

# 國立交通大學

經營管理研究所

碩士論文

台灣共同基金之分項投入效率

**Disaggregate Input Efficiency of Mutual Funds in Taiwan**

研 究 生：張瑋倫

指 導 教 授：胡均立教授

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研究生：張瑋倫

Student: Wei-Lun Chang

指導教授：胡均立

Advisor: Dr. Jin-Li Hu



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研究生：張瑋倫

指導教授：胡均立

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## 中文摘要

本文利用隨機邊界法(SFA)來計算出台灣共同基金的分項投入效率表現，而根據 Zhou (2002)重新推導的距離函數去估計單一投入效率，以及 Battese and Coelli (1995)提出的縱橫面隨機邊界模型同時估算隨機邊界以及無效率方程式。資料期間為 2007~2012 共六年，合計 310 檔共同基金的資料。我們將費用比率、總資產以及淨值作為三個投入變項，風險調整後報酬則作為一個產出變項，並利用 2006 年作為基期將所有名目變數平減為實質變數。本文的環境變數有五個，分別是基金的風險等級、基金的成立年限、基金經理人的性別、基金經理人是否擁有國外學歷以及基金經理人是否擁有商管碩士學位。較低的風險、較長的成立年限、女性基金經理人、國內學歷以及有管理碩士學位的基金經理人在費用的掌控上較有效率；較高的風險、較短的成立年限、擁有國外學歷以及擁有管理碩士學位的基金經理人在總資產的運用上較有效率；而較低的風險、較短的成立年限、男性基金經理人、擁有國外學歷以及擁有管理碩士學位的基金經理人在淨值的操作上較有效率。

關鍵字：隨機邊界法、共同基金、分項投入效率

# Disaggregate input efficiency of mutual in Taiwan

Student: Wei-Lun Chang

Advisor: Dr. Jin-Li Hu

Institute of Business and Management  
National Chiao Tung University

## ABSTRACT

This thesis applies the stochastic frontier approach (SFA) to compute disaggregate input efficiency of mutual funds in Taiwan. Following Zhou et al. (2002), a re-arranged distance function is derived to estimate an individual input efficiency. The panel data SFA model proposed by Battese and Coelli (1995) is applied to simultaneously estimate the stochastic frontier and the equation of inefficiency. A panel dataset contains 310 mutual funds in Taiwan from 2007 to 2012. There are three inputs (expense ratio, total fund asset, and net assets value) and one output (risk-adjusted return) in the SFA model. All nominal variables are deflated into real variables in the base year of 2006. The Risk Rank, age of fund, gender, foreign academic degree, and MBA degree are the six environmental variables. Lower risk, longer operation, female, domestic academic degree, and MBA degree help improve efficiency for expense ratio. Higher risk, shorter operation, foreign academic degree, and MBA degree help improve efficiency for total fund asset. Lower risk, shorter operation, male, foreign academic degree, and MBA degree help improve efficiency for net assets value.

Key words: Stochastic frontier approach, Mutual funds, Disaggregate input efficiency

## 誌 謝

記憶中那個徬徨無措的影子，已淡出，呈現在投影幕上的，是新的一頁，彩色。人生天地之間，若白駒之過隙，忽然而已，兩年間受到的幫助太多，能回報的太少，在此由衷感謝。

謝謝交通大學經營管理研究所所長，也是我的指導教授胡均立教授，他對於教學上的熱忱以及為人的幽默感都深深地刻畫在我的心中。在人生道路上盲目時，他給予指引；在論文遇到難關時，他傳授密技；在用字遣詞失準時，他幫助修正。記得剛進研究所時，因為老師的一句話：「我們經管所不會讓你失望的，」而選擇了老師擔任指導教授，至今，不僅沒有失望，更超出期望。

謝謝一起寫論文到早上爆肝的戰友們，凌濤、戴勤政、黃于嘉、曾麗娟、陳冠宇、向龍賢。謝謝一起嘴砲八卦放鬆心情的酸酸們，陳秉軒、葉宇峻、林顯誠、林欣煌、黃浩庭、許博涵、石大中。謝謝提攜後生晚輩的阿立家族師哥師姊師弟師妹們，簡瑞、林韋君、曾怡瑄、張絡捷、朱曉輝。謝謝海外同胞的支持鼓勵，林采葳、簡汶恩、歐陽巧、李崇民。

特別感謝我的父母以及家人，在我毅然決然要念研究所之後，給予支持肯定，能夠順利地從交通大學畢業，這份榮耀我也最想和我的家人分享，也希望能夠用在此所學，對社會貢獻回饋於我的家人。

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謹誌於交通大學經營管理所

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## 1. Introduction

Mutual fund is investment vehicle which is collected money of investors and operated by professional managers, just because of this, the funds, premiums and risks of investors are taken together. In the era of low interest rates, investors should find their ways to manage their earnings. However, most of the investors are risk averters who prefer lower risks and they lack time and knowledge of sensitive market. Therefore, mutual fund has been a popular investment tool in financial market because it is an effective risk diversification tool by investing in different types and areas.

To evaluate the performance of mutual funds, investors or fund managers usually consider only net value and actual returns. However, the efficiency model could solve this kind of problem. Research on mutual fund efficiency is vast and spread wide, early scholars focus on what factors would affect the performance of mutual funds.

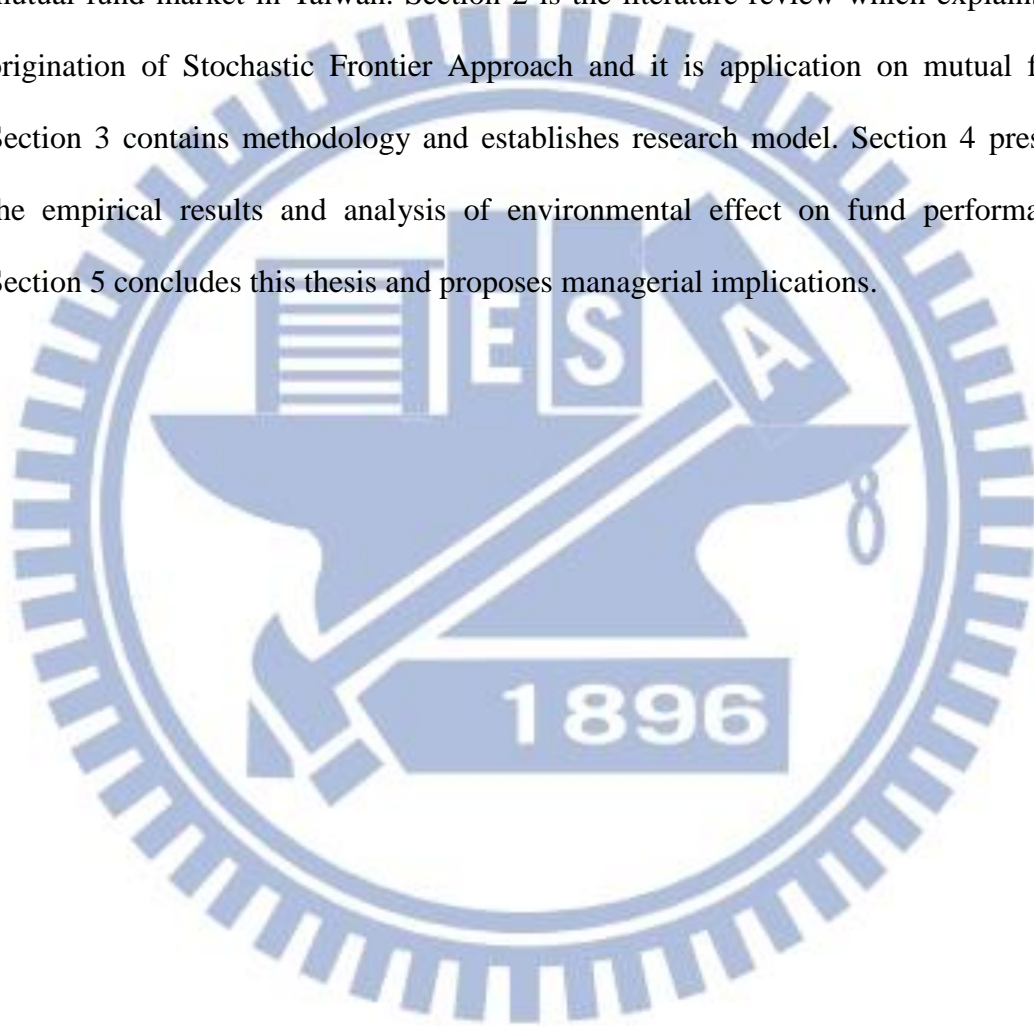
For example, Grinblatt and Titman (1989) think fund size might affect the performance of funds; Murthi et al. (1997) think expense ratio, load, turnover and standard deviation would affect the performance. Most of them explore the overall efficiency of mutual funds. In this paper, we would like to know the performance of single input instead of overall efficiency. Then, exploring what factor would affect the performance of these inputs.

According to the Fund Industry Analysis Overview in Taiwan by Financial Supervisory Commission in the end of August 2012, Securities Investment Trust Business total number is 39; total revenue of the business is NTD 22,620 million and net income is NTD 5,550 million. The total number of onshore funds is 621 which total size is NTD 1,830 billion and the total number of offshore is 1032, making total size of all mutual funds in Taiwan be NTD 2,451 billion. Therefore, the market of



mutual funds is huge and a great numbers of investors involved. Which fund is relative efficiency and how to choose suitable funds and portfolio is a tough and important task to general investors in financial field.

This paper is organized as follows: Section 1 is an introduction explaining the research motivation and purpose, as well as describes the general situation of the mutual fund market in Taiwan. Section 2 is the literature review which explains the origination of Stochastic Frontier Approach and it is application on mutual fund. Section 3 contains methodology and establishes research model. Section 4 presents the empirical results and analysis of environmental effect on fund performance. Section 5 concludes this thesis and proposes managerial implications.



## 2. Literature review

The Stochastic Frontier Approach (SFA) was proposed by Meeusen and van den Broeck (1977) and Aigner et al. (1977). And they carried out the estimate of the Cobb-Douglas production frontier. This approach has been used in different industries and in different issues widely from the theory was established till now. For example, Vitaliano and Toren (1994) analyzed cost and efficiency in nursing homes in New York. Burns et al. (1996) estimated electricity distribution on data for the 12 regional electricity companies of England and Wales. Lim and Nam (2012) measured the relative market potential of 2Gmobile service in 31 Chinese provinces.

And also, a lot of researchers used this approach in financial market especially in mutual fund. Annaert et al. (2002) identified ex ante fund statistics that can be related to future performance of European equity funds. They found fund efficiency is positively related to fund size and historical performance. Hu, Chang and Chou (2013) investigated the non-monotonic and non-linear effect of diversification on mutual fund performance and estimated fund efficiency and the benefit of diversification. The results show that managers should not select concentration strategy. And if collect too large of number diversify stocks in one fund, it would negatively affects performance.

Zhou et al. (2012) proposed Parametric Frontier Approach that is extended from Hu and Wang (2006) for estimating energy efficiency. In this paper, we extend the approach and use it in estimate mutual fund.

The investors of mutual fund input their risk or cost and get their reward. However, what factors are related to the risk and return rate of mutual fund? Mark M. Carhart (1997) demonstrated that common factors in stock returns and investment expenses, include mutual fund expense and transaction cost, explain almost all of the predictability in mutual funds' mean and risk-adjusted returns.

Murthi et al. (1997) proposed DEA to measure mutual fund performance, and

compared with traditional indices of performance that are Jensen's alpha and the Sharp index. They had four inputs: expense ratio, load, turnover and standard deviation; one output: return, and found strong evidence that mutual fund is not related to transaction costs and that larger funds are more efficient in some categories.

Grinblatt and Titman (1989) pointed out relatively small fund has more advantages than the relatively large fund but face higher transaction costs; and smallest net asset values have the highest transaction costs and performance.

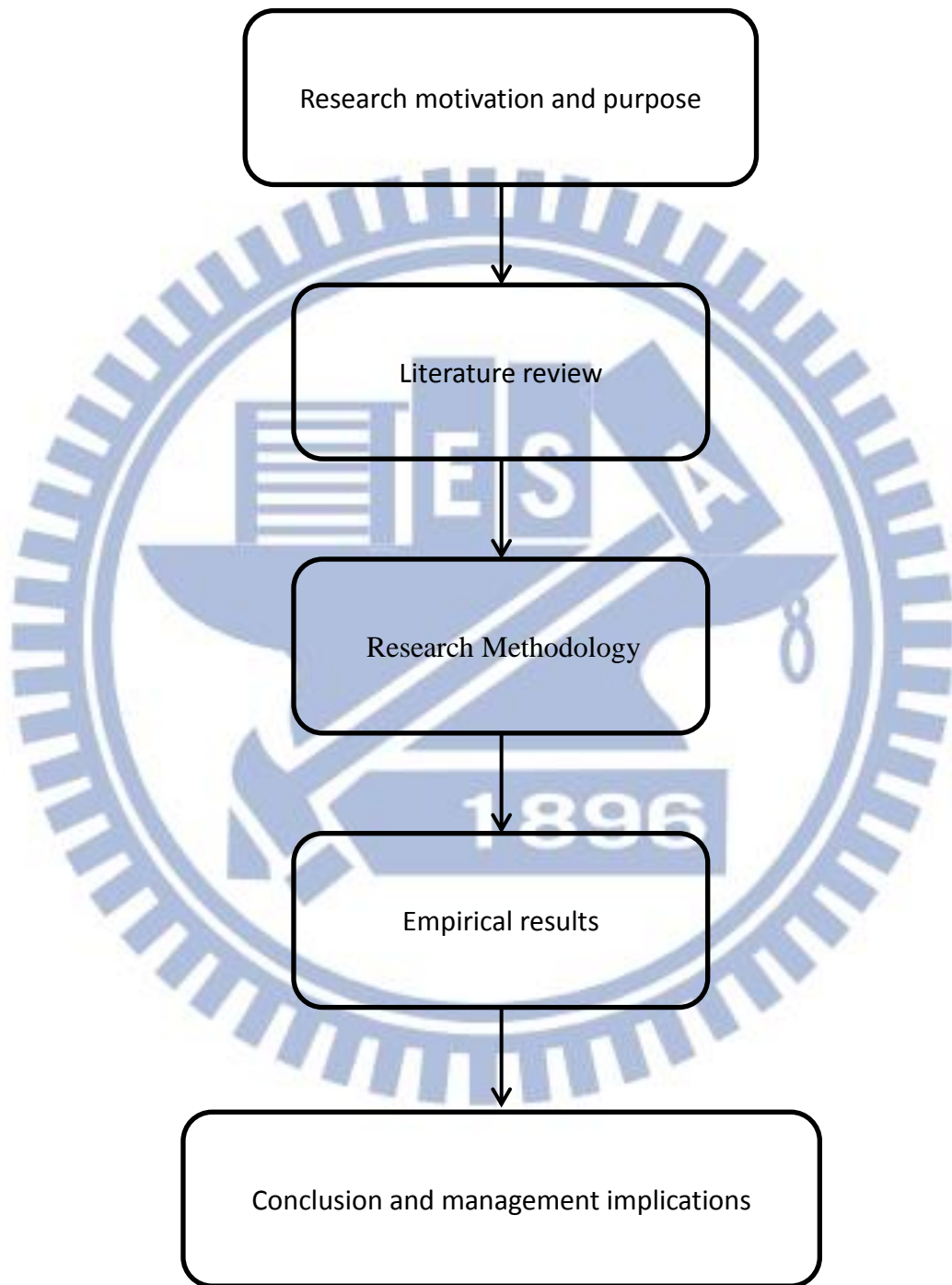
Premachandra et al. (2012) researched 66 large mutual fund families in the US over the period 1993-2008 by two-stage DEA model and found out that the difference between the portfolio managers who manage highlight and poorly performing mutual fund families. In this study, Premachandra et al. (2012) applied six inputs for stage 1: management fees, marketing and distribution expenses, fund size, net expense ratio, turnover ratio and standard deviation of the returns of the family portfolio over the last 3 years. Net asset value is the output of stage 1 and also the input of stage 2, mean return of the family portfolio is the output for stage 2.

Hu and Chien (2012) researched the risk-adjusted performance of 342 mutual funds during 2006-2011 in Taiwan by DEA model. In this paper, Hu and Chien (2012) applied three inputs: turnover rate, total fund assets, net assets value and one output risk-adjusted return rate.

Referring to the above literature, we know that mutual fund return could be affected by several factors. In this paper, we select expense ratio, total fund assets and net asset value to be our input, and risk-adjusted return rate to be our output.

**Table 1: Literature on mutual fund**

	Method	Research sample	Main contribution
Carhart (1997)	Capital Asset Pricing Model Carhart 4-factor model	1,892 diversified equity funds and 16,109 fund from January 1962 to December 1993	1. Expense ratios appear to reduce Performance 2. Turnover reduces performance about 95 basis points 3. Transaction costs account for some of the spread in the best- and worst-performing mutual funds.
Murthi et al. (1997)	DEA	2083 mutual fund for the third quarter of 1993 from Morningstar	1. The mutual funds are all approximately mean-variance efficient. 2. Mutual funds are not related to transaction costs and that larger funds are more efficient in some categories.
Grinblatt and Titman (1989)		155 mutual funds from 1974 to 1984	1. Smaller funds have more advantage than larger fund. 2. Smaller funds face larger transaction cost. 3. Smallest net assets value of funds has the highest costs and performance.
Hu and Chang (2008)	three-stage DEA	156 mutual funds during 2005-2006 in Taiwan	Mutual fund size, previous performance, manager's tenure and education will significantly increases a fund's performance, while it decreases with the age.
Premachandra (2012)	two-stage DEA	66 large mutual fund families in the US over the period 1993–2008	1. Demonstrate the model applicability by assessing the relative performance of mutual fund families 2. Reveal the best performers, the families that deteriorated in performance, and those that improved in their performance over the sample period.



**Figure 1: Research process**

### 3. Research Methodology

#### 3.1 Distance function

In this paper, there is a sample of Taiwan whose expense efficiency, total fund asset efficiency and net assets value efficiency in mutual fund are be compared. We use expense ratio ( $X_1$ ), total fund asset ( $X_2$ ) and net assets value ( $X_3$ ) as our inputs, and risk-adjusted return ( $Y$ ) as our output. The production technology can be described as follows:

$$T = \{(X_1, X_2, X_3, Y): (X_1, X_2, X_3) \text{ can produce } Y\} \quad (1)$$

$T$  consists of all the feasible input–output vectors. In production theory,  $T$  is often assumed to be a closed and bounded set. In addition, the inputs and output are often assumed to be strongly disposable. It says that  $(X_1', X_2', X_3', Y') \in T$  if  $(X_1', X_2') \geq (X_1, X_2)$  and  $Y' \leq Y$

To measure expense efficiency from the production efficiency viewpoint, we define the Shephard sub-vector input distance function for expense use as follows:

$$D_{X_1}(X_1, X_2, X_3, Y) = \sup \{\alpha: (X_1, X_2, X_3/\alpha, Y) \in T\} \quad (2)$$

We can also use above function to define the Shephard sub-vector input distance function for total fund asset and net assets value use as follows:

$$D_{X_2}(X_1, X_2, X_3, Y) = \sup \{\alpha: (X_1, X_2, X_3/\alpha, Y) \in T\} \quad (3)$$

$$D_{X_3}(X_1, X_2, X_3, Y) = \sup \{\alpha: (X_1, X_2, X_3/\alpha, Y) \in T\} \quad (4)$$

Equations (2)-(4) attempts to reduce the use of expense, total fund asset and net assets value as much as possible while keeping the resulting input–output combination within the production technology set as defined by (1).

#### 3.2 Disaggregate Input Efficiency

Following the cross-section SFA model proposed by Zhou et al. (2012), this paper further applies the panel data SFA to measure disaggregate input efficiency of mutual funds in Taiwan. We assumed that the stochastic frontier distance function is

in Cobb-Douglas form as follows:

$$\begin{aligned} \ln D_{X1}(X_{1it}, X_{2it}, X_{3it}, Y_{it}) = & \beta_0 + \beta_{X1} \ln X_{1it} \\ & + \beta_{X2} \ln X_{2it} + \beta_{X3} \ln X_{3it} + \beta_Y \ln Y_{it} + v_{it} \end{aligned} \quad (5)$$

where  $D(\cdot)$  is distance function,  $X_{1it}$  is the expense ratio,  $X_{2it}$  is the total fund assets,  $X_{3it}$  is the net assets value,  $Y_{it}$  is the risk-adjusted return rate  $i$  indicates the mutual fund,  $t$  means at  $t$ -period (2007-2012), and  $v_{it}$  is a random variable accounting for statistical noise that following normal distribution.

Since the Shephard distance function is linearly homogenous in energy, we have

$$D_{X1}(X_{1it}, X_{2it}, X_{3it}, Y_{it}) = X_{1it} D_{X1}(1, X_{2it}, X_{3it}, Y_{it}) \quad (6)$$

Function (5) can be re-arranged as:

$$\begin{aligned} \ln D_{X1}(X_{1it}, X_{2it}, X_{3it}, Y_{it}) = & \ln X_{1it} + \beta_0 \\ & + \beta_{X1} \ln 1 + \beta_{X2} \ln X_{2it} + \beta_{X3} \ln X_{3it} + \beta_Y \ln Y_{it} + v_{it} \end{aligned} \quad (7)$$

From above function, we can arrange it again as:

$$\begin{aligned} -\ln X_{1it} = & \beta_0 + \beta_{X2} \ln X_{2it} + \beta_{X1} \ln 1 + \beta_{X3} \ln X_{3it} \\ & + \beta_Y \ln Y_{it} + v_{it} - \ln D_{X1}(X_{1it}, X_{2it}, X_{3it}, Y_{it}) \end{aligned} \quad (8)$$

That is,

$$\ln(1/X_{1it}) = \beta_0 + \beta_{X2} \ln X_{2it} + \beta_{X3} \ln X_{3it} + \beta_Y \ln Y_{it} + v_{it} - u_{it} \quad (9)$$

Where  $u_{it} \equiv \ln D_{X1}(X_{1it}, X_{2it}, X_{3it}, Y_{it})$  is a non-negative variable associated with inefficiency term and  $v_{it} - u_{it}$  is the error component term of a stochastic production frontier. The total-factor efficiency of expense ratio of mutual fund  $i$  at time  $t$  then is

$$\text{TFE}_{it} \text{ of expense ratio} = \exp(-u_{it}) \quad (10)$$

Therefore, we derive a SFA model with equation (9) for estimating the efficiency of one mutual fund in expense ratio.

As the same way, if we want to estimate the efficiency of total fund assets of a mutual fund, we assumed that the stochastic frontier distance function is in Cobb-Douglas form as function (5), and re-arranged it as:

$$\ln D_{X2}(X_{1it}, X_{2it}, X_{3it}, Y_{it}) = \ln X_{2it} + \beta_0$$

$$+ \beta_{X1} \ln X_{1it} + \beta_{X2} \ln 1 + \beta_{X3} \ln X_{3it} + \beta_Y \ln Y_{it} + v_{it} \quad (11)$$

Equation (11) can be also arranged as:

$$\begin{aligned} -\ln X_{2it} = & \beta_0 + \beta_{X1} \ln X_{1it} + \beta_{X2} \ln 1 + \beta_{X3} \ln X_{3it} \\ & + \beta_Y \ln Y_{it} + v_{it} - \ln D_{X2}(X_{1it}, X_{2it}, X_{3it}, Y_{it}) \end{aligned} \quad (12)$$

That is,

$$\ln (1/X_{2it}) = \beta_0 + \beta_{X1} \ln X_{1it} + \beta_{X3} \ln X_{3it} + \beta_Y \ln Y_{it} + v_{it} - u_{it} \quad (13)$$

We can also derive the total-factor efficiency of total fund asset of region i at time t

that is

$$\text{TFE}_{it} \text{ of total fund asset} = \exp(-u_{it}) \quad (14)$$

We derive another SFA model which is measure the total fund assets efficiency. Providing by the same methods, we can derive a SFA model for measuring the efficiency of net assets value as follows:

$$\ln (1/X_{3it}) = \beta_0 + \beta_{X1} \ln X_{1it} + \beta_{X2} \ln X_{2it} + \beta_Y \ln Y_{it} + v_{it} - u_{it} \quad (15)$$

The total-factor efficiency of net assets value of region i at time t is

$$\text{TFE}_{it} \text{ of net assets value} = \exp(-u_{it}) \quad (16)$$

By equations (9), (13) and (15), we discuss disaggregate input efficiency of mutual fund with three inputs: expense ratio, total fund assets and net assets value.

In this paper, we can also incorporate environmental variables in the equation of inefficiency as Battese and Coelli (1995) propose. The technical inefficiency effect,  $u_{it}$ , in the SFA model could be specified as follow

$$u_{it} = \delta z_{it} + \varepsilon_{it} \quad (17)$$

where  $z_{it}$  is the vector of environmental variables and  $\delta$  is a vector of coefficients; and  $\varepsilon_{it}$  is a random variable that is defined the truncation of the normal distribution with zero mean and variance. A coefficient  $\delta < 0$  means that an increase in  $z_{it}$  leads to a decrease in  $u_{it}$  and vice versa.



### 3.3 Date collection and variable definitions

The data is collected from the database of Taiwan Economic Journal (TEJ), Directorate General of Budget, Accounting and Statistics, Chung-Hua Institution for Economic Research, and Republic of China Securities Investment Trust and Consulting Association (SITCA). We divided the data that do not rank, established after 2007 and incomplete. Eventually, the data remaining 310 mutual funds that are balanced data from 2007 to 2012 in Taiwan, all add up to six years. We take 2006 as the base year, and all nominal variables are converted into real variables through GDP deflator. The research fund category is divided into five risk categories, RR1 to RR5.

According to previous literatures, this paper choice risk-adjusted return as our output variable; expense ratio, total assets of fund and net asset value of fund as input variables. The definition describe respectively as follows.

#### 3.3.1 Output variable:

Traditional assessment method of mutual fund used actual return to evaluate mutual funds' performance, but this method has some shortcomings. For example, it cannot consider the effect of overall market risk and average return of funds. Therefore, this paper adopt the method to evaluate performance is that Modigliani & Modigliani (1997) proposed an alternative measure of risk-adjusted return rate: Risk-Adjusted Performance (RAP). It overcomes the disadvantages of the early method. It considers both of rate of return and the degree of fund risk, and easier to compare which one performed better between unit stick and mutual fund return. In this way, we avoid the bias that only consider the actual return result in mislead the investors. In addition, risk-adjusted return rate consider the overall impact of fund market by including in the market portfolio difference ( $\sigma_m$ ). Modigliani & Modigliani

(1997) pointed out that the best performance is therefore attained by separating the decision regarding with portfolio to hold, from the decision as to how much risk to bear. Investors achieve the highest risk-adjusted returns by choosing the best portfolio – that with highest risk-adjusted performance (RAP). Based on the above observations, we choose risk-adjusted performance to evaluate return of mutual funds instead of actual return.

The function of output variable, risk-adjusted return as follow:

$$RAP = (\sigma_m / \sigma_i) (r_i - r_f) + r_f \quad (10)$$

The equation (10) is composed of:

$\sigma_m$ : standard deviation of the average return of market portfolio

$\sigma_i$ : standard deviation of  $r_i$

$r_i$ : average return of fund  $i$

$r_f$ : risk-free interest rate

Risk-free interest rate refers to the investment in particular investment targets without any risk to get interest rate. In the capital markets, long-term government treasury bonds interest rate is usually regarded as risk-free interest rate, because the credibility of the government recognized by the market behavior will be no defaults. Therefore, we adopt ten-year government treasury bonds interest rate as risk-free interest rate by Central Bank of Taiwan in this study.

### 3.3.2 Input variables:

Several factors effect on the return of mutual fund, Based on previous literatures, this study choose three inputs: expense ratio, total fund asset and net assets value. The data of input variables are collected from Taiwan Economic Journal (TEJ), and the data is computed in this study. The description of these variables as follows:

(1) Expense Ratio (EPR) (%): Means total expenses divided by one thousand and divided by net assets of mutual. Multiplied by one hundred percent. And total expenses include manager fees, custodian fees, guarantee fees and other expenses.

(2) Total fund asset (TA) (NTD in million): Means fund size in the end of month.

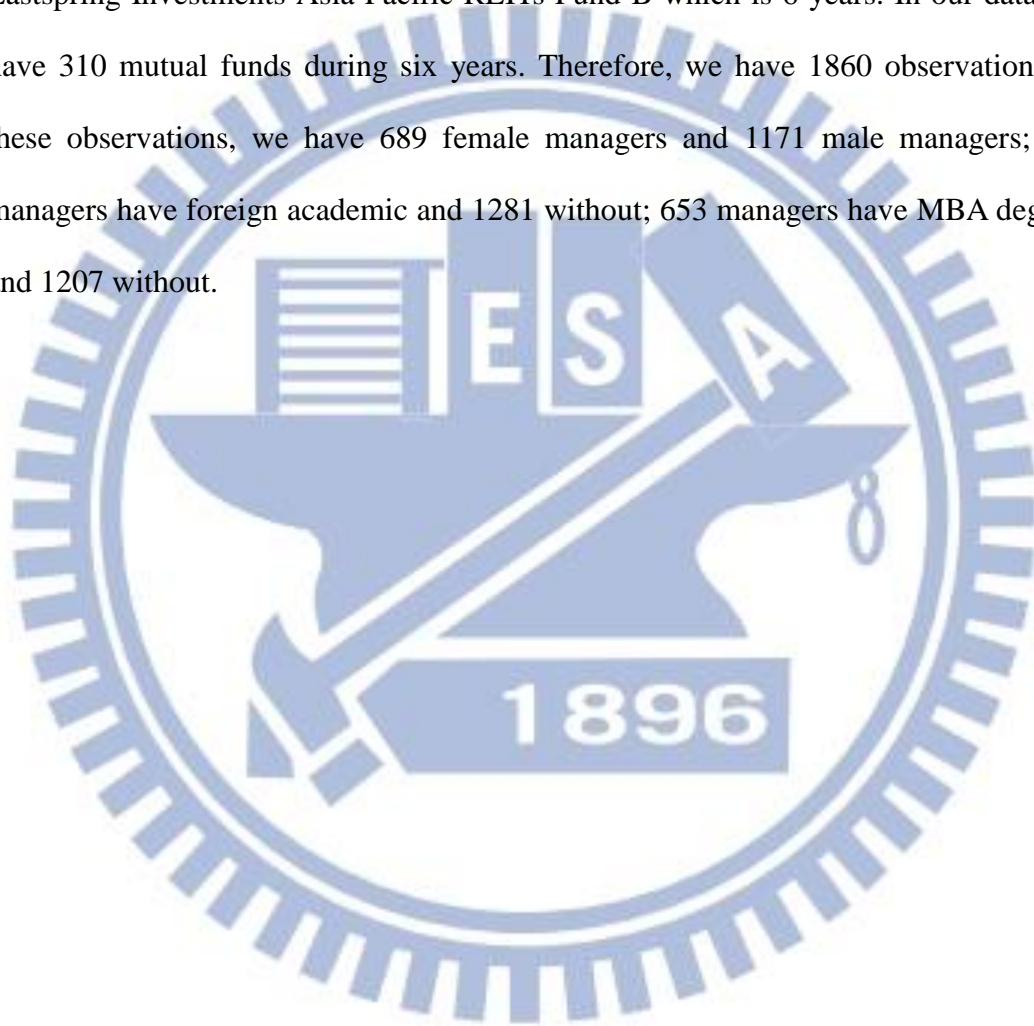
(3) Net assets value (NAV) (NTD): Represents per share market value of a fund. This is the price at which investors buy (bid price) fund shares from a fund company and sell them (redemption price) to a fund company. It is derived by dividing the total value of all the cash and securities in a fund's portfolio, less any liabilities, by the number of shares outstanding. In general, the number based on the Securities Investment Trust or Bank announced.

### **3.3.3 Environmental variables:**

In this study, we apply five environmental variables: RR, age of fund, gender, fund managers with foreign academic degree or not and fund managers with MBA degree or not. Then we use these variables to analyze the influence on three inputs respectively.

According to the level of investment risk, Association of Banks of the Republic of China classify mutual funds to five rank, RR1, RR2, RR3, RR4 and RR5. RR1 means the mutual funds with low risk and pursuits the stable income, usually invest in short-term money market, for example, short-term bills and bank deposit. RR2 means the mutual funds with middle risk and pursuits stable income, usually invest in developed country government bonds, for example, bond level of Standard & Poor's rating BBB and above. RR3 represents the mutual funds with intermediate risk and pursuits fixed income and capital gain, for example, stock, bond and high-yield securities. RR4 represents high risk and pursues capital gain, for example, developed

country's stock. RR5 means very high risk and pursues maximum capital gain, for example, aggressive growth stock and wide fluctuation stock. We classify the data is based on the rank standard. We collect the data of age of fund, managers' gender, FAD and MBA from Money DJ finance news in 2007-2012. The average years of fund is 12.6 years; longest is ING Taiwan China Focus Fund which is 25 years and shortest is Eastspring Investments Asia Pacific REITs Fund B which is 6 years. In our data, we have 310 mutual funds during six years. Therefore, we have 1860 observations. In these observations, we have 689 female managers and 1171 male managers; 579 managers have foreign academic and 1281 without; 653 managers have MBA degrees and 1207 without.



**Table 2: Definition of input and output variables**

Variables	Units	Description	Data Sources
<b><u>Output</u></b>			
Risk-adjusted return rate	%	The annual actual rate of fund is risk-adjusted proposed by Modigliani and Modigliani (1997)	TEJ and computed from this research
<b><u>Input</u></b>			
Expense ratio	%	Total expenses divided by one thousand and divided by net assets of mutual Multiplied by one hundred percent	TEJ
Total fund assets	NTD in 2006 (in thousand)	Means funds size in the end of month	TEJ
Net assets value	NTD in 2006	Per share market value of a fund, it is a bid price or redemption price. The total amount after deducting all relevant costs	TEJ

Note: Risk-adjusted return rate has been computed form actual return, and all nominal variables are in this study have been transformed into real variables through GDP deflators by using 2006 as the base year. The value of 2012 GDP deflator of is predicted by Chung-Hua Institution Economic Research.

**Table 3: Definition of environmental variables**

Variables	Description	Data Sources
<b><u>Fund characteristics</u></b>		
RR	According to the degree of investment risk Association of Banks of the Republic of China classifies 5 level (the preparation of low-high RR=1 to 5).	TEJ and computed from this research
Age of fund	From the fund has been established so far. (year)	Money DJ finance news
<b><u>Manager attributes</u></b>		
Gender	A dummy variable which represents the fund manager is female or male (Gender=1 is female, Gender=0 is male).	Money DJ finance news
FAD	A dummy variable which represents the fund manager have foreign academic degree (FAD=1 is the manager has FAD, otherwise=0).	Money DJ finance news
MBA	A dummy variable which represents the fund manager have MBA degree (MBA=1 is the manager has MBA degree, otherwise=0).	Money DJ finance news

#### 4. Empirical results

Table 4 lists the statistics of all variables with mean, standard deviation, minimum, and maximum. Comparing with the average risk-free interest return, which is 1.68 % in 2007 to 2012, the mean of risk-adjusted return, which is -46.7 %, indicates the negative investment behavior on the mutual funds. The minimum risk-adjusted return is -3613.7 % and the maximum is 818.7 %. The average expense ratio is 0.12 % represents that the proportion of total expenses to total assets is low. Some mutual funds charge fees still quite high of 1.1 %. The average of total fund asset is 4,278,288 thousand NT dollars and the minimum is 76,111, maximum is 82,220,145 thousand NT dollars. The average of net assets value is 17.5111 NT dollars and the minimum is 2.99 NT dollars, the maximum is 689.64 NT dollars. Table 5 shows the correlation coefficient among the output and input variables. There is a 0.443837 correlation between risk-adjusted return and expense ratio; -0.314474 between risk-adjusted return and total fund asset; 0.015985 between risk-adjusted return and net assets value; -0.406554 between expense ratio and total fund asset; 0.008553 between expense ratio and net assets value; 0.078250 between total fund asset and net assets value.

In this paper, we include the characteristics of the 310 funds and the fund managers' basic information include RR, age of fund, genders of fund managers, fund manager with foreign academic degree and with MBA degree in six years. The data represents the mutual fund managers in Taiwan, the average of age of fund is 10 years, male managers are more than female managers, the manager with foreign academic degree are more than without the degree and the managers with MBA degree are more than without MBA degree.

**Table 4: The summary of statistics of all variables**

Variable	Mean	Standard deviation	Minimum	Maximum
Risk-adjusted return (%)	-46.7072	197.5473	-3613.69	818.6923
Expense ratio (%)	0.1228	0.0577	0.0060	1.1040
Total fund asset (NTD)	4,278,288	9,018,828	76,111	82,220,145
Net assets value (NTD)	17.5111	33.0387	2.99	689.64
RR	3.7419	1.4521	1	5
Age of fund (year)	10.10	4.5029	1.08	25.17
Gender	0.3704	0.4830	0	1
FAD	0.3112	0.4631	0	1
MBA	0.3510	0.4774	0	1

Note: Gender, foreign academic degree (FAD) and MBA degree are dummy variables.

**Table 5: Correlation coefficient among the output and input variables**

Variable	Risk-adjusted return (y)	Expense ratio (x <sub>1</sub> )	Total fund asset (x <sub>2</sub> )	Net assets value (x <sub>3</sub> )
Risk-adjusted return (y)	1.000000			
Expense ratio (x <sub>1</sub> )	0.443837	1.000000		
Total fund asset (x <sub>2</sub> )	-0.314474	-0.406554	1.000000	
Net assets value (x <sub>3</sub> )	0.015985	0.008553	0.078250	1.000000



In this study, we select three inputs (expense ratio, total fund value and net assets value) and five environmental variables (RR, age of fund, gender of the manager, with foreign academic degree or not and with MBA degree or not), then explore their efficiency respectively. Tables 5-22 list the results of SFA regression and TFE scores of three inputs. We will describe the result of three inputs after a brief introduction for the parametric.

The parameter  $\gamma$  is the proportion of variance in the inefficiency term ( $u_{it}$ ) to the total variance of the error component term ( $v_{it} - u_{it}$ ). Tables 5, 11 and 17 show that the values of  $\gamma$  are significantly different from zero, indicating that stochastic frontier analysis model is more appropriate than the ordinary least squares (OLS) method by taking into account the inefficiency term.

In Tables 5-22,  $x_1$  represents expense ratio,  $x_2$  means total fund asset,  $x_3$  is net assets value,  $z_1$  stands for RR of fund,  $z_2$  represents the age of fund,  $z_3$  is the gender of the manager,  $z_4$  stands for the manager with foreign academic degree or not and  $z_5$  represents the manager with MBA degree or not. The descriptions are as follows:

#### **4.1 Expense ratio**

Table 6 shows that the estimation of stochastic frontier analysis on expense ratio. The coefficient of RR ( $z_1$ ) is 0.316462 and significantly differs from zero, implying that the lower risk obtains the higher efficiency on expense ratio. The mutual fund of higher risk charge higher expense and transaction cost. However, a high risk fund charges high expense and cost but there is no corresponding gain in 2007 global financial crisis, lead to low efficiency on expense ratio. Table 7 presents average TFE scores of RR1 to RR5 in 2007-2012. We can see that no matter what year it is, the more risk accompanies more inefficiency on expense ratio.

The coefficient of age of fund ( $z_2$ ) is -0.017022 and significantly differ from zero, it means that the longer established mutual funds do better than newly funds on expense ratio. Longer fund could follow the previous experience and fix the mistake on expense and it has a better efficiency on expense ratio.

The coefficient of gender of managers ( $z_3$ ) is -0.027422 and significantly differ from zero, it means that female managers have higher efficiency on expense ratio. Table 8 presents average TFE of gender to expense ratio, showing that the female on average performs better than male.

The coefficient of a manager with foreign academic degree or not ( $z_4$ ) is 0.079319, which significantly differs from zero, implying that if a manager does not have foreign academic degree, then he/she has higher efficiency on expense ratio. Compared with the domestic culture and education, foreign is more opener. These backgrounds reflect on their attitude of operating funds. However, face relative expense and cost of funds should be conservative. Hence the efficiency of the managers without foreign academic degree would be better. Table 9 shows that the average TFE score of managers with foreign academic degree is 0.155618 and that without MBA degree is 0.200563.

The coefficient of a manager has MBA degree or not ( $z_5$ ) is -0.044596 differ from zero, it means that if a manager has MBA degree, the efficiency of expense ratio could be higher. A lot of managerial courses about costs and expenses have to be taken in MBA. These courses are helpful in financial practice.

**Table 6: Stochastic frontier estimation results on expense ratio**

Variable	coefficient	Standard Error	<i>t</i> -ratio	
Constant	-0.889636	0.133366	-6.670645	***
ln(x <sub>2</sub> )	0.077310	0.005647	13.691483	***
ln(x <sub>3</sub> )	-0.009687	0.014331	-0.675950	
ln(y)	-0.094638	0.030728	-3.079887	***
z <sub>1</sub>	0.316462	0.001497	211.341570	***
z <sub>2</sub>	-0.017022	0.001618	-10.518236	***
z <sub>3</sub>	-0.027422	0.014673	-1.868926	**
z <sub>4</sub>	0.079319	0.015919	4.982637	***
z <sub>5</sub>	-0.044596	0.014930	-2.987087	***
$\sigma^2 = \sigma_v^2 + \sigma_u^2$	0.088007	0.002701	32.581926	***
$\gamma = \sigma_u^2 / \sigma^2$	0.995756	0.127383	7.816994	***
Log-likelihood		-380.091290		
Total obs.		310		

Note: \* represents 10% level of significance, \*\* represents 5% level of significance, \*\*\* represents 1% level of significance.

**Table 7: Average TFE of RR to expense ratio**

Variables	2007	2008	2009	2010	2011	2012	Average
RR 1	0.397984	0.443633	0.504914	0.524920	0.533447	0.553162	0.493010
RR 2	0.204763	0.240708	0.215570	0.216201	0.215646	0.229891	0.220463
RR 3	0.151479	0.160789	0.161783	0.163787	0.160025	0.159259	0.159520
RR 4	0.121401	0.125688	0.125752	0.122488	0.125207	0.125226	0.124294
RR 5	0.114967	0.118286	0.119080	0.113791	0.117098	0.117054	0.116713
Average	0.198119	0.217821	0.225420	0.228238	0.230285	0.236918	0.222800

**Table 8: Average TFE of gender to expense ratio**

Variables	2007	2008	2009	2010	2011	2012	Average
Female	0.212283	0.210006	0.217399	0.238348	0.234319	0.252747	0.227517
Male	0.148263	0.165008	0.170598	0.164336	0.166972	0.158636	0.162302
Average	0.180273	0.187507	0.193999	0.201342	0.200646	0.205692	0.194910

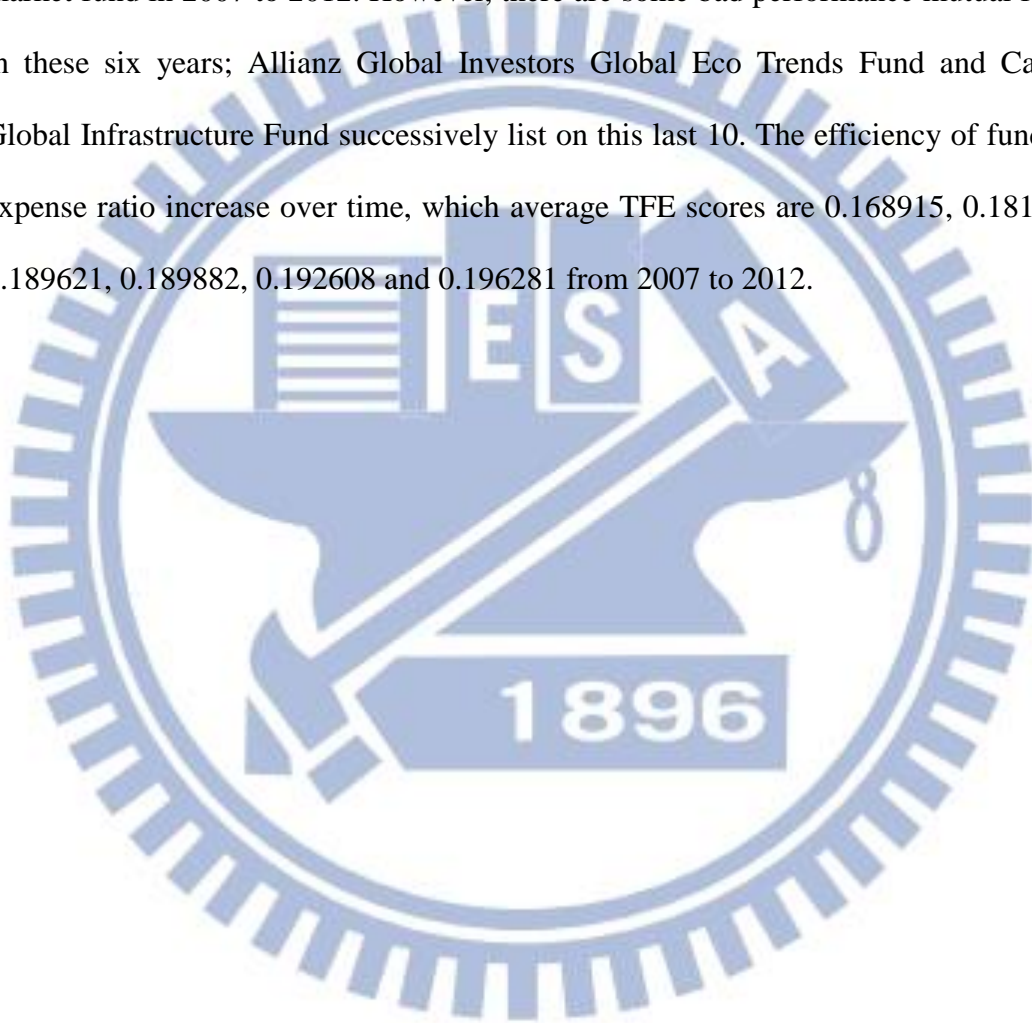
**Table 9: Average TFE of FAD to expense ratio**

Variables	2007	2008	2009	2010	2011	2012	Average
FAD	0.137592	0.157282	0.151065	0.174132	0.156953	0.156683	0.155618
Without FAD	0.181529	0.191642	0.206144	0.197271	0.209337	0.217452	0.200563
Average	0.159561	0.174462	0.178605	0.185702	0.183145	0.187067	0.178090

**Table 10: Average TFE of MBA to expense ratio**

Variables	2007	2008	2009	2010	2011	2012	Average
MBA	0.146275	0.166978	0.165329	0.171112	0.163828	0.157376	0.161817
Without MBA	0.180017	0.189802	0.202794	0.199775	0.209116	0.217678	0.199864
Average	0.163146	0.178390	0.184061	0.185444	0.186472	0.187527	0.180840

In expense ratio efficiency, we rank the efficiency of the top 10 and bottom 10 mutual funds in 6 years. We found that KGI Victory Money Market Fund is the most efficient in 2007 and 2008; HSBC NTD Money Market Fund 2 is top 1 in 2010 to 2012; Manulife Money Market Fund is the most stable performance fund, it appears in the ranking top10 in these six years. Almost all of the top 10 funds are money market fund in 2007 to 2012. However, there are some bad performance mutual funds in these six years; Allianz Global Investors Global Eco Trends Fund and Cathay Global Infrastructure Fund successively list on this last 10. The efficiency of funds to expense ratio increase over time, which average TFE scores are 0.168915, 0.181556, 0.189621, 0.189882, 0.192608 and 0.196281 from 2007 to 2012.



**Table 11: Annual ranking of expense ratio TFE**

2007	Top 10	2007	Last 10
KGI Victory Money Market Fund	0.636329	Prudential Financial Global Small & Mid Cap Fund	0.079181
Truswell Hua-Win Money Market Fund	0.617500	Prudential Financial Global Bio-Health Fund	0.077642
Yuanta Wan Tai Money Market Fund	0.606100	HSBC BRIC Fund	0.077224
Manulife Money Market Fund	0.603835	Deutsche Far Eastern DWS Global Material & Energy Fund	0.077072
Eastspring Investments Well Pool Money Market Fund	0.579427	JPMorgan (Taiwan) Global Emerging Markets Fund	0.075768
BlackRock TWD Money Market Fund	0.562827	HSBC Global Emerging Markets Fund	0.074303
ABITL Money Market Fund	0.549472	Allianz Global Investors Global Eco Trends Fund	0.070699
Truswell Money Market Fund	0.547336	FSITC Malaysia Fund	0.070426
Paradigm Pion Money Market Fund	0.539144	Mega Balanced Fund	0.062080
Invesco ROC Money Market Fund	0.489157	Cathay Global Infrastructure Fund	0.040450
2008	Top 10	2008	Last 10
KGI Victory Money Market Fund	0.700410	JPMorgan (Taiwan) China Concept Fund	0.081528
Manulife Money Market Fund	0.692646	HSBC Global Emerging Markets Fund	0.079425
BlackRock TWD Money Market Fund	0.689059	Allianz Global Investors Global Biotech Fund	0.078982
Truswell Hua-Win Money Market Fund	0.649490	HSBC BRIC Fund	0.077992
Jih Sun Money Market Fund	0.637508	Cathay Global Infrastructure Fund	0.077649
JPMorgan (Taiwan) Wealth Management Fund	0.601199	Prudential Financial Global Small & Mid Cap Fund	0.075925
Shinkong Chi-Shin Money Market Fund	0.597250	JPMorgan (Taiwan) Global Dynamic Fund	0.073396
Eastspring Investments Well Pool Money Market Fund	0.596005	JPMorgan (Taiwan) Global Emerging Markets Fund	0.065520
Yuanta Wan Tai Money Market Fund	0.581616	Eastspring Investments Asia-Pacific High Yield Equity Fund	0.029473
Paradigm Pion Money Market Fund	0.575529	PineBridge Taiwan Giant Fund	0.016154

**Table 11: Annual ranking of expense ratio TFE (con't)**

2009	Top 10	2009	Last 10
Manulife Money Market Fund	0.858375	JPMorgan (Taiwan) Global Dynamic Fund	0.086980
HSBC NTD Money Market Fund 2	0.846735	JPMorgan (Taiwan) China Concept Fund	0.086860
Eastspring Investments Well Pool Money Market Fund	0.799781	Deutsche Far Eastern DWS Global Material & Energy Fund	0.085660
HSBC NTD Money Market Fund	0.797687	Mega Global Fund	0.084023
Yuanta Wan Tai Money Market Fund	0.787555	Prudential Financial Global Bio-Health Fund	0.079705
Truswell Hua-Win Money Market Fund	0.785948	HSBC Global Emerging Markets Fund	0.078720
Invesco ROC Money Market Fund	0.747006	HSBC BRIC Fund	0.074930
BlackRock TWD Money Market Fund	0.742248	Allianz Global Investors Global Eco Trends Fund	0.070590
Shinkong Chi-Li Money-market Fund	0.706012	Cathay Global Infrastructure Fund	0.069854
Shinkong Chi-Shin Money Market Fund	0.655020	JPMorgan (Taiwan) Global Emerging Markets Fund	0.069660
2010	Top 10	2010	Last 10
HSBC NTD Money Market Fund 2	0.917262	FSITC Malaysia Fund	0.084339
Manulife Money Market Fund	0.893475	JPMorgan (Taiwan) Global Dynamic Fund	0.084077
HSBC NTD Money Market Fund	0.858438	Prudential Financial Global Bio-Health Fund	0.080982
Eastspring Investments Well Pool Money Market Fund	0.838562	Allianz Global Investors Global Eco Trends Fund	0.078765
Invesco ROC Money Market Fund	0.761257	Deutsche Far Eastern DWS Global Material & Energy Fund	0.078310
Yuanta Wan Tai Money Market Fund	0.755573	HSBC BRIC Fund	0.075217
Paradigm Pion Money Market Fund	0.747872	HSBC Global Emerging Markets Fund	0.074204
BlackRock TWD Money Market Fund	0.718386	JPMorgan (Taiwan) Global Emerging Markets Fund	0.073749
Deutsche Far Eastern DWS Taiwan Money Market Fund	0.677736	Eastspring Investments Asia-Pacific High Yield Equity Fund	0.068306
Schroder New Era Money Market Fund	0.652684	Cathay Global Infrastructure Fund	0.067837

**Table 11: Annual ranking of expense ratio TFE (con't)**

2011	Top 10	2011	Last 10
HSBC NTD Money Market Fund 2	0.940837	JPMorgan (Taiwan) China Concept Fund	0.086546
Manulife Money Market Fund	0.933811	JPMorgan (Taiwan) Global Dynamic Fund	0.085118
HSBC NTD Money Market Fund	0.880094	Prudential Financial Global Selection Fund	0.082654
BlackRock TWD Money Market Fund	0.792476	Prudential Financial Global Bio-Health Fund	0.079834
Schroder New Era Money Market Fund	0.780954	Allianz Global Investors Global Eco Trends Fund	0.079695
Invesco ROC Money Market Fund	0.771084	HSBC Global Emerging Markets Fund	0.079635
Yuanta Wan Tai Money Market Fund	0.755643	Cathay Global Infrastructure Fund	0.079042
Eastspring Investments Well Pool Money Market Fund	0.725779	HSBC BRIC Fund	0.074699
Paradigm Pion Money Market Fund	0.687203	JPMorgan (Taiwan) Global Emerging Markets Fund	0.074153
ABITL Money Market Fund	0.654839	Prudential Financial Emerging Market Selection Fund	0.038358
2012	Top 10	2012	Last 10
HSBC NTD Money Market Fund 2	0.906632	JPMorgan (Taiwan) Global Dynamic Fund	0.082778
HSBC NTD Money Market Fund	0.848585	Allianz Global Investors Global Eco Trends Fund	0.081927
BlackRock TWD Money Market Fund	0.834482	Prudential Financial Global Small & Mid Cap Fund	0.081755
Invesco ROC Money Market Fund	0.780944	Prudential Financial Global Bio-Health Fund	0.078941
JPMorgan (Taiwan) Wealth Management Fund	0.766765	HSBC BRIC Fund	0.076726
Manulife Money Market Fund	0.722070	JPMorgan (Taiwan) Global Emerging Markets Fund	0.073865
ABITL Money Market Fund	0.720827	JPMorgan (Taiwan) Global Balanced Fund	0.073563
Yuanta Wan Tai Money Market Fund	0.707725	Cathay Global Infrastructure Fund	0.073188
THE RSIT Enhanced Money Market Fund	0.699717	Prudential Financial Global Selection Fund	0.065664
Eastspring Investments Well Pool Money Market Fund	0.688325	Prudential Financial Emerging Market Selection Fund	0.054256



## 4.2 Total fund asset

Table 12 lists the SFA results on total fund asset. The coefficient of RR ( $z_1$ ) is -2.027837 and it significantly differs from zero, it means that high risk associate with high efficiency on total fund asset. The larger size funds have more financial space could use in high risk financial market, of course, have better efficiency. The results can be seen more clearly in table 13 which shows that the average TFE of RR to total fund asset every year. In 2007, the average TFE of RR1 is 0.069272 and RR5 is 0.884434, not only see the difference between RR1 and RR5 and showed an increase trend form RR1 to RR5.

The coefficient of age of fund ( $z_2$ ) is 0.095442 and it significantly differs from zero, it means that the newer established mutual funds do better than longer established funds on total fund asset.

The coefficient of gender of managers ( $z_3$ ) is 0.004382 and do not significantly differs from zero, it means that female managers have no difference with male managers on total fund asset. Shows that either female or male managers make decisions in treatment of assets will be no difference. From the average TFE scores of gender in table 14 could see the TFE scores of male managers slightly larger than female managers.

The coefficient of a manager has foreign academic degree or not ( $z_4$ ) is -0.268113 differ from zero, it means that if managers have foreign academic degree have higher efficiency on total fund asset. This result reveals the difference between foreign and domestic education. In Taiwan, conservative investment attitude sometimes lose some investment opportunities. Besides, if managers can go to the cities that are world economic center overseas, like New York and London, learning local culture and attitude, it would be helpful in financial market.

The coefficient of managers graduated from MBA or not ( $z_5$ ) is -0.394284 differ from zero, it means that if a manager has MBA degree, the efficiency of total fund asset could be higher. In order to get a MBA degree, one has to take management-related courses. Assets management is also one of the courses, therefore, have MBA degree is positive on this part.

**Table 12: Stochastic frontier estimation results on total fund asset**

Variable	coefficient	Standard Error	t-ratio	
Constant	-8.532561	1.029935	-8.284561	***
ln(x <sub>1</sub> )	-0.463652	0.081486	-5.689970	***
ln(x <sub>3</sub> )	-0.646152	0.050330	-12.838261	***
ln(y)	-0.284373	0.124534	-2.283500	**
z <sub>1</sub>	-2.027837	0.124248	-16.320836	***
z <sub>2</sub>	0.095442	0.016541	5.770104	***
z <sub>3</sub>	0.004382	0.117356	0.037337	
z <sub>4</sub>	-0.268113	0.115782	-2.315671	**
z <sub>5</sub>	-0.394284	0.114352	-3.447980	***
$\sigma^2 = \sigma_v^2 + \sigma_u^2$	1.552884	0.074384	20.876508	***
$\gamma = \sigma_u^2 / \sigma^2$	0.437303	0.032493	13.458520	***
Log-likelihood		-2629.185400		
Total obs.		310		

Note: \* represents 10% level of significance, \*\* represents 5% level of significance, \*\*\* represents 1% level of significance.

**Table 13: Average TFE of RR to total fund asset**

Variables	2007	2008	2009	2010	2011	2012	Average
RR 1	0.069272	0.078418	0.078696	0.092889	0.106322	0.114482	0.090013
RR 2	0.508786	0.572995	0.541506	0.552416	0.601695	0.616997	0.565733
RR 3	0.754425	0.776472	0.783704	0.796960	0.807613	0.814459	0.788939
RR 4	0.838935	0.849479	0.850072	0.855557	0.861479	0.863837	0.853227
RR 5	0.884434	0.889794	0.889175	0.893125	0.895654	0.897529	0.891618
Average	0.611170	0.633432	0.628631	0.638190	0.654553	0.661461	0.637906

**Table 14: Average TFE of gender to total fund asset**

Variables	2007	2008	2009	2010	2011	2012	Average
Female	0.616267	0.661085	0.679125	0.647623	0.661432	0.653017	0.653091
Male	0.759129	0.763697	0.756309	0.777172	0.790369	0.807523	0.775700
Average	0.687698	0.712391	0.717717	0.712398	0.725900	0.730270	0.714396

**Table 15: Average TFE of FAD to total fund asset**

Variables	2007	2008	2009	2010	2011	2012	Average
FAD	0.795169	0.799236	0.815708	0.786632	0.815863	0.818627	0.805206
Without FAD	0.679972	0.695515	0.686035	0.707038	0.706300	0.706741	0.696934
Average	0.737571	0.747376	0.750872	0.746835	0.761082	0.762684	0.751070

**Table 16: Average TFE of MBA to total fund asset**

Variables	2007	2008	2009	2010	2011	2012	Average
MBA	0.802058	0.789765	0.806679	0.805122	0.818511	0.831956	0.809015
Without MBA	0.669394	0.689872	0.680610	0.694155	0.696995	0.698291	0.688219
Average	0.735726	0.739818	0.743644	0.749639	0.757753	0.765124	0.748617

Table 17 shows the annual ranking of total fund asset TFE. We rank top 10 and bottom 10 performances in 2007 to 2012. Among the top 10, Fubon Taiwan Phoenix Fund gets the first place on total fund asset over these six years and the average TFE scores up to 0.922549. Besides, Deutsche Far Eastern DWS Technology Fund has great performance and average TFE scores is 0.916947. Capital Money Market Fund is the worst performance and the average TFE score is 0.025801. However, these top 10 funds and last 10 funds on total fund asset do not appear in the table 5 of annual ranking of total fund asset TFE. There is no correlation between performance and time. The TFE score is 0.713045 in 2007 which is the worst performance, and the scores is 0.745721 in 2012 which is the best performance in recent six years.

**Table 17: Annual ranking of total fund asset TFE**

2007	Top 10	2007	Last 10
Fubon Taiwan Phoenix Fund	0.918656	Fubon Chi-Hsiang Money Market Fund	0.037191
Deutsche Far Eastern DWS Technology Fund	0.911224	Prudential Financial Money Market Fund	0.035877
Invesco Taiwan Select Growth Fund	0.910514	ING Taiwan Money Market Fund	0.034404
Mega Life Science Fund	0.909368	Fuh Hwa Money Market Fund	0.033714
Deutsche Far Eastern DWS Taiwan Flagship Fund	0.908909	Polaris De-Li Money Market Fund	0.033301
Paradigm Global Oil Resources Fund	0.907658	FSITC Taiwan Money Market Fund	0.032943
BlackRock Baoli Fund	0.906829	ING Taiwan Income Money Market Fund	0.032313
Union China Fund	0.905624	Eastspring Investments Well Pool Money Market Fund	0.027177
Manulife Dynamic Fund	0.905416	Yuanta Wan Tai Money Market Fund	0.025580
Manulife Taiwan High Dividend Fund	0.905109	Capital Money Market Fund	0.021938
2008	Top 10	2008	Last 10
Fubon Taiwan Phoenix Fund	0.924873	UPAMC James Money Market Fund	0.030488
Paradigm Global Oil Resources Fund	0.915720	Fuh Hwa Money Market Fund	0.029911
Invesco Taiwan Select Growth Fund	0.915114	ING Taiwan Money Market Fund	0.029692
Deutsche Far Eastern DWS Technology Fund	0.914315	Hua Nan Phoenix Money Market Fund	0.029540
Mega Life Science Fund	0.913808	Polaris De-Li Money Market Fund	0.027191
Deutsche Far Eastern DWS Taiwan Flagship Fund	0.911472	Prudential Financial Money Market Fund	0.025646
Polaris Global REITs Fund-A	0.908811	Fubon Chi-Hsiang Money Market Fund	0.025032
Union China Fund	0.908154	Yuanta Wan Tai Money Market Fund	0.022892
Eastspring Investments US High Tech Fund	0.907976	Eastspring Investments Well Pool Money Market Fund	0.022197
BlackRock Baoli Fund	0.906573	Capital Money Market Fund	0.020074

**Table 17: Annual ranking of total fund asset TFE (con't)**

2009	Top 10	2009	Last 10
Fubon Taiwan Phoenix Fund	0.920574	Hua Nan Phoenix Money Market Fund	0.035168
Deutsche Far Eastern DWS Technology Fund	0.916467	Mega Diamond Money Market Fund	0.032866
Mega Life Science Fund	0.913483	Prudential Financial Money Market Fund	0.032760
Deutsche Far Eastern DWS Taiwan Flagship Fund	0.913122	Jih Sun Money Market Fund	0.031823
Manulife Taiwan High Dividend Fund	0.912962	Polaris De-Li Money Market Fund	0.030484
Invesco Taiwan Select Growth Fund	0.911022	Fuh Hwa Money Market Fund	0.028949
Paradigm Global Oil Resources Fund	0.909620	Eastspring Investments Well Pool Money Market Fund	0.025484
Ontario High-Tech Fund	0.908104	Fubon Chi-Hsiang Money Market Fund	0.025276
Eastspring Investments US High Tech Fund	0.906955	Capital Money Market Fund	0.024322
Taishin China Equity Fund	0.906772	Yuanta Wan Tai Money Market Fund	0.021879
2010	Top 10	2010	Last 10
Fubon Taiwan Phoenix Fund	0.921819	Union Money Market Fund	0.040410
Deutsche Far Eastern DWS Technology Fund	0.917641	Hua Nan Phoenix Money Market Fund	0.040161
Union China Fund	0.916330	Cathay Taiwan Money Market Fund	0.038608
Manulife Taiwan High Dividend Fund	0.914306	Mega Diamond Money Market Fund	0.033575
Deutsche Far Eastern DWS Taiwan Flagship Fund	0.914096	Fuh Hwa Money Market Fund	0.031708
Invesco Taiwan Select Growth Fund	0.913538	Jih Sun Money Market Fund	0.030535
Ontario High-Tech Fund	0.911349	Yuanta Wan Tai Money Market Fund	0.027413
Paradigm Global Oil Resources Fund	0.910995	Fubon Chi-Hsiang Money Market Fund	0.027276
Polaris Asia Taiwanese Enterprises Fund	0.910573	Eastspring Investments Well Pool Money Market Fund	0.026432
Yuanta European Growth Fund	0.909220	Capital Money Market Fund	0.025557

**Table 17: Annual ranking of total fund asset TFE (con't)**

2011	Top 10	2011	Last 10
Fubon Taiwan Phoenix Fund	0.923299	Hua Nan Phoenix Money Market Fund	0.045173
Deutsche Far Eastern DWS Technology Fund	0.919861	Cathay Taiwan Money Market Fund	0.040615
Union China Fund	0.918068	Fuh Hwa Money Market Fund	0.038354
Deutsche Far Eastern DWS Taiwan Flagship Fund	0.916258	Taishin 1699 Money Market Fund	0.036694
Ontario High-Tech Fund	0.914177	Capital Money Market Fund	0.036512
Polaris Asia Taiwanese Enterprises Fund	0.913883	Jih Sun Money Market Fund	0.035894
Paradigm Global Oil Resources Fund	0.913686	Mega Diamond Money Market Fund	0.033630
Invesco Taiwan Select Growth Fund	0.912933	Fubon Chi-Hsiang Money Market Fund	0.031917
Polaris Global REITs Fund-A	0.912389	Eastspring Investments Well Pool Money Market Fund	0.031746
Polaris Small-Medium Cap Fund	0.912275	Yuanta Wan Tai Money Market Fund	0.027237
2012	Top 10	2012	Last 10
Fubon Taiwan Phoenix Fund	0.926070	Union Money Market Fund	0.048841
Deutsche Far Eastern DWS Technology Fund	0.920768	Cathay Taiwan Money Market Fund	0.046300
Invesco Taiwan Select Growth Fund	0.920521	Taishin 1699 Money Market Fund	0.044856
Union China Fund	0.920173	UPAMC James Money Market Fund	0.042869
Mega Life Science Fund	0.918579	Mega Diamond Money Market Fund	0.035539
Paradigm Global Oil Resources Fund	0.917219	Fubon Chi-Hsiang Money Market Fund	0.035285
Union Technology Fund	0.916074	Jih Sun Money Market Fund	0.034607
Ontario High-Tech Fund	0.914578	Eastspring Investments Well Pool Money Market Fund	0.033652
Paradigm Technology Fund	0.913811	Yuanta Wan Tai Money Market Fund	0.027275
Deutsche Far Eastern DWS Taiwan Flagship Fund	0.912994	Capital Money Market Fund	0.026405

### 4.3 Net assets value

Table 18 shows the SFA results on net assets value. The coefficient of RR ( $z_1$ ) is 1.362321 and it significantly differs from zero, implying that low risk associate with high efficiency on net assets value and a higher risk portfolio of mutual fund poorly perform in recent six years. Review table 4, the average risk-adjusted return is -46.7072% shows that the overall economic is a recession situation. Such a case, conservative and stable strategy sometimes is better than a bold and positive strategy. Therefore, the higher RR might appear a poor result. Look Table 19 shows that RR2 is perform well in recent six years and the average TFE is 0.858529 which RR5 is perform poorly and the average TFE is 0.683755. After the year of 2008, TFE score has a decline trend over time.

The coefficient of age of fund ( $z_2$ ) is 0.264586 and it significantly differs from zero, it means that the newer established mutual funds do better than longer established funds on net assets value.

The coefficient of gender of managers ( $z_3$ ) is 0.473419 and it significantly differs from zero, it means that male managers have better performance than female managers on net assets value. Many research and investigation pointed out the gender differences have influence on net assets value. Atkinson M. Stanley et al. (2003) proposed that the net asset flows into funds managed by females are lower than for males especially for the manager's initial year managing the fund. This result is accordance with this paper.

The coefficient of a manager has foreign academic degree or not ( $z_4$ ) is -0.858776 and significantly differ from zero, implying that if managers with foreign academic degrees have higher efficiency on net assets value.

The coefficient of a manager has MBA degree or not ( $z_5$ ) is -0.516246 differ from zero, it means that if a manager has MBA degree, the efficiency of net assets value could be higher.

**Table 18: Stochastic frontier estimation results on net assets value**

Variable	coefficient	Standard Error	t-ratio	
Constant	-1.210455	0.359707	-3.365116	***
ln(x <sub>1</sub> )	0.058350	0.015502	3.764046	***
ln(x <sub>3</sub> )	-0.073240	0.007091	-10.329026	***
ln(y)	-0.025388	0.039336	-0.645422	
z <sub>1</sub>	1.362321	0.194504	7.004070	***
z <sub>2</sub>	0.264586	0.043559	6.074170	***
z <sub>3</sub>	0.473419	0.102824	4.604153	***
z <sub>4</sub>	-0.858776	0.158781	-5.408555	***
z <sub>5</sub>	-0.516246	0.105812	-4.878919	***
$\sigma^2 = \sigma_v^2 + \sigma_u^2$	1.606394	0.239532	6.706395	***
$\gamma = \sigma_u^2 / \sigma^2$	0.955065	0.006125	155.934190	***
Log-likelihood		-989.294090		
Total obs.		310		

Note: \* represents 10% level of significance, \*\* represents 5% level of significance, \*\*\* represents 1% level of significance.



**Table 19: Average TFE of RR to net assets value**

Variables	2007	2008	2009	2010	2011	2012	Average
RR 1	0.853359	0.850943	0.852448	0.847469	0.842858	0.843798	0.848479
RR 2	0.873842	0.868217	0.861715	0.855736	0.848670	0.842996	0.858529
RR 3	0.796204	0.850840	0.788396	0.769929	0.796740	0.776054	0.796361
RR 4	0.644145	0.802555	0.686361	0.666644	0.723920	0.696425	0.703342
RR 5	0.621822	0.798115	0.649120	0.637317	0.710315	0.685840	0.683755
Average	0.757874	0.834134	0.767608	0.755419	0.784501	0.769023	0.778093

**Table 20: Average TFE of gender to net assets value**

Variables	2007	2008	2009	2010	2011	2012	Average
Female	0.752761	0.830502	0.737687	0.720106	0.756966	0.742440	0.756744
Male	0.676011	0.811690	0.706907	0.699299	0.751219	0.728038	0.728861
Average	0.714386	0.821096	0.722297	0.709702	0.754092	0.735239	0.742802

**Table 21: Average TFE of FAD to net assets value**

Variables	2007	2008	2009	2010	2011	2012	Average
FAD	0.727060	0.838017	0.734300	0.740082	0.782728	0.750158	0.762057
Without FAD	0.690182	0.810543	0.713039	0.690715	0.739649	0.725052	0.728197
Average	0.708621	0.824280	0.723670	0.715399	0.761188	0.737605	0.745127

**Table 22: Average TFE of MBA to net assets value**

Variables	2007	2008	2009	2010	2011	2012	Average
MBA	0.686564	0.814767	0.707892	0.708270	0.764577	0.732164	0.735706
Without MBA	0.707735	0.820781	0.725668	0.705538	0.746999	0.734697	0.740236
Average	0.697150	0.817774	0.716780	0.706904	0.755788	0.733431	0.737971

Net assets value of mutual funds react the ability that the managers operate the portfolio, therefore, net assets value is a determinate factor on the mutual fund performance. Table 23 shows that the annual ranking of net assets value TFE. We rank top 10 and bottom 10 performances in 2007 to 2012. Among top 10, Yuanta Global Telecommunication Fund get 5 first places and the average TFE score on net assets value is 0.931366. ING Taiwan High Tech Selection Fund is has great performance that is usually appears in top 3 and the average TFE score on net assets value is 0.921106. It is worth mentioning is Fubon Taiwan Phoenix Fund is the worst performance and the average TFE score is 0.020797 on net assets value. However, Fubon Taiwan Phoenix Fund is best performing fund on total fund asset. Besides this Fubon Taiwan Phoenix Fund, most of fund has the different strength in expense ratio, total fund asset or net assets value. One mutual fund's performance will be reflected in a variety of different projects. The TFE score is 0.700769 in 2007, 0.818608 in 2008, 0.719418 in 2009, 0.706481 in 2010, 0.753406 in 2011 and 0.733798 in 2012.

**Table 23: Annual ranking of net assets value TFE**

2007	Top 10	2007	Last 10
Yuanta Global Telecommunication Fund	0.919298	Capital OTC Fund	0.287290
Taishin Lucky Money Market Fund	0.912721	Yuanta Excellence Equity Fund	0.276825
Cathay Global Money Market Fund	0.906623	Eastspring Investments High-Tech Fund	0.263822
ING Taiwan High Tech Selection Fund	0.904684	UPAMC All Weather Fund	0.253963
Schroder New Era Money Market Fund	0.904012	Fubon Supreme Fund	0.240636
HSBC Global Fund of Bond Funds	0.902742	Fubon Precision Fund	0.237374
ING Taiwan Aggressive Growth Selection Fund	0.900677	Prudential Financial High Growth Fund	0.195133
Mega Diamond Money Market Fund	0.900417	Capital Marathon Fund	0.177077
Paradigm Pion Money Market Fund	0.900408	FSITC Money Market Fund	0.118008
Cathay Taiwan Money Market Fund	0.900282	Fubon Taiwan Phoenix Fund	0.016632
2008	Top 10	2008	Last 10
ING Taiwan High Tech Selection Fund	0.947174	Eastspring Investments High-Tech Fund	0.485294
Yuanta Global Telecommunication Fund	0.940354	UPAMC All Weather Fund	0.483934
ING Taiwan Aggressive Growth Selection Fund	0.938513	Yuanta Duo Fu Equity Fund	0.482844
Eastspring Investments Asia Pacific REITs Fund A	0.938487	Fubon Supreme Fund	0.442003
Prudential Financial New Century Fund	0.935726	Fubon Precision Fund	0.438968
Eastspring Investments Asia Pacific REITs Fund B	0.934521	Polaris 2001 Fund	0.420093
Fubon Elite Fund	0.932888	Prudential Financial High Growth Fund	0.338477
Cathay Dragon Fund	0.932260	Capital Marathon Fund	0.312791
Polaris Global REITs Fund-B	0.930976	FSITC Money Market Fund	0.116064
Yuanta OTC Fund	0.930517	Fubon Taiwan Phoenix Fund	0.029756

**Table 23: Annual ranking of net assets value TFE (con't)**

2009	Top 10	2009	Last 10
Yuanta Global Telecommunication Fund	0.932784	Yuanta Duo Fu Equity Fund	0.293297
Eastspring Investments Asia Pacific REITs Fund A	0.927643	UPAMC All Weather Fund	0.274872
Eastspring Investments Asia Pacific REITs Fund B	0.919502	Capital OTC Fund	0.270855
Polaris Global REITs Fund-B	0.919167	Fubon Supreme Fund	0.260185
Taishin Lucky Money Market Fund	0.913004	Polaris 2001 Fund	0.259138
ING Taiwan High Tech Selection Fund	0.910741	Fubon Precision Fund	0.254104
Mega Diamond Money Market Fund	0.904565	Prudential Financial High Growth Fund	0.214072
Deutsche Far Eastern DWS Taiwan Money Market Fund	0.903324	Capital Marathon Fund	0.200894
Fubon Global REIT Fund	0.903244	FSITC Money Market Fund	0.119109
Prudential Financial New Century Fund	0.903114	Fubon Taiwan Phoenix Fund	0.016980
2010	Top 10	2010	Last 10
Yuanta Global Telecommunication Fund	0.931157	UPAMC Long Ma Fund	0.286817
Polaris Global REITs Fund-B	0.918838	Yuanta Duo Fu Equity Fund	0.285087
ING Taiwan High Tech Selection Fund	0.916475	UPAMC All Weather Fund	0.254843
Eastspring Investments Asia Pacific REITs Fund A	0.914152	Fubon Precision Fund	0.253597
Taishin Lucky Money Market Fund	0.911803	Fubon Supreme Fund	0.249682
Allianz Global Investors Global Eco Trends Fund	0.909424	Capital OTC Fund	0.248122
Mega Diamond Money Market Fund	0.904077	Capital Marathon Fund	0.189077
Eastspring Investments Asia Pacific REITs Fund B	0.903834	Prudential Financial High Growth Fund	0.188453
Cathay Taiwan Money Market Fund	0.901331	FSITC Money Market Fund	0.119346
Deutsche Far Eastern DWS Taiwan Money Market Fund	0.899882	Fubon Taiwan Phoenix Fund	0.018474

**Table 23: Annual ranking of net assets value TFE (con't)**

2011	Top 10	2011	Last 10
Yuanta Global Telecommunication Fund	0.933059	Polaris 2001 Fund	0.358926
ING Taiwan High Tech Selection Fund	0.926504	UPAMC Long Ma Fund	0.352989
Polaris Global REITs Fund-B	0.926472	Capital OTC Fund	0.336904
Allianz Global Investors Global Eco Trends Fund	0.924999	Fubon Precision Fund	0.290981
Ontario High-Tech Fund	0.919042	UPAMC All Weather Fund	0.289062
Eastspring Investments Asia Pacific REITs Fund A	0.916675	Fubon Supreme Fund	0.282078
Yuanta OTC Fund	0.915067	Prudential Financial High Growth Fund	0.234873
Taishin Lucky Money Market Fund	0.909034	Capital Marathon Fund	0.215372
HSBC Taiwan Mid & Small Cap Fund	0.907966	FSITC Money Market Fund	0.118845
Mirae Asset Apollo Fund	0.906690	Fubon Taiwan Phoenix Fund	0.022343
2012	Top 10	2012	Last 10
Yuanta Global Telecommunication Fund	0.931543	Polaris 2001 Fund	0.351460
Yuanta OTC Fund	0.922825	UPAMC Long Ma Fund	0.325203
ING Taiwan High Tech Selection Fund	0.921057	Fubon Precision Fund	0.310863
Allianz Global Investors Global Eco Trends Fund	0.920193	Capital OTC Fund	0.283382
Polaris Global REITs Fund-B	0.911484	Fubon Supreme Fund	0.271801
Ontario High-Tech Fund	0.910951	UPAMC All Weather Fund	0.263851
Paradigm Global Oil Resources Fund	0.910347	Prudential Financial High Growth Fund	0.217914
Polaris Global ETFs Growth Fund	0.909899	Capital Marathon Fund	0.206765
Taishin Lucky Money Market Fund	0.908566	FSITC Money Market Fund	0.116572
Mega Diamond Money Market Fund	0.904687	Fubon Taiwan Phoenix Fund	0.020594

## 5. Conclusions and limitations

### 5.1 Conclusions and managerial implications

In this paper, we apply the panel data stochastic frontier approach to compute the disaggregate inputs efficiency of 310 mutual funds in Taiwan during 2007-2012. The SFA mainly extended from Zhou et al. (2012) and develop it to financial field. We compute risk-adjusted return (RAP) that is proposed by Modigliani & Modigliani (1997) to replace actual return. Use three inputs to compute the total efficiency scores and find out the influence factors of them.

The results of this study about top 10 and last 10 efficiency scores refer to table 5, 11 and 17. It is worthy of mentioning is that a mutual fund performs outstanding in an item does not mean it would be excellent in other items. For example, Fubon Taiwan Phoenix Fund is good at manage total asset value (refer to table 11), but has a poor performance on net assets value (refer to table 17). Besides, the best performance on expense ratio is HSBC NTD Money Market Fund 2, the best performance on total fund asset is Fubon Taiwan Phoenix Fund and the best performance on net assets value is Yuanta Global Telecommunication Fund. The risk-adjusted return of HSBC NTD Money Market Fund 2 is -86.2605%, Fubon Taiwan Phoenix Fund is 2.4025% and Yuanta Global Telecommunication Fund is 27.6125%. This result presents that efficiency of net assets value might have high correlation with the risk-adjusted return. Therefore, the management of net assets value is an important factor in whole mutual fund performance.

We divide five parts to describe the results of environmental variables: RR, age of fund, gender, FAD and MBA, which influence three inputs respectively as follow:

- (1) Lower Risk contains higher efficiency on expense ratio; higher risk contains higher efficiency on total fund asset; lower risk contains higher efficiency on net assets value.
- (2) Longer operation of fund contains higher efficiency on expense ratio; shorter operation of

fund contains higher efficiency on total fund asset; shorter operation of fund contains higher efficiency on net assets value.

(3) Female managers of fund have higher efficiency on expense ratio; gender is not related with total fund asset; male managers of fund have higher efficiency on net assets value.

(4) Managers with domestic academic degree have higher efficiency on expense ratio; managers with foreign academic degree have higher efficiency on total fund asset; managers with foreign academic degree have higher efficiency on net assets value.

(5) Managers with MBA degree have higher efficiency on expense ratio; managers with MBA degree have higher efficiency on total fund asset; managers with MBA degree have higher efficiency on net assets value.

From the results of the above, we find that managers with MBA degree have positive effect on managing expense, total fund asset and net assets value. This is the only one which could significantly increase the efficiency of these three factors. Therefore, an MBA degree could help improve operation of mutual funds.

## **5.2 Research limitations and future suggestions**

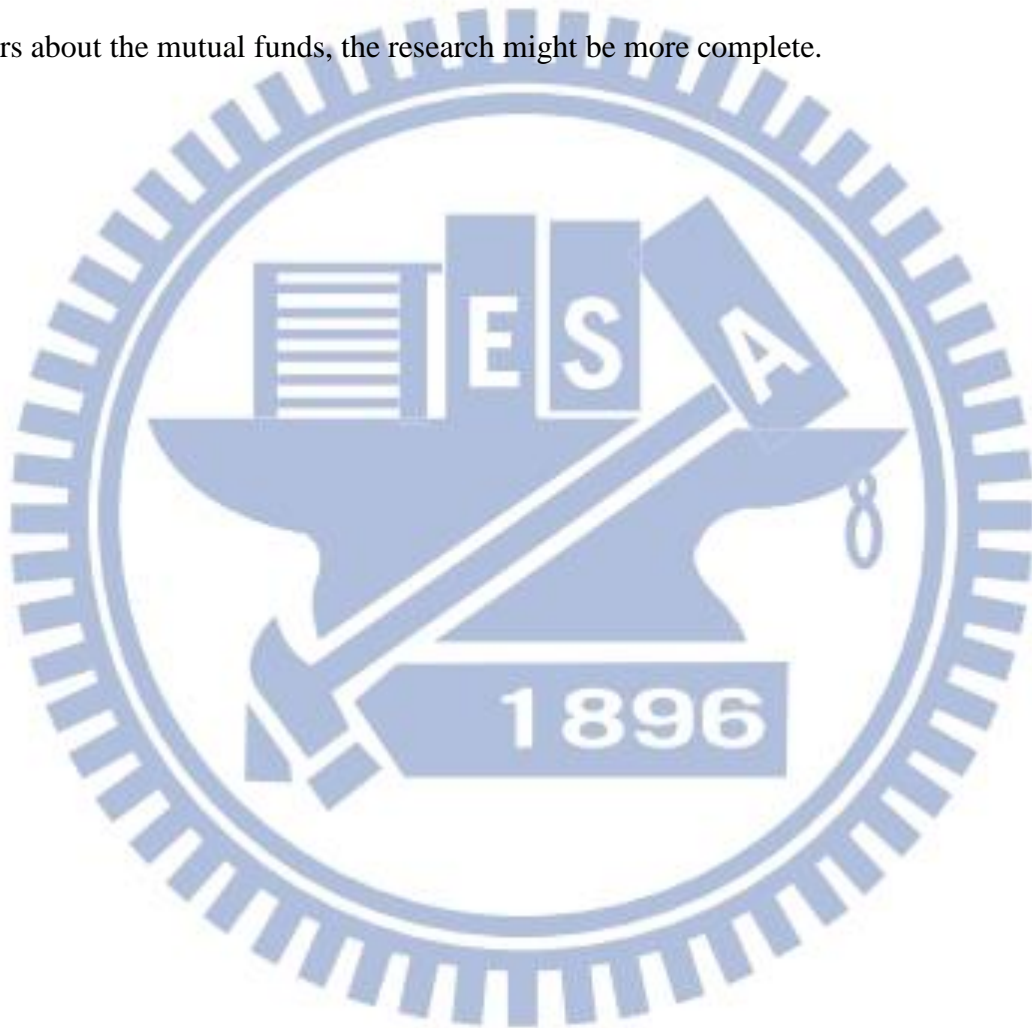
A mutual fund performance could be influenced by several factors, whole economic environment, government policies etc. We try to control uncertain factors but still encounter some difficulties. Some limitations and future suggestions as follow:

According to Financial Supervisory Commission, there are 621 domestic mutual funds since September 2012. In this study, we include 310 mutual funds in Taiwan. The economic and political corporation of Taiwan and China is more and more frequently. If the future studies could consider more related samples, even contains foreign funds, especially in China, and financial information, the range of explanation might be wider.

Business cycle is a long-term change or some single events are short-term phenomenon. However, the research period in this study is 2007-2012. If the future studies could lengthen

the research period to ten years or even more, the data or results might be more objective and reflect long-term economic situation.

Mutual funds could be influence by several factors and we apply three inputs (expense ratio, total fund assets and net assets value) to analyze them. The characteristics of fund managers are important features, we apply five environment variables (RR, age of fund, gender, FAD, and MBA) to describe them. If the future studies could involve more influence factors about the mutual funds, the research might be more complete.





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## Appendix

**Appendix Table 1: Ranking average TFE scores on expense ratio during 2007-2012**

Mutual fund name	TFE score	Mutual fund name	TFE score
Manulife Money Market Fund	0.784035	THE RSIT Enhanced Money Market Fund	0.501100
HSBC NTD Money Market Fund 2	0.759294	Allianz Global Investors Taiwan Money Market Fund	0.497316
BlackRock TWD Money Market Fund	0.723246	Miare Asset Solomon Money Market Fund	0.492778
HSBC NTD Money Market Fund	0.715867	Fubon Chi-Hsiang Money Market Fund	0.487710
Eastspring Investments Well Pool Money Market Fund	0.704647	Capital Money Market Fund	0.477337
Yuanta Wan Tai Money Market Fund	0.699035	Taishin Ta-Chong Money Market Fund	0.476757
Invesco ROC Money Market Fund	0.672721	Taishin Lucky Money Market Fund	0.474061
KGI Victory Money Market Fund	0.635956	Prudential Financial Money Market Fund	0.460324
Paradigm Pion Money Market Fund	0.619671	ING Taiwan Money Market Fund	0.459888
Shinkong Chi-Li Money-market Fund	0.568262	FSITC Taiwan Money Market Fund	0.443223
ABITL Money Market Fund	0.561509	FSITC Money Market Fund	0.442332
Schroder New Era Money Market Fund	0.561126	PineBridge Taiwan Money Market Fund	0.424467
JPMorgan (Taiwan) Wealth Management Fund	0.554559	ING Taiwan Select Money Market Fund	0.416515
Deutsche Far Eastern DWS Taiwan Money Market Fund	0.540185	Truswell Money Market Fund	0.397427
Taishin 1699 Money Market Fund	0.532801	JPMorgan (Taiwan) Taiwan Money Market Fund	0.392318
Polaris De-Li Money Market Fund	0.528768	Prudential Financial Return Fund	0.390972
Shinkong Chi-Shin Money Market Fund	0.528746	ING Taiwan Income Money Market Fund	0.388142
Truswell Hua-Win Money Market Fund	0.517305	Fuh Hwa Money Market Fund	0.383121
Jih Sun Money Market Fund	0.511173	Fuh Hwa Yu Li Money Market Fund	0.377233
JPMorgan (Taiwan) First Money Market Fund	0.509894	UPAMC James Money Market Fund	0.373987

**Appendix Table 1: Ranking average TFE scores on expense ratio during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Hua Nan Phoenix Money Market Fund	0.372822	Truswell Global Fixed-Income Fund Of Fund	0.207963
SinoPac Money Market Fund	0.371353	SKIT Global Top Fund	0.206784
Fubon Taiwan Technology ETF	0.371279	Union Quantitative Balanced Fund	0.204139
Ontario Fortune Money Market Fund	0.361835	Allianz Global Investors Global Bond Fund-A Share	0.200549
Hua Nan Global Henry Fund	0.328608	SinoPac World Bond Selection Fund	0.200077
Union Money Market Fund	0.326537	Capital Multi-Asset Allocation Fund	0.199660
Hua Nan Kirin Money Market Fund	0.314647	ING Global Balanced Portfolio	0.195388
Cathay Taiwan Money Market Fund	0.313130	Eastspring Investments Global Equity Fund of Fund	0.194662
Mega Diamond Money Market Fund	0.298172	Yuanta Win-Win Balanced Fund	0.191415
Cathay Global Money Market Fund	0.279692	Cathay Global Aggressive Fund of Fund	0.190445
PineBridge Global Medallion Fund of Funds	0.257306	Yuanta Global Asset Allocation Fund	0.189335
Cathay Global Balance Fund of Fund	0.244233	Union Advantage Global Fixed Income Portfolio Fund	0.188838
Reliance Wealth Bond Fund	0.242708	Manulife Global Fund of Bond Funds	0.186740
Fidelity Balance Fund of Funds	0.236884	Polaris Global ETFs Stable Fund	0.178796
Miare Asset Global Selection Fund	0.234214	Eastspring Investments Quality Quantity Fund	0.177719
Fidelity Excellent Navigation Global Fund of Funds	0.233359	Truswell Stable Growth Fund	0.175107
UPAMC Global Fixed Income Selection Fund	0.217822	Eastspring Investments Global Bond Fund of Fund A	0.174270
Polaris TAIEX Index Fund	0.215923	PineBridge Flagship Global Growth Fund of Funds	0.170962
HSBC Taiwan Success Fund	0.208793	SinoPac Global Balance Fund of Funds	0.169809
PineBridge Flagship Global Balance Fund of Fund	0.208366	Prudential Financial Global Fixed Income Selection Fund	0.169055

**Appendix Table 1: Ranking average TFE scores on expense ratio during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Fuh-Hwa Global Bond Fund	0.168471	Yuanta Duo Yuan Equity Fund	0.153587
PineBridge Flagship Global Conservative Fund of Funds	0.166942	SinoPac Balance Fund	0.152803
ING Global Bond Portfolio	0.166749	HSBC Global Fund of Bond Funds	0.152393
Taishin High Dividend Yield Balanced Fund	0.165464	Franklin Templeton SinoAm Franklin Templeton Global Bond Fund of Funds-Accu.	0.151934
Invesco Balanced Fund	0.164060	Mega Balanced Fund	0.149979
Hua Nan Long-Win Balance Fund	0.161140	UPAMC Tung Hsin Fund	0.148084
SinoPac High ROE&Dividend Balanced Fund	0.161137	ING Taiwan Dynamic Asset Allocation Fund	0.147775
Fuh Hwa Global Fixed Income Fund of Funds	0.160915	Shinkong Fu-Kuei Fund	0.146452
Polaris Global ETFs Growth Fund	0.160132	JPMorgan (Taiwan) Taiwan Fund	0.144499
SKIT Fortune Balanced Fund	0.159291	Fuh-Hwa Heirloom Balance Fund	0.144493
Capital Multi-Income Allocation Fund	0.159233	Polaris 2001 Fund	0.144369
SinoPac Balance 2 Fund	0.159131	Capital Value Balance Fund	0.143914
Cathay Balanced Fund	0.157297	Fuh-Hwa Life Goal Balance Fund	0.142422
Fuh-Hwa Olympic Global Fund	0.156940	Polaris Global Emerging Market Fund	0.142404
Prudential Financial Balanced Fund	0.154981	Fuh-Hwa Heirloom Balance Fund II	0.141640
Capital Strategic Balance Fund	0.154396	HSBC Taiwan Electronics Fund	0.140554
ING Taiwan Balanced Fund	0.154328	UPAMC All Weather Fund	0.139840
FSITC Greater China Balanced Fund	0.154209	HSBC Taiwan Safe & Rich Fund	0.138957
Manulife Dynamic Fund	0.154031	Fuh-Hwa Aegis Balance Fund	0.138669
Hua Nan Yung Chong Fund	0.153985	HSBC Taiwan Phoenix Fund	0.137612

**Appendix Table 1: Ranking average TFE scores on expense ratio during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Prudential Financial Global Selection Fund	0.135061	Truswell Taiwan A-Plus Fund	0.126798
Capital Balance Fund	0.134947	Paradigm Taiwan Fund	0.126772
JPMorgan (Taiwan) Growth Fund	0.134149	Mega Top 20 Fund	0.126697
Ontario High-Tech Fund	0.133938	Fubon Taiwan Phoenix Fund	0.126353
Taishin Ta-Chong Equity Fund	0.133411	Fubon Technology Fund	0.126222
Prudential Financial High Growth Fund	0.132853	Invesco Taiwan Select Growth Fund	0.126083
Deutsche Far Eastern DWS Technology Fund	0.131965	Eastspring Investments OTC Fund	0.126076
Manulife Taiwan High Dividend Fund	0.131576	Mega Citizen Fund	0.126015
Polaris Silicon Valley Fund	0.130593	Dah-Fa Fund	0.125993
FSITC Wonderful Fund	0.130280	HSBC Taiwan Blue-Chips Fund	0.125927
Hua Nan Vision Tech Fund	0.129719	Mirae Asset Apollo Fund	0.125771
KGI Pioneer Fund	0.129210	Taishin North American Income Trust Fund A	0.125754
Union China Fund	0.128354	HSBC Taiwan Mid & Small Cap Fund	0.125558
Fubon Global REIT Fund	0.128084	Shinkong National Development Fund	0.125381
Fubon Fubon Fund	0.128021	Mega High Tech Fund	0.124902
ABITL Da Li Fund	0.127788	Deutsche Far Eastern DWS Taiwan Flagship Fund	0.124825
Fubon Champion Fund	0.127192	JPMorgan (Taiwan) Balanced Fund	0.124801
FSITC Fu Yuan Fund	0.126971	Mega New Emerging Enterprise Fund	0.124722
Union Technology Fund	0.126948	UPAMC Small And Medium Cap Fund	0.124061
ING Taiwan Aggressive Growth Selection Fund	0.126889	UPAMC Optima Fund	0.123780

**Appendix Table 1: Ranking average TFE scores on expense ratio during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Fubon Value Fund	0.123730	ING Taiwan Growth Selection Fund	0.119240
Truswell IC Fund	0.123454	Shinkong Innovative Technology Fund	0.119118
FSITC Taiwan Fortune Fund	0.123414	Capital Large Cap. Growth Fund	0.119102
FSITC High-Tech Fund	0.123299	BlackRock Baoli Fund	0.119082
Cathay Dragon Fund	0.123018	SinoPac Hi-Tech Fund	0.118911
Jih Sun New Taiwan Enterprises Fund	0.122886	Mega First Fund	0.118774
Fubon Taiwan Heart Fund	0.122383	Jih Sun Top Five Fund	0.118769
FSITC OTC Fund	0.122026	Jih Sun Small Cap Fund	0.118224
ING Taiwan China Focus Fund	0.121637	Polaris High Performance Fund	0.118201
ING Taiwan Growth Fund	0.121585	Fuh-Hwa Omni Fund	0.118009
UPAMC Long Ma Fund	0.121224	Capital Strategic Alpha Fund	0.117859
Invesco Mainstream Fund	0.121192	FSITC Global Taiwan Enterprise Fund	0.117573
Invesco Taiwan Technology Fund	0.120922	Taishin 2000 High Technology Equity Fund	0.117514
UPAMC Infrastructure Fund	0.120755	Polaris Small-Medium Cap Fund	0.117486
THE RSIT Digital Fund	0.120669	FSITC Great China Fund	0.117321
Fuh-Hwa Fund	0.120665	Prudential Financial First Fund	0.117249
Taishin China Equity Fund	0.120605	Fubon Precision Fund	0.117068
Eastspring Investments High-Tech Fund	0.120241	Paradigm Small Capital Fund	0.116947
Eastspring Investments E-Tech Fund	0.120087	Shinkong OTC Market Fund	0.116885
FSITC Small Capital Fund	0.119885	JPMorgan (Taiwan) Value Growth Fund	0.116835

**Appendix Table 1: Ranking average TFE scores on expense ratio during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
ING Taiwan High Tech Selection Fund	0.116146	ING Taiwan High Dividend Fund	0.112959
Allianz Global Investors Taiwan Technology Fund	0.116098	ING Singapore & Malaysia Fund	0.112888
Yuanta Buffett Equity Fund	0.115945	Capital OTC Fund	0.112562
Fubon Elite Fund	0.115917	Fuh-Hwa Global Balance Fund	0.112517
Jih Sun Jih Sun Fund	0.115681	ING Taiwan High Tech Fund	0.112507
Eastspring Investments Essence Fund	0.115225	Eastspring Investments US High Tech Fund	0.112414
Eastspring Investments Small Medium Capital Fund	0.114995	Invesco Global Health Sciences Fund	0.112397
Fubon Aggressive Growth Fund	0.114930	Allianz Global Investors Taiwan Fund	0.112374
SinoPac Pilot Fund	0.114716	Shinkong Great China Fund	0.112317
ING Japan Fund	0.114483	ING Taiwan Superior Equity Fund	0.112153
Fidelity Taiwan Growth Fund	0.114203	Fuh-Hwa High Growth Fund	0.112004
Jih Sun Hi-Tech Fund	0.114116	UPAMC Pentium Fund	0.111921
Fubon Supreme Fund	0.113727	Prudential Financial New Century Fund	0.111616
Capital Asia-Pacific Mega-Trend Balanced Fund	0.113502	Fuh-Hwa Asia Pacific Balanced Fund	0.111562
Yuanta Global Growth Fund	0.113397	Prudential Financial High Tech Fund	0.111547
Capital Small and Medium Cap. Fund	0.113356	Prudential Financial Taiwan Enterprise Fund	0.111471
Paradigm Technology Fund	0.113315	Cathay Technology Fund	0.110761
ING Global Equity Fund	0.113235	Fuh-Hwa Digital Economy Fund	0.110735
JPMorgan (Taiwan) Micro Fund	0.113188	Prudential Financial Small & Medium Capital Fund	0.110723
Capital Strategic Growth Fund	0.113089	Eastspring Investments Export Fund	0.110561



**Appendix Table 1: Ranking average TFE scores on expense ratio during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
ABITL Asian Real Estate Non-dividend Fund	0.110350	ING Taiwan Small Cap Fund	0.106408
SinoPac Small and Medium Fund	0.109991	Yuanta Hi-Tech Equity Fund	0.106222
JPMorgan (Taiwan) Smaller Company Fund	0.109945	SinoPac Fund	0.105771
Mega Life Science Fund	0.109868	FSITC Asian Technology Fund	0.105520
Prudential Financial OTC Fund	0.109772	Eastspring Investments Asia Pacific REITs Fund B	0.104893
Yuanta International Trade Fund	0.109625	Jih Sun Upstream Fund	0.104325
FSITC Flagship Fund	0.109296	Cathay Small Cap Growth Fund	0.104141
JPMorgan (Taiwan) New Technology Fund	0.108820	Paradigm Global Oil Resources Fund	0.104043
Yuanta Duo Fu Equity Fund	0.108247	Allianz Global Investors Asian Pacific Dynamic Strategy Fund	0.103647
Yuanta Excellence Equity Fund	0.108151	Yuanta Duo Duo Equity Fund	0.103376
Yuanta Global Telecommunication Fund	0.108008	Mega Global Fund	0.102046
Yuanta OTC Fund	0.107981	Shinkong Asia Equity Fund	0.101977
Invesco Capital Appreciation Fund	0.107901	Yuanta Mainstream Fund	0.101876
ING Global REITs Fund Accumulate	0.107293	Prudential Financial Emerging Market Selection Fund	0.101001
Franklin Templeton SinoAm First Fund	0.107150	Capital High Tech Fund	0.100911
Cathay Fund	0.106921	HSBC Pacific Stars Fund	0.099886
Prudential Financial Maxime Fund	0.106667	Cathay Greater China Fund	0.099351
Fuh-Hwa Small Capital Fund	0.106623	Yuanta European Growth Fund	0.098998
ABITL Asian Real Estate Dividend Fund	0.106595	UPAMC Quality Growth Fund	0.098834
UPAMC Asia Pacific Fund	0.106479	JPMorgan (Taiwan) Global Balanced Fund	0.098819

**Appendix Table 1: Ranking average TFE scores on expense ratio during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Polaris Asia Taiwanese Enterprises Fund	0.098757	Hua Nan Global Luxury Goods Fund	0.090969
Polaris Global REITs Fund-A	0.098732	Yuanta Asia Pacific Growth Fund	0.090664
Invesco Global Technology Fund	0.098693	Polaris Global REITs Fund-B	0.090401
Capital Marathon Fund	0.098521	JPMorgan (Taiwan) Asia Fund	0.088077
ING Europe High Dividend Fund Accumulate	0.097722	Prudential Financial Global Small & Mid Cap Fund	0.086120
Prudential Financial Asia-Pacific Fund	0.097179	JPMorgan (Taiwan) China Concept Fund	0.085386
Eastspring Investments European Fund	0.096148	Deutsche Far Eastern DWS Global Material & Energy Fund	0.083717
ING Global High Dividend Fund Accumulate	0.094889	JPMorgan (Taiwan) Global Dynamic Fund	0.082457
PineBridge Taiwan Giant Fund	0.094628	Prudential Financial Global Bio-Health Fund	0.080507
PineBridge Latin America Fund	0.093638	HSBC Global Emerging Markets Fund	0.078178
ING Global Luxury Brands Fund	0.093313	Eastspring Investments Asia-Pacific High Yield Equity Fund	0.077924
Eastspring Investments Asia Pacific REITs Fund A	0.092886	Allianz Global Investors Global Eco Trends Fund	0.077509
Allianz Global Investors Global Biotech Fund	0.092545	HSBC BRIC Fund	0.076131
FSITC Malaysia Fund	0.091329	JPMorgan (Taiwan) Global Emerging Markets Fund	0.072119
Prudential Financial Great China Fund	0.091018	Cathay Global Infrastructure Fund	0.068003

**Appendix Table 2: Ranking average TFE scores on total fund asset during 2007-2012**

Mutual fund name	TFE score	Mutual fund name	TFE score
Fubon Taiwan Phoenix Fund	0.922549	Polaris Asia Taiwanese Enterprises Fund	0.903409
Deutsche Far Eastern DWS Technology Fund	0.916713	Fubon Champion Fund	0.902744
Invesco Taiwan Select Growth Fund	0.913940	Polaris Small-Medium Cap Fund	0.902297
Deutsche Far Eastern DWS Taiwan Flagship Fund	0.912808	JPMorgan (Taiwan) Micro Fund	0.902235
Paradigm Global Oil Resources Fund	0.912483	SinoPac Pilot Fund	0.902057
Union China Fund	0.912185	Capital Strategic Alpha Fund	0.901994
Mega Life Science Fund	0.912125	Eastspring Investments OTC Fund	0.901632
Manulife Taiwan High Dividend Fund	0.909972	Paradigm Small Capital Fund	0.901456
Ontario High-Tech Fund	0.908859	Invesco Taiwan Technology Fund	0.901198
Eastspring Investments US High Tech Fund	0.908400	ABITL Da Li Fund	0.901040
Union Technology Fund	0.906266	ING Global REITs Fund Accumulate	0.900730
Yuanta European Growth Fund	0.905941	Fubon Value Fund	0.900691
Polaris Global REITs Fund-A	0.905417	Allianz Global Investors Taiwan Technology Fund	0.900562
BlackRock Baoli Fund	0.905361	Fubon Taiwan Heart Fund	0.900539
Paradigm Technology Fund	0.904994	ING Taiwan Growth Fund	0.900293
Mirae Asset Apollo Fund	0.904949	Polaris Silicon Valley Fund	0.900249
Fubon Technology Fund	0.904682	Mega High Tech Fund	0.900053
Taishin China Equity Fund	0.904424	FSITC Great China Fund	0.899861
HSBC Taiwan Blue-Chips Fund	0.904273	FSITC Small Capital Fund	0.899590
Manulife Dynamic Fund	0.903769	FSITC High-Tech Fund	0.899564

**Appendix Table 2: Ranking average TFE scores on total fund asset during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Eastspring Investments High-Tech Fund	0.898970	Deutsche Far Eastern DWS Global Material & Energy Fund	0.894145
FSITC Taiwan Fortune Fund	0.898910	Shinkong Great China Fund	0.894120
Shinkong OTC Market Fund	0.898901	Capital Large Cap. Growth Fund	0.893965
PineBridge Latin America Fund	0.898871	Polaris Global Emerging Market Fund	0.893644
Invesco Mainstream Fund	0.898526	Allianz Global Investors Global Biotech Fund	0.893598
Taishin 2000 High Technology Equity Fund	0.898417	HSBC Taiwan Electronics Fund	0.893546
Eastspring Investments E-Tech Fund	0.898411	FSITC OTC Fund	0.893186
Mega Top 20 Fund	0.898247	Cathay Technology Fund	0.893015
UPAMC Small And Medium Cap Fund	0.898060	Polaris High Performance Fund	0.892960
Shinkong National Development Fund	0.898038	Hua Nan Vision Tech Fund	0.892487
FSITC Wonderful Fund	0.897286	Eastspring Investments Essence Fund	0.892243
THE RSIT Digital Fund	0.897225	Mega Citizen Fund	0.892027
FSITC Malaysia Fund	0.896664	Shinkong Innovative Technology Fund	0.891987
Mega First Fund	0.896372	Eastspring Investments Small Medium Capital Fund	0.891812
Capital Strategic Growth Fund	0.896354	HSBC Pacific Stars Fund	0.891633
SinoPac Hi-Tech Fund	0.896121	Polaris 2001 Fund	0.891531
Yuanta Buffett Equity Fund	0.895962	Polaris Global REITs Fund-B	0.891425
Fidelity Taiwan Growth Fund	0.895508	ING Taiwan Aggressive Growth Selection Fund	0.891159
Yuanta Duo Yuan Equity Fund	0.895197	HSBC Taiwan Mid & Small Cap Fund	0.891047
Prudential Financial Emerging Market Selection Fund	0.895116	Mega New Emerging Enterprise Fund	0.890885

**Appendix Table 2: Ranking average TFE scores on total fund asset during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
ING Taiwan China Focus Fund	0.890161	ING Taiwan Superior Equity Fund	0.885478
HSBC Taiwan Success Fund	0.890066	Capital OTC Fund	0.885201
SinoPac Small and Medium Fund	0.889863	Fuh-Hwa Digital Economy Fund	0.884680
Yuanta Global Growth Fund	0.889783	Allianz Global Investors Taiwan Fund	0.884563
Fubon Supreme Fund	0.889314	Fubon Aggressive Growth Fund	0.884260
Fuh-Hwa Fund	0.888806	Invesco Global Technology Fund	0.883786
HSBC Global Emerging Markets Fund	0.888746	Prudential Financial OTC Fund	0.883710
Cathay Global Infrastructure Fund	0.888555	Prudential Financial High Tech Fund	0.883629
Jih Sun Small Cap Fund	0.887909	Franklin Templeton SinoAm First Fund	0.883570
Fuh-Hwa High Growth Fund	0.887485	ING Taiwan High Tech Selection Fund	0.883493
ING Singapore & Malaysia Fund	0.887477	Truswell Taiwan A-Plus Fund	0.883485
UPAMC Pentium Fund	0.887065	FSITC Fu Yuan Fund	0.883209
Yuanta International Trade Fund	0.886788	HSBC BRIC Fund	0.883111
Shinkong Fu-Kuei Fund	0.886724	ING Taiwan Small Cap Fund	0.882730
Yuanta Asia Pacific Growth Fund	0.886667	SKIT Global Top Fund	0.882497
Prudential Financial Small & Medium Capital Fund	0.886087	PineBridge Taiwan Giant Fund	0.882260
ING Taiwan Growth Selection Fund	0.886058	Fuh-Hwa Small Capital Fund	0.882241
JPMorgan (Taiwan) Smaller Company Fund	0.885924	Jih Sun Jih Sun Fund	0.882153
ING Taiwan High Tech Fund	0.885774	Hua Nan Yung Chong Fund	0.882105
Jih Sun Hi-Tech Fund	0.885505	Fubon Precision Fund	0.881967

**Appendix Table 2: Ranking average TFE scores on total fund asset during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Invesco Capital Appreciation Fund	0.881870	Capital Small and Medium Cap. Fund	0.874497
Fubon Elite Fund	0.881550	Allianz Global Investors Asian Pacific Dynamic Strategy Fund	0.873887
Polaris TAIEX Index Fund	0.881252	Cathay Greater China Fund	0.873772
Invesco Global Health Sciences Fund	0.880693	Jih Sun New Taiwan Enterprises Fund	0.873608
HSBC Taiwan Phoenix Fund	0.880495	Taishin Ta-Chong Equity Fund	0.873557
Cathay Fund	0.880478	Capital Strategic Balance Fund	0.873058
Yuanta Duo Duo Equity Fund	0.879928	JPMorgan (Taiwan) New Technology Fund	0.872913
KGI Pioneer Fund	0.879304	Jih Sun Upstream Fund	0.872708
Fubon Global REIT Fund	0.878806	Shinkong Asia Equity Fund	0.872523
Paradigm Taiwan Fund	0.878781	Yuanta Global Telecommunication Fund	0.871152
SinoPac Fund	0.878125	Eastspring Investments Export Fund	0.870541
FSITC Flagship Fund	0.877941	Yuanta Mainstream Fund	0.870339
Prudential Financial Global Small & Mid Cap Fund	0.877782	Yuanta Duo Fu Equity Fund	0.869403
Yuanta Excellence Equity Fund	0.877328	Yuanta OTC Fund	0.867099
UPAMC Asia Pacific Fund	0.877215	Yuanta Hi-Tech Equity Fund	0.866388
Eastspring Investments Asia Pacific REITs Fund B	0.877162	ING Europe High Dividend Fund Accumulate	0.865794
Fubon Taiwan Technology ETF	0.876847	FSITC Asian Technology Fund	0.864739
Cathay Small Cap Growth Fund	0.876791	Allianz Global Investors Global Eco Trends Fund	0.864508
Hua Nan Global Luxury Goods Fund	0.875916	UPAMC Infrastructure Fund	0.864386
Yuanta Win-Win Balanced Fund	0.875139	FSITC Global Taiwan Enterprise Fund	0.862917

**Appendix Table 2: Ranking average TFE scores on total fund asset during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Cathay Global Aggressive Fund of Fund	0.862767	UPAMC Optima Fund	0.846943
Capital High Tech Fund	0.862469	PineBridge Flagship Global Growth Fund of Funds	0.846735
Capital Marathon Fund	0.862199	Prudential Financial Taiwan Enterprise Fund	0.845637
Cathay Dragon Fund	0.861720	Mega Global Fund	0.844491
Fuh-Hwa Omni Fund	0.860106	Eastspring Investments European Fund	0.843644
Fidelity Excellent Navigation Global Fund of Funds	0.860061	Prudential Financial New Century Fund	0.843423
ING Taiwan High Dividend Fund	0.860001	Taishin High Dividend Yield Balanced Fund	0.843012
ING Global Luxury Brands Fund	0.859334	Capital Value Balance Fund	0.842324
Jih Sun Top Five Fund	0.859012	Dah-Fa Fund	0.838849
ING Global High Dividend Fund Accumulate	0.858443	Prudential Financial First Fund	0.838127
Truswell IC Fund	0.858109	ABITL Asian Real Estate Non-dividend Fund	0.835593
Eastspring Investments Asia-Pacific High Yield Equity Fund	0.857262	Prudential Financial Asia-Pacific Fund	0.835581
ING Japan Fund	0.856815	Union Quantitative Balanced Fund	0.835421
JPMorgan (Taiwan) Value Growth Fund	0.856743	ING Global Equity Fund	0.834734
Capital Asia-Pacific Mega-Trend Balanced Fund	0.855498	SinoPac High ROE&Dividend Balanced Fund	0.832107
Fubon Fubon Fund	0.853212	Truswell Stable Growth Fund	0.831493
Miare Asset Global Selection Fund	0.852182	Eastspring Investments Global Equity Fund of Fund	0.830514
UPAMC All Weather Fund	0.849829	UPAMC Tung Hsin Fund	0.830174
UPAMC Long Ma Fund	0.849637	SKIT Fortune Balanced Fund	0.826659
Eastspring Investments Asia Pacific REITs Fund A	0.847237	Hua Nan Long-Win Balance Fund	0.826456

**Appendix Table 2: Ranking average TFE scores on total fund asset during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
SinoPac Balance 2 Fund	0.822681	JPMorgan (Taiwan) China Concept Fund	0.800433
ABITL Asian Real Estate Dividend Fund	0.820827	Invesco Balanced Fund	0.797957
Prudential Financial Great China Fund	0.820618	Prudential Financial High Growth Fund	0.797654
Taishin North American Income Trust Fund A	0.819907	JPMorgan (Taiwan) Global Dynamic Fund	0.794968
JPMorgan (Taiwan) Asia Fund	0.819888	Prudential Financial Balanced Fund	0.794781
Prudential Financial Global Selection Fund	0.819812	Polaris Global ETFs Growth Fund	0.792818
Capital Multi-Asset Allocation Fund	0.817822	Fuh-Hwa Asia Pacific Balanced Fund	0.789582
Prudential Financial Maxime Fund	0.816873	UPAMC Quality Growth Fund	0.788849
JPMorgan (Taiwan) Growth Fund	0.816871	Polaris Global ETFs Stable Fund	0.787818
FSITC Greater China Balanced Fund	0.816024	ING Global Balanced Portfolio	0.783390
Fidelity Balance Fund of Funds	0.815762	PineBridge Global Medallion Fund of Funds	0.775515
SinoPac Balance Fund	0.815431	ING Taiwan Balanced Fund	0.767442
JPMorgan (Taiwan) Taiwan Fund	0.812764	Prudential Financial Global Bio-Health Fund	0.765122
Capital Balance Fund	0.812620	Fuh-Hwa Life Goal Balance Fund	0.761187
JPMorgan (Taiwan) Global Emerging Markets Fund	0.811772	Mega Balanced Fund	0.759693
SinoPac Global Balance Fund of Funds	0.810634	Eastspring Investments Quality Quantity Fund	0.753626
Cathay Global Balance Fund of Fund	0.809387	Fuh-Hwa Heirloom Balance Fund	0.752203
Yuanta Global Asset Allocation Fund	0.808905	Fuh-Hwa Aegis Balance Fund	0.746314
Cathay Balanced Fund	0.806880	Fuh-Hwa Heirloom Balance Fund II	0.743727
Fuh-Hwa Global Balance Fund	0.803719	Fuh-Hwa Olympic Global Fund	0.735918



**Appendix Table 2: Ranking average TFE scores on total fund asset during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
HSBC Taiwan Safe & Rich Fund	0.723463	Fuh Hwa Global Fixed Income Fund of Funds	0.461931
ING Taiwan Dynamic Asset Allocation Fund	0.716351	JPMorgan (Taiwan) Wealth Management Fund	0.413345
Hua Nan Global Henry Fund	0.706631	Franklin Templeton SinoAm Franklin Templeton Global Bond Fund of Funds-Accu.	0.403176
JPMorgan (Taiwan) Global Balanced Fund	0.700984	Truswell Hua-Win Money Market Fund	0.318459
PineBridge Flagship Global Balance Fund of Fund	0.695983	Prudential Financial Return Fund	0.307093
Reliance Wealth Bond Fund	0.692768	Cathay Global Money Market Fund	0.306895
Truswell Global Fixed-Income Fund Of Fund	0.684210	Ontario Fortune Money Market Fund	0.295876
JPMorgan (Taiwan) Balanced Fund	0.673243	Truswell Money Market Fund	0.253786
SinoPac World Bond Selection Fund	0.669118	BlackRock TWD Money Market Fund	0.207847
Manulife Global Fund of Bond Funds	0.647934	Paradigm Pion Money Market Fund	0.170260
UPAMC Global Fixed Income Selection Fund	0.624890	Miare Asset Solomon Money Market Fund	0.131515
Union Advantage Global Fixed Income Portfolio Fund	0.623625	KGI Victory Money Market Fund	0.114006
Prudential Financial Global Fixed Income Selection Fund	0.597142	Deutsche Far Eastern DWS Taiwan Money Market Fund	0.112598
Fuh-Hwa Global Bond Fund	0.594610	ABITL Money Market Fund	0.109132
PineBridge Flagship Global Conservative Fund of Funds	0.588023	Schroder New Era Money Market Fund	0.106106
Allianz Global Investors Global Bond Fund-A Share	0.573475	Shinkong Chi-Li Money-market Fund	0.104455
Capital Multi-Income Allocation Fund	0.564540	Manulife Money Market Fund	0.099454
Eastspring Investments Global Bond Fund of Fund A	0.553010	Taishin Lucky Money Market Fund	0.088782
ING Global Bond Portfolio	0.546494	Allianz Global Investors Taiwan Money Market Fund	0.086577
HSBC Global Fund of Bond Funds	0.496906	ING Taiwan Select Money Market Fund	0.086571

**Appendix Table 2: Ranking average TFE scores on total fund asset during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
HSBC NTD Money Market Fund	0.086284	Taishin Ta-Chong Money Market Fund	0.047347
Fuh Hwa Yu Li Money Market Fund	0.084915	Hua Nan Phoenix Money Market Fund	0.045000
HSBC NTD Money Market Fund 2	0.084334	ING Taiwan Money Market Fund	0.044551
THE RSIT Enhanced Money Market Fund	0.082176	Prudential Financial Money Market Fund	0.043058
Invesco ROC Money Market Fund	0.077247	UPAMC James Money Market Fund	0.042989
SinoPac Money Market Fund	0.065552	Polaris De-Li Money Market Fund	0.042311
Hua Nan Kirin Money Market Fund	0.064149	FSITC Taiwan Money Market Fund	0.041337
JPMorgan (Taiwan) First Money Market Fund	0.063914	Cathay Taiwan Money Market Fund	0.039031
PineBridge Taiwan Money Market Fund	0.062203	Jih Sun Money Market Fund	0.036923
ING Taiwan Income Money Market Fund	0.056152	Mega Diamond Money Market Fund	0.036016
Shinkong Chi-Shin Money Market Fund	0.053649	Fuh Hwa Money Market Fund	0.035538
Taishin 1699 Money Market Fund	0.053369	Fubon Chi-Hsiang Money Market Fund	0.030329
Union Money Market Fund	0.051849	Eastspring Investments Well Pool Money Market Fund	0.027782
FSITC Money Market Fund	0.050102	Capital Money Market Fund	0.025801
JPMorgan (Taiwan) Taiwan Money Market Fund	0.049008	Yuanta Wan Tai Money Market Fund	0.025379

**Appendix Table 3: Ranking average TFE scores on net assets value during 2007-2012**

Mutual fund name	TFE score	Mutual fund name	TFE score
Yuanta Global Telecommunication Fund	0.931366	Cathay Global Money Market Fund	0.892613
ING Taiwan High Tech Selection Fund	0.921106	Paradigm Pion Money Market Fund	0.891787
Polaris Global REITs Fund-B	0.913058	Allianz Global Investors Taiwan Money Market Fund	0.889743
Eastspring Investments Asia Pacific REITs Fund A	0.912505	Eastspring Investments European Fund	0.889423
Taishin Lucky Money Market Fund	0.910139	Eastspring Investments Global Bond Fund of Fund A	0.888785
Eastspring Investments Asia Pacific REITs Fund B	0.903417	Allianz Global Investors Global Eco Trends Fund	0.888689
Mega Diamond Money Market Fund	0.902348	Miare Asset Solomon Money Market Fund	0.887854
Prudential Financial New Century Fund	0.900408	Cathay Global Infrastructure Fund	0.887196
Cathay Taiwan Money Market Fund	0.900164	FSITC OTC Fund	0.885784
ING Taiwan Aggressive Growth Selection Fund	0.899369	SinoPac World Bond Selection Fund	0.884818
Deutsche Far Eastern DWS Taiwan Money Market Fund	0.898246	PineBridge Taiwan Giant Fund	0.884673
Yuanta OTC Fund	0.897326	Union Money Market Fund	0.884634
Fubon Global REIT Fund	0.896188	Polaris Global REITs Fund-A	0.884632
Schroder New Era Money Market Fund	0.895851	Fidelity Balance Fund of Funds	0.884530
Hua Nan Kirin Money Market Fund	0.895453	ABITL Asian Real Estate Dividend Fund	0.884393
Polaris Global ETFs Growth Fund	0.895324	Taishin 1699 Money Market Fund	0.883731
KGI Victory Money Market Fund	0.894643	ING Taiwan Select Money Market Fund	0.882621
HSBC Taiwan Mid & Small Cap Fund	0.894543	Franklin Templeton SinoAm Franklin Templeton Global Bond Fund of Funds-Accu.	0.882014
Paradigm Global Oil Resources Fund	0.894239	Union Technology Fund	0.881974
Eastspring Investments Well Pool Money Market Fund	0.893529	Fuh Hwa Money Market Fund	0.881500

**Appendix Table 3: Ranking average TFE scores on net assets value during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Eastspring Investments Quality Quantity Fund	0.881306	Fuh Hwa Global Fixed Income Fund of Funds	0.870639
JPMorgan (Taiwan) Wealth Management Fund	0.880281	Capital Multi-Income Allocation Fund	0.870351
Fubon Elite Fund	0.880048	Jih Sun Hi-Tech Fund	0.869382
Fidelity Excellent Navigation Global Fund of Funds	0.879978	PineBridge Taiwan Money Market Fund	0.868301
ING Japan Fund	0.879904	Allianz Global Investors Taiwan Fund	0.868190
THE RSIT Enhanced Money Market Fund	0.879023	Fubon Fubon Fund	0.868190
UPAMC Global Fixed Income Selection Fund	0.878962	Cathay Global Balance Fund of Fund	0.868123
Invesco Balanced Fund	0.878960	Eastspring Investments Global Equity Fund of Fund	0.867874
Fuh Hwa Yu Li Money Market Fund	0.878737	SinoPac Money Market Fund	0.867624
Hua Nan Global Luxury Goods Fund	0.878722	Reliance Wealth Bond Fund	0.864156
Cathay Dragon Fund	0.878394	Capital Money Market Fund	0.863447
Taishin Ta-Chong Money Market Fund	0.878169	HSBC Global Emerging Markets Fund	0.862309
HSBC Global Fund of Bond Funds	0.876650	ING Global Bond Portfolio	0.862238
Yuanta Wan Tai Money Market Fund	0.876302	BlackRock TWD Money Market Fund	0.861842
Polaris Asia Taiwanese Enterprises Fund	0.874824	Fubon Chi-Hsiang Money Market Fund	0.861685
Jih Sun Money Market Fund	0.874027	PineBridge Flagship Global Conservative Fund of Funds	0.861647
Mirae Asset Apollo Fund	0.872617	JPMorgan (Taiwan) Global Emerging Markets Fund	0.860729
Truswell Hua-Win Money Market Fund	0.872213	Manulife Money Market Fund	0.860243
Fuh-Hwa Fund	0.871871	Paradigm Technology Fund	0.860030
Ontario High-Tech Fund	0.871521	Fuh-Hwa Asia Pacific Balanced Fund	0.859969

**Appendix Table 3: Ranking average TFE scores on net assets value during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
JPMorgan (Taiwan) Global Dynamic Fund	0.858987	ING Global REITs Fund Accumulate	0.845767
Truswell Taiwan A-Plus Fund	0.858189	Ontario Fortune Money Market Fund	0.845545
FSITC Taiwan Money Market Fund	0.857692	ING Global Balanced Portfolio	0.844961
Manulife Global Fund of Bond Funds	0.857000	JPMorgan (Taiwan) First Money Market Fund	0.844686
Prudential Financial Global Fixed Income Selection Fund	0.856180	Cathay Global Aggressive Fund of Fund	0.843048
Eastspring Investments E-Tech Fund	0.854757	Truswell Global Fixed-Income Fund Of Fund	0.841539
Prudential Financial Money Market Fund	0.854417	Eastspring Investments Asia-Pacific High Yield Equity Fund	0.839935
ABITL Asian Real Estate Non-dividend Fund	0.854063	Prudential Financial Emerging Market Selection Fund	0.839305
Union Quantitative Balanced Fund	0.853271	Yuanta Asia Pacific Growth Fund	0.838914
PineBridge Global Medallion Fund of Funds	0.853070	Hua Nan Phoenix Money Market Fund	0.838880
Yuanta European Growth Fund	0.852003	ING Taiwan Money Market Fund	0.838509
JPMorgan (Taiwan) Taiwan Fund	0.851214	Fuh-Hwa Aegis Balance Fund	0.837790
Shinkong Chi-Shin Money Market Fund	0.850614	Taishin North American Income Trust Fund A	0.837728
Allianz Global Investors Global Bond Fund-A Share	0.849015	HSBC NTD Money Market Fund	0.836562
Capital Multi-Asset Allocation Fund	0.848460	ING Global Equity Fund	0.836133
Polaris De-Li Money Market Fund	0.848414	UPAMC James Money Market Fund	0.835835
HSBC NTD Money Market Fund 2	0.848205	Fuh-Hwa Omni Fund	0.834546
ING Europe High Dividend Fund Accumulate	0.847964	PineBridge Flagship Global Balance Fund of Fund	0.833997
Invesco Global Technology Fund	0.846965	ABITL Money Market Fund	0.833819
Truswell IC Fund	0.846281	Hua Nan Global Henry Fund	0.832304

**Appendix Table 3: Ranking average TFE scores on net assets value during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Jih Sun Jih Sun Fund	0.831180	Union Advantage Global Fixed Income Portfolio Fund	0.819917
Hua Nan Yung Chong Fund	0.830902	Invesco ROC Money Market Fund	0.819411
Fuh-Hwa Global Bond Fund	0.830564	SKIT Fortune Balanced Fund	0.818681
Shinkong Innovative Technology Fund	0.830513	Polaris Global ETFs Stable Fund	0.818221
Yuanta Global Asset Allocation Fund	0.830197	Prudential Financial Global Selection Fund	0.818174
SKIT Global Top Fund	0.830151	Invesco Global Health Sciences Fund	0.814842
Truswell Money Market Fund	0.829978	Mega First Fund	0.814308
JPMorgan (Taiwan) Taiwan Money Market Fund	0.828737	FSITC Malaysia Fund	0.813229
Fuh-Hwa Olympic Global Fund	0.827472	Polaris Global Emerging Market Fund	0.812286
Capital Strategic Growth Fund	0.826727	Truswell Stable Growth Fund	0.811993
FSITC Flagship Fund	0.825731	Mega Top 20 Fund	0.806675
PineBridge Latin America Fund	0.825263	Yuanta Duo Yuan Equity Fund	0.806302
ING Taiwan High Tech Fund	0.824054	Prudential Financial Return Fund	0.804995
SinoPac Global Balance Fund of Funds	0.822852	Capital Asia-Pacific Mega-Trend Balanced Fund	0.804354
ING Taiwan Balanced Fund	0.822032	JPMorgan (Taiwan) Global Balanced Fund	0.803396
PineBridge Flagship Global Growth Fund of Funds	0.821871	ING Taiwan High Dividend Fund	0.802382
HSBC BRIC Fund	0.821724	Polaris TAIEX Index Fund	0.798007
BlackRock Baoli Fund	0.821192	Polaris Silicon Valley Fund	0.797103
Miare Asset Global Selection Fund	0.820567	ING Taiwan Growth Selection Fund	0.796960
FSITC Fu Yuan Fund	0.820256	ING Taiwan Dynamic Asset Allocation Fund	0.795426

**Appendix Table 3: Ranking average TFE scores on net assets value during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
ING Taiwan Income Money Market Fund	0.794362	Mega New Emerging Enterprise Fund	0.761774
JPMorgan (Taiwan) Value Growth Fund	0.793917	Fuh-Hwa Life Goal Balance Fund	0.760400
Capital Strategic Balance Fund	0.793322	UPAMC Small And Medium Cap Fund	0.759524
Taishin High Dividend Yield Balanced Fund	0.792615	UPAMC Quality Growth Fund	0.756775
Fuh-Hwa Global Balance Fund	0.792215	FSITC Asian Technology Fund	0.755327
Fuh-Hwa Heirloom Balance Fund II	0.789529	Capital Balance Fund	0.752773
ING Global High Dividend Fund Accumulate	0.785722	ING Global Luxury Brands Fund	0.751923
Hua Nan Long-Win Balance Fund	0.785398	Manulife Dynamic Fund	0.750967
FSITC Global Taiwan Enterprise Fund	0.782434	Mega Life Science Fund	0.749408
Cathay Fund	0.781235	Eastspring Investments OTC Fund	0.742638
Eastspring Investments US High Tech Fund	0.780747	Prudential Financial Global Bio-Health Fund	0.742228
Shinkong Chi-Li Money-market Fund	0.779912	THE RSIT Digital Fund	0.739476
Fubon Taiwan Heart Fund	0.779229	Union China Fund	0.738280
Invesco Mainstream Fund	0.778591	Allianz Global Investors Global Biotech Fund	0.738112
SinoPac Hi-Tech Fund	0.776712	Capital Strategic Alpha Fund	0.734639
Hua Nan Vision Tech Fund	0.774052	FSITC Greater China Balanced Fund	0.732412
Jih Sun Small Cap Fund	0.772762	Deutsche Far Eastern DWS Technology Fund	0.731715
Yuanta Hi-Tech Equity Fund	0.771201	Fubon Aggressive Growth Fund	0.729197
Fuh-Hwa Heirloom Balance Fund	0.767683	FSITC Wonderful Fund	0.728833
Eastspring Investments Small Medium Capital Fund	0.763189	Taishin 2000 High Technology Equity Fund	0.728132

**Appendix Table 3: Ranking average TFE scores on net assets value during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
HSBC Pacific Stars Fund	0.726701	JPMorgan (Taiwan) Micro Fund	0.686159
ING Singapore & Malaysia Fund	0.725462	Cathay Balanced Fund	0.684340
Mega Balanced Fund	0.722769	Prudential Financial High Tech Fund	0.683422
Manulife Taiwan High Dividend Fund	0.720116	JPMorgan (Taiwan) Balanced Fund	0.674465
FSITC Taiwan Fortune Fund	0.719223	Dah-Fa Fund	0.670224
Cathay Greater China Fund	0.714790	Eastspring Investments Essence Fund	0.669451
ING Taiwan Growth Fund	0.711232	Prudential Financial Global Small & Mid Cap Fund	0.665240
KGI Pioneer Fund	0.710784	SinoPac Pilot Fund	0.663400
Yuanta Mainstream Fund	0.708902	Fuh-Hwa Digital Economy Fund	0.661199
SinoPac High ROE&Dividend Balanced Fund	0.707678	Yuanta Buffett Equity Fund	0.659008
HSBC Taiwan Blue-Chips Fund	0.707368	UPAMC Asia Pacific Fund	0.658654
Allianz Global Investors Asian Pacific Dynamic Strategy Fund	0.703752	Taishin China Equity Fund	0.656267
Yuanta Global Growth Fund	0.699676	ING Taiwan Superior Equity Fund	0.655930
Shinkong Great China Fund	0.697465	FSITC Great China Fund	0.651489
Allianz Global Investors Taiwan Technology Fund	0.692478	JPMorgan (Taiwan) China Concept Fund	0.651431
Capital Value Balance Fund	0.690191	Prudential Financial First Fund	0.648887
Polaris Small-Medium Cap Fund	0.689517	HSBC Taiwan Safe & Rich Fund	0.647367
Capital Large Cap. Growth Fund	0.688695	FSITC High-Tech Fund	0.643188
Fubon Value Fund	0.687900	Taishin Ta-Chong Equity Fund	0.640323
Deutsche Far Eastern DWS Taiwan Flagship Fund	0.686419	Prudential Financial Balanced Fund	0.638207



**Appendix Table 3: Ranking average TFE scores on net assets value during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
Yuanta Duo Duo Equity Fund	0.635741	SinoPac Balance Fund	0.584239
Capital High Tech Fund	0.635300	Franklin Templeton SinoAm First Fund	0.582577
Fidelity Taiwan Growth Fund	0.634675	Fubon Technology Fund	0.580935
Jih Sun Top Five Fund	0.632090	Shinkong Asia Equity Fund	0.580144
ING Taiwan China Focus Fund	0.630357	FSITC Small Capital Fund	0.579471
JPMorgan (Taiwan) Smaller Company Fund	0.623689	Prudential Financial Taiwan Enterprise Fund	0.578302
Paradigm Taiwan Fund	0.623585	UPAMC Tung Hsin Fund	0.577707
Prudential Financial Asia-Pacific Fund	0.622969	Cathay Technology Fund	0.567392
Shinkong OTC Market Fund	0.617035	Paradigm Small Capital Fund	0.546621
UPAMC Infrastructure Fund	0.612604	Invesco Capital Appreciation Fund	0.545322
Invesco Taiwan Select Growth Fund	0.609638	HSBC Taiwan Electronics Fund	0.541687
Deutsche Far Eastern DWS Global Material & Energy Fund	0.606862	Jih Sun Upstream Fund	0.541171
ING Taiwan Small Cap Fund	0.603649	SinoPac Fund	0.539026
Mega High Tech Fund	0.602446	Yuanta International Trade Fund	0.531084
Yuanta Win-Win Balanced Fund	0.602131	Prudential Financial OTC Fund	0.530946
Invesco Taiwan Technology Fund	0.591707	Jih Sun New Taiwan Enterprises Fund	0.527228
Shinkong National Development Fund	0.589938	Fuh-Hwa Small Capital Fund	0.511610
Prudential Financial Great China Fund	0.589375	Capital Small and Medium Cap. Fund	0.494377
Shinkong Fu-Kuei Fund	0.587017	Fuh-Hwa High Growth Fund	0.487369
SinoPac Balance 2 Fund	0.586503	Fubon Champion Fund	0.480680

**Appendix Table 3: Ranking average TFE scores on net assets value during 2007-2012 (con't)**

Mutual fund name	TFE score	Mutual fund name	TFE score
UPAMC Optima Fund	0.477470	JPMorgan (Taiwan) Asia Fund	0.390350
Cathay Small Cap Growth Fund	0.474284	SinoPac Small and Medium Fund	0.383211
HSBC Taiwan Success Fund	0.470915	Yuanta Excellence Equity Fund	0.360177
Eastspring Investments Export Fund	0.467802	UPAMC Long Ma Fund	0.355701
Prudential Financial Maxime Fund	0.462938	Yuanta Duo Fu Equity Fund	0.350850
ABITL Da Li Fund	0.443933	Eastspring Investments High-Tech Fund	0.344220
UPAMC Pentium Fund	0.441747	Polaris 2001 Fund	0.330120
Polaris High Performance Fund	0.441141	Capital OTC Fund	0.321527
Mega Citizen Fund	0.429752	UPAMC All Weather Fund	0.303421
Prudential Financial Small & Medium Capital Fund	0.429401	Fubon Precision Fund	0.297648
Fubon Taiwan Technology ETF	0.424673	Fubon Supreme Fund	0.291064
Mega Global Fund	0.411153	Prudential Financial High Growth Fund	0.231487
HSBC Taiwan Phoenix Fund	0.405691	Capital Marathon Fund	0.216996
JPMorgan (Taiwan) Growth Fund	0.399882	FSITC Money Market Fund	0.117991
JPMorgan (Taiwan) New Technology Fund	0.395553	Fubon Taiwan Phoenix Fund	0.020796