (Talis Asset Management Company Limited, 2019). However, if considering the historical data for 7 years, the SET Index used to be at its lowest point as of January 3, 2014, at 1,224.62 due to the situation of the Thai capital market experiencing domestic political problems. Uncertainties from global economic recovery and volatility in world capital markets (The Stock Exchange of Thailand, 2019). This information indicates that the Thai economy is highly volatile due to many risks. Therefore, selecting a good asset is an important step to ensure an efficient investment, market excess return, and risk reduction.

There are two types of asset risk. The first risk, the systematic risk is intrinsic to the entire market and unavoidable. The second one is the unsystematic risk which only affects certain investments. The different types of risk can affect the assessment of the investment's return or cannot fully predict the risk. Therefore, it is critical to use a model that covers various types of risks to make a better investment decision based on the rate of return. The five-factor model developed from the three-factor model is widely used in predicting the returns of securities. The model can capture different types of risk and provide more clarity compared to other models.

In general, securities are classified according to their financial ratios. SET, for example, has created the SET50 Index and SET100 Index using a market capitalization-weighted approach from the stock prices of the top 50 and 100 listed companies in terms of large market capitalization and high liquidity. The indexes help create a benchmark for investors to select their stocks rigorously. In addition, SET has grouped listed companies with similar structures and policies together resulting in eight industry groups: (1) Agro & Food Industry (2) Consumer Products (3) Financials (4) Industrials (5) Property & Construction (6) Resources (7) Services and (8) Technology. Before investing in stocks, it is imperative to comprehend the risk and rewards involved in the industry.

For this reason, I chose the five-factor model to explain the rate of return and excess return (Jensen, 1967, pp.389-416) of the eight industry groups to comprehend the risk and rewards of each industry. Moreover, CAPM and the three-factor model are further studied to compare and analyze the performance of each model. Investors can use this data to better their financing decision.

Literature Review

Method and Theory

1. Securities Grouping Theory

Securities grouping aims to provide a more efficient investment for investors. Nowadays, there are various methods in selecting assets. Two main approaches are 1. Passive investing diversifies portfolios to reduce risk and generate a near-market return. 2. Active

investing selects securities that study financials and economics, focuses on outstanding assets, and expects good returns. However, a higher profit potential comes with a higher risk. (Sharp, 1990, pp.720-726).

SET, for example, has created the SET50 Index and SET100 Index using a market capitalization-weighted approach from the stock prices of the top 50 and 100 listed companies in terms of large market capitalization and high liquidity. The indexes help create a benchmark for investors to select their stocks rigorously.

This research has grouped assets in a similar industry together following SET's criteria of classification of industry group and business sector. They are divided into eight groups: (1) Agro & Food Industry (AGR) (2) Consumer Products (CON) (3) Financials (FIN) (4) Industrials (IND) (5) Property & Construction (PRO) (6) Resources (RES) (7) Services (SER) (8) Technology (TEC).

Grouping the asset industry using SET's criteria helps find the similarities in each type of business, such as the nature of business management, financial ratio, business size, and historical rate of return. On the other hand, it is wise to consider the return of each group to find the most worthwhile investment. It is also essential to acknowledge the risk according to the five-factor models that are significant to all eight groups.

2. Securities Assessment Theory

Sharpe (1964, pp.425-422), Lintner (1965, pp.13-37), and Mossin (1966, pp.768-783) have assessed assets using the Markowitz model (Markowitz, 1952, pp.77-91) and later formulated the Capital Asset Pricing Model (CAPM) which investigates the relationship between the expected return and the systematic risk. However, the CAPM has many limitations. In reality, the CAPM hypothesis cannot capture the nature of the market efficiency and does not have sufficient power to explain the changes in the rate of return.

Fama and French (1993, p.3), as a result, proposed a new model by applying the CAPM to other non-systemic risks. The model adds size risk premium (market value), value risk premium (BE/ME ratio) into the CAPM.

Later, Fama and French (2015, pp. 1-22) improved the explanatory power of the five-factor model by adding two new non-systematic risk factors. The first is the profitability risk premium or the company's profitability risk factor. And the last one is the investment risk premium or investment risk factor of the listed companies..

3. Securities Group Assessment Theory

Jensen (1967, pp.389-416) has adapted a performance evaluation theory using the foundation groundwork of the CAPM. This metric compares the differences between the actual return and expected return or the coefficient. If the value is positive, the portfolio is earning an excess return. On the other hand, the negative value means that the portfolio is underperforming.

Literature Review

Fama and French (2015, p.18) enhanced the three-factor model into the five-factor model to test the rate of returns and observe

the risk factors that have an explaining power on the NYSE Amex and NASDAQ. The model used regression analysis on data collected from NYSE Amex and NASDAQ, US market from 1963 to 1990. The result indicates that the two new factors, profitability, and investment, can explain the excess return. On the other hand, the size risk premium (HML) is considered a redundant factor due to its high return rate. Hence, the four-factor model was introduced. It is comprised of the market factor (Rm-Rf), size factor (SMB), profitability factor (RMW), and investment factor (CMA). The two new factors: RMW and CMA, has a significant negative correlation to the rate of return.

In "Testing Alternative Versions of the Fama-French Five-Factor Model in the UK," Foye (2018, pp.167-183) evaluated the ability of the CAPM, the three-factor model, and the five-factor model to describe equity return focusing on the London Stock Exchange. The data collected covers the period from October 1989 to September 2016, a total of 360 months from liquidated and unliquidated companies using regression analysis to test all three models. The result indicates that the five-factor model has more explanatory power than the three-factor model. Moreover, the RMW can significantly be used to explain the return of industry groups.

Kruealao (2017, pp.75-78) analyzed the performance of the CAPM, the three-factor model, and the five-factor model to compare their ability to explain stock price movement and average return. The sample was collected monthly and annually from SET from December 29th, 2000 to December 29th, 2017. The Linear regression model was performed using SPSS Statistics. The result portrays that the five-factor model can best illustrate the changes in excess return considering the highest adjusted R2 value. And the market premium, investment premium, value premium can significantly explain the variation at a 95% confidence level.

Methods

Data Collection and Samples

This research used secondary data collected monthly from the listed companies in SET and other financial information including SET Index, monthly highest interest rate, business value, book-to-market ratio, operating profit, shareholder value, and asset value. The study took place between January 2013 to December 2019, a total of 84 months from the SETSMART database.

Hypotheses

1) Testing Coefficient of the Five-Factor Model

Fama and French's (2015, p.18) five-factor model with five risk premiums can explain all eight groups of industries' returns. This idea leads to the hypothesis;

Hypothesis 1: The five risk premiums can explain the rate of return in all eight industry groups.

2) Testing Constant Coefficient of Excess Return

According to Jensen (1967, pp.389-416), the five risk premiums in the five-factor model can describe excess return in eight industry sectors. This idea leads to the hypothesis;

Hypothesis 2: The five risk premiums can explain the excess return in all eight industry groups

Methodology

1) I created a stock group using secondary data according to the SET classification of industry group and sector which is divided into eight groups. Then I calculated the average return of each group using data collected from January 2013 to December 2019.

$$R_{p,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \quad \text{--- (1)}$$

Where

$R_{p,t}$ is the expected return from stock p at time t

$P_{i,t}$ is the price of stock i at time t

$P_{i,t-1}$ is the price of stock i at time t-

2) I classified all listed companies in SET into MKT, SMB, HML, RMW, and CMA according to the five-factor model.

1. I used the market risk premium factor following Fama and French's (1993, p. 3) model to calculate the data collected from January 2013 to December 2019 which is shown in the following equation.

$$R_{m,t} = \frac{S_{i,t} - S_{i,t-1}}{S_{i,t-1}} \quad \text{--- (2)}$$

Where

$R_{m,t}$ is the rate of return of market i at time t

$S_{i,t}$ is SET Index at time t

$S_{i,t-1}$ is SET Index at time t-1

Then I calculated the market risk premium using a risk-free rate of return and the highest guaranteed saving deposits from the Bank of Thailand.

$$MKT_{i,t} = R_{m,t} - R_{f,t} \quad \text{--- (3)}$$

Where

$MKT_{i,t}$ is the market risk premium of i at time t

$R_{m,t}$ is the rate of return of market i at time t

$R_{f,t}$ is the risk-free rate of i at time t

2. Fama–French (1993, p.3) has developed a model consisting of the size factor (size risk premium) and value factor (value risk premium, the book-to-market, HML). I used market capitalization from year t-1 to rank all firms into small stock (S) and big stock (B). Then I sorted the BE/ME ratio from year t-1 into small and big. Lastly, I computed the monthly returns of listed companies in SET from January 2013 to December 2019 to divide the stocks into six groups; SL, SM, SH, BL, BM, and BH shown in the following equation.

$$\frac{BE_{i,t}}{ME_{i,t}} = \frac{\text{Book value of equity}_{i,t-1}}{\text{Market value of equity}_{i,t-1}} \quad \text{--- (4)}$$

Where

$\frac{BE_{i,t}}{ME_{i,t}}$ is the book-to-market ratio of securities i at time t

$\text{Book value of equity}_{i,t-1}$ is the book value of equity i at time t - 1

$\text{Market value of equity}_{i,t-1}$ is the market value of equity i at time t - 1

1. Securities group with the highest BE/ME (SH, BH) accounted for 30% of the total securities. In terms of the value factor, it is hypothesized that those are companies with a high book-to-market ratio, efficient management and operating, good financial condition, low risk, and low expected returns from investors.

2. Securities group with medium BE/ME (SM, BM) accounted for 40% of the total securities.

3. Securities group with low BE/ME (SL, BL) accounted for 30% of the total securities.

In terms of the value factor, it is hypothesized that those are companies with a low book-to-market ratio, ineffective management and operating, good financial condition, high risk, and high expected return from investors.

	Market Value		
	Small : S	Big : B	
30 th BE/ME Percentile	SL	BL	30% : Low : L
	SM	BM	40% : Medium : M
70 th BE/ME Percentile	SH	BH	30% : High : H

Picture No. 1 Six groups of securities according to market size value (B, S) and BE/ME ratio (L, M, H)

SMB = Average return of Small Size Minus Big Size --- (5)

= 1/3 * (SL + SM + SH) - 1/3 * (BL + BM + BH)

HML = Average return on high B/M ratio minus low B/M ratio --(6)

= 1/2 * (SH + BH) – 1/2 * (SL + BL)

Where

SH represents the securities group with a small size market capitalization and a high book-to-market ratio.

SM represents the securities group with a small size market capitalization and a medium book-to-market ratio.

SL represents the securities group with a small size market capitalization and low book-to-market ratio.

BH represents the securities group with a big size market capitalization and a high book-to-market ratio.

BM represents the securities group with a big size market capitalization and a medium book-to-market ratio.

3. Data collected from January 2013 to December 2019 are grouped according to Fama and French's model (2015, p.18) using the intersection of the profitability risk premium and market value premium. The size of the portfolio is small (S) and big (B). Then I divided the portfolios according to the profitability performance into high profitability portfolio (robust), medium profitability (neutral), and low profitability (weak). The six groups of data: BR, BN, BW, SR, SN, and SW from time t-1 were computed in the following equation.

$$OP_{i,t} = \frac{EBIT_{i,t-1}}{\text{Book value of equity}_{i,t-1}} \quad \text{--- (7)}$$

Where

$OP_{i,t}$ is profitability of i at time t

$EBIT_{i,t-1}$ is earnings before interest and tax of I at time t-1

Book value of equity$_{i,t-1}$ is book value of equity of i at time t-1

1. Securities group with robust profitability (SR, BR) accounted for 30% of the total securities. It is hypothesized that the stock has high profitability, low risk, and low expected return from investors.

2. Securities group with nature profitability (SN, BN) accounted for 40% of the total securities.

3. Securities group with weak profitability (SW, BW) accounted for 30% of the total securities. It is hypothesized that the stock has low profitability, low risk, and high expected return from investors.

	Market Value		
	Small : S	Big : B	
30 th Operating Profit Percentile	SW	BW	30% : Weak : W
	SN	BN	40% : Nature : N
70 th Operating Profit Percentile	SR	BR	30% : Robust : R

Picture No. 2 Six groups of securities according to the market value (B, S) and profitability ratio (R, N, W)

RMW = Average Return on Robust Minus Week --- (8)

= 1/2 * (SR + BR) – 1/2 * (SW + BW)

Where

SR is the average rate of return of a small size securities group with a robust profitability.

SN is the average rate of return a of small size securities group with a neutral profitablity.

SW is the average rate of return of a small size securities group with a weak profitablity.

BR is the average rate of return of a big size securities group with a robust profitability.

BN is the average rate of return of a big size securities group with a neutral profitability.

BW is the average rate of return of a big size securities group with a weak profitability.

4. I grouped the assets from listed companies in SET using Fama and French's (2015, p. 18) investment risk premium. The data was collected from January 2013 to December 2019. They were classified into two groups according to the changes in the asset from year t-2 to t-1. The assets with substantial change are called aggressive (A). And the assets with a small change are called conservative (C). There is a total of six groups; BC, BN, BA, SC, SN, and SA which are shown in the following equation.

$$Inv_{i,t} = \frac{TA_{i,t-1} - TA_{i,t-2}}{TA_{i,t-2}} \quad \text{--- (9)}$$

Where

$Inv_{i,t}$ is an investment premium at time t.

$TA_{i,t-1}$ is a total asset of securities i at time t-1.

$TA_{i,t-2}$ is a total asset of securities i at time t-2.

1. A securities group with substantial asset change or aggressive (SA, BA) accounted

for 30% of the total securities. It is hypothesized that a company with high investment will have high risk.

2. A securities group with medium asset change or neutral (SN, BN) accounted for 40% of the total securities.

3. A securities group with low asset change or conservative (SC, BC) accounted for 30% of the total securities. It is hypothesized that a company with a low investment will have low risk.

Market Value

	Small : S	Big : B	
30 th Investment Firm Percentile	SW	BW	30% : Conservative : W
	SN	BN	40% : Nature : N
70 th Investment Firm Percentile	SA	BA	30% :Aggressive : A

Picture No. 3 Six groups of securities according to market value (B, S) and the investment value (C, N, A)

CMA = Average return on Conservative Minus Aggressive --- (10)

= 1/2 * (SC + BC) – 1/2 * (SA + BA)

Where

SC is the average rate of return of a small securities group with a conservative investment.

SN is the average rate of return of a small securities group with neutral investment.

SA is the average rate of return of a small securities group with an aggressive investment.

BC is the average rate of return of a big securities group with a conservative investment.

BN is the average rate of return of a big securities group with a neutral investment.

BA is the average rate of return of a big securities group with an aggressive investment.

3. First, a descriptive analysis of dependent variables (eight industry groups) and independent variables (five-factor model) was performed. Then I examined the data using inference statistics by testing multiple regression to find coefficient $\propto_i$, β_i, s_i, h_i, r_i, and c_i of the eight industries group. Lastly, I investigated the relationship between the coefficient value and the independent variable from eight formulas to see which can best predict the rate of return and explain the risk. Here is the equation.

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + s_i(SMB_t) + h_i(HML_t) + r_i(RMW_t) + c_i(CMA_t) + e_{i,t} \quad \text{--- (11)}$$

Where

$R_{i,t}$ is the rate of return of equity i at time t.

$R_{f,t}$ is the risk-free return at time t.

R_m is the rate of return of securities group at time t.

α_i is the fixed value of securities i.

$\beta_i, s_i, h_i, r_i, c_i$ are coefficients of the premiums.

SMB_t is the average rate of return of a small securities group minus a big securities group (small minus big).

HML_t is the average return of a high BE/ME securities group minus the a low BE/ME industry group (high minus low).

RMW_t is the average return of a high profitability securities group minus a low profitability securities group (robust minus weak).

CMA_t is the average return of a low investment securities group minus a high investment securities group (conservative minus aggresive).

$e_{i,t}$ is an error.

Data Analysis

Descriptive Statistics

The necessary statistical data in various groups of variables were computed to test the hypothesis and analyze using descriptive statistics. The results were displayed in terms of mean, maximum, minimum, standard deviation, and coefficient of variation.

Inferential statistics

Multiple regression analyses were used to test the five-factor model hypothesis.

Results

Descriptive Statistic

1. Dependent variables of the average return on the asset were summarised as per each group of businesses in the eight industry groups.

Table No. 1 shows descriptive statistics of the average return on the asset in the eight industry groups.

Avg. Return	AGR	CON	FIN	IND	PRO	RES	SER	TEC
2556	-1.28	0.50	0.89	-0.32	0.51	1.65	0.87	1.39
2557	1.49	5.15	1.79	2.58	2.13	4.08	2.06	2.08
2558	-0.46	-0.44	0.02	-1.04	0.01	-1.69	-0.35	-1.19
2559	2.72	0.36	1.29	2.79	0.67	1.99	1.43	1.69
2560	-0.08	-0.56	1.21	0.35	-0.02	0.35	0.98	-0.17
2561	-2.79	-2.19	-1.54	-1.95	-1.19	-1.79	-1.80	-2.23
2562	-0.01	-0.74	-0.23	-1.69	-0.59	0.31	-0.39	-0.38
Average	-0.06	0.30	0.49	0.10	0.22	0.70	0.40	0.17
S.D.	11.15	15.29	10.35	11.01	10.6	15.42	10.12	11.17
Max.	203.62	544.62	141.07	187.50	197.98	566.67	115.00	97.66
Min.	-57.87	-75.85	-67.31	-54.55	-77.27	-57.43	-53.25	-43.75
C.V. Ratio	-200.12	51.35	21.10	110.03	48.78	21.99	25.29	65.44

Table No. 2 shows the relationship of the eight industry groups in certain conditions

Correlation	AGR	CON	FIN	IND	PRO	RES	SER	TEC
AGR	1							
CON	0.58	1						
FIN	0.74	0.57	1					
IND	0.85	0.63	0.84	1				
PRO	0.79	0.60	0.81	0.888	1			
RES	0.72	0.58	0.78	0.784	0.80	1		
SER	0.83	0.63	0.88	0.9	0.92	0.81	1	
TEC	0.82	0.57	0.83	0.846	0.83	0.81	0.88	1

Table No. 1 points out that the resources industry has the highest average rate of return at 0.70% because many investors are interested in this sector. Moreover, the returns usually increase in compliance with continuous economic growth. Though Thailand faces contraction in some years, the economy is expanding in the big picture. On the contrary, the Agro and food industry has the lowest average rate of return at -0.06% due to an oversupply caused by a decreasing purchasing power. Considering the coefficient of variation (CV) in each group, the industrials group has the highest CV at -200.12. This number implies a higher risk at the same return rate. The financials industry has the lowest CV at 21.10. Though it has an average rate of return, the standard deviation is not quite high.

Table No. 2 shows that the returns of the agro and food industry, financials industry, industrials industry, property and construction industry, resources industry, services industry, and technology industry have a high level of positive correlation. To clarify, the returns of the mentioned industries move up and down in the same direction. However, the consumer products industry has a moderate negative correlation with the rest. The independent variables; RM-RF, SMB, HML, RMW and CMA returns, were calculated

Table No. 3 shows a calculated average monthly risk premium of RM-RF, SMB, HML, RMW, and CMA.

Avg. Return	RM-RF	SMB	HML	RMW	CMA
2556	-1.18	1.24	0.74	-0.79	0.63
2557	0.47	1.82	0.36	-0.85	2.08
2558	-1.95	-0.03	0.90	-0.07	0.70
2559	0.92	-0.25	0.63	0.31	0.08
2560	0.46	-0.36	0.95	1.04	0.48
2561	-1.50	0.29	1.21	-0.77	0.52

Avg. Return	RM-RF	SMB	HML	RMW	CMA
2562	-0.50	-0.78	-0.53	0.48	0.08
Average	-0.47	0.28	0.61	-0.09	0.65
S.D.	3.55	2.12	2.13	1.99	1.89
Max.	6.17	7.94	-0.79	4.17	11.85
Min.	-9.80	-3.56	-0.85	-6.64	-3.59
C.V. Ratio	-7.54	7.66	3.50	-21.71	2.90

Table No. 4 shows a correlation risk premium of RM-RF, SMB, HML, RMW, and CMA.

Correlation	RM-RF	SMB	HML	RMW	CMA
RM-RF	1				
SMB	-0.01	1			
HML	-0.262	0.201	1		
RMW	0.41	-0.82	-0.23	1.00	
CMA	0.106	0.842	0.07	-0.578	1

Table No. 3 indicates that the market premium (RM-RF) from January 2013 to December 2019 has a monthly average of -0.47%. In year 2013, 2015, 2018, and 2019, the risk premium rate are at -1.18%, -1.05%, -1.50%, and 0.50% respectively. These statistics imply that the risk-free return is higher than the market return causing the market risk premium to be negative. While in 2014, 2016, and 2017, the market risk premium are positive at 0.47%, 0.92%, and 0.46% respectively. This is because the market return rate is higher than the risk-free return.

The average return of a small securities group compared to a large group per month of size risk premium (SMB) in 2015, 2016, 2017, and 2018 is negative. However, the overall outlook presents that SMB variables have an average of 0.28%. The data aligns with Fama and French's idea (1993, p.3). They stated that small firms have more disadvantages in terms of business operation. The risk is high, so the investors also expect a high return.

The average return of a high book-to-market ratio (BH, SH) compared to a small book-to-market ratio (BL, SL) per month or value risk premium (HML) in 2019 is negative at 0.53%. However, the average return is positive at 0.61% which indicates that large-capitalization portfolios outperform small-capitalization portfolios. This data conflicts with Fama and French's hypothesis (1993, p.3).

The average return of high profitability firms (SR, BR) compared to low profitability firms (SW, BW) per month or profitability risk premium (RMW) in 2013, 2014, 2015, and 2018 is negative. On the other hand, the rest have a positive value. However, the overall average return is negative at 0.09%. This data implies that a portfolio with a robust profitability rate has high risk and high expectations of returns from investors. The finding contradicts with Fama and French model (2015, pp.1-22).

The monthly average return of high investment portfolios (SA, BA) compared to low investment portfolios (SC, BC) or investment risk premium (CMA) in all seven years is positive as well as the yearly average. It can be interpreted that assets with a conservative investment are considered high risk so investors expected higher returns, in contrast to assets with aggressive investment. This data contradicts Fama and French model (2015, pp.1-22).

Table No. 4 demonstrates a correlation of the differences between monthly risk premium RM-RF, SMB, HML, RMW, and CMA. The test shows that the correlation range from negative to positive (-0.578 to 0.842) in all variables. It shows that each group of variables is not related.

Table No. 5 shows the ability to explain investment returns of the CAPM, the five-factor model, and the three-factor model when a statistical significance value is at 0.05.

Model /Industry Groups		AGR	CON	FIN	IND	PRO	RES	SER	TEC	Avg. R^2 abj.
5 Factor Model	Constant	-0.097	-0.64	-0.323	-0.073	0.179	0.436	0.282	0.211	
	Rm-RF	*0.996	*0.697	*1.063	*1.057	*1.033	*1.286	*1.062	*1.142	
	SMB	0.07	*0.616	*0.779	*0.74	*0.774	*0.903	*0.465	*0.805	
	HML	-0.286	*0.634	-0.028	0.329	-0.24	*-0.66	-0.149	*-0.471	
	RMW	-0.175	-0.31	0.002	*0.442	*-0.399	-0.246	-0.089	0.063	
	CMA	-0.155	-0.106	-0.194	-0.082	*-0.52	0.381	*-0.274	-0.28	
	adj. R^2 (%)	70.10	51.40	80.60	74.40	82.40	74.40	83.20	74.60	73.89
CAPM	Constant	-0.319	-0.116	-0.227	0.24	-0.004	0.575	0.176	-0.004	
	Rm-RF	*1.035	*0.714	*1.114	*1.06	*1.143	*1.326	*1.118	*1.222	
	adj. R^2 (%)	70.10	31.10	71.40	66.40	69.90	59.70	79.80	67.00	64.43
3 Factor Model	Constant	-0.203	*-0.755	-0.404	-0.008	-0.132	0.542	0.146	0.106	
	Rm-RF	*1.021	*0.722	*1.085	*1.048	*1.109	*1.253	*1.097	*1.172	
	SMB	0.073	*0.698	*0.69	*0.517	*0.705	*1.18	*0.377	*0.651	
	HML	-0.234	*0.739	-0.044	0.161	-0.136	*-0.54	-0.138	*-0.517	
	adj. R^2 (%)	70.20	51.30	80.70	72.30	78.70	76.30	82.60	74.40	73.31
adj. R^2 (%) Max.		Three Factor	Five Factor	Three Factor	Five Factor	Five Factor	Three Factor	Five Factor	Five Factor	

Note : *a statistical significance value is 0.05

Table No. 5 shows that using a regression formula to analyze the five-factor model on all eight industry groups can efficiently explain the asset returns. The adjusted R2 is as high as 73.89%, signifies that the five-factor model can explain the rate of returns better than the CAPM and the three-factor model.

The coefficient of multiple determinations based on the five-factor model of the eight industry groups; the services industry, property and construction industry, industrials industry, technology industry, resources indus-

try, financials industry, agro and food industry, and consumer products industry have R2 values equal to 83.20%, 82.40%, 80.60%, 74.60%, 74.40%, 74.40%,70.10%, and 51.40% respectively. The data implies that the five-factor model is able to explain the rate of return of every industry group. And the services industry has the highest coefficient value, which means the five-factor model can best capture the returns of this group.

Agro and food industry group coefficients are statistically significant (p-value) at 0.05. The coefficient for market risk premium (β) is 0.996. In other words, if the market risk premium increases one unit, the predicted returns for the portfolio would increase by 0.996 units. Coefficients for other premiums are not statistically significant.

Consumer products industry group (CON) coefficients are statistically significant (p-value) at 0.05. The coefficient for market risk premium (β) is 0.697. In other words, if the market risk premium increases one unit, the predicted returns for the portfolio would increase by 0.697 units. The coefficient for the size risk premium (s) is 0.616. To be specific, if the size premium increases by one unit, the predicted returns for the portfolio would increase by 0.616 units. As for value risk premium (h), the coefficient is 0.634, meaning if the value premium increases one unit, the predicted returns for the portfolio would increase by 0.634 units. Coefficients for other premiums are not statistically significant.

Industrials industry group (IND) coefficients are statistically significant (p-value) at 0.05. The coefficient for market risk premium (β) is 1.063. In other words, if the market risk premium increases one unit, the predicted returns for the portfolio would increase by 1.063 units. The coefficient for the size risk premium (s) is 0.779. To be specific, if the size premium increases by one unit, the predicted returns for the portfolio would increase by 0.779 units. Coefficients for other premiums are not statistically significant.

Financials industry group (IND) coefficients are statistically significant (p-value) at 0.05. The coefficient for market risk premium (β) is 1.057. In other words, if the market risk premium increases one unit, the predicted returns for the portfolio would increase by 1.057 units. The coefficient for the size risk premium (s) is 0.74. To be specific, if the size premium increases by one unit, the predicted returns for the portfolio would increase by 0.74 units. As for profitability premium (r), the coefficient is 0.442, meaning if the profitability premium increases one unit, the predicted returns for the portfolio would increase by 0.442 units. Coefficients for other premiums are not statistically significant.

Property and construction industry group (PRO) coefficients are statistically significant (p-value) at 0.05. The coefficient for market risk premium (β) is 1.033. In other words, if the market risk premium increases one unit, the predicted returns for the portfolio would increase by 1.033 units. The coefficient for the size risk premium (s) is 0.774. To be specific, if the size premium increases by one unit, the predicted returns for the portfolio would increase by 0.747 units. As for profitability premium (r), the coefficient is -0.399, meaning if the profitability premium increases one unit, the predicted returns for the portfolio would

decrease by 0.399 units. And the investment risk premium (c) coefficient is at -0.52, suggesting that if the investment premium increases one unit, the predicted returns for the portfolio would decrease by 0.52 units. Coefficients for other premiums are not statistically significant.

Resources industry group (RES) coefficients are statistically significant (p-value) at 0.05. The coefficient for market risk premium (β) is 1.286. In other words, if the market risk premium increases one unit, the predicted returns for the portfolio would increase by 1.286 units. The coefficient for the size risk premium (s) is 0.903. To be specific, if the size premium increases by one unit, the predicted returns for the portfolio would increase by 0.903 units. As for value risk premium (h), the coefficient is -0.66, meaning if the profitability premium increases one unit, the predicted returns for the portfolio would decrease by 0.66 units. Coefficients for other premiums are not statistically significant.

Services industry group (SER) coefficients are statistically significant (p-value) at 0.05. The coefficient for market risk premium (β) is 1.062. In other words, if the market risk premium increases one unit, the predicted returns for the portfolio would increase by 1.062 units. The coefficient for the size risk premium (s) is 0.465. In other words, if the size premium increases by one unit, the predicted returns for the portfolio would increase by 0.465 units. And the investment risk premium (c) coefficient is at -0.274, suggesting that if the investment premium increases one unit, the predicted returns for the portfolio would decrease by 0.274 units. Coefficients for other premiums are not statistically significant.

Technology industry group (SER) coefficients are statistically significant (p-value) at 0.05. The coefficient for market risk premium (β) is 1.142. In other words, if the market risk premium increases by one unit, the predicted returns for the portfolio would increase by 1.142 units. The coefficient for the size risk premium (s) is 0.805. In other words, if the size premium increases by one unit, the predicted returns for the portfolio would increase by 0.805 units. As for value risk premium (h), the coefficient is -0.471, meaning if the profitability premium increases one unit, the predicted returns for the portfolio would decrease by 0.471 units. Coefficients for other premiums are not statistically significant.

Furthermore, Jensen (1967, pp.389-416) has analyzed the excess return using the five-factor model to calculate the constant variable (p-value=0.05). The result shows no excess return in all eight industry groups, meaning all constant variables are statistically insignificant. In conclusion, the five-factor model can efficiently and thoroughly explain the rate of returns.

Further study using CAPM and the three-factor model was carried out to provide a better explanation. The CAPM has a coefficient of determination value of 64.43%, while the three-factor model has 73.31%. The two numbers are lower than that of the five-factor model. It signifies that overall, the five-factor model outperforms the others in explaining returns.

The results also indicate that profitability risk premium, one of the two new factors in the five-factor model, can explain the rate of return with statical significance in the financials

sector and property and construction sector. This finding aligns with the entrepreneurs' and investors' idea that the financial business such as commercial banks and insurance companies often announce their turnover so the investors would know their capability every quarter and decide to invest. Property and construction groups, such as housing estate companies, will announce their turnover so investors can learn about their popular projects. The low profitability firm will have more return in the property and construction industry.

The investment premium, the other new factor in the five-factor model, can explain the rate of return with statical significance in the property and construction industry and services industry. The asset change would explain the sell ability of the housing project. More changes in the asset in the year means the company invests more in construction. Vice versa, less changes means the property is selling well. Thus, tbe more changes in assets or investments will capture more interest from investors. As for the services industry, the more changes in the asset signifies that the company is investing, for example, storefront investment for product distribution or car and plane investment for better logistics. Therefore, investors look for the change in assets to determine their investment in this business group. Statistically, the investment risk premium has a good ability to explain the rate of return in the services industry.

Conclusion and Discussion

From the total of eight industry groups classified by SET, the services industry has the highest monthly average return at 0.70%. This business group has widespread popularity among investors since its return depends on economic growth which continues to increase. The agro and food group has the lowest average monthly return at -0.06% due to its high volatility from 2013 to 2019. The import-export is another impacting factor since most businesses face the fluctuance of the currency exchange rate. In addition, Thai economic performance in 2013 grew only 2.9%, slowed down from the previous year. But in 2014, the Thai economy recovered, pushing the agro and food business to perform better. Moving to 2018-2019, the conflict between US and China caused global trade to slow down. Alongside the declination in export on all markets, including agro and food industry.

Comparing the risk of each industry using a coefficient of variation (CV) projects that the industrials industry has the highest CV at -200.12. And the agro and food industry has the highest risk at the same return rate. Whereas the financials group has the lowest CV at 21.10. The financials sector has a medium return rate compared to others and a high standard deviation.

I used multiple regression to compare the efficiency of each industry group following the five-factor model, the CAPM, and the three-factor model. The test indicates that the CAPM and the five-factor model have no statistically significant excess return. However, testing the three-factor model, the consumer product industry has a negative constant with statistical significance. It can imply that the consumer product sector has less return than

normal. The date used is an average monthly return from 2013 to 2019.

The adjusted coefficient of determination (adjusted R2) of the CAPM, the three-factor model, and the five-factor model are 64.43%, 73.31%, and 73.89%, respectively. The result can conclude that the five-factor model has the supreme power to predict a return of the overall industry.

When considering the variable coefficients in the five-factor model, the CAPM, and the three-factor model, it can be observed that;

1. Market risk premium is the only factor that has a positive correlation with the rate of return in all eight industry groups (the statistically significant level at 0.05).

2. Size risk premium has a positive correlation with six groups of industry including, the consumer product industry, financials industry, industrials industry, property and construction industry, resources industry, and technology industry (the statistically significant level at 0.05).

3. Value risk premium has a positive correlation with the consumer product industry's return (the statistically significant level at 0.05). And it has a negative relationship with the resources industry and technology industry with the same rate of statistical significance.

4. Profitability risk premium has a positive correlation with the rate of return from the financials industry (the statistically significant level at 0.05). And it has a negative relationship with the property and construction industry with the same rate of statistical significance.

5. Investment risk premium has a positive correlation with the rate of return from the property and construction industry (the statistically significant level at 0.05).

Discussion

This research examines the return on investment of eight industry groups in the SET using the five-factor model, the CAPM, and the three-factor model. The results are discussed based on the hypothesis of the study show that:

Considering the adjusted R2 level of the three models, the five-factor model has the highest average coefficient of multiple determination value. It interprets that the five-factor model can explain a portfolio return better than other models. This result aligns with Foye's work (2018, pp.167-183) on the efficiency of the three-factor model and the five-factor model on the London Stock Exchange. Moreover, Kruealao's research (2017, pp.75-78) on the return of assets in SET also observed that the five-factor model has the highest adjusted R2 value.

While testing for excess return (Jensen, 1967, pp. 389-416), it is noted that none of the industry groups has statistically significant excess return. This data contradicts the hypothesis of Fama and French (2015 pp.1-22) stated that some individual stocks in NYSE Amex and NASDAQ have excess returns. However, this study of eight industry groups in SET confirmed that the five-factor model has the power to explain the rate of return and cover all the risks, hence no excess return.

Data collected from eight industry groups in SET using the five-factor model, the

CAPM, and the three-factor model shows that the size premium coefficient (si) is positive, or has a positive correlation. This result aligns iwith Fama and French's (2015, pp.1-22) idea. For the value risk premium (hi), the resources sector and technology sector coefficients are negative or have a negative correlation. This result aligns with Fama and French's (2015, pp.1-22) idea. For the profitability premium coefficient (ri), the financials industry is positive, or has a positive correlation which contradicts Fama and French's (2015, pp.1-22) theory. On the other hand, the property and construction industry is a negative, or has a negative correlation which aligns with Fama and French's (2015, pp.1-22) idea. As for the investment premium coefficient (ci), the property and construction industry and services industry are negative, or have a negative correlation which aligns with Fama and French's (2015, pp.1-22) theory. It can be concluded that the coefficient of each premium aligns with the hypothesis because the industry groups in Thailand, the USA, and England share similar company fundamentals and operations, which is reflected in the correlation. Whereas the coefficient of profitability premium (ri) conflicts with Fama and French's (2015, pp.1-22) theory. It is feasible that Thai investors give more importance and attention to high profitability industry groups which provide more return. Fama and French's hypothesis (2015, pp.1-22), on the contrary, claims that the high profitability group has low risk, therefore, investors expected low returns as well. It should be noted that the statistically significant level is 0.05.

Foye (2018, pp.167-183) conducted research based on the US market using the five-factor model, adding two new factors; RMW and CMA. Both new factors have a statistically significant negative correlation. Moreover, the new factors agree with Foye's study (2018, pp. 167-183) on the return of assets on the English market (2015, pp. 17-18). The profitability premium can significantly explain the securities return. And the investment premium has a negative correlation with the return.

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