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Implementation of Reinganum's Investment Strategy in Long Term Equity Fund in the Stock Exchange of Thailand

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ABSTRACT

This research tested the investment strategy of Reinganum, which used value factors, momentum factors and size factors in the stock exchange of Thailand from 2002 to 2016. The results showed that value and momentum factors were able to excellently provide above-the-market returns, whiles size factors produced the opposite outcome. In addition, the aforementioned research findings were expanded upon by implementing Reinganum's investment strategy with long term equity fund.

Keywords: Investment Strategy, Portfolio Management, Trading Strategy
JEL Classifications: G11, G12

1. INTRODUCTION

Financial instrument investments have become significant and widely popular across the globe. However, not all investors who invest in the financial market gain positive returns or above-the-market returns from their investments. This is because investors tend to utilize similar investment models, which as a result cause some strategies to fail to win in the market. Due to the problem on how to make investments for optimal remunerations in respect to risks and how to augment financial ratios to screen for the most attractive stocks, the study was conducted to test the investment strategy model of Reinganum, which was previously tested in the New York stock exchange (NYSE) from 1970 to 2006 and to explore the outcomes of excess returns (Alpha) above the market from all forms of investment.

Therefore, the present study implemented Reinganum's investment strategy by testing in the stock exchange of Thailand (SET) to determine whether usage of the Reinganum's strategy in Thai investments, due to differences in market conditions, can produce positive returns or win in the market for investors. In addition, Reinganum's investment strategy was implemented with long term equity fund (LTF).

Section 2 consists of the review of literature related to Reinganum's investment strategy, while Section 3 contains an explanation about the tested information and factors; Section 4 addresses the testing of Reinganum's investment strategy; Section 5 presents the portfolio evaluation by factor; Section 6 discusses investment strategy testing based on all four factors; Section 7 covers implementation of Reinganum's investment strategy with the LTF; and Section 8 contains the conclusion.

2. LITERATURE REVIEW

In order to test Reinganum's strategy in the SET, the review was conducted on the research by Reinganum (1988) on 222 companies in which share prices doubled over a single year from 1970 to 1983 by using stocks traded in NYSE and American stock exchange (AMEX), from which nine technical and fundamental factors for changes in share prices emerged as follows: (1) Price-to-book ratio of lower than 1.0, (2) positive growth over 5 years in quarterly performance, (3) accelerating quarterly earnings, (4) positive profit margins before tax deductions, (5) <20 million ordinary stocks issued for sales, (6) relative strength at one of the top 70 or higher, (7) quarterly relative strength growth, (8) O'Neil datagraph rating of at least 70, and (9) stocks sold at 15% of the maximum price over the two latest years. The nine factors were used to create two investment strategies, namely, the nine variables model and the four variables model. It appeared that both strategies produced returns exceeding the market mean.

On value and momentum, Asness (1997) conducted a study that found value and momentum to be effective strategies, even though both strategies were negatively correlated. Concurrently, Chan et al. (1999) studied momentum-based investment on price and performance aspects and concluded that momentum-based strategies can produce above-the-market returns. Hence, additional studies were conducted by Chan and Lakonishok (2004) to review value-based investment and growth and obtained the conclusions that value-based investment produced higher returns due to investment behaviors and expenses than growth investments.

Russel and Sankaran (2008) stated that the best methods to manage stock portfolios are value- and momentum-based strategies, both of which produce above-the-market returns. The findings of the aforementioned study were expanded by using a risk model described by the arbitrage pricing theory to reveal that above-the-market returns resulted from risk premiums.

Fama and French (1993) conducted a study evaluating the five risk factors of stocks and bonds. There were three market factors, namely, overall market, firm size and book-to-book equity factors. The aforementioned factors seemed to describe the average returns of stocks.

Meanwhile, on company size, Abidin et al. (2013) stated that 12-month interval returns are vastly different in investments between best- and worst-performing stocks. Studies of the characteristics of the aforementioned stocks were conducted and found that similar aspects. Extreme performers were likely to be small companies with significant fluctuations in stock prices and investments relative to R and D and financial variables were inclined to be separators between best and worst performers, where worst performers were likely to be small companies with low stock values. Concurrently, a study conducted by Jensen et al. (1997) stated that company size and price-to-book ratio can be used to describe the returns of cross-sectional stocks, where the average returns of companies with small market values and low price-to-book ratios produced higher returns than companies with high market values and high price-to-book ratios.

Yu (2009) reexamined the value, momentum and size factors employed in Reinganum's trading strategy and enhanced better understanding of the impact of these factors over time. Yu (2009) showed why it was increasingly difficult to implement Reingnum's original trading strategy, then tested his strategy on 23 additional years of data through 2006. Later on, Gu (2014) tested Reinganum's investment strategy in the S and P ten sector indexes. At the end of each quarter, the investments in the top performers of each quarter produced the lowest return rates in all for models. Inversely, the bottom performers in subsequent quarters holding the aforementioned stocks for over two quarters produced the highest rates of return in all four models. This research significantly indicates that investors should not make investments based on the financial reports of top performers.

All of the aforementioned research implemented investment strategy using value, momentum and size factors to produce conclusions concurrent to research by Baresa et al. (2013) that stated that several factors affect share prices and all of which are unpredictable. Hence, one of the best methods to avoid uncertainty in the aforementioned factors is share fundamental factor analysis. Share fundamental factor analysis is widely popular for evaluating stock price directions and is implemented via analyses of the micro- and macro-economic factor impacts on business to produce economic and financial outcomes. In addition, stock fundamental factor analysis also investigates financial statements to evaluate the actual values of stocks.

Furthermore, on duration of stock possession, Bhatt (2011) conducted a study on the strategies that used economic and financial bases to evaluate stock returns using earning yield and return on capital in order to rank stocks sold below financial value and generate a portfolio holding 30 stocks divided into two stages at possession for 1 year and for 2 years. According to the findings, the stocks producing above-the-market returns were stocks sold below book value and that the strategy would be best used with stocks with market value of <100 million USD (small cap), while being suitable for stocks that concur with business cycles. In addition, it was found that statistical significance was greater for possession of stocks for 1 year.

Meanwhile, on measuring returns, a study that employed the capital assets pricing model to measure stock returns by Fama and French (2004) stated that capital asset pricing model (CAPM) is an asset pricing theory that is widely implemented in the present such as for evaluating for company financial costs, that CAPM is a prediction model used to evaluate risks and relationships between expected returns and risks but that the CAPM model holds arguments about weaknesses, hypotheses and application.

3. DATA USED

The research tested the strategy by implementing Reinganum's investment model in the SET with Thomson Reuters' Data streaming program providing test information from 2002 to 2016 for a period of 14 years. Investment began in March of each year because the financial statements announced through the website of the SET (www.set.or.th) are published on February of each year. Next, stocks were held for a period of 1 year and then sold in March of the following year. Each stock was equally weighted in the portfolio. Price-to-book ratios, quarterly EPS, relative strength and common stocks outstanding were used as financial filters to create the investment strategy for each year. The details are as follows:

1. Price-to-book ratios were lower than one with value higher than 0 or positive value. Price-to-book ratios are financial ratios composed of two parts, namely, price per share and book value per share, as shown in the following equation:

$$\frac{\text{Price per share}}{\text{Book value per share}} < 1 \qquad (1)$$

2. Quarterly EPS is the earnings per share (EPS) of the current quarter compared with the EPS of the preceding quarter. The current earnings per quarter have to be higher than that of the preceding quarter, as shown in the following equation:

$$\frac{EPS_q - EPS_{q-1}}{|EPS_{q-1}|} - \frac{EPS_{q-1} - EPS_{q-2}}{|EPS_{q-2}|} > 0 \quad (2)$$

Where,
EPS_q is quarterly EPS,
q is the current quarter,
q−1 is one quarter preceding the current quarter,
q−2 is two quarters preceding the current quarter.

3. Relative strength was used as the momentum of stock returns in the current quarter compared to the returns of preceding quarters. The greatest weight is 40% for the current quarter and 20% for the three preceding quarters. Relative strength can be shown in the following equation:

$$[0.4*R_q+0.2*(R_{q-1}+R_{q-2}+R_{q-3})]-[0.4*R_{q-1}+0.2*(R_{q-2}+R_{q-3}+R_{q-4}]>0 \quad (3)$$

$$Return_q = \frac{Price_q - Price_{q-1}}{Price_{q-1}} \quad (4)$$

Where,
R_q ($Return_q$) is the rate of stock returns,
q is the current quarter,
q−1 is one quarter preceding the current quarter,
q−2 is two quarters preceding the current quarter,
q−3 is three quarters preceding the current quarter,
and q−4 is four quarters preceding the current quarter.

4. COMMON STOCKS OUTSTANDING WERE LOWER THAN 20 MILLION STOCKS

Table 1 shows testing by using the filters of Reinganum with the SET. It shows stock amounts and percentages screened by filters. According to the findings when considering the number of screened stocks each year, only a small number of stocks remain, most of which are stocks that have been screened by an average of no more than five companies. Furthermore, when the data is viewed in percentage as time passes, the stock exchange expands due to increased company registrations in the stock exchange and increased number of stocks, but the stock percentages screened by Reinganum's filters show a declining trend. This raised the observation that the original filter of Reinganum was overly strict and not very flexible.

5. TESTING REINGANUM'S INVESTMENT STRATEGY

Based on the aforementioned filters, a portfolio was created by using filters as investment strategies for different models. Afterward, analysis was conducted on the effectiveness of created strategies to obtain the excess returns that were above-the-market (Alpha) from 2002 to 2016 for a period of 14 years.

Strategy 1 involved using the original filters of Reinganum with the price-to-book ratios lower than 1 combined with quarterly EPS higher than preceding quarters reinforced by relative strength and common stocks outstanding of lower than 20 million stocks.

Strategy 2 used the same filters as in Strategy 1, but with increased stringency by using the bottom 50% in the portfolio of price-to-book ratios of lower than 1, top 50% in the portfolio of quarterly EPS exceeding the preceding quarters, the top 50% in the portfolio of relative strength and bottom 25% in the portfolio of common stocks outstanding lower than 20 million stocks.

Strategy 3 used the same filters as in Strategy 1, except that common stocks outstanding lower than 20 million stocks filter was not used.

Strategy 4 used the same filters as in Strategy 2, except that the bottom 25 in the portfolio of common stocks outstanding lower than 20 million stocks filter was not used.

In testing the effectiveness of the investment strategy, the annual returns and risks were tested by using the CAPM as shown in the following equation:

Table 1: Number of all stocks and percentage of stocks meeting filter rules

Year	Number of stocks	% of stocks meet Filter 1	% of stocks meet Filter 2	% of stocks meet Filter 3	% of stocks meet Filter 4	% of stocks meet all 4	Number of stocks meet all 4
2002	330	79.39	17.27	69.09	16.67	1.52	5
2003	336	62.80	27.08	81.55	15.77	2.38	8
2004	358	69.27	28.21	22.63	12.57	1.96	7
2005	393	38.42	25.95	32.06	9.67	0.51	2
2006	439	43.28	24.60	72.67	8.66	0.68	3
2007	480	50.00	30.21	67.71	7.29	2.08	10
2008	503	52.68	31.01	20.08	6.76	0.20	1
2009	512	51.37	34.77	64.65	6.84	1.95	10
2010	519	79.38	19.46	78.81	6.94	0.58	3
2011	531	60.08	34.46	46.33	7.34	1.88	10
2012	532	45.30	30.83	37.41	7.33	0.56	3
2013	544	46.14	22.06	84.19	6.62	0.74	4
2014	566	26.15	34.28	72.44	5.65	0.18	1
2015	601	35.27	26.62	30.12	4.99	0.33	2
2016	651	25.04	32.57	75.88	4.45	0.31	2
Highest	651	79.39	34.77	84.19	16.67	2.38	10
Lowest	330	25.04	17.27	20.08	4.45	0.18	1

$$r_{pt} - r_{ft} = \alpha_{pt} + \beta_{pt} (r_{mt} - r_{ft}) + \varepsilon_{pt} \quad (5)$$

Where,
r_{pt} is the portfolio rate of returns,
r_{mt} is the rate of total returns of the stock exchange (SET TRI),
r_{ft} is the rate of returns on short-term government bonds,
$_{pt}$ is the beta of the portfolio and,

The results of the effectiveness testing of investments by using the original filters of Reinganum in Strategy 1 compared with other strategies and in Strategies 2-4 devised based on Reinganum's strategy found that Strategy 1 and Strategy 3 demonstrated interesting effectiveness with the most excess returns above the market or alpha value when compared with Strategy 4. At the same time, no company stocks passed the screening of the filters in Strategy 2.

Strategies 1 and 3 differed in that Strategy 3 left out common stocks outstanding lower than 20 million stocks that controlled portfolio size. This caused the portfolio generated by Strategy 3 to have a higher number of stocks than the portfolio created by Strategy 1. However, upon considering the percentages of similar returns, Strategy 3 was slightly lower than Strategy 1. Nevertheless, the higher number of stocks inside the portfolio gave investors more options in choosing the stocks that matched best with their strategies. In addition, the beta risk of 0.11 in Strategy 1 increased to 0.4 in Strategy 3, which is still considered low and lower than the market value. Furthermore, R-square in Strategy 3 was 39.25%, which was clearly higher than that of other strategies, while the R-square of Strategy 1 was only 0.49%. As a result, the returns from Strategy 3 became more interesting as shown in Table 2.

Table 2: Outcomes of effectiveness testing of Ringanum's investment strategies

Year	SET TRI (%)	Strategy 1	Strategy 2	Strategy 3	Strategy 4
2002	−1.80	32.60	0.00	29.39	7.96
2003	96.45	36.85	0.00	70.66	69.96
2004	6.58	15.76	0.00	19.06	0.00
2005	11.10	−1.40	0.00	21.04	20.10
2006	−5.32	−2.85	0.00	11.35	16.57
2007	26.33	20.02	0.00	12.35	25.80
2008	−45.23	−8.07	0.00	−12.38	28.98
2009	80.89	75.86	0.00	94.46	116.01
2010	43.43	17.35	0.00	49.08	41.02
2011	22.00	34.08	0.00	27.24	35.07
2012	41.08	63.86	0.00	66.44	0.00
2013	−11.27	−3.57	0.00	−12.85	−44.56
2014	15.91	0.00	0.00	54.59	12.98
2015	−7.32	1.33	0.00	5.10	20.95
CAPM					
Intercept		17.56	−1.77	17.36	14.33
t-statistic		2.1336	−149.0561	6.4979	2.3450
Slope		0.11	0.00	0.40	0.34
t-statistic		4.2281	2.8266	48.5699	18.1995
R^2		0.49	0.22	39.25	8.32

SET: Stock exchange of Thailand, CAPM: Capital asset pricing model

6. PORTFOLIO EVALUATION BASED ON INDIVIDUAL FACTORS

On evaluating portfolio based on individual factors, only the financial factor was left for use in analyzing the above-the-market returns (Alpha) or risk-adjusted returns. The financial factors used in portfolio evaluation were price-to-book ratios, year-over-year quarterly EPS, past 6 months returns and market capitalization. Accordingly, ten sub-portfolios were created with reference to the percentiles of all four financial factors used in portfolio testing and evaluation.

6.1. Price-to-Book Ratios

According to Table 3, each level of returns from the portfolio resulted from the creation of ten sub-portfolios with reference to the percentiles of price-to-book ratios in ascending order. According to the findings, Portfolios 1-3, which were the portfolios with low percentiles of price-to-book ratios, achieved the lowest returns. This raised an observation that low price-to-book ratios indicated underpriced stocks leading to large capital gain potential from the differences in stock prices in the future.

6.2. Year-over-year Quarterly EPS Changes

According to Table 4, each level of returns from the portfolio resulted from the creation of ten sub-portfolios with reference to the percentiles of year-over-year quarterly EPS changes in ascending order. The variable was used to screen stock momentum. According to the findings, Portfolios 6 and 7 produced the highest returns from excess returns (Alpha). The finding is interesting in that the highest momentum stock portfolios do not always produce the highest returns. Furthermore, upon evaluating the returns of Portfolios 2, 3, 9 and 10, the findings indicated that all had similar returns, despite the significantly different changes in EPS. This raised the observation about the probability that suitable changes in EPS or stock momentum that are not too high or low can generate portfolios with maximum returns such as Portfolios 6-7.

6.3. Past 6 Months Returns

According to Table 5, each level of returns from the portfolio resulted from the creation of ten sub-portfolios with reference to the percentiles of past 6 months returns in ascending order. The variable was used to screen stock momentum in the same manner as year-over-year quarterly EPS changes. According to the findings, Portfolios 5 and 6 were able to achieve the highest profits in concurrence with the outcomes in Table 4 in that the portfolios were in the mid-range percentiles of the tested financial factors. Hence, it was observed that stock effective, capable momentum for market outperformance should not be excessively high or low. For optimum results, stocks should have mid-range momentum percentiles.

6.4. Market Capitalization

According to Table 6, each level of returns from the portfolio resulted from the creation of ten sub-portfolios with reference to the percentiles of market capitalization in ascending order. According to the findings, stock portfolios with low market capitalization can generate higher returns. Portfolio 1, which was considered to have the least market capitalization, was clearly able to generate the highest returns and with more effectiveness than other portfolios. Inversely, Portfolios 9 and 10, which were

Table 3: Returns by percentiles of price-to-book ratios

Year	1 low (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	8 (%)	9 (%)	10 high (%)
2002	22.02	30.52	50.50	38.11	16.19	19.26	14.21	7.63	0.00	−13.22
2003	131.02	77.55	129.35	104.76	75.49	91.40	89.59	130.51	94.07	104.97
2004	−6.82	5.46	4.07	−1.82	−0.86	12.12	0.52	−10.66	2.62	1.65
2005	8.91	9.57	18.19	11.72	0.60	3.91	5.02	−0.48	−8.38	−8.30
2006	11.97	10.20	5.28	5.52	11.91	9.14	9.30	3.35	5.32	−11.42
2007	23.68	13.04	14.74	12.97	17.49	15.39	6.43	14.06	35.49	37.04
2008	−16.46	−17.52	−21.98	−24.75	−18.23	−33.22	−44.37	−27.14	−44.46	−29.43
2009	92.23	112.42	110.11	80.77	70.05	83.00	70.92	97.97	80.45	29.97
2010	58.95	33.14	57.04	41.88	55.63	45.95	45.68	37.52	41.91	32.46
2011	21.06	20.27	19.39	30.33	13.59	13.67	23.99	18.85	16.60	28.81
2012	88.54	97.26	83.12	81.33	117.67	95.26	79.26	76.15	65.22	64.56
2013	−7.06	−8.47	−9.96	−8.59	−11.47	−5.80	−17.15	−13.74	−11.81	−13.70
2014	63.57	48.34	64.56	22.39	37.78	43.07	57.37	50.28	39.15	62.92
2015	−7.44	−7.61	−4.09	−11.42	−13.67	−14.29	−8.26	−11.97	−7.94	−3.92
CAPM										
Intercept	16.44	14.38	17.94	11.88	11.08	10.27	6.98	8.29	5.21	3.74
t-statistic	4.9597	5.0996	6.6557	5.0136	4.6738	4.2857	2.9420	3.6029	2.2514	1.1283
Slope	0.55	0.51	0.54	0.52	0.53	0.61	0.63	0.65	0.67	0.76
t-statistic	53.5693	58.1079	64.8622	70.7732	71.7224	82.4433	85.6511	91.2302	93.7777	74.3240
R_2	44.01	48.05	53.54	57.84	58.49	65.06	66.77	69.51	70.66	60.21

CAPM: Capital asset pricing model

Table 4: Returns by percentiles of year-over-year quarterly earnings per share changes

Year	1 low (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	8 (%)	9 (%)	10 high (%)
2002	−0.85	18.71	47.14	32.87	16.05	48.99	23.31	11.69	6.00	19.51
2003	168.38	95.83	65.16	53.40	54.82	47.93	73.22	85.97	87.39	122.61
2004	−10.18	5.73	17.94	−6.92	9.49	0.60	8.00	2.29	0.43	−6.95
2005	6.75	3.61	−0.51	1.38	14.31	26.87	21.83	6.56	2.86	−11.15
2006	−18.22	−1.50	−4.07	7.50	0.76	7.11	6.62	8.26	12.60	9.74
2007	18.88	11.51	14.54	9.02	19.17	10.82	21.31	6.54	27.03	22.57
2008	−40.61	−21.54	−23.31	−31.72	−23.42	−21.95	−25.18	−35.79	−24.95	−26.40
2009	102.91	97.35	82.03	70.54	62.91	80.74	82.49	84.42	78.98	89.21
2010	61.77	42.08	45.01	52.05	40.22	37.96	39.83	58.68	42.07	28.85
2011	22.81	10.54	23.15	27.11	23.99	25.50	20.41	25.26	20.96	18.84
2012	100.21	89.94	74.40	63.57	52.00	76.27	75.24	58.68	74.15	89.50
2013	−5.12	−9.12	−13.76	−8.45	−16.57	−9.21	−9.94	−6.35	−3.99	−10.47
2014	56.07	52.77	45.76	25.29	19.54	26.05	35.26	32.35	37.10	91.97
2015	−22.77	−3.49	−6.14	−16.53	−9.37	1.63	−2.83	−4.75	1.19	−9.73
CAPM										
Intercept	9.06	11.62	11.08	6.83	7.14	12.68	12.60	9.29	11.13	10.82
t-statistic	2.6331	3.7753	4.1098	2.8681	3.3071	6.0888	6.1395	4.3883	4.7009	3.1804
Slope	0.69	0.58	0.57	0.50	0.48	0.43	0.46	0.51	0.54	0.72
t-statistic	64.6776	61.4120	68.7457	68.5037	71.6298	66.8943	72.4190	77.1981	74.0365	68.5959
R^2	53.40	50.81	56.42	56.24	58.43	55.07	58.96	62.01%	60.02	56.31

CAPM: Capital asset pricing model

portfolios with the greatest market capitalization, were least effective and generated the lowest earnings. Notably, Reinganum's investment strategy that involved purchasing stocks and holding onto those stock yielded better effectiveness in stocks with low market capitalization. This might be due to the fact that stock prices are more easily changed and, therefore, allow more earning potential than stocks with high market capitalization.

7. TESTING INVESTMENT STRATEGIES BASED ON ALL FOUR FACTORS

The aforementioned four factors were created into portfolios as different investment strategy models. From previously use as filters, the new models used the percentile rankings of the four factors to enable development of less flexible and strict Reinganum's investment strategies. Afterward, analysis was conducted on the effectiveness of the strategies that were created to obtain above-the-market returns (Alpha) from 2002 to 2016 for a period of 14 years. The strategies were created as follows:

Strategy A was a creation of a portfolio composed of the bottom 50% price-to-book ratios of the market, the top 50% year-over-year quarterly EPS changes of the market, the top 50% past 6 months returns of the market and the bottom 50% of market capitalization of the market. On the other hand, Strategy B employed all opposite factors of Strategy A, while Strategies C and D did not use market capitalization to create portfolios and only used the first three factors of Strategies A and B. It was hypothesized that

Table 5: Returns by percentiles of past 6 months returns

Year	1 low (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	8 (%)	9 (%)	10 high (%)
2002	19.65	49.47	33.57	25.08	15.11	30.48	15.25	13.42	0.94	−11.36
2003	97.18	63.46	74.18	91.14	74.09	147.85	86.32	94.20	157.89	164.96
2004	−12.14	−11.88	5.73	4.79	6.58	1.10	7.47	9.66	1.60	−10.27
2005	−0.45	−4.14	−0.61	15.00	18.37	2.15	16.87	3.78	2.76	−13.57
2006	0.86	−1.13	−3.26	12.48	10.60	9.06	6.26	3.48	7.12	8.02
2007	43.21	26.73	15.08	11.40	18.20	16.06	11.53	19.84	5.12	23.08
2008	−35.99	−35.63	−24.70	−31.55	−27.25	−26.39	−22.59	−28.57	−30.49	−27.94
2009	86.79	116.68	94.67	99.01	95.00	72.63	57.46	86.62	72.16	37.23
2010	68.93	47.27	45.30	55.55	50.42	33.10	55.37	41.35	34.75	47.24
2011	23.17	16.76	25.01	14.89	27.12	22.70	15.93	32.57	19.51	17.25
2012	135.93	92.95	79.28	74.38	67.04	90.02	62.11	77.24	92.03	57.32
2013	−7.35	−9.73	−8.72	−11.91	−4.81	−6.97	−13.40	−12.87	−15.74	−11.77
2014	55.45	26.79	19.90	30.66	34.66	38.45	57.26	55.18	45.32	106.76
2015	−24.50	−13.41	−5.19	−2.47	−6.83	−9.23	−9.63	−7.21	−10.01	−13.49
CAPM										
Intercept	10.79	8.21	9.32	11.85	12.73	13.13	10.68	11.68	9.28	7.14
t-statistic	3.0361	2.5030	3.6997	4.6993	6.1473	5.8223	4.5820	4.9835	3.8760	2.0576
Slope	0.75	0.67	0.62	0.54	0.47	0.49	0.51	0.55	0.57	0.69
t-statistic	68.4974	65.9249	79.2498	69.0397	73.0719	70.4394	70.6112	75.8975	76.6015	64.0417
R^2	56.24	54.35	63.24	56.63	59.39	57.61	57.73	61.21	61.64	52.90

CAPM: Capital asset pricing model

Table 6: Returns by percentiles of market capitalization

Year	1 low (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	8 (%)	9 (%)	10 high (%)
2002	81.56	32.76	20.75	38.81	28.31	4.17	13.41	19.55	−11.84	−6.13
2003	119.68	65.70	92.90	114.68	123.95	116.00	83.22	64.59	97.52	118.85
2004	−1.67	13.94	−4.88	10.95	−12.36	−6.83	−2.86	−1.84	−0.17	−5.86
2005	9.02	−9.07	−5.06	−1.58	−15.90	4.91	18.85	12.24	11.10	−9.86
2006	19.53	12.38	6.56	−4.14	1.61	4.39	16.26	−3.40	−4.50	11.39
2007	29.12	26.38	40.50	16.54	16.21	11.80	14.51	21.68	20.11	16.66
2008	−17.71	−21.68	−23.21	−17.90	−30.11	−31.14	−34.51	−33.28	−45.95	−32.19
2009	131.40	75.16	70.07	69.58	51.94	79.14	93.48	72.83	102.92	80.79
2010	70.11	50.75	37.34	43.95	37.20	46.40	50.97	65.75	51.74	26.80
2011	21.49	19.87	21.55	15.51	14.01	10.35	15.47	19.95	21.03	35.51
2012	91.17	91.01	72.34	103.75	103.47	127.25	100.36	89.23	71.00	51.21
2013	−9.92	2.25	−9.44	−17.73	−13.12	−7.45	−14.49	−14.96	−18.50	−15.66
2014	96.07	78.67	50.23	39.72	40.63	46.20	41.75	36.41	17.27	44.38
2015	−5.02	−15.85	−23.14	−10.86	−23.24	−6.12	−1.25	−10.33	−4.07	3.51
CAPM										
Intercept	24.13	14.60	9.94	12.00	6.22	10.62	11.19%	7.80	3.07	5.49
t-statistic	5.9463	4.5840	3.1709	4.2090	2.1232	3.8788	4.1021	3.2232	1.3704	2.1502
Slope	0.47	0.51	0.53	0.55	0.58	0.56	0.60	0.66	0.78	0.73
t-statistic	37.6532	51.7125	54.4198	62.2954	63.8745	66.3726	70.8092	87.6051	112.336	92.1577
R^2	27.97	42.28	44.79	51.52	52.77	54.68	57.86	67.76	77.56	69.94

CAPM: Capital asset pricing model

Strategies A and C would produce more excess returns (Alpha) than Strategies B and C. The summary of investment strategies are shown in Table 7.

According to Table 8, Strategy A produced the greatest returns, followed by Strategy C, which was identical to Strategy A in all aspects, except for the removal of market capitalization filtering, which caused more stocks to be included in Strategy C's portfolio, but with lower returns and higher beta scores. Meanwhile, Strategies B and D, which were opposite to Strategies A and C, respectively, produced lower returns. In other words, Strategies A and C were more effective than Strategies B and D. Upon evaluating the attributes of stocks in Strategies A and C, it was found that the stocks were underpriced and had high momentum. This caused the aforementioned stocks to retain significant earning potential as shown in Table 8, while the difference in Strategy C where market capitalization filter was removed caused the portfolio of the aforementioned strategy to be larger than Strategy A, but without improving effectiveness. Moreover, decreased effectiveness was observable by the decreased alpha value and increased beta value.

8. IMPLEMENTATION OF REINGANUM'S INVESTMENT STRATEGY WITH LTF

As Reinganum's investment strategy was able to produce above-the-market returns based on observations of outcomes from the aforementioned experiment, the best strategy for producing maximum returns is Strategy 3 used with LTF to

Table 7: Investment strategies of all four factors developed from Reinganum's strategy

Filter	Strategy A (%)	Strategy B (%)	Strategy C (%)	Strategy D (%)
Price to book ratios	Lowest 50	Highest 50	Lowest 50	Highest 50
Year-over-year quarterly Earnings per share changes	Highest 50	Lowest 50	Highest 50	Lowest 50
Past 6 month returns	Highest 50	Lowest 50	Highest 50	Lowest 50
Market capitalization	Lowest 50	Highest 50		

allow management of funds invested in the SET index to produce regular above-the-market returns. Table 9 shows investments in the LTF with stocks portfolio held for a period of 5 years compared with the returns from SET TRI and portfolio from Strategy 3 of Reinganum at initial investment value of 100,000 baht. According to the findings on all ten investments, Reinganum's strategy implemented with LTF was able to win the market every time with a market-winning probability of 100%. However, the analyzed information consisted of information with a limited duration of only 14 years, which allowed for the LTF investment model to be simulated only ten times. Therefore, outcomes might deviate from reality. Furthermore, the majority of stocks were chosen from Reinganum's Strategy 3, which had low liquidity and could possibly impact purchase and sales in practice.

9. CONCLUSION

The outcomes provided the conclusions that Reinganum's strategy can actually produce above-the-market returns (Alpha) in the SET. When considering the effectiveness of filters used in stock screening, Filter 1, price-to-book-ratios, was used to determine whether stocks are underpriced or not; Filter 2, quarterly EPS, and Filter 3, relative strength, were used to measure stock momentum and can be used to effectively screen for stocks capable of market outperformance. Meanwhile, Filter 4, common stocks outstanding, was used to limit portfolio size and produced contrary outcomes to predictions. This occurred because using the same strategy, but with Filter 4 excluded, caused the number of portfolio stocks to increase with more diversified risks.

Furthermore, the findings showed Strategies 3 and 1 to produce lower returns and higher risks due to the unique characteristics and overall effectiveness of the SET that stood apart from the (NYSE-AMEX). In any case, Strategies 2 and 4 produced increased returns. Moreover, when Strategy 1, which used the original filters presented by Reinganum, was compared with Strategy A based on Reinganum's strategy by using other filters to perform the same functions but with less stringency, Strategy A was found to be slightly less effective than Strategy 1. This led to the observation that the SET was an inefficient market when compared to the AMEX (NYSE-AMEX) at the time of Reinganum. Nevertheless, the R-square values of Strategies 1 and A were vastly different at 0.49% and 44.29%, respectively. If the number of study years was broadened, it might be possible to obtain information with better clarity.

The research findings indicate that it is possible to apply the aforementioned investment strategy with LTF, and test outcomes showing that Reinganum's strategy can be used to manage LTF with 100% probability of winning the market.

Table 8: Testing of investment strategies developed from Reinganum's strategy

Year	SET TRI	Strategy A	Strategy B	Strategy C	Strategy D
2002	−1.80	43.66	19.66	24.54	25.18
2003	96.45	116.48	106.59	127.23	105.10
2004	6.58	3.33	4.06	2.55	0.67
2005	11.10	5.61	-0.16	16.58	-5.61
2006	−5.32	9.05	6.34	10.31	2.03
2007	26.33	20.81	22.78	14.31	22.09
2008	−45.23	−17.64	−29.51	−18.27	−28.98
2009	80.89	83.94	62.34	72.89	62.11
2010	43.43	39.23	44.36	56.17	41.51
2011	22.00	18.13	28.02	20.52	27.07
2012	41.08	83.70	72.07	89.91	73.62
2013	−11.27	−16.02	−11.53	−10.84	−11.94
2014	15.91	91.44	52.76	59.50	60.30
2015	−7.32	−11.81	−9.86	−8.35	−9.39
CAPM					
Intercept		16.36	9.19	15.66	8.79
t-statistic		5.8594	3.7458	7.4985	3.3915
Slope		0.46	0.69	0.48	0.69
t-statistic		53.8799	91.4189	75.0392	86.6187
R^2		44.29	69.60	60.67	67.27

CAPM: Capital asset pricing model, SET: Stock exchange of Thailand

Table 9: Investment outcomes of Reinganum's investment strategies with LTF

Investment Horizon	Annual return	
	SET TRI	Reingunam
2002-2006	16.68	19.51
2003-2007	22.71	23.31
2004-2008	−4.95	19.22
2005-2009	5.65	17.23
2006-2010	11.19	25.22
2007-2011	16.97	28.43
2008-2012	19.59	37.33
2009-2013	31.70	40.63
2010-2014	20.49	33.60
2011-2015	10.41	21.33

SET: Stock exchange of Thailand, LTF: Long term equity fund

REFERENCES

Abidin, S., Bird, R., Yeung, D. (2013), Forecasting extreme performance: The experience with Australian equities. Jassa, 1, 32-37.

Asness, C.S. (1997), The interaction of value and momentum strategies. Financial Analysts Journal, 53(2), 29-36.

Baresa, S., Bogdan, S., Ivanovic, Z. (2013), Strategy of stock valuation by fundamental analysis. UTMS Journal of Economics, 4(1), 45-51.

Bhatt, P.T. (2011), Beating the Market: Fundamental Factors and Stock Performance. Order No. 1504386. ABI/INFORM Collection (902633023). Available from: http://www.search.proquest.com/docview/902633023?accountid=44809.

Chan, L.K.C., Jegadeesh, N., Lakonishok, J. (1999), The profitability

of momentum strategies. Financial Analysts Journal, 55(6), 80-90.
Chan, L.K.C., Lakonishok, J. (2004), Value and growth investing: Review and update. Financial Analysts Journal, 60(1), 71-86.
Fama, E.F., French, K.R. (1993), Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33(1), 3-15.
Fama, E.F., French, K.R. (2004), The capital asset pricing model: Theory and evidence. The Journal of Economic Perspectives, 18(3), 25-46.
Gu, A.Y. (2014), Higher return from investing in the worst performing sector: Evidence from the S and P ten sectors. The Journal of Applied Business and Economics, 16(1), 26-31.
Jensen, G.R., Johnson, R.R., Mercer, J.M. (1997), New evidence on size and price-to-book effects in stock returns. Financial Analysts Journal, 53(6), 34-42.
Reinganum, M.R. (1988), The anatomy of A stock market winner. Financial Analysts Journal, 44(2), 16.
Russel, P.S., Sankaran, K. (2008), Value and momentum strategies: Returns from risk-controlled portfolios. The Journal of Business and Economic Studies, 14(2), 25-38, 118.