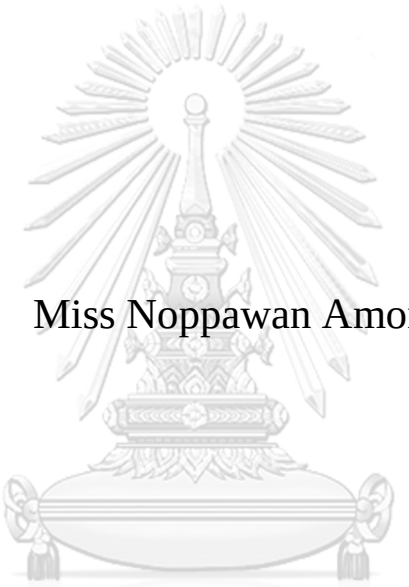
Mutual Fund Performance Attribution Using Portfolio Holdings: Case of Thai Equity Mutual Fund

Miss Noppawan Amornsri



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Mutual Fund Performance Attribution Using Portfolio Holdings: Case of Thai Equity Mutual Fund

น.ส.นพวรรณ อมรศรี

สารนิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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Selection skill and timing skill are two fundamental abilities which have been discussed to determine fund performance. This paper extends understanding of these two skills of Thai equity mutual fund. This paper is distinguished from prior study by using different method which is the Brinson model and based on the portfolio holdings. The model is decomposed the excess return into “allocation effect” and “selection effect”. Thailand SET industry group and sector classification which composed of 28 sectors is applied in order to examine both effects in the sector level. For the mutual fund returns, Jensen Alpha and Treynor-Mazuy are subsequently employed to examine the overall ability and timing ability, respectively. For the return attribution, Treynor-Mazuy is subsequently employed to examine picking ability and timing ability. As a whole with SET TRI Index, the finding suggests that picking ability dominate timing ability for both effects. Although the results do not reveal any timing ability to both allocation effect and selection effect, timing ability has lots of negative impact especially for selection effect in terms of security timing ability. Between two effects, security picking tend to be the main skill that most funds can achieve compare to sector picking. Therefore, selection effect is a larger contribution to the excess return than allocation effect as a result of security picking. Within the same fund with SET TRI Index, only 12% of mutual fund observations exhibit positive effect to both sector picking ability and security picking ability.

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Field of Study:	Finance	Student's Signature .....
Academic Year:	2019	Advisor's Signature .....

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1. INTRODUCTION

Background and Objective

Financial academics have debated the ability of mutual fund to exhibit positive alpha through active management for years. Mutual fund performance have analyzed through lot of literatures in various aspects since it is important to both managers and investors that affected to wealth.

There have many literatures discuss about the ability to add value through active mutual funds. Some literatures show evidence that mutual funds does not generate alpha. Jensen (1968) shows evidence that on average gross return of mutual funds underperform buy-and-hold strategy. Carhart (1997) shows result that fund managers do not provide skilled. French (2008) shows if investors invest in passive investment over the 1980-2006, average annual return would increase 67 basis points compare to active investment. However, recent literatures show mutual funds outperform. Kacperczyk et al., Sialm and Zheng (2005) find that concentrated funds which hold securities in fewer industries tend to perform better than diversified-funds. Cremers and Petajisto (2009) shows mutual fund with the highest active share have both net return and gross return outperform their benchmarks. Kacperczyk, Nieuwerburgh and Veldkamp (2014) show that in expansions and recessions, the same fund managers have stock picking and timing ability, respectively.

There also have several literatures which try to decompose mutual fund performance into various aspects. Chen, Jegadeesh and Wermers (2000) used stockholdings and trading data to investigate mutual fund performance. Stock-selection skill was found in growth funds which better than in income funds. Avramov and Wermers (2006) shows the source of investment profitability comes from predictability in manager skill by timing industry allocations over the business cycle. Busse and Tong (2012) analyze mutual fund selection skill in the level of industry and stock. They find only industry-selection skill drives performance persistence and significantly to total alpha. Andreu, Matallin-Saez and Sarto (2018) analyze investment decision including past return strategies, security selection, market timing and passive timing by using portfolio holdings. They found that security selection skill is more pertinent than

market timing ability. R. Stark (2019) decompose mutual fund alpha into weighting and selecting. The result shows security selecting alpha is -0.02% per month while the security weighting alpha is 0.15% per month. These results imply that security weighting decisions make a larger contribution to total alpha than security selection decisions.

My study aims to extend understanding of the abilities which have been discussed to determine fund performance. The Brinson model which is the foundation of return attribution used by widely practitioners has been applied. This model identify the source of excess return which compare to designated benchmark assuming two investment strategies consist of top-down and bottom-up strategies. In other word, with attribution analysis, it can go straight into the main driver of excess return which is return earn above benchmark. In the case of top-down strategy, fund managers will aim to overweight outperforming sectors and underweight underperforming sector which relying on analyzing macroeconomic relationships. This is usually explained by 'allocation skill'. While bottom-up strategy, fund manager will aim to picking outperforming stocks into portfolios which relying on firm-specific drivers. This is usually explained by 'selection skill'. In this paper, only equity mutual funds are focused. Thailand SET industry group and sector classification as the benchmark which consists of 8 industries and 28 sectors has also been applied. Therefore, I decompose the excess return into "allocation effect' and 'selection effect' in the level of sector by using portfolio holdings. Subsequently employ Jensen Alpha and Treynor-Mazuy to study overall ability, picking ability and timing ability.

In the original article of Brinson, Hood and Beebower (1985) called 'allocation effect' is 'timing'. Including Busse and Tong (2012), they suggest that funds with industry-selection skill time the market. When market conditions change, they rotate into better-performing industries. Therefore, I also refer Treynor and Mazuy (1966) in order to identify timing ability.

My paper is distinguished from prior study by using different method which is the Brinson model and based on the portfolio holdings. This model decomposes into two

sources of excess return including Thailand SET industry group and sector classification has been applied.

2. LITERATURE REVIEW

Relevant Research

Bhattacharya and Pfleiderer (1983) examine 71 US equity pension fund manager performances. The result shows that pension fund managers have better stock picking than market timing on average. Irrespective of the choice of benchmark portfolio or estimation was used, the measure of average selectivity is positive while the average timing measure is negative.

Chang and Lewellen (1984) examine 67 monthly mutual funds return in the period 1971 - 1979. The results show that timing ability is of no value and most of them show negative timing.

Gallo and Swanson (1996) examine international mutual funds to test selectivity ability and timing ability. The result shows fund managers have selectivity ability but do not have any timing ability.

Daniel, Grinblatt, Titman and Wermers (1997) examine mutual fund performance with characteristic-based benchmarks in the period 1975 - 1994 covers over 2,500 equity funds. The returns of 125 passive funds are constructed as the benchmark. Stock holding in the evaluation portfolio on the basis of the previous-year return characteristics, book-to-market and market capitalization matched to the benchmark. Based on these benchmarks, they measure ‘characteristic timing’ and ‘characteristic selectivity’. The result shows that selectivity ability has been exhibited in aggressive-growth funds but timing ability has not been exhibited.

Chen, Jegadeesh and Wermers (2000) study the value of active mutual fund by examining the stockholdings and trades of mutual funds. The results show that growth funds have stock-selection skills better than income funds. They also find weak evidence that stock-picking skill is found in the best past performance funds more than the worst past performance funds.

Kacperczyk et al., Sialm and Zheng (2005) show concentrated funds which hold securities in fewer industries tend to perform better than diversified-funds.

Avramov and Wermers (2006) study US equity mutual funds including predictability in manager skills, fund risk loadings and benchmark returns. The result shows that the source of investment return comes from predictability in manager skill by timing industry allocations over the business cycle and has large exposure to the metals, energy and utilities industries. This result indicates that active mutual have significant value added and that 3 industries are important in locating outperforming mutual funds.

Busse and Tong (2012) analyze mutual fund industry selection and persistence. They find only industry-selection skill drives performance persistence and significantly to total alpha because when market conditions change, fund managers can rotate into different industries. It indicates that industry selection is stable across time. While stock-selection is eroded by fund size increased. Future stock selectivity cannot be predicted by stock selectivity but future industry selectivity can be predicted up to two quarters by past industry selectivity.

Andreu, Matallin-Saez and Sarto (2018) analyse investment decision including past return strategies, security selection, market timing and passive timing by using portfolio holdings. The results show that security selection skill is more pertinent than market timing ability. And also found positive significant persistence in past return strategies and security selection skill.

R. Stark (2019) examine US actively mutual fund portfolios since January 2004 to December 2017 in order to decompose alpha into security weighting and security selection. This research also examines the number of securities holding impact to the ability to generate weighting and selecting alpha. The result shows that these two alphas do not driven by the number of securities holding. This research also considers which alpha is more important and how is the persistence. The initial result shows selecting alpha is -0.02% per month while the weighting alpha is 0.15% per month. These results imply that weighting decisions make a larger contribution to total alpha compared to selecting decisions. Moreover, the skill to generate weighting alpha

persist for twelve months while selecting alpha persist just one month. For the overall performance of mutual fund, both skills have significant outperformance and persist for one month.

Research Question and Hypothesis

Taking into account the previous empirical studies, especially Busse and Tong (2012) analyzed mutual fund selection skill in the level of industry selection and stock selection. They find only industry-selection skill drives performance persistence and significantly to total alpha because these funds can rotate into the industry that outperform the market.

Applied to a method widely used by practitioners, Brinson, Hood and Beebower (1986), they study allocations among stocks, bonds and cash which is the typically allocation in the investment process. They find that more than 90% of the variation in portfolio returns can explain these allocation decisions.

This paper is also applied to the SET industry group and sector classification as the benchmark which consists of 8 industries and 28 sectors. By construction, my sample is equity mutual funds. I begin with the sector level rather than asset class or industry level. It implies that the more sectors dispersion, it might be the potential value which can provide a better portfolio returns in terms of allocation decision. This study develops the research questions and hypothesis as follow

Research question: Whether "allocation effect" dominates "selection effect" across funds?

Hypothesis 1: The sources of excess return mainly come from "allocation effect" rather than "selection effect" due to the various SET sectors which funds can hold.

Hypothesis 2: Under "allocation effect", "sector picking" dominates "sector timing" because different sectors outperform as market conditions change.

Concept and Theory

1. Jensen's Alpha

Michael Jensen formulated a model in 1968 in order to measure the abnormal return of a portfolio which based on capital asset pricing model or CAPM. Jensen's measure is

$$\boldsymbol{R_p - R_f = \propto_p + \beta\left(R_m - R_f\right) + \varepsilon_p}$$

Where $\boldsymbol{R_p}$ is a portfolio return p

$\boldsymbol{\propto_p}$ is an alpha of a portfolio

$\boldsymbol{R_f}$ is a risk free return

$\boldsymbol{R_m}$ is a market return

2. Treynor-Mazuy

Treynor and Mazuy (1966) added a quadratic term which is market timing. They argued that if fund managers can time the market, a proper proportion of the portfolio will be held at the right time. Treynor-Mazuy measure is

$$\boldsymbol{R_p - R_f = \propto_p + b\left(R_m - R_f\right) + c_p\left(R_m - R_f\right)^2 + \varepsilon_p}$$

Where $\boldsymbol{R_p}$ is a portfolio return p

$\boldsymbol{\propto_p}$ is a measure selection ability

$\boldsymbol{c_p}$ is a measure of timing ability

$\boldsymbol{R_f}$ is a risk free return

$\boldsymbol{R_m}$ is a market return

3. The Return Attribution

The return attribution model was established by Brinson, Hood and Beebower (1986). This model is called "Brinson model" which use for decompose excess return into allocation effect, selection effect and interaction effect. This return attribution model is applied in this paper in order to identify the source of the excess return compared to designated benchmarks. Over an evaluation period, portfolios produce a return that is different from its benchmark referred to the value-added. Therefore, the method I use in line with current industry standards for performance attribution which is compare to designated benchmark.

The allocation effect is the measure of fund manager's decision to allocate their portfolio's assets into various sectors. When the portfolio is overweighted to

outperforming sector and underweighted to underperforming sector, allocation effect will be positive.

In order to applies the concept with SET sector benchmark, the portfolio allocation effect is calculated by

$$\sum_{i=1}^{n}(W_{pi} - W_{Bi})R_{Bi}$$

Where W_{pi} is the sector i portfolio weight

W_{Bi} is the sector i benchmark weight

R_{Bi} is the sector i benchmark return

The selection effect is the measure of fund manager's decision to effectively select securities within a sector compared to designated benchmark. When the portfolio sector return outperforms the benchmark sector return, selection effect will be positive. While the portfolio sector return underperforms the benchmark sector return, selection effect will be negative. The benchmark sector weight is the multiplier to the outperformance or underperformance. The larger the benchmark sector weight, the larger the selection effect.

In order to applies the concept with SET benchmark, the portfolio selection effect is calculated by

$$\sum_{i=1}^{n} W_{Bi}\left(R_{pi} - R_{Bi}\right)$$

Where W_{Bi} is the sector i benchmark weight

R_{pi} is the sector i portfolio return

R_{Bi} is the sector i benchmark return

There is another effect which is the joint effect of fund managers' decisions to select security and allocate more or less fund to the sector which security is in, called interaction effect. It measures the inevitable side-effect which impact from allocation decision and selection decision. When securities are bought, they usually increase the weight of the sector they are in. Without selling some investment to keep the sector weight unchanged, the security selection usually leads to weighting decision. Consequently, interaction effect is commonly included in selection effect.

In order to applies the concept with SET benchmark, the portfolio interaction effect is calculated by

$$\sum_{i=i}^{n}(W_{pi} - W_{Bi})(R_{pi} - R_{Bi})$$

Where W_{pi} is the sector i portfolio weight

W_{Bi} is the sector i benchmark weight

R_{pi} is the sector i portfolio return

R_{Bi} is the sector i benchmark returns

When interaction effect is included to selection effect, the formula for selection effect is

$$\sum_{i=1}^{n} W_{pi}\left(R_{pi} - R_{Bi}\right)$$

Where W_{pi} is the sector i portfolio weight

R_{pi} is the sector i portfolio return

R_{Bi} is the sector i benchmark return

Therefore, decomposing the overall performance:

Portfolio Return – Benchmark = Allocation + Selection

Overall performance: Portfolio Return - Benchmark

$$R_p - R_B = \sum_{i=1}^{n} W_{pi}R_{pi} - \sum_{i=1}^{n} W_{Bi}R_{Bi} = \sum_{i=1}^{n}(W_{pi}R_{pi} - W_{Bi}R_{Bi}) \quad (1)$$

From (1), total contributions from sector i:

$$W_{pi}R_{pi} - W_{Bi}R_{Bi} \quad (2)$$

Contribution from allocation:

$$(W_{pi} - W_{Bi})R_{Bi} \quad (3)$$

Contribution from selection:

$$W_{pi}(R_{pi} - R_{Bi}) \quad (4)$$

Consequently, total contribution from sector i equal to:

(2) = (3) + (4)

$$W_{pi}R_{pi} - W_{Bi}R_{Bi} = (W_{pi} - W_{Bi})R_{Bi} + W_{pi}(R_{pi} - R_{Bi})$$

3. DATA and METHODOLOGY

Data

I obtain weekly mutual fund return and portfolio holdings from "Morningstar Direct Database". The database provides quarterly portfolio holdings data for Thai mutual funds since quarter 3 in 2014. Therefore, each fund covers 22 quarters or 287 weeks until December 2019. For the benchmark, I obtain SET return, SET TRI return and SET sector weight and sector return from Bloomberg terminal. The risk free rate is the 3-Month Zero Rate Return (ZRR). The 3-Month ZRR Index is a measurement of the total return from a synthetic portfolio investing in a 3-month maturity of government bond and treasury bills. I obtain ZRR data from ThaiBMA (The Thai Bond Market Association).

I focus on actively Thai equity mutual funds "EQSET" which are classified by the AIMC (The Association of Investment Management Companies). From this sample, I remove index funds and sector funds. In order to clean the data and make the results are reliable, each fund must have return data and portfolio holding data at least 144 weeks which is the half of 287 weeks through the period June 2014 to December 2019 so that I get 100 Thai equity mutual funds to my sample.

I drop out 66 out of 166 available mutual funds in my study period which do not have enough data. The funds were dropped out in the period before 2014 due to the incomplete data. For the funds set up in the period 2017-2019, some funds were dropped out because it cannot provide data at least 144 weeks. Focus on my study period 2014-2019, all the funds that existed in 2014 still survive until 2019 and included in my sample. The reason to drop out some funds is not about funds are no longer available. Therefore, my study is free of survivorship bias. The table reported in the appendix B shows the number of new funds and the number of dropped out funds in each year.

Methodology

Follow the research question and hypothesis, the method is decided to test whether sector allocation dominates security selection by follow these methods

Part 1: Descriptive Statistics

1.1 Obtain weekly mutual fund returns from Morningstar.

1.2 Obtain weekly SET return and SET TRI return from Morningstar.

1.3 Calculate the excess return which is the weekly portfolio return earned above SET return and SET TRI return.

1.4 Obtain mutual fund's portfolio holdings from Morningstar.

1.5 Obtain SET sector weight and return at the weekly basis from Bloomberg.

1.6 Calculate portfolio's sector return from quarterly portfolio holdings with the return data at the weekly basis under the assumption that fund holds the same weights during that quarter, the weight is based on the end of quarter holding.

1.7 Each fund and each week, calculate allocation effect and selection effect

$$Allocation\ effect\ or\ R_a = \sum_{i=1}^{n} (W_{pi} - W_{Bi}) R_{Bi}$$

Where W_{pi} is the sector i portfolio weight

W_{Bi} is the sector i benchmark weight

R_{Bi} is the sector i benchmark returns

$$Selection\ effect\ or\ R_s = \sum_{i=1}^{n} W_{pi} (R_{pi} - R_{Bi})$$

Where W_{pi} is the sector i portfolio's weight

R_{pi} is the sector i portfolio return

R_{Bi} is the sector i benchmark return

1.8 Using one sample t-Test in order to test whether the sample mean is statistically different from zero at 95% confidence interval. The excess return, allocation effect and selection effect are tested.

1.9 Provide descriptive statistics of the excess return, allocation effect, selection effect and the difference between weekly average actual excess return and the summation of allocation effect with selection effect compose of mean, max, min, standard deviation, 25th percentile, median and 75th percentile values. And also separate the results into 3 groups which are positive significance, negative significance and insignificance at 95% confidence interval.

Part 2: Mutual Fund Returns

2.1 Apply Jensen-Alpha (1968, 1969) in order to test the overall ability. Run the whole 22 quarters with the return data at the weekly basis. Obtained from the regression

$$\boldsymbol{R_{p,t} - R_{f,t} = \propto_p + \beta\left(R_{m,t} - R_{f,t}\right) + \varepsilon_{p,t}}$$

Where $\boldsymbol{R_{p,t}}$ is the portfolio p return earned during week t

$\propto_{\boldsymbol{p}}$ is the measure of overall ability

$\boldsymbol{R_{f,t}}$ is the risk free return which is the 3-month ZRR during week t

$\boldsymbol{R_{m,t}}$ is the SET return and SET TRI return during week t

2.2 Apply Treynor-Mazuy (1966) in order to test timing ability. Run the whole period which is 22 quarters with the return data at the weekly basis so that I only get one alpha over 22 quarters for each fund. Obtained from the regression

$$\boldsymbol{R_{p,t} - R_{f,t} = \propto_p + b\left(R_{m,t} - R_{f,t}\right) + c_p\left(R_{m,t} - R_{f,t}\right)^2 + \varepsilon_{p,t}}$$

Where $\boldsymbol{R_{p,t}}$ is the portfolio p return earned during week t

$\propto_{\boldsymbol{p}}$ is the measure of overall ability

$\boldsymbol{c_p}$ is the measure of timing ability

$\boldsymbol{R_{f,t}}$ is the risk free return which is the 3-month ZRR during week t

$\boldsymbol{R_{m,t}}$ is the SET return and SET TRI return during week t

2.3 Provide the results into 4 groups which are positive significance, negative significance, positive insignificance and negative insignificance at 95% confidence interval.

Part 3: The Return Attribution Analysis: Allocation Effect and Selection Effect

3.1 Apply Treynor-Mazuy (1966) in order to test market timing ability and selectivity ability for both "allocation effect" and "selection effect".

3.1.1 Allocation effect

$$\boldsymbol{R_{a,t} - R_{f,t} = \propto_a + b\left(R_{m,t} - R_{f,t}\right) + c_a\left(R_{m,t} - R_{f,t}\right)^2 + \varepsilon_{p,t}}$$

Where $\boldsymbol{R_{a,t}}$ is the allocation effect of a fund p earned during week t

$\propto_{\boldsymbol{a}}$ is the measure of sector picking ability

c_a is the measure of sector timing ability

$R_{f,t}$ is the risk free return which is the 3-month ZRR during week t

$R_{m,t}$ is the SET return and SET TRI return during week t

3.1.2 Selection effect

$$R_{s,t} - R_{f,t} = \propto_s + b\left(R_{m,t} - R_{f,t}\right) + c_s\left(R_{m,t} - R_{f,t}\right)^2 + \varepsilon_{p,t}$$

Where $R_{s,t}$ is the security selection effect of a fund p earned during week t

$\propto_s$ is the measure of security picking ability

c_s is the measure of security timing ability

$R_{f,t}$ is the risk free return which is the 3-month ZRR during week t

$R_{m,t}$ is the SET return and SET TRI return during week t

3.2 Provide the results into 4 groups which are positive significance, negative significance, positive insignificance and negative insignificance at 95% confidence interval.

4. EMPIRICAL RESULTS

Thai equity mutual funds which already remove index funds and sector funds are examined. Because the main data is quarterly portfolio holdings from Morningstar which provided the portfolio weight since quarter 3 in 2014 until the end of 2019. This actual period is equal to 22 quarters or 287 weeks. It should be noted that my research limitation is that I cannot know weight on each day. Therefore, the portfolio weight at the end of quarter is assumed a constant weight for that quarter. I also run with the return data at the weekly basis and the weight is assumed a constant at the weekly basis. To be selected into the samples, each fund must have data at least 144 weeks (a half of 287 weeks). The final sample consists of 100 mutual funds. The return data is total return which includes dividends and capital gains. The market portfolio is SET Index which does not include dividends and SET TRI Index which include dividends. The risk free rate is 3-Month Zero Rate Return (ZRR) has been used. The 3-Month ZRR Index is a measurement of the total return from a synthetic portfolio investing in a 3-Month maturity security.

According to Brinson model, the excess return must equal to allocation effect plus selection effect. However, the empirical results do not provide that equality due to the

limitations. First, the portfolio weight at the end of quarter is assumed a constant weight for that quarter. Second, the actual weekly portfolio return takes into account of dividend reinvested, cash returns and other security returns for example warrant or security in MAI while my method only based on sectors in SET. Third, the actual period of buying or selling security and the actual date the fund was launched are not known. Finally, this paper ignores expenses and transaction costs. It should be noted that even most of funds have MAI security in their portfolio, the MAI security weight does not exceed 7%. And also few funds have warrant in their portfolio and the weight is not significant. The maximum and minimum security weights without cash are around 95% and 75%, respectively. Therefore, the results will be totally separated among the excess return, allocation effect and selection effect. This means that allocation effect and selection effect are calculated based on portfolio holding data and nothing to do with the actual portfolio return.

Since the portfolio holdings are provided in the quarterly basis, using quarterly returns or monthly returns would be more accurate. Hence, the problem of the limitation could reduce. However, the availability data of quarterly portfolio holdings are too short when apply with regression analysis. Therefore, weekly returns data is more proper in this paper when apply with regression analysis.

Part 1: Descriptive Statistics

The one sample t-Test is used in order to test whether the sample mean is statistically different from zero at 95% confidence interval. The sample means compose of weekly average excess return, weekly average allocation effect, weekly average selection effect and the difference between weekly average actual excess return and the summation of allocation effect with selection effect. Therefore, this part provides descriptive statistics which are mean, maximum, minimum, standard deviation, 25^{th} percentile, median and 75^{th} percentile values. In each table, I separated the value into 3 groups which are positive significance, negative significance and insignificance at 95% confidence interval.

Table 1: The Descriptive Statistics of Weekly Average Excess Return (SET Index)

Weekly Average Excess Return (Benchmark: SET)	Number of Fund	Mean	Max	Min	Std. Dev.	25th Pct	Median	75th Pct
Positive Significance	35	0.0767%	0.1227%	0.0518%	0.0192%	0.0654%	0.0689%	0.0865%
Negative Significance	0							
Insignificance	65							

As reported in Table 1, the result for the period 3Q2014 through 4Q2019 and each fund contains at least 144 until 287 weekly excess return observations across 100 mutual funds. The average excess return is the average of the weekly portfolio return earned above the benchmark which is SET Index through the sample period. The result shows that 35 mutual funds provide positive significance of weekly average excess return approximately 0.0767% and the rests are insignificance. This result indicates that 35% of mutual fund observations outperform SET Index benchmark approximately 0.0767%.

Table 2: The Descriptive Statistics of Weekly Average Excess Return (SET TRI Index)

Weekly Average Excess Return (Benchmark: SET TRI)	Number of Fund	Mean	Max	Min	Std. Dev.	25th Pct	Median	75th Pct
Positive Significance	1	0.0636%	0.0636%	0.0636%	-	0.0636%	0.0636%	0.0636%
Negative Significance	13	-0.0802%	-0.0454%	-0.1539%	0.0324%	-0.0779%	-0.0673%	-0.0617%
Insignificance	86							

As reported in Table 2, the result for the period 3Q2014 through 4Q2019 and each fund contains at least 144 until 287 weekly excess return observations across 100 mutual funds. The average excess return is the average of the weekly portfolio return earned above the benchmark which is SET TRI Index through the sample period. The result shows that only 1 mutual fund provide positive significance of weekly average excess return equal to 0.0636% whereas 13 mutual funds show negative significance of weekly average excess return approximately -0.0802%. 86 mutual funds are insignificance. This result indicates that only 1% of mutual fund observations outperform SET TRI benchmark approximately 0.0636%.

It is interesting to point out that the number of mutual fund provided positive significance is drastically reduced from 35% in Table 1 to 1% in Table 2. These results occurred due to the omission of dividends reinvest from the SET Index in Table 1. SET TRI Index is more proper than SET Index and is not biased contribute to fund managers. The excess returns are quite sensitive to the benchmark chosen.

Table 3: The Descriptive Statistics of Weekly Average Allocation Effect

Weekly Average Allocation Effect	Number of Fund	Mean	Max	Min	Std. Dev.	25th Pct	Median	75th Pct
Positive Significance	45	0.0447%	0.0972%	0.0229%	0.0180%	0.0351%	0.0395%	0.0478%
Negative Significance	1	-0.0202%	-0.0202%	-0.0202%	-	-0.0202%	-0.0202%	-0.0202%
Insignificance	54							

As reported in Table 3, the result for the period 3Q2014 through 4Q2019 and each fund contains at least 144 until 287 weekly allocation effect observations across 100 mutual funds. The allocation effect is the fund manager's ability to distribute their portfolio's assets into various sectors through the sample period. The result shows that 45 mutual funds provide positive significance of weekly average allocation effect approximately 0.0447% whereas 1 mutual fund show negative significance equal to -0.0202%. 54 mutual funds are insignificance. This result indicates that 45% of mutual fund observations provide positive average allocation effect which result from the portfolio is overweighted to outperforming sector and underweighted to underperforming sector.

Table 4: The Descriptive Statistics of Weekly Average Selection Effect

Weekly Average Selection Effect	Number of Fund	Mean	Max	Min	Std. Dev.	25th Pct	Median	75th Pct
Positive Significance	84	0.1318%	0.4678%	0.0542%	0.0840%	0.0790%	0.1015%	0.1394%
Negative Significance	0	-	-	-	-	-	-	-
Insignificance	16							

As reported in Table 4, the result for the period 3Q2014 through 4Q2019 and each fund contains at least 144 until 287 weekly selection effect observations across 100 mutual funds. The selection effect is the fund manager's ability to select securities within a sector compared to designated benchmark through the sample period. The

result shows that 84 mutual funds provide positive significance of weekly average selection effect approximately 0.1318% and the rests are insignificance. This result indicates that 84% of mutual fund observations provide positive average selection effect which results from the portfolio sector return outperform the benchmark sector return.

Table 5: The Descriptive Statistics of Difference between Weekly Average Actual Excess Return and the Summation of Allocation Effect with Selection Effect (SET TRI Index)

Difference of Weekly Average Actual Excess Return with the Summation of Two Effects	Number of Fund	Mean	Max	Min	Std. Dev.	25th Pct	Median	75th Pct
Positive Significance	0	-	-	-	-	-	-	-
Negative Significance	99	-0.1100%	-0.0165%	-0.4621%	0.0787%	-0.1187%	-0.0850%	-0.0689%
Insignificance	1							

As reported in Table 5, the result for the period 3Q2014 through 4Q2019 and each fund contains at least 144 until 287 of difference between weekly average actual excess return and the summation of allocation effect with selection effect observations across 100 mutual funds. The result shows that 99 mutual funds exhibit negative significance approximately -0.11%. This result shows the magnitude of my limitation that the real weight on each day cannot be known. The higher difference reflects from the higher in positive selection effect refers to Table 4.

Part 2: Mutual Fund Returns

2.1 Jensen Alpha

In order to test the overall ability of the mutual funds, Jensen Alpha is applied.

$$\boldsymbol{R_{p,t} - R_{f,t} = \propto_p + \beta\left(R_{m,t} - R_{f,t}\right) + \varepsilon_{p,t}}$$

Table 6: The Overall Ability (SET Index is the market portfolio)

$\propto_p$	Positive	Negative	Number of Fund
Statistically Significant*	**27**	**0**	27
Statistically Insignificant	**56**	**17**	73
Number of Fund	83	17	100

$\propto_p$ is the measure of overall ability * at 5% level

As reported in Table 6, using SET Index as the market portfolio and the result shows that 27 mutual funds have positive significance of overall ability coefficient whereas 73 mutual funds are insignificant at 5%.

Table 7: The Overall Ability (SET TRI Index is the market portfolio)

$\propto_p$	Positive	Negative	Number of Fund
Statistically Significant*	**0**	**3**	3
Statistically Insignificant	**46**	**51**	97
Number of Fund	46	54	100

$\propto_p$ is the measure of overall ability * at 5% level

As reported in Table 7, using SET TRI Index as the market portfolio and the result shows that 3 mutual funds have negative significance of overall ability coefficient whereas 97 mutual funds are insignificant at 5%.

Compare Table 6 with Table 7, using SET TRI index as the market portfolio instead of SET Index has altered the results. Although 27 mutual funds have found with positive significance of overall ability when using SET Index as the market portfolio, none of the mutual funds provide positive significance of overall ability when using SET TRI Index as the market portfolio. These results occurred due to the omission of dividends reinvest from the SET Index in table 6. Therefore, using SET TRI Index as the market portfolio reduces somewhat the ability of fund managers.

Regardless of positive or negative coefficient, the number of mutual funds with statistically insignificant coefficient increase from 73 to 97 when using SET TRI

Index as the market portfolio. This result indicates that approximately 97% of mutual funds ability cannot be explained when compared to SET TRI Index.

2.2 Treynor-Mazuy

In order to test timing ability of the mutual funds, Treynor-Mazuy is applied.

$$R_{p,t} - R_{f,t} = \propto_p + b\left(R_{m,t} - R_{f,t}\right) + c_p\left(R_{m,t} - R_{f,t}\right)^2 + \varepsilon_{p,t}$$

Table 8: The Timing Ability (SET Index is the market portfolio)

c_p	Positive	Negative	Number of Fund
Statistically Significant*	**0**	**45**	45
Statistically Insignificant	**11**	**44**	55
Number of Fund	11	89	100

c_p is the measure of timing ability * at 5% level

As reported in Table 8, using SET Index as the market portfolio and the result does not reveal any positive significance of timing ability. 45 mutual funds exhibit negative significance of timing ability whereas 55 mutual funds are insignificant at 5%.

Table 9: The Timing Ability (SET TRI Index is the market portfolio)

c_p	Positive	Negative	Number of Fund
Statistically Significant*	**0**	**45**	45
Statistically Insignificant	**13**	**42**	55
Number of Fund	13	87	100

c_p is the measure of overall ability * at 5% level

As reported in Table 9, using SET TRI Index as the market portfolio and the result shows similar results to Table 8. The result does not reveal any positive significance of timing ability. 45 mutual funds exhibit negative significance of timing ability whereas 55 mutual funds are insignificant at 5%.

Irrespective of SET Index or SET TRI Index is used for the market portfolio, the results show that 45% of mutual funds have negative significance of timing ability at 5%.

Part 3: The Return Attribution Analysis: Allocation Effect and Selection Effect

The excess return which is the portfolio return earned above the benchmark can decompose into allocation effect and selection effect according to the Brinson model. In this part, Treynor-Mazuy is applied in order to test picking ability and timing ability of each effect.

3.1 Allocation Effect with Treynor-Mazuy Model

To be noted that the allocation effect approach is subject to certain limitation. Since the Morningstar provides weight at the quarterly basis, a constant weight is equally assumed through that quarter. Therefore, the allocation effect is based on the fund manager ability to rearrange the portfolio on a quarterly basis even though fund managers in practice do change allocation every day within the quarter.

In order to test allocation effect which is the ability of fund managers to allocate their portfolio's assets to various sectors, Treynor-Mazuy model is applied to test the allocation effect come from sector picking ability or sector timing ability.

$$R_{a,t} - R_{f,t} = \propto_a + b\left(R_{m,t} - R_{f,t}\right) + c_a\left(R_{m,t} - R_{f,t}\right)^2 + \varepsilon_{p,t}$$

3.1.1 Sector Picking Ability: $\propto_a$

Table 10: Sector Picking Ability (SET Index is the market portfolio)

$\propto_a$	Positive	Negative	Number of Fund
Statistically Significant*	18	4	22
Statistically Insignificant	43	35	78
Number of Fund	61	39	100

$\propto_a$ is the measure of sector picking ability * at 5% level

As reported in Table 10, using SET Index as the market portfolio and the result shows that 18 mutual funds have positive significance of sector picking ability coefficient whereas 4 mutual funds have negative significance of sector picking ability coefficient. 78 mutual funds are insignificant at 5%.

Table 11: Sector Picking Ability (SET TRI Index is the market portfolio)

$\propto_a$	Positive	Negative	Number of Fund
Statistically Significant*	**12**	**6**	18
Statistically Insignificant	**48**	**34**	82
Number of Fund	60	40	100

$\propto_a$ is the measure of sector picking ability * at 5% level

As reported in Table 11, using SET TRI Index as the market portfolio and the result shows that 12 mutual funds have positive significance of sector picking ability coefficient whereas 6 mutual funds have negative significance of sector picking ability coefficient. 82 mutual funds are insignificant at 5%.

Using SET TRI index as the market portfolio in Table 11 instead of SET Index in Table 10 slightly change the result between positive and negative coefficient, the statistically significant of positive coefficient reduce from 18 to 12 whereas negative coefficient increase from 4 to 6. On the other hand, irrespective of SET Index or SET TRI Index is used for the market portfolio, the results show that around 80% of mutual funds are statistically insignificant at 5%.

Although using SET TRI index as the market portfolio in Table 11 instead of SET Index in Table 10 does not provide extremely change in result between positive and negative coefficient, the statistically significant of positive coefficient reduce from 18 to 12. On the other hand, irrespective of SET Index or SET TRI Index is used for the market portfolio, the results show that around 80% of mutual funds are statistically insignificant at 5%.

3.1.2 Sector Timing Ability: c_a

Table 12: Sector Timing Ability (SET Index is the market portfolio)

c_a	Positive	Negative	Number of Fund
Statistically Significant*	**0**	**57**	57
Statistically Insignificant	**9**	**34**	43
Number of Fund	9	91	100

c_a is the measure of sector timing ability * at 5% level

As reported in Table 12, using SET Index as the market portfolio and the result shows that 57 mutual funds have negative significance of sector timing ability coefficient. 43 mutual funds are insignificant at 5%.

Table 13: Sector Timing Ability (SET TRI Index is the market portfolio)

c_a	Positive	Negative	Number of Fund
Statistically Significant*	**0**	**56**	56
Statistically Insignificant	**9**	**35**	44
Number of Fund	9	91	100

c_a is the measure of sector timing ability * at 5% level

As reported in Table 13, using SET TRI Index as the market portfolio and the result shows that 56 mutual funds have negative significance of sector timing ability coefficient. 44 mutual funds are insignificant at 5%.

Irrespective of the choice of market portfolio**,** positive significance of sector timing ability is not found and also approximately 44% of sector timing ability cannot be explained.

3.2 Selection Effect with Treynor-Mazuy Model

In order to test selection effect which is the ability of fund managers to select securities within a sector compared to designated benchmark, Treynor-Mazuy model is applied to test the selection effect come from security picking ability or security timing ability.

$$R_{s,t} - R_{f,t} = \propto_s + b\left(R_{m,t} - R_{f,t}\right) + c_s\left(R_{m,t} - R_{f,t}\right)^2 + \varepsilon_{p,t}$$

3.2.1 Security Picking Ability: $\propto_s$

Table 14: Security Picking Ability (SET Index is the market portfolio)

$\propto_s$	Positive	Negative	Number of Fund
Statistically Significant*	**58**	**0**	58
Statistically Insignificant	**37**	**5**	42
Number of Fund	95	5	100

$\propto_s$ is the measure of security picking ability * at 5% level

As reported in Table 14, using SET Index as the market portfolio and the result shows that 58 mutual funds have positive significance of security picking ability coefficient. 42 mutual funds are insignificant at 5%.

Table 15: Security Picking Ability (SET TRI Index is the market portfolio)

$\propto_s$	Positive	Negative	Number of Fund
Statistically Significant*	**67**	**0**	67
Statistically Insignificant	**28**	**5**	33
Number of Fund	95	5	100

$\propto_s$ is the measure of security picking ability * at 5% level

As reported in Table 15, using SET TRI Index as the market portfolio and the result shows that 67 mutual funds provide positive significance of security picking ability coefficient. 33 mutual funds are insignificant at 5%.

95% of mutual funds in Table 14 and Table 15 have positive significance of security picking ability coefficient result from the portfolio sector return outperforms the benchmark sector return. Although using SET TRI index as the market portfolio in Table 15 instead of SET Index in Table 14 does not provide change in result between positive and negative coefficient, the statistically significant of positive coefficient increase from 58 to 67.

3.2.2 Security Timing Ability: c_s

Table 16: Security Timing Ability (SET Index is the market portfolio)

c_s	Positive	Negative	Number of Fund
Statistically Significant*	**0**	**24**	24
Statistically Insignificant	**16**	**60**	76
Number of Fund	16	84	100

c_s is the measure of security timing ability * at 5% level

As reported in Table 16, using SET Index as the market portfolio and the result shows that 24 mutual funds have negative significance of security timing ability coefficient. 76 mutual funds are insignificant at 5%.

Table 17: Security Timing Ability (SET TRI Index is the market portfolio)

c_s	Positive	Negative	Number of Fund
Statistically Significant*	**0**	**24**	24
Statistically Insignificant	**15**	**61**	76
Number of Fund	15	85	100

c_s is the measure of security timing ability * at 5% level

As reported in Table 17, using SET TRI Index as the market portfolio shows the result similar to table 14. 76 mutual are insignificant whereas 24 mutual funds have negative significance coefficient at 5%.

Irrespective of the choice of market portfolio, positive significance of security timing ability is not found and also approximately 76% of security timing ability cannot be explained.

3.3 Allocation Effect vs. Selection Effect (SET TRI)

Table 18: The Average Coefficient and Number of Fund for Allocation Effect and Selection Effect at 5% Significance

Average Coefficient | Number of Fund	Allocation Effect		Selection Effect	
	α_{ap}: Sector Picking	α_{at}: Sector Timing	α_{sp}: Security Picking	α_{st}: Security Timing
Positive Significant	**0.0649 | 12**	-	**0.1476 | 67**	-
Negative Significant	**-0.0385 | 6**	**-1.4048 | 56**	-	**-3.1244 | 24**

As reported in Table 18, this table compares the whole funds refer to SET TRI Index as the market portfolio. In the case of positive significant, timing ability is of no value to both allocation effect and selection effect. Most of them appear to have a negative significant of timing ability (-1.4048 & -3.1244) which has lots of negative impact especially for security timing ability. Furthermore, consider between sector picking and security picking (0.0649 & 0.1476), security picking provide a larger coefficient than sector picking. As a whole, 67% of mutual fund observations can achieve superior ability in security picking. They tend not to focus much on sector picking ability. 56% of mutual fund observations provide negative sector timing ability.

These results indicate that under each effect, picking ability dominate timing ability whereas between allocation effect and selection effect, security picking ability dominates sector picking ability. Therefore, selection effect makes a larger contribution to the excess return than allocation effect as a result of security picking.

Table 19: The Average Coefficient and Number of Fund compare within the Same Fund at 5% Significance

Average coefficient	Allocation Effect		Selection Effect		Number of Fund
	γ_{1i}: Sector Picking	γ_{2i}: Sector Timing	γ_{3i}: Security Picking	γ_{4i}: Security Timing	
Positive Significance	0.0649	-	0.2483	-	12
Negative Significance	-	-1.8053	-	-3.4609	17
Negative Significance	-0.0363	-0.7328	-	-	2

As reported in Table 19, this table compares within the same funds refer to SET TRI Index as the market portfolio. In the case of positive significance, the result shows 12% of mutual fund observations have both sector picking ability and security picking ability within the same fund. Security picking tends to generate more return rather than sector picking (0.2483 VS. 0.0649) which benefit to these 12 funds. Refer to Table 18, 12 mutual funds that have sector picking ability, these funds also have security picking ability. Moreover, the security picking of these funds exhibit larger average coefficient compare to all funds that have this ability in Table 18 (0.2483 VS. 0.1476).

In the case of negative significance, the results reveal 2 types. First, 17% of mutual fund observations provides negative both sector timing and security timing within the same fund. Security timing tends to generate more negative return compare to sector timing (-3.4609 VS. -1.8053) which disadvantage to these 17 funds. Refer to Table 18, 17 out of 24 mutual funds, in the case of security timing, appear to have sector timing ability. Moreover, security timing and sector timing in this case provide larger average coefficient compare to all funds that have these two abilities in Table 18: -3.4609 and -1.8053 compare to -3.1244 and -1.4048, respectively. Second, 2% of mutual fund observations provides negative both sector picking and sector timing within the same fund. Sector timing tends to generate more negative return compare to sector picking (-0.7328 VS. -0.0363) which disadvantage to these 2 funds. Refer to

Table 18, 2 out of 6 mutual funds, in the case of sector picking, appear to have sector timing ability. Moreover, sector timing in this case exhibit lower average coefficient compare to all funds that have this ability in Table 18 (-0.7328 VS. -1.4048).

5. CONCLUSIONS

The study examines the performance of 100 Thai equity mutual funds for the period July 2014 to December 2019 in terms of "allocation effect" and "selection effect" according to Brinson model and also applied to 28 sectors in SET industry group and sector classification. The allocation effect is the sector allocation while the selection effect is the security selection within a sector. These examines are analyzed with Jensen (1968, 1969) and Treynor-Mazuy (1966). For the mutual fund returns, Jensen Alpha is employed in order to test the overall ability and Treynor-Mazuy is employed in order to test timing ability. While the return attribution which composes of "allocation effect" and "selection effect", Treynor-Mazuy is employed in order to test picking ability and timing ability in each effect.

First, the observation is test whether the sample mean is statistically different from zero at 95% confidence interval. The sample is the excess return which is the return earned above the benchmark. The empirical findings the excess returns are quite sensitive to the benchmark chosen. The result shows that 35% of mutual fund observations outperform SET Index. While using SET TRI Index, only 1% of mutual fund observations outperform and 13% provide negative significance with the benchmark. The rest are insignificance. Therefore, SET TRI Index is more proper to its real return and is not biased contribute to fund managers because SET TRI Index takes into account of dividend reinvested in line with fund returns. For allocation effect, the result shows that 45% of mutual fund observations have positive allocation effect which result from the portfolio is overweighted to outperforming sector and underweighted to underperforming sector and 1% is negative allocation effect. In terms of selection effect, 84% shows positive selection effect which results from the portfolio sector return outperform the benchmark sector return. The rest are insignificance. In order to show the magnitude of my limitation that the real weight on each day cannot be known and the summation of allocation effect with selection

effect do not take into account of dividend reinvested, cash returns and other security returns which funds can hold, the result shows that 99% of mutual fund observations have negative significance of the difference between weekly average actual excess return and the summation of allocation effect with selection effect. Because the portfolio holdings are provided in the quarterly basis, using quarterly returns or monthly returns would be more accurate. Hence, the problem of the limitation could reduce. However, weekly returns data is more proper in this paper when apply with regression analysis due to the shorter availability of quarterly portfolio holdings.

For the overall ability with Jensen model, the result shows 27% of mutual fund observations exhibit positive significance of Jensen Alpha coefficients while using SET Index as the market portfolio. The result has been reduced dramatically to 0% when using SET TRI Index as the market portfolio. The overall abilities are quite sensitive to the market portfolio. These results are in line with the first part that the excess returns are quite sensitive to the benchmark chosen. Moreover, these results are also in line with the empirical results in Thailand research, Lonkani, Satjawathee and Jegasothy (2013) study Thai equity mutual funds in the period 1992 – 2004. They run Jensen Alpha at the monthly basis and using SET Index as the market portfolio. They found that only 6 out of 107 mutual funds provide positive significance of Jensen alpha coefficients. For the timing ability with Treynor-Mazuy model, irrespective of SET Index or SET TRI Index is used for the market portfolio, the results show that 45% of mutual fund observations exhibit negative significance of timing ability while 55% are insignificant.

For the allocation effect and selection effect with the Treynor-Mazuy model, As a whole although the results do not reveal any timing ability to both allocation effect and selection effect, timing ability has lots of negative impact especially for security timing ability. The results also referring to timing ability remain almost unchanged between SET Index and SET TRI Index. This result is also in line with the empirical results in Thailand research; Lonkani, Satjawathee and Jegasothy (2013) applied Treynor-Mazuy model with Thai equity mutual funds in the monthly period 1992 – 2004. They found that only 2 out of 107 mutual funds provide positive timing ability coefficient. In contrast to Chunhachinda and Tangprasert (2004), they applied

Treynor-Mazuy model with Thai equity mutual funds in the monthly period 2001 – 2003. They found that 8 out of 65 mutual funds or around 12% exhibit positive significance for timing ability. The different results might come from the different time period testing and some papers have smaller period to test.

As a whole with SET TRI Index as the market portfolio, 67% of mutual fund observations can achieve superior ability in security picking. They tend not to focus much on sector picking ability. 56% of mutual fund observations provide negative sector timing ability. Therefore, selection effect is of greater importance to the excess return than allocation effect as a result of security picking.

Within the same fund with SET TRI Index as the market portfolio, although 12% of mutual fund observations have positive effect to both sector picking ability and security picking ability, security picking can generate more return compare to sector picking. 17% of mutual fund observations have negative effect to both sector timing ability and security timing ability but security timing generates more negative return than sector timing. 2% of mutual fund observations have negative effect to both sector picking and sector timing but sector timing generates more negative return than sector picking.

APPENDIX

Appendix A: Data Sources

Data	Name	Quote
Source: Morninstar		
Portfolio return	Return	RETURN
Portfolio weight	Holding	MSHOLDING
Source: ThaiBMA		
Risk free return	3-Month Zero Rate Return Index (ZRR)	-
Source: Bloomberg		
Market return (1)	SET Index	PX_LAST
Market return (2)	SETTRI Index	TOT_RETURN_INDEX_GROSS_DVDS
Benchmark sector weight, Benchmark sector return	SETAGRI	CUR_MKT_CAP, TOT_RETURN_INDEX_GROSS_DVDS
	SETFOOD	
	SETFASH	
	SETHHOLD	
	SETPERS	
	SETBANK	
	SETFIN	
	SETINS	
	SETAUTO	
	SETIMM	
	SETPKG	
	SETPAPER	
	SETPETRO	
	SETSTEEL	
	SETCONMT	
	SETCONS	
	SETPROP	
	SETPREIT	
	SETENERG	
	SETMINE	
	SETCOM	
	SETHELTH	
	SETENTER	
	SETPROF	
	SETHOT	
	SETTRANS	
	SETETRON	
	SETCOMUN	

Note: TOT_RETURN_INDEX_GROSS_DVDS is the total return which include dividend reinvested before tax.

Appendix B: Number of Available and Dropped Out Funds

Year	Number of Fund	
	New Fund	Drop out
Before 2014	98	11
2014	1	0
2015	7	5
2016	8	3
2017	27	22
2018	4	4
2019	21	21
Total	**166**	**66**

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