The flow-performance relationship of ETFs in international market

Miss Thaweeporn Krailaksanawarapar

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ความสัมพันธ์ระหว่างผลตอบแทนต่อกระแสเงินทุนของกองทุนรวมอีทีเอฟในตลาดต่างประเทศ

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By	*Miss Thaweeporn Krailaksanawarapar*
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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.)

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This paper uses sample from 15 countries from different regions around the world to examine how past performance of exchange-traded funds (ETFs) impact on their fund flow in the following period. Piecewise-linear regression following (Sirri & Tufano, 1998) which allow past performance to be non-linear are employed in the model to examine the different sensitivity of past performance ranking to flow. The evidence confirms that past bad-performing ETFs associate with outflow and past good-performing ETFs associate with inflow in the following period. Furthermore, I also find that investors are more sensitive to bad performers than good performers suggesting that there is asymmetry in flow-performance relationship in ETFs. This can be explained by the behavioral bias form investor that react more to bad news than good news. Apart from the generalize result from across countries, I also investigate the difference in flow-performance relationship in each country level. The evidence suggests that difference countries exhibit the different shape of flow-performance relationship depending on the level of investor sophistication. Investors in more developed countries imply more sophisticated and thus have less behavioral bias to chase past winner than those in less developed countries.

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Thaweeporn Krailaksanawarapar

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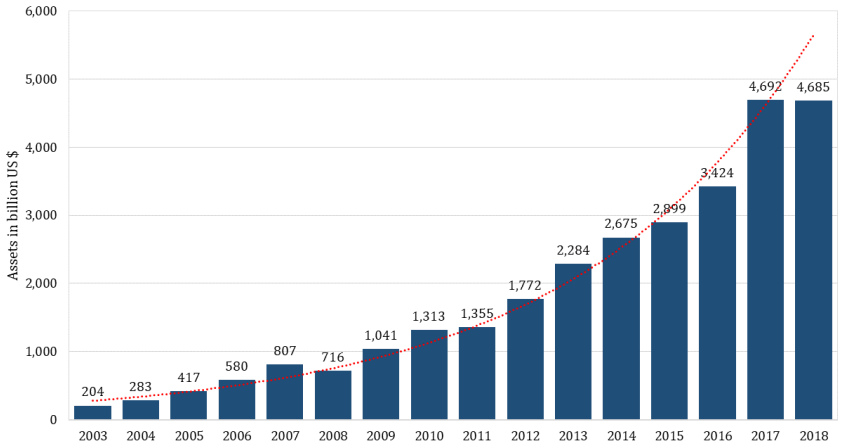
1. Introduction

In the past decade, we can observe massive flow of asset under management (AUM) moving from actively managed funds to index funds and exchange traded funds (ETFs). In addition, trading volume of ETFs experienced dramatic growth in recent years and thus received substantial attention from investor especially from institutional investors. The index tracking characteristic make ETFs increase in popularity in many ways, for example, lower expenses, tax efficiency and intraday tradability (Poterba & Shoven, 2002), outstandingly when compared with mutual funds (Guedj & Huang, 2009).

Source: Statista



Development of assets of global Exchange Traded Funds (ETFs) from 2003 to 2018

Much of the extant literature studies the relation between flow and performance in the area of mutual fund. Most empirical results concur the fact that flows are strongly dependent on past performance and that new money follow the best performers more thickly than they sell poor performers (Ivković & Weisbenner, 2009) meaning that fund investors award good past performance by putting new money into fund flow, while

bad performance is penalized by withdraw money from fund flow (Ippolito, 1992). In addition, the previous literature also shows that the flow-performance relationship in equity mutual fund is not linear, but convex. Inflows to equity funds are more sensitive to fund that perform well in the past than the sensitivity to outflow from fund that perform bad in the past. (Chevalier & Ellison, 1997; Goetzmann & Peles, 1997; Huang, Wei, & Yan, 2007; Ippolito, 1992; Lynch & Musto, 2003; Sirri & Tufano, 1998).

The convexity of flow-performance relationship is largely explored by literatures with the mix explanation. (Ippolito, 1992) indicates that past superior fund performance associates with the ability of fund manager; thus, incentivize investor to trust the signal given by past performance. Several literatures show that worst performing funds do not suffer significant outflows since investors are constrained by transaction costs (see e.g. (Huang et al., 2007; Sirri & Tufano, 1998). Another explanation is that the sensitivity of past performance to flow is the function of fund's age. The youngers fund tends to be the extreme performers as young funds have not yet built a reputation, investors seem more sensitive to the signals they give. The evidence reported by (Ippolito, 1992) suggested that investors are convinced by the advertising from fund families which tend to highlight on fund that recently outperformed. In this view, it implies that investor sophistication could explain the sensitivities of flow-performance relationship seeing that more sophisticated investors will have less behavioral biased and will not be persuaded by advertising.

The findings of this study would shed further light on empirical evidence to study how flow-performance relationship in exchange-traded funds (ETFs) behave in international market rather than mutual fund in previous studies. As ETFs have their

specific characteristics in the aspect that they are similar to mutual funds in many ways, but they are listed on exchanges and can be traded like an ordinary stock, they provide a great opportunity to study the relation between fund flows and their performances. Investigate flow-performance relationship in Exchange-Traded funds (ETFs) unlike the relation between flow and performance of mutual fund, speculative flows into ETFs will not base on fund manager skill but solely on the expectation about the underlying index itself.

The first objective of this study is to examine whether past performance can explain flow of ETFs in the following period in cross-country samples by using a piecewise linear specification for the return distribution with country and time fixed effect as suggested by (Sirri & Tufano, 1998) which allows for different flow-performance sensitivities at each level while control for the size, age, and expense ratio of each ETF. The impact of past performance is estimated separately for the bottom quintile (Bottom), the three middle quintiles (Mid), and the top quintile (Top) of the percentile ranking of fund performance to reflect the asymmetry impact of performance to flow. I also test the significant difference in performance between top and bottom quintile by using panel regression across 15 countries with time and country fixed effect.

The second objective is to observe the asymmetric effect in flow-performance relationship in individual country to examine whether investors from different countries response differently to ETFs that perform well and perform bad in the past. The results from the piecewise linear regression using pool data across 15 countries may provide the generalize results. Therefore, I use data of each country to plot graph to see the

pattern of how the average net flow in each country response to past performance in each quintile. I also regress flow on percentile ranking of fund performance together with control variables but in country level to do Wald test of difference between the top and bottom fund performance.

The third objective is to examine the level of economic development that lead to different pattern of flow-performance relationship in each country. As noted by (Goetzmann & Peles, 1997), investors tend to overestimate past fund returns they have chosen themselves, and do not exit poorly ranked funds. In this view, investors sophistication could be associated with levels of flow-performance sensitivities implies that more sophisticated investors will have less behavioral biases. In this study, I use GDP per capita as indicator for economic development to proxies for investor sophistication.

I make several contributions to the mutual fund literature. Firstly, to the best of my knowledge, this is the first study on ETFs flow-performance relationship using cross-country samples. ETFs serve as the important investing vehicles to both retail and institutional investors as they provide a better investment option than either individual stocks or a mutual fund. Secondly, cross-country sample of ETFs can be used to explore the role of economics in forming the flow-performance relationship across country. This study will help investor understand the asymmetric effect of past performance to flow and understand what determine the shape that we observe. I focus on the role of economic development in each country level as proxy for investor sophistication that could be associated to the different shape of flow-performance relationship of ETFs from 15 countries in my sample.

The remainder of the paper is organized as follows: Section 2 discusses literature review. Section 3 describes data description and summary statistics. Section 4 presents methodology. Section 5 provides the results of empirical analysis, and Section 6 concludes the discussion.

2. Literature review

While discussing the flow-performance relationship, piecewise linear specification suggested by (Sirri & Tufano, 1998) is frequently use in the literature for analyzing the flow sensitivity to performance for funds performing in the bottom 20 percent, middle 60 percent, and top 20 percent. They use all kind of return to rank performance including one-year average raw return, three-year average raw return, and market model excess returns. Whatever performance measure they use to do performance ranking, the result suggested that top quintile funds are more positively sensitive to flows than middle quintile funds. However, there is no relation among the bottom quintile funds except for small, young funds. In addition, they also find the evidence that high-fee funds associated with high marketing expenses enjoy a stronger flow-performance relationship since the marketing spotlight on performance causes consumers to chase winners.

Another strand of the literature is discussed based on theory of cognitive dissonance (Mayer & Cody, 1968). (Goetzmann & Peles, 1997) use questionnaire data taken from educated and casual investors to interpret the different sensitivity in their regression estimates. Response to top quartile fund is significantly stronger than the other quartiles, and the bottom quartile funds is not significantly different from the second and third quartiles. They believe that too optimistic perceptions of past performance imply investor aversion to switching from poor performers.

Along with the convexity of flow-performance relationship in equity mutual funds are well-documented in voluminous literature. (Berk & Green, 2004) find a link between such relationship and imperfect indication of managers' ability. In addition, they find that slope is affected by the fund's age. The youngers fund tends to be the extreme performers as young funds have not yet built a reputation; investors seem more sensitive to the signals they give.

The recent literature by (Goldstein, Jiang, & Ng, 2017) whose study of flow-performance relationship is on bond fund. They find that corporate bond funds exhibit a concave shape as opposed to convex shape in equity mutual funds during the same period. Their outflows are more sensitive to bad performance than their inflows are sensitive to good performance. They also find that greater sensitivity of outflows associates with the more illiquid assets that corporate hold.

Another evidence is provided by (Ferreira, Keswani, Miguel, & Ramos, 2012), who study how mutual fund flows depend on past performance across 28 countries around the world. Their study shows that the convexity of flow-performance relationship in previous US literature cannot apply broadly in other countries. Investors in more developed countries sell losers more and buy winners less than those in less developed countries since they are more sophisticated and bear lower participating costs. Moreover, they also find that country with higher convexity is positively related with risk taking by fund managers.

3. Data description and summary statistics

3.1 Observation and samples

In this study, I use the active data of ETFs around the world from Bloomberg in the period of 2013-2019. I restrict the sample to only ETF that focus its investment in equity exclude fixed income, money market, commodity, and alternative investment. I select the country that has number of ETFs more than 15 to lead to more reliable conclusions from different countries which result in the final sample of 1,564 ETFs in 15 countries over 2013-2019. *Table 1* presents the number of exchange-traded funds at the end of 2019 that I use in this study.

Table1
Number of exchange-traded fund across countries at the end of 2019

Country	Number of ETFs
Australia	20
Canada	116
China	40
France	56
Germany	64
Hong Kong	20
India	17
Ireland	186
Japan	60
Luxembourg	206
South Africa	12
South Korea	62
Switzerland	10
Taiwan	16
United States	679
All countries	**1,564**

3.2 Variables used

As ETF is not designed to generate abnormal return but specifically to replicate a benchmark index, it is reasonable to measure ETF performance by using raw returns in local currency. I use the percentage of total return that take into account of the amount of price increase and distribution of dividend in measuring the performance of ETFs in each month. The calculation of raw return is as follows:

$$Return_{i,c,t} = \frac{TRI_{i,c,t} - TRI_{i,c,t-1}}{TRI_{i,c,t-1}} \quad (1)$$

where $TRI_{i,c,t}$ represents the total return index gross of dividend of ETF i in country c at the end of quarter t.

I define fund flow as the net growth in total net assets (TNAs). $R_{i,c,t}$ is the total return, including dividend and capital gain distribution based on the assumption that dividend and capital gains are reinvested, and all cash flows occur at the end of each period. Fund flow for fund i in country c at quarter t is calculated as:

$$Flow_{i,c,t} = \frac{TNA_{i,c,t} - TNA_{i,c,t-1}(1 + R_{i,c,t})}{TNA_{i,c,t-1}} \quad (2)$$

where $TNA_{i,c,t}$ is the total net asset value in local currency of fund i in country c at the end of quarter t, and $R_{i,c,t}$is fund i's raw return from country c in quarter t.

Regarding to control variables, many non-performance variables are applied in this study. I control for fund age as there are many studies show that fund size and fund age explain fund flow (Barber, Odean, & Zheng, 2005; Chevalier & Ellison, 1997; Sirri & Tufano, 1998). Larger ETFs are expected to seize more money; thus, I include ETFs total net asset to control for size effect. I also use expense ratio of ETFs to control for expenses variable, as previous studies show that these expenses explain funds flow (Barber et al., 2005; Huang et al., 2007). I include lagged flows as control variable to control for autocorrelation like (Cashman, Deli, Nardari, & Villupuram, 2007).

3.3 Data descriptive

Table 2 presents the performance of ETFs by country in each quarter and control variables. China enjoy the highest average return of 0.0307 per quarter (or 12.28% per year), while South Korea accounts for the lowest average return of 0.0075 per quarter (or 3% per year). On average, Asia-pacific countries perform better than other regions during the sample period. Average age of ETFs in my dataset is 8.35 years. Despite of

the longest ETFs history in the United States, Germany has the highest average age of ETFs in my dataset since United States keep issuing a lot of new ETF products in recent years. The region where fund assets of ETFs proved to be the largest is the United States, with amounting to $ 2,733.92 million dollars consistent with their longest history of ETFs in the world.

Table 3 summarizes descriptive statistics on flows by quarter for each country during 2013-2019. South Africa and India has the highest average quarterly flow during the period, while China and Hong Kong have the lowest average quarterly flow. At 50^{th} percentile, almost all countries have zero or positive flow except for China, Hong Kong and Taiwan whose flows are negative. For all countries in my sample, net flow is (on average) 0.04 per quarter or 15% per year, and the standard deviation of 0.26 per quarter or 0.52 per year. The number of fund-quarter of United States are far highest than those of other countries seeing that ETFs were first developed in US market.

Table 2

ETFs data by country.

This table presents ETF variables averaged across quarter by country for the period of 2013-2019. Performance measurement represents by raw return in the past quarter. Control variables include fund age in years at the end of each quarter (*Age*), fund size measured by fund's TNA in million US dollars at the end of each quarter (*Size*), and expenses ratio in annual percentage (*Exp*).

Country	**Raw return (per quarter)**	**SD of return**	**Fund Age (Years)**	**Size ($ mil)**	**Exp (%)**
Australia	0.0230	0.065	6.73	331.80	0.36
Canada	0.0190	0.091	7.26	321.89	0.66
China	0.0307	0.148	5.68	466.65	0.03
France	0.0134	0.098	8.35	2,101.49	0.38
Germany	0.0270	0.102	11.13	1,062.89	0.40
Hong Kong	0.0214	0.102	8.15	1,469.51	0.66
India	0.0295	0.093	8.05	32.64	0.39
Ireland	0.0230	0.076	7.03	925.03	0.39
Japan	0.0315	0.115	8.39	2,656.82	0.39
Luxembourg	0.0216	0.083	7.83	2,113.61	0.38
South Africa	0.0282	0.073	8.36	759.92	0.54
South Korea	0.0075	0.078	6.37	215.09	0.39
Switzerland	0.0266	0.054	8.40	773.22	0.27
Taiwan	0.0259	0.084	7.11	261.68	0.79
United States	0.0197	0.104	9.21	2,733.92	0.51
All countries	**0.0210**	**0.087**	**8.35**	**1,877.15**	**0.46**

Table 3

Descriptive statistic - fund flow by country.

This table presents summary of mean, standard deviation, percentiles of quarterly flow in percentage of each country from 2013-2019. All fund flow variables are winsorized at the 1st and 99th percentiles to mitigate the impact of outliers and potential data errors. N is the number of observations.

Country	Mean	SD	Percentile					N
			10th	25th	50th	75th	90th	
Australia	0.05	0.16	-0.07	-0.02	0.02	0.08	0.21	560
Canada	0.04	0.18	-0.11	-0.04	0.00	0.08	0.20	3,248
China	-0.03	0.18	-0.23	-0.10	-0.04	0.02	0.13	1,120
France	0.05	0.35	-0.25	-0.11	0.00	0.12	0.36	1,568
Germany	0.04	0.23	-0.16	-0.06	0.00	0.08	0.24	1,792
Hong Kong	-0.01	0.18	-0.15	-0.06	-0.01	0.03	0.11	560
India	0.13	0.75	-0.23	-0.07	0.00	0.09	0.35	476
Ireland	0.06	0.39	-0.22	-0.08	0.00	0.10	0.32	5,208
Japan	0.06	0.43	-0.23	-0.05	0.00	0.05	0.28	1,680
Luxembourg	0.01	0.23	-0.21	-0.08	0.00	0.07	0.23	5,768
South Africa	0.23	1.82	-0.10	-0.04	0.00	0.04	0.13	336
South Korea	0.05	0.37	-0.27	-0.10	0.00	0.07	0.37	1,736
Switzerland	0.03	0.13	-0.08	-0.04	0.00	0.06	0.15	280
Taiwan	0.08	0.88	-0.23	-0.11	-0.03	0.02	0.19	448
United States	0.04	0.23	-0.14	-0.05	0.00	0.08	0.23	19,012
All countries	**0.04**	**0.26**	**-0.17**	**-0.06**	**0.00**	**0.08**	**0.24**	**43,792**

Previous literatures suggest that poor-performing fund persists in the following period, but not for good-performing funds (Hendricks, Patel, & Zeckhauser, 1993). Correspondingly, we should not observe sophisticated investor do behavioral bias like chasing past winner or selling past loser. Therefore, I use economic development indicator which is GDP per capita as a proxy for investor sophistication like (Ferreira et al., 2012). *Table 4* presents average gross domestic product per capita in US dollars (GDP per capita) of each country for the period of 2013-2019. I identify countries with above median GDP per capita as more developed countries and countries with below GDP per capita as less developed countries. *Figure 2* plot the plausible association of GDP per capita to flow-performance relationship. I use the countries with top five and

bottom five GDP per capita to plot the relationship between flow and performance quintile. As GDP per capita proxy for investor sophistication, the result suggests that countries in top five GDP per capita (sophisticate investor) are less sensitive to top and bottom performance than countries in bottom five GDP per capita.

Table 4

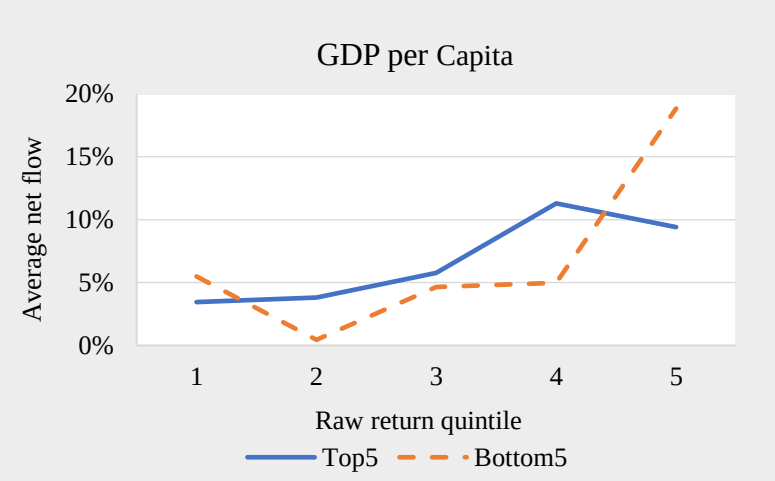
GDP per capita variables by country

This table presents average gross domestic product per capita in US dollars (GDP per capita) of each country for the period of 2013-2019. GDP per capita is used as a measure of economic development indicator and proxy for investor sophistication. Country with above median GDP per capita are more developed countries and vice versa.

Country	GDP per capita ($)
Australia	49,252
Canada	47,336
China	8,515
France	43,178
Germany	50,529
Hong Kong	44,072
India	1,770
Ireland	70,400
Japan	40,489
Korea	39,119
Luxembourg	108,407
South Africa	6,126
Switzerland	65,530
Taiwan	23,774
United States	58,706
All countries	43,814
Median	44,072
More developed	61,779
Less developed	23,282

Figure 2

This figure presents quarterly net flow by past quarter raw return quintile averaged across top five and bottom five countries based on GDP per capita.



4. Methodology

4.1 Measuring asymmetry in flow-performance relationship of ETFs: cross-country evidence

Most empirical results concur the fact that flows are strongly dependent on past performance and that new money follow the best performers more thickly than they sell poor performers (Ivković & Weisbenner, 2009). This implies the fact that there is asymmetry in flow-performance relationship between fund that perform well and perform bad in the past. In this study, I thereby investigate asymmetry in flow-performance relationship in ETFs whether investors' response differently between good past performance as compared to bad past performance. I use piecewise-linear specification following (Sirri & Tufano, 1998) to measure the level of asymmetry across all countries to measure the association between good fund performance and flow, and between poor fund performance and flows. In each quarter and for each

country, I assigned percentile rank to fund according to the raw return, with 0 represents the worst performing fund and 1 represents the best performing fund. Piecewise-linear specification allows us to estimate the impact (coefficient) of past performance on flows for different sections of past performance separately including top 20 percentile, middle 60 percentile, and bottom 20 percentile based on past performance ranking. These coefficients represent the marginal fund-flow response to performance. Methodically, the three performance measures are constructed as follows:

$$\begin{aligned} Bottom_{i,c,t-1} &= \min(0.2, Rank_{i,c,t-1}) \\ Mid_{i,c,t-1} &= \min(0.6, Rank_{i,c,t-1} - Bottom_{i,c,t-1}) \\ Top_{i,c,t-1} &= Rank_{i,c,t-1} - (Bottom_{i,c,t-1} + Mid_{i,c,t-1}) \end{aligned} \quad (3)$$

Then, I combine the data of all countries and regress fund flows on three fractions of past performance together with control variables with country and time fixed effects. Control variables include size, age, and expenses. I also control for lagged flow to avoid autocorrelation in fund flows like (Cashman et al., 2007).

$$\begin{aligned} Flow_{i,c,t} = \beta_0 + \beta_1 Bottom_{i,c,t-1} + \beta_2 Mid_{i,c,t-1} + \beta_3 Top_{i,c,t-1} + \beta_4 logSize_{i,c,t-1} \\ + \beta_5 logAge_{i,c,t-1} + \beta_6 Fee_{i,c,t-1} + \beta_7 Exp_{i,c,t-1} + \varepsilon_{i,c,t-1} \end{aligned} \quad (4)$$

Where β_1, β_2, and β_3 represent the sensitivity of past performance to flow. β_4 and β_5 are expected to be positive as ETFs with larger size and more age are expected to seize more money. β_6 coefficient represents expenses ratio which measure investors' costs and are expected to have a negative relation to the flows.

In order to test for asymmetry in flow-performance relationship, I also do a Wald test to test for the significantly difference between β_1 and β_3.

4.2 Measuring asymmetry in flow-performance relationship of ETFs in individual country

To measuring asymmetry in flow-performance relationship for each ETF in each country, for each quarter, I categorize ETFs into quintiles according to past quarter raw return and calculate the average fund flow of each quintile. For each quintile, I draw up the relationship between average net flow and past quintile performance to see the asymmetric response between good and poor performance.

Next, I regress fund flows on piecewise past performance as well as the same control variable in *Equation (4)* varying by each country to investigate the flow-performance relationship for each country. I also do Wald test like in section 4.1 for β_1 and β_3 for each individual country level.

4.3 Macroeconomic factors& flow-performance relationship across countries

Previous literatures suggest that investor sophistication should be negatively correlated with asymmetry, in other word, less sensitive to top-performing fund and more sensitive to poor-performing fund for the countries with higher sophistication (Brown & Goetzmann, 1995; Carhart, 1997; Hendricks et al., 1993). As GDP per capita is the most popularly measured of economic development by policymaker and academics, I use economic development indicator as a proxy for investor sophistication which is GDP per capita like (Ferreira et al., 2012).

These variables are obtained from the Organization for Economic Cooperation and Development (OECD) and World Development Indicators (WDI) database. Then, I draw up the flow-performance relationship from the top five and bottom five countries according to GDP per capita. I identify more developed countries and less developed countries by those with above and below median GDP per capita, respectively, at the end of each quarter.

To estimate the impact of GDP per capita to flow-performance while controlling for the factors of fund flows, I regress flows for all ETFs on piecewise past performance interacted with the GDP per capita with time fixed effect. The control variables in the regression are the similar set in *Equation (4)*.

$$Flow_{i,c,t} = \beta_0 + \beta_1 Bottom_{i,c,t-1} + \beta_2 Bottom_{i,c,t-1} * logGDPPC_{i,c,t-1} + \beta_3 Middle_{i,c,t-1} + \beta_4 Middle_{i,c,t-1} * logGDPPC_{i,c,t-1} + \beta_5 Top_{i,c,t-1} + \beta_6 Top_{i,c,t-1} * logGDPPC_{i,c,t-1} + \beta_7 logGDPPC_{i,c,t-1} + \beta_8 logAge_{i,c,t-1} + \beta_9 logSize_{i,c,t-1} + \beta_{10} Exp_{i,c,t-1} + \beta_{11} Flow_{i,c,t-1} + \varepsilon_{i,c,t-1} \quad (5)$$

According to the regression in *Equation (5)*, I expect to see negative coefficient for β_6. The implication is that investors in countries with higher GPD per capita chase winners less than those with lower GDP per capita.

5. Empirical results

5.1 Measuring asymmetry in flow-performance relationship of ETFs: cross-country evidence

Table 4 reports regression results from *Equation (4)* with country and time fixed effect and robust t-statistics. Coefficient of Top (β_3), Mid (β_2), and Bottom (β_1) are all statistically significant meaning that there is asymmetry in flow-performance relationship. The size of coefficients represents the marginal fund-flow response to past performance. For example, the Top coefficient (β_3) in column (2) can be interpreted as an increase in performance ranking in certain quarter from 80th to 90th percentile is related to an increase in fund flow of 0.61% and vice versa.

Interestingly, the result exhibit concave shape in the flow-performance relationship in ETFs rather than convex shape in equity mutual funds in previous literatures. For equity mutual fund literature, flows are more positive to good past performance and less negative to bad past performance (Ferreira et al., 2012). On the other hand, the regression result in *Table 4* reports higher negative amount for β_1 than positive amount of β_3, in other words, ETFs that perform bad in the past has greater impact to outflow than the impact of good-performing fund to inflow in the following period. This consistent with the prospect theory as noted by (Kahneman & Tversky, 1979). People are loss aversion as investors are more sensitive to losses than to gains. In addition, Barberis and Huang (2001) finds that the degree of loss aversion associates with prior and losses (Barberis & Huang, 2001). Once they have experienced loss, they become more sensitive to additional failures. In addition, another theory put forwards

that asymmetry is evidence of *cognitive weighting*. More attention is given to information that is more extreme (Fiske, 1980).

Considering of the coefficient of control variables, the result suggests that they strongly significant associate with flow; thus, these control variables can capture the variation in ETFs' flow-performance relationship. The younger and smaller fund lead to more inflow in the following period consistent with previous literature (see e.g. (Chevalier & Ellison, 1997; Ferreira et al., 2012; Sirri & Tufano, 1998). One plausible explanation is that young smaller funds can exhibit superior short-term performance, which can be misleading. Not many superior stocks in the portfolio could lead to a large superior fund's performance. In addition, some investors are convinced to purchase fund managed by inexperienced manager while lack of long historical performance to consider. The higher expenses ratio relates to less inflow as ETFs with high expenses can earn lower net return to fund investor when compare with ETFs with lower expenses. I also included lagged flow to control for autocorrelation in fund flows in column (2), like (Cashman et al., 2007). I find that these control variables enhance the explanatory power over flow.

Table 4

The flow-performance relationship across all countries.

This table presents the results of panel regression of flow-performance relationship with ETFs across 15 countries by using *Equation (4)* with time and country fixed effect:

$$Flow_{i,c,t} = \beta_0 + \beta_1 Bottom_{i,c,t-1} + \beta_2 Mid_{i,c,t-1} + \beta_3 Top_{i,c,t-1} + \beta_4 logAge_{i,c,t-1} + \beta_5 logSize_{i,c,t-1} + \beta_6 Exp_{i,c,t-1} + \beta_7 Flow_{i,c,t-1} + \varepsilon_{i,c,t-1}$$

The dependent variable is ETF flows and independent variables are piecewise past performance and control variables. Robust t-statistics are reported in parentheses. Wald test the different between good and poor performance quintile of ETFs are presented in the last row of table. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1) $Flow_t$		(2) $Flow_t$	
Bottom $_{t-1}$	- 0.2359	***	- 0.2304	***
	(-7.36)		(-7.06)	
Mid $_{t-1}$	0.0990	***	0.1040	***
	(13.55)		(14.22)	
Top $_{t-1}$	0.0745	*	0.0605	*
	(1.65)		(1.70)	
Log Age $_{t-1}$			- 0.1034	***
			(-12.56)	
Log Size $_{t-1}$			- 0.0279	***
			(-14.02)	
Exp $_{t-1}$			- 0.0604	***
			(-10.89)	
Flow $_{t-1}$			0.0032	
			(0.41)	
Intercept			0.2733	***
			(18.50)	
Number of observations	43,792		43,792	
Time fixed effect	YES		YES	
Country fixed effect	YES		YES	
Wald test Top=Bottom (*F-stat*)	50.51		39.85	***

5.2 Measuring asymmetry in flow-performance relationship of ETFs in individual country

The result from the piecewise linear regression using pool data across 15 countries suggests that bad past performance ETFs has more negatively relation to outflow than good past performance ETFs has positively relation to inflow in the following period. However, the result from the piecewise linear regression using pool data across 15 countries may provide the generalize results and did not provide the differential performance sensitivities by country. In this section, I use data of each country to draw up graph to see the pattern of how the average net flow in each country response to past performance in each quintile. The procedure is, firstly sort ETFs into quintile each quarter according to their raw returns and then averaged the fund flow by quintile.

Figure 1 presents plotting of average ETF flow using past quarter raw return quintile for each country. Plotting graph gives us a clear picture and better understanding of how performance-rank related to fund flow. I adjust the scale to suit with the different range of fund flow for each country. For example, China, Hong Kong, South Africa, and Taiwan have negative flow in their flow-performance relationship while the other countries have positive inflow in every quintile.

Overall, flow-performance relationship of ETFs in each country displays the different patterns. Flow-performance relationship for countries including Canada, France, Germany, Ireland, Japan, Luxembourg, South Korea, Switzerland, and United States suggests that investors put more money into good past performance ETFs than bad past performance ETFs. Considering the flow-performance relationship by range

of quintile, almost countries have dropping in fund flows for ETFs that ranked in bottom part (1^{st}-2^{nd} quintile) and increasing in fund flows for ETFs that ranked in the top part (3^{rd}-4^{th} quintile).

However, countries including Australia, China, India, Hong Kong, South Africa, and Taiwan do not presents clear different average net flow between bad past performance ETFs and good past performance ETFs. When comparing with the previous study by (Ferreira et al., 2012) who study flow-performance relationship in equity mutual fund in cross countries, they also find the different shape of flow-performance relationship and suggest that convexity in flow-performance relationship in many US literatures cannot apply universally for other countries. Therefore, the preliminary analysis is that difference country exhibits the difference shape of flow-performance relationship.

Next, I measure the asymmetry in flow on performance in individual country level. I regress flow on percentile rank of fund performance as well as the same control variables in *Equation (4)* with time fixed effect. *Table 5* presents the result of Bottom (β_1) and Top (β_3) coefficient of each country and F-statistics of Wald test to estimate whether the sensitivity of flow to past performance of a country is significantly different for top and bottom region.

Figure 1 plots average ETF flow by past quarter raw return quintile for each country.

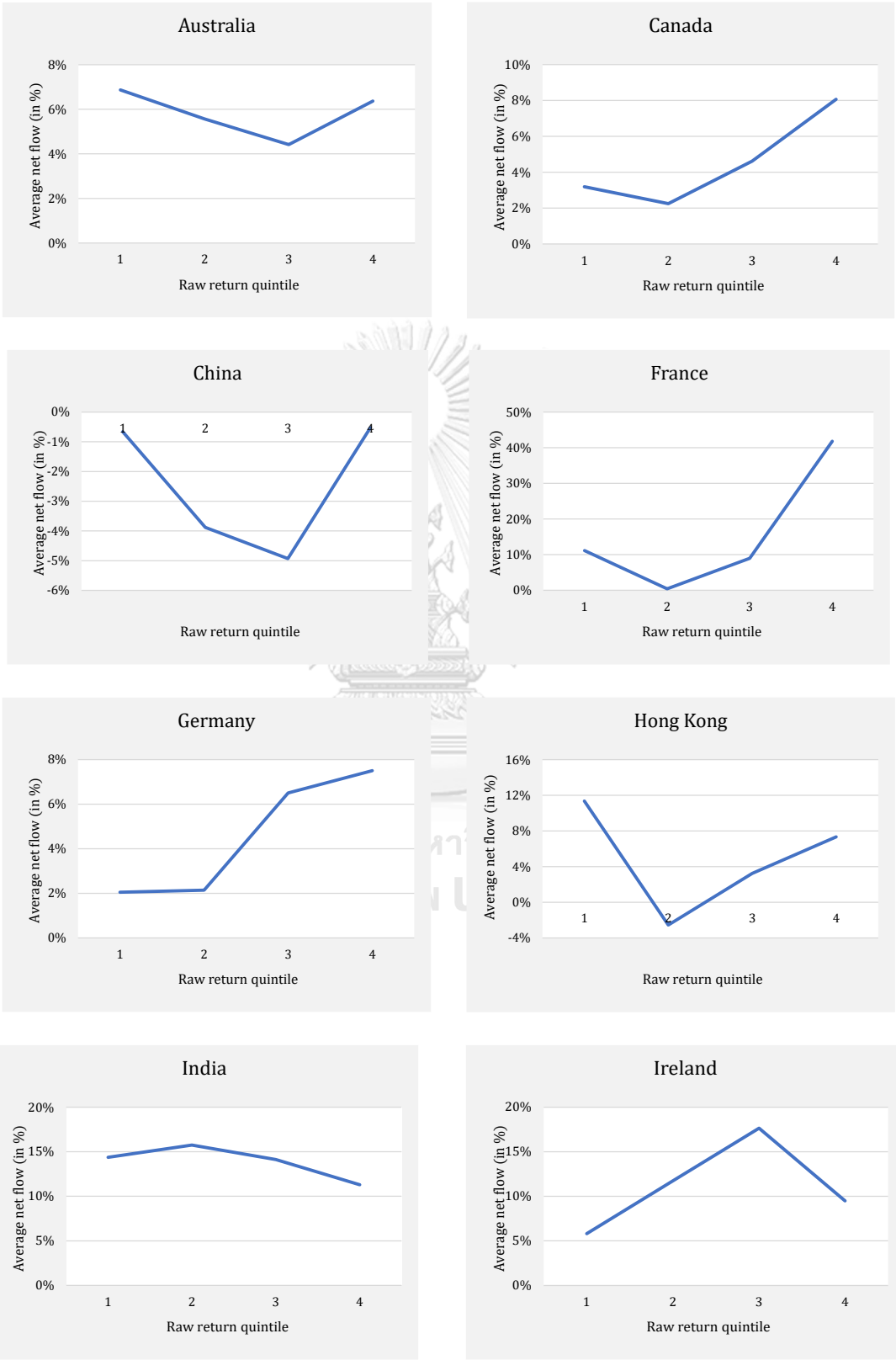
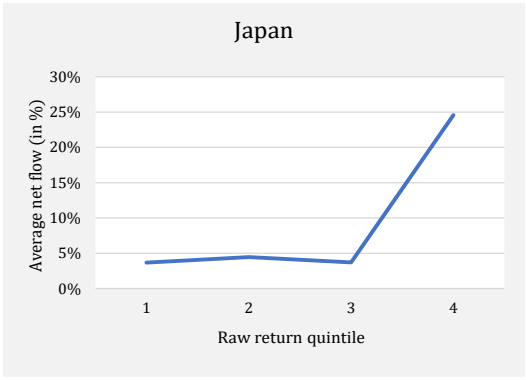
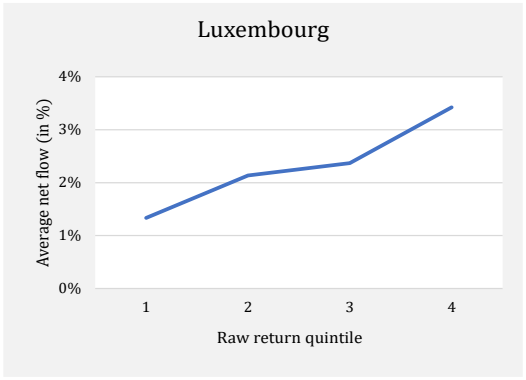
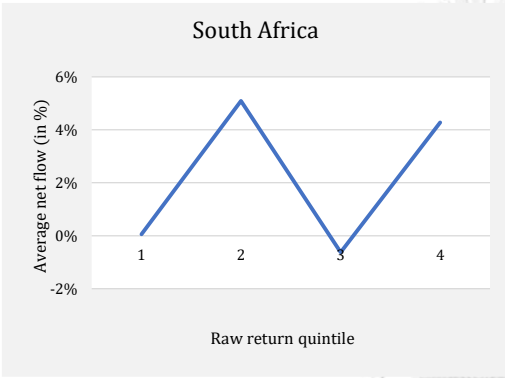
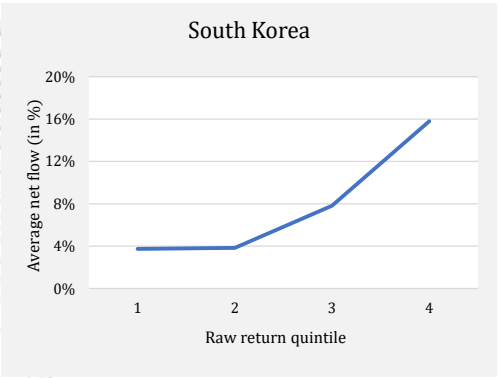


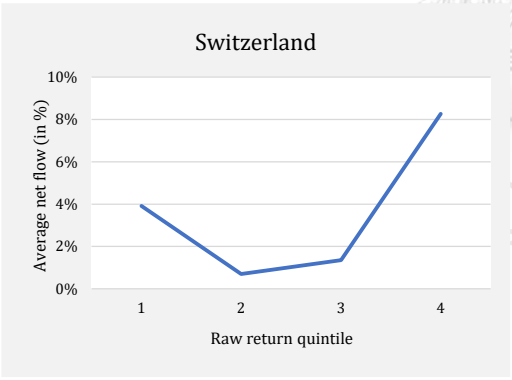
Figure 1 *(Continued)*

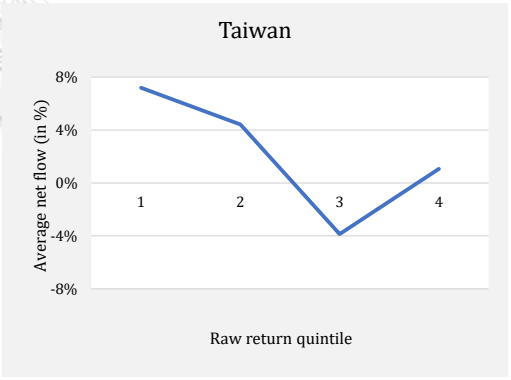












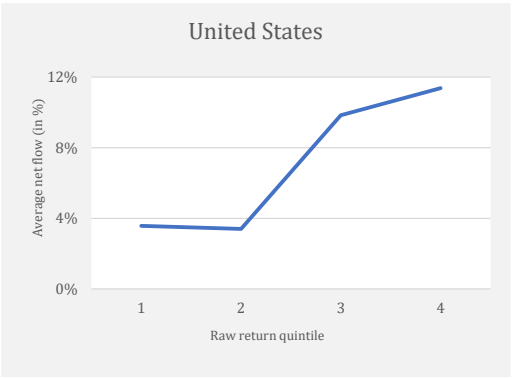


Table 5

Wald test different of Top and Bottom coefficient flow-performance relationship by country

This table presents the results of Wald test different between Top and Bottom coefficients from panel regression of flow-performance relationship with ETFs of individual 15 countries with time fixed effect:

$$Flow_{i,c,t} = \beta_0 + \beta_1 Bottom_{i,c,t-1} + \beta_2 Mid_{i,c,t-1} + \beta_3 Top_{i,c,t-1} + \beta_4 logAge_{i,c,t-1} + \beta_5 logSize_{i,c,t-1} + \beta_6 Exp_{i,c,t-1} + \beta_7 Flow_{i,c,t-1} + \varepsilon_{i,c,t-1}$$

The dependent variable is ETF flows and independent variables are piecewise past performance and control variables. Control variables are the same as *Equation (4)*. Country with above median GDP per capita are more developed countries and vice versa. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively

Country	β_1	β_3	**F-statistics**	
Australia	0.0809	-0.0398	0.24	
Canada	-0.2127	0.1809	9.05	***
China	-0.0959	0.3835	7.1	***
France	-0.4482	-0.3795	0.05	
Germany	-0.1598	0.1450	2.95	*
Hong Kong	-0.0963	0.0195	0.32	
India	0.4667	0.0407	0.28	
Ireland	0.0023	-0.2718	2.4	
Japan	-0.6400	1.3168	19.26	***
Luxembourg	-0.2290	-0.1137	1.37	
South Africa	2.3611	-0.4198	2.04	
South Korea	-0.3064	0.6243	7.61	**
Switzerland	-0.0617	0.2818	4.98	**
Taiwan	-0.0170	-0.1689	0.03	
United States	-0.2905	0.0416	22.93	***
All countries	-0.2304	0.0605	2.27	
More developed	-0.2292	-0.0088	21.55	***
Less developed	-0.2505	0.3864	20.5	***

There are seven countries in my sample show the significantly difference between top and bottom region including Canada, China, Germany, Japan, South Korea, Switzerland, and United States whereas the remaining, particularly for less developed countries, are insignificant. This may result from the noisy flow and fewer observation. Therefore, I classify the countries into two group including more developed and less developed countries to fix this problem. I defined the country with above median GDP per capita as more developed countries and country with below median GDP per capita as less developed countries (at the end of the period). At the bottom of *Table 5*, the results suggest that there are significantly differences between β_1 and β_3 in more and less developed countries.

5.3 Macroeconomic factors& flow-performance relationship across countries

In order to explain the differences degree in flow-performance relationship that we observe in previous section, I investigate the difference in investor sophistication in each country. Previous literatures suggest that poor-performing fund persists in the following period, but not for good-performing funds (Hendricks et al., 1993). Correspondingly, we should not observe sophisticated investor do behavioral bias like chasing past winner or selling past loser. In this section, I use economic development indicator which is GDP per capita as a proxy for investor sophistication like (Ferreira et al., 2012). The effect of fund flow from investor in different country is neglected since investors seem to allocate a substantial fraction of their wealth to domestic securities (Karolyi & Stulz, 2003; Lewis, 1999).

To estimate the effect of GDP per capita to flow-performance while control for the factor of fund flows, I add the interaction term between piecewise past performance

and GDP per capita which is proxy for investor sophistication in my regression. The control variables are the same set as *Equation (4)*. I also include the natural log of GDP per capita to control for their impact to flow in individual country level. The result in *Table 7* confirms that the difference sensitivity of flow-performance relationship across countries relate with the level of investor sophistication. There is significantly strong evidence that countries with higher level of investor sophistication has lower sensitivity to ETF that perform well in the past consistent with equity mutual fund evidence by (Ferreira et al., 2012). Investors in more developed countries are more sophisticated and do less behavioral bias as they chase less for past winners. However, the result marks insignificant impact of more sophisticated investor in buying poor-performing. This consistent with several literatures that show that the flow-performance relationship of outflows is more complicated to justify than inflows (Bergstresser & Poterba, 2002; Ivković & Weisbenner, 2009). In addition, prior study by (James & Karceski, 2006) finds that institutional investors chase winners significantly less than retail investors, while there is inseparably linked between these two types of investors for poor-performing funds. Thus, this implies that investor sophistication does not relate to selling behavior for past poor-performing fund.

Table 7

The impact of GDP per capita to flow-performance sensitivity.

This table presents the results of panel regression of individual fund flow on piecewise past performance and piecewise past performance interacted with GDP per capita of each country in each quarter across 15 countries time fixed effect:

$$Flow_{i,c,t} = \beta_0 + \beta_1 Bottom_{i,c,t-1} + \beta_2 Bottom_{i,c,t-1} * logGDPC_{i,c,t-1} + \beta_3 Middle_{i,c,t-1} + \beta_4 Middle_{i,c,t-1} * logGDPPC_{i,c,t-1} + \beta_5 Top_{i,c,t-1} + \beta_6 Top_{i,c,t-1} * logGDPPC_{i,c,t-1} + \beta_7 logGDPPC_{i,c,t-1} + \beta_8 logAge_{i,c,t-1} + \beta_9 logSize_{i,c,t-1} + \beta_{10} Exp_{i,c,t-1} + \beta_{11} Flow_{i,c,t-1} + \varepsilon_{i,c,t-1}$$

The dependent variable is ETF flows and independent variables are piecewise past performance, piecewise past performance interacted with GDP per capita and control variables. Proxy for economic development is natural log of gross domestic product per capita in US dollars lagged by one quarter. Robust t-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively

	$Flow_t$	
Bottom $_{t-1}$	0.622	
	(1.22)	
Bottom $_{t-1}$ *x log GDPPC* $_{t-1}$	-0.174	
	(-1.6)	
Mid $_{t-1}$	-0.304	**
	(-2.21)	
Mid $_{t-1}$ *x log GDPPC* $_{t-1}$	0.086	***
	(2.97)	
Top $_{t-1}$	1.690	***
	(3.30)	
Top $_{t-1}$ *x log GDPPC* $_{t-1}$	-0.34	***
	(-3.24)	
Log GDPPC $_{t-1}$	0.039	**
	(2.32)	
Log Age $_{t-1}$	-0.083	***
	(-11.65)	
Log Size $_{t-1}$	-0.020	***
	(-12.38)	
Exp $_{t-1}$	-0.025	***
	(-5.17)	
Flow $_{t-1}$	0.009	**
	(2.01)	
Intercept	0.049	
	(0.61)	
Time fixed effect	YES	
Adjusted *R*-square	0.033	
Number of observations	43,792	

6. Conclusion

In this study, I investigate the flow-performance relationship of exchange-traded funds (ETFs) across 15 countries in different region around the world both in cross-country and individual countries level. There are three objectives of the studies. The first objective is to examine whether past performance can explain flow of ETFs in the following period in cross-country samples by using a piecewise linear specification for the return distribution. The second objective is to observe the asymmetry in flow-performance relationship in individual country. The third objective is to examine the role of economic development that lead to different shape of flow-performance relationship in each country.

I find strong evident that there is asymmetry in flow-performance relationship. ETFs that perform bad in the past has negatively impact to outflow more than the positively impact to inflow in the following period. This can be explained by the behavioral bias form investor that react more to bad news than good news. Apart from the generalize result from across countries sample, I also investigate the difference in flow-performance relationship in each country level. The preliminary evidence suggests that difference countries exhibit the different shape of flow-performance relationship depending on the level of investor sophistication. I use economic development indicator which is gross domestic product per capita (GDP per capita) as a proxy for investor sophistication. Investors in more developed countries imply more sophisticated and thus have less behavioral bias to chase past winner than those in less developed countries.

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VITA

NAME	*Thaweeporn Krailaksanawarapar*
DATE OF BIRTH	*20 October 1991*
PLACE OF BIRTH	*Bangkok*
INSTITUTIONS ATTENDED	*Master of Science in Finance, Chulalongkorn University*
HOME ADDRESS	*91/9 Moo1 Bangkruay-Sainoi Rd., Bangkruay, Nonthaburi 11130*