THE INFLUENCES OF GREED AND FEAR ON FUND PERFORMANCE

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ABSTRACT

This paper discusses if the psychological changes of investors would influence mutual funds from the perspective of behavioral finance. In other words, we assess the psychological state of investors from the deepest psychological factors of greed and fear, and discuss whether the psychological changes in these investors would influence a mutual fund. This study presented evidence that the psychological changes of investors were related to fund performance. It better illustrated how fund performance was affected by the psychology of investors, especially from irrational behavior driven by fear and greed.

JEL: C33, C58, G02

KEYWORDS: Volatility Index (VIX), Greed, Fear, Mutual Fund Performance

INTRODUCTION

Ever since the efficient market hypothesis (EMH) was proposed by Fama (1970), the field of finance has seen a continuous wave of research on mutual funds. It is popular in academic studies to discuss whether the performance of a mutual fund can beat the market and maintain a positive anomalous performance. Overall fund performance was earlier assessed by the return rate and overlooked the underlying risks that funds should undertake. In recent years, however, the underlying risks of a fund have been considered for an overall performance assessment. Assessed indices include the Treynor Index (1965), the Sharpe Index (1966), and the Jensen Index (1968), among others. Fund performance is influenced by many factors. Study results have indicated that fund performance may be related to its size, flow, turnover period, the management fee rates, and the ratio of expenses to sales. Recently, researchers have begun to discuss the relationship between fund performance, emotion, and herding behavior. Related study results have shown that investors purchase funds with a better performance history and redeem those with a worse performance history (Elton, Gruber and Busse, 2004; Barber, Odean, and Zheng, 2005). Additionally, funds with a worse performance had a higher price (Gil-Bazo and Ruiz-Verdu, 2009). These factors are considered the main two conundrums of mutual funds.

When a mutual fund is able to maintain a positive anomaly, it means that the market is inefficient and may not be rational. When fund investors purchase a fund based on its performance history or purchase a fund with a higher price but a worse performance, it means that the investors are acting irrationally. In recent years, behavior finance has drawn greater attention. Related literature has agreed that investors show many types of behavioral biases and not all are rational. For example, Odean (1998, 1999) and Barber and Odean (2001) discovered that some investors exhibited all kinds of behavioral biases when making stock investment decisions. In a recent study, Bailey, Kumar, and Ng (2011) analyzed the data of several mutual fund investors and discovered that they had behavioral biases, such as disposition effect, narrow framing, overconfidence, and speculation preference as well as local bias. The irrational behavior of investors may influence market returns and cause fluctuations that further influence the operation and performance of a mutual fund. In another sense, the emotional fluctuations of investors, especially changes between greed and fear, may lead to price variations. Fund managers may try to cater to or take advantage of such market opportunities caused by the emotional changes between greed and fear to gain abnormal returns. In this circumstance, fund performance will be related to the greed and fear of investors. Related literature has discussed the influence of investor irrational psychology on fund performance but has not drawn clear conclusions. In addition, the existing literature has not presented evidence to explain how the psychology of investors influences portfolio performance. Therefore, the

ways that greed and fear influence fund performance have academic implications and are worthy of discussion. This paper discusses whether the psychological changes of investors would influence mutual funds from the perspective of behavioral finance. In other words, it assesses the psychological state of investors from the deepest psychological factors of greed and fear, and discusses whether the psychological changes in these investors would influence mutual funds.

The study chose an open-end equity fund in Taiwan as its target, because (compared to the developed markets of other countries) retail investors made up the majority in the Taiwan market and the emotions of greed and fear in retail investors were typical. With respect to the measurement of greed and fear of investors, this paper adopted the volatility index (VIX). The empirical results indicated that greed and fear did have an influence on the performance of the open-end equity fund in the Taiwan market. The volatility index had a negative influence on fund performance, i.e. when the market was bearish or crashed, the whole market was filled with panic, stock prices would go down, and the performance of a mutual fund would be worse. This study presents evidence that the psychological changes of investors were related to fund performance. To better illustrate how fund performance was affected by the psychology of investors by the irrational behavior driven by fear and greed. This paper is structured as follows. This section (Section 1) explains the study motivation and aim and results. Section 2 is our literature review that discusses greed, fear and the factors influencing fund performance. Section 3 is our data and methodology and explains the measurement methods of the variables of greed and fear. Section 4 offers our empirical results. Section 5 offers our conclusions.

LITERATURE REVIEW

As illustrated in the introduction, when a mutual fund is able to maintain a positive anomaly return, it indicates that the market is inefficient. According to Lo (2004) and Lo, Repin, and Steenbarger (2005), the efficient market hypothesis was challenged because investors were irrational and were influenced by fear and greed. Greed and fear caused the two deepest psychological biases for investor emotions (Shefrin, 2000). The greed of investors always lead them to high spirits and made them feel bullish for the future market and results in an increase in stock prices. Meanwhile, fear always means that investors were in a gloomy mood and causes them to feel bearish, resulting in a decrease in stock prices. After considering various psychological opinions, experts in behavioral finance think that the concept of greed can be simplified to a series of unique psychological phenomena.

Firstly, this is a concept formed naturally. Under the framework of behavioral finance, when investors are faced with uncertainty, emotional and cognitive biases will influence their decisions to use improper or irrational behavior. Factors that will cause greed include over optimism, overconfidence caused by an underestimation of risks, excessive levels of longing, and adoption of a higher standard line than prospect theory offers. Jin and Zhou (2011) thought that greed had two definitional features: 1. having a high desire for wealth and 2. to satisfy the desire with aggressive action. Jin and Zhou (2011) even mentioned that greed was one of the causal factors of the financial crisis.

The corresponding psychological state of greed is fear. People will be fearful when considering the risks of uncertainty. According to Lerner and Keltner (2000, 2001), fear indicated an uncertain feeling towards situational control and people with fear would make pessimistic judgments on future events. Low (2004) even mentioned that the common pressures in financial markets were always dominated by fear and that fear was a state of extreme fear of risk. Kahneman and Tversky (1979) considered that what people were fearful of was not risk itself but losses. Rappoport and White (1994) discovered that the stock market crash in the US in 1929 could be predicted by fear in the market. Bates (2000) considered that, after the stock market crash in the US in 1987, the severe skewness of the S&P 500 option prices of futures could be explained by a fear of a market crash. With respect to fund performance, it is theoretical that the larger the size of the fund, the more likely it will display the scale economies effect and, meanwhile, fund managers will have more funds to create better portfolios. However, some scholars have had different ideas. They think that when the fund size was too big, it would lead to a lack of elasticity in operation

with decreases in flexibility and return rates (Woerheide, 1982; Gorman, 1991; Volkman and Wohar, 1995, Ding, Shawky, and Tian, 2009). In addition, according to Pollet and Wilson (2008), when funds were invested in large scale stocks, returns would be increased without diversification as large scale stocks had a better liquidity while small scale ones often needed the diversification of funds to increase returns.

According to the study results of Elton, Gruber, and Busse (2004) and Barber, Odean, and Zheng (2005), investors would make investments based on the performance history of a fund. When the fund performance was good, the fund flow would be increased, and when the performance was poor, they would redeem capital. The literature has further indicated that when a large amount of capital is invested in a fund, it inevitably influences the operational behavior of the fund managers (Sirri and Tufano, 1998; Fant and O'Neal, 2000; Jain and Wu, 2000; Froot, O'Connell, and Seasholes, 2001; O'Neal, 2004), and surely influences the operational performance of a fund. According to existent literature, Coval and Stafford (2007) considered that when a large amount of capital was invested in a mutual fund, it would cause a large number of exchanges between certain mutual funds and lead to price pressures in securities. Bailey, Kumar, and Ng (2011) also considered that some investor investments in a mutual fund would have an indirect influence on stock returns. Studies by Zheng (1999) and Berk and Green (2004) proposed that when investors made an investment decision based on the increase and decrease of fund flow, they would obtain an excess return. Additionally, Sirri and Tufano (1998), Fant and O'Neal (2000), Jain and Wu (2000) and Bilson, Frino, and Heaney (2005) considered that there was a significant relationship between fund flow and fund performance returns.

Additionally, previous literature has often discussed the emotions of investors, the relationships between investor emotions and herding behavior in fund investments, and the impact of herding behavior on fund investments at market prices. Related literature has shown that there is a relationship between the emotions of investors and close-end fund discount rates and fund flows (literature related to the former relationship included that of Ben-Rephael, Kandel, and Wohl (2012)), and literature relating to the latter one included that of Lee, Shleifer, and Thaler (1991) and Liao Huang and Wu (2011) indicates that the emotions of investors played an important role in explaining the succeeding herding behavior in mutual fund investment, especially in a seller's market. Wermers (1999) discovered that herding behavior on the small cap growth fund would accelerate the process of price adjustment to indicate that there was a close relationship between herding behavior and fund performance.

DATA AND METHODOLOGY

Data and Descriptive Statistics

This study chose an open-end stock fund in Taiwan as our study sample. One of the variables, the volatility index, was compiled from December 1 2006, and the data period for this study lasted from December 2006 to March 2011, for total data of 52 months. Excluding funds being settled and merged during the sampling period, there were 127 examples in the sampling fund (see appendix), and the total number of samples reached 6,604. Poterba and Summers (1988) and Fama and French (1992) proposed that the actions of noise traders had strong continuity and slow transitivity. Shiller (2000) considered that the observation of investor behavior during a short period would lead to a bias in the results because the beginning and ending of the market bubble was not completed in a short period.

We adopted monthly data for assessment. Data came from the database of the Taiwan Economic Journal (TEJ) and Securities Investment Trust & Consulting Association of the R.O.C. (SITCA). Table 1 shows the value of skewness and kurtosis both show that the distribution of samples is inconsistent with a normal distribution and is skewed to the right. In addition, the distribution of samples is steeper and narrower when compared to a normal distribution and is distributed closer to the average value. Table 1 further shows that compared to other explanatory variables, the standard deviation, and maximum and minimum values of the explanatory variables of the volatility index, have the largest level of variation and, in a long-short market cycle, the emotions of investors will vary greatly causing extreme values to occur.

Table 1: Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
VIX	26.395	25.562	58.912	13.731	9.334	0.977	4.316
PR	0.005	0 .010	0.150	-0.188	0.075	-0.263	2.871
LOGNA	14.090	14.023	16.930	11.821	0.934	0.258	2.487
HM	1.003	1.001	1.019	0.992	0.004	1.417	5.561
NETINFLOW	0.006	-0.005	5.931	-0.476	0 .131	19.392	701.960

Notes: the sample period lasts from December 2006 to March 2011, a total of 52 months. There are 127 examples in the sampling fund. Variables include Volatility Index (VIX), Return Rate of Taiwan Stock Index (PR), Net Asset Value (LOGTNA), Herding Measure (HM), and Fund Net Cash Flow (NETINFLOW). The total number of samples reached 6,604

Estimation Model

The regression equation of fund performance is as follows:

$$PERFORMANCE_{i,t} = \beta_0 + \beta_1 VIX_t + \beta_2 PR_t + \beta_3 LOGTNA_{i,t} + \beta_4 HM_t + \beta_5 NETINFLOW_{i,t} + \varepsilon_{i,t} \quad (1)$$

Dependent Variables

Performance: this paper adopted the Sharpe index commonly used in the field and the industry to measure fund performance. Xu and Burton (2003) and Wei and Chu (2006) both discovered that idiosyncratic risks tended to take up a significantly increasing percentage of the total risk. Studies by Campbell et al. (2001), Durnev et al. (2002), and Chiang and Kung (2003) proposed that systemic risk was not necessarily the only factor that affected asset pricing and obtained a risk premium. Idiosyncratic risks also played a role. Considering the aforementioned reasons, we adopted the Sharp index (including systemic risk and idiosyncratic risk) to measure fund performance.
The equation is as follows:

$$Sharp \text{ index} = \frac{R_p - R_f}{\sigma_p} \quad (2)$$

Where R_p stands for the return rate of the portfolio, R_p stands for risk free rate, and σ_p stands for the standard deviation of the return rate of the portfolio. This index indicates the excess return to be obtained when taking a unit of total risk. The bigger the value, the better it indicates better portfolio performance.

Independent Variable – The Measurement of Greed And Fear

The volatility index (VIX) presents the level of panic in the market (investors). In Taiwan, it is the volatility index of option fluctuations and is generated by the Taiwan Future Exchange based on the volatility index generating equation of the Chicago Board Options Exchange (CBOE) with the aim of exchanges in the Taiwanese option market. The volatility index was proposed by CBOE in 1993. This index is the weighted average of the implied volatility of index options (VIX). VIX is commonly considered as an index indicating investor fear of the price falling (panic index) and, thus, is widely used to indicate the level of investor panic towards the market. A higher value for the index means that investors are more upset about the situation of the stock market while a lower value means the variation of the stock index is alleviated (i.e. investor greed increases). Studies by Fleming, Ostdiek, and Whaley (1995), Simons (1999), and Whaley (2000) proposed that VIX could be used to measure fear.

Independent Variable – Others

The return rate of the stock index in Taiwan (PR): the return rate of the current stock price index equals the current stock price index minus the previous stock price index over the previous stock price index. As stocks are the objectives for fund investment, the return rates of the stock market will directly influence

fund returns. This study set PR as a control variable. This paper also set the level of PR fluctuation as a control variable, but it failed in the VIF test. Log Net Asset Value (LOGTNA): existing literature indicated that fund size has a certain influence on fund performance. This paper sets the size of the fund as a control variable and takes the logarithm of the total amount of the net asset of the fund for each month of measurement. Herding measure (HM): herding behavior refers to the same actions taken by a certain group over a certain period. The related empirical results for the existing literature showed that herding behavior commonly exists among fund managers and influences fund performance. Therefore, to avoid herding behavior influence on the empirical results, this paper set the herding behavior of fund managers as a control variable. The herding behavior index was measured by a model improved from the measurement model proposed by Chang, Cheng, and Khorana (2000). The smaller dispersion degree for different fund returns indicates a higher degree of herding behavior by fund managers. The model is:

$$CSAD_t = \frac{1}{N}\sum_{t=1}^{N}\left|R_{i,t} - R_{m,t}\right| \tag{3}$$

$CSAD_t$ refers to the weighing value of the absolute value of the difference between individual fund returns and the return of all samples in t month. $R_{i,t}$ refers to the return rate of a fund in t month. $R_{m,t}$ refers to the monthly average return rate of all sample funds in t month. N refers to the number of the sampling fund. Fund net cash flow (NETINFLOW) stands for the fund flow. It is equal to the inflow rate minus the outflow rate. Considering that the same flow amount may have a different influence on a large scale fund to a small scale fund, this paper standardized the value by dividing the inflow and outflow amounts by the previous fund scale, respectively. Therefore, the inflow rate is equal to the inflow amount over the previous fund net and the outflow rate equals the outflow amount over the previous fund net. This study set fund net cash flow as a control variable.

EMPIRICAL RESULTS

Before carrying out a regression analysis, it was first verified whether there were collinearity problems among the independent variables to avoid a decrease of explanatory ability because of the substitutability of some of the variables. The verification results of this study showed that the VIF (variance inflation factor) values of all the variables were smaller than 5, to indicate that there were no collinearity problems among the variables. Table 2 shows our empirical results. The return rate of the stock index in Taiwan (PR) has a positive impact on fund performance, i.e. when the stock market is bullish, fund performance will be comparatively better. This is because, according to the operational policies of the mutual funds, purchasing is the only way to obtain capital gains or dividend income. Regardless of the market situation, mutual funds need to maintain a high percentage of stock holdings; this is closely connected to the stock market. Net asset value (LOGTNA) has a positive impact on fund performance, i.e. a larger fund size will result in a better fund performance. It means that the larger the net asset value of the fund, the more likely it will display the economies of scale effect.

Besides, managers of larger funds have more sufficient capital to make a better portfolio. Fund net cash flow (Net inflow) has a positive impact on fund performance. When a fund flow shows a net inflow, the fund performance will become better and indicates that there is a mutual causality between the fund performance and the fund flow (Elton, Gruber and Busse, 2004 and Barber, Odean and Zheng, 2005). The empirical results indicate that greed and fear influence the performance of open-end mutual stock funds in Taiwan. The volatility index has a negative impact on fund performance, i.e., the higher the volatility index, the worse the fund performance. When the market is bearish or crashes, the whole market (investors) will be full of panic and stock prices decrease. As a mutual fund has a close connection with the stock market, the performance of the mutual fund would be worse. On the contrary, the higher the level of investors greed, the better the fund performance. The study results provide evidence to demonstrate the relationship between the psychological changes of investors and fund performance that better explain the way that fund performance is influenced by the psychological changes of investors, especially from the irrational behaviors driven by greed and fear. This study also examined the influences

using the Treynor index (only considering the systemic risks) and achieved the same results.

Table 2: All Sample Regression Model Analysis

Variable	(1)	(2)	(3)	(4)	(5)
VIX	-0.025***	-0.024***	-0.022***	-0.022***	-0.022***
	(-70.92)	(-67.75)	(-65)	(-57.90)	(-59.00)
PR		0.612***	0.506***	0.496***	0.465***
		(13.36)	(11.52)	(11.18)	(10.62)
LOGNA			0.257***	0.257***	0.241***
			(24.90)	(24.88)	(23.49)
HM				-1.561	-1.206
				(-1.78)	(-1.39)
NETINFLOW					0.318***
					(13.46)
Sample	6,604	6,604	6,604	6,604	6,604

Notes: the sampling period lasts from December 2006 to March 2011. There are 52 monthly data, 127 fund items, and the total number for the regression samples is 6,604. The regression equation is $PERFORMANCE_{i,t} = \beta_0 + \beta_1 VIX_t + \beta_2 PR_t + \beta_3 LOGTNA_{i,t} + \beta_4 HM_t + \beta_5 NETINFLOW_{i,t} + \varepsilon_{i,t}$ *, Where the dependent variable is the performance of the fund (PERFORMANCE), independent variables include the volatility index (VIX), , the return rate of the stock index (PR), the log value of the fund net asset value (LOGTNA), the value of the herding behavior (HM) and the fund net cash flow (NETINFLOW). After carrying out a Hausman test, T test and LM test, equations (1) to (5) all adopt the fixed effect model. The values in parentheses for the fixed effect model are t-values. ***Significance at 1%, ** Significance at 5%,* Significance at 10%.*

Robust Test

This study adopted a quantile regression and considered the impact of the global financial crisis to carry out the robust test and to achieve a more rigorous conclusion. Tables 3 and 4 are robust tests. The testing results indicated that that the empirical results of this study are consistent. Quantile regression: the quantile regression was firstly proposed by Koenker and Bassett (1978) and clearly explained the general distribution of explained variables in a model, and, thus, further dealt with the heterogeneity of the data. The quantiles chosen for this study were 0.25, 0.5, and 0.75. Table 3 shows the regression results for the greed index and the fear index were consistent. The impact of the global financial crisis: as the sampling period lasted from December 2006 to March 2011, it covered the period of the global financial crisis. Therefore, this study defined the three months declared by the Taiwan government when the short-selling of stocks was banned in the period of the financial crisis. This was the three months before and after the stock index reached the lowest point.

Table 3: Robust Test: Quantile Regression

Quantile	0.25		0.5		0.75	
Variable	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
VIX	-0.026***	-62.23	-0.023***	-57.33	-0.022***	-37.16
PR	0 .416***	8.33	0 .343***	7.35	0 .413***	6.50
LOGNA	0.007	1.96	0.007	1.93	0.026***	4.49
HM	5.847***	6.68	0.554	0.63	0.390	0.30
NETINFLOW	0.397***	12.31	0.511***	20.87	0.730***	22.28
Pseudo R^2	0.3671		0.2687		0.1991	

*Notes: the influences of the greed index and the fear index on fund performance were analyzed using a quantile regression. Where the dependent variable was the performance of fund (PERFORMANCE), independent variables included the volatility index (VIX), the return rate of stock index (PR), the log value of the fund net asset value (LOGTNA), the value of herding behavior (HM) and the fund net cash flow (NETINFLOW). ***Significance at 1%, ** Significance at 5%,* Significance at 10%.*

The study removed the samples of these three months to see whether they would affect the study results. Table 4 shows that after comparing the whole sample and the sample following the removal of samples for the period of the financial crisis, the indices of the variables such as greed and fear were consistent to indicate the impact of the global crisis did not influence the empirical results of this study.

Table 4: Robust Test: Removing the Impact of the Global Financial Crisis

Variable	The Whole Sample	The Sample following removal of the Samples for the Period of the Global Financial Crisis
VIX	-0.022***	-0.023***
	(-59.00)	(-47.92)
PR	0.465***	0.556***
	(10.62)	(11.97)
LOGNA	0.241***	0.236***
	(23.49)	(22.10)
HM	-1.206	-1.129
	(-1.39)	(-1.24)
NETINFLOW	0.318***	0.333***
	(13.46)	(13.80)
Sample	6,604	6,223

*Notes: the period from October 2008 to December 2008 was defined as the period of the global financial crisis. After removing the samples for these three months, there remained 49 monthly data, 127 fund items, giving the total number of samples as 6,223. Where, the dependent variable was the performance of fund (PERFORMANCE), independent variables included the volatility index (VIX), the return rate of stock index (PR), the log value of the fund net asset value (LOGTNA), the value of herding behaviors (HM) and the fund net cash flow (NETINFLOW). After carrying out a Hausman test, T test and LM test, the fixed effect model was adopted. The values in parentheses for the fixed effect model are t-values. ***Significance at 1%, ** Significance at 5%,* Significance at 10%.*

Advanced Regression

As a fund has different risk appetites and the market will experience upward or downward trends, greed and fear may have different levels of influence on fund performance. Therefore, this study analyzed the influence of greed and fear on fund performance from the perspectives of: (1) a fund with average high and low risk; (2) the increase and the decrease of stock prices in the market; and (3) the interactive situations of the average high and low risk groups with the increase and the decrease of the market index, respectively.

(1) Groups With An Average High and Low Risk

As a high-risk fund and low-risk fund may present different regression results, when compared to the whole sample, this study adopted the standard deviation of the return rates of the 127 fund items during the sampling period as the standard risk. The average risk (0.014098) was considered the standard. During the sampling period, funds with risks above the standard were included in the average high-risk group and funds with risks below the standard line were included in the average low-risk group. There were 67 fund items in the average high-risk group and 60 items in the average low-risk group. A regression analysis was carried out using dummy variables to compare the differences. The model is as follows:

$$PERFORMANCE_{i,t} = \alpha_0 + \alpha_1 D_{i.t}^{above} VIX_t + \alpha_2 D_{i.t}^{below} VIX_t + \alpha_3 PR_t + \alpha_4 LOGTNA_{i,t} + \alpha_5 HM_t + \alpha_6 NETINFLOW_{i,t} + \varepsilon_{i,t} \quad (4)$$

$D_{i.t}^{above}$: high-risk fund; $D_{i.t}^{below}$: low-risk fund.

The increase and the decrease in the stock index of the market

As the increase and the decrease in the market index may present different regression results when compared to the whole sample, the study divided the total 52 sampling periods into 31 periods of increase and 21 periods of decrease. A regression analysis was carried out using a dummy variable to compare the differences. The model is as follows:

$$PERFORMANCE_{i,t} = \lambda_0 + \lambda_1 D_{i.t}^{up} VIX_t + \lambda_2 D_{i.t}^{down} VIX_t + \lambda_3 PR_t + \lambda_4 LOGTNA_{i,t} + \lambda_5 HM_t + \lambda_6 NETINFLOW_{i,t} + \varepsilon_{i,t} \quad (5)$$

$D_{i,t}^{up}$ and $D_{i,t}^{down}$: the stock market index during the upward period and the downward period respectively.

Interactive situations of the average high and low risk groups with market index increase and decrease

$$PERFORMANCE_{i,t} = \gamma_1 D_{i,t}^{up} + \gamma_2 D_{i,t}^{down} + \gamma_3 D_{i,t}^{up} D_{i,t}^{above} VIX_t + \gamma_4 D_{i,t}^{down} D_{i,t}^{above} VIX_t + \gamma_5 D_{i,t}^{up} D_{i,t}^{below} VIX_t + \gamma_6 D_{i,t}^{down} D_{i,t}^{below} VIX_t + \gamma_7 PR_t + \gamma_8 LOGTNA_{i,t} + \gamma_9 HM_t + \gamma_{10} NETINFLOW_{i,t} + \varepsilon_{i,t} \quad (6)$$

Table 5 indicates that the impact levels of the volatility index are equivalent to the performance of high-risk funds and low-risk funds. Table 6 indicates that the volatility index has the equivalent impact on fund performance during both the upward and downward periods of the stock market index. Finally, Table 7 indicates that, under the interactive situations of the average high and low risk groups with the increase and decrease of the market index, the volatility index (VIX) has an equivalent impact on the fund performance under all different situations.

Table 5: Groups with Average High and Low Risks

Variable	Coefficient	t-value
$D^{above}VIX$	-0.021***	-43.36
$D^{below}VIX$	-0.023***	-45.65
PR	0.464***	10.60
LOGTNA	0.243***	23.62
HM	-1.234	-1.42
NETINFLOW	0.318***	13.47
sample	6,604	

Notes：the regression model for the influences of greed and fear on the adjustment by fund managers in high and low-risk groups is $PERFORMANCE_{i,t} = \alpha_0 + \alpha_1 D_{i,t}^{above} VIX_t + \alpha_2 D_{i,t}^{below} VIX_t + \alpha_3 PR_t + \alpha_4 LOGTNA_{i,t} + \alpha_5 HM_t + \alpha_6 NETINFLOW_{i,t} + \varepsilon_{i,t}$ *. Where, the dependent variable is the performance of fund (PERFORMANCE), independent variables include the volatility index (VIX), the return rate of stock index (PR), the log value of the fund net asset value (LOGTNA), the value of herding behavior (HM) and the fund net cash flow (NETINFLOW). The dummy variables stand for funds with an average high risk (* $D_{i,t}^{above}$ *) and funds with an average low risk (* $D_{i,t}^{below}$ *). After carrying out a Hausman test, F test and LM test, the fixed effect model is adopted. The values in parentheses for the fixed effect model are t-values. ***Significance at 1%, ** Significance at 5%,* Significance at 10%.*

Table 6: The Increase and Decrease of the Stock Market Index

Variable	Coefficient	t-value
$D^{up}VIX$	-0.023***	-60.29
$D^{down}VIX$	-0.020***	-38.07
PR	0.411***	9.30
LOGTNA	0.234***	22.97
HM	-0.816	-0.95
NETINFLOW	0.305***	13.16
sample	6,604	

Notes: the regression model for the influences of greed and fear on the adjustment by fund managers under the situations of the increase and decrease of the stock market index is $PERFORMANCE_{i,t} = \lambda_0 + \lambda_1 D_{i,t}^{up} VIX_t + \lambda_2 D_{i,t}^{down} VIX_t + \lambda_3 PR_t + \lambda_4 LOGTNA_{i,t} + \lambda_5 HM_t + \lambda_6 NETINFLOW_{i,t} + \varepsilon_{i,t}$ *. Where, the dependent variable is the performance of the fund (PERFORMANCE), independent variables include the volatility index (VIX), the return rate of the stock index (PR), the log value of the fund net asset value (LOGTNA), the value of herding behavior (HM) and the fund net cash flow (NETINFLOW). The dummy variables stand for the upward period of the market index (* $D_{i,t}^{up}$ *) and the downward period of the market index (* $D_{i,t}^{down}$ *). After carrying out a Hausman test, F test and LM test, the fixed effect model was adopted. The values in parentheses of the fixed effect model are t-values. ***Significance at 1%, ** Significance at 5%, * Significance at 10%.*

CONCLUSIONS

This paper discussed whether the psychological changes of investors would influence mutual funds from the perspective of behavioral finance. In other words, it assessed the psychological state of investors from the deepest psychological factors of greed and fear and discussed whether the psychological changes in these investors would influence a mutual fund. The study chose an open-end equity fund in Taiwan as its target, because (compared to the developed markets of other countries) retail investors made up the majority in the Taiwan market and the emotions of greed and fear in retail investors were typical. With respect to the measurement of greed and fear of investors, this paper adopted the volatility index. As the sample variables were featured by cross-sectional and time-series types, this paper adopted the panel data regression model for empirical tests. Our empirical results indicated that greed and fear influenced the

performance of open-end mutual stock funds in Taiwan and the volatility index had a negative impact on fund performance. When the market is bearish or crashes, the whole market will be full of panic, stock prices will decrease, and the performance of mutual funds will worsen.

Table 7: Interactive Situations for the Average High and Low Risk Groups with the Increase and the Decrease of the Market Index

Variable	Coefficient	t-value
$D^{up}D^{above}VIX$	-0.022***	-44.63
$D^{down}D^{above}VIX$	-0.020***	-28.00
$D^{up}D^{below}VIX$	-0.024***	-46.73
$D^{down}D^{below}VIX$	-0.021***	-28.66
PR	0.412***	9.27
LOGTNA	0.236***	23.09
HM	-0.846	-0.98
NETINFLOW	0.305***	13.15
sample	6,604	

Notes: the regression model for the influences of greed and fear on the adjustment by fund managers under the interactions between high and low-risk samples and the increase and the decrease of the market index is $PERFORMANCE_{i,t} = \gamma_1 D_{i,t}^{up} + \gamma_2 D_{i,t}^{down} + \gamma_3 D_{i,t}^{up} D_{i,t}^{above} VIX_t + \gamma_4 D_{i,t}^{down} D_{i,t}^{above} VIX_t + \gamma_5 D_{i,t}^{up} D_{i,t}^{below} VIX_t + \gamma_6 D_{i,t}^{down} D_{i,t}^{below} VIX_t + \gamma_7 PR_t + \gamma_8 LOGTNA_{i,t} + \gamma_9 HM_t + \gamma_{10} NETINFLOW_{i,t} + \varepsilon_{i,t}$ *Where, the dependent variable is the performance of the fund (PERFORMANCE), and independent variables include the volatility index (VIX), the return rate of stock index (PR), the log value of the fund net asset value (LOGTNA), the value of herding behavior (HM) and the fund net cash flow (NETINFLOW). The dummy variables stand for the high-risk fund in an upward period of the market index (* $D_{i,t}^{up} D_{i,t}^{above}$ *), the high-risk fund in a downward period of the market index (* $D_{i,t}^{down} D_{i,t}^{above}$ *), the low-risk fund in the upward period of the market index (* $D_{i,t}^{up} D_{i,t}^{below}$ *) and the low-risk fund in the downward period of the market index (* $D_{i,t}^{down} D_{i,t}^{below}$ *). After carrying out a Hausman test, T test and LM test, the fixed effect model was adopted. The values in parentheses for the fixed effect model are t-values. ***Significance at 1%, ** Significance at 5%, * Significance at 10%.*

The study results demonstrate the relationships between the psychological changes in investors and the fund performance that better explain way that fund performance was influenced by the psychological changes of investors, especially, for irrational behavior driven by greed and fear. Although the study results have shown us how the psychological states of investors influenced the fund performance, our results were concluded from samples of a developing country where retail investors make up the majority. These same results will also be concluded from samples of other areas where retail investors are not the majority part of the market (such as other developed countries) still needs further study. This is the biggest limitation of this study. Therefore, it is recommended that future studies include samples from more countries and areas that compare the differences of the influence of greed and fear on fund performance in markets with different investor-structures and different levels of maturity to find out whether the influences are still significant and to compare the differences of the ways they influence the fund performance.

APPENDICES

Appendix A: Sample Fund List

#	Fund Name	#	Fund Name
1	Mega Citizen Fund	33	Eastspring Investments OTC Fund
2	Mega High Tech Fund	34	Eastspring Investments Export Fund
3	Mega New Emerging Enterprise Fund	35	Eastspring Investments Essence Fund
4	Mega Top 20 Fund	36	Prudential Financial Taiwan Enterprise Fund
5	FSITC Fu Yuan Fund	37	Prudential Financial New Century Fund
6	FSITC Great China Fund	38	Prudential Financial Small & Medium Capital Fund
7	FSITC OTC Fund	39	Prudential Financial OTC Fund
8	FSITC Taiwan Growth Fund	40	Prudential Financial High Growth Fund
9	FSITC Small Capital Fund	41	Prudential Financial Maxime Fund
10	FSITC High-Tech Fund	42	Prudential Financial First Fund
11	FSITC Taiwan Fortune Fund	43	Prudential Financial High Tech Fund
12	HSBC Taiwan Growth Fund	44	UPAMC Pentium Fund
13	HSBC Taiwan Electronics Fund	45	UPAMC Tung Hsin Fund
14	HSBC Taiwan Phoenix Fund	46	UPAMC Optima Fund
15	HSBC Taiwan Mid & Small Cap Fund	47	UPAMC Long Ma Fund
16	HSBC Taiwan Blue-Chips Fund	48	UPAMC Small And Medium Cap Fund

17	Yuanta Duo Yuan Equity Fund	49	UPAMC Quality Growth Fund
18	Yuanta Duo Fu Equity Fund	50	UPAMC Infrastructure Fund
19	Yuanta Mainstream Fund	51	UPAMC All Weather Fund
20	Yuanta OTC Fund	52	Fubon Value Fund
21	Yuanta Hi-Tech Equity Fund	53	Fubon Elite Fund
22	Yuanta Excellence Equity Fund	54	Fubon Technology Fund
23	Yuanta Duo Duo Equity Fund	55	Fubon Aggressive Growth Fund
24	Yuanta Buffett Equity Fund	56	Fubon Precision Fund
25	Yuanta International Trade Fund	57	Fubon Supreme Fund
26	Invesco Taiwan Technology Fund	58	Fubon Taiwan Phoenix Fund
27	Invesco Capital Appreciation Fund	59	Fubon Taiwan Heart Fund
28	Invesco Taiwan Select Growth Fund	60	Fubon Internet Fund
29	Invesco Mainstream Fund	61	Fubon Champion Fund
30	Eastspring Investments E-Tech Fund	62	JF (Taiwan) Value Growth Fund
31	Eastspring Investments Small Medium Capital Fund	63	JF (Taiwan) Micro Fund
32	Eastspring Investments High-Tech Fund	64	JF (Taiwan) Taiwan Fund
65	JF (Taiwan) Growth Fund	97	SinoPac Hi-Tech Fund
66	JF (Taiwan) Smaller Company Fund	98	SinoPac Pilot Fund
67	JF (Taiwan) New Technology Fund	99	Truswell IC Fund
68	Hua Nan Yung Chong Fund	100	Manulife Taiwan High Dividend Fund
69	Hua Nan Vision Tech Fund	101	Manulife Dynamic Fund
70	Polaris 2001 Fund	102	Ontario High-Tech Fund
71	Shinkong OTC Market Fund	103	ING Taiwan High Dividend Fund
72	Shinkong Taiwan Yong-Hwa Fund	104	ING Taiwan Growth Selection Fund
73	Shinkong Fu-Kuei Fund	105	ING Taiwan High Tech Fund
74	Capital High Tech Fund	106	ING Taiwan Superior Equity Fund
75	Capital Large Cap. Growth Fund	107	ING Taiwan China Focus Fund
76	Capital OTC Fund	108	ING Taiwan Aggressive Growth Selection Fund
77	Capital Small and Medium Cap. Fund	109	ING Taiwan Growth Fund
78	Capital Strategic Alpha Fund	110	ING Taiwan High Tech Selection Fund
79	Capital Marathon Fund	111	ING Taiwan Small Cap Fund
80	THE RSIT Digital Fund	112	Union Knowledge Industry Fund
81	Reliance Small-and-Medium Cap Fund	113	Union China Fund
82	Dah-Fa Fund	114	Union Technology Fund
83	TIIM OTC Fund	115	Mirae Asset Apollo Fund
84	AllianceBernstein Concept Fund	116	Allianz Global Investors Taiwan Fund
85	AllianceBernstein Da Li Fund	117	Allianz Global Investors Taiwan Technology Fund
86	Jih Sun Jih Sun Fund	118	Cathay Technology Fund
87	Jih Sun Top Five Fund	119	Cathay Fund
88	Jih Sun Hi-Tech Fund	120	Cathay Small Cap Growth Fund
89	Jih Sun Upstream Fund	121	Deutsche Far Eastern DWS Technology Fund
90	Jih Sun Small Cap Fund	122	Deutsche Far Eastern DWS Taiwan Flagship Fund
91	Jih Sun New Taiwan Enterprises Fund	123	Paradigm Small Capital Fund
92	Fuh-Hwa Digital Economy Fund	124	Franklin Templeton SinoAm First Fund
93	Fuh-Hwa High Growth Fund	125	Taishin China Equity Fund
94	Fuh-Hwa Omni Fund	126	Taishin Ta-Chong Equity Fund
95	Fuh-Hwa Fund	127	Polaris Small-Medium Cap Fund
96	Fuh-Hwa Small Capital Fund		

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