İSTANBUL TECHNICAL UNIVERSITY ★ INSTITUTE OF SCIENCE AND TECHNOLOGY

NONPARAMETRIC PERFORMANCE EVALUATION OF TURKISH MUTUAL FUNDS WITH DATA ENVELOPMENT ANALYSIS

Master Thesis by

Özgüç Akdağ, B.Sc.

507031031

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Supervisor (Chairman): Assist. Prof. Dr. Oktay Taş (İTÜ)

Members of the Examining Committee Prof.Dr. Burç Ülengin (İTÜ)

Prof.Dr. Suat Teker (OÜ.)

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PREFACE

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ABBREVIATIONS

DEA : Data Envelopment Analysis
MC : Management Costs
CC : Charged Commissions
OC : Other Costs
RSD : Relative Semi Deviation
AR : Annual Return
V : Variable Mutual Funds
M : Mixed Mutual Funds
E : Equity Mutual Funds
I : Index Mutual Funds
A : Affiliate Company Mutual Funds
P : Private Mutual Funds
S : Sector Mutual Funds
L : Liquid Mutual Funds
B : Bond Mutual Funds

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NONPARAMETRIC PERFORMANCE EVALUATION OF TURKISH MUTUAL FUNDS WITH DATA ENVELOPMENT ANALYSIS

SUMMARY

In this work the performance Turkish Mutual Funds(Type A and Type B) of years 2002, 2003, 2004 and 2005 were evaluated with DEA method according to their risks and various costs. Data Envelopment Analysis (DEA) as a non-parametric method enabling multi criteria evaluation is one of the most prominent alternatives of traditional parametric performance evaluation methods. Since the paper of Charnes, Cooper and Rhodes (1978) DEA has an ever increasing importance among non-parametric performance evaluation methods. Especially in recent years the number of DEA researches carried out in Turkey has been increasing. All mutual funds quoted to the Board of Capital Markets are sorted according to their types and kinds; and each group has been evaluated individually and together in order to determine best performed mutual funds of that year.

VERİ ZARFLAMA METODU İLE TÜRK YATIRIM FONLARININ PERFORMANS DEĞERLENDİRMESİ

ÖZET

Bu çalışmada 2002, 2003, 2004 ve 2005 yıllarına ait Türk Yatırım Fonlarının (A Tipi ve B Tipi) risk düzeyleri ve çeşitli maliyetlerine göre Veri Zarflama Analizi metoduyla performans değerlendirmesi yapılmıştır. Veri Zarflama Analizi çok yönlü değerlendirmeye olanak tanıyan parametrik olmayan bir değerleme metodu olarak, geleneksel parametrik performans değerlendirme metotları karşısında öne çıkan alternatiflerden birisidir. Charnes, Cooper ve Rhodes'in 1978 yılındaki çalışmalarından bu yana Veri Zarflama Analizinin önemi sürekli artmaktadır. Özellikle son yıllarda ülkemizdeki Veri Zarflama Analizi araştırmalarının sayısında artış gözlemlenmektedir. Sermaye Piyasası Kuruluna bağlı tüm yatırım fonları tiplerine ve türlerine bağlı olarak bireysel ve topluca değerlendirilerek ilgili yılın en iyi performans göstermiş yatırım fonları belirlenmiştir.

1. INTRODUCTION

Given today's volatile global investment climate, the increasing number of private investors and managed funds, and growing financial services industry, investment performance appraisal is of great importance. Investors have always been eager to assess the performance of their managed portfolios.

Previously, performance was evaluated by comparing the total return of a managed portfolio with a randomly chosen unmanaged portfolio (Modigliani and Modigliani, 1997). Later, the concept of an unmanaged market or a capitalisation-weighted portfolio comprising the entire market was introduced, so that the managed portfolio performance could be evaluated and compared against the market portfolio as a benchmark.

It is well-known that the return earned by a portfolio alone is not an accurate measure of its performance. Moreover it is obvious that higher expected returns are associated with higher levels of risk. Under bearish scenarios, these higher levels of risk may generate unexpected return losses. All in all, there is a trade-off between risk and return. The vast majority of investors are generally risk aversive. Therefore, for any risk associated with their investment, investors expect compensation, in other words a risk premium.

Finally, some basic performance evaluation methods emerged in the late 1960s. With the rapid growth and globalisation of finance sectors, the financial services industry responded with relative performance measures that have now become very popular and are widely used by private and institutional investors. However, there is no agreement in the literature about the measure of risk and evaluating the risk adjusted performance. The main drawback in the common measure of the risk adjusted return is the inability to incorporate the costs to generate the returns. In the late 1990´s, several studies attempted to measure managed portfolio performance by considering the return adjusted for both risk and cost, using a non-parametric methodology of production frontier estimation commonly known as Data Envelopment Analysis (DEA).

2.INVESTMENT PERFORMANCE EVALUATION

2.1. Traditional Methods of Investment Performance Evaluation

2. 1. 1) Early Developments

The measures used to evaluate asset or funds performance are based on some variations risk adjusted return.

Sharpe Index: Sharpe (1966) suggested that the historical performance of a portfolio may be calculated as the excess return earned for bearing risk per unit of total risk. Symbolically, the Sharpe Index, S_p , is written as:

$$S_p = \frac{\overline{R}_p - \overline{R}_f}{\sigma_p} \qquad \textbf{(2.1)}$$

Where, $\overline{R}_p$ is the mean portfolio return, $\overline{R}_f$ is the mean risk-free asset return and $\sigma_{,p}$ is the semi deviation of portfolio returns. A higher value for S_p indicates that the portfolio delivers a higher performance for its total risk measured by $\sigma_{,p}$. The absence of a benchmark for comparison of performance measures obtained from Sharpe Index is the main drawback of this method.

Treynor Index: Treynor (1965) considered only the non-diversifiable market risk, β_p , is defined as:

$$\beta_p = \frac{\sigma_p}{\sigma_m} r_{pm} \qquad \textbf{(2.2)}$$

Where r_{pm} is the correlation coefficient between the portfolio return and the market return and σ_m is the semi deviation of market returns. Treynor developed the following relative measure of portfolio performance:

$$T_p = \frac{\overline{R}_p - \overline{R}_f}{\beta_p} \tag{2.3}$$

Since this measure does not include diversifiable risk, it can be regarded as a general performance measure and used regardless of the extent of diversification of the portfolio being evaluated. Using (2.1) and (2.3);

$$T_p = S_p \left(\frac{\sigma_m}{r_{pm}} \right) \tag{2.4}$$

In this case, if the fund is perfectly diversified (r_{pm} = 1.0) , then the Treynor Index is equal to the Sharpe Index times a constant and a portfolio ranking according to these methods will be identical. If the fund is not perfectly diversified (r_{pm} < 1.0) there would be differences between rankings based on these methods.

Depending on the nature of the portfolio being evaluated, one of these methods would be chosen. If the entire portfolio is considered, the total risk of the portfolio will be the same as that of the risk borne by the investor; therefore the Sharpe Index may be used here. On the other hand, if the evaluation is only on a component of the portfolio, the risk to the investor will only be the non-diversifiable systematic risk. Hence the Treynor measure will be more appropriate.

Jensen's Alpha: Jensen (1969) considered an empirical version of the one-period security market line (SML), which expresses the return an individual investor can expect in terms of a risk-free rate and the relative risk of a security or portfolio. The SML with respect to security i can be written as:

$$E(R_i) = R_f + \beta_i \{E(R_m) - R_f\}$$

Where $\beta_i = \frac{\sigma_i r_{im}}{\sigma_m} = \frac{\text{cov}(R_i, R_m)}{\sigma_m^2}$ and r_{im} is the correlation between security return R_i and the market portfolio return. The β_i can be interpreted as the amount of non-diversifiable risk inherent in the security relative to the risk of the market portfolio. Based on SML Jensen has developed:

$$R_{pt} = R_{ft} + \beta_p (R_{mt} - R_{ft}) + e_{pt} \quad \textbf{(2.5)}$$

Where;

R_{pt} = realised portfolio return during time period t

R_{ft} = risk-free asset return during time period t

R_{mt} = realised market return during time period t

e_{pt} = error term that reflects portfolio return unrelated to market return

Jensen introduced an additional term, α_p, to the above model to present a constant periodic return (positive or negative) that an investor is able to earn in addition to the return of an unmanaged portfolio with identical market risk. Rearranging the terms in (2.5) together with α_p gives:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + e_{pt} \quad \textbf{(2.6)}$$

Jensen suggested using regression procedures to estimate α_p and β_p, and interpreted the estimated alpha based on its sign; if $\alpha_p > 0$ and significant, then the portfolio outperformed and if $\alpha_p < 0$ and significant the portfolio underperformed a possible buy-hold strategy, predicted by the market. Portfolio managers can off course manipulate the

alpha through leverage. Therefore, while the Jensen's Index is a basic risk adjusted performance measure based on non-diversifiable risk, as measured by the beta, it cannot be used for ranking portfolios.

From (2.3) and (2.6); it can be seen that Jensen's Alpha is related to the Treynor's Index as follows:

$$T_p = \frac{\alpha_p}{\beta_p} + \left(\overline{R}_m - \overline{R}_f\right) \qquad \textbf{(2.7)}$$

Since $\left(\overline{R}_m - \overline{R}_f\right)$ is a constant, the Treynor index is simply a transformation of Jensen's Alpha divided by the portfolio systematic risk. A criticism of the Treynor's and Jensen's measures is that, their derivations are based on an explicit functional relationship between risk and return only.

2. 1. 2) Recent Development:

In order to interpret Treynor and Jensen's Alpha indices one should have sufficient background of regression analysis and modern finance theory. However, the vast majority of investors are unfamiliar with these concepts. Therefore, everyday more private investors are showing interest in performance appraisal methods that an average investor can easily understand. Meanwhile, the number of managed funds and the number of institutions managing these funds has grown rapidly. The financial services industry has responded to the needs of investors by establishing to do research and rate managed funds based on many factors in addition to the return versus risk. There is no doubt that the basic performance appraisal measures provide valuable information on management effectiveness. However factors such as asset class presentation, portfolio correlations, expenses and turnover are also very relevant variables that should be taken into account in managed fund performance appraisal. Respecting these variables will undoubtedly improve the performance measures of funds and their ratings. Morningstar Incorporated in the United States is a well-known establishment that provide ratings of a

very large number of managed funds in their respective countries. Institutional and private investors heavily rely on these ratings for their investment choices.

Modigliani & Modigliani measure:

Modigliani & Modigliani (1997) developed a risk-adjusted performance measure equating the total risk of a managed portfolio with that of the market by creating a hypothetical portfolio comprising a risk-free asset and the managed portfolio. The idea is to adjust the managed portfolio to the level risk of the market portfolio and then measure the returns of the risk matched portfolio. The M&M measure, M_p^2 is calculated as,

$$M_p^2 = \frac{\overline{R}_p - \overline{R}_f}{\sigma_p}\sigma_m + \overline{R}_f \qquad \textbf{(2.8)}$$

Since R_f is common to all portfolios a simpler measure of risk adjusted performance, M_p^2 (adjusted) is given as:

$$M_p^2(adjusted) = \frac{\overline{R}_p - \overline{R}_f}{\sigma_p}\sigma_m \qquad \textbf{(2.9)}$$

M_p^2 and M_p^2 *(adjusted)* rank portfolios identically. From (2.1) and (2.9) we obtain,

$$M_p^2(adjusted) = S_p\sigma_m \qquad \textbf{(2.10)}$$

suggesting that the Modigliani & Modigliani measure and Sharpe Index rank portfolios identically. Further, M_p^2 is expressed in percentages similar to portfolio returns and therefore, it is thought to be easily understood by an ordinary investor.

Morningstar Rating:

Morningstar Incorporated produces a number of managed fund performance measures that take risk and return into account. In some of their measures such as the

Morningstar-Sharpe ratio and the Morningstar alpha, each fund receives a numerical rating independent of the performance of other funds. Others such as the category risk adjusted rating (domestic equities, foreign equities, municipal bonds and taxable bonds), the three year risk adjusted rating and the three year star rating are relative measures. As with any other risk adjusted performance measure, Morningstar also calculates the returns (Morningstar Return – MSRET) and the risk (Morningstar Risk- MSRISK) of the funds and defines their risk adjusted rating as the difference between MSRET and MSRISK (Sharpe 1998).

2. 1. 3) Alternative methods of performance evaluation

The assessment of the performance of individual production units based on the concept of a production frontier has taken an important role in the recent years. The concept of a production frontier reflects desired achievement levels for production units within an industry. So the aim of the individual production unit would be to optimise its efforts to achieve such a level defined by the production frontier. This idea is consistent with the economic theory of optimising behaviour and therefore is a good reason to introduce production frontiers in empirical studies of this nature. While production units want to reach the production frontier, in reality, they may fall short due to reasons within, and beyond, their control. This notion of shortfall introduces the concept of inefficiency of production which can be measured.

Efficiency measures:

The term ‘productive efficiency’ is commonly used to describe the level of performance of a production unit in terms of its utilisation of input resources in generating outputs. Koopmans (1951) defined technical efficiency as a feasible input/output vector where it is technologically impossible to increase any output without simultaneously reducing another output. This analogy holds for a reduction in any input or both a reduction in any input and an increase in any output. Farrell (1957) demonstrated that a production unit’s ‘overall efficiency’ is composed of two separate efficiency measures called ‘technical efficiency’ and ‘allocative efficiency’. Farrell measured technical inefficiency as the maximum equi-proportional reduction in all inputs consistent with equivalent production of observed output. A Farrell-efficient unit however, may not be Koopmans-efficient

since even after Farrell efficiency is achieved, there may exist additional slack in individual inputs. The efficiency measures are described below for the single-output two-input production function.

Let x_1 and x_2 denote the two inputs, the output and $y = f(x_1, x_2)$ the production function. The production function shows the maximum output possible for a given set of inputs, assuming that the firm is technically efficient. Then, assuming that the frontier is characterised by constant returns-to-scale (CRS), it may be written as $1 = f(x_1 / y, x_2 / y)$ unit (output) isoquant. The unit isoquant may be considered as characterising frontier technology. This is graphically presented as the curve UU' in Figure 2.1. By definition of the production frontier, any observed point, say $A \equiv (x_1^o / y^o, x_2^o / y^o)$, corresponding to a production unit must lie either on or above the unit isoquant. Farrell defined the technical efficiency of production unit A as OB / OA.

The technical efficiency of production unit A may be interpreted as the ratio of inputs needed to produce y^o to the inputs actually used to produce y^o with input maintained at the same levels of x_1^o and x_2^o. Therefore, technical efficiency will lie between 0 and 1 inclusive. Any point along the line OA will have the same input mix as well. Technical inefficiency results when more output could be produced given the same level of input.

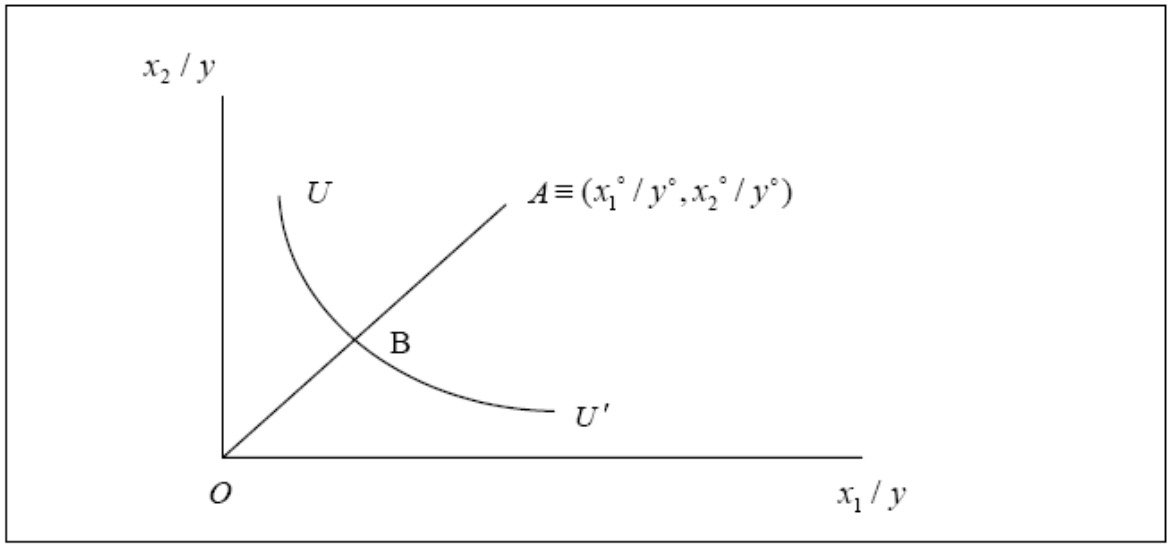

Figure 2.1: Technical and Allocative Efficiency

On the other hand allocative efficiency is based on cost considerations. The type of efficiency measured depends on the data availability and appropriate behavioural assumptions (Yin, 1999). Depending on the quantities, technical efficiency can be calculated. In addition to the quantities, if prices of these quantities are available, then economic efficiency can be calculated and be decomposed into technical and allocative components.

Production frontier estimation:

There are two main production frontier estimation methods, namely parametric and non-parametric methods. Used in the estimation of production frontiers and individual production unit efficiency both of the methods have strengths and weaknesses. One should decide between structure and flexibility, for choosing the method whether parametric or non-parametric.

2. 1. 3. 1) Parametric Methods

The efficient frontier can be calculated through an explicit functional form representing the model. These methods are called parametric methods. Parametric methods are used in both economic techniques and stochastic frontier methods. Stochastic frontier estimation mainly depends on two factors, namely the sector subject to research and data

availability. According to these factors the structure and the flexibility of the model is affected. Moreover, using stochastic frontier estimation methods, stochastic noise in the data set can be successfully separated from the information part of data. However, the requirement of an explicit specification of the production function and assumption of distributions for the error term without regard to the theory are considered as shortcomings of stochastic frontier methods.

2. 1. 3. 2) Non-parametric methods

In contrast to the parametric methods, non-parametric methods do not require an explicit functional form. There are numerous techniques belonging to non-parametric methods. One of such methods is Data Envelopment Analysis. Data Envelopment Analysis uses mathematical programming techniques and derives the deterministic frontier instead of estimating it. Not requiring any explicit functional form a possible frontier misspecification is avoided in Data Envelopment Analysis. Non-parametric methods need less information than parametric methods, but the results of non-parametric methods are less precise accordingly. For DEA to be successful, the data should be assumed to be free from statistical noise. Otherwise, when applying DEA to estimate the technical efficiency at production unit level, inefficiency may include statistical noise as well. In DEA, the production frontier is derived based on sample data and therefore its results could be sensitive to outliers.

One of the prominent advantages of Data Envelopment Analysis is its ability to handle multiple outputs easily. All parametric approaches are limited to single output case. For example in the CAPM method output is a single input - single output method, where risk premium is the only input and return is the only output. In the Arbitrage Pricing Theory there is more than one input, but the output remains single. This is because the extension of parametric methods for frontier estimation to the multiple output case raises additional theoretical and computational problems (Banker, Conrad and Strauss, 1986).
Variable selection in Data Envelopment Analysis method is of great importance. The more variable included in the model, the more production units become efficient. In other words, the extension of input-output variables has a diminishing affect to the precision and accuracy of the model. Therefore inclusion of many input-output

variables, regardless of the quality of data sets, may cause further problems. For example, if some of the input or output data are highly correlated among themselves - the so called multi-collinearity - the model can become redundant, despite the high statistical significance of data individually. On the other hand, when some variables are removed from the Data Envelopment Analysis Model, the production unit efficiency decreases or at most remains unchanged. There is no commonly accepted and standardized approach for variable selection in Data Envelopment Analysis. However past literature suggests some methods. For example, Adler and Golany (2001) suggested using principal component analysis to select a number of variables that are representative of the available data set.

Norman and Stoker (1991) proposed a step-wise approach in which they start with a few input-output variables and subsequently add variables to the initial set. Selection of new variables depends on the strength of their correlation with the DEA efficiencies computed using the initial variable set. This is continued until a reasonable set of input-output variables is included.

The essential factors affecting the efficiency estimates are the choice of the functional form of production technology and the measurement methodology employed. The inconsistency of the results with the different techniques makes it imperative that more research is performed to determine the appropriate use of the two measurement methodologies (Galagedera, 2004).

3. METHODOLOGY OF DATA ENVELOPMENT ANALYSIS

Data Envelopment Analysis technique defines an efficiency measure of a production unit by its position relative to the frontier of the best performance established mathematically by the ratio of the weighted sum of outputs to the weighted sum of inputs (Norman and Stoker (1991). The estimated frontier of the best performance is also referred to as efficient frontier, or envelopment surface. The frontier of the best performance characterizes the efficiency of production units and identifies inefficiencies based on known levels of attainment. Thus, a production unit attains one hundred per cent efficiency only when it is not found to be inefficient in using the inputs to generate the output when compared with other relevant production units.

Considerable research effort has been expanded in the development of more sophisticated methods of evaluating the efficiency of a unit in relation to the other units in its grouping. One of the major objections to the frontier approach has been that, the frontier itself is determined by the extreme observations of the data set, thus the definition of the frontier could be sensitive to errors or inconsistencies in the data. A way around this, taking account of all observations, is to fit a constrained frontier around the data according to some functional form, such as Cobb-Douglas, with errors constrained to one sign. The fit itself is achieved by linear or quadratic programming techniques.

In some observations it is not satisfactory to define a restricted functional form of the process that generates outputs from the resources and environmental factors that serve as inputs. One further consideration is of the greatest importance, the need to take into account for multiple inputs and multiple outputs.

The research in this area came from Charnes, Cooper and Rhodes, therefore this work of Charnes, Cooper and Rhodes research report in 1978 is the basis for all subsequent

development in the non parametric approach to evaluating technical efficiency. In a subsequent paper Charnes and Cooper (1985) give their formal definition of efficiency:

"100% efficiency is attained for a unit only when:

(a) None of its outputs can be increased without either increasing one or more of its inputs, or decreasing some of its outputs.

(b)None of its inputs can be decreased without either decreasing one or more of its outputs, or increasing some of its inputs."

This definition accords with the economists' concept of Pareto optimality. If we have no way of establishing a true and theoretical model of efficiency, that is some absolute standard, we have to adapt the definition so that it refers to levels of efficiency relative to known levels attained elsewhere in similar circumstances. Moreover Charnes and Cooper (1985) stated:

"100% relative efficiency is attained by any unit only when comparisons with other relevant units do not provide evidence of inefficiency in the use of any input output."

The term "Decision Making Units" (DMU) was first introduced by Charnes, Cooper and Rhodes (1978) to describe the collection of firms, departments, divisions or administrative units which have common inputs and outputs, and which are being assessed for efficiency. At the beginning, the concentration of DEA research was on "Not for Profit" organisations, because of the focus of these organisations on multiple problems in addition to economic weighting factors such as market prices. Therefore the most distinctive criteria among researches of DEA is the implementation area of research, in other words the researches that were carried out in private or public sector. The term DEA has been used since the Charnes, Cooper and Rhodes (1978) paper to describe their approach to efficiency evaluation, but in that paper they refer to DEA as a method for adjusting data prescribed theoretical requirements, such as optimal production surfaces etc., prior to undertaking various statistical tests for public policy analysis. The reference to public analysis is found unnecessary by Norman and Stoker (1991) and they made another universal definition for DEA as a non-parametric assessment method:

"The DEA technique defines an efficiency measure of a production unit by its position relative to the frontier of the best performance established mathematically by the ratio of the weighted sum of inputs" (Galagedera, 2004).

The original formulation of the DEA model by Charnes, Cooper and Rhodes (1978):

Let;

S = {1 , . . . , s} is the set of outputs considered in the analysis

M = {1, . . . , m} is the set of inputs considered in the analysis

y_{rj} = known positive output level of production unit j, r $\in$ S

x_{ij} = known positive input level of production unit j, i $\in$ M

n = total number of production units evaluated

And the Charnes, Cooper and Rhodes (CCR) model for determining the relative efficiency of a designated production unit 'k' is given as:

$$\left\{ \frac{\sum_{r=1}^{s} u_r y_{rk}}{\sum_{i=1}^{m} v_i x_{ik}} \right\} \qquad \textbf{(3.1)}$$

$$\text{subject to:} \quad \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1, \qquad j = 1, 2, \ldots, n, \qquad \textbf{(3.2)}$$

$$u_r, v_i \geq 0, \qquad r = 1, 2, \ldots, s, \quad \text{and} \quad i = 1, 2, \ldots, m. \qquad \textbf{(3.3)}$$

The above formulation assumes constant returns-to-scale (CRS) and the production frontier is a piecewise linear envelopment surface. The variables in the model are the input and output weights u_r and v_i respectively. The objective function (3.1) is the ratio of the weighted sum of outputs to the weighted sum of inputs of production unit 'k'. The

optimal values of the variables u_r and v_i are determined as a solution to the problem of maximising the efficiency measure of production unit 'k', subject to the constraint that the efficiency measures of all production units be less than, or equal to, one. The model (3.1-3.3) has an infinite number of optimal solutions, since if $\{u_r^*, v_i^*\}$ is an optimal solution, then $\{\alpha u_r^*, \alpha v_i^*\}$ will also be an optimal solution. One way of avoiding this is to impose the constraint $\sum_{i=1}^{m} v_i x_{ij} = 1$ that results in the following optimisation model:

$$Max \sum_{r=1}^{s} u'_r \; y_{rk} \qquad \textbf{(3.4)}$$

subject to $$\sum_{r=1}^{s} u'_r \; y_{rj} - \sum_{i=1}^{m} v'_i x_{ij} \leq 0, \qquad \text{j = 1, 2, . . . , n,}$$

(15)

$$\sum_{i=1}^{m} v'_r \; x_{rk} = 1, \qquad \textbf{(3.5)}$$

$$u'_{r,} v'_i \geq 0, \text{ r = 1, 2, . . . , s, and i = 1, 2, . . . ,m.} \qquad \textbf{(3.6)}$$

There is an associated linear programme to the model given in (3.4-3.7) called 'the dual'. The optimal solution to one model reveals the optimal solution to the other. Hence, the dual problem, which always has a fewer number of constraints, is the preferred form to handle. The dual of the model given in (3.4-3.7) is:

$$\text{Min } \theta \qquad \textbf{(3.7)}$$

Subject to $$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{rk}, \qquad r = 1, 2, \ldots, s, \qquad \textbf{(3.8)}$$

$$\theta x_{ik} \geq \sum_{j=1}^{n} \lambda_j x_{ij,} \qquad i = 1, 2, \ldots, m, \qquad \textbf{(3.9)}$$

$$\lambda_j \geq 0, \qquad j = 1, 2, \ldots, n. \qquad \textbf{(3.10)}$$

The variables in the model (3.7-3.10) are unrestricted θ and λ_j which is non-negative for all j. The variable θ, as evident in constraint (3.9), is the proportional reduction in all inputs of the production unit 'k' required to achieve efficiency. Hence, θ will be the Farrell (technical) efficiency. The constraints in the model ensure that the relative efficiency of unit 'k' never exceeds 1. The sufficient condition for the efficiency of unit 'k' is that the optimum value of θ is 1. Otherwise, it is labelled as inefficient compared to the other units in the sample.

The orientation of the model given in (3.7-3.10) is an input reduction approach since it provides information on how much proportional reduction of inputs is necessary (while maintaining production levels of output) for an inefficient unit to become DEA-efficient. A measure of efficiency obtained from the solution to model (3.7-3.10) therefore, consists of technical as well as scale efficiencies. The variable returns-to-scale (VRS) version of the model (3.7-3.10) was proposed by Banker, Charnes and Cooper (1984), hereafter called the BCC model. The BCC model is (3.7-3.10) together with the additional constraint,

$$\sum_{j=1}^{n} \lambda_j = 1, \qquad \textbf{(3.11)}$$

that captures returns-to-scale characteristics. The BCC model measures technical efficiency only. Hence, the efficiency estimates obtained in the BCC model may be considered as "pure" technical efficiency estimates.

A DEA run will produce a relative efficiency score, θ and a set of λ_j, j = 1, 2, . . . , n, values for each production unit. In the DEA literature, the units evaluated are referred to as decision-making units (DMUs). The set of λ_j values of each unit defines a point on the envelopment surface made up of a convex combination of the efficient units. Therefore, for an inefficient unit, the point so defined by the λ_j values becomes a role model that in turn establishes precedence for it to become efficient. The set of efficient production units $\{j : \lambda_j > 0\}$ is called the peer group of the designated unit, 'k'. The constraint given in (3.11) is referred to as the convexity constraint and accounts for VRS. When the convexity constraint is removed the resulting model represents the CRS situation. The relative efficiency score obtained for a designated unit under CRS is a measure of the overall technical efficiency of the unit and is always at least as much as the corresponding value obtained under VRS. The relative efficiency score obtained under VRS is a measure of pure technical efficiency. The difference in overall and pure technical efficiencies is attributed to scale efficiency. A measure of scale efficiency is simply the ratio of overall and pure technical efficiencies.

The efficiency of certain production units obtained as the solution to model (3.7-3.11) sometimes can be misleading due to what is known as input slack. Input slack results when the section of the linear piecewise frontier used in the measurement of efficiency of a certain unit lies parallel to the axis of measure. Input slack can be obtained from the solution to the model (3.7-3.11) by substituting the optimal values of $\theta(\theta^*)$ and $\lambda_j(\lambda_j^*)$ in (3.11). For the designated unit "k", the slack of input "i" will be:

$$\theta^* x_{ik} - \sum_{j=1}^{n} \lambda_j^* x_{ij} \qquad \textbf{(3.12)}$$

The value of (3.12) will be either zero or positive. Most studies ignore this and simply solve the BCC model for θ which is the Farrell technical efficiency.

4. LITERATURE REVIEW

The seminal paper of Charnes, Cooper and Rhodes (1978) introduced the CRS model to measure technical efficiency only. Their model was initially applied to the public sector (Bessent and Bessent, 1980), non-profit institutions (Charnes and Cooper, 1980), and the education sector (Charnes, Cooper and Rhodes, 1981). Later Banker, Charnes and Cooper (1984) extended the CCR model to accommodate the VRS assumption that enables measurement of scale efficiency. This led to the rapid expansion of the application of DEA to a number of areas, including hospitals (Conrad and Strauss, 1983; Nunamaker, 1983), electric utilities (Fare, Grosskopf and Logan, 1983), courts (Levin, Morey and Cook, 1982), agriculture (Fare, Grabowski and Grosskopf, 1985) and marketing (Charnes, Cooper, Learner and Phillips, 1985), to name a few. In the 1990s, DEA became very popular due to significant advances in model development and computational efficiency. See Seiford (1996) for an evolution map that illustrates the growth of DEA in theory and application from 1978 to 1995.

The DEA approach can be problematic when some of the inputs and/or outputs of the decision-making unit (DMU) are stochastic. In situations where the input or output variables of the DMUs are assumed to be random variables, a number of studies have resorted to analytical approaches where a random component is added to the efficient frontier (Olesen and Petersen, 1995; Retzlaff-Roberts and Morey, 1993; Sengupta, 1987). Premachandra, Powell and Shi (1998) used a DEA-based numerical approach to investigate the relative performance of New Zealand managed portfolios under a stochastic environment. Now, DEA application is becoming more sophisticated and is used as a versatile and effective tool in empirical analysis.

4.1. Application in Finance

A growing number of studies on bank branches can be found in the literature in many different countries. See Berger and Humphrey (1997) for a survey of 130 studies that apply frontier efficiency analysis to financial institutions in twenty-one countries. The reason for the rapid growth of such studies was mainly due to intensified competition among major banking players at the local level and their having to operate under different regulatory regimes in foreign markets.

Efficiency measurement techniques generally separate bank branches that perform better, relative to a benchmark, from the others. Since DEA is a relative efficiency measurement technique, the use of DEA to measure bank branch efficiency is now becoming increasingly popular. See, for example, Parkan (1987) for an assessment of the branches of a Canadian chartered bank, Giokas (1991) of the Greece Commercial Bank, Al-Faraj, Alidi and Bu-Bshait (1993) of a Saudi Arabian bank and Athanassopoulas (1998) of a commercial bank in the United Kingdom.

4. 2. Application in Securities and Managed Funds

Powers and McMullen (2000) applied the DEA technique with weight restrictions to distinguish between strong performers and others in a set of financial securities. Weight restrictions are generally imposed to avoid production units achieving efficiency while having undesirable input-output levels (Thompson, Langemeier, Lee, Lee and Thrall, 1990; Wong and Beasley, 1990). They argued that security selection could be thought of as a multi-criteria decision-making problem since security selection is usually based on an examination of several attributes. Considering 1-, 3-, 5-, and 10-year average returns and earnings per share as output variables, and price to earnings ratio, beta risk and 3-year semi deviation of returns as input variables, Powers and McMullen estimated the DEA-efficiency of 185 of the largest market cap securities in the US. They highlighted that DEA is able to (i) provide a single composite score for each security, (ii) inform the decision-maker as to which securities are consistently the best when several attributes are considered and (iii) provide information as to how much improvement is needed for each security to become efficient with respect to given inputs and outputs.

Investment performance measures such as the Sharpe, Treynor and Jensen indices can be used to evaluate the risk-return performance of managed funds based on the risk-adjusted return or its variations. Murthi, Choi and Desai (1997), were the first to apply DEA to mutual fund appraisal. Motivated by this application and the results, they argued that the superiority of DEA over the above three indices comes from the fact that DEA can accommodate important variables such as transaction costs, while the indices do not make use of such information. Another drawback of the Treynor and Jensen indices is the requirement of a benchmark7 for performance comparisons.

Transaction costs include loads and/or other fees that financial institutions charge investors for their expertise and for conducting financial transactions on their behalf. Murthi, Choi and Desai (1997) modified the idea of the Sharpe index by incorporating transaction costs. Their index, denoted by I, is expressed as:

$$I = \frac{R}{\sum_{i=1}^{n} w_i X_i + v\sigma} \qquad \textbf{(4.1)}$$

where, R is the excess return, σ is the semi deviation of returns, n is the number of components of the total transaction costs and X_i is the transaction costs associated with the cost component i, w_i and v are the weights associated with variables X_i and σ. The index I is interpreted as the excess return after controlling for the level of risk of the investment and the expenses incurred through transactions. The weights w_i: i = 1, . . . , n and v can be determined by employing a parametric approach and specifying a functional form for the association between the output variable R and input variables X_i: i = 1, . . . , n, and σ. However, acknowledging the criticism of Varian (1990) for using parametric specifications here, Murthi, Choi and Desai (1997) employed DEA to appraise 731 mutual funds using the actual return as the output variable and four input variables: expense ratio (accounts for management fees, marketing expenses and other operational expenses), load (a charge at the time of investment and/or withdrawal also referred to as sales charge), turnover (captures the trading activity of the fund manager proxied by min{monthly purchases, sales}/average net asset value) and the semi

deviation of returns. Murthi, Choi and Desai (1997) found strong evidence that mutual funds are approximately mean-variance efficient and that efficiency is not related to transaction costs. However, their study assumed a CRS frontier and therefore was unable to examine the issue of scale effects on the mutual funds.

McMullen and Strong (1998), on the other hand, analysed 135 common stock mutual funds using DEA. Their choice of the input-output variable set differed slightly from that of Murthi, Choi and Desai (1997). McMullen and Strong postulated that an investor's choice of a mutual fund would be typically a function of recent performance, long-term performance, the associated risks of these returns and transaction costs. In particular, they considered 1-, 3- and 5-year annualised returns as output variables and sales charge, expense ratio, minimum initial investment and semi deviation of return measured over three years as the input variables.

Apart from the choice of the input-output variable set, the McMullen and Strong (1998) study differed from Murthi, Choi and Desai (1997) in two other aspects. These are: (i) relaxing the CRS assumption and (ii) imposing weight restrictions on the input-output variables. McMullen and Strong demonstrated that DEA results could assist investors to decide which funds to buy or not to buy, by providing them with reasons.

Sedzro and Sardano (1999) analysed 58 US equity funds in Canada using DEA. Their study differs from McMullen and Strong (1998) in two aspects: (i) the use of another proxy (Vos ratio) for risk, different from the usual semi deviation of returns and (ii) comparison of the DEA results with three other performance measures – the Morningstar rating, the Sharpe index and the Vos ratio (Vos, 1997). Sedzro and Sardano (1999) treat annual return as the output variable and expenditure ratio, minimum initial investment and inverse of Vos risk measure9 as the input variables.

Sedzro and Sardano (1999) reported that DEA yields results similar to those of the Sharpe, Vos and Morningstar measures, and through critical examination of the DEA results emphasised the advantage of using DEA over the other measures. In particular they highlighted the possibility of identifying the causes for the under-performance of inefficient funds.

Morey and Morey (1999) addressed the issues of integrating fund performance over different time horizons and identification of dominant funds. They suggested a method of eliminating subjectivity in the selection of weights in the integration of fund performance over different time horizons by adopting a DEA-based approach. Premachandra, Powell and Shi (1998) on the other hand, proposed a spreadsheet-based stochastic DEA model for ranking a set of portfolios created by mixing three alternative investments, namely, securities in the New Zealand stock exchange, the NZSE40 index and a risk-free asset.

4. 3. Application in Turkey

Since early 90s numerous researches have been carried out with DEA in Turkey. For example; Oral and Yolalan (1990) on a Turkish bank, Ulucan (1999) on the performance evaluation of 225 IMKB companies, Yalciner, Atan, Kayacan and Boztosun. (2004) on performance of IMKB 30 shares.

5. THE MODEL

The model of DEA in this work is consisting of inputs, outputs, constraints and a performance coefficient as mentioned above.

The inputs (M) of the model are defined as the resources expended by the investor when investing in a mutual fund. For the mutual fund investment, the investor nincers certain sales charges to acquire the mutual fund in the form of loads and other expenses of the fund that are passed on to the investor and included in the expense ratio. A fund´s expense ratio refers to the general overall costs incurred by the fund and is typically expressed as a percentage of total assets being managed. The total expense ratios of the managed funds are broken down into:

1. Semi deviation of the return of mutual fund
2. Management costs of the fund
3. Commissions charged for transactions (for all Bond, Re-Po, Stock Exchange)
4. Other costs (marketing, distribution fees etc.)

The only input (S) in the model is defined as the benefit derived by the investor from having the investment, in other words annual return of the mutual fund. Being exposed to the same annual deflation coefficient, all data are used in nominal values.

In order to represent the efficiency of the Decision Making Unit, the variable *"θ"* is being used in the DEA methodology. Using a input oriented DEA method, the goal of programming process is minimizing the variable *"θ"*. If the model cannot find any lower θ value than 1, the Decision Making Unit is called DEA efficient, in other words located on the efficient frontier. The goal function of the programme is:

$$\text{Min } \theta \qquad \textbf{(5.1)}$$

For every iteration there are six constraints, four of which are input constraints, also one output constraint and one lambda constraint respectively. As mentioned in the DEA methodology the input constraints are shown as,

$$\theta x_{ik} \geq \sum_{j=1}^{n} \lambda_j x_{ij,} \qquad \text{i = 1, 2, 3, 4.} \qquad \textbf{(5.2)}$$

For i = 1; then the equation represents the constraint of "Management Costs",
For i = 2; then the equation represents the constraint of "Commisions",
For i = 3; then the equation represents the constraint of "Other Costs",
For i = 4; then the equation represents the constraint of "Semi deviation of Returns".

The only output constraint of the model is the constaint of "Annual Return":
Here r = 1, because there is only one output constraint.

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{rk}, \qquad \text{r = 1} \qquad \textbf{(5.3)}$$

The last constraint of the model is the so-called "lambda constraint". Lambda may be called as an auxiliary constraint, to help carrying out comparison of output and input constraints. For every iteration the sum of lambdas must be 1, which means in every iteration only one Decision Making Unit should be considered for programming.

$$\sum_{j=1}^{n} \lambda_j = 1, \qquad \textbf{(5.4)}$$

All "Reference sets" and "Equations" are entered as indicated in the above form in Excel Worksheet.

	A	B	C	D	E	F	G	H	I	J
1	CODE	MNGMNT	COMSN	OTHER	STD DVTN		RETURN		λ	***Efficiency***
2	ADF	4,38	8,23	0	0,088509055		0,028398862		0	0,684483894
3	AAF	5,48	2,83	0,1	0,038125132		0,085259909		0	0,929732633
4	AN1	5,48	0,94	0,08	0,042602891		0,172560035		0	0,99667063
5	DZA	5,5	7,97	0,01	0,031687719		0,248462833		0	1
6	EC2	5,06	3,86	0	0,059926097		0,293728045		0	1
7	EVA	6,2	3,35	0	0,075156014		0,007518797		0	0,569034148
8	FYD	5,57	4,19	0	0,129315856		0,304811242		0	0,734424002
9	GYA	5,46	1,45	0,08	0,052664144		0,095459546		0	0,815448974
10	GL1	5,49	0,93	0	0,035613016		0,191816365		0	1
11	IYD	1,84	3,28	0	0,099514161		0,315481342		0	1
12	KCA	5,46	2,84	0,06	0,042245215		0,229997348		0	0,997254305
13	MNA	7,3	6,33	0	0,091365651		0,046456494		0	0,479162817
14	TZ1	3,72	2,69	0	0,068188606		0,087486838		0	0,835048538
15	TI7	5,48	2,46	0	0,062857725		0,003835225		0	0,653100931
16	TMD	5,46	2,85	0	0,056911291		0,05280886		0	0,682517948
17	KA2	6,57	1,3	0	0,070992828		0,108258382		0	0,78168423
18	TSF	7,35	5	0	0,038679447		0,042651593		0	0,920721953
19	YAD	5,49	3,23	0	0,05548207		0,096171269		0	0,696829814
20	TZD	3,64	1,38	0	0,0390015		0,159976416		1	1
21										
22		Reference		DMU under	19	**Efficiency**				
23	**Constraints**	Set		Evaluation		1				
24	Management Costs	3,64	≤	3,64						
25	Commission	1,38	≤	1,38						
26	Other	0	≤	0						
27	Deviation	0,0390015	≤	0,0390015						
28	Return	0,159976416	≥	0,1599764						
29	Cummulative Lambda	1	=	1						

Figure 5.1: Microsoft Excel Worksheet

As shown in the Figure 4; Column A is the Codes of the Mutual Funds, Column B is the Management Costs of the Mutual Funds, Column C is the Commissions charged by the Mutual Funds, Column D is the Other Costs of the Mutual Funds, Column E is the Semi deviation of the Returns of the Mutual Funds, Column G is the Annual Returns of the Mutual Funds, Column I is the Lambda value of the equation and Column J is the DEA Efficiency of the Mutual Funds.

The constraints of the Model are shown in Lines 24 to 29.

Line 24 represents the input constraint of "Management Costs", calculated as:

SUMPRODUCT(B2:B20;I2:I20) ≤ F23*INDEX(B2:B20;E22;1)

Line 25 represents the input constraint of "Commissions", calculated as:

SUMPRODUCT(C2:C20;I2:I20) ≤ F23*INDEX(C2:C20;E22;1)

Line 26 represents the input constraint of "Other Costs", calculated as:

SUMPRODUCT(D2:D20;I2:I20) ≤ F23*INDEX(D2:D20;E22;1)

Line 27 represents the input constraint of "Semi Deviation of Annual Return", calculated as:

SUMPRODUCT(E2:E20;I2:I20) $\leq$ F23*INDEX(E2:E20;E22;1)

Line 28 represents the output constraint of "Annual Return", calculated as:

SUMPRODUCT(E2:E20;I2:I20) $\geq$ INDEX(E2:E20;E22;1)

Line 29 represents the Lambda constraint, calculated as:

SUM(I2:I20) = 1

F23 indicates the DEA efficiency of the Mutual Fund being evaluated.

Having entered the data and the reference set in the Excel Worksheet as indicated above, DEA calculation can be carried out through Excel Solver.

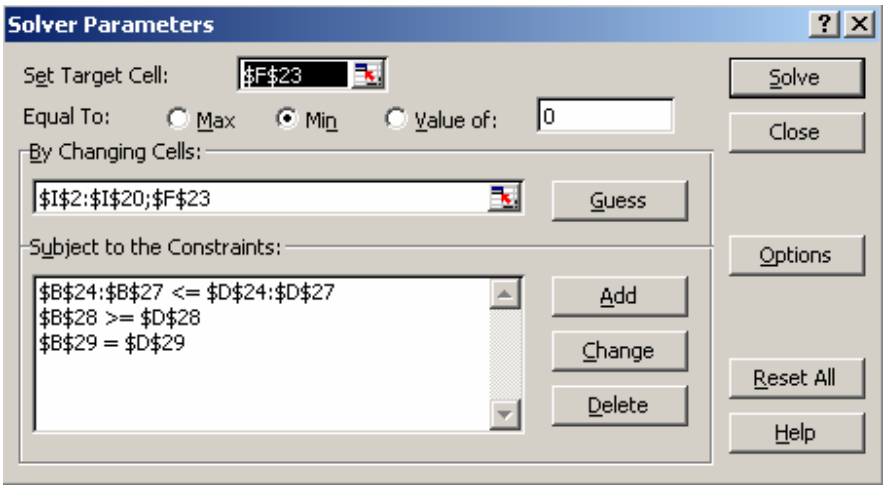

Figure 5.2: Microsoft Excel Solver Window

As shown in Figure 5, in the "Set Target Cell" area, the "goal function" of the model, in other words θ is entered (in this case F23) and the goal is set as minimization. Then, in the "By changing Cells" area, the θ and λ variations in the model are entered (in this case I2:I20 and F23). Finally, the above mentioned constraints are given in the "Subject to the Constraints" area.

B24:B27 <= D24:27 (for the input constraint)

B28 >= D28 (for the output constraint)

B29 = D29 (for the lambda constraint)

Solver considers the model for only the first Decision Making Unit. To carry on the process automatically until the last Decision Making Unit, a Visual Basic Code is needed.

```
<<<<<<
Sub DEA()
Dim DMUNo As Integer
For DMUNo = 1 To 19
Range("E22") = DMUNo
SolverSolve UserFinish:=True
With Range("J1")
.Offset(DMUNo, 0) = Range("F23")
End With
Next DMUNo

End Sub
>>>>>>
```

Using this VBA code, the whole process can be carried out automatically until the last Decision Making Unit. The DEA efficiency of the evaluated Mutual Funds are indicated in the Column J of the Figure 4. As mentioned before; the Mutual Funds are DEA efficient, whose θ value are 1. The remaining Mutual Funds are the more efficient, the higher θ value they have. (Zhu, 2003)

6. DATA

As mentioned before, in this study the return, semi deviation of return and various costs of Turkish Mutual Funds in years 2002, 2003, 2004 and 2005 are being evaluated from the annual cross-sectional data.

All data in this study are obtained from the Internet site of "Board of Capital Markets" (SPK) The data is consisting of Annual Returns, Semi Deviation of Returns and various costs of the mutual funds, being managed in Turkey.

The raw data is broken down according to types and kinds of mutual funds.

There are two different types of mutual funds in Turkey, Type A and Type B. Type A mutual funds are required to invest at least 25% of their assets in equities issued by Turkish companies. Mutual funds that have no such obligations are classified as Type B mutual funds. Containing equities issued by companies, Type A funds are more volatile, in other words more risky than Type B funds. According to this risk, the return expectations of investors are higher in Type A funds than in B Type Funds. The mutual funds data were broken down into two groups, namely Type A and Type B. Numbers of Type A and Type B funds being evaluated in this study according to years are given in Table 6.1.

Table 6.1: Mutual Fund Breakdown According to Years and Types

	2002	**2003**	**2004**	**2005**
Type A	79	116	85	
Type B	140	195	176	

Moreover Turkish Mutual fund are also classified according to their asset allocation such as Variable, Balanced/Mixed, Affiliate Companies, Sector, Equity, Private, Index, Notes and Bonds, Liquid and Foreign Securities Funds. These are called as kinds of mutual funds.

Each subgroup is also evaluated according to the kinds of mutual funds. The kinds of Type A mutual funds are Variable (V), Equity (E), Sector (S), Index (I), Balanced/Mixed (M), Affiliate Companies (C) and Private (P). The breakdown of Type A mutual funds according to kinds is given in Table 6.2.

Table 6.2: Type A Mutual Fund Breakdown According to Years and Kinds

	2002	2003	2004	2005
Variable	31	38	35	
Mixed	16	41	14	
Equity	13	15	15	
Index	11	13	13	
Aff.Company	3	3	3	
Private	3	3	3	
Sector	2	3	2	

The kinds of Type B mutual funds are Variable (V), Liquid (L) and Notes/Bonds (B). The breakdown of Type B mutual funds according to kinds is given in Table 6.3.

Table 6.3: Type B Mutual Fund Breakdown According to Years and Kinds

	2002	2003	2004	2005
Variable	20	27	27	
Liquid	22	32	39	
Bond	19	20	25	

Annual returns and semi deviation of returns of mutual funds are calculated directly from the daily values of a unique share of mutual fund.

Annual Return:

Annual return is the only output of the mutual funds in this model and calculated as follows:

Let i = 1, 2, 3, … , k; representing the working days of the year and x_i is the daily value of a unique share of the mutual fund at day i.

If 1 is the first and k is the last working day of the year, then annual return is

$$R_m = \frac{x_t - x_1}{x_1} \qquad \text{m = 2002, 2003, 2004 and 2005} \qquad \textbf{(6.1)}$$

Semi Deviation of Return:

For semi deviation calculation of return, the method referred by Elton and Gruber (1992) is adopted, which considers only negative deviations from expected return. Elton and Gruber suggest that positive deviation of mutual funds from the expected return is welcomed by the investor, therefore does not lead any risk for the investor and should be ignored at semi deviation calculation of returns of mutual funds.

As shown in Figure 6, at the beginning fund value has a positive deviation from the expected return, which is ignored by this model. Then fund value has a negative deviation from the expected return, which is considered for calculations of semi deviation of return by this model.

For the expected return calculations, annual return data is taken into consideration and a straight line is drawn between first and last annual values of the mutual fund, which represents a benchmark of a mutual fund with the same return and zero deviation.

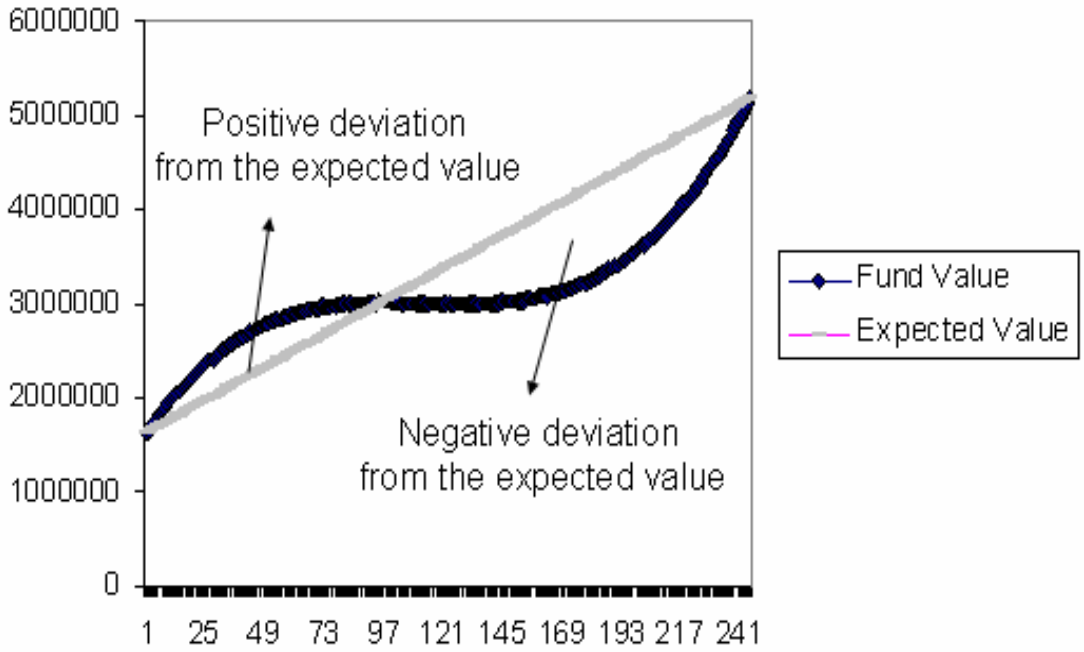

Figure 6.1: Calculation of Semi Deviation

Let x_i is the daily value of a unique share of the mutual fund being evaluated and x_i' the daily value of a unique share of the benchmark mutual fund and $\bar{x}$ is the average value of a unique share of the mutual fund being evaluated.

For every i realising $x_i' > x_i$ and *D* is number of days that $x_i' > x_i$ condition is realised; then the semi deviation of the return of the mutual fund is calculated as:

$$\sqrt{\sigma} = \sqrt{\frac{\sum (x_i' - x_i)^2}{D-1}} \qquad \textbf{(6.2)}$$

In order to compare semi deviations of all mutual funds, these values are divided to average value of a unique share of the mutual fund, so a relative semi deviation (RSD) is obtained;

$$RSD = \frac{\sqrt{\sigma}}{\bar{x}} \qquad \textbf{(6.3)}$$

Management, Commission and Other Costs:

Data about the Management, Commission and Other costs are obtained from the internet site of Board of Capital Markets in Turkish Currency. In order to compare these cost values for all mutual funds, these cost values are divided by the average total values of the corresponding year of the mutual funds. These values are also representing the weight of Management, Commission and Other costs in the total costs of mutual funds.

Having classified the data in order to years, types and kinds of fund; the first stage is the evaluation of funds according to the smallest subset, namely “kinds of mutual funds”.

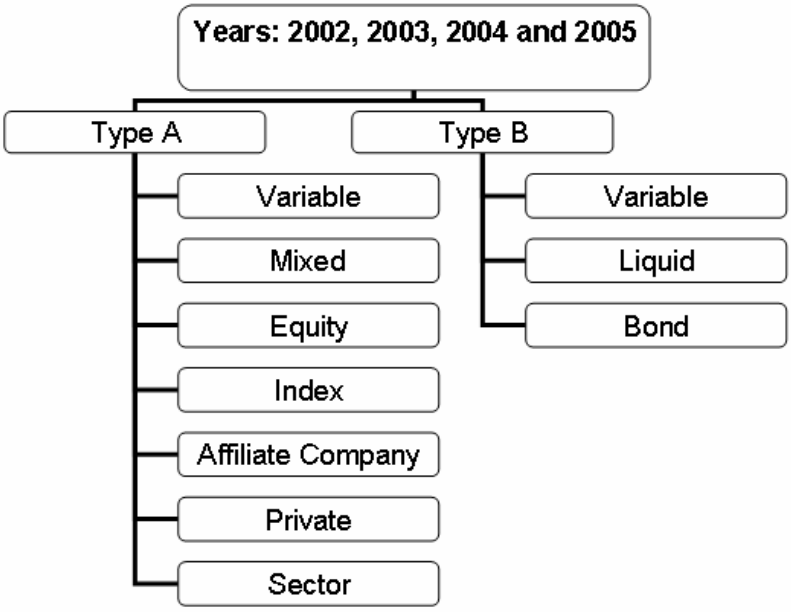

Figure 6.2: Schematic Illustration of Types and Kinds of Turkish Mutual Funds

Shown in Figure 5 Type A mutual funds have 7 and Type B mutual funds have 3 different kinds. However Sector, Affiliate Company and Private mutual funds are quite few in number, therefore these mutual funds are evaluated together, in order to obtain a reliable efficient frontier. So totally Type A mutual funds are divided into 5 subsets namely: Variable (V), Mixed (M), Equity (E), Index (I) and Sector-Affiliate Company-Private (SAP). Type B mutual funds are divided into three groups namely: Variable (V), Liquid (L) and Bond (B).

Finally the subsets, whose vast majority of members have negative annual returns, have not been evaluated in this model. Because inputs and outputs in the models should be positive in the Input Oriented Data Envelopment Analysis. Those negative members in the subsets are excluded from the model and the rest of the mutual funds, that have positive annual return values, are evaluated accordingly.

7. RESULTS

7. 1. Performance Evaluation Mutual Funds in 2002

7. 1. I. First Stage Evaluation According to Kinds of Mutual Funds in 2002

7. 1. I. A. Performance Evaluation of Type A Mutual Funds in 2002

a) Variable Mutual Funds:

Table 7.1: Descriptive Statistics Table for Type A Variable Mutual Funds in 2002

	MC	CC	OC	RSD	AR
Mean	5,10806452	4,58	0,01580645	0,06644955	0,04511945
Standard Error	0,22513815	0,6099353	0,00645538	0,00419408	0,02726398
Median	5,48	3,56	0	0,06818861	0,04265159
Semi deviation	1,25351617	3,39597605	0,03594201	0,02335162	0,1517994
Sample Variance	1,5713028	11,5326533	0,00129183	0,0005453	0,02304306
Kurtosis	0,41993902	3,01356283	4,66468851	0,06309852	0,18808884
Skewness	-0,3752359	1,48276467	2,32747985	0,49757664	-0,1722732
Range	5,51	16,01	0,14	0,09762814	0,64696649
Minimum	1,84	0	0	0,03168772	-0,3314814
Maximum	7,35	16,01	0,14	0,12931586	0,31548134
Sum	158,35	141,98	0,49	2,05993609	1,39870308
Count	31	31	31	31	31

As indicated in the descriptive statistics Table 7.1 for Type A Variable Mutual Funds in 2002, the funds have a 4.5 % of mean value of annual return, and the variance around this value is 2.3 %, in other words σ/μ ratio of the return is 51.1 % and the range of return is 64.7 %. So the risk level of Type A Variable Mutual Funds in 2002 is very high. On the other hand, the Risk Value of the mutual funds is 6.6 %. The mean value for management costs, commissions charged and other costs are 5.1 %, 4.5 %, and 0.01% respectively.

There are 31 Type A Variable Mutual Funds in 2002 to evaluate, having filtered the mutual funds with negative returns, 17 mutual funds remain. The ranking of the remaining Type A Variable Mutual Funds in 2002 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.2: Performance Ranking for Type A Variable Mutual Funds in 2002

CODE	MC	CC	OC	RSD	AR	Efficiency
EC2	5,06	3,86	0,00	0,06	0,29	1
DZA	5,50	7,97	0,01	0,03	0,25	1
IYD	1,84	3,28	0,00	0,10	0,32	1
GL1	5,49	0,93	0,00	0,04	0,19	1
TZD	3,64	1,38	0,00	0,04	0,16	1
KCA	5,46	2,84	0,06	0,04	0,23	0,99725431
AN1	5,48	0,94	0,08	0,04	0,17	0,99667063
AAF	5,48	2,83	0,10	0,04	0,09	0,92973263
TSF	7,35	5,00	0,00	0,04	0,04	0,92072195
TZ1	3,72	2,69	0,00	0,07	0,09	0,83504854
GYA	5,46	1,45	0,08	0,05	0,10	0,81544897
KA2	6,57	1,30	0,00	0,07	0,11	0,78168423
FYD	5,57	4,19	0,00	0,13	0,30	0,734424
YAD	5,49	3,23	0,00	0,06	0,10	0,69682981
ADF	4,38	8,23	0,00	0,09	0,03	0,68448389
TMD	5,46	2,85	0,00	0,06	0,05	0,68251795
TI7	5,48	2,46	0,00	0,06	0,00	0,65310093
EVA	6,20	3,35	0,00	0,08	0,01	0,56903415
MNA	7,30	6,33	0,00	0,09	0,05	0,47916282

The first column is indicating the Codes of Mutual Funds according to Board of Capital Markets (SPK). The second column is the management costs, the third is the total amount charged by fund management as commission, the fourth is other costs, the fifth is the risk value (relative semi deviation) of annual return, the sixth is the annual return in per cent and the seventh is the DEA of the related mutual fund. As shown in Table 7.2 EC2, DZA, IYD, GL1 and TZD are the DEA efficient funds among the 17 Type A Variable Mutual Funds in 2002.

b) Mixed Mutual Funds:

Table 7.3: Descriptive Statistics Table for Type A Mıxed Mutual Funds in 2002

	MC	CC	OC	RSD	AR
Mean	4,971875	4,119375	0,025	0,05622524	0,10849691
Standard Error	0,29334311	0,72043185	0,01719981	0,00457805	0,04203976
Median	5,475	3,455	0	0,05929869	0,1374282
Mode	5,48	2,6	0	#N/A	#N/A
Semi deviation	1,17337245	2,88172742	0,06879922	0,01831219	0,16815902
Sample Variance	1,37680292	8,30435292	0,00473333	0,00033534	0,02827746
Kurtosis	0,71033007	-0,5678472	12,3759242	-0,9680285	-0,4219574
Skewness	-0,5531504	0,57365062	3,43576938	0,13871056	-0,6269027
Range	4,57	9,85	0,27	0,06059331	0,53013249
Minimum	2,73	0,18	0	0,03026644	-0,2133260
Maximum	7,3	10,03	0,27	0,09085975	0,31680644
Sum	79,55	65,91	0,4	0,8996039	1,7359505
Count	16	16	16	16	16

As indicated in the descriptive statistics Table 7.3 for Type A Mixed Mutual Funds in 2002, the funds have a 10.8 % of mean value of annual return, and the variance around this value is 2.8 %. The σ/μ ratio of the return is 25.9 % and the range of return is 53 %. So the risk level of Type A Mixed Mutual Funds in 2002 is high but relatively better than Variable Mutual Funds because of the risk aversive effect of Mixed Mutual Funds. On the other hand, the Risk Value of the mutual funds is 5.6 %. The mean value for management costs, commissions charged and other costs are 4.97 %, 4.12 %, and 0,02 % respectively .

There are 16 Type A Mixed Mutual Funds in 2002 to evaluate, having filtered the mutual funds with negative returns, 11 mutual funds remain. The ranking of the remaining Type A Mixed Mutual Funds in 2002 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.4: Performance Ranking for Type A Mixed Mutual Funds in 2002

CODE	MC	CC	OC	RSD	AR	Efficiency
TKK	4,37	1,05	0,00	0,03	0,31	1
TE3	5,48	0,81	0,00	0,03	0,26	1
ECK	5,06	2,87	0,00	0,03	0,32	1
TKF	2,76	2,59	0,04	0,07	0,05	1
TZK	3,51	2,60	0,00	0,04	0,07	1
HLK	5,48	0,18	0,00	0,08	0,17	1
AKA	4,38	4,99	0,00	0,06	0,20	0,90762756
DZK	5,52	4,04	0,01	0,04	0,29	0,81216616
GA4	5,49	1,59	0,00	0,05	0,25	0,77721755
IYK	5,49	7,74	0,00	0,07	0,18	0,71107497
AAK	5,47	6,98	0,08	0,07	0,11	0,63540521

As shown in Table 7.4 TKK, TE3, ECK, TKF, TZK and HLK are the DEA efficient funds among the 11 Type A Mixed Mutual Funds in 2002.

c) Equity Mutual Funds:

Table 7.5: Descriptive Statistics Table for Type A Equity Mutual Funds in 2002

	MC	CC	OC	RSD	AR
Mean	5,44769231	6,77153846	0,04538462	0,08890352	-0,0906709
Standard Error	0,19327194	1,30130942	0,02240694	0,00874256	0,03057152
Median	5,48	4,63	0	0,07864133	-0,0645203
Mode	5,48	#N/A	0	#N/A	#N/A
Semi deviation	0,6968519	4,69193785	0,08078937	0,03152175	0,1102272
Sample Variance	0,48560256	22,0142808	0,00652692	0,00099362	0,01215003
Kurtosis	-4,77799097	-0,32334316	-3,38594144	-0,48618983	1,7981216
Skewness	1,20180389	0,87958732	1,9251768	-0,2915586	-0,9857027
Range	2,94	14,38	0,26	0,10845426	0,43403346
Minimum	4,38	1,59	0	0,02864501	-0,3566961
Maximum	7,32	15,97	0,26	0,13709927	0,07733729
Sum	70,82	88,03	0,59	1,15574577	-1,1787228
Count	13	13	13	13	13

As indicated in the descriptive statistics Table 7.5 for Type A Equity Mutual Funds in 2002, the funds have a -9 % of mean value of annual return, in other words loss. Having filtered the negative return values only two mutual funds remain, and that is insufficient to calculate a reliable Efficient Frontier, therefore Type A Equity Mutual Funds in 2002 are not evaluated for DEA efficiency.

d) Sector, Affiliate Company and Private (SAP) Funds:

Table 7.6: Descriptive Statistics Table for Type A SAP Mutual Funds in 2002

	MC	CC	OC	RSD	AR
Mean	3,92125	2,05375	0,0425	0,1077011	-0,0188162
Standard Error	0,63678724	0,53558359	0,02650809	0,00697986	0,02069729
Median	4,38	2,12	0	0,11243577	-0,0094716
Mode	4,38	#N/A	0	#N/A	#N/A
Semi deviation	1,80110631	1,51485914	0,07497619	0,01974203	0,05854079
Sample Variance	3,24398393	2,29479821	0,00562143	0,00038975	0,00342702
Kurtosis	0,59168115	-1,2551503	3,87263812	2,82066312	1,86525912
Skewness	-1,3235516	0,13020663	1,99877101	-1,5691158	-0,0871974
Range	4,97	4,16	0,21	0,06367015	0,20647746
Minimum	0,51	0,06	0	0,06563532	-0,1220848
Maximum	5,48	4,22	0,21	0,12930546	0,08439263
Sum	31,37	16,43	0,34	0,86160878	-0,1505299
Count	8	8	8	8	8

As shown in the descriptive statistics table for Type A SAP Mutual Funds in 2002, the funds have a -1 % of mean value of annual return, in other words loss. Having filtered the negative return values only one mutual fund remain, and that is insufficient to calculate a reliable Efficient Frontier, therefore Type A SAP Mutual Funds in 2002 are not evaluated for DEA efficiency.

e) Index Mutual Funds;

Table 7.7: Descriptive Statistics Table for Type A Index Mutual Funds in 2002

	MC	CC	OC	RSD	AR
Mean	5,28909091	1,01	0	0,14006219	-0,2597131
Standard Error	0,13365121	0,16622548	0	0,00905496	0,02077672
Median	5,47	0,88	0	0,13634219	-0,2890218
Mode	5,47	#N/A	0	#N/A	#N/A
Semi deviation	0,4432709	0,55130754	0	0,0300319	0,06890859
Sample Variance	0,19648909	0,30394	0	0,00090191	0,00474839
Kurtosis	1,99048738	2,82724747	#DIV/0!	5,6444629	6,18790938
Skewness	-1,900112	1,25110217	#DIV/0!	1,64978902	2,37930205
Range	1,15	2,1	0	0,12672001	0,23935091
Minimum	4,38	0,23	0	0,09187015	-0,3108790
Maximum	5,53	2,33	0	0,21859016	-0,0715281
Sum	58,18	11,11	0	1,54068405	-2,8568441
Count	11	11	11	11	11

As shown in the descriptive statistics Table 7.7 for Type A Index Mutual Funds in 2002, the funds have a -25.9 % of mean value of annual return, in other words loss. This kind of funds performed worst among all Type A Mutual Funds in 2002. All return values are negative, so there is no need to calculate DEA efficiency for Type A Index Mutual Funds in 2002.

7. 1. I. B. Performance Evaluation of Type B Mutual Funds in 2002

a) Variable Mutual Funds:

Table 7.8: Descriptive Statistics Table for Type B Variable Mutual Funds in 2002

	MC	CC	OC	RSD	AR
Mean	5,3945	0,7365	0,0035	0,03275814	0,44452136
Standard Error	0,4392802	0,2235365	0,00181731	0,00578508	0,03607321
Median	5,465	0,365	0	0,02387504	0,50227132
Mode	5,48	0,16	0	#N/A	#N/A
Semi deviation	1,96452077	0,99968561	0,00812728	0,02587165	0,16132431
Sample Variance	3,85934184	0,99937132	6,6053E-05	0,00066934	0,02602553
Kurtosis	2,48884668	1,54497123	5,9522927	1,71010127	2,45461353
Skewness	1,26845165	1,67874323	2,50169956	1,48854077	-1,6536310
Range	7,92	3,35	0,03	0,0949545	0,65482809
Minimum	2,55	0	0	0,00709813	-0,0089766
Maximum	10,47	3,35	0,03	0,10205263	0,64585146
Sum	107,89	14,73	0,07	0,6551628	8,89042729
Count	20	20	20	20	20

As indicated in the descriptive statistics table for Type B Variable Mutual Funds in 2002, the funds have a 44.4 % of mean value of annual return, and the variance around this value is 2.6 %. The σ/μ ratio of the return is 5.9 % and the range of return is 65 %. So the risk level of Type B Variable Mutual Funds in 2002 is quite low. The Risk Value of the mutual funds is 3.2 %. The mean value for management costs, commissions charged and other costs are 5.39 %, 0.73 %, and 0,004 % respectively .

There are 20 Type B Variable Mutual Funds in 2002 to evaluate, having filtered the mutual funds with negative returns, 19 mutual funds remain. The ranking of the remaining Type A Mixed Mutual Funds in 2002 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.9: Performance Ranking for Type B Variable Mutual Funds in 2002

CODE	MC	CC	OC	RSD	AR	Efficiency
ABF	5,50	0,16	0,00	0,02	0,57	1
ATD	2,84	0,50	0,00	0,01	0,53	1
AND	5,40	0,47	0,01	0,01	0,55	1
TYD	10,47	2,54	0,00	0,10	0,65	1
ADE	2,55	0,54	0,00	0,02	0,52	1
HBD	5,48	0,02	0,00	0,01	0,43	1
GA3	4,46	0,00	0,00	0,01	0,54	1
KCB	4,20	0,08	0,01	0,01	0,51	1
TI4	5,46	0,25	0,02	0,02	0,56	0,9255718
TZ2	3,80	0,52	0,00	0,02	0,54	0,89189754
YDF	2,93	3,35	0,00	0,03	0,15	0,87030717
VK3	5,47	0,02	0,00	0,03	0,50	0,80494652
TDF	5,46	0,13	0,00	0,02	0,36	0,75340195
ZBD	5,49	0,16	0,00	0,03	0,44	0,73646872
IYB	5,48	0,30	0,00	0,07	0,50	0,68184135
GBF	5,55	0,43	0,00	0,05	0,50	0,63075191
GBD	5,48	0,48	0,03	0,05	0,36	0,62136223
KA1	6,57	2,28	0,00	0,03	0,20	0,41851144
EK1	9,93	2,29	0,00	0,04	0,50	0,27721854

As shown in Table 7.9 ABF, ATD, AND, TYD, ADE, HBD, GA3, and KCB are the DEA efficient funds among the 19 Type B Variable Mutual Funds in 2002.

b) Liquid Mutual Funds:

Table 7.10: Descriptive Statistics Table for Type B Liquid Mutual Funds in 2002

	MC	CC	OC	RSD	AR
Mean	4,777	0,2255	0,007	0,0102358	0,42521697
Standard Error	0,37570572	0,05252806	0,00465098	0,0035248	0,01088114
Median	4,615	0,225	0	0,00398995	0,4365028
Mode	2,92	0,27	0	#N/A	#N/A
Semi deviation	1,68020707	0,23491264	0,0207998	0,0157634	0,04866194
Sample Variance	2,82309579	0,05518395	0,00043263	0,00024848	0,00236798
Kurtosis	5,27162637	8,26461265	14,9005052	7,24470326	2,00680065
Skewness	1,75467	2,4076116	3,75962858	2,71445704	-1,2719888
Range	7,71	1,06	0,09	0,06228308	0,2087638
Minimum	2,55	0	0	0,00116809	0,28909527
Maximum	10,26	1,06	0,09	0,06345117	0,49785906
Sum	95,54	4,51	0,14	0,20471597	8,50433939
Count	20	20	20	20	20

As indicated in the descriptive statistics Table 7.10 for Type B Liquid Mutual Funds in 2002, the funds have a 42.5 % of mean value of annual return, and the variance around this value is 0.2 %, in other words σ/μ ratio of the return is 0.47 % and the range of return is 20.9 %. So the risk level of Type B Variable Mutual Funds in 2002 is extremely low. On the other hand, the Risk Value of the mutual funds is 1 %. That is the lowest risk level for all mutual funds in 2002, despite these mutual funds have a mean return value of 42.5 %. So according to risk level, liquid mutual funds have performed very good in 2002. The mean value for management costs, commissions charged and other costs are 4.77 %, 0.23 %, and 0.007 % respectively.

There are 22 Type B Liquid Mutual Funds in 2002 to evaluate, and all of them have positive return values. The ranking of the Type B Liquid Mutual Funds in 2002 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.11: Performance Ranking for Type B Liquid Mutual Funds in 2002

CODE	MC	CC	OC	SD	AR	Efficiency
VK6	5,48	0,03	0,09	0,01	0,48	1
MBL	5,50	0,02	0,00	0,00	0,36	1
TLF	5,46	0,00	0,00	0,01	0,39	1
DLY	2,92	0,09	0,00	0,00	0,45	1
GBL	5,47	0,27	0,00	0,00	0,40	1
SLF	5,48	0,22	0,00	0,00	0,43	1
AK1	2,55	0,38	0,00	0,00	0,46	1
GA2	4,59	0,00	0,00	0,06	0,45	1
KLY	4,64	0,10	0,01	0,00	0,50	1
YLF	2,92	1,06	0,00	0,00	0,44	0,99609703
ZBL	5,47	0,00	0,01	0,02	0,39	0,98437688
HLB	4,80	0,01	0,00	0,04	0,29	0,97408031
ANL	3,29	0,24	0,01	0,01	0,47	0,94230159
ECB	3,80	0,30	0,00	0,00	0,46	0,91795305
FI5	4,40	0,09	0,00	0,01	0,45	0,89118841
TZ3	3,90	0,20	0,00	0,00	0,43	0,86831081
YBL	4,40	0,23	0,00	0,00	0,45	0,85454958
TI1	5,47	0,30	0,03	0,00	0,42	0,8058029
AAL	3,64	0,27	0,00	0,00	0,43	0,79765768
YFL	3,57	0,26	0,00	0,01	0,45	0,77781706
ELF	10,26	0,36	0,00	0,00	0,40	0,66528192
KLF	6,57	0,34	0,00	0,02	0,35	0,433312

As shown in Table 7.11 VK6, MBL, TLF, DLY, GBL, SLF, AK1, GA2 and KLY are the DEA efficient funds among the 22 Type B Liquid Mutual Funds in 2002.

c) Bond Mutual Funds:

Table 7.12: Descriptive Statistics Table for Type B Bond Mutual Funds in 2002

	MC	CC	OC	RSD	AR
Mean	4,89	0,29157895	0,03684211	0,02620949	0,52464436
Standard Error	0,28491304	0,09042222	0,03040711	0,00345461	0,01251662
Median	5,44	0,2	0	0,02126506	0,53657758
Mode	5,48	0,2	0	#N/A	#N/A
Semi deviation	1,24190714	0,39414131	0,13254151	0,01505831	0,05455869
Sample Variance	1,54233333	0,15534737	0,01756725	0,00022675	0,00297665
Kurtosis	1,00527513	4,0231651	18,3228661	1,34613416	2,90562321
Skewness	0,09295779	2,10930788	4,25517631	1,47962617	-1,5922375
Range	5,37	1,44	0,58	0,05315462	0,21843579
Minimum	2,55	0	0	0,00983816	0,36884913
Maximum	7,92	1,44	0,58	0,06299279	0,58728492
Sum	92,91	5,54	0,7	0,4979804	9,96824275
Count	19	19	19	19	19

As shown in the descriptive statistics Table 7.12 for Type B Bond Mutual Funds in 2002, the funds have a 52.4 % of mean value of annual return, and the variance around this value is 0.29 %. The σ/μ ratio of the return is 0.55 % and the range of return is 21.8 %. So the risk level of Type B Variable Mutual Funds in 2002 is quite low. The Risk Value of the mutual funds is 2.6 %. The mean value for management costs, commissions charged and other costs are 4.89 %, 0.29 %, and 0,0036 % respectively . The results obtained from Bond Mutual Funds are quite alike with the results of Liquid Mutual Funds.

There are 19 Type B Bond Mutual Funds in 2002 to evaluate, and all of them have positive return values. The ranking of the Type B Bond Mutual Funds in 2002 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.13: Performance Ranking for Type B Bond Mutual Funds in 2002

CODE	MC	CC	OC	SD	AR	***Efficiency***
TZ4	3,87	0,07	0,00	0,02	0,57	1
DZT	5,52	0,10	0,00	0,01	0,53	1
AK2	2,55	0,21	0,00	0,02	0,59	1
GA1	4,66	0,00	0,00	0,02	0,56	1
ABB	7,92	0,65	0,01	0,02	0,57	0,98202548
ATT	5,36	1,44	0,00	0,01	0,49	0,96936505
YBT	2,94	0,23	0,00	0,03	0,57	0,88674497
YFB	3,68	0,46	0,00	0,02	0,54	0,88278426
KTF	3,28	0,20	0,07	0,06	0,37	0,87693584
TI6	5,44	0,14	0,01	0,02	0,56	0,85248922
ZBT	5,47	0,00	0,02	0,03	0,50	0,85191956
GAT	5,48	0,20	0,58	0,02	0,53	0,83611583
VK2	5,47	0,01	0,00	0,03	0,52	0,83469806
HLT	5,48	0,01	0,00	0,05	0,42	0,83320562
TYB	5,48	0,28	0,00	0,02	0,54	0,81848909
KCT	4,59	0,24	0,01	0,02	0,58	0,81810981
TBB	5,65	0,05	0,00	0,06	0,50	0,74988506
YBB	4,40	1,16	0,00	0,02	0,54	0,73123889
FI3	5,67	0,09	0,00	0,03	0,50	0,71235617

As shown in Table 7.13 TZ4, DZT, AK2 and GA1 are the DEA efficient funds among the 19 Type B Bond Mutual Funds in 2002.

7. 1. II. Second Stage Evaluation According to Types of Mutual Funds in 2002

a) Type A Mutual Funds:

All Type A mutual funds Variable (V), Mixed (M), Equity (E), Index (I) and Sector-Affiliate Company-Private (SAP); that are found DEA efficient in the first stage, are evaluated together in the second stage.

Table 7.14: Second Stage Evaluation of Type A Mutual Funds in 2002

CODE	MC	CC	OC	SD	AR	***Efficiency***	**Kind**
IYD	1,84	3,28	0,00	0,10	0,32	1	V
TKK	4,37	1,05	0,00	0,03	0,31	1	M
TKF	2,76	2,59	0,04	0,07	0,05	1	M
TZK	3,51	2,60	0,00	0,04	0,07	1	M
ECK	5,06	2,87	0,00	0,03	0,32	1	M
TZD	3,64	1,38	0,00	0,04	0,16	1	V
TE3	5,48	0,81	0,00	0,03	0,26	1	M
HLK	5,48	0,18	0,00	0,08	0,17	1	M
DZA	5,50	7,97	0,01	0,03	0,25	0,95514745	V
GL1	5,49	0,93	0,00	0,04	0,19	0,954919668	V

There were 11 mutual funds (5 Variable and 6 Mixed mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 2 Variable (IYD and TZD) and 6 Mixed mutual funds (TKK, TKF, TZK, ECK, TE3 and HLK) are found efficient.

b) Type B Mutual Funds:

All Type B mutual funds Variable (V), Liquid (L) and Bond (B); that are found DEA efficient in the first stage, are evaluated together in the second stage.

Table 7.15: Second Stage Evaluation of Type B Mutual Funds in 2002

CODE	MC	CC	OC	SD	AR	Efficiency	Kind
ADE	2,55	0,54	0,00	0,02	0,52	1	D
ATD	2,84	0,50	0,00	0,01	0,53	1	D
GA3	4,46	0,00	0,00	0,01	0,54	1	D
TYD	10,47	2,54	0,00	0,10	0,65	1	D
AK1	2,55	0,38	0,00	0,00	0,46	1	L
DLY	2,92	0,09	0,00	0,00	0,45	1	L
GBL	5,47	0,27	0,00	0,00	0,40	1	L
KLY	4,64	0,10	0,01	0,00	0,50	1	L
MBL	5,50	0,02	0,00	0,00	0,36	1	L
SLF	5,48	0,22	0,00	0,00	0,43	1	L
AK2	2,55	0,21	0,00	0,02	0,59	1	T
DZT	5,52	0,10	0,00	0,01	0,53	1	T
TZ4	3,87	0,07	0,00	0,02	0,57	1	T
GA1	4,66	0,00	0,00	0,02	0,56	1	T
GA2	4,59	0,00	0,00	0,06	0,45	0,971678	L
KCB	4,20	0,08	0,01	0,01	0,51	0,961717	D
TLF	5,46	0,00	0,00	0,01	0,39	0,873161	L
AND	5,40	0,47	0,01	0,01	0,55	0,857296	D
HBD	5,48	0,02	0,00	0,01	0,43	0,841252	D
ABF	5,50	0,16	0,00	0,02	0,57	0,840476	D
VK6	5,48	0,03	0,09	0,01	0,48	0,787624	L

There were 21 mutual funds (8 Liquid, 9 Variable and 4 Bond mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 4 Variable (ADE, ATD, GA3 and TYD), 6 Liquid (AK1, DLY, GBL, KLY, MBL and SLF) and 4 Bond mutual funds (AK2, DZT, TZ4 and GA1) are found efficient.

7. 1. III. Third Stage Evaluation of All Efficient Mutual Funds in 2002:

All Type A and B mutual funds; that are found DEA efficient in the second stage, are evaluated together in the second stage. The results of this stage indicates the most efficient mutual funds of 2002.

Table 7.16: Third Stage Evaluation of All Efficient Mutual Funds in 2002

CODE	MC	CC	OC	SD	AR	Efficiency	Kind	Type
TZ4	3,87	0,07	0,00	0,02	0,57	1	B	B
ATD	2,84	0,50	0,00	0,01	0,53	1	B	V
SLF	5,48	0,22	0,00	0,00	0,43	1	B	L
TYD	10,47	2,54	0,00	0,10	0,65	1	B	V
GBL	5,47	0,27	0,00	0,00	0,40	1	B	L
GA3	4,46	0,00	0,00	0,01	0,54	1	B	V
DLY	2,92	0,09	0,00	0,00	0,45	1	B	L
MBL	5,50	0,02	0,00	0,00	0,36	1	B	L
KLY	4,64	0,10	0,01	0,00	0,50	1	B	L
GA1	4,66	0,00	0,00	0,02	0,56	1	B	B
DZT	5,52	0,10	0,00	0,01	0,53	1	B	B
IYD	1,84	3,28	0,00	0,10	0,32	1	A	V
AK2	2,55	0,21	0,00	0,02	0,59	1	B	B
AK1	2,55	0,38	0,00	0,00	0,46	1	B	L
ADE	2,55	0,54	0,00	0,02	0,52	0,97851708	B	V
TKF	2,76	2,59	0,04	0,07	0,05	0,79402933	A	M
TZK	3,51	2,60	0,00	0,04	0,07	0,68283094	A	M
TZD	3,64	1,38	0,00	0,04	0,16	0,66232833	A	V
TKK	4,37	1,05	0,00	0,03	0,31	0,56790084	A	M
HLK	5,48	0,18	0,00	0,08	0,17	0,52982601	A	M
ECK	5,06	2,87	0,00	0,03	0,32	0,4884309	A	M
TE3	5,48	0,81	0,00	0,03	0,26	0,46112608	A	M

There were 22 mutual funds (8 Type A and 14 Type B mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier only one Type A (variable mutual fund IYD) mutual fund is found to be efficient, the rest of the efficient mutual funds are all Type B (TZ4, GA1, DZT and AK2 as bond mutual funds; ATD, TYD and GA3 as variable mutual funds; and SLF, GBL, DLY, MBL, KLY and AK1 as liquid mutual funds).

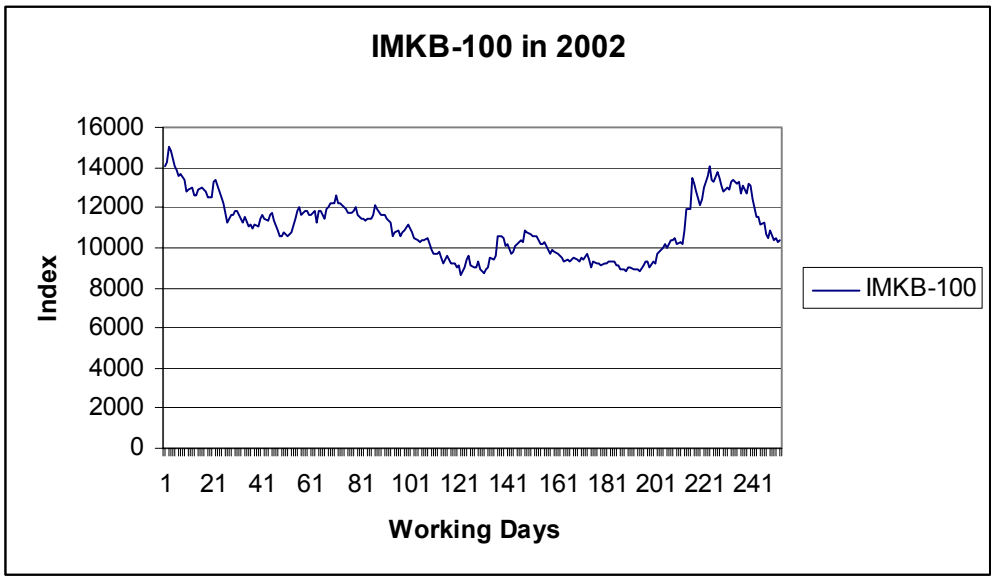

Figure 7.1: The values of IMKB-100 Index in 2002

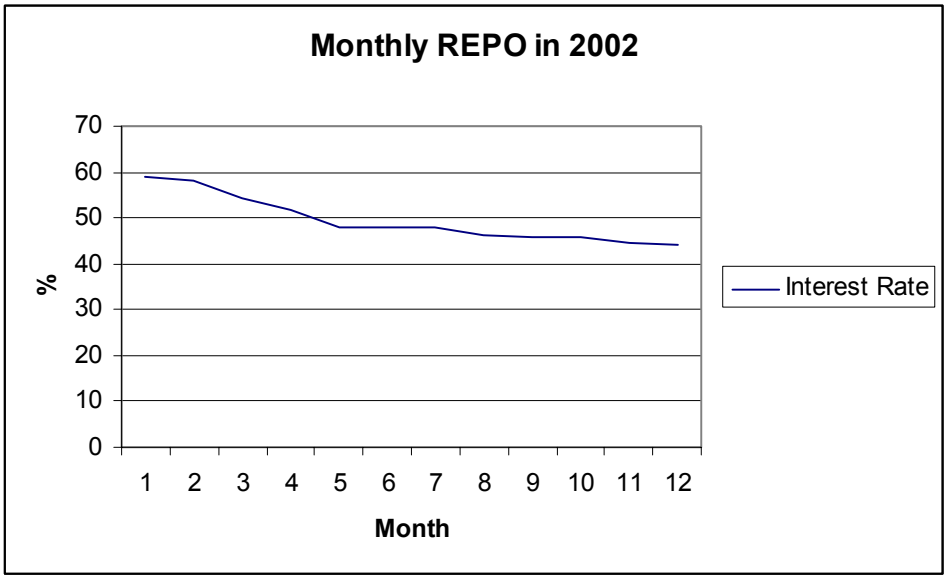

Figure 7.2: Monthly interest rates in 2002

The Index was at 14000 at the beginning of the year 2002. In the first half a marked decline in the IMKB-100 index of approximately 26% happened. In the following period the index continued declining gradually until November. In November the index have ascended up to 14000 and then declined again to about 10000 at the end of the year. On

the other hand the interest rates of repurchase orders have declined simultaneously from 59% to 44% in 2002.

Depending on the negative performance of IMKB in 2002 the vast majority of efficient funds are of Type B. There is only one Type A mutual fund to be found efficient (IYD). The performance of IMKB has a limited effect especially to Bond and Liquid Mutual Funds, which have mostly performed relatively better than other mutual funds in this period.

7. 2. Performance Evaluation Mutual Funds in 2003

7. 2. I. First Stage Evaluation According to Kinds of Mutual Funds in 2003

7. 2. I. A. Performance Evaluation of Type A Mutual Funds in 2003

a) Variable Mutual Funds:

Table 7.17: Descriptive Statistics Table for Type A Variable Mutual Funds in 2003

	MC	CC	OC	RSD	AR
Mean	5,071053	6,427105	0,02646579	0,09450464	0,52251451
Standard Error	0,00203806	0,01145309	0,00444017	0,00617636	0,02796835
Median	0,0547	0,03845	0,02415	0,09514354	0,5337806
Mode	0,0547	0	#N/A	#N/A	#N/A
Semi deviation	0,01256346	0,07060162	0,02737106	0,03807363	0,17240851
Sample Variance	0,00015784	0,00498459	0,00074917	0,0014496	0,0297247
Kurtosis	2,10247143	4,83221511	18,0677037	0,75455019	1,23801643
Skewness	-1,1364215	2,10698802	3,61704949	-0,0018816	0,00767748
Range	0,061	0,3105	0,1654	0,18255431	0,87401879
Minimum	0,012	0	0	0,005435	0,13680346
Maximum	0,073	0,3105	0,1654	0,18798931	1,01082225
Sum	1,927	2,4423	1,0057	3,59117635	19,8555514
Count	38	38	38	38	38

As indicated in the descriptive statistics Table 7.17 for Type A Variable Mutual Funds in 2003, the funds have a 52.3 % of mean value of annual return, and the variance around this value is 2.8 %, in other words σ/μ ratio of the return is 5.2 % and the range of return is 87.4 % and the Risk Value of the mutual funds is 6.6 %. In 2003 Type A variable mutual funds performed much better then the previous year. The mean annual return values have increased to 52.3 %, on the other hand the mean variance value remained about the same. The mean value for management costs, commissions charged and other costs are 5 %, 6.4 %, and 0.02 % respectively.

There are 38 Type A Variable Mutual Funds in 2003 and all of them have positive annual return values. The ranking of the Type A Variable Mutual Funds in 2003 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.18: Performance Ranking for Type A Variable Mutual Funds in 2003

CODE	MC	CC	OC	RSD	AR	Efficiency
ACD	0,04	0,05	0,00	0,08	0,40	1
GA5	0,05	0,02	0,00	0,14	0,80	1
TMD	0,06	0,01	0,00	0,04	0,27	1
SMA	0,04	0,04	0,02	0,01	0,63	1
EVA	0,06	0,02	0,01	0,17	1,01	1
TZ1	0,01	0,02	0,01	0,11	0,54	1
PAD	0,06	0,02	0,01	0,01	0,53	1
TZD	0,04	0,00	0,01	0,06	0,69	1
ADD	0,05	0,31	0,00	0,09	0,43	1
IYD	0,02	0,12	0,02	0,11	0,57	0,95091675
HSA	0,06	0,11	0,00	0,19	0,59	0,90147851
YAF	0,04	0,02	0,01	0,14	0,60	0,88303559
YAD	0,05	0,04	0,00	0,11	0,50	0,82079073
AN1	0,05	0,01	0,02	0,06	0,51	0,77490652
FI2	0,06	0,03	0,02	0,14	0,77	0,74337348
CODE	MC	CC	OC	RSD	AR	***Efficiency***
HK1	0,04	0,13	0,03	0,08	0,25	0,70604119
GL1	0,06	0,01	0,04	0,07	0,45	0,70455809
TUD	0,05	0,18	0,03	0,05	0,65	0,69881739
TCD	0,06	0,03	0,02	0,11	0,72	0,69632593
OY1	0,07	0,02	0,02	0,05	0,59	0,68783515
VAF	0,05	0,00	0,03	0,11	0,51	0,66970803
AAF	0,05	0,01	0,04	0,09	0,40	0,65334407
FYD	0,06	0,03	0,05	0,10	0,68	0,64027054
NU1	0,04	0,05	0,04	0,11	0,57	0,6255566
ADF	0,04	0,11	0,02	0,10	0,53	0,6232036
GYA	0,06	0,01	0,03	0,09	0,55	0,61454809
KA2	0,06	0,02	0,02	0,07	0,48	0,60598677
SAD	0,05	0,04	0,02	0,10	0,54	0,60270657
EC2	0,05	0,05	0,03	0,09	0,46	0,58963446
DZA	0,06	0,04	0,05	0,08	0,35	0,57473142
KCA	0,05	0,04	0,17	0,09	0,50	0,57138862
ABA	0,05	0,11	0,04	0,13	0,59	0,55581055
TI7	0,05	0,04	0,04	0,10	0,49	0,55162275
TSF	0,05	0,12	0,03	0,11	0,23	0,49595471
TAD	0,06	0,11	0,03	0,10	0,58	0,46985962
ST1	0,05	0,09	0,04	0,14	0,58	0,45481629
MNA	0,07	0,09	0,04	0,07	0,17	0,45067082

As shown in Table 7.18 ACD, GA5, TMD, SMA, EVA, TZ1, PAD, TZD and ADD are the DEA efficient funds among the 38 Type A Variable Mutual Funds in 2003.

b) Mixed Mutual Funds

Table 7.19: Descriptive Statistics Table for Type A Mixed Mutual Funds in 2003

	MC	CC	OC	RSD	AR
Mean	4,725625	3,265	0,01745625	0,08149125	0,55501495
Standard Error	0,00366836	0,0071806	0,0030442	0,0063337	0,02409313
Median	0,0543	0,02285	0,01645	0,07459767	0,56756604
Mode	0,0548	#N/A	0,0055	#N/A	#N/A
Semi deviation	0,01467342	0,02872242	0,01217681	0,02533481	0,09637251
Sample Variance	0,00021531	0,00082498	0,00014827	0,00064185	0,00928766
Kurtosis	-1,26693664	-0,89313196	-1,34301602	-0,20999889	-1,43774338
Skewness	-0,95058118	0,71290464	0,41010674	0,79403677	0,06052468
Range	0,0609	0,0842	0,0343	0,08610172	0,30316431
Minimum	0,012	0,0009	0,0037	0,04945528	0,41831657
Maximum	0,0729	0,0851	0,038	0,13555699	0,72148088
Sum	0,7561	0,5224	0,2793	1,30386004	8,88023919
Count	16	16	16	16	16

As indicated in the descriptive statistics Table 7.19 for Type A Mixed Mutual Funds in 2003, the funds have a 55.5 % of mean value of annual return, the variance around this value is 0.9 %, and the σ/μ ratio of the return is 1.6 %, the range of return is 30.3 % and the Risk Value of the mutual funds is 8.1 %. Like the various mutual funds, in 2003 Type A mixed mutual funds performed much better then the previous year, too. The mean value for management costs, commissions charged and other costs are 4.7 %, 3.3 %, and 0.017 % respectively.

There are 16 Type A Mixed Mutual Funds in 2003 and all of them have positive annual return values. The ranking of the Type A Mixed Mutual Funds in 2003 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.20: Performance Ranking for Type A Mixed Mutual Funds in 2003

CODE	MC	CC	OC	RSD	AR	Efficiency
TKK	0,04	0,00	0,01	0,07	0,65	1
GAK	0,03	0,08	0,01	0,12	0,72	1
TZK	0,01	0,03	0,01	0,07	0,59	1
YAK	0,05	0,06	0,00	0,10	0,46	1
TE3	0,05	0,01	0,02	0,05	0,48	1
TKF	0,03	0,00	0,01	0,06	0,54	1
HLK	0,04	0,00	0,03	0,06	0,42	0,99020007
GA4	0,05	0,01	0,01	0,08	0,65	0,98179355
ECK	0,05	0,03	0,04	0,06	0,48	0,93770654
FYK	0,06	0,04	0,03	0,08	0,61	0,81757918
AKA	0,04	0,09	0,02	0,07	0,46	0,80848006
IYK	0,05	0,01	0,01	0,10	0,65	0,75580078
DZK	0,05	0,02	0,04	0,07	0,49	0,72580251
EV1	0,07	0,05	0,02	0,10	0,62	0,63768317
AAK	0,06	0,08	0,03	0,09	0,43	0,60546052
GBK	0,06	0,02	0,02	0,14	0,62	0,58174793

As shown in Table 7.20 TKK, GAK, TZK, YAK, TE3 and TKF are the DEA efficient funds among the 16 Type A Mixed Mutual Funds in 2003.

c) Equity Mutual Funds:

Table 7.23: Descriptive Statistics Table for Type A Equity Mutual Funds in 2003

	MC	CC	OC	RSD	AR
Mean	5,615333	5,838	0,02817333	0,12230039	0,52721265
Standard Error	0,0018436	0,0091951	0,01100091	0,01027568	0,03488107
Median	0,0549	0,0514	0,0178	0,12462325	0,53356389
Mode	0,0548	#N/A	0,0178	#N/A	#N/A
Semi deviation	0,00714021	0,03561246	0,04260635	0,03979752	0,13509382
Sample Variance	5,0983E-05	0,00126825	0,0018153	0,00158384	0,01825034
Kurtosis	1,13426616	-0,9813763	13,2217287	0,66435944	-0,1634423
Skewness	0,28889791	0,4644115	3,5375489	-0,8505125	-0,1991613
Range	0,0278	0,1122	0,1781	0,14881339	0,46482622
Minimum	0,0438	0,0118	0,0002	0,02974306	0,2821369
Maximum	0,0716	0,124	0,1783	0,17855645	0,74696312
Sum	0,8423	0,8757	0,4226	1,8345059	7,90818977
Count	15	15	15	15	15

As shown in the descriptive statistics Table 7.23 for Type A Equity Mutual Funds in 2003, the funds have a 52.7 % of mean value of annual return, the variance around this

value is 1.8 %, and the σ/μ ratio of the return is 3.4 %, the range of return is 46.5 % and the Risk Value of the mutual funds is 12.2 %. Like the various and mixed mutual funds, in 2003 Type A equity mutual funds performed better then the previous year, too. The mean value for management costs, commissions charged and other costs are 5.6 %, 5.8 %, and 0.028 % respectively. There are 15 Type A Equity Mutual Funds in 2003 and all of them have positive annual return values. The ranking of the Type A Equity Mutual Funds in 2003 according to DEA Efficiency is as follows:

Table 7.22: Performance Ranking for Type A Equity Mutual Funds in 2003

CODE	MC	CC	OC	RSD	AR	Efficiency
FAF	0,06	0,03	0,02	0,16	0,73	1
HSH	0,06	0,08	0,00	0,07	0,55	1
AKH	0,04	0,08	0,02	0,14	0,53	1
GAF	0,05	0,11	0,01	0,16	0,75	1
AK3	0,04	0,05	0,03	0,12	0,51	1
TI2	0,05	0,01	0,03	0,11	0,61	1
KMH	0,07	0,03	0,03	0,03	0,50	1
TAH	0,06	0,02	0,00	0,09	0,45	1
ASA	0,05	0,03	0,02	0,10	0,43	0,993270185
YAH	0,06	0,05	0,01	0,16	0,45	0,959421923
TYH	0,05	0,05	0,02	0,11	0,57	0,954266405
KCH	0,05	0,08	0,18	0,15	0,65	0,93457528
IAH	0,05	0,12	0,02	0,18	0,59	0,863752228
DAH	0,06	0,10	0,03	0,12	0,28	0,848427029
AAH	0,07	0,02	0,03	0,13	0,30	0,783541033

As shown in Table 7.22 25 FAF, HSH, AKH, GAF, AK3, TI2, KMH and TAH are the DEA efficient funds among the 15 Type A Equity Mutual Funds in 2003.

d) Sector, Affiliate Company and Private (SAP) Funds:

Table 7.23: Descriptive Statistics Table for Type A SAP Mutual Funds in 2003

	MC	CC	OC	RSD	AR
Mean	3,937778	2,61	0,0277	0,11261903	0,5962664
Standard Error	0,00626008	0,00630679	0,0088167	0,01643212	0,03603307
Median	0,0438	0,0281	0,0218	0,11671312	0,61569869
Mode	0,0438	#N/A	#N/A	#N/A	#N/A
Semi deviation	0,01878023	0,01892036	0,02645009	0,04929637	0,10809921
Sample Variance	0,0003527	0,00035798	0,00069961	0,00243013	0,01168544
Kurtosis	0,37767797	-1,5228570	7,28307359	3,06315003	-1,1853122
Skewness	-1,3244634	-0,0937053	2,55647814	-1,5087713	-0,4203272
Range	0,0498	0,0523	0,0924	0,16619521	0,28952777
Minimum	0,005	0,0007	0,0032	0,00107586	0,44094218
Maximum	0,0548	0,053	0,0956	0,16727106	0,73046995
Sum	0,3544	0,2349	0,2493	1,01357126	5,36639758
Count	9	9	9	9	9

As indicated in the descriptive statistics table 7.23 for Type A SAP Mutual Funds in 2003, the funds have a 59.6 % of mean value of annual return, and the variance around this value is 1.2 %, in other words σ/μ ratio of the return is 2 % and the range of return is 28.9 % and the Risk Value of the mutual funds is 11.3 %. In 2003 Type A SAP mutual funds has the second best performance according to mean return values of 59.6 %. The mean value for management costs, commissions charged and other costs are 3.9 %, 2.6 %, and 0.028 % respectively.

There are 9 Type A SAP Mutual Funds in 2003 and all of them have positive annual return values. The ranking of the Type A SAP Mutual Funds in 2003 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.24: Performance Ranking for Type A SAP Mutual Funds in 2003

CODE	MC	CC	OC	RSD	AR	Efficiency
YAR	0,01	0,00	0,00	0,15	0,71	1
GBM	0,05	0,04	0,02	0,00	0,73	1
KAS	0,01	0,04	0,03	0,12	0,62	1
KAK	0,05	0,00	0,10	0,14	0,68	0,98460617
TI3	0,05	0,01	0,01	0,13	0,62	0,94812537
AGF	0,04	0,02	0,02	0,09	0,44	0,8879494
AIF	0,04	0,05	0,02	0,09	0,44	0,72934649
ASF	0,04	0,03	0,02	0,11	0,52	0,70407534
AAM	0,04	0,05	0,02	0,17	0,61	0,55290148

As shown in Table 7.24 YAR, GBM and KAS are the DEA efficient funds among the 9 Type A SAP Mutual Funds in 2003.

e) Index Mutual Funds:

Table 7.25: Descriptive Statistics Table for Type A Index Mutual Funds in 2003

	MC	CC	OC	RSD	AR
Mean	5,093077	1,182308	0,01239231	0,16032558	0,65645954
Standard Error	0,00292978	0,00207742	0,00645563	0,01278637	0,05001736
Median	0,0548	0,0111	0,0072	0,17183001	0,71049652
Mode	0,0546	#N/A	#N/A	#N/A	#N/A
Semi deviation	0,01056349	0,00749023	0,02327611	0,0461019	0,18034016
Sample Variance	0,00011159	5,6104E-05	0,00054178	0,00212539	0,03252257
Kurtosis	2,40041637	1,89902931	12,4433541	11,0606086	9,37129416
Skewness	-1,5492348	1,15476419	3,49814822	-3,2010022	-2,9308233
Range	0,0404	0,0268	0,0874	0,19035448	0,70966757
Minimum	0,0245	0,0034	0,0018	0,01172465	0,09256225
Maximum	0,0649	0,0302	0,0892	0,20207914	0,80222982
Sum	0,6621	0,1537	0,1611	2,08423254	8,53397405
Count	13	13	13	13	13

As indicated in the descriptive statistics table 7.25 for Type A Index Mutual Funds in 2003, the funds have a 65.6 % of mean value of annual return, and the variance around this value is 3.3 %, in other words σ/μ ratio of the return is 5 % and the range of return is 70.9 % and the Risk Value of the mutual funds is 16 %. In 2003 Type A Index mutual funds has the best performance in all Type A mutual funds according to mean return values of 59.6 %, but on the other hand 5 % σ/μ ratio and 70.9 % range value are relatively bigger than other Type A mutual funds.. The mean value for management costs, commissions charged and other costs are 5.1 %, 1.2 %, and 0.012 % respectively. There are 13 Type A Index Mutual Funds in 2003 and all of them have positive annual return values. The ranking of the Type A Index Mutual Funds in 2003 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.26: Performance Ranking for Type A Index Mutual Funds in 2003

CODE	MC	CC	OC	RSD	AR	Efficiency
YEF	0,04	0,01	0,00	0,18	0,78	1
HBU	0,06	0,03	0,00	0,01	0,68	1
TTE	0,02	0,00	0,00	0,16	0,09	1
TIE	0,05	0,00	0,01	0,17	0,72	1
TAU	0,05	0,01	0,01	0,20	0,80	1
AKU	0,04	0,02	0,01	0,17	0,72	1
GLA	0,06	0,00	0,00	0,18	0,71	1
GAE	0,05	0,01	0,01	0,17	0,71	0,88496841
AMU	0,05	0,01	0,00	0,17	0,54	0,87039798

Continued from previous page **Table 7.26**

CODE	MC	CC	OC	RSD	AR	Efficiency
TME	0,06	0,01	0,01	0,15	0,71	0,83754874
AAE	0,06	0,01	0,00	0,18	0,69	0,79113069
KAE	0,05	0,02	0,09	0,17	0,72	0,78513899
DZE	0,06	0,01	0,01	0,18	0,65	0,78465539

As shown in Table 7.26 YEF, HBU, TTE, TIE, TAU, AKU and GLA are the DEA efficient funds among the 13 Type A Index Mutual Funds in 2003.

7. 2. I. B. Performance Evaluation of Type B Mutual Funds in 2003

a) Variable Mutual Funds:

Table 7.27: Descriptive Statistics Table for Type B Variable Mutual Funds in 2003

	MC	CC	OC	RSD	AR
Mean	5,088519	0,607778	0,0210963	0,01658277	0,41580511
Standard Error	0,00353881	0,00207323	0,00458812	0,00272432	0,02432509
Median	0,0543	0,002	0,0023	0,01331873	0,44068161
Mode	0,0545	0	0,0018	#N/A	#N/A
Semi deviation	0,01838822	0,01077281	0,02384055	0,01389136	0,12403413
Sample Variance	0,00033813	0,00011605	0,00056837	0,00019297	0,01538446
Kurtosis	3,98765731	6,97001553	-0,7859033	0,72694638	12,2681435
Skewness	1,26647464	2,6509644	0,65799007	1,12921187	-3,0696116
Range	0,0975	0,0447	0,0794	0,0529393	0,65304246
Minimum	0,012	0	0	0,00060821	-0,1017040
Maximum	0,1095	0,0447	0,0794	0,0535475	0,55133844
Sum	1,3739	0,1641	0,5696	0,43115212	10,8109329
Count	27	27	27	26	26

As indicated in the descriptive statistics table 7.27 for Type B Variable Mutual Funds in 2003, the funds have a 41.6 % of mean value of annual return, and the variance around this value is 1.5 %, in other words σ/μ ratio of the return is 3.6 % and the range of return is 65.3 % and the Risk Value of the mutual funds is 1.7 %. In 2003 Type B variable mutual funds performed like the previous year, but the effect of volatility which has increased to returns of Type A mutual funds in the same period does not effect the return of Type B variable mutual funds. The mean value for management costs, commissions charged and other costs are 5.1 %, 0.6 %, and 0.02 % respectively.

There are 27 Type B Variable Mutual Funds in 2003 to evaluate, having filtered the mutual funds with negative returns, 25 mutual funds remain. The ranking of the

remaining Type B Variable Mutual Funds in 2003 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.28: Performance Ranking for Type B Variable Mutual Funds in 2003

CODE	MC	CC	OC	RSD	AR	Efficiency
TI4	0,05	0,00	0,00	0,02	0,52	1
TZ2	0,01	0,00	0,00	0,01	0,50	1
GA3	0,04	0,00	0,00	0,01	0,43	1
TYD	0,05	0,02	0,00	0,03	0,55	1
ZBD	0,05	0,00	0,04	0,02	0,47	1
NBD	0,09	0,00	0,00	0,00	0,47	1
TDF	0,07	0,00	0,00	0,00	0,29	1
IBF	0,05	0,01	0,00	0,00	0,51	1
ADE	0,04	0,00	0,00	0,01	0,47	1
HBD	0,04	0,00	0,04	0,00	0,35	1
VK3	0,05	0,00	0,05	0,01	0,49	1
GBD	0,05	0,01	0,00	0,00	0,35	0,98534164
ATD	0,04	0,00	0,00	0,01	0,47	0,948287
HSF	0,06	0,00	0,00	0,01	0,40	0,84624639
ABF	0,05	0,00	0,05	0,01	0,45	0,77386988
KCB	0,04	0,00	0,08	0,01	0,41	0,72842885
ECD	0,04	0,00	0,05	0,01	0,49	0,68669902
AND	0,04	0,00	0,00	0,02	0,48	0,63057571
IYB	0,05	0,00	0,04	0,01	0,47	0,58237532
YDF	0,04	0,01	0,00	0,04	0,42	0,58209858
TSD	0,06	0,00	0,04	0,03	0,43	0,49538456
KA1	0,06	0,03	0,00	0,05	0,40	0,39273692
EK1	0,11	0,02	0,04	0,01	0,38	0,36011408
TFD	0,05	0,01	0,04	0,03	0,31	0,33125413
GBF	0,06	0,00	0,04	0,04	0,39	0,26891745

As shown in Table 7.28 TI4, TZ2, GA3, TYD, ZBD, NBD, TDF, IBF, ADE, HBD and VK3 are the DEA efficient funds among the 25 Type B Variable Mutual Funds in 2003.

b) Liquid Mutual Funds:

Table 7.29: Descriptive Statistics Table for Type B Liquid Mutual Funds in 2003

	MC	CC	OC	RSD	AR
Mean	4,323438	0,117188	0,03499063	0,00043262	0,30737744
Standard Error	0,0027265	0,00027665	0,00400928	0,00021139	0,00535582
Median	0,0412	0,0008	0,03395	0,00019692	0,31289491
Mode	0,0548	0	0,032	0	#N/A
Semi deviation	0,01542339	0,00156499	0,02267994	0,00119582	0,03029711
Sample Variance	0,00023788	2,4492E-06	0,00051438	1,43E-06	0,00091791
Kurtosis	3,23902536	9,67590656	2,02422165	29,3136365	2,24429467

Continued from previous page **Table 7.29**

	MC	CC	OC	RSD	AR
Skewness	0,98553496	2,62575844	0,81538584	5,32369849	-1,2545769
Range	0,0839	0,0078	0,1055	0,00685691	0,12759263
Minimum	0,012	0	0	0	0,22553555
Maximum	0,0959	0,0078	0,1055	0,00685691	0,35312819
Sum	1,3835	0,0375	1,1197	0,01384371	9,83607799
Count	32	32	32	32	32

As indicated in the table 7.29 for Type B Liquid Mutual Funds in 2003, the funds have a 30.7 % of mean value of annual return, and the variance around this value is 0,09 %, and σ/μ ratio of the return is 0.3 % and the range of return is 12.8 % and the Risk Value of the mutual funds is 0,04 %. In 2003 Type B variable mutual funds performed worse then the previous year. The mean value for management costs, commissions charged and other costs are 4.3 %, 0.12 %, and 0.03 % respectively. There are 32 Type B Liquid Mutual Funds in 2003 and all of them have positive return values. The ranking of the Type B Liquid Mutual Funds in 2003 according to DEA Efficiency is as follows:

Table 7.30: Performance Ranking for Type B Liquid Mutual Funds in 2003

CODE	MC	CC	OC	RSD	AR	Efficiency
HLL	0,02	0,00	0,01	0,00	0,35	1
TZ3	0,01	0,00	0,00	0,00	0,30	1
ADL	0,04	0,00	0,00	0,01	0,35	1
IYL	0,04	0,00	0,00	0,00	0,32	1
FBL	0,03	0,00	0,03	0,00	0,35	1
KYB	0,04	0,00	0,03	0,00	0,35	1
HLB	0,05	0,00	0,00	0,00	0,29	1
ANL	0,03	0,00	0,00	0,00	0,32	1
TEL	0,03	0,00	0,04	0,00	0,32	0,9270073
TSL	0,04	0,00	0,05	0,00	0,32	0,91429794
YLF	0,03	0,01	0,00	0,00	0,31	0,84196249
GA2	0,04	0,00	0,03	0,00	0,31	0,7956044
DLY	0,03	0,00	0,03	0,00	0,33	0,77372088
AAL	0,04	0,00	0,05	0,00	0,29	0,69398907
ZBL	0,05	0,00	0,03	0,00	0,30	0,66058394
MBL	0,05	0,00	0,08	0,00	0,24	0,65817204
VK6	0,05	0,00	0,03	0,00	0,31	0,62898122
FI5	0,04	0,00	0,04	0,00	0,32	0,62817678
TKL	0,05	0,00	0,05	0,00	0,29	0,62715224
TLF	0,06	0,00	0,04	0,00	0,30	0,59247136
AK1	0,03	0,00	0,04	0,00	0,32	0,58623318
TUL	0,05	0,00	0,07	0,00	0,32	0,56701609

Continued from previous page **Table 7.30**

CODE	MC	CC	OC	RSD	AR	Efficiency
YBL	0,04	0,00	0,03	0,00	0,33	0,54841957
KLY	0,04	0,00	0,11	0,00	0,32	0,47554903
ECB	0,04	0,00	0,04	0,00	0,32	0,43534176
SLF	0,06	0,00	0,05	0,00	0,29	0,42863204
YFL	0,04	0,00	0,04	0,00	0,31	0,42769262
KLF	0,04	0,00	0,05	0,00	0,23	0,40344699
TI1	0,05	0,00	0,03	0,00	0,29	0,39758182
GBL	0,06	0,00	0,04	0,00	0,30	0,33429044
HSL	0,06	0,00	0,03	0,00	0,31	0,32546872
ELF	0,10	0,00	0,02	0,00	0,23	0,22401603

As shown in Table 7.33 HLL, TZ3, ADL, IYL, FBL, KYB, HLB and ANL are the DEA efficient funds among the 32 Type B Liquid Mutual Funds in 2003.

c) Bond Mutual Funds

Table 7.31: Descriptive Statistics Table for Type B Bond Mutual Funds in 2003

	MC	CC	OC	RSD	AR
Mean	4,633	0,1275	0,01878	0,01561384	0,50414869
Standard Error	0,00245386	0,000304	0,00508726	0,00124562	0,00933348
Median	0,04945	0,0008	0,0019	0,01599659	0,50301691
Mode	0,0548	0	0	#N/A	#N/A
Semi deviation	0,01097399	0,00135952	0,02275091	0,00557056	0,04174057
Sample Variance	0,00012043	1,8483E-06	0,0005176	3,1031E-05	0,00174228
Kurtosis	3,80181094	0,71309515	-1,69361776	-0,34954364	-0,40324428
Skewness	-1,65719597	1,19420083	0,55507443	-0,41081376	-0,10926221
Range	0,0435	0,0047	0,0573	0,0202127	0,15838918
Minimum	0,012	0	0	0,0052576	0,42200019
Maximum	0,0555	0,0047	0,0573	0,0254703	0,58038937
Sum	0,9266	0,0255	0,3756	0,31227684	10,0829737
Count	20	20	20	20	20

As indicated in the descriptive statistics table 7.31 for Type B Bond Mutual Funds in 2003, the funds have a 50.4 % of mean value of annual return, and the variance around this value is 0,1 %, in other words σ/μ ratio of the return is 0.2 % and the range of return is 15.8 % and the Risk Value of the mutual funds is 1.6 %. In 2003 Type B bond mutual funds performed like the previous year. The mean value for management costs, commissions charged and other costs are 4.6 %, 0.13 %, and 0.02 % respectively.

There are 20 Type B Bond Mutual Funds in 2003 and all of them have positive annual return values. The ranking of the Type B Bond Mutual Funds in 2003 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.32: Performance Ranking for Type B Bond Mutual Funds in 2003

CODE	MC	CC	OC	RSD	AR	Efficiency
ATT	0,06	0,00	0,00	0,02	0,56	1
TZ4	0,01	0,00	0,00	0,01	0,52	1
TI6	0,05	0,00	0,00	0,01	0,42	1
HLT	0,04	0,00	0,04	0,02	0,44	1
HST	0,06	0,00	0,00	0,01	0,50	1
VK2	0,05	0,00	0,05	0,02	0,55	1
GAT	0,04	0,00	0,00	0,02	0,55	1
FI3	0,06	0,00	0,04	0,01	0,46	1
AK2	0,04	0,00	0,00	0,01	0,52	1
ZBT	0,05	0,00	0,04	0,02	0,49	1
KTF	0,04	0,00	0,00	0,02	0,58	1
GA1	0,04	0,00	0,00	0,01	0,51	1
KCT	0,04	0,00	0,06	0,02	0,54	0,94752066
TYB	0,05	0,00	0,04	0,01	0,48	0,78389537
YBB	0,04	0,00	0,00	0,02	0,52	0,74305314
DZT	0,05	0,00	0,00	0,02	0,46	0,70735166
YFB	0,04	0,00	0,05	0,02	0,49	0,70088418
YBT	0,04	0,00	0,00	0,02	0,52	0,63413062
ABB	0,05	0,00	0,00	0,02	0,49	0,62543984
TBB	0,05	0,00	0,05	0,03	0,48	0,54343829

As shown in Table 7.32 ATT, TZ4, TI6, HLT, HST, VK2, GAT, FI3, AK2, ZBT, KTF and GA1 are the DEA efficient funds among the 21 Type B Bond Mutual Funds in 2003.

7. 2. II. Second Stage Evaluation According to Types of Mutual Funds in 2003

a) Type A Mutual Funds:

Table 7.33: Second Stage Evaluation of Type A Mutual Funds in 2003

CODE	MC	CC	OC	RSD	AR	Efficiency	Kind
GBM	0,05	0,04	0,02	0,00	0,73	1	SAP
TAH	0,06	0,02	0,00	0,09	0,45	1	E
YEF	0,04	0,01	0,00	0,18	0,78	1	M
PAD	0,06	0,02	0,01	0,01	0,53	1	V
YAR	0,01	0,00	0,00	0,15	0,71	1	SAP
ADD	0,05	0,31	0,00	0,09	0,43	1	V
TKK	0,04	0,00	0,01	0,07	0,65	1	M
TZK	0,01	0,03	0,01	0,07	0,59	1	M
YEF	0,04	0,01	0,00	0,18	0,78	1	I

Continued from previous page **Table 7.33**

CODE	MC	CC	OC	RSD	AR	Efficiency	Kind
EVA	0,06	0,02	0,01	0,17	1,01	1	V
TAH	0,06	0,02	0,00	0,09	0,45	1	M
ACD	0,04	0,05	0,00	0,08	0,40	1	V
TZD	0,04	0,00	0,01	0,06	0,69	1	V
SMA	0,04	0,04	0,02	0,01	0,63	1	V
HSH	0,06	0,08	0,00	0,07	0,55	1	E
HBU	0,06	0,03	0,00	0,01	0,68	1	I
GA5	0,05	0,02	0,00	0,14	0,80	1	V
KAS	0,01	0,04	0,03	0,12	0,62	0,89477685	SAP
GLA	0,06	0,00	0,00	0,18	0,71	0,85669513	I
TZ1	0,01	0,02	0,01	0,11	0,54	0,84655098	V
TTE	0,02	0,00	0,00	0,16	0,09	0,76385646	I
TIE	0,05	0,00	0,01	0,17	0,72	0,70932841	I
KMH	0,07	0,03	0,03	0,03	0,50	0,69990925	E
TAU	0,05	0,01	0,01	0,20	0,80	0,68115632	I
GAF	0,05	0,11	0,01	0,16	0,75	0,65505165	E
AKU	0,04	0,02	0,01	0,17	0,72	0,63960032	I
FAF	0,06	0,03	0,02	0,16	0,73	0,53960421	E
TI2	0,05	0,01	0,03	0,11	0,61	0,52094822	E
AK3	0,04	0,05	0,03	0,12	0,51	0,45788767	E
AKH	0,04	0,08	0,02	0,14	0,53	0,40933338	E

There are 31 mutual funds (9 Variable, 6 Mixed, 8 Equity, 3 SAP and 7 Index mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 8 variable (PAD, ADD, EVA, ACD, TZD, SMA, TMD and GA5), 9 mixed mutual funds (YEF, TZK, TKK, TAH and TKF), one equity mutual fund (HSH), 2 SAP mutual funds (GBM and YAR) and one index mutual fund (HBU) are found efficient.

b) Type B Mutual Funds:

Table 7.34: Second Stage Evaluation of Type B Mutual Funds in 2003

CODE	MC%	CC%	OC%	RSD%	AR%	Efficiency	**Kind**
NBV	0,09	0,00	0,00	0,00	0,47	1,000000001	V
BZ4	0,01	0,00	0,00	0,01	0,52	1,000000001	B
IBF	0,05	0,01	0,00	0,00	0,51	1,000000001	V
GA1	0,04	0,00	0,00	0,01	0,51	1	B
BZ2	0,01	0,00	0,00	0,01	0,50	1	V
IYL	0,04	0,00	0,00	0,00	0,32	1	L
AK2	0,04	0,00	0,00	0,01	0,52	1	B

Continued from previous page **Table 7.34**

CODE	MC	CC	OC	RSD	AR	Efficiency	Kind
GAB	0,04	0,00	0,00	0,02	0,55	1	B
VK2	0,05	0,00	0,05	0,02	0,55	1	B
FBL	0,03	0,00	0,03	0,00	0,35	1	L
HSB	0,06	0,00	0,00	0,01	0,50	1	B
BZ3	0,01	0,00	0,00	0,00	0,30	1	L
HLL	0,02	0,00	0,01	0,00	0,35	1	L
KBF	0,04	0,00	0,00	0,02	0,58	1	B
AVL	0,04	0,00	0,00	0,01	0,35	1	L
HLB	0,05	0,00	0,00	0,00	0,29	1	L
GA3	0,04	0,00	0,00	0,01	0,43	0,990130801	V
FI3	0,06	0,00	0,04	0,01	0,46	0,949848889	B
ANL	0,03	0,00	0,00	0,00	0,32	0,946737334	L
ABB	0,06	0,00	0,00	0,02	0,56	0,934997618	B
VK3	0,05	0,00	0,05	0,01	0,49	0,909210901	V
HLB	0,04	0,00	0,04	0,02	0,44	0,886677504	B
ZBB	0,05	0,00	0,04	0,02	0,49	0,875836037	B
BYV	0,05	0,02	0,00	0,03	0,55	0,813985812	V
ZBV	0,05	0,00	0,04	0,02	0,47	0,79894093	V
BVF	0,07	0,00	0,00	0,00	0,29	0,782271572	V
HBV	0,04	0,00	0,04	0,00	0,35	0,739288187	V
BI6	0,05	0,00	0,00	0,01	0,42	0,706019334	B
KYB	0,04	0,00	0,03	0,00	0,35	0,66686919	L
BI4	0,05	0,00	0,00	0,02	0,52	0,590520039	V

There are 7.34 mutual funds (12 Variable, 8 Liquid and 11 Bond mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 4 variable (NBV, IBF, BZ2 and AVE), 6 liquid mutual funds (IYL, FBL, BZ3, HLL, AVL and HLB) and 7 bond mutual funds (BZ4, GA1, AK2, GAB, VK2, HSB and KBF) are found efficient.

7. 2. III. Third Stage Evaluation of All Efficient Mutual Funds in 2003

All Type A and B mutual funds; that are found DEA efficient in the second stage, are evaluated together in the second stage. The results of this stage indicate the most efficient mutual funds of 2003.

Table 7.35: Third Stage Evaluation of All Efficient Mutual Funds in 2003

CODE	MC%	CC%	OC%	SD%	AR%	***Efficiency***	**Type**	**Kind**
YAR	0,01	0,00	0,00	0,15	0,71	1	A	SAP
NBD	0,09	0,00	0,00	0,00	0,47	1	B	V
FBL	0,03	0,00	0,03	0,00	0,35	1	B	L

Continued from previous page **Table 7.35**

CODE	MC%	CC%	OC%	SD%	AR%	Efficiency	Type	Kind
HBU	0,06	0,03	0,00	0,01	0,68	1	A	I
HST	0,06	0,00	0,00	0,01	0,50	1	B	B
IBF	0,05	0,01	0,00	0,00	0,51	1	B	V
TZ2	0,01	0,00	0,00	0,01	0,50	1	B	V
AK2	0,04	0,00	0,00	0,01	0,52	1	B	B
ADE	0,04	0,00	0,00	0,01	0,47	1	B	V
EVA	0,06	0,02	0,01	0,17	1,01	1	A	V
TZ4	0,01	0,00	0,00	0,01	0,52	1	B	B
IYL	0,04	0,00	0,00	0,00	0,32	1	B	L
HLL	0,02	0,00	0,01	0,00	0,35	1	B	L
HLB	0,05	0,00	0,00	0,00	0,29	1	B	L
YEF	0,04	0,01	0,00	0,18	0,78	1	A	I
GAT	0,04	0,00	0,00	0,02	0,55	1	B	B
KTF	0,04	0,00	0,00	0,02	0,58	1	B	B
VK2	0,05	0,00	0,05	0,02	0,55	1	B	B
TZ3	0,01	0,00	0,00	0,00	0,30	1	B	L
ADL	0,04	0,00	0,00	0,01	0,35	1	B	L
GBM	0,05	0,04	0,02	0,00	0,73	1	A	SAP
GA5	0,05	0,02	0,00	0,14	0,80	1	A	V
GA1	0,04	0,00	0,00	0,01	0,51	1	B	B
SMA	0,04	0,04	0,02	0,01	0,63	0,9370013	A	V
TZK	0,01	0,03	0,01	0,07	0,59	0,9210559	A	M
ACD	0,04	0,05	0,00	0,08	0,40	0,9069494	A	V
TKK	0,04	0,00	0,01	0,07	0,65	0,8166485	A	M
ADD	0,05	0,31	0,00	0,09	0,43	0,6410256	A	V
PAD	0,06	0,02	0,01	0,01	0,53	0,5575728	A	V
HSH	0,06	0,08	0,00	0,07	0,55	0,5323964	A	E
TAH	0,06	0,02	0,00	0,09	0,45	0,531181	A	E
TMD	0,06	0,01	0,00	0,04	0,27	0,5016287	A	V
TKF	0,03	0,00	0,01	0,06	0,54	0,4718205	A	M

There were 34 mutual funds (17 Type A and 17 Type B mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 7 Type A (EVA, TZD and GA5 as variable mutual funds; YAR and GBM as SAP mutual funds; and HBU and YEF as index mutual funds) mutual funds are found to be efficient, the rest of the efficient mutual funds are all Type B (NBD, IBF, TZ2 and ADE as variable mutual funds; FBL, IYL, HLL, HLB, TZ3 and ADL as liquid mutual funds; and HST, AK2, TZ4, GAT, KTF, VK2 and GA1 as bond mutual funds).

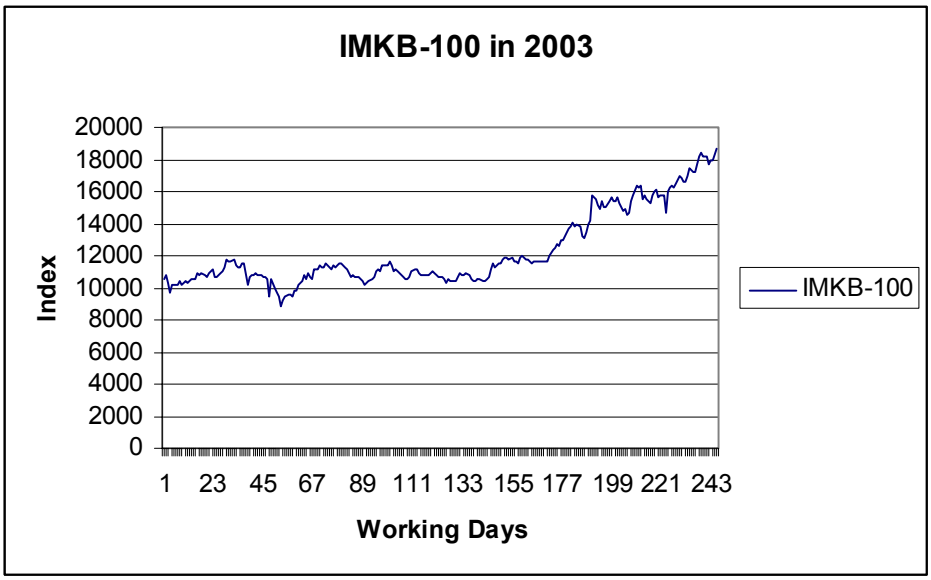

Figure 7.3: The values of IMKB-100 Index in 2003

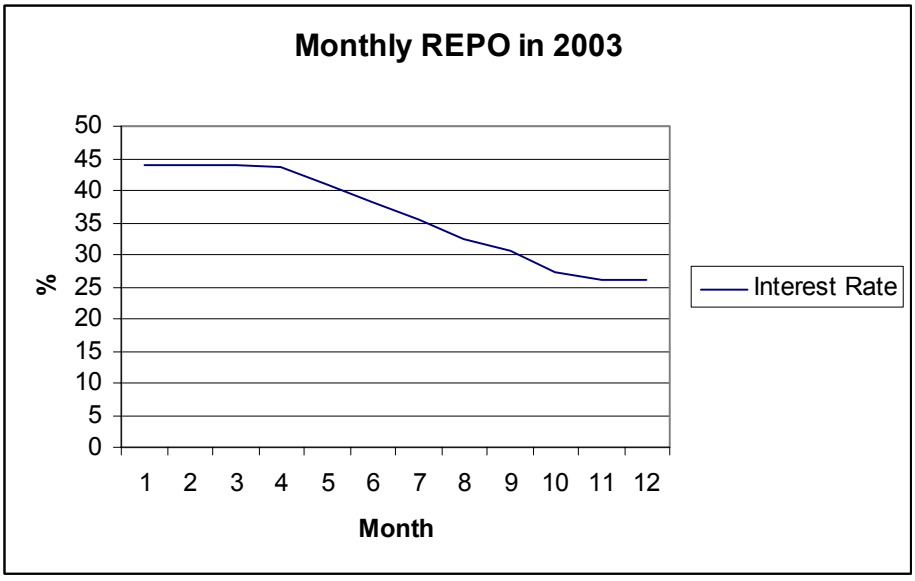

Figure 7.4: Monthly Interest Rates in 2003

The Index was at 10598 at the beginning of the year 2003. In the first half index had a remarkable volatility but no clear upward or downward direction. In the following period the index has risen exceptionally to 18625 until the end of the year and has realised an annual return of about 76%. On the other hand the interest rates of repurchase orders have declined adversely from 44% to 26% in 2003.

Depending on the outstanding positive performance of IMKB in 2003 there are more Type A efficient mutual funds, which are more vulnerable to the developments in IMKB. There are seven Type A mutual fund to be found efficient. Although, the vast majority of efficient mutual funds are still of Type B.

7. 3. Performance Evaluation Mutual Funds in 2004

7. 3. I. First Stage Evaluation According to Kinds of Mutual Funds in 2004

7. 3. I. A. Performance Evaluation of Type A Mutual Funds in 2004

a) Variable Mutual Funds:

Table 7.36: Descriptive Statistics Table for Type A Variable Mutual Funds in 2004

	MC	CC	OC	RSD	AR
Mean	4,646	4,898	0,058	0,06853592	0,18635522
Standard Error	0,00222636	0,01046458	0,00045992	0,00523616	0,01873069
Median	0,0518	0,0216	0	0,05791589	0,20450449
Mode	0,0549	0,0216	0	#N/A	#N/A
Semi deviation	0,0131713	0,06190932	0,00272092	0,03097752	0,11081228
Sample Variance	0,00017348	0,00383276	7,4034E-06	0,00095961	0,01227936
Kurtosis	1,26266972	5,39756579	33,8668687	6,26939288	2,08013087
Skewness	-1,0861457	2,31496063	5,7836024	2,2328996	0,19857967
Range	0,0603	0,2773	0,0161	0,15082575	0,62775351
Minimum	0,0126	0	0	0,03315932	-0,1210613
Maximum	0,0729	0,2773	0,0161	0,18398507	0,5066922
Sum	1,6261	1,7143	0,0203	2,39875731	6,52243269
Count	35	35	35	35	35

As shown in the descriptive statistics table 7.36 for Type A Variable Mutual Funds in 2004, the funds have a 18.6 % of mean value of annual return, and the variance around this value is 1.2 %, in other words σ/μ ratio of the return is 6.5 % and the range of return is 62.7 % and the Risk Value of the mutual funds is 6.8 %. In 2004 Type A variable mutual funds performed worse then the previous year. The mean annual return values have decreased to 18.6 %, on the other hand the mean variance value remained about the same. The mean value for management costs, commissions charged and other costs are 4.7 %, 4.9 %, and 0.05 % respectively.

There are 35 Type A Variable Mutual Funds in 2004 to evaluate, having filtered the mutual funds with negative returns, 34 mutual funds remain. The ranking of the

remaining Type A Variable Mutual Funds in 2004 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.37: Performance Ranking for Type A Variable Mutual Funds in 2004

CODE	MC%	CC%	OC%	SD%	AR%	Efficiency
EC2	0,01	0,01	0,00	0,08	0,05	1
SMA	0,02	0,02	0,00	0,04	0,26	1
ISA	0,02	0,01	0,00	0,05	0,07	1
VAF	0,05	0,00	0,00	0,06	0,25	1
BEA	0,01	0,03	0,00	0,09	0,10	1
TZD	0,04	0,01	0,00	0,05	0,22	1
GL1	0,05	0,01	0,00	0,04	0,21	1
KA2	0,04	0,02	0,00	0,03	0,27	1
ST1	0,05	0,05	0,00	0,07	0,51	1
FYD	0,06	0,02	0,00	0,03	0,24	1
ABA	0,05	0,02	0,00	0,08	0,30	0,99995034
ACD	0,04	0,03	0,00	0,05	0,21	0,9366336
ADD	0,05	0,21	0,00	0,18	0,37	0,9074774
HAS	0,06	0,01	0,00	0,05	0,23	0,89272176
DZA	0,06	0,05	0,00	0,04	0,16	0,84979152
HK1	0,04	0,14	0,00	0,05	0,07	0,83761098
SAD	0,06	0,01	0,00	0,05	0,20	0,80043448
NU1	0,04	0,03	0,02	0,05	0,24	0,7617439
TUD	0,06	0,14	0,00	0,16	0,36	0,74023575
TI7	0,05	0,01	0,00	0,06	0,16	0,72968238
GYA	0,06	0,01	0,00	0,06	0,11	0,72669631
OY1	0,07	0,02	0,00	0,05	0,17	0,70977708
ADF	0,04	0,09	0,00	0,06	0,06	0,70806649
FI2	0,06	0,02	0,00	0,07	0,22	0,70584743
KCA	0,06	0,04	0,00	0,05	0,08	0,68252632
YAF	0,04	0,01	0,00	0,08	0,12	0,66720197
TSF	0,05	0,15	0,00	0,07	0,23	0,65940988
MNA	0,04	0,04	0,00	0,08	0,15	0,64769922
IHD	0,06	0,02	0,00	0,06	0,14	0,64473045
AN1	0,05	0,02	0,00	0,09	0,22	0,64064353
IYD	0,05	0,08	0,00	0,07	0,12	0,60253481
YAD	0,05	0,04	0,00	0,08	0,12	0,55868897
TMD	0,05	0,06	0,00	0,10	0,29	0,55596648
GA5	0,06	0,02	0,00	0,10	0,14	0,48887965

As shown in Table 7.37 EC2, SMA, ISA, VAF, BEA, TZD, GL1, KA2, ST1 and FYD are the DEA efficient funds among the 34 Type A Variable Mutual Funds in 2004.

b) Mixed Mutual Funds:

Table 7.38: Descriptive Statistics Table for Type A Mixed Mutual Funds in 2004

	MC	CC	OC	RSD	AR
Mean	4,605	2,305714	0,107143	0,06117133	0,19835474
Standard Error	0,00514128	0,0056275	0,00076965	0,00596538	0,01296823
Median	0,05485	0,01765	0	0,06045169	0,19399309
Mode	0,055	0,0025	0	#N/A	#N/A
Semi deviation	0,01923689	0,02105618	0,00287975	0,0223204	0,04852268
Sample Variance	0,00037006	0,00044336	8,293E-06	0,0004982	0,00235445
Kurtosis	1,82129613	1,38494426	12,1273128	0,3071744	-0,6112510
Skewness	-1,399004	1,21505475	3,42811049	0,55795553	-0,4465574
Range	0,0731	0,0745	0,0108	0,07964247	0,15907967
Minimum	0,0001	0	0	0,03021709	0,10887178
Maximum	0,0732	0,0745	0,0108	0,10985956	0,26795145
Sum	0,6447	0,3228	0,015	0,85639867	2,77696638
Count	14	14	14	14	14

As shown in the descriptive statistics table for Type A Mixed Mutual Funds in 2004, the funds have a 19.8 % of mean value of annual return, and the variance around this value is 0.2 %, σ/μ ratio of the return is 1 %, the range of return is 15.9 % and the Risk Value of the mutual funds is 6.1 %. In 2004 Type A mixed mutual funds performed worse then the previous year. The mean annual return values have decreased to 19.8 %, on the other hand the mean variance value remained about the same. The mean value for management costs, commissions charged and other costs are 4.6 %, 2.3 %, and 0.1 % respectively.

There are 14 Type A Mixed Mutual Funds in 2004 and all of them have positive annual return values. The ranking of the Type A Mixed Mutual Funds in 2004 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.39: Performance Ranking for Type A Mixed Mutual Funds in 2004

CODE	MC%	CC%	OC%	SD%	AR%	Efficiency
FAF	0,06	0,02	0,00	0,09	0,27	1
TAH	0,05	0,06	0,00	0,14	0,28	1
ASA	0,05	0,02	0,00	0,10	0,24	1
KCH	0,05	0,04	0,00	0,07	0,16	1
AKH	0,04	0,13	0,00	0,06	0,14	1
KMH	0,07	0,03	0,00	0,04	0,27	1
TI2	0,05	0,01	0,00	0,08	0,11	1
YAH	0,06	0,03	0,00	0,07	0,24	1
AK3	0,04	0,10	0,00	0,08	0,14	1

Continued from previous page **Table 7.39**

CODE	MC%	CC%	OC%	SD%	AR%	Efficiency
DAH	0,06	0,12	0,00	0,05	0,14	1
BZA	0,06	0,01	0,00	0,10	0,11	0,99417233
IAH	0,06	0,07	0,00	0,10	0,24	0,96151349
OAH	0,05	0,03	0,00	0,09	0,16	0,95623548
TYH	0,05	0,07	0,00	0,08	0,07	0,91336563
HSH	0,06	0,11	0,00	0,10	0,06	0,75969029

As shown in Table 7.39 HLK, TZK, FYK, DZK, GA4, ECK and VKA are the DEA efficient funds among the 14 Type A Mixed Mutual Funds in 2004.

c) Equity Mutual Funds:

Table 7.40: Descriptive Statistics Table for Type A Equity Mutual Funds in 2004

	MC	CC	OC	RSD	AR
Mean	3,82822667	1,57010667	0,012	0,082782	0,17528123
Standard Error	3,77359835	1,51077873	6,264E-05	0,00644389	0,01903273
Median	0,0549	0,0559	0	0,08242758	0,15640555
Mode	0,0549	#N/A	0	#N/A	#N/A
Semi deviation	14,6150836	5,85122085	0,0002426	0,02495707	0,07371345
Sample Variance	213,600668	34,2367855	5,8857E-08	0,00062286	0,00543367
Kurtosis	14,999995	14,9982232	3,47749008	0,9955196	-1,4615089
Skewness	3,87298244	3,872661	2,1554698	0,44131429	0,05086128
Range	56,6147	22,71	0,0007	0,09992781	0,21537371
Minimum	0,0439	0,0105	0	0,04087789	0,06119238
Maximum	56,6586	22,7205	0,0007	0,14080569	0,27656609
Sum	57,4234	23,5516	0,0018	1,24173004	2,62921845
Count	15	15	15	15	15

As shown in the descriptive statistics table 7.40 for Type A Equity Mutual Funds in 2004, the funds have a 17.5 % of mean value of annual return, and the variance around this value is 0.5 %, σ/μ ratio of the return is 2.9 %, the range of return is 21.5 % and the Risk Value of the mutual funds is 8.3 %. In 2004 Type A equity mutual funds performed worse then the previous year. The mean annual return values have decreased to 17.5 %, on the other hand the mean variance value increased from 0.2 % to 0.5 %. The mean value for management costs, commissions charged and other costs are 3.8 %, 1.6 %, and 0.1 % respectively.

There are 15 Type A Equity Mutual Funds in 2004 and all of them have positive annual return values. The ranking of the Type A Equity Mutual Funds in 2004 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.41: Performance Ranking for Type A Equity Mutual Funds in 2004

CODE	MC%	CC%	OC%	SD%	AR%	Efficiency
FAF	0,06	0,02	0,00	0,09	0,27	1
TAH	0,05	0,06	0,00	0,14	0,28	1
ASA	0,05	0,02	0,00	0,10	0,24	1
KCH	0,05	0,04	0,00	0,07	0,16	1
AKH	0,04	0,13	0,00	0,06	0,14	1
KMH	0,07	0,03	0,00	0,04	0,27	1
TI2	0,05	0,01	0,00	0,08	0,11	1
YAH	0,06	0,03	0,00	0,07	0,24	1
AK3	0,04	0,10	0,00	0,08	0,14	1
DAH	0,06	0,12	0,00	0,05	0,14	1
BZA	0,06	0,01	0,00	0,10	0,11	0,99417233
IAH	0,06	0,07	0,00	0,10	0,24	0,96151349
OAH	0,05	0,03	0,00	0,09	0,16	0,95623548
TYH	0,05	0,07	0,00	0,08	0,07	0,91336563
HSH	0,06	0,11	0,00	0,10	0,06	0,75969029

As shown in Table 7.41 FAF, TAH, ASA, KCH, AKH, KMH, TI2, YAH, AK3 and DAH are the DEA efficient funds among the 15 Type A Equity Mutual Funds in 2004.

d) Sector, Affiliate Company and Private (SAP) Funds:

Table 7.42: Descriptive Statistics Table for Type A SAP Mutual Funds in 2004

	MC	CC	OC	RSD	AR
Mean	3,75375	1,89375	0	0,08286791	0,22819973
Standard Error	0,00678546	0,00582896	0	0,00956369	0,05222164
Median	0,0439	0,0152	0	0,08804177	0,19190713
Mode	0,0439	#N/A	0	#N/A	#N/A
Semi deviation	0,01919218	0,01648679	0	0,0270502	0,1477051
Sample Variance	0,00036834	0,00027181	0	0,00073171	0,0218168
Kurtosis	-0,1438335	-1,2119383	#DIV/0!	-0,0285886	-1,2286934
Skewness	-1,1834160	0,57817256	#DIV/0!	0,24061756	0,28744208
Range	0,0499	0,0428	0	0,08204209	0,42371539
Minimum	0,005	0,0006	0	0,04757713	0,02706866
Maximum	0,0549	0,0434	0	0,12961922	0,45078405
Sum	0,3003	0,1515	0	0,66294326	1,82559785
Count	8	8	8	8	8

As shown in the descriptive statistics table 7.42 for Type A Equity Mutual Funds in 2004, the funds have a 22.5 % of mean value of annual return, and the variance around this value is 0.2 %, σ/μ ratio of the return is 0.9 %, the range of return is 42.4 % and the Risk Value of the mutual funds is 8.3 %. In 2004 Type A SAP mutual funds performed worse then the previous year. The mean annual return values have decreased from 59 % to 22.5 %, on the other hand the mean variance value increased from 0.1 % to 0.2 %. The mean value for management costs, commissions charged and other costs are 3.8 %, 1.9 %, and 0 % respectively.

There are 8 Type A SAP Mutual Funds in 2004 and all of them have positive annual return values. The ranking of the Type A SAP Mutual Funds in 2004 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.43: Performance Ranking for Type A SAP Mutual Funds in 2004

CODE	MC%	CC%	OC%	SD%	AR%	Efficiency
KAK	0,05	0,00	0,00	0,05	0,10	1
YAR	0,01	0,00	0,00	0,13	0,45	1
TI3	0,05	0,01	0,00	0,08	0,35	1
KAS	0,01	0,02	0,00	0,07	0,18	1
AIF	0,04	0,04	0,00	0,05	0,03	1
AAM	0,04	0,04	0,00	0,10	0,38	0,99768338
AGF	0,04	0,01	0,00	0,09	0,20	0,74787315
ASF	0,04	0,03	0,00	0,10	0,14	0,64251381

As shown in Table 7.43 KAK, YAR, TI3, KAS and AIF are the DEA efficient funds among the 8 Type A SAP Mutual Funds in 2004.

e) Index Mutual Funds:

Table 7.44: Descriptive Statistics Table for Type A Index Mutual Funds in 2004

	MC	CC	OC	RSD	AR
Mean	5,305385	1,030769	0,0154952	0,10956759	0,20297443
Standard Error	0,00165969	0,00142341	4,9852E-05	0,0043919	0,03629318
Median	0,0549	0,0118	0	0,11123248	0,24569851
Mode	0,0549	0,0127	0	#N/A	#N/A
Semi deviation	0,00598409	0,00513216	0,00017974	0,01583521	0,13085692
Sample Variance	3,5809E-05	2,6339E-05	3,2308E-08	0,00025075	0,01712353
Kurtosis	4,87764515	0,25527683	6,96428571	5,20795604	4,40252077
Skewness	-2,2863813	-0,4877135	2,68239523	-1,6064757	-2,2464928
Range	0,0222	0,0182	0,0006	0,06885088	0,43815034
Minimum	0,0366	0	0	0,06570879	-0,1494913
Maximum	0,0588	0,0182	0,0006	0,13455967	0,28865897

Continued from previous page **Table 7.44**

	MC	CC	OC	RSD	AR
Sum	0,6897	0,134	0,0009	1,42437864	2,63866757
Count	13	13	13	13	13

As shown in the descriptive statistics table 7.44 for Type A Index Mutual Funds in 2004, the funds have a 20.3 % of mean value of annual return, and the variance around this value is 0.2 %, σ/μ ratio of the return is 1 %, the range of return is 43.8 % and the Risk Value of the mutual funds is about 11 %. In 2004 Type A Index mutual funds performed worse then the previous year. The mean annual return values have decreased from 65.6 % to 20.3 %, on the other hand the mean variance value decreased from 0.3 % to 0.2 %. The mean value for management costs, commissions charged and other costs are 5.3 %, 1 %, and 0.15 % respectively.

There are 13 Type A Index Mutual Funds in 2004 and all of them have positive annual return values. The ranking of the Type A Index Mutual Funds in 2004 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.45: Performance Ranking for Type A Index Mutual Funds in 2004

CODE	MC%	CC%	OC%	SD%	AR%	Efficiency
VEF	0,05	0,00	0,00	0,11	0,26	1
AKU	0,04	0,02	0,00	0,11	0,29	1
DZE	0,06	0,02	0,00	0,10	0,22	1
YEF	0,04	0,01	0,00	0,11	0,29	1
KAE	0,05	0,01	0,00	0,11	0,27	0,98870806
TIE	0,05	0,00	0,00	0,11	0,26	0,97578929
GLA	0,06	0,01	0,00	0,11	0,23	0,95343009
GAE	0,06	0,01	0,00	0,11	0,23	0,94364086
HBU	0,06	0,01	0,00	0,11	0,23	0,92749766
AAE	0,06	0,01	0,00	0,12	0,25	0,89450447
TAU	0,05	0,01	0,00	0,13	0,28	0,87070869

As shown in Table 48 VEF, AKU, DZE and YEF are the DEA efficient funds among the 13 Type A SAP Mutual Funds in 2004.

7. 3. I. B. Performance Evaluation of Type B Mutual Funds in 2004

a) Variable Mutual Funds:

Table 7.46: Descriptive Statistics Table for Type B Variable Mutual Funds in 2004

	MC	CC	OC	RSD	AR
Mean	4,542963	0,328889	0,114444	0,02276263	0,20991768
Standard Error	0,00282381	0,00078276	0,00093099	0,00328328	0,00601208
Median	0,0438	0,0017	0	0,01907348	0,20958172
Mode	0,0368	0	0	#N/A	#N/A
Semi deviation	0,01467297	0,00406735	0,00483754	0,01706042	0,03123968
Sample Variance	0,0002153	1,6543E-05	2,3402E-05	0,00029106	0,00097592
Kurtosis	4,58652551	2,83773455	25,7665788	14,7523397	1,67122229
Skewness	0,96479037	1,7808937	5,03391487	3,43309817	-0,4032121
Range	0,0847	0,0162	0,0251	0,09147224	0,15211217
Minimum	0,0096	0	0	0,00613591	0,12116927
Maximum	0,0943	0,0162	0,0251	0,09760816	0,27328144
Sum	1,2266	0,0888	0,0309	0,61459114	5,66777726
Count	27	27	27	27	27

As indicated in the descriptive statistics table 7.46 for Type B Variable Mutual Funds in 2004, the funds have a 20.1 % of mean value of annual return, and the variance around this value is 0.09 %, in other words σ/μ ratio of the return is 0.45 % and the range of return is 15.2 % and the Risk Value of the mutual funds is 2.3 %. In 2004 Type B variable mutual funds performed worse than the previous year. The mean value for management costs, commissions charged and other costs are 4.5 %, 0.33 %, and 0.11 % respectively.

There are 27 Type B Variable Mutual Funds in 2004 to evaluate, and all of the mutual funds have positive annual values of return. The ranking of the Type B Variable Mutual Funds in 2004 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.47: Performance Ranking for Type B Variable Mutual Funds in 2004

CODE	MC	CC	OC	SD	AR	Efficiency
ETB	0,05	0,00	0,03	0,10	0,27	1
VK3	0,05	0,00	0,00	0,02	0,21	1
TFD	0,05	0,00	0,00	0,01	0,18	1
ZBD	0,03	0,00	0,00	0,02	0,22	1
ECD	0,01	0,00	0,00	0,04	0,17	1
SKD	0,03	0,00	0,00	0,01	0,12	1
KCB	0,04	0,00	0,00	0,01	0,20	1
HBD	0,03	0,00	0,00	0,01	0,20	1
ADE	0,04	0,00	0,00	0,02	0,24	1
AOB	0,04	0,01	0,00	0,01	0,27	1
ATD	0,04	0,00	0,00	0,02	0,20	0,94436053
IYB	0,04	0,00	0,00	0,02	0,23	0,92403687

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CODE	MC	CC	OC	SD	AR	Efficiency
TI4	0,04	0,00	0,00	0,03	0,21	0,893527
NBD	0,06	0,00	0,00	0,01	0,17	0,8858543
TZ2	0,04	0,01	0,00	0,02	0,21	0,87537938
AND	0,04	0,00	0,00	0,02	0,23	0,8753218
TSD	0,05	0,00	0,00	0,01	0,20	0,85556786
TDF	0,04	0,01	0,00	0,02	0,23	0,81755628
IHB	0,04	0,00	0,00	0,02	0,21	0,81453132
KA1	0,04	0,02	0,00	0,02	0,25	0,80500221
TEF	0,06	0,00	0,00	0,01	0,20	0,78756638
GA3	0,04	0,00	0,00	0,02	0,20	0,76212855
HSF	0,06	0,00	0,00	0,02	0,19	0,70811347
IBF	0,06	0,00	0,00	0,03	0,23	0,6417991
YDF	0,04	0,01	0,00	0,04	0,23	0,62894838
GBF	0,06	0,00	0,00	0,03	0,18	0,57825191
EK1	0,09	0,01	0,00	0,01	0,20	0,55245848

As shown in Table 7.47, ETB, VK3, TFD, ZBD, ECD, SKD, KCB, HBD, ADE and AOB are the DEA efficient funds among the 27 Type B Variable Mutual Funds in 2004.

b) Liquid Mutual Funds:

Table 7.48: Descriptive Statistics Table for Type B Liquid Mutual Funds in 2004

	MC	CC	OC	RSD	AR
Mean	0,0378641	0,00120769	0,00031795	0,000542	0,17311452
Standard Error	0,00194615	0,00024512	0,00018616	0,00017495	0,00256268
Median	0,0366	0,0011	0	0,00012898	0,17515139
Mode	0,0366	0	0	0	#N/A
Semi deviation	0,01215372	0,0015308	0,00116255	0,00109254	0,01600393
Sample Variance	0,00014771	2,3434E-06	1,3515E-06	1,1936E-06	0,00025613
Kurtosis	0,7182818	8,1491526	20,8536966	6,31376554	3,6868019
Skewness	-0,4887706	2,48844679	4,39540703	2,59948507	-1,3577436
Range	0,0508	0,0077	0,0064	0,00457409	0,08540378
Minimum	0,0042	0	0	0	0,11458737
Maximum	0,055	0,0077	0,0064	0,00457409	0,19999115
Sum	1,4767	0,0471	0,0124	0,02113815	6,75146633
Count	39	39	39	39	39

As indicated in the descriptive statistics table 7.48 for Type B Liquid Mutual Funds in 2004, the funds have a 17.3 % of mean value of annual return, and the variance around this value is 0.025 %, in other words σ/μ ratio of the return is 0.14 % and the range of return is 8.5 % and the Risk Value of the mutual funds is 0.05 %. In 2004 Type B

variable mutual funds performed worse then the previous year. The mean value for management costs, commissions charged and other costs are 3.7 %, 0.12 %, and 0.03 % respectively.

There are 39 Type B Liquid Mutual Funds in 2004 and all of them have positive annual return values. The ranking of the Type B Liquid Mutual Funds in 2004 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.49: Performance Ranking for Type B Liquid Mutual Funds in 2004

CODE	MC	CC	OC	SD	AR	Efficiency
BEB	0,00	0,00	0,00	0,00	0,19	1
ECB	0,01	0,00	0,00	0,00	0,17	1
HLL	0,03	0,00	0,00	0,00	0,18	1
DLY	0,03	0,00	0,00	0,00	0,19	1
PRL	0,02	0,00	0,00	0,00	0,16	1
ADL	0,04	0,00	0,00	0,00	0,20	1
ZBL	0,03	0,00	0,00	0,00	0,18	1
IYL	0,04	0,00	0,00	0,00	0,17	1
FBL	0,03	0,00	0,00	0,00	0,20	1
TSL	0,04	0,00	0,00	0,00	0,18	0,93399569
TII	0,03	0,00	0,00	0,00	0,20	0,85492801
HLB	0,04	0,00	0,01	0,00	0,17	0,70525188
TKL	0,05	0,00	0,00	0,00	0,16	0,66302368
MBL	0,06	0,00	0,00	0,00	0,11	0,66181818
TLF	0,05	0,00	0,00	0,00	0,16	0,65294118
SMB	0,03	0,00	0,00	0,00	0,18	0,61280272
TUL	0,05	0,00	0,00	0,00	0,18	0,61006473
VK6	0,05	0,00	0,00	0,00	0,16	0,60655738
FI5	0,04	0,00	0,00	0,00	0,18	0,56129929
YBL	0,04	0,00	0,00	0,00	0,18	0,52475935
ANL	0,03	0,00	0,00	0,00	0,19	0,48897322
OBT	0,04	0,00	0,00	0,00	0,18	0,47933944
KYB	0,04	0,00	0,00	0,00	0,19	0,47017494
KLY	0,04	0,00	0,00	0,00	0,18	0,46297618
YLF	0,03	0,01	0,00	0,00	0,18	0,45351129
AK1	0,04	0,00	0,00	0,00	0,18	0,4324758
GA2	0,04	0,00	0,00	0,00	0,17	0,43244621
TZ3	0,04	0,00	0,00	0,00	0,17	0,41274947
YFL	0,04	0,00	0,00	0,00	0,18	0,40023316
KLF	0,03	0,00	0,00	0,00	0,15	0,38298349
SLF	0,05	0,00	0,00	0,00	0,16	0,36203467
AAL	0,04	0,00	0,00	0,00	0,17	0,33743868
HSL	0,05	0,00	0,00	0,00	0,17	0,32497755
TI1	0,05	0,00	0,00	0,00	0,16	0,3036225
GBL	0,05	0,00	0,00	0,00	0,16	0,3036225
TEL	0,04	0,00	0,00	0,00	0,18	0,27705208

As shown in Table 7.49; BEB, ECB, HLL, DLY, PRL, ADL, ZBL, IYL and FBL are the DEA efficient funds among the 39 Type B Liquid Mutual Funds in 2004.

c) Bond Mutual Funds

Table 7.50: Descriptive Statistics Table for Type B Bond Mutual Funds in 2004

	MC	CC	OC	RSD	AR
Mean	0,043136	0,001476	0,00004	0,02480415	0,20566967
Standard Error	0,00220697	0,00034681	1,9149E-05	0,00250067	0,00791193
Median	0,0436	0,0008	0	0,02452204	0,21353471
Mode	#N/A	0,0007	0	#N/A	#N/A
Semi deviation	0,01103486	0,00173404	9,5743E-05	0,01250336	0,03955967
Sample Variance	0,00012177	3,0069E-06	9,1667E-09	0,00015633	0,00156497
Kurtosis	2,39614255	1,72198683	8,16790253	9,49334072	18,2303421
Skewness	-0,7935149	1,60664411	2,7866186	2,40049502	-4,0178578
Range	0,0544	0,0064	0,0004	0,07085571	0,20695422
Minimum	0,0096	0	0	0,00243875	0,02842081
Maximum	0,064	0,0064	0,0004	0,07329446	0,23537504
Sum	1,0784	0,0369	0,001	0,62010387	5,14174177
Count	25	25	25	25	25

As indicated in the descriptive statistics table 7.50 for Type B Bond Mutual Funds in 2004, the funds have a 20.6 % of mean value of annual return, and the variance around this value is 0.16 %, in other words σ/μ ratio of the return is 0.8 % and the range of return is 20.7 % and the Risk Value of the mutual funds is 2.5 %. In 2004 Type B bond mutual funds performed worse than the previous year, in spite of the higher variance values realised in this term. The mean value for management costs, commissions charged and other costs are 4.3 %, 0.15 %, and 0.04 % respectively.

There are 25 Type B Bond Mutual Funds in 2004 and all of them have positive annual return values. The ranking of the Type B Bond Mutual Funds in 2004 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.51: Performance Ranking for Type B Bond Mutual Funds in 2004

CODE	MC	CC	OC	SD	AR	Efficiency
TZ4	0,04	0,00	0,00	0,02	0,22	1
TI6	0,04	0,00	0,00	0,01	0,22	1
VK2	0,05	0,00	0,00	0,02	0,21	1
AK2	0,04	0,00	0,00	0,03	0,24	1
BET	0,01	0,00	0,00	0,04	0,21	1
ZBT	0,03	0,00	0,00	0,02	0,22	1

Continued from previous page **Table 7.51**

CODE	MC	CC	OC	SD	AR	Efficiency
YFB	0,04	0,00	0,00	0,02	0,23	1
HLT	0,03	0,00	0,00	0,01	0,23	1
DZT	0,03	0,00	0,00	0,00	0,20	1
TIF	0,03	0,00	0,00	0,03	0,22	0,89363391
KTF	0,04	0,00	0,00	0,02	0,23	0,80508865
YBT	0,04	0,00	0,00	0,03	0,23	0,78330446
GAT	0,04	0,00	0,00	0,03	0,21	0,74432966
TBB	0,05	0,00	0,00	0,02	0,21	0,73923493
GA1	0,04	0,00	0,00	0,02	0,21	0,73666083
FI3	0,05	0,00	0,00	0,02	0,21	0,73468634
YBB	0,04	0,00	0,00	0,02	0,22	0,70489002
KCT	0,04	0,00	0,00	0,03	0,21	0,6575853
ABB	0,06	0,01	0,00	0,02	0,22	0,63398383
SKB	0,04	0,00	0,00	0,07	0,03	0,60347482
OBB	0,05	0,00	0,00	0,02	0,20	0,59903874
TYB	0,06	0,00	0,00	0,02	0,19	0,55043752
HTT	0,06	0,00	0,00	0,03	0,21	0,52968692
ATT	0,06	0,00	0,00	0,03	0,18	0,48642168
HST	0,06	0,00	0,00	0,03	0,19	0,43341877

As shown in Table 7.51 TZ4, TI6, AK2, BET, VK2, ZBT, YFB, HLT and DZT are the DEA efficient funds among the 25 Type B Bond Mutual Funds in 2004.

7. 3. II. Second Stage Evaluation According to Types of Mutual Funds in 2004

a) Type A Mutual Funds:

Table 7.52: Second Stage Evaluation of Type A Mutual Funds in 2004

CODE	MC	CC	OC	SD	AR	Efficiency	Kind
KAK	0,05	0,00	0,00	0,05	0,10	1	SAP
ECK	0,01	0,01	0,00	0,04	0,15	1	M
DZK	0,06	0,03	0,00	0,03	0,24	1	M
KAS	0,01	0,02	0,00	0,07	0,18	1	SAP
GA4	0,00	0,02	0,00	0,08	0,18	1	M
VKA	0,05	0,00	0,00	0,06	0,27	1	M
KA2	0,04	0,02	0,00	0,03	0,27	1	V
VEF	0,05	0,00	0,00	0,11	0,26	1	I
ST1	0,05	0,05	0,00	0,07	0,51	1	V
HLK	0,03	0,00	0,01	0,03	0,20	1	M
GL1	0,05	0,01	0,00	0,04	0,21	1	V
VAF	0,05	0,00	0,00	0,06	0,25	1	V
SMA	0,02	0,02	0,00	0,04	0,26	1	V

Continued from previous page **Table 7.52**

CODE	MC	CC	OC	SD	AR	Efficiency	Kind
YAR	0,01	0,00	0,00	0,13	0,45	1	SAP
FYD	0,06	0,02	0,00	0,03	0,24	0,99340975	V
ISA	0,02	0,01	0,00	0,05	0,07	0,92923028	V
TI3	0,05	0,01	0,00	0,08	0,35	0,90783579	SAP
TZD	0,04	0,01	0,00	0,05	0,22	0,85790001	V
FYK	0,06	0,01	0,00	0,05	0,23	0,84321257	M
EC2	0,01	0,01	0,00	0,08	0,05	0,82283875	V
KMH	0,07	0,03	0,00	0,04	0,27	0,81118001	E
AIF	0,04	0,04	0,00	0,05	0,03	0,77155338	SAP
BEA	0,01	0,03	0,00	0,09	0,10	0,75216433	V
DAH	0,06	0,12	0,00	0,05	0,14	0,72397546	E
AKH	0,04	0,13	0,00	0,06	0,14	0,65634832	E
YEF	0,04	0,01	0,00	0,11	0,29	0,63048339	I
AKU	0,04	0,02	0,00	0,11	0,29	0,60796959	I
TZK	0,04	0,07	0,00	0,08	0,23	0,58764044	M
FAF	0,06	0,02	0,00	0,09	0,27	0,58246396	E
TI2	0,05	0,01	0,00	0,08	0,11	0,57662009	E
YAH	0,06	0,03	0,00	0,07	0,24	0,57034275	E
KCH	0,05	0,04	0,00	0,07	0,16	0,56517819	E
ASA	0,05	0,02	0,00	0,10	0,24	0,53855332	E
AK3	0,04	0,10	0,00	0,08	0,14	0,49621819	E
DZE	0,06	0,02	0,00	0,10	0,22	0,48834107	I
TAH	0,05	0,06	0,00	0,14	0,28	0,4038165	E

There are 36 mutual funds (10 Variable, 7 Mixed, 10 Equity, 5 SAP and 4 Index mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 5 variable (KA2, ST1, GL1, VAF and SMA), 5 mixed mutual funds (ECK, DZK, GA4, VKA and HLK), 3 SAP mutual funds (KAK, KAS and YAR) and one index mutual fund (VEF) are found efficient.

b) Type B Mutual Funds:

Table 7.53: Second Stage Evaluation of Type B Mutual Funds in 2004

CODE	MC	CC	OC	RSD	AR	Efficiency	Kind
ADL	0,04	0,00	0,00	0,00	0,20	1	L
ETB	0,05	0,00	0,03	0,10	0,27	1	V
DLY	0,03	0,00	0,00	0,00	0,19	1	L
FBL	0,03	0,00	0,00	0,00	0,20	1	L
ECB	0,01	0,00	0,00	0,00	0,17	1	L
HLL	0,03	0,00	0,00	0,00	0,18	1	L
HBD	0,03	0,00	0,00	0,01	0,20	1	V
ADE	0,04	0,00	0,00	0,02	0,24	1	V

Continued from previous page **Table 7.53**

CODE	MC	CC	OC	SD	AR	Efficiency	Kind
IYL	0,04	0,00	0,00	0,00	0,17	1	L
HLT	0,03	0,00	0,00	0,01	0,23	1	B
ZBT	0,03	0,00	0,00	0,02	0,22	1	B
BEB	0,00	0,00	0,00	0,00	0,19	1	L
AOB	0,04	0,01	0,00	0,01	0,27	1	V
PRL	0,02	0,00	0,00	0,00	0,16	1	L
ZBL	0,03	0,00	0,00	0,00	0,18	1	L
TZ4	0,04	0,00	0,00	0,02	0,22	1	B
BET	0,01	0,00	0,00	0,04	0,21	1	B
AK2	0,04	0,00	0,00	0,03	0,24	0,961707146	B
YFB	0,04	0,00	0,00	0,02	0,23	0,959466737	B
TI6	0,04	0,00	0,00	0,01	0,22	0,932926098	B
ZBD	0,03	0,00	0,00	0,02	0,22	0,918467346	V
DZT	0,03	0,00	0,00	0,00	0,20	0,775195482	B
VK2	0,05	0,00	0,00	0,02	0,21	0,722747165	B
VK3	0,05	0,00	0,00	0,02	0,21	0,637146195	V
TFD	0,05	0,00	0,00	0,01	0,18	0,608155465	V
ECD	0,01	0,00	0,00	0,04	0,17	0,590909091	V
KCB	0,04	0,00	0,00	0,01	0,20	0,422192653	V
SKD	0,03	0,00	0,00	0,01	0,12	0,252019386	V

There are 28 mutual funds (10 Variable, 9 Liquid and 9 Bond mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 4 variable (ETB, HBD, ADE and AOB), 9 liquid mutual funds (ADL, DLY, FBL, ECB, HLL, IYL, BEB, PRL and ZBL) and 4 bond mutual funds (HLT, ZBT, TZ4 and BET) are found efficient.

7. 3. III. Third Stage Evaluation of All Efficient Mutual Funds in 2004

All Type A and B mutual funds; that are found DEA efficient in the second stage, are evaluated together in the second stage. The results of this stage indicate the most efficient mutual funds of 2004.

Table 7.54: Third Stage Evaluation of All Efficient Mutual Funds in 2004

CODE	MC	CC	OC	RSD	AR	Efficiency	Type	Kind
ADL	0,04	0,00	0,00	0,00	0,20	1	B	L
GA4	0,00	0,02	0,00	0,08	0,18	1	A	M
DLY	0,03	0,00	0,00	0,00	0,19	1	B	L
FBL	0,03	0,00	0,00	0,00	0,20	1	B	L
HLT	0,03	0,00	0,00	0,01	0,23	1	B	B
ECB	0,01	0,00	0,00	0,00	0,17	1	B	L
ZBT	0,03	0,00	0,00	0,02	0,22	1	B	B

Continued from previous page **Table 7.54**

CODE	MC	CC	OC	RSD	AR	Efficiency	Type	Kind
YAR	0,01	0,00	0,00	0,13	0,45	1	A	SAP
HLL	0,03	0,00	0,00	0,00	0,18	1	B	L
AOB	0,04	0,01	0,00	0,01	0,27	1	B	V
VKA	0,05	0,00	0,00	0,06	0,27	1	A	M
ST1	0,05	0,05	0,00	0,07	0,51	1	A	V
HBD	0,03	0,00	0,00	0,01	0,20	1	B	V
BEB	0,00	0,00	0,00	0,00	0,19	1	B	L
IYL	0,04	0,00	0,00	0,00	0,17	1	B	L
ZBL	0,03	0,00	0,00	0,00	0,18	1	B	L
PRL	0,02	0,00	0,00	0,00	0,16	1	B	L
VEF	0,05	0,00	0,00	0,11	0,26	0,96248801	A	I
VAF	0,05	0,00	0,00	0,06	0,25	0,859562666	A	V
ADE	0,04	0,00	0,00	0,02	0,24	0,824475529	B	V
TZ4	0,04	0,00	0,00	0,02	0,22	0,693292344	B	B
KA2	0,04	0,02	0,00	0,03	0,27	0,542969807	A	V
SMA	0,02	0,02	0,00	0,04	0,26	0,520700487	A	V
BET	0,01	0,00	0,00	0,04	0,21	0,444346755	B	B
KAS	0,01	0,02	0,00	0,07	0,18	0,42	A	SAP
DZK	0,06	0,03	0,00	0,03	0,24	0,385922902	A	M
ETB	0,05	0,00	0,03	0,10	0,27	0,364303048	B	V
ECK	0,01	0,01	0,00	0,04	0,15	0,333333333	A	M
HLK	0,03	0,00	0,01	0,03	0,20	0,248080605	A	M
GL1	0,05	0,01	0,00	0,04	0,21	0,208249307	A	V
KAK	0,05	0,00	0,00	0,05	0,10	0,14384509	A	SAP

There were 31 mutual funds (14 Type A and 17 Type B mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 4 Type A (ST1 as variable mutual fund; GA4 and VKA as mixed mutual funds; and YAR as SAP mutual fund) mutual funds are found to be efficient, the rest of the efficient mutual funds are all of Type B (AOB and HBD as variable mutual funds; ADL, DLY, FBL, ECB, HLL, BEB, IYL, ZBL and PRL as liquid mutual funds; and HLT and ZBT as bond mutual funds).

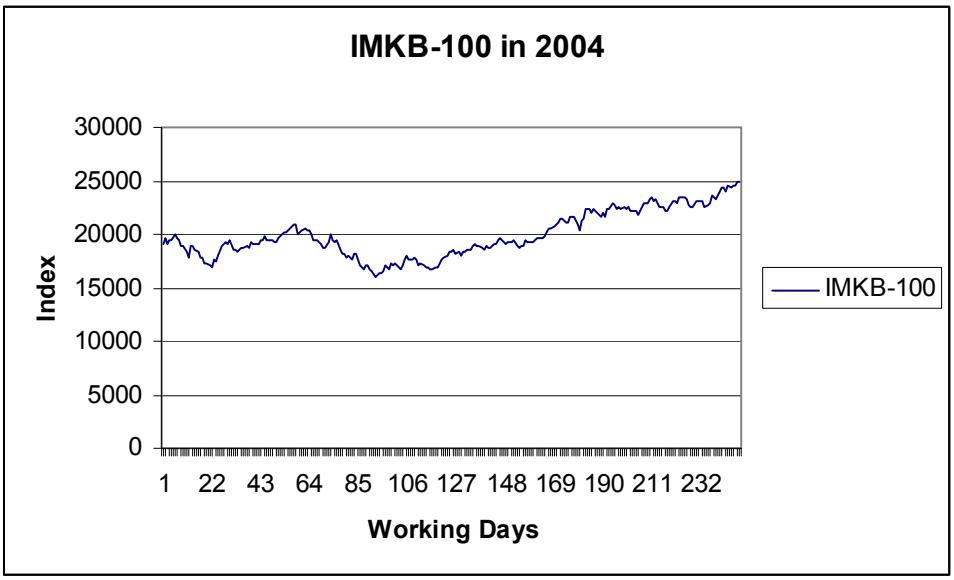

Figure 7.5: The values of IMKB-100 Index in 2004

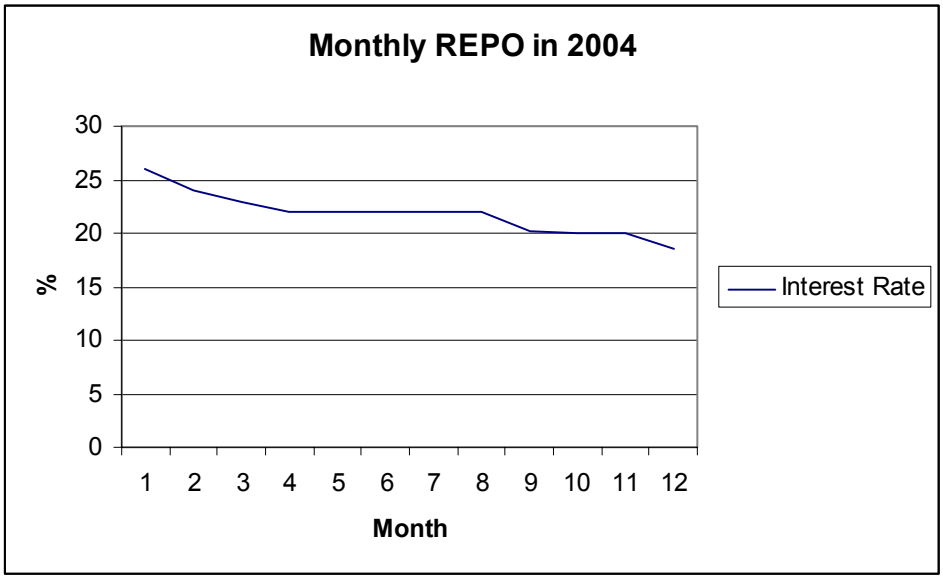

Figure 7.6: Monthly Interest Rates in 2004

The Index was at 19146 at the beginning of the year 2004. In the first half index had one upward and one downward direction but both had not made any remarkable effect on the index. But in the following period the index has risen remarkably to 24971 until the end of the year and has realised an annual return of about 30%. On the other hand the interest rates of repurchase orders have declined adversely from 26% to 18.61% in 2004.

There are only four Type A efficient mutual funds to 13 Type B efficient mutual funds. In 2004 IMKB performed relatively worse than the previous year, therefore the number of efficient Type A mutual funds has declined to 4. The most efficient Type B mutual funds are of liquid mutual funds in 2004.

7. 4. Performance Evaluation Mutual Funds in 2005

7. 4. I. First Stage Evaluation According to Kinds of Mutual Funds in 2005

7. 4. I. A. Performance Evaluation of Type A Mutual Funds in 2005

a) Variable Mutual Funds:

Table 7.55: Descriptive Statistics Table for Type A Variable Mutual Funds in 2005

	MC	CC	OC	RSD	AR
Mean	4,217	4,7595	0,21475	0,07211928	0,30276917
Standard Error	0,84189973	0,1752445	0,08295348	0,00460908	0,02535683
Median	2,2	5,42	0	0,07645177	0,28764852
Semi deviation	5,32464141	1,10834353	0,5246439	0,02915038	0,16037068
Sample Variance	28,3518062	1,22842538	0,27525122	0,00084974	0,02571876
Kurtosis	7,46853492	0,42527553	5,36697999	-0,8803871	0,45326937
Skewness	2,6052564	-1,0022325	2,53887226	0,14384769	0,70842114
Range	26,24	4,61	2,01	0,11536265	0,68950251
Minimum	0	2,02	0	0,01680423	0,02021904
Maximum	26,24	6,63	2,01	0,13216688	0,70972155
Sum	168,68	190,38	8,59	2,8847711	12,1107667
Count	40	40	40	40	40

As shown in the descriptive statistics table 7.55 for Type A Variable Mutual Funds in 2005, the funds have a 30.3 % of mean value of annual return, and the variance around this value is 2.6 %, and σ/μ ratio of the return is 8.6 % and the range of return is 69 % and the Risk Value of the mutual funds is 7.2 %. In 2005 Type A variable mutual funds performed better then the previous year. The mean annual return values have increased to 30.3 %, on the other hand the mean variance value has increased to 2.6 %. The mean value for management costs, commissions charged and other costs are 4.2 %, 4.7 %, and 0.2 % respectively. There are 40 Type A Variable Mutual Funds in 2005 to evaluate and all mutual funds have positive annual returns. The ranking of the Type A Variable Mutual Funds in 2005 according to DEA Efficiency is as follows:

Table 7.56: Performance Ranking for Type A Variable Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
ISA	1,64	2,19	0	0,03	0,2	1
TZD	0,64	3,61	0	0,03	0,22	1
NU1	2,6	3,81	1,39	0,05	0,07	1
KA2	1,36	4,39	0	0,04	0,13	1
SMA	1,46	2,3	0	0,09	0,32	1
ADD	6,7	2,02	0	0,02	0,02	1
VAF	0	5,48	0	0,08	0,25	1
TAD	0	5,4	2,01	0,03	0,14	1
SAD	2,17	4,71	0,01	0,04	0,08	1
DUA	2,23	2,68	0	0,13	0,4	0,81494128
GAD	1,27	3,83	0	0,06	0,34	0,79350129
TZ1	1,71	3,65	0	0,08	0,31	0,73324566
BEA	1,35	4,18	0,03	0,12	0,46	0,73104829
TI7	0,82	5,49	0	0,05	0,28	0,71750481
DZA	3,65	5,48	0,14	0,04	0,27	0,68029488
GA5	0,89	5,48	0	0,08	0,37	0,67817848
HSA	1,19	5,89	0	0,05	0,27	0,66245636
AN1	0,97	5,48	0,01	0,08	0,36	0,65910175
OY1	3,05	5,61	1,87	0,04	0,14	0,65636027
TCD	1,29	5,47	0,3	0,08	0,2	0,6480401
GYA	1,47	5,44	0	0,05	0,34	0,62112192
YAD	1,95	4,56	0	0,08	0,37	0,60990351
IHD	3,31	5,48	0,02	0,05	0,3	0,58272073
ACD	7,62	3,68	0	0,06	0,22	0,57039998
KCA	1,77	5,48	0	0,06	0,22	0,56507478
YAF	2,49	4,62	0	0,05	0,24	0,56090781
FYD	1,75	5,52	0,05	0,08	0,35	0,55969577
GL1	2,06	5,49	0	0,06	0,23	0,53643649
HK1	17,4	3,83	1,1	0,09	0,12	0,52741514
IYD	2,34	5,47	0	0,11	0,39	0,50719883
ADF	5	4,38	0	0,09	0,44	0,49364701
ABA	4,03	4,59	0,35	0,1	0,51	0,47511344
ST1	2,89	5,47	0	0,12	0,71	0,46540321
TMD	4,34	4,85	0,01	0,09	0,57	0,44939633
EC2	5,68	5,09	0,01	0,1	0,18	0,42514127
TSF	10,4	5,47	0	0,11	0,6	0,38575057
TUD	13,2	5,54	0	0,09	0,35	0,37530063
GPR	26,2	5,47	1,29	0,06	0,12	0,36928702
EVA	5	6,17	0	0,11	0,69	0,35422916
CKA	14,7	6,63	0	0,11	0,34	0,31509197

As shown in Table 7.56 ISA, TZD, NU1, KA2, SMA, ADD, VAF, TAD and SAD are the DEA efficient funds among the 40 Type A Variable Mutual Funds in 2005.

b) Mixed Mutual Funds:

Table 7.57: Descriptive Statistics Table for Type A Mixed Mutual Funds in 2005

	MC	CC	OC	RSD	AR
Mean	2,96368421	4,58631579	0,05684211	0,06070681	0,27022467
Standard Error	0,75551083	0,34611732	0,03137262	0,00478298	0,02042732
Median	1,72	5,47	0	0,05920034	0,26510721
Mode	1,72	5,49	0	#NV	#NV
Semi deviation	3,29319536	1,50869042	0,13675008	0,02084851	0,08904061
Sample Variance	10,8451357	2,27614678	0,01870058	0,00043466	0,00792823
Kurtosis	1,40012803	0,28265033	10,9377128	2,38693489	4,34080943
Skewness	1,46906193	-0,6654407	3,19383382	1,1060199	1,10577987
Range	11,45	6,25	0,56	0,09044044	0,42198164
Minimum	0	1,09	0	0,02892626	0,11827051
Maximum	11,45	7,34	0,56	0,11936669	0,54025215
Sum	56,31	87,14	1,08	1,15342941	5,13426878
Count	19	19	19	19	19

As shown in the descriptive statistics table 7.57 for Type A Mixed Mutual Funds in 2005, the funds have a 27 % of mean value of annual return, and the variance around this value is 0.7 %, σ/μ ratio of the return is 2,6 %, the range of return is 42.1 % and the Risk Value of the mutual funds is 6.07 %. In 2005 Type A mixed mutual funds have higher mean return then the previous year, yet the variance value has increased to 0.7 % from 0.2%. The mean value for management costs, commissions charged and other costs are 2.96 %, 4.58 %, and 0.06 % respectively.

There are 19 Type A Mixed Mutual Funds in 2005 and all of them have positive annual return values. The ranking of the Type A Mixed Mutual Funds in 2005 according to Data Envelopment Analysis Efficiency is as follows

Table 7.58: Performance Ranking for Type A Mixed Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
HLK	0,14	2,73	0,24	0,041	0,308	1
YKA	1,87	1,09	0	0,074	0,243	1
IYK	0,23	5,5	0	0,043	0,27	1
EV1	1,72	7,34	0	0,119	0,54	1
DZK	1,01	5,47	0,13	0,029	0,262	1
TKK	0,44	2,55	0	0,051	0,308	1
VKA	0	5,48	0	0,062	0,259	1
AAK	2,65	5,49	0,04	0,032	0,314	1
GA4	0,74	5,49	0	0,051	0,304	0,9961977
AKA	1,72	4,38	0	0,059	0,328	0,96737209
TE3	3,54	5,48	0	0,06	0,321	0,9143883

Continued from previous page **Table 7.58**

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
ACK	6,12	3,64	0	0,054	0,13	0,91090711
YAK	6,8	5,86	0,01	0,047	0,118	0,88372149
TZK	0,91	3,65	0	0,058	0,248	0,85413443
ECK	9,39	4,34	0,01	0,061	0,23	0,76765046
GAK	11,45	2,73	0	0,081	0,258	0,73697664
FYK	1,66	5,51	0,09	0,073	0,266	0,61142274
TKF	1,06	4,92	0,56	0,067	0,161	0,59916461
GBK	4,86	5,49	0	0,087	0,265	0,57156982

As shown in Table 7.58 HLK, YKA, IYK, DZK, EV1, TKK, AAK and VKA are the DEA efficient funds among the 19 Type A Mixed Mutual Funds in 2005.

c) Equity Mutual Funds:

Table 7.59: Descriptive Statistics Table for Type A Equity Mutual Funds in 2005

	MC	CC	OC	RSD	AR
Mean	5,91823529	5,19235294	0,02235294	0,10347043	0,38905768
Standard Error	1,14725928	0,2691019	0,01052062	0,00423768	0,03716084
Median	5,33	5,47	0	0,10196207	0,38893481
Mode	#NV	5,47	0	#NV	#NV
Semi deviation	4,73027118	1,10953554	0,04337762	0,0174724	0,15321806
Sample Variance	22,3754654	1,23106912	0,00188162	0,00030528	0,02347578
Kurtosis	3,46670501	9,61996884	2,49081565	3,25094619	2,41947439
Skewness	1,5364569	-2,7741824	1,94853629	-1,2830617	1,02565022
Range	18,99	5,24	0,13	0,07732615	0,66463799
Minimum	0,66	1,36	0	0,0536772	0,14082103
Maximum	19,65	6,6	0,13	0,13100335	0,80545903
Sum	100,61	88,27	0,38	1,75899738	6,61398051
Count	17	17	17	17	17

As shown in the descriptive statistics table 7.59 for Type A Equity Mutual Funds in 2004, the funds have a 38.9 % of mean value of annual return, and the variance around this value is 2 %, σ/μ ratio of the return is 0.5 %, the range of return is 66.5 % and the Risk Value of the mutual funds is 10.4 %. In 2005 Type A equity mutual funds performed better then the previous year by means of average annual return, yet the risk values have increased accordingly. The mean annual return values have decreased to 38.9 %, on the other hand the mean variance value increased from 0.5 % to 2 %. The

mean value for management costs, commissions charged and other costs are 5.9 %, 5.2 %, and 0.2 % respectively.

There are 17 Type A Equity Mutual Funds in 2005 and all of them have positive annual return values. The ranking of the Type A Equity Mutual Funds in 2005 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.60: Performance Ranking for Type A Equity Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
ASA	1,07	5,48	0	0,09	0,42	1
TSH	8,47	5,47	0	0,1	0,57	1
KMH	2,72	6,6	0	0,05	0,14	1
TAH	4,2	4,46	0,13	0,12	0,81	1
BZA	0,66	1,36	0	0,13	0,27	1
TI2	0,81	5,48	0	0,1	0,37	1
DAH	11,7	5,43	0,12	0,09	0,45	0,9983356
AK3	7,2	4,97	0	0,1	0,43	0,97215219
AKH	7,16	4,38	0	0,12	0,48	0,96441258
HSH	5,33	5,99	0	0,1	0,44	0,90557411
YAH	2,41	5,77	0,02	0,1	0,33	0,87733253
IAH	8,07	5,51	0	0,1	0,24	0,87532556
TYH	7,89	5,49	0	0,12	0,47	0,87012575
KCH	6,46	5,47	0,01	0,11	0,31	0,84548703
FAF	2,35	5,56	0,08	0,11	0,39	0,83487307
OAH	4,49	5,38	0	0,11	0,3	0,83360595
GAF	19,7	5,47	0,02	0,11	0,21	0,78841621

As shown in Table 7.60 ASA, TSH, KMH, TAH, BZA and TI2 are the DEA efficient funds among the 17 Type A Equity Mutual Funds in 2005.

d) Sector, Affiliate Company and Private (SAP) Funds:

Table 7.61: Descriptive Statistics Table for Type A SAP Mutual Funds in 2005

	MC	CC	OC	RSD	AR
Mean	1,529	3,53	0,003	0,11219804	0,55297092
Standard Error	0,34852531	0,58482476	0,00213437	0,00558305	0,04894418
Median	1,63	4,38	0	0,10922995	0,6077001
Mode	2,39	4,38	0	#NV	#NV
Semi deviation	1,10213379	1,84937827	0,00674949	0,01765516	0,15477509
Sample Variance	1,21469889	3,4202	4,5556E-05	0,0003117	0,02395533
Kurtosis	-1,9849615	-1,0515301	4,76502082	-0,9259518	-1,68568
Skewness	0,01176211	-0,8129482	2,27659627	0,56750509	-0,2042267
Range	2,99	4,96	0,02	0,05203417	0,438959
Minimum	0,1	0,51	0	0,0904461	0,33256537
Maximum	3,09	5,47	0,02	0,14248027	0,77152436

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	MC	CC	OC	RSD	AR
Sum	15,29	35,3	0,03	1,12198037	5,52970916
Count	10	10	10	10	10

As shown in the descriptive statistics table 7.61 for Type A Equity Mutual Funds in 2005, the funds have a 55.3 % of mean value of annual return, and the variance around this value is 2.4 %, σ/μ ratio of the return is 4.3 %, the range of return is 43.9 % and the Risk Value of the mutual funds is 11.2 %. In 2005 Type A SAP mutual funds performed better then the previous year by means of average annual return. The mean annual return values have decreased to 55.3 % while the variance values remained about the same. The mean value for management costs, commissions charged and other costs are 2.5 %, 3.5 %, and 0.003 % respectively. There are 10 Type A SAP Mutual Funds in 2005 and all of them have positive annual return values. The ranking of the Type A SAP Mutual Funds in 2005 according to DEA Efficiency is as follows:

Table 7.62: Performance Ranking for Type A SAP Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
AGF	0,91	4,38	0	0,09	0,4	1
YAR	0,1	0,51	0	0,1	0,77	1
AAM	2,39	4,38	0	0,1	0,66	0,97972985
KAK	0,46	3,99	0	0,1	0,4	0,94211016
AIF	2,39	4,38	0	0,1	0,33	0,91625617
TI3	0,39	5,47	0	0,12	0,66	0,80901051
GBM	2,46	5,45	0,02	0,12	0,63	0,80769706
ASF	2,35	4,38	0	0,12	0,59	0,78105436
BZI	0,75	1,36	0,01	0,14	0,69	0,71426077
KAS	3,09	1	0	0,14	0,41	0,68545987

As shown in Table 7.62 YAR and AGF are the DEA efficient funds among the 10 Type A SAP Mutual Funds in 2005.

e) Index Mutual Funds:

Table 7.63: Descriptive Statistics Table for Type A Index Mutual Funds in 2005

	MC	CC	OC	RSD	AR
Mean	0,658125	4,544375	0,01125	0,11380418	0,46679978
Standard Error	0,10619251	0,35074203	0,00611521	0,00544409	0,02349145
Median	0,71	5,45	0	0,11699016	0,47911827
Mode	1,01	3,65	0	#NV	#NV
Semi deviation	0,42477004	1,40296813	0,02446085	0,02177635	0,09396582
Sample Variance	0,18042958	1,96831958	0,00059833	0,00047421	0,00882957
Kurtosis	-1,3668617	1,41744737	1,86404513	13,4099926	2,83812577
Skewness	-0,2391328	-1,2956133	1,86529639	-3,5014365	-1,1461670
Range	1,24	5,18	0,07	0,09908995	0,41709844
Minimum	0	0,95	0	0,03507894	0,22337582
Maximum	1,24	6,13	0,07	0,13416889	0,64047427
Sum	10,53	72,71	0,18	1,82086694	7,46879641
Count	16	16	16	16	16

As shown in the descriptive statistics table 7.63 for Type A Index Mutual Funds in 2004, the funds have a 46.7 % of mean value of annual return, and the variance around this value is 0.08 %, σ/μ ratio of the return is 0.17 %, the range of return is 41.8 % and the Risk Value of the mutual funds is about 11.4 %. In 2005 Type A Index mutual funds performed much better then the previous year. The mean annual return values have increased from 20.3 % to 46.7 % while the mean variance value remained about the same. The mean value for management costs, commissions charged and other costs are 0.65 %, 4.5 %, and 0.01 % respectively.

There are 16 Type A Index Mutual Funds in 2005 and all of them have positive annual return values. The ranking of the Type A Index Mutual Funds in 2005 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.64: Performance Ranking for Type A Index Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
GAE	0,03	5,49	0	0,113	0,471	1
DJA	0,12	0,95	0,06	0,123	0,523	1
TAU	1,01	3,65	0	0,134	0,64	1
TIE	0,27	3,87	0	0,128	0,477	1
YEF	0,52	4,46	0	0,115	0,531	1
OBU	0,51	2,49	0	0,123	0,507	1
TTE	0,61	5,46	0	0,035	0,307	1
VEF	0	5,48	0	0,121	0,453	1
AAE	0,26	5,52	0,07	0,116	0,486	0,91345035

Continued from previous page **Table 7.64**

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
AKU	0,92	3,65	0	0,118	0,496	0,9099773
DZE	0,99	5,44	0,05	0,116	0,534	0,88442069
KAE	1,24	3,66	0	0,115	0,434	0,87841072
GBU	1,01	5,46	0	0,113	0,473	0,78465986
HBU	0,99	6,13	0	0,113	0,481	0,7836941
GLA	0,81	5,5	0	0,118	0,431	0,72290176
TME	1,24	5,5	0	0,121	0,223	0,69189072

As shown in Table 7.64 GEA, DJA, TAU, TIE, OBU,TTE, VEF and YEF are the DEA efficient funds among the 16 Type A SAP Mutual Funds in 2005.

7. 4. I. B. Performance Evaluation of Type B Mutual Funds in 2005

a) Variable Mutual Funds:

Table 7.65: Descriptive Statistics Table for Type B Variable Mutual Funds in 2005

	MC	CC	OC	RSD	AR
Mean	0,22486486	4,01189189	0,00216216	0,00601559	0,1487409
Standard Error	0,04360384	0,18245977	0,00145684	0,00250641	0,00715906
Median	0,1	3,97	0	0,00149724	0,15374352
Semi deviation	0,26523178	1,10985945	0,00886163	0,01524589	0,04354688
Sample Variance	0,0703479	1,23178799	7,8529E-05	0,00023244	0,00189633
Kurtosis	2,91095473	-0,6059398	25,1675743	27,4439052	6,25280115
Skewness	1,72319935	-0,1226354	4,86492442	5,0188052	1,05422487
Range	1,14	4,27	0,05	0,09024791	0,27968214
Minimum	0	1,83	0	0	0,03898119
Maximum	1,14	6,1	0,05	0,09024791	0,31866333
Sum	8,32	148,44	0,08	0,22257674	5,50341337
Count	37	37	37	37	37

As indicated in the descriptive statistics table 7.65 for Type B Variable Mutual Funds in 2005, the funds have a 14.8 % of mean value of annual return, and the variance around this value is 0.1 %, in other words σ/μ ratio of the return is 0.67 % and the range of return is 27.9 % and the Risk Value of the mutual funds is 0.6 %. In 2005 Type B variable mutual funds performed worse than the previous year. The mean value for management costs, commissions charged and other costs are 2.2 %, 4 %, and 0.002 % respectively. There are 37 Type B Variable Mutual Funds in 2005 to evaluate, and all of the mutual funds have positive annual values of return. The ranking of the Type B Variable Mutual Funds in 2005 according to DEA Efficiency is as follows:

Table 7.66: Performance Ranking for Type B Variable Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
MND	0,13	1,83	0	0	0,12	1
HBD	0	2,68	0	0	0,17	1
TYD	0	5,32	0,05	0,09	0,32	1
FBD	0,02	3,69	0,01	0	0,13	1
AOD	0,09	1,83	0	0	0,19	1
ATD	0,07	3,66	0	0	0,16	1
ZBD	0,02	2,7	0	0	0,16	0,92769231
TFD	0	5,48	0	0	0,11	0,82492835
ACB	0,06	2,73	0	0	0,12	0,81294237
GDF	0,31	2,29	0	0,01	0,19	0,79912664
GYD	0,12	4	0	0	0,13	0,78674194
DUB	0,53	2,38	0	0,02	0,11	0,76890756
KCB	0,08	4,38	0	0	0,13	0,70006168
IYB	0,07	3,66	0	0	0,15	0,69042265
ADE	0,07	3,65	0	0	0,18	0,68602005
TET	0,1	3,83	0	0	0,14	0,68454882
TI4	0,07	3,65	0	0	0,15	0,63693898
TZ2	0,07	3,65	0	0	0,16	0,62164948
TEF	0,14	4,71	0	0	0,14	0,61095404
IHB	0,24	4,02	0,02	0	0,16	0,6075392
ECD	0,32	3,11	0	0	0,17	0,58842444
AND	0,47	4,29	0	0	0,14	0,57611642
NBD	0	5,52	0	0	0,07	0,5760478
TDF	0,69	3,34	0	0	0,17	0,5711149
GA3	0,08	4	0	0	0,15	0,5635514
AOB	0,12	3,65	0	0	0,18	0,56027875
TSD	0,28	3,71	0	0	0,17	0,49326146
VK3	0	5,48	0	0	0,13	0,4930676
HSF	0,1	5,06	0	0	0,14	0,48118325
TMA	0,47	3,97	0	0	0,17	0,46095718
KA1	0,49	4,39	0	0,02	0,11	0,41685649
EK1	0,04	6,1	0	0	0,17	0,41372213
YDF	1,14	4,61	0	0,03	0,17	0,39696312
SKD	0,77	4,64	0	0	0,04	0,39439655
GBD	0,18	5,43	0	0	0,1	0,38242104
IBF	0,7	5,49	0	0,01	0,18	0,33333333
GBF	0,28	5,51	0	0,01	0,14	0,33212341

As shown in Table 7.66 MND, HBD, TYD, FBD, AOD and ATD are the DEA efficient funds among the 37 Type B Variable Mutual Funds in 2005.

b) Liquid Mutual Funds:

Table 7.67: Descriptive Statistics Table for Type B Liquid Mutual Funds in 2005

	MC	CC	OC	RSD	AR
Mean	0,13390244	3,58292683	0,01853659	0,00289132	0,10458748
Standard Error	0,03355352	0,14696949	0,01137263	0,00242783	0,00212243
Median	0,08	3,64	0	0,00020884	0,10627459
Semi deviation	0,21484736	0,94106388	0,07282036	0,01554568	0,01359016
Sample Variance	0,04615939	0,88560122	0,0053028	0,00024167	0,00018469
Kurtosis	14,3069213	0,69862621	16,3562545	40,2761875	3,54648989
Skewness	3,41085337	0,70740874	4,13441289	6,32447548	-1,5532737
Range	1,18	4,13	0,34	0,09960416	0,07308921
Minimum	0	1,82	0	0	0,056231
Maximum	1,18	5,95	0,34	0,09960416	0,12932021
Sum	5,49	146,9	0,76	0,11854424	4,28808667
Count	41	41	41	41	41

As indicated in the descriptive statistics table 7.67 for Type B Liquid Mutual Funds in 2005, the funds have a 10.5 % of mean value of annual return, and the variance around this value is 0.1 %, in other words σ/μ ratio of the return is 0.95 % and the range of return is 7.3 % and the Risk Value of the mutual funds is 0.029 %. In 2005 Type B variable mutual funds performed worse then the previous year. The mean value for management costs, commissions charged and other costs are 0.13 %, 3.6 %, and 0.02 % respectively.

There are 41 Type B Liquid Mutual Funds in 2005 and all of them have positive annual return values. The ranking of the Type B Liquid Mutual Funds in 2005 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.68: Performance Ranking for Type B Liquid Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
ZBL	0	2,52	0	0	0,12	1
SMB	0,03	1,92	0	0	0,12	1
FI5	0,03	3,65	0	0	0,13	1
HLB	0	3,01	0,09	0	0,11	1
PRL	0	2,31	0,34	0	0,12	1
TUL	0	5,46	0	0	0,1	1
TSL	0	3,66	0	0	0,11	1
FBL	0,03	2,55	0	0	0,12	1
IYL	0	3,66	0,32	0	0,1	1
MBL	0	5,4	0	0	0,06	1
CODE	CC%	MC%	OC%	RSD	AR	***Efficiency***

Continued from previous page **Table 7.68**

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
VBL	0	2,56	0	0	0,12	1
TLF	0	3,54	0	0	0,11	0,97984549
VK6	0	4,1	0	0	0,09	0,90891312
TII	0,16	2,55	0	0	0,12	0,89161519
DLY	0,02	2,91	0	0	0,12	0,85865
CKB	1,18	3,09	0	0	0,12	0,82524272
HLL	0	3,11	0	0,1	0,11	0,81028939
YLF	0,65	2,95	0	0	0,11	0,78477371
KLF	0,07	2,92	0	0	0,09	0,78260402
ANL	0,08	3,28	0	0	0,11	0,77743902
ELF	0	5,95	0	0	0,07	0,7121439
SBT	0,47	3,64	0	0	0,09	0,70054945
AAL	0,16	3,65	0	0	0,1	0,69863014
ADL	0	3,65	0	0	0,12	0,69041096
ECB	0,25	3,32	0	0	0,1	0,68937497
BEB	0,26	3,29	0	0	0,11	0,68175027
YFL	0,13	3,63	0	0	0,1	0,67305427
YBL	0,09	3,58	0	0	0,11	0,66338527
AK1	0,15	3,65	0	0	0,11	0,64858958
KYB	0,21	3,41	0	0	0,11	0,6402663
TZ3	0,07	3,65	0	0	0,11	0,61329275
KLY	0,13	3,65	0	0	0,11	0,60785551
OBT	0,09	3,65	0	0	0,11	0,60069672
GA2	0,13	4,31	0,01	0	0,1	0,57004961
HSL	0,13	4,19	0	0	0,11	0,55613175
IBL	0,24	4,02	0	0	0,1	0,55305774
TEL	0,21	4,09	0	0	0,1	0,55280788
TKL	0	5,48	0	0	0,09	0,54030487
SLF	0,13	3,65	0	0,01	0,1	0,51996843
TI1	0,19	5,47	0	0	0,08	0,46617916

As shown in Table 7.68; ZBL, SMB, FI5, HLB, PRL, TUL, TSL, FBL, IYL, MBL, GBL and VBL are the DEA efficient funds among the 41 Type B Liquid Mutual Funds in 2005.

c) Bond Mutual Funds

Table 6.69: Descriptive Statistics Table for Type B Bond Mutual Funds in 2005

	MC	CC	OC	RSD	AR
Mean	0,0862069	3,92034483	0,29862069	0,00357832	0,15905897
Standard Error	0,01802717	0,1865677	0,2979072	0,00069436	0,00545463
Median	0,06	3,69	0	0,00224929	0,16535156
Mode	0	3,65	0	#NV	#NV
Semi deviation	0,09707927	1,00469783	1,60427938	0,00373924	0,02937408
Sample Variance	0,00942438	1,00941773	2,57371232	1,3982E-05	0,00086284
Kurtosis	11,6435882	-0,6533431	28,999655	5,63532912	4,58311085
Skewness	2,97043846	-0,0336048	5,38511844	2,28317765	-1,9039757
Range	0,5	3,67	8,64	0,01646563	0,13516679
Minimum	0	1,82	0	0,00058232	0,05713809
Maximum	0,5	5,49	8,64	0,01704795	0,19230488
Sum	2,5	113,69	8,66	0,10377137	4,61271017
Count	29	29	29	29	29

As indicated in the descriptive statistics table 7.69 for Type B Bond Mutual Funds in 200%, the funds have a 15.9 % of mean value of annual return, and the variance around this value is 0.08 %, in other words σ/μ ratio of the return is 0.5 % and the range of return is 13.5 % and the Risk Value of the mutual funds is 0.3 %. In 2005 Type B bond mutual funds performed better than the previous year, in spite of the lower return values the variance has dramatically fallen in 2005. The mean value for management costs, commissions charged and other costs are 0.08 %, 3,9 %, and 0.3 % respectively.

There are 29 Type B Bond Mutual Funds in 2005 and all of them have positive annual return values. The ranking of the Type B Bond Mutual Funds in 2005 according to Data Envelopment Analysis Efficiency is as follows:

Table 7.70: Performance Ranking for Type B Bond Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
ZBT	0	2,7	0	0	0,156	1
TIF	0,05	1,82	0	0,002	0,183	1
TBB	0	3,69	0	0,003	0,182	1
DZT	0,05	2,55	0	0	0,192	1
HLT	0	2,7	0,02	0,002	0,172	1
TI6	0,05	3,66	0	0	0,15	1
GBE	0,03	2,44	8,64	0,012	0,093	0,9097035
ATT	0,13	5,49	0	0	0,161	0,73001742
KBE	0,05	2,95	0	0,017	0,057	0,70496084
FI3	0,03	3,7	0	0,001	0,159	0,69361722

Continued from previous page **Table 7.70**

CODE	CC%	MC%	OC%	RSD	AR	Efficiency
AK2	0,06	3,65	0	0,002	0,185	0,66842653
GA1	0,07	4,01	0	0,001	0,148	0,65243804
YBT	0,06	4,22	0	0,005	0,189	0,64411152
OBB	0,07	3,64	0	0,002	0,167	0,63976968
YFB	0,15	3,64	0	0,002	0,156	0,62998904
TZ4	0,05	3,65	0	0,009	0,176	0,62560603
BET	0,1	3	0	0,008	0,182	0,60666667
ABB	0,5	5,41	0	0,001	0,149	0,59923327
GAT	0,04	4	0	0,002	0,165	0,5916761
KCT	0,06	3,64	0	0,003	0,166	0,58565782
TYB	0,11	4,75	0	0,001	0,143	0,56449101
SKB	0,1	4,62	0	0,001	0,121	0,54923881
KTF	0,09	3,65	0	0,005	0,184	0,53480281
YBB	0,19	4,25	0	0,003	0,165	0,51890319
TUF	0	5,48	0	0,002	0,139	0,49270073
TBT	0,22	4,65	0	0,004	0,173	0,43008854
HST	0,12	5,03	0	0,004	0,178	0,40500799
HTT	0,12	5,22	0	0,005	0,182	0,38927059

As shown in Table 73, ZBT, TIF, TBB, DZT, HLT and TI6 are the DEA efficient funds among the 29 Type B Bond Mutual Funds in 2005.

7. 4. II. Second Stage Evaluation According to Types of Mutual Funds in 2005

a) Type A Mutual Funds:

Table 7.71: Second Stage Evaluation of Type A Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency	Kind
VAF	0	5,48	0	0,08	0,25	1	V
DZK	1,01	5,47	0,13	0,03	0,26	1	M
TAD	0	5,4	2,01	0,03	0,14	1	V
HLK	0,14	2,73	0,24	0,04	0,31	1	M
TZD	0,64	3,61	0	0,03	0,22	1	V
IYK	0,23	5,5	0	0,04	0,27	1	M
ADD	6,7	2,02	0	0,02	0,02	1	V
TTE	0,61	5,46	0	0,04	0,31	1	I
TAH	4,2	4,46	0,13	0,12	0,81	1	E
VKA	0	5,48	0	0,06	0,26	1	M
ISA	1,64	2,19	0	0,03	0,2	1	V
YAR	0,1	0,51	0	0,1	0,77	1	SAP
VEF	0	5,48	0	0,12	0,45	1	I
AAK	2,65	5,49	0,04	0,03	0,31	1	M
TKK	0,44	2,55	0	0,05	0,31	1	M
YKA	1,87	1,09	0	0,07	0,24	0,96566326	M

Continued from previous page **Table 7.71**

CODE	CC%	MC%	OC%	RSD	AR	Efficiency	Kind
GAE	0,03	5,49	0	0,11	0,47	0,85234418	I
DJA	0,12	0,95	0,06	0,12	0,52	0,79232107	I
KA2	1,36	4,39	0	0,04	0,13	0,77914341	V
SAD	2,17	4,71	0,01	0,04	0,08	0,76077633	V
SMA	1,46	2,3	0	0,09	0,32	0,66231984	V
OBU	0,51	2,49	0	0,12	0,51	0,60573714	I
TIE	0,27	3,87	0	0,13	0,48	0,60105722	I
TAU	1,01	3,65	0	0,13	0,64	0,59808195	I
ASA	1,07	5,48	0	0,09	0,42	0,59364504	E
YEF	0,52	4,46	0	0,11	0,53	0,59161252	I
NU1	2,6	3,81	1,39	0,05	0,07	0,58923967	V
AGF	0,91	4,38	0	0,09	0,4	0,57944376	SAP
EV1	1,72	7,34	0	0,12	0,54	0,5584411	M
KMH	2,72	6,6	0	0,05	0,14	0,54456045	E
TI2	0,81	5,48	0	0,1	0,37	0,53026665	E

There are 33 mutual funds (9 Variable, 8 Mixed, 6 Equity, 2 SAP and 8 Index mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 5 variable (VAF, TAD, TZD, ADD and ISA), 6 mixed mutual funds (HLK, DZK, IYK, VKA, AAK and TKK), one SAP mutual fund (YAR) and 2 index mutual funds (VEF and TTE) are found to be efficient.

b) Type B Mutual Funds:

Table 7.72: Second Stage Evaluation of Type B Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency	Kind
AOD	0,09	1,83	0	0	0,19	1	V
HBD	0	2,68	0	0	0,17	1	V
TIF	0,05	1,82	0	0	0,18	1	B
FBL	0,03	2,55	0	0	0,12	1	L
GBL	0,2	1,82	0	0	0,11	1	L
HLT	0	2,7	0,02	0	0,17	1	B
IYL	0	3,66	0,32	0	0,1	1	L
TSL	0	3,66	0	0	0,11	1	L
DZT	0,05	2,55	0	0	0,19	1	B
SMB	0,03	1,92	0	0	0,12	1	L
MND	0,13	1,83	0	0	0,12	1	V
ATD	0,07	3,66	0	0	0,16	1	V
TYD	0	5,32	0,05	0,09	0,32	1	V
ZBL	0	2,52	0	0	0,12	1	L
PRL	0	2,31	0,34	0	0,12	1	L
MBL	0	5,4	0	0	0,06	1	L
TUL	0	5,46	0	0	0,1	1	L

Continued from previous page **Table 7.72**

CODE	CC%	MC%	OC%	RSD	AR	Efficiency	Kind
TBB	0	3,69	0	0	0,18	1	B
HLB	0	3,01	0,09	0	0,11	0,99997289	L
VBL	0	2,56	0	0	0,12	0,98455971	L
ZBT	0	2,7	0	0	0,16	0,97654659	B
FBD	0,02	3,69	0,01	0	0,13	0,69142507	V
FI5	0,03	3,65	0	0	0,13	0,68213285	L
TI6	0,05	3,66	0	0	0,15	0,66894326	B

There are 24 mutual funds (6 Variable, 12 Liquid and 6 Bond mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 5 variable (AOD, HBD, MND, ATD and TYD), 9 liquid (FBL, GBY, TSL, SMB, ZBL, IYL, PRL, MBL and TUL) and 4 bond mutual funds (HLT, TIF, DZT and TBB) are found efficient.

7. 4. III. Third Stage Evaluation of All Efficient Mutual Funds in 2005

All Type A and B mutual funds; that are found DEA efficient in the second stage, are evaluated together in the second stage. The results of this stage indicate the most efficient mutual funds of 2005.

Table 7.73: Third Stage Evaluation of All Efficient Mutual Funds in 2005

CODE	CC%	MC%	OC%	RSD	AR	Efficiency	Type	Kind
DZT	0,05	2,55	0	0	0,192	1	B	B
HBD	0	2,68	0	0	0,171	1	B	V
TBB	0	3,69	0	0,003	0,182	1	B	B
TIF	0,05	1,82	0	0,002	0,183	1	B	B
IYL	0	3,66	0,32	0	0,102	1	B	L
SMB	0,03	1,92	0	0	0,117	1	B	L
FBL	0,03	2,55	0	0	0,12	1	B	L
MBL	0	5,4	0	0	0,056	1	B	L
TSL	0	3,66	0	0	0,106	1	B	L
AOD	0,09	1,83	0	0,001	0,191	1	B	V
TUL	0	5,46	0	0	0,099	1	B	L
PRL	0	2,31	0,34	0	0,115	1	B	L
MND	0,13	1,83	0	0,001	0,117	1	B	V
VEF	0	5,48	0	0,121	0,453	1	A	I
YAR	0,1	0,51	0	0,098	0,772	1	A	SAP
ATD	0,07	3,66	0	0	0,162	1	B	V
ZBL	0	2,52	0	0	0,116	1	B	L
TAH	4,2	4,46	0,13	0,121	0,805	1	A	E
HLT	0	2,7	0,02	0,002	0,172	0,9968203	B	B
GBL	0,2	1,82	0	0,003	0,113	0,99426887	B	L
ADD	6,7	2,02	0	0,017	0,02	0,82096512	A	V

Continued from previous page **Table 7.73**

CODE	CC%	MC%	OC%	RSD	AR	Efficiency	Type	Kind
TYD	0	5,32	0,05	0,09	0,319	0,77939307	B	V
ISA	1,64	2,19	0	0,03	0,198	0,70983793	A	V
AAK	2,65	5,49	0,04	0,032	0,314	0,65428688	A	M
VKA	0	5,48	0	0,062	0,259	0,6495404	A	M
VAF	0	5,48	0	0,084	0,246	0,62479548	A	V
TTE	0,61	5,46	0	0,035	0,307	0,57153769	A	I
TKK	0,44	2,55	0	0,051	0,308	0,56794145	A	M
HLK	0,14	2,73	0,24	0,041	0,308	0,56114036	A	M
TAD	0	5,4	2,01	0,032	0,139	0,45776037	A	V
TZD	0,64	3,61	0	0,031	0,223	0,45767694	A	V
DZK	1,01	5,47	0,13	0,029	0,262	0,42858481	A	M
IYK	0,23	5,5	0	0,043	0,27	0,33543031	A	M

There were 33 mutual funds (15 Type A and 18 Type B mutual funds) to evaluate in this stage. According to DEA efficiency of the new efficient frontier 4 Type A (VEF as index mutual fund; YAR as SAP mutual funds; and TAH as equity mutual fund) mutual funds are found to be efficient, the rest of the efficient mutual funds are all of Type B (AOD, ATD, MND and HBD as variable; SMB, MBL, FBL, ECB, TSL, TUL, IYL, ZBL and PRL as liquid mutual funds; and DZT, TBB and TIF as bond mutual funds).

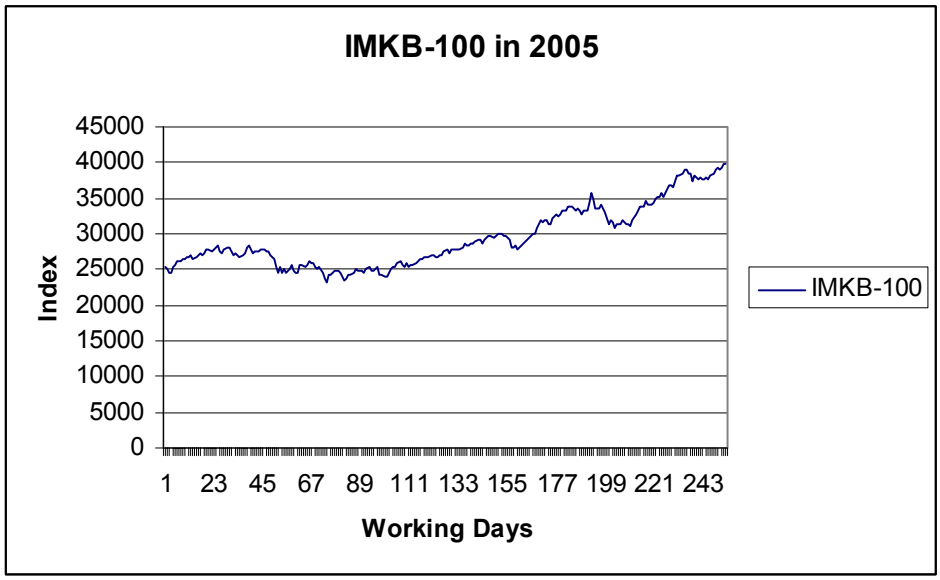

Figure 7.7: The values of IMKB-100 Index in 2005

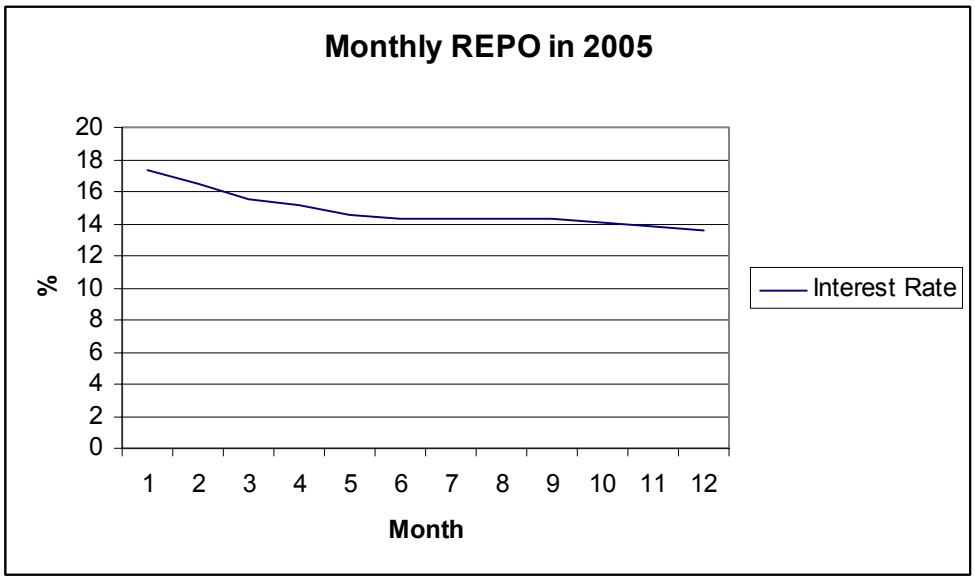

Figure 7.8: Monthly Interest Rates in 2005

The Index was at 25445 at the beginning of the year 2005. In the first quarter index had one upward and one downward direction but both had not made any remarkable effect on the index. In the following three quarters the index has risen gradually to 39777 until the end of the year and has realised an annual return of about 56%. On the other hand the interest rates of repurchase orders have declined adversely from 17.29% to 13.53% in 2005.

There are only three Type A efficient mutual funds to 15 Type B efficient mutual funds. In 2005 IMKB performed relatively better than the previous year, although the number of efficient Type A mutual funds has declined to 3. The most efficient Type B mutual funds are of liquid mutual funds in 2005.

8. CONCLUSION

In this work, the literature on investment performance appraisal methods was reviewed. Early measures like Sharpe and Treynor were based on some form of risk-adjusted return and did not include the costs in generating the return. Then companies developed comprehensive performance evaluation methods that have now become very popular among institutional and private investors. The groups are categorised on the basis of fund characteristics.

In order to calculate the performance of a unit, either a functional or a non-functional efficient frontier is needed.

The efficient frontier can be calculated through an explicit functional form representing the model. These methods are called parametric methods. The requirement of an explicit specification of the production function and assumption of distributions for the error term without regard to the theory are considered as shortcomings of stochastic frontier methods.

In contrast to the parametric methods, non-parametric methods do not require an explicit functional form. There are numerous techniques belonging to non-parametric methods. One of such methods is Data Envelopment Analysis. Data Envelopment Analysis uses mathematical programming techniques and derives the deterministic frontier instead of estimating it. Not requiring any explicit functional form a possible frontier misspecification is avoided in Data Envelopment Analysis. Non-parametric methods need less information than parametric methods, but the results of non-parametric methods are less precise accordingly. In DEA more then one output can be added in the model.

In this work Turkish Mutual Funds of years 2002-2004 have been evaluated via Data Envelopment Analysis according to risks and various costs of these mutual funds. Performance results are given in a scale of 0 to 1 (1 is the best), there is no need to have a mathematical or financial background to interpret the results.

According to the results of this work, more Type B mutual funds are found to be efficient than Type A mutual funds. Depending on the performance of IMKB some years more Type A mutual funds are found efficient but the number of efficient Type B mutual funds are always more then Type A from year 2002 to 2005.

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CURRICULUM VITAE

Özgüç Akdağ was born on 20th of December 1980 in Istanbul. He has graduated from Burak Bora Anatolian High School and then started studying Textile Engineering at Ege University.

He has attended Management Engineering Master Programme of İstanbul Technical University in 2003 and studied until 2006. He has spent eight months at Technical University of Berlin within ERASMUS Scholarship Programme and written his Master's Thesis there.