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# THE MEASUREMENT OF THE RELATIONSHIP BETWEEN TAIWAN’S BOND FUNDS’ NET FLOW AND THE INVESTMENT RISK –THRESHOLD AUTOREGRESSIVE MODEL

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## ABSTRACT

*This article applies the threshold autoregressive model to investigate the relationship between bond funds’ net flow and investment risk in Taiwan. Our empirical findings show that bond funds’ investors are concerned about the investment return and neglect the investment risk. In particular, when expanding the size of the bond funds, fund investors believe that the fund cannot lose any money on investment products. In order to satisfy investors, bond fund managers only target short-term returns so as to attract investors, while ignoring the risk. Thus, this paper reminds investors to pay attention to risk, and fund managers should look to fulfill their obligations in addition to the pursuit of profit. Finally, bond funds should have risk management professionals help run the funds.*

**Keywords:** Bond fund, Threshold autoregressive model, Funds’ net flow

**JEL classification:** G20, C12, C13

## 1. MOTIVATION AND INTRODUCTION

There are several explanations for the asymmetric performance–flow relation of mutual funds, such as the asymmetric relation implying that the market rewards high-performance funds, but does not discipline poor performers as much. Chevalier and Ellison (1997) showed this asymmetric performance– flow relation gives a fund management company an incentive to increase the riskiness of its portfolios given that management fees are proportional to fund size. If the fund performance is high, then the fund grows and total fee revenue increases, while if the fund performance is low, then the fund does not lose assets and fees as much. Thus, fund companies have an incentive to increase the riskiness of the portfolios, hoping to benefit from any increase in returns that would bring in more inflows and fee revenues.

Shu *et al.* (2002) investigated the investment flow of open-end equity mutual funds. With unique data from Taiwan, they found that most investors in large mutual funds are small-amount investors, while those that invest in small funds invest a much larger amount. These small-amount investors in large funds tend to chase past winners and redeem shares once fund performance improves. Investors are more likely to avoid actively managed funds with high turnover. On the other hand, the large-amount investors in small funds appear to be dispassionate buyers whose purchases are not remarkably affected by short-term performance. They are more likely to keep performance-improving funds, redeem the losers, and pay higher management fees.

Mutual funds in Taiwan are very popular investment products. In particular, bond funds are the largest types of domestic mutual funds in which the fund managers offer investors the advantages of diversification and professional risk assessment on both bond and stock investments. Taiwanese investors of bond funds are generally concerned with performance, which affects their motivation for investing in the funds. In order to reduce the risk of bond funds, Taiwan's Financial Supervisory Commission (hereafter FSC) decided to conduct a bond fund segregation policy before the end of 2006.

Lee and Lee (2012a) discussed Taiwan's bond market integrity and market timing ability, based on the ARMAX-GARCH model. Due to the market integrity and lack of liquidity in Taiwan's bond market, a bond manager finds it difficult to flexibly adjust portfolio allocation and systemic risk. No matter in the T-M model, T-M ARMAX-GARCH model, or H-M ARMAX-GARCH model, this study's results show that most bond funds do not have selective ability and significant systemic risk and timing ability, except for the H-M model.

Lee and Lee (2012b) used five copula functions to investigate the effects of Taiwan's bond segregation policy. Their empirical study used outright sell (OS) and outright purchase (OP), repurchase agreement (RP), short-term deposit (ST-D), Value at Risk (VaR), and five copula functions to test the policy. They concluded that the bond fund segregation policy significantly reduced the risk for bond funds. In other words, the policy has been effective and successful.

Following Lee and Lee (2012a; 2012b), we discuss the relationship between Taiwan's bond funds' net flow and investment risk with the threshold autoregressive model. Our empirical study's dataset consists of monthly fund net flow, fund size, return, management fee, Sharpe index, and volatility of fund return (Std). The sample period for the study covers ten years, from January 2001 to June 2010, containing a total of 32 bond funds.

We find that the short-term returns and fund net flows have a significant positive relationship. The risk being significant indicates that investors attach great importance to the performance reward, but do not attach importance to the risk. We use the threshold autoregressive model to distinguish between high- and low-risk bond funds.

From panel A, we see in terms of high-risk bond funds or low-risk bond funds that they both have a significant positive relationship with short-term compensation. This means one should invest in pursuit of short-term returns, but to not attach importance to the risk. Panel B presents that in addition to the concern of remuneration, investors initially put emphasis on risk, and the Sharpe index has a positive relationship with fund new flows, on behalf of the investors concerned about the performance of bond funds.

The remainder of the paper is organized as follows. Section 2 offers a brief review of the regression model. Section 3 provides the empirical results. Section 4 is conclusion and remarks.

## 2. BRIEF REVIEW OF THE THRESHOLD AUTOREGRESSIVE MODEL

We follow Shu *et al.* (2002) and use the panel data model to estimate the mutual fund net flows, where the dependent variable is monthly inflows, outflows, or net inflows of each fund. We take natural logarithms of inflows and outflows. We measure a fund's net inflow as net inflows divided by the total net asset value of the previous month. To explain the performance–flow relation, we take the performance measures (PERF), fund size (Size), management fee (Fee), volatility of fund returns (Std), and the Sharpe index as independent variables. The regression model is:

$$Flow_{i,t} = \beta_o + \beta_1 PERF_{i,t} + \beta_2 Size_{i,t} + \beta_3 Fee_{i,t} + \beta_4 Std_{i,t} + \beta_5 Sharpe\_index_{i,t} + e_{i,t} \tag{1}$$

### 2.1. Panel Unit Root Tests

Hansen (1999) panel threshold regression model is an extension of the traditional least squared estimation method. It requires that variables considered in the model need to be stationary in order to avoid the so-called spurious regression. Thus, this study first processes the unit root test. Since the data are all in panel form in this investigation, we employ both the well known LLC (Levin *et al.*, 2002) and IPS (Im *et al.*, 2003) techniques for the panel unit root tests.

### 2.2. The Threshold Autoregressive Model

Hansen (1999) used the simulation likelihood ratio test to derive the asymptotic distribution of testing statistic for a threshold. Hansen (1999) proposed the two-stage OLS method to estimate the panel threshold model. In the first stage, for any given threshold $(\gamma)$, compute the sum of square errors (SSR) separately. In the second stage, find the estimation of $(\hat{\gamma})$ by a minimization of the sum of squares. Lastly, use the estimation of the threshold to estimate the coefficient for every "regime" and then conduct an analysis. We set up single threshold autoregressive model as follows:

$$v_{it} = \begin{cases} \mu_i + \theta' h_{it} + \alpha_1 d_{it} + \varepsilon_{it} & if \quad d_{it} \le \gamma \\ \mu_i + \theta' h_{it} + \alpha_2 d_{it} + \varepsilon_{it} & if \quad d_{it} > \gamma \end{cases} \tag{2}$$

$$\theta = (\theta_1, \theta_2, \theta_3, \theta_4)', h_{it} = (s_{it}, m_{it}, g_{it}, c_{it})'$$

where $v_{it} = Flow_{i,t}$ represents the proxy variables of the funds' net inflow; $d_{it} = Std_{i,t}$, which is also the threshold variable; and $\gamma$ is the specific estimated threshold value.

There are four “control variables” ( $h_{it}$ ) that may influence the net inflow: $s_{it} = PERF_{i,t}$ is fund performance measures, $m_{it} = Size_{i,t}$ is the fund size, $g_{it} = Management\_Fee_{i,t}$ is the management fee ratio, and $c_{it} = Sharpe\_index_{i,t}$ is a measure of risk that can be exchanged for the average rate of return. Here, $\mu_i$, the fixed effect, represents the heterogeneity of companies under different operating conditions. The error $\varepsilon_{it}$ is assumed to be independent and identically distributed with mean zero and finite variance $\sigma^2$ ( $\varepsilon_{it} \sim iid(0, \ \sigma^2)$ ), while i represents different companies, and t represents different periods.

Equation (2) can be rewritten as:

$$v_{it} = \mu_i + \theta' h_{it} + \alpha_1 d_{it} I\left(d_{it} \le \gamma\right) + \alpha_2 d_{it} I\left(d_{it} > \gamma\right) + \varepsilon_{it}, \qquad (3)$$

where I (.) represents the indicator function,

$v_{it} = \mu_i + \theta' h_{it} + \alpha' d_{it}\left(\gamma\right) + \varepsilon_{it}$ .

This can be written as:

$$v_{it} = \mu_i + \left[\theta', \alpha'\right] \begin{bmatrix} h_{it} \\ d_{it}(\gamma) \end{bmatrix} + \varepsilon_{it}$$

$$v_{it} = \mu_i + \beta' x_{it}\left(\gamma\right) + \varepsilon_{it} \qquad (4)$$

$$d_{it}\left(\gamma\right) = \begin{bmatrix} d_{it} I\left(d_{it} \le \gamma\right) \\ d_{it} I\left(d_{it} > \gamma\right) \end{bmatrix}$$

where $\alpha = \left(\alpha_1, \alpha_2\right)'$, $\beta = \left(\theta', \alpha'\right)'$, and $x_{it} = \left(h_{it}', d_{it}'(\gamma)\right)'$.

The observations are divided into two “regimes”, depending on whether the threshold variable $d_{it}$ is smaller or larger than the threshold value ( $\gamma$ ). The regimes are distinguished by differing regression slopes, $\alpha_1$ and $\alpha_2$. We use the known $v_{it}$ and $d_{it}$ to estimate the parameters ( $\gamma$ , $\alpha$ , $\theta$ , and $\sigma^2$ ).

**Estimation**

Taking the averages of (4) over the time index t derives:

$$\bar{v}_{it} = \mu_i + \beta' \bar{d}_{it}\left(\gamma\right) + \bar{\varepsilon}_{it} \qquad (5)$$

where $\bar{v}_i = \frac{1}{T}\sum_{t=1}^{T} v_{it}$ , $\bar{\varepsilon}_i = \frac{1}{T}\sum_{t=1}^{T} \varepsilon_{it}$ , and

$$\bar{d}_i(\gamma) = \frac{1}{T}\sum_{t=1}^{T} d_{it}(\gamma) = \begin{bmatrix} \frac{1}{T}\sum_{t=1}^{T} d_{it} I(d_{it} \le \gamma) \\ \frac{1}{T}\sum_{t=1}^{T} d_{it} I(d_{it} > \gamma) \end{bmatrix}$$

Taking the difference between (5) and (6) yields:

$$v_{it}^* = \alpha' d_{it}^*(\gamma) + \varepsilon_{it}^*, \tag{6}$$

where $v_{it}^* = v_{it} - \bar{v}_i$, $d_{it}^*(\gamma) = d_{it}(\gamma) - \bar{d}_i(\gamma)$, and $\varepsilon_{it}^* = \varepsilon_{it} - \bar{\varepsilon}_i$.

We let:

$$v_i^* = \begin{bmatrix} v_{i2}^* \\ \vdots \\ v_{iT}^* \end{bmatrix}, \quad d_i^*(\gamma) = \begin{bmatrix} d_{i2}^*(\gamma)' \\ \vdots \\ d_{iT}^*(\gamma)' \end{bmatrix}, \quad \varepsilon_i^* = \begin{bmatrix} \varepsilon_{i2}^* \\ \vdots \\ \varepsilon_{iT}^* \end{bmatrix}$$

denote the stacked data and errors for an individual, with one time period deleted. Next let $V^*$, $D^*(\gamma)$, and $e^*$ denote the data stacked over all individuals.

$$V^* = \begin{bmatrix} v_1^* \\ \vdots \\ v_i^* \\ \vdots \\ v_n^* \end{bmatrix}, \quad D^*(\gamma) = \begin{bmatrix} d_1^*(\gamma) \\ \vdots \\ d_i^*(\gamma) \\ \vdots \\ d_n^*(\gamma) \end{bmatrix}, \quad e^* = \begin{bmatrix} \varepsilon_1^* \\ \vdots \\ \varepsilon_i^* \\ \vdots \\ \varepsilon_n^* \end{bmatrix}$$

Using this notation, (6), is equivalent to:

$$V_{it}^* = D_{it}^*(\gamma)\alpha + e_{it}^*. \tag{7}$$

Equation (7) represents the major estimation model of the threshold effect. For any given $\gamma$, the slope coefficient $\alpha$ can be estimated by ordinary least squares (OLS) - that is:

$$\hat{\alpha}(\gamma) = \left(D^*(\gamma)' D^*(\gamma)\right)^{-1} D^*(\gamma) V^* \tag{8}$$

The vector of regression residuals is:

$$\hat{e}^*(\gamma) = V^* - D^*(\gamma)\hat{\alpha}(\gamma), \quad (9)$$

and the sum of squared errors, SSE, is:

$$SSE_1(\gamma) = \hat{e}^*(\gamma)'\hat{e}^*(\gamma) = V^*(I - D^*(\gamma)(D^*(\gamma)'D^*(\gamma))^{-1}D^*(\gamma)')V^* \quad (10)$$

Chan (1993) and Hansen (1999) recommend estimation of $\gamma$ by least squares. This is easier to achieve by a minimization of the concentrated sum of squared errors (9). Hence, the least squares estimators of $\gamma$ is:

$$\hat{\gamma} = \arg\min SSE_1(\gamma). \quad (11)$$

Once $\hat{\gamma}$ is obtained, the slope coefficient estimate is $\hat{\alpha} = \hat{\alpha}(\hat{\gamma})$. The residual vector is $\hat{e}^* = \hat{e}^*(\hat{\gamma})$ , and the estimator of residual variance is:

$$\hat{\sigma}^2 = \hat{\sigma}^2(\hat{\gamma}) = \frac{1}{n(T-1)}\hat{e}^{*\prime}(\hat{\gamma})\hat{e}^*(\hat{\gamma}) = \frac{1}{n(T-1)}SSE_1(\hat{\gamma}) \quad (12)$$

Here, n indexes the number of samples, and T indexes the periods of the samples.

## 2.3. Testing for a Threshold

This paper hypothesizes that there exists a threshold effect between the debt ratio and firm value. It is important to determine whether the threshold effect is statistically significant. The null hypothesis and alternative hypothesis can be represented as follows:

$$\begin{cases} H_0 : \alpha_1 = \alpha_2 \\ H_1 : \alpha_1 \neq \alpha_2 \end{cases}$$

When the null hypothesis holds, the coefficient $\alpha_1 = \alpha_2$ of the threshold effect does not exist.

When the alternative hypothesis holds, the coefficient $\alpha_1 \neq \alpha_2$ of the threshold effect exists between the debt ratio and firm value. Under the null hypothesis of no threshold, the model is:

$$v_{it} = u_i + \theta' h_{it} + \alpha' d_{it}(\gamma) + \varepsilon_{it}. \quad (13)$$

After the fixed-effect transformation is made, we have:

$$V_{it}^* = \alpha_1' H_{it}^* + e_{it}^*. \quad (14)$$

The regression parameter is estimated by OLS, yielding estimate $\tilde{\alpha}_1$, residuals $\tilde{e}^*$, and sum of squared errors $SSE_0 = \tilde{e}^{*/}\tilde{e}^*$.

Hansen (1999) suggested that the relevant F Test Approach and the sup-Wald statistic be used to test the existence of a threshold effect and to test the null hypothesis, respectively.

$$F = \sup F(\gamma). \tag{15}$$

$$F(\gamma) = \frac{(SSE_0 - SSE_1(\hat{\gamma}))/1}{SSE_1(\hat{\gamma})/n(T-1)} = \frac{SSE_0 - SSE_1(\hat{\gamma})}{\hat{\sigma}^2}. \tag{16}$$

Under the null hypothesis, some coefficients (e.g. the pre-specified threshold, $\gamma$ ) do not exist, and therefore the nuisance exists. According to Davies (1977; 1987), the F statistic becomes a non-standard distribution. (Hansen, 1996) showed that a bootstrap procedure attains the first-order asymptotic distribution, and so p-values constructed from the bootstrap are asymptotically valid.

We treat the regressors $x_{it}$ and threshold variable $d_{it}$ as given, holding their values fixed in the repeated bootstrap samples. Next take the regression residuals $\hat{e}^*_{it}$ and group them individually: $\hat{e}^*_i = (\hat{e}^*_{i1}, \hat{e}^*_{i2}, \cdots, \hat{e}^*_{iT})$. Treat the sample $\{\hat{e}^*_1, \hat{e}^*_2, \cdots \hat{e}^*_n\}$ as the empirical distribution to be used for bootstrapping, draw a sample of size n from the empirical distribution, and use these errors to create a bootstrap sample under $H_0$.

Using the bootstrap sample, we estimate the model under the null (14) and alternative (6) and calculate the bootstrap value of the likelihood ratio statistic $F(\gamma)$ (16). We then repeat this procedure a large number of times and calculate the percentage of draws for which the simulated statistic exceeds the actual. This is the bootstrap estimate of the asymptotic p-value for $F(\gamma)$ under $H_0$.

The null of no threshold effect is rejected if the p-value is smaller than the desired critical value.

$$P = P(\tilde{F}(\gamma) > F(\gamma) \mid \zeta). \tag{17}$$

Here, $\zeta$ is the conditional mean of $\tilde{F}(\gamma) > F(\gamma)$.

## 3. ASYMPTOTIC DISTRIBUTION OF THE THRESHOLD ESTIMATE

Chan (1993) and Hansen (1999) showed that when there is a threshold effect $\alpha_1 \neq \alpha_2$, $\hat{\gamma}$ is consistent for $\gamma_0$, and that the asymptotic distribution is highly non-standard. Hansen (1999) argued that the best way to form confidence intervals for $\gamma$ is to form the 'no-rejection region' using the likelihood ratio statistic for tests on $\gamma$. One can test the hypothesis:

$$\begin{cases} H_0 : \gamma = \gamma_0 \\ H_1 : \gamma \neq \gamma_0 \end{cases}$$

We now construct the testing model:

$$LR_1(\gamma) = \frac{SSE_1(\gamma) - SSE_1(\hat{\gamma})}{\hat{\sigma}^2}. \quad (18)$$

Hansen (1999) pointed out that when $LR_1(\gamma_0)$ is too large and the p-value exceeds the confidence interval, the null hypothesis is rejected.[1] Hansen (1999) also indicated under some specific assumptions[2] and $H_0 : \gamma = \gamma_0$ that:

$$LR_1(\gamma) = d\zeta, \quad (19)$$

as $n \to \infty$, where $\zeta$ is a random variable with a distribution function:

$$P(\zeta \leq x) = (1 - \exp(-x/2))^2. \quad (20)$$

The asymptotic p-value can be estimated under the likelihood ratio. According to the proof of Hansen (1999), the distribution function (19) has the inverse:

$$c(\alpha) = -2\log(1 - \sqrt{1-\alpha}), \quad (21)$$

from which it is easy to calculate critical values. For a given asymptotic level $\alpha$, the null hypothesis $\gamma = \gamma_0$ is rejected if $LR_1(\gamma)$ exceeds $c(\alpha)$.

If there exist double thresholds, then the model is modified as:

$$v_{it} = \begin{cases} \mu_i + \theta' h_{it} + \alpha_1 d_{it} + \varepsilon_{it} & if \quad d_{it} \leq \gamma_1 \\ \mu_i + \theta' h_{it} + \alpha_2 d_{it} + \varepsilon_{it} & if \quad \gamma_1 < d_{it} \leq \gamma_2 \\ \mu_i + \theta' h_{it} + \alpha_3 d_{it} + \varepsilon_{it} & if \quad \gamma_2 \leq d_{it} \end{cases} \quad (22)$$

[1] Note that the statistic (17) tests a different hypothesis from the statistic (15) introduced in the previous section. Here, $LR_1(\gamma_0)$ tests $H_0 : \gamma = \gamma_0$, while $F(\gamma)$ tests $H_0 : \alpha_1 = \alpha_2$.

[2] Refer to Hansen (1999) .Appendix: Assumptions 1-8.

where the threshold value $\gamma_1 < \gamma_2$. This can be extended to a multiple thresholds model: ($\gamma_1, \gamma_2, \gamma_3, \cdots \gamma_n$)

## 4. EMPIRICAL RESULT ANALYSIS

The dataset consists of bond funds that were issued in Taiwan. For the purpose of comparison, the sample period for the study covers ten years, from January 2001 to June 2010. Table 1 presents a total of 32 bond funds' name, trading code, and initiation date. The data were obtained from the Taiwan Economic Journal (TEJ) database.

Table 2 reports the descriptive statistics of the average ratios of net flow, return ratio (1M), Std, and the scale of bond fund sales for before and after the bond segregation policy's set-up. The net flow is 0.0052% before 2007 and increase to 0.007% after 2007. We see the return ratio (1M) is 0.1843% before 2007 and increases to 0.0749% after that year, whereas the Std is only 0.0802% before 2007 and decreases to 0.0568%. This change is very obvious. The last column is the scale of bond fund sales, which decreases after 2007. The scale is NT$36.548 million before carrying out the bond segregation policy and decreases to NT$21.66 million.

Based on the results of the stationary test of each panel[3] in Table 3, it is abundantly clear that all the variables have stationary characteristics since the nulls of the unit root are mostly rejected, especially in the case of the LLC test.

Table 4 exhibits the estimated coefficients of the fixed effect results. We apply the non-linear fixed effects models above to observe the net flow correlation between the size, std, Sharpe index, management fee and return of bond funds, respectively. From panel A, we see short-term returns and fund flows have a significant positive relationship, but the risk is significant, which indicates that investors attach great importance to the performance reward, but do not attach importance to the risk. In 2001, the central bank's acto of easing money led to a lower interest rate and a bull bond market in Taiwan. Hence, bond fund managers put much of their funds into structured notes in the pursuit of short-term performance.

In other variables, the fund net flows have a significant relationship with bond fund size. Bond funds are a very special product, with a combination of high liquidity in monetary funds and the dual advantage of having a higher than a fixed deposit rate of return.We further find that the management fee and fund net flow have a negative relationship. This implies that investors like to buy low management fee funds.From panel B, we find that the management fee and fund net flow have a negative relationship, but short-term returns no longer have a significant positive relationship with the fund net flow. This means that the investment behavior of investors changed after the policy. The reason is that investors have been brought to the attention that bond funds are not a product that forever produces earnings.

Table 5 presents the empirical results of the test for the single threshold and the double threshold effects. We find that the test results for a single threshold and double threshold effect are

[3]For example, the explained variables, the threshold variable, and the control variables.

significant. Thus, we conclude that there is a double threshold effect of the debt ratio on firm value. For the remainder of the analysis, we will work with this double threshold model.

Table 6 shows the results of the double threshold effect model. In order to understand the investors' investment point of view, we use the threshold variable to distinguish between high-, middle-, and low-risk bond funds. Panel A exhibits the results before the policy. The high-risk threshold value is 0.1593, the middle-risk value is between 0.1140 to 0.1593, and the low-risk value is 0.1140. The variable size, Sharpe index, and return are positive significant among all threshold values. The Std is positive at the high and low threshold values. The management fee are negative significant. Panel B exhibits the results after the policy. The high-risk threshold value is 0.0745, middle-risk is between 0.0693 to 0.0745, and the low-risk value is 0.0693. Only the variable size is positive significant among all threshold values. The Std is negative at the high-risk threshold value. The management fee is negative at all threshold values. The return is negative under middle risk. It is clear that high risk implies high return and Sharpe index is also high after the policy.The transformation of the bond funds is to remind investors that they should not ignore the risks. Second, it reminds investors to be aware that the investment is not necessarily a sure win, and the investment does incur risk, especially the investment in high-yield products, where the attendant may be at greater risk.

**Table-1.** Basic descriptions of the bond funds

| Code | Name of Bond Fund | Initiation Date | Code | Name of Bond Fund | Initiation Date |
|---|---|---|---|---|---|
| UI02 | Union Bond | 1999/9/30 | DF02 | The Forever Bond Fund | 1996/10/15 |
| TR02 | Manulife Wan Li Bond Fund | 1999/9/9 | JF78 | JF (Taiwan) First Bond Fund | 1996/10/15 |
| BR02 | PrimasiaPaoyen Bond | 1999/9/7 | TS06 | Shinkong Chi-Shin Fund | 1996/9/3 |
| TC18 | IBT 1699 Bond Fund | 1999/6/7 | FP07 | Fubon Chi-Hsiang Bond Fund | 1996/6/14 |
| CP12 | PCA Well Pool Fund | 1998/12/23 | CA02 | Capital Safe Income Bond Fund | 1996/5/18 |
| AP02 | Manulife Wan Li Bond Fund | 1998/11/5 | ML04 | Prudential Financial Bond Fund | 1996/5/17 |
| DS02 | Truswell Bond Fund | 1998/10/28 | YC03 | Hua Nan Phoenix Bond Fund | 1996/2/6 |
| AI03 | PineBridge Taiwan Giant Fund | 1998/9/7 | CS03 | Invesco ROC Bond Fund | 1995/11/9 |
| TC02 | IBT Ta-Chong Bond Fund | 1998/6/22 | CI08 | HSBC NTD Money Management Fund | 1995/11/2 |
| GC02 | SinoPac Bond Fund | 1998/6/19 | IC27 | ING Taiwan Bond Fund | 1995/10/21 |
| FH02 | Fuh-Hwa Bond Fund | 1998/5/28 | KY02 | Polaris De-Li Bond Fund | 1995/9/21 |
| JS02 | Jih Sun Bond Fund | 1997/10/3 | PS04 | UPAMC James Bond Fund | 1995/6/16 |
| NC10 | NITC Taiwan Bond Fund | 1997/3/7 | JF75 | JF Taiwan Bond | 1995/6/15 |
| YT08 | Yuanta Wan-Tai Bond Fund | 1997/2/19 | NC06 | NITC Bond | 1994/4/12 |
| TI03 | TIIM Bond Fund | 1997/2/13 | TS01 | Shinkong High Yield | 1994/1/31 |
| CI10 | HSBC NTD Money Management Fund 2 | 1996/10/17 | 0008 | ING Taiwan Income Fund | 1991/12/6 |

**Note:** The code represents each bond fund's trading code.

**Table-2.** Summary statistics of bond funds

| | Panel A: Beforesegregation policy | | | | Panel B: after segregation policy | | | |
|---|---|---|---|---|---|---|---|---|
| | Net Flow | Return ratio (1M) | Std | Scale* (NT$ million) | Net flow | Return ratio (1M) | Std | Scale* (NT$ million) |
| Mean | 0.0052 | 0.1843 | 0.0802 | 36.548 | 0.0070 | 0.0749 | 0.0568 | 21.6600 |
| Std | 0.1282 | 0.1001 | 0.0712 | 502.431 | 0.4488 | 0.0541 | 0.0546 | 439.3690 |
| Max | 1.3927 | 0.9452 | 0.7216 | 502.431 | 16.207 | 0.1661 | 0.2178 | 439.3690 |
| Min | -0.8573 | 0.0155 | 0.0104 | 299.414 | -0.5977 | 0.0031 | 0.0000 | 166.4400 |
| Skewness | 2.6134 | 1.3609 | 3.6323 | 4.553 | 31.880 | 0.1002 | 1.4263 | 9.7090 |
| Kurtotsis | 22.384 | 1.5441 | 23.953 | 24.033 | 1141.2 | -1.7707 | 0.6861 | 33.3170 |
| J-B | 50721.1 | 940.12 | 60147.6 | 15.802 | 8.0999 | 196.874 | 533.677 | 15.8020 |

**Note:** 1.* Scale means the scale of bond fund sales.

2. P-value is the probability that the data come from the normal distribution, according to the Jarque -Berra normality test.

**Table-3.** Panel unit root test results

| | Panel A: Beforesegregation policy | | | Panel B: After segregation policy | | |
|---|---|---|---|---|---|---|
| Method | Levin, Lin & Chu | IPS | ADF- Fisher Chi-square | Levin, Lin & Chu | IPS | ADF- Fisher Chi-square |
| Net flow | -0.96222*** [0.0000] | -13.401*** [0.0000] | 337.901*** [0.0000] | -1.0084*** [0.0000] | -6.63613*** [0.0000] | 780.078*** [0.0000] |
| Size | -24.089 *** [0.0000 ] | -17.3025 *** [0.0000 ] | 491.581*** [0.0000 ] | -0.74656*** [0.0000 ] | -5.17714*** [0.0000 ] | 490.122*** [0.0000] |
| Std | -0.65724*** [0.0000] | -5.41334*** [0.0000] | 569.664*** [0.0000] | -0.36578*** [0.0000 ] | -3.1262*** [0.0000 ] | 242.098*** [0.0000] |
| Sharpe index | -0.72677*** [0.0000 ] | -6.76123*** [0.0000] | 776.26*** [0.0000 ] | -0.45193*** [0.0000 ] | -3.70222*** [0.0000 ] | 246.356*** [0.0000 ] |
| Manage-ment fee | -1.0333*** [0.0000 ] | -8.62404*** [0.0000] | 1075.05*** [0.0000 ] | -1.0274*** [0.0000] | -6.81789*** [0.0000 ] | 818.984*** [0.0000 ] |
| Return | -0.79048*** [0.0000 ] | -7.37884*** [0.0000 ] | 827.291*** [0.0000] | -0.77697*** [0.0000] | -5.81053*** [0.0000 | 629.188*** [0.0000 ] |

**Notes:** The numbers in brackets indicate p-values. ***, **, and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively.

**Table-4.** Estimated coefficients of the fixed effect results

| | Panel A: Before policy | | Panel B: After policy | |
|---|---|---|---|---|
| | Coefficient | p-value | Coefficient | p-value |
| Size | 0.0209 | 5.19e-06 *** | 0.0085 | 0.4203 |
| Std | 0.1088 | 0.0792* | 0.0698 | 0.9113 |
| Sharpe index | -0.0018 | 0.3143 | 0.0041 | 0.3049 |
| Management fee | -2.7182 | 1.21e-016*** | -5.5872 | 0.0007*** |
| Return | 0.8630 | 4.48e-017*** | 0.3945 | 0.5700 |

**Notes:** The numbers in brackets indicate p-values. ***, ***, and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively.

**Table-5.** Tests for the results of the threshold effects

| **Panel A: Beforesegregation policy (risk)** | | |
|---|---|---|
| Single threshold effect test | | |
| Threshold value | F | p-value |
| 0.1593 | 16.8297 | 0.0000*** |
| Double threshold effect test | | |
| Threshold value | F | p-value |
| **0.1593 0.1140** | 7.6899 | 0.0000*** |
| Panel B: After segregation policy (risk) | | |
| Single threshold effect test | | |
| Threshold value | F | p-value |
| 0.07450 | 33.6143 | 0.0000*** |
| Double threshold effect test | | |
| Threshold value | F | p-value |
| **0.0745 0.0693** | 187.7279 | 0.0000*** |

**Note:** ***, **, and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively.

**Table-6.**Threshold Autoregressive Model's Results

| **Panel A: Before policy** | | | | | | |
|---|---|---|---|---|---|---|
| | risk≧0.15930 | | 0.15930≧risk≦0.11400 | | risk≦0.11400 | |
| Variable | Coefficient | p-value | Coefficient | p-value | Coefficient | p-value |
| Size | 0.0418 | 0.0046*** | 0.0128 | 0.3964 | 0.0282 | 0.00001*** |
| Std | 0.1930 | 0.0106** | -0.2859 | 0.5776 | 0.1658 | 0.3098 |
| Sharpe index | -0.0117 | 0.5018 | -0.0013 | 0.8814 | -0.0008 | 0.4297 |
| Management fee | -10.9573 | 0.00001*** | -5.5342 | 0.0002*** | -2.2718 | 0.00001*** |
| Return | 0.3472 | 0.0013*** | 0.3042 | 0.0073*** | 0.35284 | 0.00001*** |
| Panel B: After policy | | | | | | |
| | risk≧0.07450 | | 0.07450≧risk≦0.06930 | | risk≦0.06930 | |
| Variable | Coefficient | p-value | Coefficient | p-value | Coefficient | p-value |
| Size | 0.0019 | 0.7052 | 2.0516 | 0.01598*** | 0.0228 | 0.00001*** |
| Std | -1.0840 | 0.00001*** | 93.2979 | 0.86988 | 1.1749 | 0.0138** |
| Sharpe index | 0.0268 | 0.0055*** | -2.3878 | 0.00371*** | 0.0009 | 0.4972 |
| Management fee | -2.8967 | 0.0008*** | -97.4287 | 0.48296 | -4.2439 | 0.00001*** |
| Return | 0.6866 | 0.0016*** | -18.8610 | 0.32914 | 0.2883 | 0.0061*** |

**Note:** ***, **, and * indicate significance at the 0.01, 0.05 and 0.1 level, respectively.

## 5. CONCLUDING AND REMARKS

From the empirical results, we find that bond fund investors emphasize on short-term returns versus paying attention to investment risks. However, the Sharpe index under a low level of knowledge tells investors that they should have be aware of risk and performance indicators.

Bond fund investors generally believe that investment funds should not lose money, however, the mentality of pursuing short-term returns in order to satisfy investors actually expands bond funds' size. The fund companies have a liquidity risk and system risk after the bond segregation policy. Furthermore, investors also face these same risks.

This paper lastly remind investors that there are risks for any investment, and that fund managers should diligently fulfill their obligations, in addition to their pursuit of profit. Bond funds should also employ risk management professionals.

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