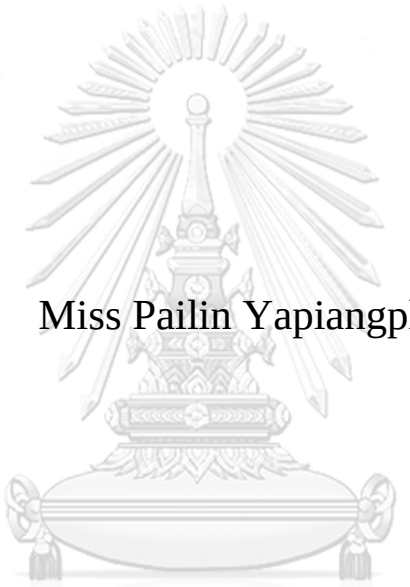
The Relation Between Portfolio Turnover and Mutual Fund Performance: Evidence from Thailand

Miss Pailin Yapiangplook



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ความสัมพันธ์ระหว่างอัตราส่วนหมุนเวียนการลงทุนของกองทุนและผลการดำเนินงานของกองทุนรวม: การศึกษาในประเทศไทย

น.ส.ไพลิน ยะเปียงปลูก

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By	Miss Pailin Yapiangplook
Field of Study	Finance
Thesis Advisor	Assistant Professor ANIRUT PISEDTASALASAI, Ph.D.

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INDEPENDENT STUDY COMMITTEE

..... Chairman

()

..... Advisor

(Assistant Professor ANIRUT PISEDTASALASAI, Ph.D.)

..... Examiner

(Associate Professor VIMUT VANITCHAREARNTHUM, Ph.D.)

..... Examiner

(Assistant Professor TANAKORN LIKITAPIWAT, Ph.D.)

ไพลิน ยะเปียงปลูก : ความสัมพันธ์ระหว่างอัตราส่วนหมุนเวียนการลงทุนของกองทุนและผลการดำเนินงานของกองทุนรวม: การศึกษาในประเทศไทย. (The Relation Between Portfolio Turnover and Mutual Fund Performance: Evidence from Thailand) อ.ที่ปรึกษาหลัก : ผศ. ดร.อนิรุต พิเสฏฐศลาศัย

This paper examines whether the active management strategy can outperform the market by using turnover ratio as the proxy. Turnover ratio is the percentage of changing fund's holding in a given year. Therefore, a high turnover ratio can indicate an active management.

This paper will focus on an active equity fund in Thailand from 2010 to 2019. The first objective is to examine the effect of the different levels of turnover ratio on fund performance. This objective sorts mutual funds based on their turnover ratio. The findings are the performance of the high-turnover funds are indifferent from the low-turnover funds and the moderate-turnover funds significantly underperform the market and in the aggregate, active funds underperform the market in the net return basis which supports the Efficient Market Hypothesis that investors have the same information. Thus, the buy-and-hold strategy is preferred in Thai mutual fund industry. The second is to examine the subsequent performance by using the past turnover ratio and past performance as an investment strategy. The result suggests that there is no strategy that significantly beat the market. At the same levels of the past performance, investing in the past high-turnover ratio is indifferent from investing in the past low-turnover ratio. While investing in fund with moderate turnover ratio in the past without considering its past performance will significantly lead to adverse return in the subsequent year. The third objective is to investigate the relationship between portfolio turnover and mutual fund performance by employing panel regression, panel vector autoregression, and panel granger causality. These three approaches affirm that there is no relation between turnover and mutual fund performance. Additionally, the result of impulse response function (IRF) and forecast-error variance decomposition (VDC) indicates that the variability of trading activities is explained by the shocks of performance. In contrast, shocks to trading activities do not tend to have an impact on corresponding performance.

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ปีการศึกษา	2562	ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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1. Introduction

Many prior studies have investigated the impact of well-known fund characteristics such as fund size, management fee, prior performance, and portfolio turnover ratio on fund performance. They attempt to indicate whether its fund characteristics able to significantly explain its performance and further analysis of the ability to predict future fund performance. However, the empirical evidence shows various results, especially for the portfolio turnover ratio.

Turnover ratio (TR) is the percentage of changing fund's holding that change in a given year which can reflect fund investment strategy by lower number in buy and hold strategy and higher number in active management strategy. The changing in assets portfolio that turns out to outperform the market might be the signal of asymmetric information. It can indicate that the insider trading of fund managers is existing.

Grinblatt and Titman (1994) state that turnover ratio positively affects mutual fund performance because the intense research and trading, funds may discover the underpriced stock. Dahlquist et al., (2000) find that small equity funds, low fee funds, high trading activities and good past performance have positive relation with superior performance. Wermers (2000) finds that active fund management create value to investment because high-turnover funds beat low-turnover fund in net return basis. Pástor et al., (2016) indicate that more trading activities cause more return, especially for the small and high-fee funds because those funds have better skill to detect profit opportunity. Chen et al., (2001) find that high-turnover funds are able to obtain better results than low-turnover but cannot conclude that the higher given returns can overcome the higher trading costs.

Some studies show that higher turnover portfolio has an unfavorable impact on performance. Elton et al., (1993) indicate that fund manager did not earn enough excess return to compensate for the higher trading cost from the increase in turnover. Carhart (1997) finds that every time the turnover increases for 100 basis-point, annual abnormal return will drop by 95 basis-points. Mingo-López et al., (2018) indicate that high-turnover funds cannot beat low-turnover funds and investing in the past high-

turnover mutual funds provides investors with significant worse results than investing in previous low-turnover funds.

While there are some empirical evidence that there is no relation between portfolio turnover and mutual fund performance. Ippolito (1989) indicates that there is no relation between turnover and lag-turnover with performance. Chen et al., (2004) find that fund size is strongly deteriorate fund performance while turnover ratio, expense ratio, age and flows have no significant impact. Gottesman and Morey (2007) indicate that lower expense ratio the better predicted performance. While the expense ratio, turnover, fund size and recent past performance are not able to significantly predict future fund performance. Babbar and Sehgal (2018) find that expense and turnover ratio does not determine fund performance while fund size and growth in fund size has a negative impact, but fund age has a positive impact.

The aforementioned indicates the impact of portfolio turnover on fund performance but the performance can also stimulus trading activities. Khorana (1996) finds that poor performance manager usually attempts to increase trading activities due to trying to get better performance and prevent being unemployed. Chow et al., (2011) indicate that outperformed managers tend to have overconfidence, which leads to more trading activities in the next period but their next period performance turns out to be poorer than the previous period. This evidence is found especially in the large fund. Wu (2014) also finds that fund managers with poor performance attempt to trade more frequently to avoid being unemployed.

The persistence of performance and investment strategy are also widely studied in the past and the results are also mixed. Brown and Goetzmann (1995) find that the persistence of relative risk-adjusted mutual fund performance exists. However, the relative performance pattern depends on the observed period. Malkiel (1995) finds both gross return and net return have underperformed the benchmark portfolios. Furthermore, the study finds the performance persistence during the 1970 but there is none 1980s. Fama and French (2010) find that in the aggregate, the active mutual funds are close to the market portfolio but the high costs of active management have deteriorated the investors' return over the period 1984-2006.

In Thailand, the empirical results are also various. Jenwittayaroje (2017) examines active mutual funds during the period 1995-2014. He finds that active mutual funds have underperformed the benchmark on a risk-adjusted basis. Ratanabanchuen and Saengchote (2020) suggest that Thai equity mutual funds do not generate abnormal returns during the period 2005-2016. Klongdee and Nagmjan (2020) examine equity funds and foreign investment funds (FIFs) during 2014-2018. They find that equity funds are significantly outperformed the market whereas FIFs are underperformed.

As the results are controversial, it draws my attention to study this relation in Thailand mutual fund industry. To my best knowledge, there are none published papers about turnover ratio and fund performance. I aim to extend this study from Mingo-López et al., (2018) who has explored this relation in the U.S. market to Thai market. Furthermore, The Global Investor Experience Study: Fees and Expenses 2019 by Morningstar indicates that Thai equity mutual fund expense ratio is approximately three times higher than U.S. equity mutual fund industry. The expensive of mutual fund expenses might lead to different empirical results from other markets. It is also interesting that Thai mutual fund industry has established the different characteristic compared to other markets which have several studied in the past. Thai mutual fund industry grew more than 10% p. a. over the last decades, in average. The total assets under management are 5 trillion baht totaling or approximately 25% of the country's GDP and accounted for 37% of total Thai savings in 2019 (source from AIMC).

This study examines all active equity funds except international investment and does not specify any particular sectors or industries from 2010 to 2019. The main objective is to find the value of active management in Thailand market by using the turnover ratio as the proxy. The objective can be divided into three parts. Firstly, to examine whether the different levels of trading activities exhibit superior performance by grouping the mutual funds into quintiles according to its turnover ratio. Then, regressing the portfolio's excess returns with the Carhart-four factor model is the method to find abnormal returns of each portfolio. I expect that high-turnover portfolio can outperform low-turnover portfolio and the benchmark because an increase in trading activities leads to an increase in trading costs which deteriorate

fund returns. Thus, fund manager will change his portfolio holdings when he detects a good opportunity. Secondly, to examine whether investors can use past turnover ratio and past performance as an investment strategy to have superior in the following period. The 15 the hypothetical portfolios (5x3) are formed based on the past turnover ratio (5 portfolios) and the past performance (3 portfolios), then use the Carhart-four factor model to find the abnormal returns. I expect that past high portfolio turnover and past good performance is the best investment strategy because the outperforming fund can continuously beat the market in the following year. Thirdly, to examine the relation between turnover ratio on fund performance with the use of panel regression, panel vector autoregression (panel VAR), impulse response function (IRF), and variance decomposition (VDC). The additional data for the last objective is net expense ratio, fund age, and fund size. While the observed period is shortened which is starting from 2010 to 2013 because I require and the balanced consecutive data. Panel data regression can use to observe the relationship by controlling the effect of other variables. Hausman Test is used for the selection either fixed effects or random effects model for panel regression. While panel vector autoregressive (Panel VAR), impulse response function (IRF), and variance decomposition (VDC) are also used to address endogeneity concern when interpreting the relation between turnover ratio and fund performance. I expect that turnover ratio determines mutual fund performance. The high turnover ratio will cause the superior performance.

The remainder of this paper is structured as follows. Section 2 is the literature review that summarizes the previous empirical research. Section 3 describes and analyses the data used in this study. Section 4 describes the equation and methodology that are used in this paper. Section 5 presents and interprets the results. And section 6 is the conclusion part.

2. Literature Review

2.1) The impact of portfolio turnover on fund performance

There are many prior studies about the relation between fund performance and turnover ratio. However, the impact of turnover ratio on fund performance has been controversial. Some studies indicate that high turnover ratio has positive impact on mutual fund return. Grinblatt and Titman (1994) examine the determinants of mutual fund performance in U.S. during 1974-1984. They use the cross-sectional regressions and find that turnover ratio is significantly related to portfolio performance positively because the funds that invested in research and trade may discover underpriced stocks. Dahlquist et al., (2000) also use cross-sectional regressions to analyze this relation but applied on Swedish mutual funds (126 equity funds, 42 bond funds and 42 money market funds) from the end of 1997 to the end of 1997. The results show that small equity funds, low fee funds, high trading activities, or in some cases with good past performance exhibit good performance. Wermers (2000) studies 1,788 U.S. mutual funds from 1975 to 1994 by merging two major mutual fund databases from CDA Investment Technologies, Inc. and CRSP. He finds that high-turnover funds have better net return basis than the Vanguard Index 500 fund. This conclusion indicates that the active fund management is preferable. Pástor et al., (2016) use time-series to examine 3,126 active U.S. equity mutual funds from 1979-2011 relation between funds' turnover and its subsequent benchmark-adjusted returns. They find that for active mutual funds more activities are also more return, especially for the small and high-fee funds. This result can be explained by greater opportunity to identify time-varying profit.

In contrast, some researchers find a negative relation between turnover ratio and performance. Elton et al., (1993) find a significant negative relation by using three-index model. They concluded that fund manager does not earn enough excess return to compensate for the higher trading cost of increased turnover. Carhart (1997) used Fama-MacBeth estimator and finds a negative turnover-performance relation. He finds that every time the turnover increases for 100 basis-point, annual abnormal return will drop by 95 basis-points. Mingo-López et al., (2015) use Carhart four-factor

model to analyse this relation by studying 4,058 U.S. domestic equity funds from 1999 to 2014. The results indicate that high-turnover funds cannot beat low-turnover funds and investing in the past high-turnover mutual funds provides investors with significantly worse resulting than investing in previous low-turnover funds.

Whereas the aforementioned, there are some empirical evidence that find no significant relation between turnover ratio and mutual fund performance. Ippolito (1989) examines 143 mutual funds during the period 1965 to 1984 by using cross-section regression. The result indicates that there is no relation between turnover and lag-turnover with performance. Chen et al., (2004) observe 3,439 U.S. equity mutual funds over the period 1962 to 1999. They find that fund size is strongly deteriorate fund performance while turnover ratio, expense ratio, age and flows have no significant impact. Gottesman and Morey (2007) examine that whether the emerging market mutual fund characteristics such as expense ratio, turnover, fund size and recent past performance have the ability to predict the mutual fund performance by using the survivorship bias methodology. The result shows that lower expense ratio the better predicted performance. While the others characteristics are not able to significantly predict future fund performance. Babbar and Sehgal (2018) examine the determination of mutual characteristic on performance over 273 open-ended Indian equity funds during the period between April 2007 and March 2013. The results from panel regression with fixed effects indicate that expense and turnover ratio does not determine fund performance while fund size and growth in fund size has negative impact, but fund age has a positive impact.

2.2) The impact of fund performance on portfolio turnover

Although turnover ratio determines performance, performance can also influence turnover ratio. Khorana (1996) finds that incompetent manager usually attempts to increase trading activities due to trying to get better performance and prevent being unemployed. Chow et al., (2011) examine the overconfidence of fund managers in Taiwan. Empirical result indicates that higher fund performance managers tend to have overconfidence, which leads to more trading activities in next period especially in the large funds but their next period performance turns out to be poorer than the

previous period. Wu (2014) also find that those fund managers with poor performance attempt to trade more frequently to avoid being unemployed.

2.3) Mutual fund performance

Apart from the study about the determination of performance as aforementioned. The persistence of performance and investment strategy has been widely explored in empirical studies. Brown and Goetzmann (1995) find that the persistence of relative risk-adjusted mutual fund performance exists. However, the relative performance pattern depends on the observed period. Malkiel (1995) finds that between 1971-1991 funds, both gross return and net return, have underperformed the benchmark portfolios. Furthermore, the study finds the performance persistence during the 1970 but there is none 1980s. Which affirms the results of Fama and French (2010) examine 3,156 U.S. equity mutual funds over the period 1984-2006. They find that in the aggregate, the active mutual funds are close to the market portfolio but the high costs of active management have deteriorated the investors' return.

In Thailand, the empirical results are also various. Jenwittayaroje (2017) examine 179 active mutual funds during the period 1995-2014. He finds that active mutual funds have underperformed the benchmark on a risk-adjusted basis. The results also indicate that investing in top-performing funds in the past cannot generate significantly profits in the futures, thus buy-and-hold investment strategy is the best investment strategy. Ratanabanchuen and Saengchote (2020) study 294 active mutual funds during the period 2005-2016 by using the Carhart (1997) 4-factor asset pricing model. The alpha is negative, on average, during the observed period. The results suggest that Thai equity mutual funds do not generate abnormal returns. Klongdee and Nagmjan (2020) examine equity funds and foreign investment funds (FIFs) during 2014-2018 by employing Sharpe, Treynor, Jensen, Information and Tracking error ratios. They find that equity funds are significantly outperformed the market whereas FIFs are underperformed. In addition, most funds that can beat the market in the previous year are not able to continuously beat the market for more than two

consecutive years. They also find that the numbers of funds that can continuously beat the market in 2017-2018 are higher than other year in research period.

3. Data

The purpose of this study is to determine the relation between turnover ratio and fund performance in Thailand. The sample data consists of all active equity funds in Thailand during 2010-2019 which excludes international investment and no focus on particular sectors or industries. The process begins by retrieving all registered equity mutual funds in Thailand from Morningstar Direct. Then, those mutual funds are filtered by "Thailand Equity". I double check all samples by its name and its investment objective to ensure that there is no index fund and no particular investment objective. Finally, I exclude the mutual funds which use buy-and-hold investment strategy by using a turnover ratio threshold of 30%. Morningstar defines the turnover ratio between 20% and 30% as a buy-and-hold strategy. Therefore, this ratio which is higher than 30% would be defined as an active management strategy in this study. The number of samples in each year present in Table 1 below.

Table 1: Number of active mutual funds sample in this study

Year	Number of mutual funds
2010	72
2011	73
2012	57
2013	69
2014	131
2015	142
2016	151
2017	180
2018	208
2019	239

Table 1 presents the number of active equity funds in Thailand that will be used in this study. The number of observations has increased approximately 3 times from 72 mutual funds in 2010 to 239 mutual funds in 2019 which established the same trend of Thailand mutual fund industry.

To examine the fund performance according to the different levels of turnover ratio and the subsequent performance based on the past turnover ratio and the past performance, the data consists of turnover ratio and mutual fund returns. Both data are obtained from Morningstar direct.

According to SEC, Turnover Ratio is the percentage of changing fund's holding in a given year which can reflect fund investment strategy by lower number in buy-and-hold strategy and higher number in active management strategy. This ratio indicates how frequently fund's assets (NAV) in a given year are bought and sold by the fund manager. Portfolio Turnover Ratio (PTR) is calculated from the lower amount between sums of value of buying and selling assets of the fund in the past 1 year period divided by averaged net asset value (NAV) in the same period.

$$Turnover\ ratio = \frac{Min\ (Purchases, Sales)}{Avg.\ NAV} \quad (1)$$

Where;

Purchases = buying of new securities

Sales = selling of old securities

Avg. NAV = the average Net Fund Asset Value over the period

Morningstar Direct has collected the turnover ratio from the fund's annual report. Unlike portfolio turnover ratios, Morningstar direct calculates mutual fund returns itself by using the change in a fund's NAV, adjusting with dividend distribution, and then dividing by the initial NAV. Thus, total return is the return that including dividend but after expenses.

$$Returns = \frac{NAV_{i,t} + Dividend\ Distribution_{i,t}}{NAV_{i,t-1}} \quad (2)$$

$$NAV_{i,t} = \frac{Total\ Fund\ Assets_{i,t} - Total\ Expenses_{i,t} - Total\ Fund\ Liabilities_{i,t}}{Total\ Number\ of\ Outstading\ Shares_{i,t}} \quad (3)$$

Where;

$NAV_{i,t}$= Net Asset Value of fund i at time t

$Dividend\ Distribution_{i,t}$= Dividend income from the holding securities of fund i at time t

Table 2: Characteristics of mutual funds sample

This table presents the characteristics of mutual funds sample from 2010 to 2019. Returns is the average monthly returns of the sample. The returns are including dividend but after expenses. Turnover is the turnover ratio.

	January 2010 - December 2019	
	Mean	S.D.
Returns	0.89%	4.11%
Turnover	315.43%	223.3%

The sample data are all active equity funds exclude the international investment with no focus on particular sectors or industries. The monthly net return of active equity funds in Thailand is 0.89% (annualized 11.19%) and their standard deviation is 4.11% (annualized 14.23%). The average turnover ratio of Thai active mutual fund is 315.43% while it is 79.31%[1] in the U.S. It can indicate that Thai active mutual fund is greater trading frequency than the U.S. Furthermore, the turnover ratio can imply the average holding period of the security. For example, a turnover ratio of 100% implies that average holding period of a security is one year. A turnover ratio of 200% implies that average holding period of a security is half a year. Therefore, a turnover ratio of 315.43% implies that the average holding period of Thailand mutual fund is around 4 months during the period 2010 to 2019. While the average holding period of the U.S. mutual fund is around 1 year and 3 months during the period 2008 to 2014.

Next, I use another way to investigate the relationship between turnover ratio and fund performance which are Panel regression, panel vector autoregression (panel

[1] Average turnover ratio of active equity funds is 79.31% and the S.D. of turnover ratio is 100.69% in U.S. from January 2008 to December 2014. Diego Víctor de Mingo-López & Juan Carlos Matallín-Sáez (2018) Institutional investment management: An investor's perspective on the relation between turnover and performance, Investment Analysts Journal, page 84.

VAR), impulse response function (IRF), variance decomposition (VDC), and variance decomposition (VDC).

I use panel regression to analyze time series across sectional. As I prefer balanced panel data regression, I require consecutive data. Thus, the sample has diminished to 54 mutual funds and observed period shorted from 10 years to 7 years (2013 to 2019), totaling 378 observations. The additional other variables apart from fund returns and turnover ratio are net expense ratio, fund age, and fund size. Those variables are also obtained from Morningstar Direct. According to the empirical study in Literature Review (section 1), the relation between fund turnover ratio and fund performance are various direction. While net expense ratio is the total fund operating expense that occurred from managing the fund in a given period. I expect that turnover ratio and net expense ratio will adversely impact mutual fund performance because these variables are the fund's costs which worsen the returns. Fund age is measured from the inception date to the observed year. According to the prior evidence, the impact of fund age relation to trading activities in both directions. Younger mutual funds have a greater turnover ratio because they want higher returns to induce investors but on the other side younger mutual funds tend to have lower trading activities since they usually face higher costs and lack of experience during the startup period. While fund size matters because larger funds can spread fixed expenses over a larger asset base, relative to smaller funds, and normally have more resources for research. However, it can argue that larger funds do normally trade with massive amounts which draws other market participant's attention and therefore suffer higher price impact costs.

Table 3: Independent variables statistic

This table presents the characteristics of independent variables for panel data regression. Turnover is the turnover ratio of each mutual over the observed period.Net expense is the net expense ratio. Age is the years of the fund since inception date to the observed period. Size is total net assets managed by the fund.

	Min	Max	Average	S.D.
Turnover	35.41	937.40	222.52	156.90
Net Expense	0.01	2.42	1.76	0.46
Age (year)	7.12	33.28	16.21	5.57
Size (MTHB)	20.06	64,896.45	3,806.48	9,084.55

Table 3 presents variable statistic of sample for panel regression. The average turnover ratio and net expense ratio is 122.52% (average holding period 11 months) and 1.76%, respectively. The average age of the sample is 16.21 years and their average net asset under managed is 3,806.48 MTHB.

4. Methodology

Three objectives are designed to examine the relation between turnover ratio and fund performance. The first objective is to study the effect of the different levels of the turnover ratio on fund performance. The second objective is to study the use of previous year turnover ratio and fund performance to find the best investment strategy in the following year. Both objectives run the time-series regression with the Carhart four-factor model to find abnormal returns (alpha). The third objective is to study the relation between turnover ratio and fund performance by using panel regression, panel vector autoregression (panel VAR), impulse response function (IRF), and variance decomposition (VDC).

4.1) To examine the fund performance according to the different levels of turnover ratio

In order to study the effect of different levels of trading activities in active management on fund performance. This study uses turnover ratio as the measurement of an active management strategy. The fund with high volume trade will raise the turnover ratio and vice versa. The abnormal returns or alpha can measure as the interception of the Carhart four-factor model. The positive alpha means that the mutual funds can outperform the market.

I start from sort mutual funds into 5 groups by its annual turnover ratio (from low to high turnover ratio). Next, I calculate each the portfolio's excess return by minus the risk-free from an average monthly mutual funds return grouped which are in portfolio. Then, find the alpha of each portfolio by regressing each portfolio's excess return with The Carhart four-factor model (1997) (equation 4). Finally, I test alpha of each portfolio which is the intercept of The Carhart four-factor model by using Newey-West's t-statistics (1987) heteroscedasticity and autocorrelation. I expect that high-turnover portfolio outperforms the low-turnover portfolio because an increase in trading activities is also an increase in trading costs which deteriorate fund

returns. Thus, fund manager will change his portfolio holdings once he detects a good opportunity.

The Carhart four-factor (1997) equation is

$$R_{p,t} = \alpha_p + \beta_{1,p}R_{MKT,t} + \beta_{2,p}SMB_t + \beta_{3,p}HML_t + \beta_{4,p}UMD_t + \varepsilon_{p,t} \quad (4)$$

Where;

$R_{p,t}$ is the return of each portfolio which is classified by the different levels of turnover ratio

$R_{f,t}$ is the risk-free which is 3-month Zero Rate Return (ZRR) from ThaiBMA. The ZRR Index is the total return from a synthetic portfolio investing in 3-month government bond and treasury bill.

α_p is the intercept of The Carhart four-factor model. Alpha is the measurement of fund performance.

$R_{MKT,t}$ is the total return from SET index during the observed period minus risk -free

SMB_t is the different monthly return between the simple average of the returns of the three average small stock portfolios and the average of the returns on three big stock portfolios.

The formula is computed as follows:

SMB = 1/3 (Small Value + Small Neutral + Small Growth) - 1/3 (Big Value + Big Neutral + Big Growth)

HML_t is the different monthly return between the simple average of the returns of the two average two high-book value portfolios and the average of the returns on two low-book value portfolios The formula is computed as follows:

HML = 1/2 (Small Value + Big Value) - 1/2 (Small Growth + Big Growth)

UMD_t is the different monthly return between the average return of top 30% percentile of winner stock and losers will be the bottom 30% percentile of data. The formula is computed as follows:

UMD = 1/2 (Winner portfolio) - 1/2 (Loser portfolio)

Table 5: Monthly market factor returns

This table presents the data descriptive of Market Portfolio according to the Carhart four-factor model. Market is the average SET Index total return from 2010 to 2019. SMB is the size factor which is calculated by the simple average of the returns of the three average small stock portfolios minus the average of the returns on three big stock portfolios. HML is the value factor which is calculated by the simple average of the returns of the two average two high-book value portfolios minus the average of the returns on two low-book value portfolios Note: The market portfolio will rebalance every year. UMD is the momentum factor which is the average return of top 30% percentile of winner stock minus losers (the bottom 30% percentile of data).
Note: Market portfolio is rebalanced every year.

	January 2010 - December 2019	
	Mean	S.D.
Market	1.02%	4.15%
SMB	-0.24%	2.05%
HML	-0.36%	2.75%
UMD	0.29%	2.60%

Table 5 gives a summary statistic of market factors according to the Carhart four-factor model (1997). The average monthly market return is 1.02% (annualized 12.97%) while the sample average mutual return (Table 2) is 0.89% (annualized 11.19%). It can be seen that the average mutual fund return is lower than the market return during the observed period. For the remaining factors, SMB which is small market capitalization minus big market capitalization and HML which is high-book to market ratio minus low-book to market ratio turns out to be a negative return. It can be implied that the big market capitalization outperforms the small market capitalization. And it is the same relation between the low-book market ratio to the high-book to market ratio. While UMD or momentum factor is given a positive return of 0.29% (annualized 3.52%) meaning that investing in prior outperformed securities is better than underperformed during the observed period. The last point worth mentioning is that greater returns magnitude in line with higher volatilities.

4.2) To examine fund performance based on prior portfolio turnover and prior fund performance

The first objective (4.1) is designed to study the relation of the turnover ratio and the performance in the same year and see if the difference level of turnover ratio effects the performance or not. But this objective is to use the previous year of turnover ratio and performance for investment decisions in order to find the abnormal return in the following year. The methodology and regression equation are the same as the first objective (4.1) but the criteria for forming the portfolio is the difference.

For each year t, I begin to sort funds according to its past turnover ratio (t-1) into 5 quintiles. Then, I rank mutual funds in each 5 quintiles by its past performance (t-1) into 3 subsamples: low, medium, and high. Thus, the total sample will be 15 portfolios (5x3). Then, I calculate monthly portfolio excess return in year t by averaging the returns of mutual fund in each portfolio minus risk-free. I repeat this process for each year throughout the observed period. Finally, I will have time-series of excess returns of 25 portfolios from 2010 to 2019. Then, I evaluate each portfolio performance by regressing the portfolio's excess return one-by-one with the Carhart four-factor model. Finally, portfolio alpha are tested by Newey-West's T-statistics (1987) heteroscedasticity and autocorrelation.

4.3) To examine whether the effect of portfolio turnover on fund performance is impelled by other variables.

In this section, I use other methodologies to investigate the relation between turnover ratio and fund performance which are; panel data regression, panel vector autoregression (panel VAR) and variance decomposition (VDC).

Panel regression benefits to compare across different characters of mutual funds and different periods. Additionally, panel regression allows the analyzing impact of turnover ratio on fund performance but controlling the effects from other variables. Hausman test is used to indicate either the random effects or the fixed effects are suitable in this study. The dependent variable is mutual funds abnormal returns while the independent variables are turnover ratio, net expense ratio, funds age, and size. The panel regression model is as follows:

$$Abnormal\ returns_{i,t} = a_{i,t} + \beta_1 TURN_{i,t} + \beta_2 EXPENSE_{i,t} + \beta_3 lnAGE_{i,t} + \beta_4 lnSIZE_{i,t} + \varepsilon_{i,t} \quad (5)$$

Where;

$Abnormal\ returns_{i,t}$ = The excess returns (actual returns minus risk-free) of mutual fund i at time t minus the proxy returns from the Carhart four-factor model at time t. I begin to calculate abnormal returns by regressing the excess returns of fund i and the the Carhart four-factor model factors throughout the observed period. At the first step, I will obtain one intercept and 4 coefficients. Then, I calculate returns proxy for fund i at time t by using given figures from the first step. Finally, the abnormal returns of fund i time t compute from excess return of fund i at time t minus proxy returns of fund i. I will obtain excess return of fund i at time t for the whole observed period. I repeat this process for each mutual fund in the observed period. The equation for abnormal returns is presented in equation 5 as follows:

According to The Carhart four-factor (1997) equation 4 is

$$R_{i,t} = \alpha_i + \beta_{1,i} R_{MKT,t} + \beta_{2,i} SMB_t + \beta_{3,i} HML_t + \beta_{4,i} UMD_t + \varepsilon_{p,t}$$

$$\underset{Return}{Abnormal}_{i,t} = R_{i,t} - \alpha_i + \beta_{1,i} R_{MKT,t} + \beta_{2,i} SMB_t + \beta_{3,i} HML_t + \beta_{4,i} UMD_t + \varepsilon_{p,t} \quad (6)$$

$TURN_{i,t}$ = Turnover ratio of each mutual fund at time t

$EXPENSE_{i,t}$ = Net expense ratio of each mutual fund at time t

$lnAGE_{i,t}$ = Natural logarithm of years since the inception date of each mutual fund at time t

$lnSIZE_{i,t}$ = Natural logarithm of net assets value of each mutual fund at time t

As the trading activities and fund performance can have a causality relationship. Some studies (Chen et al., (2001), Mingo-Lopez et al,. (2015), Pastor et al,. (2016)) indicate that trading activities determine fund performance but some

results argue that fund performance cause trading activities (Khorana (1996), Chow et al,. (2011), Wu (2014)). I employ a Panel vector autoregressive (Panel VAR) to address causality between them in the following model:

$$Y_{i,t} = a_{0,i} + \sum_{j=1}^{J} A_j Y_{i,t-j} + \sum_{l=1}^{L} B_l X_{i,t-l} + \mu_{i,t} \quad (7)$$

Where;

$Y_{i,t}$ = Turnover ratio and performance which are endogenous variables

$X_{i,t}$ = Exogenous variables which are funds age, and size

$\mu_{i,t}$ = The residual vector of the model

The sample data in this section is the same as panel regression. I follow the use of command Stata from Abrigo and Love (2016). The first step to address this is to perform stationary test on 'turnover ratio' by using *Levin-Lin-Chu (2002)*. If 'turnover ratio' pass stationary test. Then, I use *pvarsoc* command in stata to select lag criteria according to Akaike Information Criterion (AIC). The lowest AIC will be considered for the lag selection criteria. Then, I use command 'pvar' to examine the dynamic relationship between endogenous variables. The next step is to apply pvargranger command to examine Grander-causality between variables in the VAR system by using the standard F-test. For the null hypothesis that the lag coefficients of Turnover are jointly zero when Performance is the dependent variable in the VAR system. If the F-test rejects the null hypothesis, we can conclude that turnover Granger causes performance or turnover determines performance. After that, I employ impulse response function (IRF) and variance decomposition (VDC) to perform short-run mechanism analysis of the VAR system. The VDC and IRF are used to uncovering the interrelationship among the variable in the system. The VDC can indicate the proportion of the n-step-ahead movement in a sequence due to its own shocks and that of another variable in the system. While the IRF shows impulse responses of a variable in the VAR system to the time path of its own shock and the shock to another variable in the system. The IRF can trace out the effects of one-unit shock and in aggregate of a variable over the time paths. In addition, I plot the IRF to visualize the dynamic relationship between the two variables in the VAR system and

statistical significance is established at 95 percent confidence intervals by using the Monte Carlo simulation.

5. Empirical results

5.1) To examine the fund performance according to the different levels of turnover ratio

I address this issue by sorting portfolio turnover ratio into quintiles, then calculate monthly equally-weighted return of quintiles. The data descriptive of each portfolio shown in the table below.

Table 6: Annualized portfolio turnover ratio, return, and risk

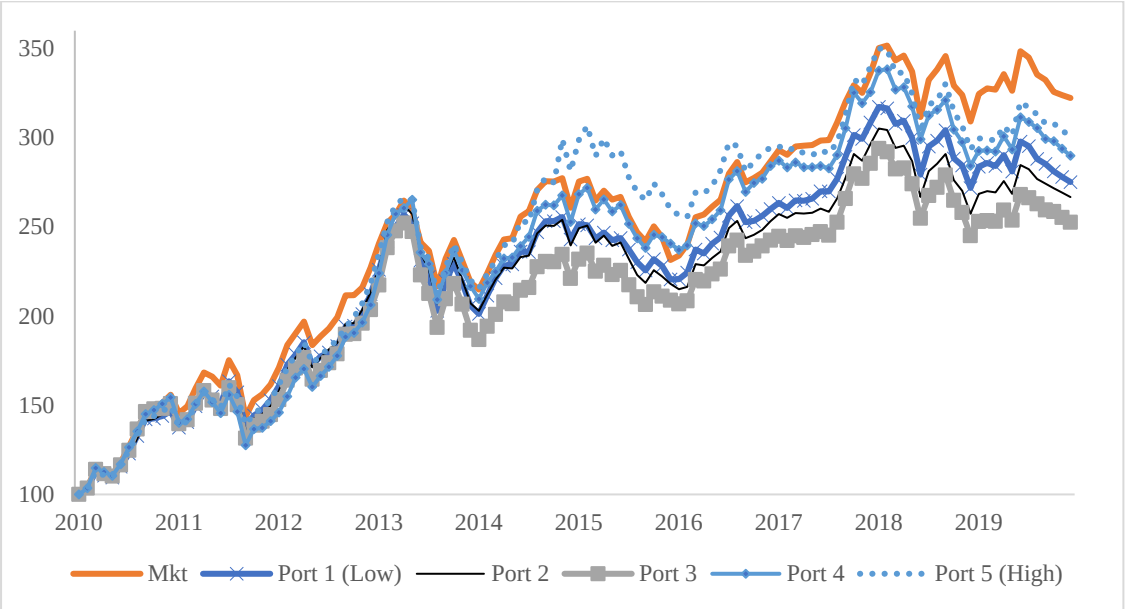
This table presents the average monthly return and standard deviation of five portfolios. Those portfolios represent the different levels of turnover ratio from low to high. Port 1 is the lowest level of turnover ratio. While port 5 is the highest level of turnover ratio.

	January 2010 - December 2019	
	Mean	S.D.
Port 1 (Low)	0.89%	3.94%
Port 2	0.85%	4.12%
Port 3	0.81%	4.23%
Port 4	0.93%	4.31%
Port 5 (High)	0.96%	4.19%

Table 6 shows the annualized returns and standard deviation of each portfolio. Each portfolio represents mutual funds that have similar levels of turnover ratio. For example, Port 1 (Low) is a group of lowest turnover funds and Port 5 (High) is a group of the highest portfolio turnover funds. According the table 3, the highest turnover portfolio (Port 5) is given the highest return. However, the lowest turnover portfolio (Port 1) exhibit superior performance compared to Port 2 and Port 3. For the volatilities, Port 4 has experienced the most volatility compared to other portfolios.

Figure 1: Comparative portfolios return with market return

This figure illustrates the cumulative returns of each portfolio from 2010 to 2019. Mkt is the total SET Index return. Each portfolio represents the different levels of turnover ratio from low to high. Port 1 is the lowest level of turnover ratio. While port 5 is the highest level of turnover ratio.



I have plotted the line graph to illustrate the return of each portfolio compared to market return over the observed period. As aforementioned in section 3 that the mutual return is the returns include dividend but after expense. It is the net returns that investors receive. It can be seen that Port 5 which is the highest level of portfolio turnover outperforms the remaining portfolio. However, Port 5 is not continuously beat the market. It obviously beats the market from 2015 to 2016 while it has been beaten from 2018 to 2019.

As my purpose is to compare the fund performance, based on the different levels of portfolio turnover ratio. I begin to sort an individual mutual fund from its turnover ratio into five portfolios. Then, to find the portfolio alpha is by regressing the portfolio's excess returns with the Carhart four-factor model.

Table 7: Fund portfolio alpha according to the different levels of turnover ratio

This table reports the monthly abnormal returns (alpha) of each portfolio of equation 4 as presented below:

$$R_{p,t} = \alpha_p + \beta_{1,p}R_{MKT,t} + \beta_{2,p}SMB_t + \beta_{3,p}HML_t + \beta_4 UMD_t + \varepsilon_{p,t}$$

The dependent variable is the monthly performance of the funds, measured as total returns minus risk-free. The independents are the factors according to The Carhart four-factor model. The performance is measured as the intercept (α) of the Carhart four-factor model.
Note: The reported α_p is the annualized and *, **, and *** denote significant level at 10%, 5% and 1%, respectively. T-statistics shown in parentheses () are from Newey-West's (1987) heteroscedasticity and autocorrelation consistent covariance estimator.

	Port 1 (Low)	Port 2	Port 3	Port 4	Port 5 (High)	All	High-Low
α_p	-0.0009	-0.0017**	-0.0023**	-0.0012	-0.0004	-0.0013	0.0005
	(-1.39)	(-2.25)	(-2.39)	(-0.95)	(-0.32)	(-1.58)	(0.38)

The results shown in table 7 indicates that mutual funds underperform the market on the average, although this underperformance is significant in the Port 2 and Port 3. The negative alpha implies Thai active mutual funds do not generate abnormal returns on a net return basis during 2010 to 2019. The finding is in line with the study of Thai active mutual fund from Jenwittayaroje (2017) and Ratanabanchuen and Saengchote (2020). The highest portfolio turnover (Port 5) generates the highest alpha of -0.04% per month (0.5% per year) but no significant (t-statistic -0.32). The second and third best performance is Port 1 which is the lowest portfolio turnover and Port 4, respectively. Port 1 and Port 4 generate monthly alpha of -0.09% (-1.1% per year) and -0.17% (-1.4% per year), respectively but are not statistically significant. However, Port 2 and Port 3 have a significant lowest performance with monthly alpha -0.17% (-0.20% per year) and -0.23% (-0.27% per year). I also perform the results of the difference between Port 5 and Port 1 in the last column (High-Low). It can be seen that I long 'High' turnover portfolio and short 'Low' turnover portfolio strategy outperformance the market with monthly alpha of 0.05% (0.6% per year) but not statistically significant. In summary, I can conclude that three findings as follows: Thai active mutual funds underperform the market in a net returns basis, the portfolio returns of 'High' turnover portfolio is indifferent with 'Low' turnover portfolio and the moderate turnover portfolios significantly underperform the market. While the result from the study of Mingo-López et al., (2018) also indicates all portfolios underperform the market. However, the superior performance is the low turnover portfolio and fund performance is worsens as a high level of turnover ratio but these

results are insignificant. The support reason might be the average changing holding securities is 4 months in Thailand while U.S experience longer period around 1 year and 3 months.

5.2) To examine fund performance based on the past portfolio turnover and the past fund performance

The portfolio is formed by considering the prior portfolio turnover and prior fund performance. I begin to sort mutual funds according to the past turnover into quintiles and then dividing them by its past fund performance into 3 sub-groups. Thus, the sample will be 15 portfolios (5x3) plus 17 portfolios (All and High-Low), totaling 32 portfolios.

Table 8: Portfolio raw returns per month according to the past turnover ratio and the past performance

This table presents monthly return of portfolio according to the past turnover ratio and past performance. Standard deviation is presented in parentheses ().

	Turnover$_{t-1}$					
Performance t-1	Port 1 (Low)	Port 2	Port 3	Port 4	Port 5 (High)	All
Low	0.85%	0.86%	0.81%	0.71%	0.67%	0.81%
	(4.18%)	(4.17%)	(4.32%)	(3.73%)	(3.42%)	(4.15%)
Medium	0.99%	0.72%	0.60%	0.65%	0.68%	0.83%
	(4.13%)	(4.32%)	(4.44%)	(4.27%)	(4.46%)	(4.25%)
High	0.89%	0.79%	0.84%	0.61%	0.93%	0.81%
	(3.80%)	(4.02%)	(3.86%)	(4.06%)	(4.00%)	(3.82%)
All	0.91%	0.79%	0.82%	0.68%	0.78%	0.00%
	(3.99%)	(4.14%)	(4.15%)	(4.02%)	(3.98%)	(0.00%)
High-Low	0.85%	0.86%	0.81%	0.71%	0.67%	0.81%
	(4.18%)	(4.17%)	(4.32%)	(3.73%)	(3.42%)	(4.15%)

The table 8 presents the monthly return and standard deviation of each portfolio according to the past turnover ratio and past performance. According to Table 2, monthly market return is 1.02% (annualized 12.79%) during the observed period. Meaning that all portfolio underperforms the market during 2010 to 2019.

Table 9: Fund portfolio alpha based on the past portfolio turnover and the past performance

This table reports the abnormal returns (alpha) of each portfolio of equation 4 as presented below:

$$R_{p,t} = \alpha_p + \beta_{1,p}R_{MKT,t} + \beta_{2,p}SMB_t + \beta_{3,p}HML_t + \beta_4 UMD_t + \varepsilon_{p,t}$$

The dependent variable is the monthly performance of the funds, measured as total returns minus risk-free. The independents are the factors according to The Carhart four-factor model. The performance is measured as the intercept (α) of the Carhart four-factor model.
Note: The reported α_p is a monthly basis and *, **, and *** denote a significant level at 10%, 5%, and 1%, respectively. t-statistics shown in parentheses () are from Newey-West's (1987) heteroscedasticity and autocorrelation consistent covariance estimator.

	Turnover$_{t-1}$						
Returns t-1	Port 1 (Low)	Port 2	Port 3	Port 4	Port 5 (High)	All	High-Low
Low	-0.0017*	-0.0016*	-0.0025**	-0.0011	-0.0007	-0.0015**	0.0009
	(-1.79)	(-1.71)	(-2.56)	(-0.59)	(-0.40)	(-1.96)	(0.43)
Medium	-0.0010	-0.0034***	-0.0047***	-0.0028	-0.0031	-0.0028***	-0.0030
	(-0.1)	(-3.49)	(-3.05)	(-1.29)	(-1.47)	(-2.67)	(-1.33)
High	-0.0005	-0.0020***	-0.0011	-0.0037**	-0.0006	-0.0016	-0.0001
	(-0.69)	(-2.61)	(-1.05)	(-2.51)	(-0.37)	(-1.9)	(-0.06)
All	-0.0008	-0.0023***	-0.0028***	-0.0025**	-0.0015	-0.0020**	
	(-1.12)	(-3.00)	(-3.11)	(-2.13)	(-1.11)	(-2.47)	
High-Low	0.0011	-0.0004	0.0015	-0.0026	0.0010		
	(1.31)	(-0.50)	(1.38)	(-1.13)	(0.04)		

Table 9 presents the abnormal returns (alpha) of the portfolio by using the difference level of past turnover ratio and past performance. I expect that the portfolio with high past turnover and high past performance will significantly generate alpha. However, the empirical results presented in Table 5 shows that there is no strategy that outperform the market. High past turnover and high past performance insignificantly underperform the market with the negative alpha of -0.06% (-0.8% per year) (t-statistic -0.37)). There are 4 portfolios having positive alpha but none of them significantly different from zero. It is worth to mention that all of them are long 'High' and short 'Low' portfolio. However, this study finds that funds with low turnover ratio (without considering past performance) can generate the highest monthly alpha (the lowest negative alpha) of -0.05% (-0.9% per year) but there is no statistic evidence (t-statistic -1.12). While moderate past turnover ratio (Port 2 and Port 3) significantly underperform the market. The main result is in line with the

study of Mingo-López et al., (2018). They find that investing in mutual funds with the lowest levels of the past turnover ratio is better than the funds with the highest levels of past turnover. However, this strategy does not outperform the market.

5.3) To examine whether the effect of portfolio turnover on fund performance is impelled by other variables.

To address this issue, I employ panel data regression by using fixed effects (individual effects can change across funds) and random effects (individual effects are uncorrelated with the independent variables). I use Hausman test to indicate the suitable model in this study. The result from the Hausman test suggests that there is correlation between errors and regressor in the model so I use fixed effect model.

Table 10: The impact of variables on fund performance period 2013 to 2019

This table shows the results of fixed effects model from panel regression equation 3. The number of observations is 378 observations from 2013 to 2019. The panel regression is presented as follows:

$$Abnormal\ returns_{i,t} = a_{i,t} + \beta_1 TURN_{i,t} + \beta_2 EXPENSE_{i,t} + \beta_3 lnAGE_{i,t} + \beta_4 lnSIZE_{i,t} + \varepsilon_{i,t}$$

The dependent variable is mutual fund abnormal returns from equation 5. The independent variables are the turnover ratio of the fund (Turnover), the annual net expense ratio (Expenses), the natural logarithm of the years of the fund since inception (Age), and the natural logarithm of the total net assets managed by the fund (Size).
Note: t-statistics in parentheses are robust to heteroscedasticity and autocorrelation and *, **, and *** denote a significant level at 10%, 5%, and 1%, respectively.

Fixed Effect	Coefficient	t-statistic
Turnover ratio	0.002	(0.57)
Expenses	0.246	(0.10)
Age	-0.054***	(-3.55)
Size	-0.011**	(-2.14)
Intercept	0.322	(2.50)

Table 10 indicate that there is no evidence of a statically significant relation between portfolio turnover and fund performance in Thailand over the period 2013 to 2019. This empirical result indicates that there is no relation between portfolio turnover and fund performance. While the result from the study of Mingo-López et al., (2018) shows that increase in turnover ratio has adverse impact on fund performance. However, empirical result is consistent with what Ippolito (1989) and Chen et al., (2004) found in the U.S. market, Gottesman and Morey (2007) found in

the emerging market and Babbar and Sehgal (2018) found in India mutual fund industry.

While fund age has a statistically negative coefficient relation to fund performance. A 1 year increase in fund age decreases the abnormal returns by 0.05%. This empirical find that younger funds perform better. The reason to support might be a younger fund needs to induce investors. Therefore, they might try their best to obtain outstanding performance. This relation also found from Mingo-López et al., (2018) were studied in the U.S. equity fund during 1999-2014 and Tangjitprom (2014) who study Thai equity mutual funds during 2006-2012.

Fund size has an adverse impact on fund performance. An increase in fund size 1% decrease the abnormal returns by 0.011%. The reason might be the same as the study by Chen et al., (2004). They find that large fund size erodes fund performance because trading large amounts associate with illiquidity or price impact as easily to draw other market participants' attention. However, this empirical result is different from the study of Mingo-López et al., (2018) which find a positive relationship between them whereas the prior study in Thailand from Tangjitprom (2014) finds that fund size and performance have a quadratic relationship not linear in 2006-2012. The reason for the difference could be diverse in the observed period. As the growth of Thai funds in the past decade was rapid, the fund characteristics might be impacted.

In conclusion, the panel regression indicates that fund age and fund size are an adversely significant impact on fund performance. While turnover ratio and expense have no relation with fund performance in a linear relationship.

To test whether there is a causality between turnover ratio and fund performance, I will use panel vector autoregression (panel VAR) to address this problem. Additionally, impulse response function (IRF) and variance decomposition (VDC) will be used to capture the effects of shocks between turnover ratio and fund performance.

The results of the unit-roots test for turnover ratio based on Levin-Lin-Chu. The p-value is 0.0000 which indicates that the turnover ratio is stationary. Then, I use

pvarsoc command to perform lag and use Akaike Information Criterion (AIC) to select lag criteria. The first lag is preferred because it gives the lowest value compared to other lags. Therefore, I select 'first lag' as the lag criteria to perform in this study.

Table 11: Result of panel vector autoregressive (Panel VAR)

This table shows the results of Panel vector autoregressive (Panel VAR) with one lag to examine the dynamic relationship between turnover ratio and fund performance. Y is endogenous variables (assumed to affect each other) which are turnover ratio and fund performance (abnormal returns). While X is exogenous variables (control variables) which are fund age and fund size under Panel VAR system.

$$Y_{i,t} = a_{0,i} + \sum_{j=1}^{J} A_j Y_{i,t-j} + \sum_{l=1}^{L} B_l X_{i,t-l} + \mu_{i,t}$$

Note: t-statistics in parentheses are robust to heteroscedasticity and autocorrelation and *, **, and *** denote a significant level at 10%, 5%, and 1%, respectively.

	Alpha	Turnover
Lag1 Abnormal returns	-0.353**	2.33
	(-2.15)	(0.86)
Lag1 Turnover	-0.014	0.769***
	(-1.06)	(3.53)
Age	0.018	-1.589
	(0.18)	(-1.15)
Size	-0.13	1.82
	(-0.99)	(0.88)

The results from Panel vector autoregressive (Panel VAR) affirm that turnover ratio and fund performance has no relationship.

Then, I perform Granger causality test to address this issue as well. My null hypothesis is the lag coefficients of *Turnover* are jointly zero when *Performance* is the dependent variable in the VAR system. The results of Granger causality test are presented in table below.

Table 12: Result of panel VAR-granger causality wald test

This table shows the P-value for testing the Panel VAR-Granger causality wald test. Turnover is turnover ratio and fund performance (abnormal returns).
Note: *, **, and *** denote significant level at 10%, 5% and 1%, respectively.

	P-value
Abnormal returns => Turnover	0.290
Turnover => Abnormal returns	0.390

According to Table 12, F-test fails to reject the null hypothesis, I can conclude that both performance and turnover ratio does not determine each other.

Finally, I employ impulse response function (IRF) and variance decomposition (VDC) to perform short-run mechanism analysis of the VAR system

Figure 2: Results of Impulse response function (IRF)
This figure illustrates the response over time of abnormal returns to shocks in Turnover and Turnover to shocks in abnormal returns. While fund age and fund size are considered as exogenous variables.
Note: Statistical significance is established at 95 percent confidence intervals by using Monte Carlo simulation.

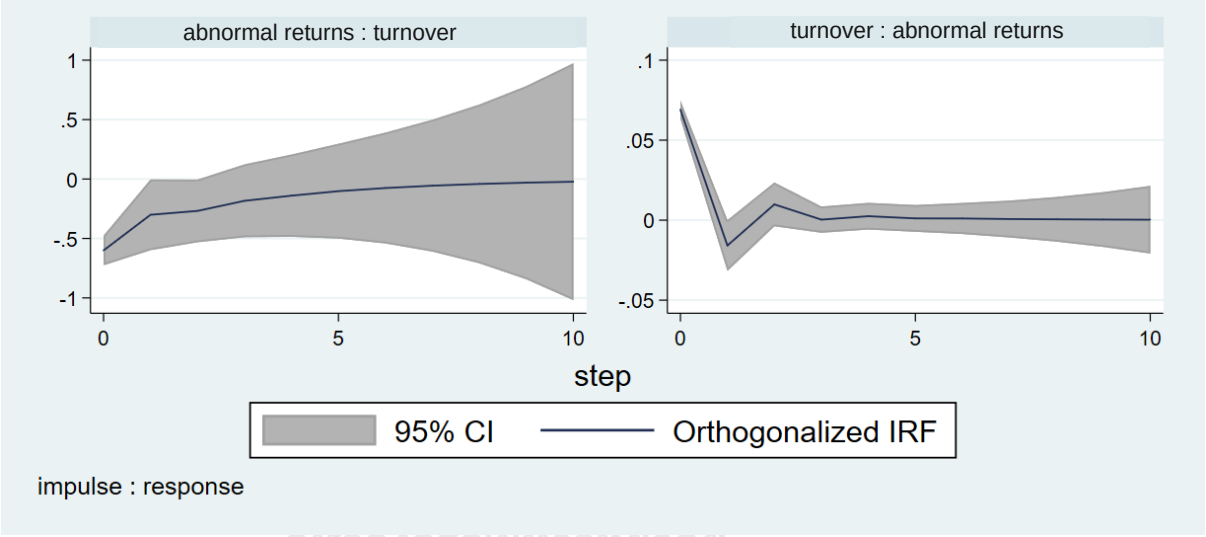


Figure 2 presents the result of the impulse response function. The IRF function showed that the shocks to performance (abnormal returns) are crucial to predict the future movement of their corresponding trading activities (turnover) (the left figure). If there is one unit positive shock on fund performance will significantly cause the turnover ratio to drop immediately and the impact last about one period. In contrast, shocks to trading activities (turnover) do not tend to have a significant impact on their corresponding performance (abnormal returns) (the right figure). When compared with the study of Mingo-López et al., (2018), they find the movements in fund performance are explained by the shock to trading activities.

Table 13: Result of Forecast-error variance decomposition (VDC)

This table presents the decomposition between abnormal returns and turnover ratio and itself
Note: The confidence intervals are based on 200 Monte Carlo simulation

	Abnormal returns		Turnover	
Period	Abnormal returns	Turnover	Abnormal returns	Turnover
1	1.000	0.000	0.270	0.730
2	0.962	0.038	0.225	0.775
3	0.957	0.043	0.220	0.780
4	0.951	0.049	0.216	0.784
5	0.948	0.052	0.214	0.786
6	0.947	0.053	0.213	0.787
7	0.946	0.054	0.213	0.787
8	0.946	0.054	0.213	0.787
9	0.945	0.055	0.212	0.788
10	0.945	0.055	0.212	0.788

According to the Table 13, performance (abnormal returns) affects itself a hundred percent and starting to lose its variation in the second period where it ends up 94% on the tenth period. Trading activities (turnover) slightly affects the fund performance (abnormal returns) at the second period and gradually increase the impact to around 6% in the tenth period. In the other hand, the fund performance (abnormal returns) immediately affects trading activities (turnover) by 27% in the first period and the explanatory power is lower to around 21% in the fifth period and keep constant until the tenth period. Trading activities (turnover) impact itself by 78% throughout the period.

6. Conclusion

This paper aims to examine Thai active mutual fund from 2010 to 2019 by considering the turnover ratio as a proxy to observe trading activities in active management. This study employs time-series regression, panel regression, panel vector autoregression (panel VAR), impulse response function (IRF), and variance decomposition (VDC) to investigate the relation between turnover ratio and fund performance.

There are three objectives designed in this paper. The first objective is to examine whether the effects of different turnover ratio on fund performance. I address this issue by forming the five hypothetical portfolios based on its turnover ratio. Then, I estimate fund performance by regressing each portfolio's excess returns with The Carhart four-factor model. This result indicates the performance of the high-turnover funds are indifferent from the low-turnover funds and the moderate-turnover funds significantly underperform the market. Furthermore, in the aggregate active equity funds underperform the market in the net return basis. Meaning that fund managers cannot find abnormal returns which supports the Efficient Market Hypothesis that investors have the same information. Thus, the best investment is the buy-and-hold strategy. Therefore, the buy-and-hold strategy is preferable in Thailand mutual fund industry during the observed period. The second objective is to examine the subsequent performance according to the past turnover ratio and past performance as investment criteria. The hypothetical portfolios are established based on the individual mutual fund turnover ratio and its past performance. The methodology and equation are the same as the first objective but the way to form a portfolio is different. The result suggests that there is no strategy that investors can use to significantly beat the market. At the same levels of the past performance, investing in the past high turnover ratio is indifferent from investing in the past low turnover ratio. However, investing in fund with moderate turnover ratio in the past without considering its past performance will significantly underperform the market in the subsequent year. The last objective is to study the relation between portfolio turnover ratio and fund performance by employing panel regression. The results from panel regression indicate that there is no relation between turnover ratio and performance. While fund age and fund size have

an adverse impact on fund performance. This indicates that Thai mutual funds perform better in the beginning stage. The reason might be those funds need to induce investors by outstanding performance and when the funds are small, they are more flexible to purchase and sell securities without drawing other market participants' attention. Additionally, using panel vector autoregressive (Panel VAR) and panel granger causality to examine the causality relationship between turnover ratio and fund performance also affirm that no relation between them. Besides, the results from impulse response function (IRF) and forecast-error variance decomposition (VDC) indicates that variability of trading activities are explained by the shocks of performance. In contrast, shocks to trading activities do not tend to have an impact on corresponding performance.

REFERENCES

Abrigo, M. and I. Love (2016). "Estimation of Panel Vector Autoregression in Stata." The Stata Journal: Promoting communications on statistics and Stata **16**: 778-804.

Babbar, S. and S. Sehgal (2018). "Mutual Fund Characteristics and Investment Performance in India." Management and Labour Studies **43**(1-2): 1-30.

Brown, S. and W. Goetzmann (1995). "Performance Persistence." Journal of Finance **50**(2): 679-698.

Carhart, M. (1997). "On Persistence in Mutual Fund Performance." Journal of Finance **52**(1): 57-82.

Chen, J., et al. (2004). "Does Fund Size Erode Mutual Fund Performance? The Role of Liquidity and Organization." American Economic Review **94**(5): 1276-1302.

Chow, E. H., et al. (2011). "The Performance of Overconfident Fund Managers." Emerging Markets Finance and Trade **47**(2): 21-30.

Dahlquist, M., et al. (2000). "Performance and Characteristics of Swedish Mutual Funds." The Journal of Financial and Quantitative Analysis **35**(3): 409-423.

de Mingo-López, D. V. and J. C. Matallín-Sáez (2018). "Institutional investment management: An investor's perspective on the relation between turnover and performance." Investment Analysts Journal **47**(2): 81-94.

Elton, E. J. and et al. (1993). "Efficiency with Costly Information: A Reinterpretation of Evidence from Managed Portfolios." Review of Financial Studies **6**(1): 1-22.

Gottesman, A. and M. Morey (2006). "Predicting Emerging Market Mutual Fund Performance." The Journal of Investing **16**.

Grinblatt, M. and S. Titman (1994). "A Study of Monthly Mutual Fund Returns and Performance Evaluation Techniques." Journal of Financial and Quantitative Analysis **29**(3): 419-444.

Ippolito, R. A. (1989). "Efficiency with Costly Information: A Study of Mutual Fund Performance, 1965–1984*." The Quarterly Journal of Economics **104**(1): 1-23.

Jensen, M. (1968). "THE PERFORMANCE OF MUTUAL FUNDS IN THE PERIOD 1945–1964." Journal of Finance **23**(2): 389-416.

Jenwittayaroje, N. (2017). "The performance and its persistence of Thailand equity mutual funds from 1995 to 2014." Chulalongkorn Business Review **152**: 57-89.

Khorana, A. (1996). "Top management turnover An empirical investigation of mutual fund managers." Journal of Financial Economics **40**(3): 403-427.

Klongdee, J., and Nagmjan, P. (2020). "A study on persistence and performance of mutual funds in Thailand." International Acadamin Multidisciplinary Research Conference in Switzerland 2019: 221-227.

Malkiel, B. G. (1995). "Returns from Investing in Equity Mutual Funds 1971 to 1991." Journal of Finance **50**(2): 549-572.

Pastor, L. a. S., Robert F. and Taylor, Lucian A. (2016). "Do Funds Make More When They Trade More?" Journal of Finance, Forthcoming.

Ratanabanchuen, R., and Saengchote, K. (2020). "Institutional capital allocation and equity returns: Evidence from Thai mutual funds' holdings." Finance Research Letters

32.

Sharp, W. F. (1966). "Mutual fund performance." Journal of Business **39**: 199-138.

Wermers, R. (2000). "Mutual Fund Performance: An Empirical Decomposition into Stock Picking Talent, Style, Transactions Costs, and Expenses." Journal of Finance **55**: 1655-1695.

Wu (2014). "Interaction between Mutual Fund Performance and Portfolio Turnover." Journal of Emerging Issues in Economics Finance and Banking **3**(4).

VITA

NAME	Pailin Yapiangplook
DATE OF BIRTH	31 March 1992
PLACE OF BIRTH	Lampang
INSTITUTIONS ATTENDED	BA Degree in Finance, 2011-06 to 2014-04 Chiang Mai University
HOME ADDRESS	25 M.9 T. Bowheaw A. Meang Lampang province 25100