# A SEEMINGLY UNRELATED REGRESSION ANALYSIS ON THE TRADING BEHAVIOR OF MUTUAL FUND INVESTORS

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### ABSTRACT

*This paper provides a comprehensive investigation on the causality relationship between fund performance and trading flows. We analyze if investors behave asymmetrically in fund purchasing and selling by seemingly unrelated regression which comprises several individual relationships that are linked by the fact that their disturbances or the error terms are correlated. The empirical result shows a significantly negative relationship between fund performance and purchase flows for domestic funds. The magnitude of domestic funds redemption negatively affects current return, but not for international funds. As previous fund return positively affects current net flows, the further lagged performances have no significant impact on the trading flows, revealing that fund investors are sensitive only to short-term past*

*performance. Most importantly, while negative fund performance leads to the increases in redemption, positive performance contrarily leads to the decreases in purchase. The evidences strongly indicate an asymmetry behavior of fund investors in the return-purchase causality relations.*

**Keywords:** *Fund performance, Fund flows, trading behavior, Seemingly unrelated regression.*

## 1.  INTRODUCTION

The behavioral difference between purchase and redemption of fund investors can provide valuable management implications for fund managers. It is beneficial to know investors' attitudes toward trading with poor or good fund performance. Purchase could depend on investors' demand, the option to sell shares at any time, and could also be another way for investors to request redemption of outstanding fund units or shares. Therefore, one can study the open-end fund transactions of investor purchases and redemptions in accordance with the fund net value that is traded under normal conditions. Previous literature explored the relationship between fund performance and its flow, but most of them focused on the net flow (Ippolito, 1992; Carhart, 1997; Goetamann and Peles, 1997; Chevalier and Ellison, 1997; and Sirri and Tufano, 1998) rather than on the purchase and redemption flows. Focuses only on the view of net flow point is likely to lose investor's decision-making process. Furthermore, it cannot understand detailed trading decisions. Therefore, this article looks at the fund flows in three parts—purchase, redemption, and net flows to discuss the fund's investment behavior. We use seemingly unrelated regression (SUR) to observe if the current and deferred fund performance impacts the fund flows. Fund flows may be affected by unknown factors that externally affect research results. Adopting the SUR models to observe current and deferred returns that affect the fund flows can effectively reduce the empirical results bias for residuals of the regression model. This article proceeds as follows. Section 2 provides research purpose, samples, research periods, and the statistical models. Section 3 provides the empirical evidences of the following questions: (1) the relationship between fund flows and returns linked to various types of domestic fund investors; (2) whether trade asymmetry exists in the relationship between fund returns in the domestic fund market and investment behavior; (3) whether policyholders who used various purchase and redemption methods held various views about return signals; and (4) whether the investment behaviors of policyholders in various risk groups influenced return factors at varying degrees.. Finally, Section 4 concludes the paper.

## 2.  RESEARCH METHODS

We can look at whether fund performance will impact fund flows and whether the current flow can be used to speculate future performance. Many scholars explore the relationship between fund performance and flows. The paper analyzes the trading behavior of mutual fund investors in an onshore fund and provides a future reference for mutual fund investors.

### 2.1.  Research samples

Our sample focuses on Taiwan domestic funds from the *Taiwan Economic Journal (TEJ)*. The research period was from May 1, 2007 to December 31, 2011. The data drawn from the *TEJ* database included all types of domestic funds in Taiwan, monthly fund flows, the purchase prices of monthly funds, the redemption prices of monthly funds, the net value of funds at the end of each month, and the net asset value of funds. Domestic funds are divided into

equity, balanced, and bond funds according to investment objective. Allocation of investment objective is as shown in Table 1. Equity funds are much greater than the others; the share is more than 50%, balance funds are less than 10%, and bond funds are 10%. Descriptive statistics can aggregate meaningful explanations and provide the average and distribution for sample data. This study will analyze the purchase, redemption, net assets, net flow, and fund returns to understand the distribution of those relevant variables. Table 2 indicates the statistical results. The study sample is divided into equity funds, balanced funds, and bond funds, respectively. We can understand the sample distribution by the different investment groups. For the sample distribution, the balance funds' purchase and redemption are more centralized than the equity and the bond funds. Therefore, investment decisions are more similar between different investors.

## 2.2. Research methods

This study investigated whether fund inflows and outflows were affected by return factors. Warther (1995) and Edwards and Zhang (1998) have defined fund flows as the difference between the amount of purchases and the amount of redemptions (i.e., the value obtained by subtracting the amount of redemptions from the amount of purchases). By referring to Johnson (2010), the flow of fund holders was calculated in this study. Because the total net assets of funds affect fund flows, the flow of fund holders is equal to the sum of the fund level and net assets during the entire research period.
The calculation formula is:

$$Flow_{i,t} = \sum_{2}^{i} Dollar_{i,t} / TNA_{i,t-1} ,$$

where *Flow* denotes fund flows, *Dollar* denotes the total mutual funds at the $t^{th}$ phase, *TNA* denotes the total net assets of funds, *i* denotes the $i^{th}$ fund, and *t* denotes time. As indicated by previous studies, this definition considers the influence of asset size on total fund investment and therefore suitable for this study. Original return is the difference between the per-unit net value on a current day and the per-unit net value on a previous day. Because this study considered the influence of cash dividends on original returns, the rate of return is $Return_{i,t} = (v_{i,t} * Adj_{i,t} - v_{i,t-1}) / v_{i,t-1}$, where $Adj_{i,t} = v_{i,t-1} / (v_{i,t-1} - Div_{i,t})$, where *Return* denotes the rate of fund return, *V* denotes fund net value, *Adj* denotes adjustment factor, *Div* denotes cash dividend, *i* denotes the $i^{th}$ fund, and *t* denotes time. The adjustment factor that includes cash dividends can reflect the rate of actual return.

This study adopted a SUR model to investigate the relationship between fund flows and returns for various types of investors, various investment targets, and various purchase and redemption methods. In this study, net flows were decomposed into purchase inflows and redemption outflows to examine whether the relationship between purchases and sales by investors was a symmetric relationship. In this study, the relationship between fund flows and returns under various conditions was investigated by using the SUR model proposed by Zellner (1962) to replace a typical regression model and by using an ordinal least squares (OLS) method to estimate parameters. The SUR equation is as follows: $y_{\mu t} = \chi \beta_{\mu t} + \varepsilon_{\mu t}, \mu = 1,...,N; t = 1,...,T$ ; that is, $y_{\mu t} = \chi \beta_{\mu} + \varepsilon_{\mu t}, \mu = 1,...,N$ , where $y_{\mu}$ denotes the vector of (T × 1), $x_{\mu}$ denotes (T × $\beta_{\mu}$), and $\varepsilon_{\mu}$ denotes the model parameter for ($\beta_{\mu}$ × 1).

The SUR equation can be expressed by using the following matrices:

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_N \end{bmatrix} = \begin{bmatrix} x_1 & 0 & \cdots & 0 \\ 0 & x_2 & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & x_N \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_N \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_N \end{bmatrix}$$

In a SUR model, the variables used in this study can be expressed as follows: $Flow_{i,t} = (Return_{i,t} Return_{i,t-1})$, where *Flow* denotes fund flow, *Return* denotes fund return, *i* denotes the *i*[th] fund, and *t* denotes time. This formula can be used to examine the impact of current and deferred returns on current fund flow and to investigate the investment behaviors of various types of investors in the Taiwanese mutual funds market. Zellner (1962) assumed that residual errors varied heterogeneously and were cross-sectional correlated errors; that is, a correlation existed among error terms. Therefore, the error terms of a regression model probably included some determinants that had the same effects as a dependent variable and further affected the error terms to some degree; thus the variance of error terms was a nondiagonal matrix. An OLS model was not an adequate method for estimating coefficients. The reason for using a SUR model to replace an OLS model is that although these two models yield similar results, the structure of a SUR model is conducive for explaining cross-sectional factors. In addition, for identical parameters, the estimated coefficients and standard deviation of a SUR model is 25% of the estimated coefficients and standard deviation of an OLS model, indicating that the SUR model can more accurately estimate model parameters (Lee & Forbes, 1980; Bolton, 1989). This study adopted a SUR model to examine the relationship between investment flows and returns caused by the purchase of domestic funds through investment-linked products and to investigate whether a difference existed in investment behavior between policyholders who purchased funds through investment trust and consulting companies or banks. In other words, this study investigated whether the investment behaviors of fund investors who adopted various investment methods were similar.

## 3. EMPIRICAL RESULTS

Previous literature indicates that fund return and net flow share a positive relationship, but changes in net flow are related to fund inflow purchase and not solely redemption. This indicates that the investors' purchase decision is related to a fund's high returns, but their redemption decision is not significantly associated with fund return (O 'Neal, 2004; Johnson, 2010). In this paper, to verify whether fund return will affect the fund flow, we divide the fund performance into 10 divisions. Division 1 indicates that the fund performance is in the worst 10%, whereas division 10 indicates that the fund performance is in the best 10%. Thus, we can analyze whether high fund return can attract more capital inflow. The research period is April 19, 2007 to December 31, 2011. Figure 1 shows the relationship between the fund flow and return in the different groups of return classification of the Taiwan onshore fund. This figure demonstrates that purchase and redemption undergo a large change at deciles 4 to 7. However, the fund return at the worst 40% has more trends consistent with purchase and redemption. The net flow influenced purchase at the best fund return of 20%. The results would explain that an investor's purchase decision is relative to high fund return and cannot explain the dramatic changes at deciles 4 to 7. It only shows that fund flow and return have a

substantially consistent trend. Previous studies noted that prior fund performance can trigger a response in fund flow, that is, fund return can affect fund investors' decisions. This study uses the SUR model to analyze the prior fund return impacts on the net flow of deferred purchases. Table 3 shows the relationship between net fund flow and fund return on the Taiwanese onshore fund from April 19, 2007 to December 31, 2011. The table includes the three SUR statistical models to explain the relationship between net fund flow and fund return. The variables include six prior fund returns, a dummy variable, and constant terms. The estimation result is multiplied by 100, and it shows the impact on the fund benchmark of each variable change of 1%. The results indicate that fund return has a significant positive correlation with fund flow and domestic fund net flows only have an impact on the current return. Higher fund return usually attracts capital investment. When we sell an investment without considering the return level, this phenomenon is referred to as "buy and sell asymmetric behavior." In this paper, we explore different investment funds within the Taiwan onshore fund to see whether buy and sell asymmetric trading behavior exists. We separated data into net flow, purchase, and redemption, and used SUR model to analyze the impact on fund return. Net flow, purchase, and redemption are independent variables in Table 4. The empirical results show that fund flow has a significant negative correlation with current return in the onshore fund; however, prior return will produce a positive effect on current flow. As for other prior returns, they have no significant effect on fund flow. We also found that fund return has a significant negative correlation with redemption flow, but only for one prior return. The flow of redemption only affects the current funds in the Taiwan onshore fund.

## 4. CONCLUSION

To explore the general fund purchase behavior, we divided the research sample into equity, balanced, and bond funds by investment risk to better understanding investors' investment propensity under different risk preferences. For the sample distribution, the balance funds' purchase and redemption are more centralized than the equity and the bond funds. The empirical result shows a significantly negative relationship between fund performance and purchase flows for domestic funds. The magnitude of domestic funds redemption negatively affects current return, but not for international funds. As previous fund return positively affects current net flows, the further lagged performances have no significant impact on the trading flows, revealing that fund investors are sensitive only to short-term past performance. Most importantly, while negative fund performance leads to the increases in redemption, positive performance contrarily leads to the decreases in purchase. The evidences strongly indicate an asymmetry behavior of fund investors in the return-purchase causality relations.

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*Table 1: Descriptive statistics of onshore fund characters in Taiwan*

| Fund Classification | Onshore fund | |
|---|---|---|
| | Number of funs(%) | |
| equity funds | 644 | 60.75% |
| balanced funds | 102 | 9.62% |
| bond funds | 106 | 10.00% |
| other | 208 | 19.62% |

Note: This table shows that the Taiwan onshore fund market includes stocks, balanced, bond, and other types of funds.
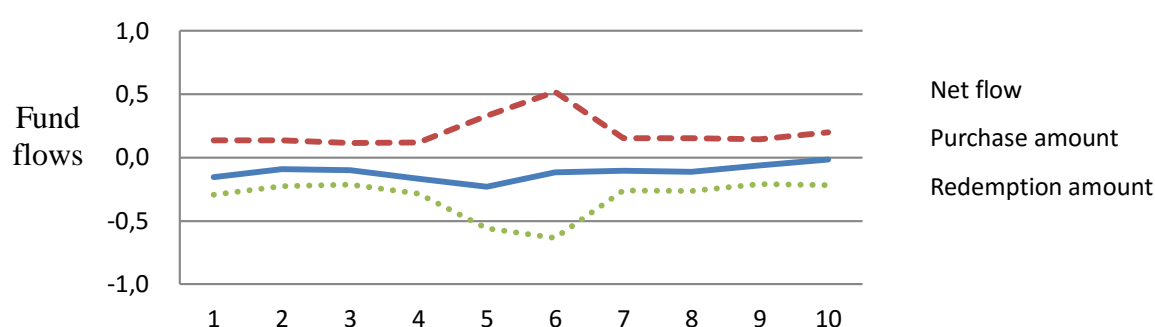


*Fig. 1 shows the relationship between fund flow and return on the Taiwan onshore fund. The considered period is from April 19, 2007 to December 31, 2011.*

*Table 2: Sample descriptive statistics*

| Fund Classification | Domestic funds | | | Equity funds | | |
|---|---|---|---|---|---|---|
| | mean | Standard deviation | median | mean | Standard deviation | median |
| Purchase | 250 | 2159 | 16 | 268 | 22 | 2470 |
| redemption | 149 | 1776 | 3 | 156 | 1610 | 5 |
| Net asset value value value | 7688 | 3240 | 13276 | 5067 | 2375 | 6395 |
| Fund net flows | -0.008 | 0.000 | 2.278 | -0.004 | 0.000 | 2.996 |
| Rate of fund returns | -0.008 | 0.002 | 1.154 | -0.024 | 0.046 | 1.451 |
| Fund Classification | Balanced funds | | | Bond funds | | |
| | mean | Standard deviation | median | mean | Standard deviation | median |
| Purchase | 53 | 8 | 218 | 109 | 436 | 14 |
| redemption | 27 | 152 | 2 | 197 | 2773 | 3 |
| Net asset value value value | 5353 | 5005 | 1305 | 639 | 579 | 178 |
| Fund net flows | 0.001 | 0.000 | 0.039 | -0.113 | 0.001 | 2.819 |
| Rate of fund returns | -0.006 | 0.001 | 0.575 | 0.017 | 0.004 | 0.391 |

Note: The statistical variables in this table are purchase, redemption, fund net assets (the unit is NT $(thousand).

*Table 3: The relationship between fund flows and fund returns for*

*Taiwanese onshore fund*

| Period of returns | Domestic funds | | | | | |
|---|---|---|---|---|---|---|
| | Net flow | | Purchase amount | | Redemption amount | |
| period_0 | 15.435 | ** | -3.823 | ** | -19.258 | *** |
| period _1 | 14.522 | ** | 2.969 | * | -11.553 | * |
| period _2 | 0.439 | | -0.375 | | -0.813 | |
| period _3 | 2.726 | | 0.983 | | -1.743 | |
| period _4 | 5.481 | | 1.555 | | -3.927 | |
| period _5 | 2.646 | | 1.679 | | -0.966 | |
| period _6 | -4.379 | | 0.739 | | 5.118 | |
| $R^2$ | 0.303 | | 0.187 | | 0.274 | |

Note: The significance levels of 10%, 5%, and 1% are signified by *, **, and ***.