The Disposition Effect of Taiwanese Open-end Mutual Fund  

Investors: Recursive Threshold Model in Variable  

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Abstract 

A unique data set with complete information of purchase and redemptions of individuals and institutions in the Taiwan open-end equity mutual fund market. With the monthly data, we employ the recursive ordinary least square model in variable to identify the determinants of purchasing and redemption activities over a 56-month period. In this study, two models with different assumption about investors’ behavior are discussed. The first model incorporates the assumption that investors choose funds on the basis of past capital returns. In the second model, we assume investors choose funds according to the excess return of each fund. Our results show that investors in Taiwan have two types of disposition effect. For all disposition effect types, we find investors flock to recent high performing funds but their behavior is different in loss domain. First, we find that investors are not to redeem the funds with past negative capital return, we call that “insignificant redemption disposition effect”. Second, we find investors are significantly less willing to flee from past extremely negative excess return but the unwilling to redeem the funds with moderate negative excess return is not significant. We call that “less willing redemption disposition effect”. Our findings offer direct support for the disposition effect in Taiwan open-end mutual fund market. Our finding also supports that the investors in Taiwan prefer funds with improving performance and lower transaction fees. We find that investors are risk-seeking in gain domain, which implies that the investor’s behavior in Taiwan is not consistent with the prospect theory. 

\textit{JEL classification} 

Keywords: Open-end equity mutual fund, disposition effect, the recursive threshold model in variable.

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I. Introduction

Past research found that investors tend to sell winners too early and ride losers too long. That is, investors have the tendency to realize gains too soon and hold losses too long. (Shefrin and Statman, 1985; Garvey and Murphy, 2004). Shefrin and Statman (1985) first named this phenomenon as the “disposition effect”. Extending the research by Shefrin and Statman, Ippolito (1992) found the ratio of purchasing high-performance funds is disproportionately higher than that of redemption low-performance funds. To be more specific, mutual fund investors flock to recent high-performance funds and fail to flee from past losers (Chevalier and Ellison, 1997). Shu, Yeh and Yamada (2002) also indicated that the individual investors’ redemption may not discipline the funds because they do not punish the losers by redeeming. In other words, the redemption behavior of losers is not significant.

In past literature, Jensen’s $\alpha$, Sharpe ratio, raw return rate and excess return rate are commonly used in evaluating the performance of funds. However, according to Goodwin (1998), excess return rate is proved to be more informative than Jensen’s $\alpha$. Moreover, raw and excess return rates are easier to be calculated and understood by unprofessional investors. Some research used excess return rate as a performance measure of fund (Chevalier and Ellison, 1997; Jorion, 2003), and some used raw return rate to discuss investment behavior (Sirri and Tufano, 1998; Fant and O'Neal, 2000; Prather, Bertin and Henker, 2004). In this study, in stead of using raw or excess return respectively, we try to use both raw and excess return rates to analyze the disposition effect of investors in Taiwan open-end mutual fund market. Since Taiwan mutual fund market has more than 99% individual investors, using raw and excess return rates as the decision making references is a reasonable assumption in this study\(^1\).

Past research defined winners (losers), when their investments earned positive (negative) raw return rate (see Sirri and Tufano, 1998; Fant and O'Neal, 2000; and Sinha and Jog, 2005). However, in reality, investors may make their purchasing decision only when the fund has better performance substantially than the corresponding index in the equity market. That is, an investor will not buy a fund just because there exists a “positive” return especially when the stock market is bull. That is, investors will not satisfy with a positive raw return, instead, they prefer higher excess returns (i.e., the difference between raw return and benchmark index). In

\(^1\) In Taiwan, most of fund advertisements parade their past performance by emphasizing their beating the benchmark, the stock index, substantially. Moreover, the Securities Investment Trust and Consulting Association (SITCA) in Taiwan have Lipper, S&P and National Taiwan University Professors’ versions which evaluate the performance of mutual funds. All of them also provide raw and excess returns as the indicators.
order to capture this asymmetric phenomenon and to re-examine the disposition effect more completely, in our study, we redefine “losers” and “winners” by a more objective methodology, the recursive threshold model in variables (R-OLSV).

The R-OLSV model is commonly used to identify the threshold points in recent literature (Tsay, 1989; Shen and Hakes, 1995; Hakes, Gamben and Shen, 1998; Shen, Lee and Lee, 1999; Robert, 2003; Tsionas and Christopoulos, 2003; and Funkea and Niebuhr, 2005). We employ R-OLSV method to identify the threshold values. This method employs recursive t-ratios graph which simplified the process of identifying the number and location of the thresholds. The thresholds are considered as the “reference point”. (Kahneman and Tversky, 1979; Weber and Camerer, 1998). Base on the threshold values, we redefine the winners as funds with higher performance than the threshold value, and the losers as funds with lower performance than the threshold value.

Moreover, we separate losers into “extreme losses” and “moderate losses” by the threshold values. According to our findings, we decompose the disposition effect into two types: the “insignificant redemption disposition effect” and “less willing redemption disposition effect” respectively. Our particular description is as follow: prior research didn’t distribute the losers into two groups. Grinblatt and Keloharju (2001) found that investors with extreme capital losses (> 30 percent) exhibit a stronger disposition effect than investors with moderator capital losses (≤ 30 percent). Our study apply Grinblatt and Keloharju’s new finding in mutual fund markets, and redefine the disposition effect as the “insignificant redemption disposition effect” and the “less willing redemption disposition effect”. The phenomenon that fund investors with moderate losses flee from losers insignificantly is named as the “insignificant redemption disposition effect”. On the other hand, the phenomenon that investors with extreme losses are more reluctant to realize their losses is called the “less willing redemption disposition effect”. Such asymmetric relations imply that the market “rewards” extreme losses fund and does not discipline poor performers too much (insignificant). Our results are consistent with the conclusions by Chevalier and Ellison (1997), which indicated that fund companies have the incentive to increase the riskiness of the portfolio hoping to benefit from any increase in the return that would bring in more inflows and fee revenues. If their risky portfolio brings no benefits or even causes huge loss, the outflows would not be seriously influenced because of the disposition effect. Therefore, the two types of disposition effects will have some policy implication for government administration. In other words, investors are more

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2 We follow the model of Shu et. al. (2002) and revise the specifications of variables to estimate the deposition effect.
reluctant to realize their extreme losses with progressively worse performance. When the “less willing redemption disposition effect” exists, we conjecture that the managers with poor performance will probably have the incentive to increase the riskiness of their portfolios to turn loss into gain. Relative to the “insignificant redemption disposition effect”, the “less willing redemption disposition effect” is more likely to cause “moral hazard” when managers’ portfolio is going worse.

This paper is organized as follows: Section 2 sheds some light on the previous literature. Section 3 describes the empirical models. Section 4 explains the data and summary statistics. Section 5 reports the empirical results. Section 6 concludes.

II. Related work and theory

Disposition effect has been an emerging topic among behavioral finance in recent years. Previous studies offer direct support for the disposition effect (Shefrin and Statman, 1985; Ippolito, 1992; Gruber, 1996; Odean, 1998; Frino, Johnstone and Zheng, 2004; Sinha and Jog, 2005). Odean (1998) examines the disposition effect by analyzing trading records from 1987 through 1993 for 10,000 accounts which have 162,948 records at a large discount brokerage house. The analysis of these records shows that, overall, investors realized their winners more readily than their losers. These observations lead the author to suggest that investors may exhibit the disposition effect.

In the literature, there are several reasons that cause the disposition effect: (1) Lakonishok and Smitd (1986) indicated that investors who do not hold the market portfolio may respond to large price increases by selling some of the appreciated stock to restore diversification to their portfolios. They also documented that investors who purchases stocks on favorable information may sell if the price goes up, rationally believing that price reflects this information, and may continue to hold if the price goes down, rationally believing that their information is not yet incorporated in price. (2) Harris (1988) suggested that investors avoid to sell the losers because of the higher transaction costs associated with selling low price assets, and further, he also conjectured that investors avoid to purchase the additional shares that they already held. To the contrary, Barber and Odean (1999) indicated that investors tend to purchase additional shares of their losers than winners. (3) Odean (1998), and Grinblatt and Keloharju (2001) indicated that investors are likely to sell the winners because of their desire to profit, and more likely to hold the losers due to the attitude of loss aversion. (4) Shefrin and Statman (1985), and Weber and Camerer (1998) conjectured that the disposition effect can be explained by the Kahneman and
Tversky’s (1979) prospect theory. They identified that investors are risk-seeking in the domain of possible losses and risk-averse as a certain gain is obtainable. Investors expect to turn their losses into gains in the future by holding their losers. That is the rational reason why investors may choose to hold their losers too long and sell the winners too soon. (5) Odean (1998), Barber and Odean (1999), and Shu et al. (2005) indicated that investors who have stronger beliefs in mean reversion exhibit disposition effect. If investors believe prices may revert to the mean, they will sell winners and hold losers in that they expect the losers to outperform the winners in the future. Shu et al. (2005) showed that Taiwanese investors exhibit a stronger disposition effect than U.S. investors. They conjectured that the cultural difference between the Ease and the West could partly explain this phenomenon. (6) Lakonishok and Smidt (1986) and Barber and Odean (1999) suggested that investors may sell winners and hold losers in an effort to rebalance their portfolio. Other reasons for disposition effect include mental accounting, tax-loss selling, and self-deception theory.

Many researches also discuss the impact of disposition effect\(^3\) on investors and financial markets. Lakonishok and Smidt (1986), and Ferris, Haugen and Makhiija (1998) indicated that the current volume was negatively (positively) correlated with the volume on previous days in which stock price were higher (lower) than the current price on an aggregate level. Moreover, Benartzi and Thaler (1995), Odean\(^4\) (1998), and Grinblatt and Keloharju (2001) suggested that disposition effect will lower investors’ profitability and expand their losses. Sirri and Tufano (1998) documented that the disposition effect gives fund managers incentives to increase the riskiness of the portfolios given that management fees are proportional to fund size. According to the agency theory, this asymmetric performance-flow relation may generate moral hazard. For example, when the fund performance is high, the revenue increases as fund size growth. When the fund performance is poor, managers may have incentive to increase the riskiness of their worse portfolio. However, when the fund turns loss into gain really, investors will reward high performance funds (cash inflow increases significantly) but not discipline poor performance funds significantly. To put it the other way round, when manager’s high risk portfolio does not improve the poor

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\(^3\) Most of the literature examined the existence of disposition effect. Nevertheless, some researchers’ findings were contrary to others. For example, Sinha and Jog (2005) documented that investors tend to redeem fund with negative returns. Lehenkari and Perttunen (2004) found that capital losses reduce the selling propensity of investors but offered no direct support for the disposition effect in the Finnish stock market. They also found that both positive and negative historical returns reinforce the negative association between the selling propensity of investors and capital losses significantly.

\(^4\) For example, Odean (1998) found that the unsold losers return only 5% over the subsequent year, while winners that are sold would have returned 11.6%, which implies that the disposition effect will reduce investor returns.
performance, the disposition effect would be the main reason for insignificant redemption (Brown et al., 1996; Chevalier and Ellison, 1997; Shu et al., 2002; and Eser, 2005).

As to the impact of disposition effect on financial market, Odean (1998) indicated that the disposition effect will accelerate the financial market equilibrium, because when the prices go up, investors with profits would like to sell the stock in hand. This increase in supply will pull down the increasing prices. Oppositely, when the investors face losses, they will be reluctant to sell the security, and this will slow down the rapid drop in prices. Garvey and Murphy (2004) found that the professional traders in U.S. exist the disposition effect, this phenomenon may influence in the pricing of many U.S. equities because of the volume they traded is close to 16% of daily NASDAQ/NYSE share volume. Finally, Cici (2005) indicated that the performance is significantly negatively related to the disposition effect. That is, the bigger the disposition effect, the poorer the fund performance.

In Taiwan, many researches support that the investors exhibit the disposition effect. (Chou, et al., 2002; Shu et al., 2002; Shu and Lin, 2005; Shu, 2005 and Shu et al., 2005). Shu et al. (2002) examined Taiwanese mutual fund investors’ behavior from 1996 through 1999. They employed the following variables: past performance (raw return rate and Jensen’s $\alpha$), average net asset value (NAV) per-account, management fee, standard deviation of past returns and fund flow ratio. They found that Taiwanese small-amount investors prefer to invest large funds with well known and detest funds with high management fees. They provided evidence that small-amount investors display the disposition effect, and the disposition effect will cause the agency problem. In this study we propose a further rational explanation for the disposition effect in open-end mutual fund market by the ROLS-V model. Our ROLS-V model was proposed by Shu et al. (2002) for panel data of mutual fund flows for the Taiwan data. However, we made some revisions including sample period, sample size, methodology, and the definitions of variables. Past researches found that the existence of disposition effect have some differences in the phenomenon caused by disposition effect. For example, Sirri and Tufano (1998), and

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5 Recent studies have found evidence of the disposition effect in stock markets (Schlarbaum et al., 1978; Ferris et al., 1988; Odean, 1998; Weber and Camerer, 1998; and Shu et al., 2005), in the asymmetric performance-flow relation of mutual funds (Shu et al., 2002; and Sinha and Jog, 2005), in initial public offers (IPOs) markets (Brown et al., 2002; and Kaustia, 2004), in the futures (Locke and Mann, 2005; and Coval and Shumway, 2005), and in professional traders (Garvey and Murphy, 2004; and Scherbina and Jin, 2005).

7 They defined a disposition coefficient $\alpha=(S_{-}S)/(S_{+}+S_{-})$, where $S_{-}$ ($S_{+}$) be the number of sales if the price has gone up (down) in the last period. There are no disposition effect if $\alpha \leq 0$; there exist disposition effect if $\alpha > 0$.
Shu et al. (2002) indicated that mutual fund investors redeem losers insignificantly; Ippolito (1992) found that mutual fund investors tend to redeem losers significantly, and also flock to purchase winners. He pointed out that investors’ purchasing comprise around 0.9% of the fund’s net asset value (fund size), but redemption comprise around 0.35%. The proportion of losers’ trading volume is strongly more than winners’ significantly. We use ROLS-V model to analyze the behavior of Taiwanese investors. We also find two types of the disposition effect in Taiwanese market, their tendency was fail to flee from the extreme losers (excess return rate \(\leq -5.17\%\)) and redeem insignificantly from moderated losers (-5.17% \(\leq\) excess return \(\leq 0\%\)).

### III. Empirical Method

#### Model Specification

Among various researches that have contributed to the development of the disposition effect, there are two methods in empirical analysis: using questionnaire to collect data (e.g., Weber and Camerer, 1998) and using secondary transaction data (e.g., Odean, 1998; and Grinblatt and Keloharju, 2001). Weber and Camerer used a questionnaire to compute the disposition coefficient for the disposition effect\(^7\). Odean (1998) addressed “disposition spread” (\(\text{Disp}\)) to measure the disposition effect.\(^8\) In our study, we employ the ROLS-V to analyze the disposition effects in Taiwan open-end mutual fund markets.\(^9\)

In the following paragraphs, we will introduce the ROLS-V and the related model specification in detail. First, we estimate the following regression model by OLS:

\[
NF_{i,t} = \alpha + \beta_1 \text{Perform}_{i,t-1} + \beta_2 \text{LnSize}_{i,t} + \beta_3 \text{Turnover}_{i,t} + \beta_4 \text{Std}_{i,t} + \beta_5 \text{Fees}_{i,t} + \varepsilon_{i,t} \quad (1)
\]

Where \(NF_{i,t} = (\text{Purchase}_{i,t} - \text{Redeem}_{i,t})/\text{Size}_{i,t-1}\), that is, \(NF_{i,t}\) is calculated by the fund net

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\(^7\) The formula of disposition spread is as follows: \(\text{Disp}_{i,t} = Rg^i_t/(Rg^i_t + \text{Unrg}^i_t) - Rl^i_t/(Rl^i_t + \text{Unrl}^i_t)\), where \(Rg^i_t\) is the amount of realized gain on stock \(i\) at time \(t\); \(\text{Unrg}^i_t\) is the amount of unrealized gain on stock \(i\) at time \(t\); \(Rl^i_t\) is the amount of realized gain on stock \(i\) at time \(t\); \(\text{Unrl}^i_t\) is the amount of unrealized loss on stock \(i\) at time \(t\).

\(^8\) Grinblatt and Keloharju (2001) employ regression model to analyze the transactions of both individuals and institutions behavior. Other methodologies for disposition effect analysis include panel data regression model (Shu et al., 2002; Barber et al. Zheng, 2003), weighted least square (Cici, 2005), seemingly unrelated regression (Fiotakis and Philippas, 2004) and Logit regression (Grinblatt and Keloharju, 2001).
flow divided by the net assets value.\textsuperscript{10} To explain the performance-flow relation, we use raw return rate and excess return rate as the proxy variables of performance (\textit{Perform}). \textit{Size} (Net Asset Value; NAV) is the total asset of each fund. We take natural logarithms of total net assets (\textit{LnSize}) at time \textit{t}. Turnover rate of each fund (\textit{Turnover}) is the average of purchase turnover and sell turnover divided by NAV. Standard deviation (\textit{Std}) of funds return is used to measure fund’s total risk. We calculate the standard deviation (\textit{Std}) of the past twelve months returns. \textit{Fees} is defined as the total fee divided by the net assets value. In the regression model, the coefficient, \(\beta\), is the marginal effect of each independent variable on net flow ratio.

For example, the coefficient \(\beta_i\) implies the influence of past performance on current net flow ratio.

As mentioned above, we use both raw and excess returns in our study. Following Shapira and Venezia (2001) and Chevalier and Ellison (1997), we compute raw return rate (\(RR_{i,t}\)) by equation (2).

\[
RR_{i,t} = \frac{\text{Netvalue}_{i,t} - \text{Netvalue}_{i,t-1}}{\text{Netvalue}_{i,t-1}} (2)
\]

Where \(\text{Netvalue}_{i,t}\) is the net assets value on fund \(i\) at time \(t\). Since we can’t tell if the return outperform the benchmark by raw return. Therefore, we apply excess return to measure the investment performance.\textsuperscript{11} The equation is as follow:

\[
ER_{i,t} = RR_{i,t} - BR_t
\]

Where \(ER_{i,t}\) is the excess return. \(RR_{i,t}\) is the return on fund \(i\) at time \(t\), and \(BR_t\) is the return on the value-weighted market index of the Taiwan Stock Exchange (TSE) \((\text{Index}_{i,t} - \text{Index}_{i,t-1})/\text{Index}_{i,t-1}\) at time \(t\). By excess return rate (\(ER_{i,t}\)), we can realize investors’ investment performance relative to the value-weighted market index of the Taiwan Stock Exchange.

\textsuperscript{10} The definition of \(NF_{i,t}\) in our paper mainly follows that by Shu et al. (2002). And “\(Purchase_{i,t}\)” is the amount of monthly fund’s in-flows. “\(Redeem_{i,t}\)” is the amount of monthly fund’s outflows. However, some literature analyzes net fund inflows as follows: \(NF_{i,t} = TNA_{i,t}/TNA_{i,t-1} - (1 + RR_{i,t})\), where \(TNA_{i,t}\) denotes is the total net asset on fund \(i\) at time \(t\), \(RR_{i,t}\) is the raw return rate on fund \(i\) at time \(t\) (e.g., Jain and Wu, 2000; and Fiotakis and Philippas, 2004 \[\text{\textit{I}}\])

\textsuperscript{11} See Jorion’s (2003), and Chevalier and Ellison (1997)
As to average monthly total net asset \((\text{LnSize}_{i,t})\), Jain and Wu (2000), and Shu, et al. (2002) document that most individual investors prefer to invest in large mutual funds that are well known, hence we try to test the size effect in Taiwan by using the total net asset. Our measure is different with that by Shu et al. (2002), who used average size of account per investor, which is the total net asset divided by the number of investors.

Barber, Odean and Zheng (2003) indicated that investors concern the transaction costs. Yet, Shu et al. (2002) only concerned about management fee ratio. To capture all possible fees in the investment of funds, we try to use the total fee and divide it by NAV \((\text{Fees}_{i,t})\). That is, the variable \(\text{Fees}_{i,t}\) is the percentage of total fee to NAV. The total fees in our study include direct transaction cost (service charge and tax), operating expenses, management fee and insurance.

Following the same variable definition, the recursive threshold disposition effect model in variable is as follows:

\[
\text{NF}_{i,t} = \alpha^1 + \beta^1 \text{Perform}_{i,t-1} + \beta^2 \text{LnSize}_{i,t} + \beta^3 \text{Turnover}_{i,t} + \beta^4 \text{Stdev}_{i,t} + \beta^5 \text{Fees}_{i,t} + \varepsilon^i_{t,t}
\]

If \(\text{Perform}_{i,t-1} > R_c\); \hspace{1cm} (3-1)

\[
\text{NF}_{i,t} = \alpha^2 + \beta^1 \text{Perform}_{i,t-1} + \beta^2 \text{LnSize}_{i,t} + \beta^3 \text{Turnover}_{i,t} + \beta^4 \text{Stdev}_{i,t} + \beta^5 \text{Fees}_{i,t} + \varepsilon^2_{t,t}
\]

If \(\text{Perform}_{i,t-1} \leq R_c\) \hspace{1cm} (3-2)

Where \(R_c\) is the threshold value of past performance which is used to differentiate between losers (less than the threshold value) and winners (more than the threshold value). The value \(R_c\) could be any number, not necessarily to be zero. In equation (3-1) and (3-2), if the disposition effect exists, we will observe significantly positive \(\beta^1\) and insignificant \(\beta^2\). It means investors will tend to purchase funds that perform well in the recent past (implied by \(\beta^1 > 0\)) and they will not redeem funds with poor performance (implied by insignificant \(\beta^2\)).
Grinblatt and Keloharju (2001) documented that both moderate and extreme losses decrease the propensity to sell, and investors with extreme capital losses will have less propensity to sell than those with moderate losses. We combine our model with the concept from Grinblatt and Keloharju’s (2001), and further, we try to characterize the losers fund by the “ROLS-V model” and distinguish the extreme losses and moderate losses by the threshold values. The foregoing equation (4) can be extended to equation (4-1) as follows:

\[ NF_{i,t} = \alpha^1 + \beta^1_{i} \text{Perform}_{i,t-1} + \beta^1_{i} \text{LnSize}_{i,t} + \beta^1_{i} \text{Turnover}_{i,t} + \beta^1_{i} \text{Stddev}_{i,t} + \beta^1_{i} \text{Fees}_{i,t} + \epsilon^1_{i,t} \]

If \( \text{Perform}_{i,t-1} > R_C \) ; \( 4-1 \)

\[ NF_{i,t} = \alpha^2 + \beta^2_{i} \text{Perform}_{i,t-1} + \beta^2_{i} \text{LnSize}_{i,t} + \beta^2_{i} \text{Turnover}_{i,t} + \beta^2_{i} \text{Stddev}_{i,t} + \beta^2_{i} \text{Fees}_{i,t} + \epsilon^2_{i,t} \]

If \( R_{LC} \leq \text{Perform}_{i,t-1} \leq R_C \) \( 4-2 \)

\[ NF_{i,t} = \alpha^3 + \beta^3_{i} \text{Perform}_{i,t-1} + \beta^3_{i} \text{LnSize}_{i,t} + \beta^3_{i} \text{Turnover}_{i,t} + \beta^3_{i} \text{Stddev}_{i,t} + \beta^3_{i} \text{Fees}_{i,t} + \epsilon^3_{i,t} \]

If \( \text{Perform}_{i,t-1} < R_{LC} \) \( 4-3 \)

In equations (4-1)-(4-3), there are two threshold values, \( R_C \) and \( R_{LC} \), which enable us to separate the investors into moderate losses (\( R_{LC} \leq \text{Perform}_{i,t-1} \leq R_C \)), extreme losses (\( \text{Perform}_{i,t-1} < R_{LC} \)) and winners(\( \text{Perform}_{i,t-1} > R_C \)). If the disposition effect exists, we will observe significantly positive \( \beta^1 \), insignificant \( \beta^2 \), and significantly negative \( \beta^3 \). That is, we conjecture that investors are more reluctant to redeem their loss funds, especially when their investment goes from bad to worse performance. We anticipate that fund performance is positively correlated with the amount of redemptions. In other words, fund performance is negatively correlated with net flow ratio of each fund.

Further, we not only test the disposition effect but also discuss investors’ decision making facing uncertainty. In equations (3-1)-(3-2) and (4-1)-(4-3), the standard deviation (\( \text{Std}_{i,t} \)) is calculated from monthly raw (excess) return rates of the
past 12 months. We treat standard deviation ($Std_{i,t}$) as fund’s total risk. If the investor’s behavior is consistent with prospect theory, under that, individuals formalized an S-shaped valuation function which is concave above $R_C$ (risk-aversion $\beta_1^l < 0$) and convex below $R_{i,C}$ (risk-seeking $\beta_1^h > 0$).

Model Estimation

To estimate the coefficients in ROLS-V model, we, first, arranged the variables of each observation according to the value of the threshold variable; that is, place the observations in order based on the performance for that period, from the lowest net flow rate progressing to the highest. Second, choose performance as a proposed threshold that is sufficiently small, yet large enough to allow Equation (2) to be estimated. Estimate equation (2) and obtain the t-ratio on $\beta_1^l$, the coefficient on performance. Save the t-ratio for the later use. Third, increase the proposed threshold sequentially, and repeat step two. Finally, plot the t-ratios of the estimated performance coefficients against $R_C$ the proposed performance thresholds. By using ROLS-V, we can observe recursive t-ratios in a graphical manner, which greatly simplifies the process of identifying the number and location of the threshold values objectively. For example, we estimate Equation (3-1) by OLS using the first “n” (say n=60) arranged observations. Second, perform a one-step ahead forecast of the dependent variable and obtain the recursive t-ratio (ROLS-V bring 5661 recursive t ratios from n=60 to n=5720 one by one). After obtaining the threshold values, we employ the threshold values as the reference points to analysis Taiwanese investors’ behavior respectively.

IV. Data

We obtain the unique monthly data from July 2000 through February 2005 for 130 Taiwan open-end mutual funds from SITCA and TEJ. Our primary variables include return on the value-weighted market index of the TSE, total net assets, past month return (%), fund size, month turnover ratio (%), month total fee and net flow ratio (%). Each variable contains 7,280 records. The “TSE index” is obtained from TEJ data base, and others are collected from SITCA. In Taiwan, although the equity ownership of mutual funds is small (8.99% of the market value in Feb. 2005), open-end mutual

12 Standard deviation is calculated from monthly fund return of the past 12 month. Hence, our sample size is reduced from 7280 to 5720.
fund investors comprise around 60.21% of all the investors in the market. This is the reason why we choose the open-end mutual fund market as our objective. Moreover, there is no survivorship bias (Malkiel, 1995) in our research sample, because no funds were defunct during our observation period.

Summary statistics

The descriptive statistics of the sample is presented in Table 1. The table shows the means, medians, standard deviations, minimum and maximum values of each series. Table 1 shows that the mean of monthly net fund flow rate is around 0.002. We find that the funds on average performed worse than the market for our sample, but mean raw return rate is positive (0.47%). Furthermore, the raw (excess) return rate of the best performance fund is around 40.18% (17.08%), and the worst is -22.55% (-14.88%). Table 1 displays that the fund size of our sample on average is around NT 1,380.07 million. Turnover rate of each fund on average is 34.56% per month, moreover, the highest turnover rate is 213.97% per month and the lowest is around 0% per month. Total fee ratio of our sample on average is around 0.35% of the net asset value per month, the maximum ratio is around 5.46% per month. Standard deviation on average is around 8.4% per month. Table 2 shows the correlations of all the independent variables, and none of the correlations exceeds 0.7, which implies there exists no high correlation between independent variables.

V. Empirical Results

The Regression Analysis of Net Fund Flows ($NF_{it}$)

Table 3 shows the OLS regression results of equation (1) using raw return rate ($RR$) and excess return rate ($ER$) as the performance measure respectively. The results were quite similar in both regressions, and consistent with the past research (e.g., Shu et al., 2002). From the results, we find the influences of $RR$ and $ER$ on $NF_{it}$ are both significantly greater than zero, which means Taiwanese investors prefer funds with good past performance. Moreover, the variables of turnover and fund size have positive impact on net fund flows, and total expenses ($Fees$) have significant negative effect.
The Results of ROLS-V Model

To examine the existence of disposition effect in Taiwan mutual fund market, we further apply Tsay’s (1989) ROLS-V regression method to find the reference points (threshold values). As described in the previous section, we define the funds that perform better (worse) than the threshold value as winners (losers).

First, we estimate the ROLS-V model by estimating equation (3-1) on the first 60 arranged observations. We progress sequentially through the arranged data. Figure 2 provides the scatterplot of the t-ratios of the raw returns versus fund flow ratio. Recall that equations (3-1) and (3-2) are representatives of a special case where there is only one threshold value and thus one raw return rates. There could, of course, be more thresholds. Figure 2 shows that there is one significant peak to the t-ratios of the coefficient on the past performance. The peak is at 9.04% which implies that there is one significant threshold value (reference point).13 Thus, we find two performance regimes in our model. The first regime there the raw return rate is below 9.04%, in which we call the fund as the losers. The second regime there the raw return rate is exceeds 9.04%, in which we call the fund as the winner. The number of observations in each regime is 5064, and 5065, respectively.

Table 4 presents the ROLS-V results for both losers (RR< 9.04%) and winners (RR> 9.04%). We find that the coefficients to the fund size (LnSize) and average turnover ratio (Turnover) are significantly positively related to fund flow. However, the coefficient of the total fund fees (Fees) is negative statistically significant, which implies Fees has negative effects on net fund flow. The estimated coefficients of the risk measure (StdRR and StdER) are insignificant in our study. This result implies that Taiwanese investors tend to chase the past winners but they seem to ignore the risk. This result is similar to the past research (Jain and Wu, 2000 and Shu et al. 2002). Besides, we find that Taiwanese investors tend to invest in actively managed funds with high turnover, pay low fees and large size funds.

Figure 3 provides the scatterplot of t-ratios of the excess return rate versus the fund flow ratio. Figure 3 shows clearly that there are two significant peaks to the t-ratios of the coefficient on excess return. The peaks are at -5.17% and -0.4% which implies that there are two significant thresholds, and thus three regimes. As marked by

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13 Since large sample size might cause insensitivity to detecting the structure change points, in our study, we apply fixed window recursive model to capture the real threshold values.
grey shadows in Figure 3, the first regime is when the excess return rate is below -5.17% and we call the fund as “extreme losers.” The second regime describes the funds with excess return rates between -5.17% and -0.4%, which we call them “moderate losers”. The third regime is the regime where the excess return rate exceeds -0.4%, and we call the funds as winners.

Table 5 reports the ROLS-V results of the three regimes found by Figure 3. For regime 1, the case of extreme loser, the coefficient of excess return rate is -0.002, and is significant at the 10% significance level. This implies when the performance of fund is worse enough (i.e., extreme loser, ER<-5.17%), investors will reduce the redemption of bad-performing fund. In regime 2, the moderate losers, the coefficient of excess return rate is -0.009 and is insignificant. This insignificant coefficient implies that investors do not dispose their fund investment actively. In regime 3, the winners, the results shows that the coefficient of excess return rate is statistically significant (0.004). It means that positive excess returns will cause the increase of net flow.

Base on the results for regimes 1 and 2, we find that investors are more and more reluctant to redeem their losers when the fund performance is getting worse and worse. Our finding support that Taiwanese investors exhibit the “less willing redemption disposition effect.” We find that Taiwanese investors redeem their losers insignificantly when their investments are moderate loss (-5.17% ≤ ER < -0.4%), we call this phenomenon as the “insignificant redemption disposition effect.” When the excess return rate almost outperform the market (excess return > 0%), investors tend to chase funds (winners). Compare with this two types of disposition effects, “insignificant redemption disposition effect” and “less willing redemption disposition effect”, the later is more critical than the fore. It implies that investor’s attitudes to redeeming loser are different between extreme losers and moderate losers. We find that investors’ redemption is not significant for moderate losers and they are more reluctant to redeem extreme losers. Similar results relating to Finland stocks could be found in Grinblatt and Keloharju’s (2001) research. Yet Grinblatt and Keloharju (2001) didn’t predict that investors exhibit the “insignificant redemption disposition effect”.

To sum up, our results show that: (1) Investors are more likely reluctant to redeem the fund underperforming the bench-market (e. g., TSE). (2) Investors redeem the fund insignificantly when their investment is moderate loss (the regime is between -5.17% and -0.4%). (3) Investors tend to chase past winners significantly when the fund’s excess return rate exceeds -0.4%.
VI. Conclusion and Discussion

In this study, there are two differences from the existing reference. First, in addition to raw return rate, we also use excess return rates as the performance measure because it is easier to be understood and computed by investors. Second, we employ Tsay’s method to identify the threshold values (reference points). This method utilizes recursive t-ratios in a graphical manner that greatly simplifies the process of identifying the number and location of the threshold values. Moreover, past research use positive (negative) raw return rate to identify winners and losers. However, in this paper, we define winners and losers according to threshold values objectively. To get better insight of disposition effects, we separate losers into “extreme losers” and “moderate losers” respectively.

When using raw return rate as the performance measure, our results are consistent with the past research and the threshold value (reference point) used to define winner and losers is 9.04%. That is, Taiwanese mutual fund investors exhibit disposition effect, which we call it as “insignificant redemption disposition effect”. On the other hand, when using excess return rate to measure performance, the threshold values are -5.17% and -0.4%. The two values separate funds into three regimes: extreme losers, moderate losers, and winners. In extreme loss regime, we find Taiwanese investor exhibit the “less willing redemption disposition effect”. In moderate loss regime, we find there exists “insignificant redemption disposition effect”. “Insignificant redemption disposition effect” indicates that investors did not redeem moderate losing funds significantly. However, “less willing redemption disposition effect” indicates that investors are less willing to redeem extreme losses due to their reluctance to realize loss. This is similar with the findings by Odean (1998) and Grinblatt and Keloharju (2001). From the facts we found, some implication about moral hazard could be derived. First, for fund managers, when they observe the existence of “less willing redemption disposition effect”, they might have the incentives to increase the riskiness of their weak performance portfolio given that management fees are proportional to fund size. If fund managers turn loss into gain successfully, investors might evaluate this kind of funds as funds with high performance and tend to chase these high performance funds. This will cause fund sizes grow and so does the fee revenue. On the contrary, if fund managers fail to turn loss into gain, the funds won’t be redeemed significantly and the fees won’t decrease as much because of disposition effect. This is what we call “insignificant redemption
disposition effect”. The above moral hazard problem would be more serious as investors exhibit “less willing redemption disposition effect”. That is to say, when the “less willing redemption disposition effect” exists in the fund market, this market will be more likely to come about market failure than the market with “insignificant redemption disposition effect”. For this reason, the government should try to regulate the moral hazard behavior of fund managers to protect investors.

In addition to the discussion about disposition effect, the empirical results also provide some information about the influence of other variables on investors’ behavior (fund net flows). Table 6 gives the summary of empirical results. We find that the coefficient on the fund size is significantly positive in winner regime and insignificant in the other two regimes. This result reflects that Taiwanese investors prefer large funds when the funds have good performance. As to the impact of turnover, we find that, in the winner regime, the coefficient of turnover is significantly positive. This result shows that investors prefer to purchase funds with high turnover rates. The coefficient of standard deviation is significantly positive to the fund flow ratio in the winner regime, this implies that investors will be risk seeker when they are in the domain of gain.

In Table 6, we also find investors’ behavior tend to consistent in the loser regimes except the impact of excess return in the extreme loses regime ($ER < -5.17\%$). In the loser regimes, we find that the coefficient of standard deviation (fund’s total risk measure) is significantly negative to the fund flow ratio. This phenomenon implies that investors will be risk aversion in the loser regimes. In other words, Taiwanese investors are risk seeker (risk aversion) in the domain of gain (loss). Under the prospect theory, individuals maximize an S-shaped valuation function that is concave in regard to gains and convex in regard to losses. This reflects risk aversion in the domain of gain and risk seeking in the domain of losses. Although much literature (Shefrin and Statman, 1985; Odean, 1998; Weber and Camerer, 1998; Grinblatt and Keloharju, 200; and Shu et al., 2005) expounds the reason of disposition effect in the light of prospect theory, they did not examine whether prospect theory exists or not, neither did they discuss if the disposition effect is derived from the prospect theory. Our results conflicts with prospect theory’s implications. In other words, our empirical results evidence that Taiwanese investors’ behavior is inconsistent with prospect theory in the open-end mutual fund market. Finally, we find that (see table 6) the coefficient on the total expense is significantly negative. This result probably reflects that Taiwanese investors do not prefer the funds with high fee ratio. Moreover, we also find that Taiwanese investors prefer large funds only when their performance is good enough.
Our empirical conclusion could be summarized as follow: First, we show two types of the disposition effect in Taiwan open-end mutual fund market. Second, Taiwanese investors exhibit the “insignificant redemption disposition effect” when their investment is extreme losses and exhibit the “less willing redemption disposition effect” when their investment is moderate losses. Further, our finding is not consistent with prospect theory’s implications because Taiwanese investors are risk seekers in the domain of gains and risk-aversion in the domain of losses. Taiwanese investors dislike funds with high total fees and prefer relatively active funds (high turnover ratio). They have the tendency to purchase the funds with high historical performance and prefer investing in large mutual funds when the fund’s performance is good enough.
Table 1. Summary statistics of all variables

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Mid</th>
<th>Stdev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fund net flow</td>
<td>0.002</td>
<td>-0.003</td>
<td>0.228</td>
<td>-1.131</td>
<td>14.179</td>
</tr>
<tr>
<td>Raw return rate</td>
<td>0.47%</td>
<td>-0.24%</td>
<td>8.12%</td>
<td>-22.55%</td>
<td>40.18%</td>
</tr>
<tr>
<td>Excess return rate</td>
<td>-0.24%</td>
<td>-0.14%</td>
<td>4.10%</td>
<td>-14.88%</td>
<td>17.18%</td>
</tr>
<tr>
<td>Size (NT Million)</td>
<td>1,380.07</td>
<td>914.67</td>
<td>1389.25</td>
<td>24.32</td>
<td>10.814</td>
</tr>
<tr>
<td>Turnover ratio</td>
<td>34.56%</td>
<td>28.97%</td>
<td>25.89%</td>
<td>0.00%</td>
<td>213.97%</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.084</td>
<td>0.072</td>
<td>0.032</td>
<td>0.026</td>
<td>0.199</td>
</tr>
<tr>
<td>Total Fees</td>
<td>0.35%</td>
<td>0.31%</td>
<td>0.21%</td>
<td>0.03%</td>
<td>5.46%</td>
</tr>
</tbody>
</table>

Table 2. The correlations among variables

<table>
<thead>
<tr>
<th></th>
<th>ER</th>
<th>RR</th>
<th>LnSize</th>
<th>Turnover</th>
<th>StdRR</th>
<th>StdER</th>
<th>Fees</th>
</tr>
</thead>
<tbody>
<tr>
<td>ER</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LnSize</td>
<td>0.0585</td>
<td>0.0911</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnover</td>
<td>0.0022</td>
<td>0.0540</td>
<td>-0.2814</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>StdRR</td>
<td></td>
<td>-</td>
<td>0.0655</td>
<td>0.0234</td>
<td>0.2020</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>StdER</td>
<td>0.0035</td>
<td></td>
<td>-0.0168</td>
<td>0.2485</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Fees</td>
<td>-0.0062</td>
<td>0.0117</td>
<td>-0.264</td>
<td>0.6683</td>
<td>0.1257</td>
<td>0.1805</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: ER: $ER_{t,i} = RR_{t,i} - BR_t$, where $ER_{t,i}$ is the excess return. $RR_{t,i}$ is the return on fund $i$ at time $t$, and $BR_t$ is the return on the value-weighted market index of the Taiwan Stock Exchange (TSE) $(\frac{Index_t - Index_{t-1}}{Index_{t-1}})$ at time $t$; StdER: The standard deviation of excess return; RR: Raw return rate of past one month; LnSize: The natural logarithms of total net assets; Turnover: Turnover rate of each fund is the average of purchase turnover and sell turnover divided by NAV. StdRR: The standard deviation of raw return rate. Fees: The total fees ratio is defined as the total fee divided by the net assets value.
Table 3 The Regression Analysis of Net Fund Flows (OLS model)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>RR-OLS</th>
<th></th>
<th>ER-OLS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coefficient</td>
<td>t-ratio</td>
<td>coefficient</td>
<td>t-ratio</td>
</tr>
<tr>
<td>α</td>
<td>-0.139**</td>
<td>(-1.96)</td>
<td>0.083</td>
<td>(-0.85)</td>
</tr>
<tr>
<td>RR</td>
<td>-0.001**</td>
<td>(2.28)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ER</td>
<td>-</td>
<td>-</td>
<td>0.002**</td>
<td>(2.09)</td>
</tr>
<tr>
<td>LnSize</td>
<td>0.007**</td>
<td>(2.096)</td>
<td>0.008**</td>
<td>(2.30)</td>
</tr>
<tr>
<td>Turnover</td>
<td>0.162***</td>
<td>(10.19)</td>
<td>0.167***</td>
<td>(10.52)</td>
</tr>
<tr>
<td>StdRR</td>
<td>0.029</td>
<td>(-0.30)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>StdER</td>
<td>-</td>
<td>-</td>
<td>0.049</td>
<td>(-0.285)</td>
</tr>
<tr>
<td>Fee</td>
<td>-18.156**</td>
<td>(-9.58)</td>
<td>-18.199***</td>
<td>(-9.60)</td>
</tr>
</tbody>
</table>

Sample size: 5720
\( \bar{R}^2 \): 0.281

Figure 2 Recursive t-ratio (using RR as performance measure)
### Table 4 The ROLS-V Regression Results (using RR as performance measure)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Losers $(RR \leq 9.04%)$</th>
<th>Winners $(RR &gt; 9.05%)$</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coefficient</td>
<td>t-ratio</td>
<td>coefficient</td>
<td>t-ratio</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>-0.123</td>
<td>(-1.55)</td>
<td>0.083</td>
<td>(-0.85)</td>
</tr>
<tr>
<td>$RR$</td>
<td>-0.001</td>
<td>(-1.52)</td>
<td>0.002*</td>
<td>(1.90)</td>
</tr>
<tr>
<td>$\ln Size$</td>
<td>0.006</td>
<td>(-1.61)</td>
<td>0.004</td>
<td>(-0.86)</td>
</tr>
<tr>
<td>Turnover</td>
<td>0.166***</td>
<td>(9.42)</td>
<td>0.580***</td>
<td>(14.83)</td>
</tr>
<tr>
<td>$StdRR$</td>
<td>0.012</td>
<td>(-0.104)</td>
<td>0.049</td>
<td>(-0.285)</td>
</tr>
<tr>
<td>Fee</td>
<td>-16.774***</td>
<td>(-8.39)</td>
<td>-111.613***</td>
<td>(-15.90)</td>
</tr>
</tbody>
</table>

Sample size: Losers 5064, Winners 656

$R^2$: Losers 0.306, Winners 0.314

Note: 1. *, **, *** denote significant at 10%, 5% and 1% levels respectively. 2. $RR$ is denoted as raw return rate.

### Table 5 The ROLS-V Regression Results (using ER as performance measure)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Extreme Losers $(ER &lt; -5.17%)$</th>
<th>Moderate Losers $(-5.17% \leq ER &lt; -0.4%)$</th>
<th>Winners $(ER &gt; -0.4%)$</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coefficient</td>
<td>t-ratio</td>
<td>coefficient</td>
<td>t-ratio</td>
<td>coefficient</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.063</td>
<td>(-1.128)</td>
<td>-0.137</td>
<td>(-0.726)</td>
<td>-0.163***</td>
</tr>
<tr>
<td>$ER$</td>
<td>-0.002*</td>
<td>(-1.927)</td>
<td>-0.009</td>
<td>(-1.388)</td>
<td>0.004***</td>
</tr>
<tr>
<td>$\ln Size$</td>
<td>0.003</td>
<td>(-1.033)</td>
<td>0.01</td>
<td>(-1.093)</td>
<td>0.007***</td>
</tr>
<tr>
<td>Turnover</td>
<td>0.425***</td>
<td>(13.027)</td>
<td>0.394***</td>
<td>(8.773)</td>
<td>0.068***</td>
</tr>
<tr>
<td>$StdER$</td>
<td>-0.543***</td>
<td>(-2.349)</td>
<td>-1.576***</td>
<td>(-2.385)</td>
<td>0.253*</td>
</tr>
<tr>
<td>Fee</td>
<td>-75.955***</td>
<td>(-13.459)</td>
<td>-44.923***</td>
<td>(-7.871)</td>
<td>-7.856***</td>
</tr>
</tbody>
</table>

Sample size: Extreme Losers 546, Moderate Losers 2054, Winners 3119

$R^2$: Extreme Losers 0.321, Moderate Losers 0.306, Winners 0.332

Note:* *, **, *** denote significant at 10%, 5% and 1% levels respectively.
Table 6  Regression Summary (using ER as performance measure)

<table>
<thead>
<tr>
<th>Regime</th>
<th>Situation</th>
<th>ER</th>
<th>LnSize</th>
<th>Turnover</th>
<th>StdER</th>
<th>Fees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme</td>
<td>$ER&lt;-5.17%$</td>
<td>-</td>
<td>Ð</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>losers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>$-5.17%\leq ER&lt;-0.4%$</td>
<td>Ð</td>
<td>Ð</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>losers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winners</td>
<td>$ER&gt;-0.4%$</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: “-” and “+” denote that the variables is significant at 10%, 5% or 1% levels. If the variable is insignificant, it will be added as “Ð”) or “ñ”.

Figure 3 Recursive t-ratio (using ER as performance measure)
Reference


