School of Business,
Economics and Law
GÖTEBORG UNIVERSITY

Mutual Fund Performance – An Empirical Analysis of China's Mutual Fund Market

Mingxia Lu and Yuzhong Zhao

Graduate Business School

Industrial and Financial Economics
Master Thesis No 2005:6
Supervisor: Jianhua Zhang

Abstract

This paper investigates the performance of China's mutual funds in the period 2001-2005 by using mean-variance, downside-risk and value-at-risk approaches. We distinguish between the open-end funds and closed-end funds in terms of their different characteristics and investment styles. The results of this paper reveal most of the Sharpe ratios, Treynor ratios, Sortino ratios and VaR measures are negatively rather than positively signed because of the depression of China's stock market during this period. For the open-end funds, 96.30% of funds are better than our benchmark index, which is composed of 80% stocks and 20% government bonds. The bond funds have better performance than stock and mixed funds. Regarding the closed-end funds, 41.67% of them have positive Jensen's alphas when Closed-end Fund Index has been used as the benchmark. The small size funds have better performance than medium and large size funds, and E Fund Management Company has best performance. Although all the returns series is not normally distributed, and from the analysis of efficient frontiers, the MLPM approach is more efficient than MV and VaR approaches, all of the different measures produce the similar results of ranking. There is no significant effect on ranking despite different measures used.

Key words: Open-end fund, Closed-end fund, Mean-variance theory, Downside risk, Lower Partial Moment, Value at Risk, Efficient frontier

Acknowledgements

We would like to thank our supervisors Dr. Jianhua Zhang and visiting professor Enjun Xia. Dr. Jianhua Zhang has provided much help to our thesis. We would not have finished this thesis smoothly without your patient guidance and valuable feedback. Visiting professor Enjun Xia has provided us many useful Chinese articles, and given us valuable instruction into China's mutual fund market. We also appreciate the comments from Gert Sandahl. Finally, we would like thank to all GBS staff and administration for their help during our master program.

Mingxia Lu & Yuzhong Zhao

Special thanks to my boyfriend Yongqiang Bu who has provided all of the available data and given me much support at the whole process of the thesis.

Mingxia Lu

Goteborg, Dec 2005

Table of Contents

List of Tables

List of Figures

1. Introduction

1.1 Background

The China's mutual fund market is growing at an incredible pace and is catching up with developed markets. The strong growth is due to several factors. Firstly, China has a very strong economic growth, and there is a huge capital flow to financial markets. However, the stock market has been in depression since 2001. More and more investors are beginning to invest in the mutual fund market because they believe fund managers are professional and can diversify the risk of the assets. Secondly, the government encourages the development of the mutual fund market and want to provide a good capital market environment for Social Insurance Foundations, Trust Companies and Financial Company Annuities. Thirdly, this is a necessary result due to the development of the financial market, and the need for advanced investment tools. These give the financial institutions the opportunities to develop and offer a number of different financial products.

There are two types of funds: closed-end fund which listed and traded on the stock exchange with a fixed number of shares and open-end fund in which unlisted shares are open to investors for purchase or redemption at net asset value. With the establishment of the first two closed-end funds Kai Yuan and Jin Tai in 1998, and the first open-end fund Hua An Creation in 2001, by the end of June 2005, the number of the approved funds has reached 190, with 438.9 billion outside shares, and net asset value is about 420 billion RMB[1]. There are 54 close-end funds in the market, 81.7 billion outstanding shares with the net asset value of 77.05 billion RMB. The assets managed by closed-end funds cover 18.29% of the total fund assets. While the number of the open-end funds is 136, with 357.2 billion outstanding shares and the net asset value of 344.3 billion RMB, which is 81.71% of the total fund assets.[2] Open-end funds develop much faster than closed-end funds and are becoming the mainstream in China's mutual fund market. Obviously, mutual funds have become an important investment tool in China even they are disadvantages like: the investors have to pay fees and commissions whether they make or lose money on the investment. Therefore, it is necessary and meaningful to measure the funds performance.

1.2 Question Discussion

A fund manager should act in the best interest of his clients, then how the fund performs becomes the focus of more and more investors. Sharpe ratio, Treynor ratio

[1] The exchange rate on Jun 30, 2005 is 1US Dollar = 8.27RMB

[2] From fund research of China Merchants Securities, 2005(2)

and Jenson's alpha have been widely used to measure the funds performance, especially for Sharpe ratio. These three traditional measures are based on the mean-variance theory.

However, Sharpe ratio, its measurement of performance is based upon the assumption of normality of returns. Actually, most of returns of fund are not normally distributed. At the same time, it disobeys the investors' real feeling when using the standard deviation as the risk measurement because it implies that the investors are equally concerned about both loss and gain. Therefore, Sharpe ratio has been criticized by the later researchers, but it is still widely used in fact. Downside risk has been introduced to measure the funds performance. As it name indicates, which only considers the loss as the real feeling of investors, and it is not based on the assumption of normal distribution. From the theoretic point of view, it seems more attractive, but does it really have an important effect on the results of China mutual fund market? Moreover, Value at Risk has also been widely introduced as a risk measure to funds performance. It is a measure of the worst loss within a specified confidence interval. What then is the effect on the ranking of funds with different approaches? Another important problem is about the negative excess returns which will occur in empirical analysis, because we use the historical portfolio returns to replace the expected returns. It is difficult to interpret the use of the standard Sharpe ratio and other measures. Then how to measure the funds performance when the excess returns are negative?

In this paper, the main research question is how does the fund perform and what is the effect on ranking with different approaches? Many other questions are also included, such as are the returns of funds normally distributed, which measures are chosen to measure funds performance, how to deal with the problem when the excess returns are negative?

1.3 Purpose

The objective of this paper is to measure the performance of China mutual funds, and we will try to find the effect on ranking through the use of three approaches: mean-variance, downside-risk and value-at-risk. The mean-variance is based on the assumption of normal distribution, so we also test the normality of returns of funds. We do an empirical investigation to the performance of mutual funds in the period of 2001-2005, and try to find the effect on the ranking with different measures. We hope our work can give some indication to the understanding of downside risk and value at risk approaches since most of the domestic researches have still not applied these measures to practice.

1.4 Outline

This paper will be organized as follows: (1) Introduction; (2) Theoretical Framework;

(3) China's Mutual Fund Market; (4) Methodology and Data; (5) Empirical Results & Analysis; (6) Conclusions; (7) References; (8) Appendices.

The theoretical part will cover the theories of mean-variance, downside risk and value at risk.
The development history will be introduced regarding the China mutual fund market, as well as the classification of mutual funds, two main evaluation methods, and some Chinese empirical studies.
The part of methodology and data will introduce the methods that we use to measure the funds performance; the method to test normality and the traditional measures as well as the LPM measures and VaR measures; the negative excess return will also be discussed. Moreover, the sample funds and the calculation of return will be described, including the choice to the risk free rate and benchmark.
The part on Empirical Results & Analysis will present the results as well as the analysis, then the conclusions will be presented, and references and appendices.

2. Theoretical Framework

2.1. Mean-variance Theory

Mean-variance theory began in the 1950s by Harry Markowitz. Markowitz (1952) provided a quantitative framework for measuring portfolio risk and return. He developed a general portfolio algorithm to solve the optimal portfolio in 1956. Markowitz (1956) uses mean returns, variances and covariance to derive an efficient frontier where every portfolio on the frontier maximizes the expected return for a given variance or minimizes the variance for a given expected return. This is usually called EV criterion where E is the expected return and V is the variance of the portfolio.

Mean-variance is an important model of investments based on decision theory. It is a also a simple model by assuming that preferences depend only on the mean and variance of payoffs, and we can obtain a number of robust results. Capital Asset Pricing Model (CAPM) is the derivation of mean-theory theory, but it composes the risk of portfolio into systematic risk and unsystematic risk.

The Mean-Variance theory is based on the assumptions that:

- Single-period model
- Preferences depend only on the mean and variance of payoffs: At a given mean lower variance is preferred; at a given variance, a higher mean is preferred
- Price-taking with no taxes or transaction costs
- No information asymmetry
- Competitive equilibrium

There are three traditional measures based on mean-variance theory. Treynor (1965), Sharpe (1966), Jenson (1968) provide the basic models when measuring the performance. Although they have been criticized by some later researchers, they are still widely used to measure the performance, especially for the Sharpe ratio.

2.1.1. Sharpe Ratio

This ratio was developed by William Sharpe to measure risk-adjusted performance. Subtracting the risk free rate from the rate of return for a portfolio and dividing the result by the standard deviation of the portfolio returns to calculate it.

$$\text{Sharpe ratio} = \frac{\overline{r_p} - r_f}{\sigma_p} \qquad (2.1)$$

$\overline{r_p}$ Expected portfolio return

r_f Risk free rate

σ_p Portfolio standard deviation

The Sharpe Ratio indicates the excess return per unit of risk associated with the excess return. It is known as the "Reward-to-Volatility Ratio". A higher Sharpe ratio means a better performance.

2.1.2. Treynor Ratio

Treynor ratio is a risk-adjusted measure of return based on systematic risk. It is similar to the Sharpe ratio with the difference that it uses beta as the measurement of volatility. It is also known as the "Reward-to-Volatility Ratio". A higher Treynor ratio also means a better performance.

$$\text{Treynor ratio} = \frac{\overline{r_p} - r_f}{\beta_p} \qquad (2.2)$$

$\overline{r_p}$ Expected portfolio return

r_f Risk free rate

β_p Beta of the portfolio

Treynor ratio only focuses on the systematic risk, while the Sharpe ratio focuses on the total risk. Therefore, when the unsystematic risk has been fully diversified, then these two ratios would have the same results.

2.1.3. Jenson's Alpha

A risk-adjusted performance measurement that represents the average return on a portfolio over and above that predicted by the CAPM, given the portfolio's beta and the average market return. This is the portfolio's alpha.

$$\alpha_p = \overline{r_p} - \left[r_f + \beta_p (\overline{r_m} - r_f) \right] \qquad (2.3)$$

$\overline{r_p}$ Expected portfolio return

r_f Risk free rate

$\overline{r_m}$ Expected market return

β_p Beta of the portfolio

Jensen's alpha is one of the ways to help determine if a portfolio is earning the proper return for its level of risk. It is an absolute measure of fund performance. If Jensen's alpha is positive, then the portfolio is earning excess returns. In other words, a positive value for Jensen's alpha means a fund manager has "beat the market" with his or her stock picking skills.

2.2. Downside Risk

Nawrocki (1999) states the concept of downside risk started with the publication of two papers in 1952. The first is "Portfolio Selection" by Markowitz, and the second is "Safety First and the Holding of Assets" by Roy. Roy (1952) states that an investor will prefer safety of principal first and will set some minimum acceptable return that will conserve the principal. Markowitz (1959) realizes that investors are interested in minimizing downside risk because only the downside risk or safety first is relevant to an investor and the security distributions may not be normally distributed. When distributions are normally distributed, both the downside risk measure and the variance provide the correct answer. But if the distributions are not normally distributed only the downside risk measure provides the correct answer. Markowitz provides a semi-variance computed from the mean return or below-mean semi-variance and a semi-variance computed from a target return or below-target semi-variance to measure downside risk. These two measures compute a variance using only the returns below the mean return or below a target return. Since only a subset of the return distribution is used, Markowitz calls these measures partial or semi-variances. Due to the formidable computational problems and the variance model was already mathematically very complex, Markowitz didn't continue the research on the semi-variance. There are more and more later researches that focus on semi-variance.

Bawa (1975) generalizes the semi-variance measure of risk to reflect a less restrictive class of decreasing absolute risk-averse utility function which is known as Lower Partial Moment (LPM). Fishburn (1977) shows this concept accurately reflects the decision maker's preferences between the combination of risk and return of a portfolio. Additionally the induced efficient set of this model strongly satisfies the stochastic dominance criteria which is a well-known tool for investment decision evaluation and fits with several types of utility functions. After that, the downside risk concept means the Lower Partial Moment. We also use LPM presents the concept of downside risk in our paper.

2.2.1. Lower Partial Moment

Bawa (1975) defines lower partial moment (LPM) as a general family of below-target

risk measures. The LPM illustrates below-target risk with different risk tolerance. Given the risk attitude level α of an investor, the lower partial moment is defined as:

$$LPM(\alpha,\tau)=\frac{1}{K}\sum_{t=1}^{k}Max\left[0,(\tau-r_t)^{\alpha}\right] \qquad (2.4)$$

Where K is the number of observations, τ is the target return, α is the degree of the lower partial moment, r_t is the return for the asset during time t, Max is a maximization function which chooses the larger of the two numbers, 0 or $(\tau - r_t)$. It is the α value that makes the LPM different from SVt. There is no limitation to what value of α is in the LPM but we have to calculate it. The α value does not have to be a whole number. It can also be fractional. The LPM provides us with many utility functions. This is also why the LPM risk measure is superior over the variance and semi-variance measures.

Bawa(1975) shows that the LPM measure is related to stochastic dominance for risk tolerance values of 0, 1, and 2. The LPM α =0 is sometimes called the below target probability. The name of LPM α =1 is the average downside magnitude of failure to meet the target return while the LPM α =1 assumes that an investor is neutral to risk. LPM α =2 is the semi-variance measure, which is called the below target risk measure. It is consistent with a risk averse investor.

Fishburn (1977) extends the general LPM model to the (α, τ) model, where α is the level of investor risk tolerance and τ is the target return**.** Fishburn provides the unlimited view of LPM with fractional degrees of 2.33 or 3.89. Given a value of the target return τ, Fishburn demonstrates the equivalence of the LPM measure to stochastic dominance for all values of α> 0. Fishburn also shows that the α value includes all types of investor behavior. The LPM value α<1 captures risk seeking behavior. Risk neutral behavior is α= 1, while risk averse behavior is α> 1. The higher the α value is above a value of one, the higher the risk aversion of the investor.

For the good understanding to LPM, we take an example from Silver(1993).

Table 2-1. Example of Degrees of the Lower Partial Moment

	Company A		Company B	
	Return	Prob.	Return	Prob.
	-5.00	0.20	10.00	0.80
	20.00	0.80	35.00	0.20
Mean Return	15.00		15.00	
Variance	100.00		100.00	
Skewness	-1.50		1.50	
LPM α=0.0, τ=15	0.20		0.80	
LPM α=0.5, τ=15	0.89		1.79	
LPM α=1.0, τ=15	4.00		4.00	
LPM α=1.5, τ=15	17.89		8.94	
LPM α=2.0, τ=15	80.00		20.00	
LPM α=3.0, τ=15	1600.00		100.00	

Source: Silver(1993)

Table 2-1 shows the company A and company B have the same mean return and variance, while the skewness of the return distribution is different. There is no difference between the two companies if investors make an investment decision by using mean-variance approach. However, if investors make their decisions with MLPM model, they will make totally different choices with the different value of α. When $\alpha<1$, the investors will choose company A because the investment A is less risky than investment B. When $\alpha=1$, there is no difference between these two investments. When $\alpha>1$, the investors will choose investment B since it is less risky than investment A. This is consistent with the risk averse utility function. As α increase, investment A takes on a heavier risk penalty. When $\alpha = 1.5$, investment A is only twice as risky as Investment B while when $\alpha = 3$, Investment A is sixteen times as risky as Investment B.

The selection rule that uses the mean as the return measure and the lower partial moment as the risk measure is known as the Mean Lower Partial Moment model. The MLPM model is more realistic for investors to make investment decisions compared with MV model. The MLPM model does not have any restrictions on the probability distribution of security returns and investors' preferences, so that the MLPM model is more tractable in general compared with mean-variance approach. As a result, downside risk analysis is not only more attractive in terms of its consistency with the way investors actually perceive risk, but it is also valid under a broader range of conditions.

2.2.2. Some Empirical Studies

Hallow (1991) studies the 11 countries' bond and stock markets with the MLPM

framework. The returns used in the analysis are from Jan 1980 to Dec.1990. In the MLPM model, Hallow uses the different α and τ value to get the optimal proportion of bond and stocks. He also analyzes the difference of the MLPM and MV efficient frontier and the performance differences with different investment strategies. The results indicate: (1) For a given target rate and expected return, the $MLPM_1$ and $MLPM_2$ differ substantially. The $MLPM_1$ stock allocation is higher than that for the $MLPM_2$ frontier; (2) When the returns are not normally distributed, he compares the efficient frontier of the MV and MLPM model, and only use the $MLPM_2$ risk measure in order to reflect the return comparable units. It is clear that the mean-variance frontier lies inside the $MLPM_2$ opportunity sets. In other words, $MLPM_2$ model is more efficient; (3) In order to investigate the characteristics of these two allocation strategies according to their ex post returns and risk. He uses return data over the preceding 60 months to get the required inputs. The portfolio construction procedure is applied each month, as the portfolios are rebalanced over the 72 months ending in Dec.1990. In each case, the 60 months of return data immediately preceding the portfolio formation month is used for the optimizations. He finds that $MLPM_2$ model outperforms the MV model in all cases by providing more downside protection and higher returns.

In 1994, Rom & Ferguson issued an article “Post-Modern Portfolio Theory Comes of Age”. He calls the Mean-Variance theory by Markowitz as Modern Portfolio Theory and the MLPM frame as Post-Modern Portfolio Theory. He classifies the assets as: large-cap stocks, small-cap stocks, foreign stocks, bonds and Cash. The returns used in the research cover 15 years from 1978 to 1992. He compares the minimum-risk, maximum-efficiency and equivalent-risk portfolios generated from the optimizations under the MPT and PMPT theory for holding 5 years. The results indicate: (1) The Minimum-Risk portfolios of MLPM have higher returns and lower risk than that of MV; (2) The maximum efficiency portfolios of MLPM have higher expected return while they also have higher risk; (3) For the risk equivalent-risk portfolios, the downside risk portfolio has a higher allocation to large-cap stocks and lower weightings to foreign stocks and bonds than the mean-variance portfolio in terms of the skewness.

Grootveld & Hallerbach (1999) notice that downside risk become more and more popular because the classical mean-variance model punishes the upside potential in the same way as the downside risk. They investigate the differences and similarities by using a variance and a downside risk measure from both a theoretical and empirical point of view. They show that only a few downside risk measures possess better theoretical properties than variance under the return-risk framework. On the empirical side, they use the monthly returns from three US benchmark government bond indices and three US industry stock indices covering 15 years of 1980-1994 to analyze the differences of them based on the variance and semi-variance. They find that downside risk approaches tend to produce higher stock allocations than the classical mean-variance model in minimum risk point portfolios, while the

mean-downside approaches would allocate a higher proportion for bonds in the composition of tangency portfolios.

2.3. Value at Risk

Jorion (1997) defines Value at Risk as the expected maximum loss over a chosen time horizon within a given confidence interval. He uses the variance-covariance metrics to measure VaR. This concept takes the relevance of the risky assets into account and performs a covariance metrics for all the assets, then we can get the variance of the portfolio investment through timing the weight of the risky assets and the covariance metrics. Assume the returns of the risky assets are normally distributed, for example

$R_j \sim N(\mu_j, \sigma_j^2)$

It can be calculated as follows:

$$R_{p,t+1} = \sum_{j=1}^{N} w_{j,t} R_{j,t+1} \qquad (2.5)$$

$R_{p,t+1}$: the return of the portfolio investment at time t + 1

$R_{j,t+1}$: the return of asset j at time t + 1

$w_{j,t}$: the weight of the asset j at time t

This formula can be written as the form of metrics as follows:

$$R_p = [w_1, w_2 \cdots w_N] \begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ R_N \end{bmatrix} = w' R \qquad (2.6)$$

The expected return and variance of the R_p:

$$E(R_P) = \mu_P = \sum_{j=1}^{N} w_j E(R) = \sum_{j=1}^{N} w_J \mu_j \qquad (2.7)$$

$$V(R_P) = \sigma_p^2 = \sum_{j=1}^{N} w_j^2 \sigma_j^2 + \sum_{j=1}^{N} \sum_{k=1, k \neq j}^{N} w_j w_k \sigma_{jk} \qquad (2.8)$$

Then $R_p \sim N(\mu_j, \sigma_j^2)$, we define the $\sum$ as $\begin{bmatrix} \sigma_1^2 & \sigma_{12} & \cdots & \sigma_{1N} \\ \vdots & & & M \\ \sigma_{N1} & \sigma_{N2} & \cdots & \sigma_N^2 \end{bmatrix}$, therefore, the variance of the portfolio investment can be denoted as follows:

$$\sigma_p^2 = w' \sum w \qquad (2.9)$$

Under the probability of α, $R_p = \mu_p + Z_\alpha \sigma_p$, If we assume α=5% then $R_{p|\alpha=5\%} = \mu_p - 1.65\sigma_p$, so the VaR (maximum loss) of the portfolio with α=5% is calculated as:

$$VaR = E(R_p) - E(R_{p1\alpha=5\%}) = \mu_p - (\mu_p - 1.65\sigma_p) = 1.65\sigma_p$$

So VaR can be also be simply defined as:

$$VaR = Z_\alpha * \sigma_p \qquad (2.10)$$

Value at Risk (VaR) is becoming more and more important as a measure of the worst loss within a specified confidence interval. In April 1995, the Basel Committee on Banking Supervision declared VaR to determine capital adequacy requirements for commercial banks. Thereafter, the SEC also used VaR as one of three methods for listed companies to use for reporting derivatives activity. VaR can also be used to set limits on transactions to evaluate risk-adjusted investment returns. VaR can be used to control exposure to risk for institutional investors.

Dowd (1999) highlights the importance of dealing with net rather than gross portfolio exposures and suggest implementing a value at risk (VaR) approach to risk-return analysis. He applies VaR to the Sharpe ratio, uses VaR to replace the standard deviation. This method is a good improvement to measure the performance. It is particularly useful when making hedge decisions by helping to avoid a number of problems that easily arise using the traditional approach to hedging.

3. China's Mutual Fund Market

3.1. The Development of China's Mutual Fund Market

The mutual fund begins 1991 in China, with the issuance of "Provisional Regulatory Rules for Mutual Funds" as a symbol; the development can be divided in two stages: the first stage is from1992 to 1997 and the second stage is from 1997 to now.

The first stage: 1992~1997

The People's Bank of China acts as governor during this period. 75 mutual funds have been established with management of 6 billion RMB at the end of 1997. Most of the funds are established and managed by security companies and trust investment companies. Usually, the internal fund department is responsible for the investment of funds, and there are also some professional fund management companies. As the representative of the fund management company-Shenzhen Investment Fund Management Company, which was established on Otc.8th 1992, represents the beginning of standardized management of fund. The fund characteristic of this stage is that the funds are approved and set up by the local people's banks. Most of the funds are operated by the internal fund department of the security or trust companies, not by the professional fund management companies till 1997.

The second stage: 1997 to present

With the issuance of "Provisional Regulatory Rules for Mutual Funds" as a symbol on Nov.4th 1997, China Securities Regulatory Commission administers have been the governor during this period. After half a year´s preparation, Guotai and China Southern Fund Management Companies are approved to issue 2 billion closed-end funds via the Internet: Jintai Fund and Kaiyuan Fund, more close-end funds are issued subsequently. The funds can not be owned by individuals. No more than 10% of one fund invests in one company. The funds should also not hold more than 10% of a company's stock. Furthermore, 80% of assets held by the funds must be invested in stocks and bonds, and a minimum 20% must be invested in government bonds.

China Securities Regulatory Commission issued "Provisional management rules for the open-end funds" in Oct. 2000, thereby indicating the beginning of open-end funds development. According to the rule, fund management firms can charge investors a front-end load up to 5% of the investment and a back-end load up to 3% of the withdrawn amount. In Sep. 2001, Hua An Fund Management launched the first open-end fund named as "Hua An Creation", which was a historical event for the fund industry of China. China Southern Steady Fund and China Growth Fund were also issued consequently in the same year. With the further open up of the securities market, joint venture fund management companies are established, such as ABN AMRO Xiangcai Fund Management Co.,Ltd.

3.2. The Classification of Funds

There are two types of funds in China: open-end fund and closed-end fund.

Open-end fund issues and redeems shares on demand, whenever investors put money into the fund or take it out. This happens routinely every day and the total assets of the fund grow and shrink as money flows in and out. There is no limit to the number of shares the fund can issue. Nor is the value of each individual share affected by the number outstanding, since net asset value (NAV) is determined solely by the change in prices of the stocks or bonds the fund owns, not the size of the fund itself.

Closed-end fund issues a set number of shares in an initial public offering and they trade on an exchange. No new shares are issued after the fund is launched; no shares are redeemed for cash or securities until the fund liquidates. The price is not determined by the total value of the assets it holds, but by the demand for the fund. The main differences are shown in Table 3-1.

Table 3-1.The Comparison of Open-end Fund and Closed-end Fund

	Closed-End Fund	Open-End Fund
Trading Place	Shenzhen and Shanghai Stock Exchange	Fund management company or banks
Fund Existence Time	Limited time(Usually 10 or 15 years)	Unlimited time
Fund Size	Fixed	Not fixed, Minimum size limit
Redemption Restriction	Not redeemable	Can purchase or redeem anytime
The Way of Trading	Go public	Fund management company or banks
Pricing	Supply and demand of market	Net asset value of mutual funds
Dividend	Cash	Cash or reinvestment
Fee	Trading Fee：2.5‰ of the trading sum	Purchase Fee: no more than 5% of the assets. Redemption Fee: no more than 3% of the redemption.
Investment Strategy	No need to take reserve; Long term investment	Must reserve some cash for investors' redemption; Pursue high returns
Information Disclosure	Net asset value must be notified at least once a week	Net asset value must be notified every trading day

Source: from the website of Shenzhen Stock Exchange (http://www.szse.cn)

The open-end funds can be categorized into: stock funds, mixed funds and bond funds according to the different investment strategies.

Stock Funds are the funds which are primarily invested in stocks and the investment on stock is no less than 60%.The flexible stock mutual fund means that the proportion of the investment on stocks is more than 20%. Otherwise, it is called steady stock mutual fund.

Mixed funds: The mixed mutual fund invests in shares as well as in bonds and money market papers. Depending on the situation they can switch between the different investment types. The proportion of the investment on stock and debt is not in accordance with either stock or debt mutual fund.
Bond funds: are the funds which invest primarily in debt securities to provide current income with preservation of principal. The proportion of the investment on debt is no less than 80%. They are generally conservative in nature (except for high-yield bonds) and focus on paying dividends and preserving principal.

3.3. Main Evaluation in China

We will present two popular approaches for the evaluation of mutual fund performance in China, which are Morningstar and Value.

3.3.1. Morningstar

1. Morningstar ranks all the funds in China and the Morningstar ranking is published once a week. They have not classified the closed-end funds, but they do classify the open-end funds. They classify the open-end mutual funds according to the proportion of their investments on different assets so that the rating is only held among the same kind of mutual fund. It is important to note that the fund classification of Morningstar is usually based on the fund's prospectus. However, in some cases, Morningstar may define a fund type differently from that implied by the fund's name or by the fund's prospectus if Morningstar figures out that the fund invests in a way that is different from the meaning of its prospectus. The classifications of the mutual funds are shown in Table 3-2.

Table 3-2. The Classification Criterion for Open-end Fund

Fund Type	Discription
Stock funds	The funds which primarily invest in stocks and the investment on stock is no less than 60%
Bond funds	The funds which invest primarily in bond securities and the investment on bond is no less than 80%.
Mixed funds	The mutual fund invests in shares as well as in bonds and money market papers and don't match the criterion of stock and bond funds.
Money market funds	The funds that invests solely in money market instruments, such as Interest Rate Swaps, CDs, Bonds, T-bills, Treasuries.
Preserve Princiapl funds	The funds that can assure the principal for investor if the mutual funds can be held for some time.

Source: the website of Morningstar (http://cn.morningstar.com)

2. In the ranking of Morningstar, total return is used as the return measure; standard deviation and Morningstar risk are used to measure risk; Sharpe ratio is used to measure the fund performance. When calculate the returns of the mutual fund, Morningstar uses the monthly total return to measure the return of the mutual fund. The assumption is that the dividends will be reinvested and the tax and transaction fee are not taken into account. Morningstar ranks the fund from high return to low return. Standard deviation reflects the fluctuations of the returns. If the standard deviation is high, the investment is also risky. Morningstar risk measures the downside risk of some funds. If Morningstar risk is high, it also indicates the funds are risky. Sharpe ratio shows the excess returns of taking unit risk. The funds with high Sharpe ratio indicate the funds have better performance. Morningstar gives the funds a quartile ranking according to the standard deviation, Morningstar risk and Sharpe ratio respectively. See Table 3-3. Note: When calculate the Sharpe ratio, one year bank deposit rate is used as risk free rate.

Table 3-3. Quartile Ranking of Morningstar

Ranking	Standard Deviation	Morningstar Risk	Sharpe Ratio
The first 25%	High	High	High
The second 25%	Medium	Medium	Medium
The third 25%	Relatively low	Relatively low	Relatively low
The last 25%	Low	Low	Low

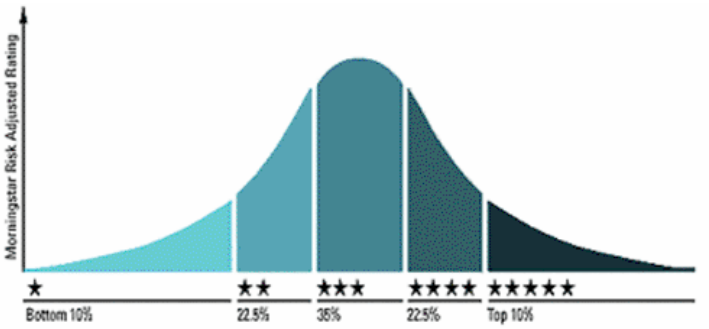
Source: the website of Morningstar (http://cn.morningstar.com)

3. Morningstar only rates the open end funds with more than one year of returns. Money market funds and preserve principal funds are not included. They publish their rating at the beginning of every month. They use the same method to calculate the total return. But use different adjusted risk to rating. The calculation of the risk-adjusted return is based on the expected utility theory. This theory assumes that the investors are risk-averse. This theory assumes that: (1) compared with the uncertain high return, the investors refer the foreseeable low income; (2) the investors want to give up part of the expected return to get the certain return. They construct a utility function in terms of the terminal value for every portfolio investment and get the value of expected utility and rank the mutual funds in terms of the value. Thus, if the returns of two mutual funds are equal, but the fluctuations of one mutual fund is bigger than another one, then some returns will be deducted from that mutual fund as a “penalty”. In other words, the adjusted return has eliminated the risk factor or we can say, the adjusted return was made when the risk was the same for all the mutual funds.

4. They rate the mutual funds with a five-star rating service based on the risk-adjusted returns. If the fund scores in the top 10% of its investment category, it receives a

rating of five stars; if the fund falls in the next 22.5%, it receives four stars; if it is in the middle 35%, it receives three stars; if it lies in the next 22.5%, the fund receives two stars and if it is in the last 10%, it receives only one star. This is shown in Figure3-1.

Figure 3-1.The Rating of Morningstar



Source: the website of Morningstar (http://cn.morningstar.com)

3.3.2. Value

There are many different funds in the market, such as stock funds, bond funds etc. It is unfair to just compare the returns of all the funds since different portfolios have different risks. For example, money market funds have a very low risk, while the expected return is also relatively low; though the expected return of the stock funds are high, the risk are also high. So Value also firstly classifies the mutual funds. According to the different portfolios of the mutual funds and the investment preference, they classify the mutual funds: Stock funds, balanced funds, bonds funds, preserve principal funds, money market funds, index funds. Moreover, they use different benchmarks to the different types of mutual funds. (See the website of Value www. valuegood.com)

The benchmarks of different funds:

1. Benchmark for all the closed-end funds, stock funds, index funds: 50% Shanghai Security Index + 30% Shenzhen Security Index + 20% Zhongxin Treasury Bond Index
2. Benchmark for bond mutual funds:
   Zhongxin Treasury Bond Index
3. Benchmark for balanced mutual fund: 40% Shanghai Security Index+30% Shenzhen Security Index+50% Zhongxin Treasury Bond Index.
4. Benchmark for money market funds: after tax interest rate of current deposit 0.72%
5. Benchmark for preserve principal funds: after tax interest rate of one year fixed deposit 1.8%.

Value Rating uses the excess rate of return over the benchmark as the rate of return. The risk is measured by the fluctuations of the excess rate of return. We can also call it standard deviation of the excess rate of return. For the comprehensive rating, Value Rating uses the Information ratio to rank the mutual funds. It depicts the excess return of unit risk. It is easy to tell that the higher Information ratio, the better performance the mutual funds have.

Similar to Morningstar, Value rating also uses star rating service to rank the mutual fund. If the fund lies in the top 10% of the investment category, it gets a rating of five stars; if the fund falls in the next 25%, it receives four stars; if it is in the middle 30%, it gets three stars; if it lies in the next 25%, the fund receives two stars and if it is in the last 10%, it receives only one star.

From comparison, we can find that both Morningstar and Value have different criteria in the classification of the funds. Even the same fund may be classified as the stock funds in Morningstar, but belongs to balanced funds in Value. Morningstar uses Sharpe ratio to rank, Value uses information ratio for rating as well as the different benchmarks for different types of funds. Moreover, their criteria for five-star rating is also different. However, even though there is much difference in the measurement of performance of funds, their idea when measuring performance is the same. Their steps are to first classify the funds, then calculate the returns and risk for all types of funds, and use the traditional measures to evaluate the performance of funds to rank and rating.

3.4. Some Chinese Empirical Studies

Here, we will introduce some empirical studies made by Chinese scholars, most of them were made before 2002. Wang (2000) investigates the performance of single fund and single fund management company under three different periods based on the Shanghai Stock Index, he finds that the performance is fairly different in the different periods, but after excluding the gain from the issuance of the new stock, the performance of funds is quite similar to the market. Shen & Huang (2001) use the three traditional measures to investigate whether the mutual funds can get extra gains. They also use T-M model, H-M model to analyse the market timing selection ability. By working on the weekly net asset growing value for the 70 traded funds between May 14, 1999 and March 23, 2001. They find that after adjusting the risk, 60% of funds are better than the performance of the funds portfolio, 70% of the funds do not have the noticeable market time-selection ability. Zhang & Du (2002) exclude the returns from the resale of new stock, then use three traditional measures to investigate the performance of 22 funds between Dec.31, 1999 and Sep 28, 2001. They find that no funds have a preferred ability for stock-selection and time-selection. There is some limitation to their research: the observable samples are small or the period is not long enough since the China mutual fund market only developed quickly during 2003; it can not eliminate its short-term fluctuation.

4. Methodology and Data

4.1. Methodology

In this paper, we test the normality of returns of China mutual funds and empirically analyze mutual funds performance by using different approaches. We use skewness, kurtosis and Jarque-Bera value to test whether the returns are normally distributed. We measure funds performance with three different approaches. Three traditional measures, Sharpe ratio, Treynor ratio and Jenson's alpha that are based on the mean-variance theory will be used. Sortino ratio which is based on the downside risk approach and benchmark-relative value at risk measurement which is based on VaR approach will be also introduced and used. Moreover, the negative excess return will be analyzed, and a useful method will be used to modify these measures and solve the problems derived from the negative excess return.

When we compare with the different approaches to measure the funds performance, virtually, this is also to compare the methods to measure the risk. Here, we will first state the risk. Mean-variance approach is based on the assumption that the returns are normally distributed. It takes the volatility or standard deviation as the risk. This standard deviation states both the upside risk and downside risk. However, in downside risk approach, it only considers the downside risk as the investor's real attitude to risk. VaR approach assesses risk by stating the probability of a loss that a portfolio may experience with a fixed time horizon.

4.1.1. The Methodology of Test Normality

A probability distribution shaped like a bell is often found in statistical samples. The distribution of the curve implies that for a large population of independent random numbers, the majority of the population often cluster near a central value, and the frequency of higher and lower values taper off smoothly. We use Eviews to test the distribution, so here we introduce the methods according to the explanation in Eviews. Skewness is a measure of asymmetry of the distribution of the series around its mean. Skewness is computed as:

$$S = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i - \bar{y}}{\hat{\sigma}}\right)^3 \qquad (4.1)$$

Where $\hat{\sigma}$ is an estimator for the standard deviation that is based on the biased estimator for the variance $\hat{\sigma} = s\sqrt{(N-1)/N}$. For a normal distribution, the skewness is zero. Positive skewness means that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail. By skewed left, it means that the left tail is heavier than the right tail, skewed right means that the right tail is

heavier than the left tail.

Kurtosis measures the peakness or flatness of the distribution of the series. Kurtosis is computed as

$$K = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i - \bar{y}}{\hat{\sigma}}\right)^4 \qquad (4.2)$$

Where $\hat{\sigma}$ is again based on the biased estimator for the variance. For the normal distribution, the kurtosis is 3. If the kurtosis exceeds 3, the distribution is peaked relative to the normal; if the kurtosis is less than 3, the distribution is flat relative to the normal.

Jarque-Bera is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. The statistic is computed as:

$$Jarque - Bera = \frac{N-k}{6}\left(S^2 + \frac{(K-3)^2}{4}\right) \qquad (4.3)$$

Where S is the skewness, K is the kurtosis, and N represents the number of estimated coefficients used to create the series.

Under the null hypothesis of a normal distribution, the Jarque-Bera statistic is distributed as χ^2 with 2 degrees of freedom. The reported probability is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis-a small probability value leads to the rejection of the null hypothesis of a normal distribution.

4.1.2. Three Traditional Measures

We use three traditional measures: Sharpe ratio, Treynor ratio and Jenson's alpha. We have introduced them in the theoretic part, now we use the history mean returns of portfolio to replace the expected portfolio returns in the standard formulas.

Sharpe ratio = $\dfrac{r_p - r_f}{\sigma_p}$ (4.4)

Treynor ratio = $\dfrac{r_p - r_f}{\beta_p}$ (4.5)

Jenson's alpha $\alpha_p = r_p - \left[r_f + \beta_p(r_m - r_f)\right]$ (4.6)

r_p Expected portfolio return

r_f Risk free rate

r_m Expected market return

β_p Beta of the portfolio

4.1.3. Sortino Ratio

Sortino ratio gives excess return per unit of risk, but uses downside semi-variance instead of total risk, the standard deviation of the portfolio. Where returns of a portfolio are not normally distributed, a better measure than standard deviation for measuring an investment's risk is its downside semi-variance or downside semi-standard deviation. A large Sortino ratio indicates a low risk of large losses occurring. Sortino & Robert (1991) use the lower partial moments to measure funds performance.

$$Sortino(\alpha,\tau) = \frac{r_p - \tau}{\sqrt[\alpha]{LPM_\alpha(\tau, r_p)}} \qquad (4.7)$$

$$LPM(\alpha,\tau) = \frac{1}{K}\sum_{t=1}^{k} Max\left[0, (\tau - r_p)^\alpha\right] \qquad (4.8)$$

Where r_p Expected portfolio return

τ Target return
α the level of investor risk tolerance, the degree of LPM
K The No. of observation

The α value includes all types of investor behavior. The LPM value α<1 captures risk seeking behavior. Risk neutral behavior is α= 1, while risk averse behavior is α> 1. The higher α value means the higher the risk aversion. In this paper, we assume the investors are risk averse, so we will choose α = 2, α = 3.Here, we have to mention that when α = 2 and also use the mean of portfolio as the target return, then LPM_2 is analogous to variance in that it is the squared deviations. Therefore, LPM_2 becomes the traditional semi-variance measure. When α = 3 and the target return equal to the mean of portfolio, then LPM_3 is analogous to skewness which is the trinal deviations. As a result, the LPM value will become larger with the increase of the level of investor risk tolerance (α). In our paper, the target return rate (τ), we use both risk free return and market return. So we get four ratios, Sortino (2, r_f), Sortino (2,r_m), Sortino (3, r_f), Sortino(3, r_m).

4.1.4. VaR Measurement

Murry (1999) gives the concept of Benchmark-relative value at risk (BRVaR), it is a summary risk statistic that expresses the VaR of a portfolio in relative terms as compared to its benchmark. There are simple BRVaR and correlated BRVaR. The former is simpler to calculate but ignores correlations between the portfolio and

benchmark. The latter reflects these correlations but creates a more cumbersome measurement problem. By using a one-day time horizon at a 5% level, he gets the formula to calculate them.

Simple BRVaR is calculated by subtracting the absolute VaR of the portfolio from that of the benchmark:

(1) $BRVaR^{Simple} = VaR_{Portfolio} - VaR_{Benchmark} = 1.65(\sigma_P - \sigma_B)$ (4.9)

The BRVaR will be negative if the benchmark is more volatile than the portfolio. The simple BRVaR method allows asset managers to compare worst-case days between the two portfolios but does not consider the possibility that those days will occur at the same time. To get better information about the likelihood of worst-case events occurring together, correlation must be taken into consideration.

To embed correlation estimates into the BRVaR calculation, the "correlated BRVaR" would be calculated as follows:

(2) $BRVaR^{Corrlated} = 1.65\sigma_{P\text{-}B}$ (4.10)

Where

$$\sigma_{P-B} = \sqrt{\sigma_P^2 + \sigma_B^2 - 2\sigma_{P-B}} \qquad (4.11)$$

In this paper, correlated BRVaR will be used to measure the funds performance. We also use both risk free return and market return as the target return. So we get the formulas as follows:

$$BRVaR\text{-}r_f = \frac{r_p - r_f}{BRVaR} \qquad (4.12)$$

$$BRVaR\text{-}r_m = \frac{r_p - r_m}{BRVaR} \qquad (4.13)$$

r_p Expected portfolio return

r_m Expected market return

BRVaR Benchmark-relative value at risk

Therefore, with the different target returns, we have two ratios: BRVaR-r_f and BRVaR-r_m, to compare with other ratios and measure funds performance.

4.1.5. Negative Excess Return

Since we use the historical returns to calculate the Sharpe ratio, sometimes it will result in a problem, which is about the negative excess returns. When the returns of funds are lower than the risk free return, the Sharpe ratios will be negative. The negative Sharpe ratios are difficult to interpret. For example, given two portfolios A and B, the excess returns of them are the same, with a negative value.

ER_A= -1%, ER_B = -1%

σ_A = 10%, σ_B= 20%

Then we can calculate the Sharpe ratios of portfolios A and B:

$SR_A = ER_A / \sigma_A$ = -1%/10 %= -0.1

SR_B= ER_B / σ_B = -1%/20%= -0.05

Since we are dealing with negative number here, -0.05 is a smaller than -0.1 and we get $SR_A < SR_B$. This means that portfolio B is better than portfolio A because it has a higher Sharpe ratio, even though portfolio B has larger volatility. As a result, it results in a dilemma.

McLeod &Vuuren (2004) state the Sharpe ratio arguably enjoys the greatest success and most widespread implementation. It has undergone several refinements and augmentations in its 37-year life, but the basic concept has survived remarkably intact and with few modifications. They believe the formulation works well when excess returns are positive, but a flaw arises when negative excess returns are used. However, they interpret that Sharpe ratios, is to measure the higher excess returns per unit of risk. Even in the case of negative excess, the Sharpe ratio can still be used because the choice should be based upon the maximum probability of outperforming the risk free return. It can also be interpreted by achieving a certain negative result with a larger volatility is better since the larger volatility implies that the probability is higher in achieving a positive return. It seems make sense, however, as an investor, they will never invest in assets with high volatility. It is not reasonable to rank the funds ignoring in the case of negative excess return, then, how to deal with this dilemma?

Israelsen (2005) provides a good method of dealing with the dilemma. By modifying the denominator, both Sharpe ratio and Information ratio (Treynor&Black,1973) provide correct rankings during periods of negative excess returns.

The Modified SR/IR = $\dfrac{ER}{SD^{(ER/absER)}}$ (4.14)

Where ER is the excess return (where excess return = asset return-risk free return to Sharpe ratio, and excess return = asset return-benchmark return to Information ratio)

SD is the standard deviation of ER, and abs is the absolute value.

The standard Sharpe ratio and Information ratio have been modified by adding an exponent to the denominator. The exponent is: excess return divided by the absolute value of excess return. When excess return is positive, the standard Information ratio is identical to the modified Information ratio. Likewise, when excess return is positive, the Sharpe ratio is identical, whether using the standard or the modified formula. When excess return is negative, the modified Information ratio and the standard Information ratio can be very different. Therefore, the results of ranking will be the same if the excess return is positive, but will be very different with the negative excess return. It is a good way to solve the difficulty; we also prove it is reasonable and true. Take the example that we use before, given two portfolios A and B,

ER_A= -1%, ER_B = -1%

σ_A = 10%, σ_B= 20%

Now we can calculate the Sharpe ratios of portfolios A and B by modifying the denominator.

$SR_A = ER_A /(\sigma_A \wedge (ER_{A/abs}\ ER_A)) = -1\%/10\%^{\wedge(-1)} = -0.001$

$SR_B = ER_B /(\sigma_B \wedge (\ ER_{B/abs}\ ER_B)) = -1\%/20\%^{\wedge(-1)} = -0.002$

The value -0.001 is a smaller than -0.002 so we get $SR_A > SR_B$. This means that portfolio A is better than portfolio B. Now we get the opposite answer with the first example. It also considers the volatility in the case of negative excess return. When the excess return is positive, then the modified Shape ratio is equal to the standard Sharpe ratio.

In this paper, we will use this method to modify all the ratios that have been used in ranking, such as Sharpe ratio, Treynor ratio, Sortino ratio, BRVaR measurement. Jenson' alpha has not been used in ranking since it is mainly used to analyze whether the returns of portfolio can beat the market or not.

4.2. Data

In China, the net asset values of open-end funds are required to be notified daily, and the closed-end funds are required to be notified at least once a week according to the Investment Fund Law. So we choose daily net asset value for open-up funds and weekly net asset value for closed-end funds. We get all of the history data including net asset value of funds and fund indices from Tianxiang Analysis System, which is very famous in China, and it has been admitted and adopted by many fund management companies. Tianxiang investment consulting company is one of the authority companies which can provide the Indices in security market.

4.2.1. The Sample

The first two closed-end funds Kai Yuan and Jin Tai were launched in 1998, by the end of 2000, the number of closed-end funds reached 33. However, the establishment of open-end funds was later than closed-end fund, even the first open-end fund that was launched in Sep, 2001. By the end of 2002, there were only 17 open-end funds. In 2003, there were many of open-end funds emerged; most of open-end funds were launched this year.

Generally speaking, the longer period of the funds will be more significant when evaluating its performance because it has eliminated the factors that will influence the performance, such as the manager's behavior or the occasional affairs. Before May in 2000, the policy factors existed to affect the performance of funds. At that time, the profit of funds companies was very high. According to the former research Wang (2000) and Zhang & Du (2002), when they evaluate the performance of China's funds, they exclude the extra profit. However, it is difficult to calculate them precisely. As a result, there is also some limitation for the previous researches. If they exclude these period, then there are only several funds to choose, the sample would be very small and it cannot represent the whole funds market, which would then will results in some other limitation.

In this paper, we distinguish between the open-end funds and closed-end funds in terms of their different characteristics and investment styles. We will not consider the period before 2000, since it cannot reflect the real performance of funds due to much policy benefit. We select the period for closed-end funds from 01/07/2001 to 30/06/2005, a period of four years which is also sufficient. Considering that open-end funds were established later, thus, the period for closed-end fund is from 01/07/2003 to 30/06/2005 which is two years. As a result, there are 36 closed-end funds selected and 27 open-end funds selected as the sample. Two tables have been listed including the basic information of these funds. It includes fund code, fund name, fund type, fund management company, custodian bank, date of go public or establishment, fund size, and the duration for closed-end funds. See Appendix 1 and 2.

When analyzing the empirical results, we classify the open-end funds as stock funds, mixed funds and bond funds. There are 5 bond funds, 5 mixed funds and 17 stock funds in the total sample open-end funds. We classify closed-end funds as large size funds (size $\geq$3 billion), medium size funds (1 billion$\leq$ size $\leq$2 billion) and small size funds (size $\leq$1 billion). There are 9 large size funds, 13 medium size fund and 14 small size funds in the sample.

4.2.2. The Calculation of Returns

There are two methods to calculate the rate of return of the net asset value, and these involve the formations of simple returns and continuously compounded returns.

Simple returns: $R_t = \frac{NAV_t - NAV_{t-1}}{NAV_{t-1}} \times 100\%$ (4.15)

Continuously compounded returns: $R_t = LN(\frac{NAV_t}{NAV_{t-1}}) \times 100\%$ (4.16)

In these two formulas: NAV_t denotes the net asset value at time t.
NAV_{t-1} denotes the net asset value at time t-1.
Ln denotes the natural logarithm
R_t denotes the return at time *t*

Here, the net asset value is the adjusted value after dividend. The data is only the trading days or the weekly data, so it will therefore be better to use continuously compounded returns.

In this paper, daily net asset value has been used for open-up funds and weekly net asset value for closed-end funds, so we also use the daily returns and weekly returns. Why did we choose them? This was for the purpose of precise calculation, especially we were also doing the empirical analysis using the downside risk approach. If we only choose the annual return rate, and the average return rate is positive, then it states that there is no downside risk. This would therefore mislead the investors. When we observe the daily or weekly data, it is easy to find the real volatility. As a consequence, the daily or weekly data can eliminate the calculation error; it is more reliable and reasonable.

4.2.3. Risk Free Rate

In theory, the risk-free rate is the minimum return an investor expects for any investment since he or she would not bear any risk unless the potential rate of return is greater than the risk-free rate. In practice, however, the risk-free rate does not exist as even the safest investments carry a very small amount of risk. In the US, the interest rate on a three-month treasury bill is often used as the risk free rate.

It is usual to use a one-year bank deposit rate as the risk free rate in China although there is a limitation because the bank deposit rate does not follow the market, but is decided by the government. According to most of the relative research, such as Shen & Huang (2001), Xu & Zhang (2004), they both use the one-year bank deposit rate as risk free rate. Because the China bond market is not mature, and the products are also few, it still cannot represent the real risk free rate. Moreover, the banks are under the protection of government in China, and to some extent, the bank deposit rate is less risky. Another important point is the main financial investment tools in China are Stocks, Bonds, Funds, and Bank deposit. Most of the investors in China are the private investors, usually they will choose bank saving as the alternative way otherwise they invest in the security market. Therefore，it is more reasonable to take the bank deposit rate as the free risk rate. In our paper, we choose the bank deposit rate for one year as the risk free rate.

Table 4-1. One-year Bank Deposit Rate

Period	Bank Deposit Rate for One Year
2004-10-29 to now	2.25%
2002-02-21 to 2004-10-28	1.98%
1996-06-10 to 2002-02-20	2.25%

Source: http://www.pbc.gov.cn/.

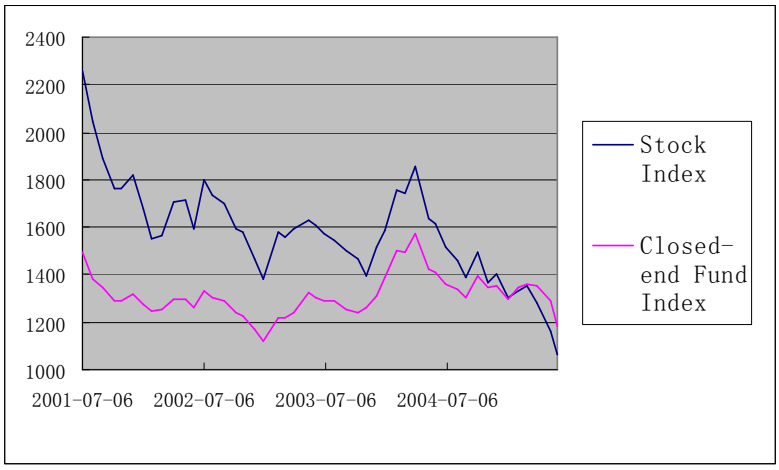
Table 4-1 shows one-year bank deposit rate, according to our sample and period, and we transform it to daily returns for open-end funds and weekly returns for closed-end funds and with separate period.

4.2.4. Benchmark

The separate benchmarks for open-end funds and closed-end funds have been used according to their different characteristics. There is no time limitation exists for open-end funds, but the investors can repurchase or redeem them at any time. Fund management companies and banks are the main trading places. The exchange price is decided according the net asset value, so it is highly related to the stock and bond market. There is a time limitation of existence for closed-end funds, but in this case investors cannot repurchase them until they have matured. They can buy or sell their funds at the Stock Exchanges. Therefore, the price is decided by the market, the demand and supply will have an important effect on the price. As a result, we also use different benchmarks to measure their performance. In our empirical analysis, when we mention to the market return, actually it is the benchmark return.

Tianxiang Closed-end Fund Index has been used as the benchmark for closed-end funds in our paper. This Index is a price index according to all exchange prices for closed-end funds, which reflects the whole trend of closed-end funds. Unlike the closed-end funds, which are listed in the stock exchange, and we can take the Fund Index directly as the benchmark, we need to compose a benchmark for open-end funds. According to the Investment Fund Law, 80% of assets held by the funds must be invested in stocks and corporate bonds, and at least 20% must be invested in government bonds. Shen & Huang (2001) has established a benchmark that is composed of 40% Shenzhen Stock Index, 40% Shanghai Stock Index and 20% Government Bond Index. In this paper, we will use the Tianxiang Mutual Fund Benchmark Index that is composed of 80% Tianxiang stock index and 20% Tianxiang government bond index. Next, two figures that show our benchmarks compared to the Stock Index.

Figure 4-1. Benchmark of Closed-end Funds Compared to Stock Index



From Figure 4-1, we can see that the stock index decreased sharply in the past four years. The stock index drop from about 2250 point to 1150 point. The Closed-end Fund Index is a little different from the Stock Index, since the closed-end funds are listed in the Stock Exchange and the price is decided by the demand and supply of the market.

Figure 4-2. Benchmark of Open-end Funds Compared to Stock Index

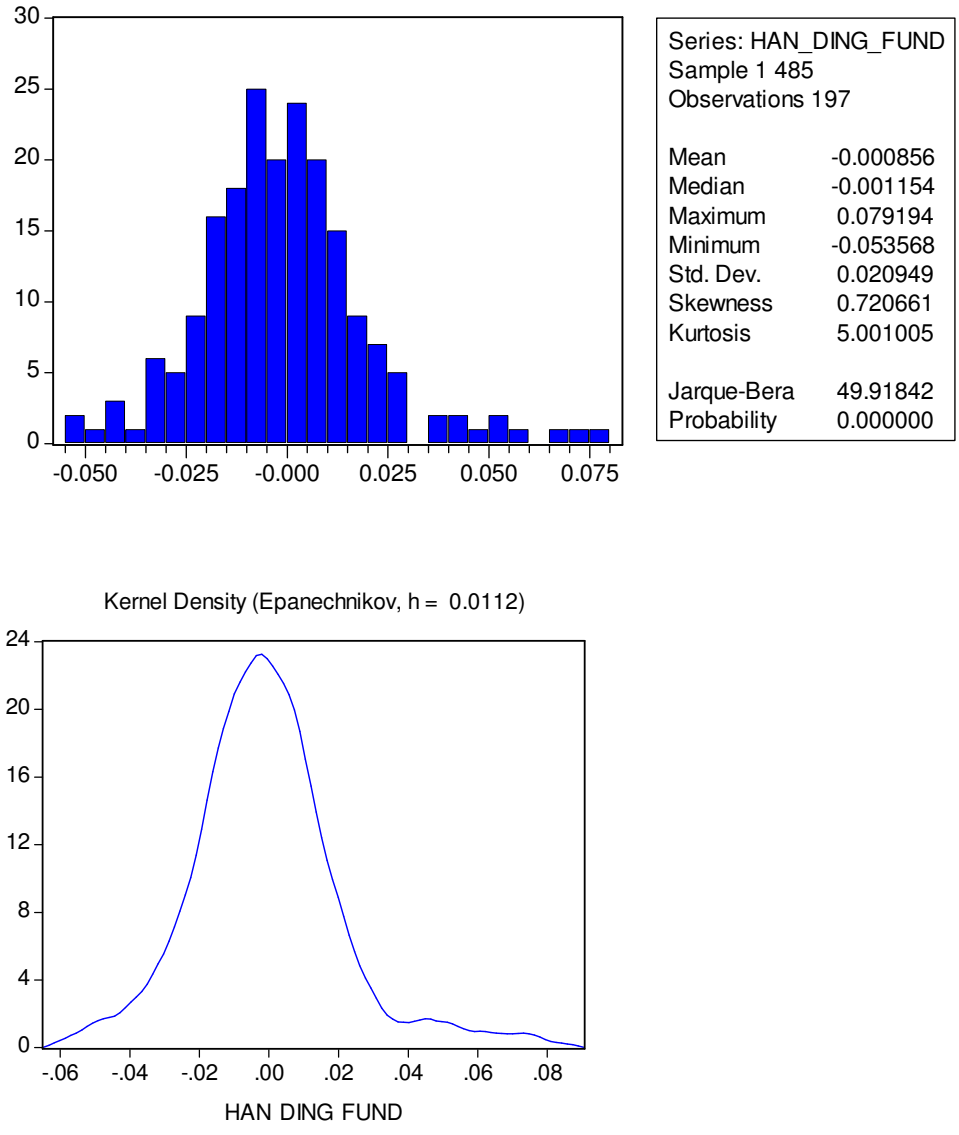
From Figure 4-2, we can see that the stock index decreased in the past two years. The stock index drops from about 1550 point to 1150point. There were increase trends between Nov. 2003 and March. 2004. The index increased from 1400 point to 1850 point. The Mutual Fund Benchmark Index had a similar trend but small fluctuation with stock index because this benchmark index is composed of 80% stock index and 20% government bond index.

5. Empirical Results & Analysis

5.1. The Test of Normality

We take one example to explain the test of normality.

Figure 5-1. Normality Test Results of Han Ding Fund



From Figure 5-1, we can see the skewness of Han Ding Fund is 0.72, it is positive. Kurtosis is 5.00, it is larger than 3. If the left hand tail is longer, skewness will be negative. If the right hand tail is longer, skewness will be positive. Obviously, for Han

Ding Fund, the skewness is positive, and it also has a right long tail. The kurtosis exceeds 3, the distribution is peaked. If the kurtosis is less than 3, the distribution is flat. Again, to this fund, the kurtosis is larger than 3, the distribution is peaked. Therefore, the returns of China Merchant Bond are not normally distributed, but skewed to the right and with "peaked" distribution. Further, Jarque-Bera is a test statistic for testing whether the series is normally distributed, the null hypothesis is the returns are normally distributed. If the standardized residual are normal distribution, then the value of Jarque-Bera is not significant. The theoretical value at 95 percent confidence level is 5.99, while the one at 99 per cent confidence level is 9.21.In this case, the value of JB is 49.92; it is very significant. So we reject the hull hypothesis, but get the conclusion that the returns of Han Ding Fund are not normally distributed. Moreover, the Probability value is very near to zero, so we also reject the null hypothesis. Therefore, we can find that the returns of Han Ding Fund are not normally distributed. We have tested all of the returns of funds with the same methods.

Table 5-1. Summary Statistics of Normality Test for Open-end Funds

	No. of Funds	Total Funds	Percentage
Skeness <0	8	27	29.63%
Skeness >0	19	27	70.37%
Kurtosis >3	27	27	100.00%
Jarque-Bera value >5.99	27	27	100.00%
Probability value<0.05	27	27	100.00%
Negative Skewness			
Stock Fund	2	17	11.76%
Mixed Fund	2	5	40.00%
Bond Fund	4	5	80.00%

From Table 5-1, we can see that all of the skewness is not equal to zero, and kurtosis is larger than 3. So the returns of open-end funds are not normally distributed. Further, all of the value of Jarque-Bera is larger than 5.99, which is the critical value at 5% confidence interval. All of the value of probability is lower than 0.05, so we can reject the null hypothesis. Therefore, we can conclude that all of the returns of open-end funds are not normally distributed.

There are 29.63% funds in which skewness is negative, this means the returns are skewed to the left, they are Bao Ying Hong Li, Da Cheng Value, Yin Hua Predominance, China Merchants Banlance, China Bond, Rong Hua Bond, China Merchants Bond. See Appendix 3. We pay more attention to the funds that have negative skewness, which is because negative skewness means more risk than the positive skewness. The negative skewness occurs when the values to the left of (less than) the mean are fewer but farther from the mean than are values to the right. For example: the return series of –30%, 5 %, 10%, and 15% has a mean of 0%. There is only one return less than zero percent, and three higher; but the one that is negative is

much farther from zero than the positive ones. So the negative skewness always indicates more risk. From the funds type, we find that there are 80% of bond funds have negative skewness, 40% of mixed funds and 11.76% of stock funds. Thus, we conclude that there is more risk with bond funds and mixed funds.

Table 5-2. Summary Statistics of Normality Test for Closed-end Funds

	No. of Funds	Total Funds	Percentage
Skeness <0	8	36	22.22%
Skeness >0	28	36	77.78%
Kurtosis >3	36	36	100.00%
Jarque-Bera value >5.99	36	36	100.00%
Probability value<0.05	36	36	100.00%
Negative Skewness			
Large Size Funds	1	9	11.11%
Medium Size Funds	4	13	30.77%
Small Size Funds	3	14	21.43%

From Table 5-2, we can see all of the skewness is not equal to zero, and kurtosis is larger than 3. Therefore, all of the returns of closed-end funds are also not normally distributed. Further, all of the value of Jarque-Bera is also larger than 5.99. All of the value of probability is lower than 0.05, so we can reject the null hypothesis. Therefore, we can also come to the conclusion that all of the returns of closed-end funds are not normally distributed.

There are 22.22% funds that have negative skewness, this means the series is skewed to the left, these funds are An Shun Fund, Xing Hua Fund, An Xin Fund, Tai He Fund, Tong Yi Fund, Ke Hui Fund, Ke Xiang Fund and Jin Sheng Fund (See Appendix 4). As stated in the part concerns open-end funds, these funds that have negative skewness have high risk. Therefore from the size of the funds, we find that there are 4 medium size funds, and 3 small size funds and only 1 large size fund. There are 30.77% medium size funds that have negative skewness, 21.43% for small size funds and 11.11% for large size funds. Thus, we conclude that there is more risk with small and medium size funds than with large size funds.

5.2. Mutual Fund Performance

Although we have tested the distribution which has proved not to be normally distributed, it is still important to measure funds performance using the three traditional measures. Firstly, they are easy to understand and accept by most investors. Secondly, they have been widely used to measure funds performance. Many of the companies or researches have used these measures. Thirdly, it provides a good way to compare the results. In this part, we use the three traditional measures and Sortino ratio and BRVaR measurement to evaluate China's mutual funds. We only choose the

Sortino (2, r_f) and BRVaR- r_f due to the fact that there are too many different ratios by change the target returns and the level of investor risk tolerance. All of these ratios take the excess return equal to the portfolio return minus risk free return. An analysis will be made in the next part about the comparison of different measures in order to find the difference under different ratios.

Table 5-3. The Performance of Open-end Funds

	No. of Funds	**Total Funds**	**Percentage**
Jenson's alpha >0	26	27	96.30%
Four Ratios >0	4	27	14.81%
Average yearly bank deposit return	2.07%		
Average yearly market return	-16.30%		
Average yearly return of funds	-2.41%		
First Four Funds	**Fund Type**	**Fund Management Company**	
Golden Eagle Growth	Stock Funds	Golden Eagle Asset Management Co.,Ltd	
China Southern Bond	Bond Funds	China Southern Fund Management Co.,Ltd	
Harvest Growth	Stock Funds	Harvest Fund Management Co.,Ltd	
E Fund Growth	Mixed Funds	E Fund Management Co.,Ltd	
Last Four Funds	**Fund Type**	**Fund Management Company**	
Bo shi Value	Mixed Funds	Bo Shi Fund Management Co.,Ltd	
Bao Ying Hong Li	Stock Funds	Bao Ying Fund Management Co.,Ltd	
Tian Tong 180	Stock Funds	Tian Tong Asset Management Co.,Ltd	
Golden Eagle Selection	Stock Funds	Golden Eagle Asset Management Co.,Ltd	

Table 5-3 shows the performance of open-end funds. The results of these four ratios: Sharpe ratios and Treynor ratios, Sortino (2, r_f) and BRVaR- r_f to the first four and last four funds are almost the same, although the ranking are a little different. There are only four funds that have positive values. This indicates that these four funds have good performance. They are Golden Eagle Growth, China Southern Bond, Harvest Growth and E Fund Growth, and the Fund Management Companies are Golden Eagle Asset Management Company, China Southern Fund Management Company, Harvest Fund Management Company and E Fund Management Company. We also list the last four funds, Boshi Value, Bao Ying Hong Li, Tian Tong 180 and Golden Eagle Selection.

There are 4 funds out of 27 funds that have the positive ratios, this indicates that 14.81% funds' returns are higher than the risk free return. There are 26 funds out of 27 that have positive Jenson's alphas, this indicates that 96.3% funds beat our benchmark. The details of the average yearly returns are also shown in the above table. The average bank deposit return is 2.07%, the average yearly market return or benchmark return is -16.3%, and the average yearly return of open-end funds is -2.41%. These values prove that the return from bank deposit is the highest, and the market return is bad. The negative market return is due to the depression of China's stock market

during the period. Although the average returns of open-end funds are also negative, but compared to the stock market, it is easy to find that their portfolios can diversify the risk efficiently, and beat the market.

From Appendix 5, we can see that the ranking of Sharpe ratios, Treynor ratios, Sortino ratios and BRVaR ratios are not much different although they use different risk measures. The first eleven are the same with Sharpe ratios and Treynor ratios. Sharpe ratio uses total risk σ as a risk measure, while Treynor ratio assumes that the unsystematic risk is already totally diversified, it only considers the systematic risk, use β to measure the risk. Therefore, if unsystematic risk has been diversified, then the total risk equals the systematic risk, which indicates that Sharpe ratio is the same with Treynor ratio. The specific analysis to other ratios will be done in the part of comparison with different measures. All of the values of the ratios are different although they produce the similar ranking results.

From Appendix 5, we can also see that bond funds have better performance than stock funds and mixed funds. All of the bond funds are ranked in the first ten funds. When observing the last four funds, they all belong to stock funds and mixed funds. We can therefore conclude that the bond funds have better performance. We think the results are because of the depression of the stock market, thus the stock funds performance is not good, and bond funds performance is better than stock funds and mixed funds.

Table 5-4. The Performance of Closed-end Funds

	No. of Funds	**Total Funds**	**Percentage**
Jenson's alpha >0	15	36	41.67%
Four Ratios >0	3	36	8.33%
Average yearly bank deposit return	2.07%		
Average yearly market return	-4.22%		
Average yearly return of funds	-4.81%		
First Three Funds	**Size**	**Fund Management Company**	
Ke Hui Fund	Small SizeFunds	E Fund Management Co.,Ltd	
Ke Xiang Fund	Small SizeFunds	E Fund Management Co.,Ltd	
Ke Xun Fund	Small SizeFunds	E Fund Management Co.,Ltd	
Last Three Funds	**Size**	**Fund Management Company**	
An Xin Fund	Medium Size Funds	Hua An Fund Management Co.,Ltd	
Tong Yi Fund	Medium Size Funds	Chang Sheng Fund Management Co.,Ltd	
Tai He Fund	Medium Size Funds	Harvest Fund Management Co.,Ltd	

Table 5-4 shows the performance of closed-end funds. The results of these four ratios to the first three and last three funds are almost the same, although the ranking is a little different. There are only three funds that have positive values. They are Ke Hui Fund, Ke Xiang Fund and Ke Xun Fund. Obviously, these three closed-end funds have excellent performance compared with other funds. We find that the first three

funds are all from E Fund Management Company. When we look at the above table, the “E Fund Growth” which also belongs to E Fund Management Company, has good performance in open-end funds. Obviously, E Fund Management Company is the best fund management company to achieve good performance. The last three funds are An Xing Fund, Tong Yi Fund and Tai He Fund.

There are 3 funds out of 36 funds have the positive ratios , which indicates that 8.33% funds’ returns are higher than the risk free return. There are 15 funds out of 36 that have positive Jenson’s alphas, this indicates that 41.67% funds beat the benchmark. The details of the average returns have also been shown in the above table. The average yearly bank deposit return is 2.07%, the average yearly market return or benchmark return is -4.22%, and the average yearly return of open-end funds is -4.81%. These values prove that the return from bank deposit is the highest, and the market returns and funds returns are negative. Moreover, we also find that the average returns of closed-end funds are lower than market returns. Here, we cannot say the performance of closed-end funds is worse than open-end funds since we use different benchmarks. The benchmark to the closed-end funds is the Tianxiang Closed-end Fund Index, which reflects the whole closed-end funds market.

From Appendix 6, we can also see that the ranking of Sharpe ratios, Treynor ratios, Sortino ratios and BRVaR ratios are not much different although they use different risk measures. We can see that the first eight are the same with Sharpe ratios and Treynor ratios, the others are only a little different. So the ranking between Sharpe ratios and Treynor ratios are not much different. The specific analysis to other ratios will also be shown in the part of comparison with different measures.

From Appendix 6, we also can see that the small size funds have better performance than medium and large size funds. In the total sample of closed-end funds, there are 9 funds that belong to large size funds, 13 funds belong to medium size funds, and 14 funds belong to small size funds. However, we can see the first five funds are all in small size funds, and the others are also ranked before. Therefore, the small size funds have better performance. When observing the last three funds, they are all medium size funds. Moreover, the large size funds performance is also not good. We therefore conclude that the small size funds have better performance. We think that this is due to the flexibility for small size funds.

5.3. A Comprehensive Comparison

In this part, Sharpe ratio, Sortino (2, r_f), Sortino(2, r_m), Sortino (3, r_f), Sortino(3, r_m) and BRVaR-r_f and BRVaR-r_m are calculated, see the results of ranking in Appendix 7 and 8.

5.3.1. The Results of Open-end Funds

Sortino ratios

From Appendix 7, we find that the ranking between Sortino (2, r_f) and Sortino (3, r_f) are closed, the ranking between Sortino (2, r_m) and Sortino (3, r_m) are closed. Such as Fullgoal Dynamic, it is at the sixth under Sortino (2, r_m) and Sortino (3, r_m), but it changed to the sixteenth with the measures of Sortino (2, r_f), and twelfth with measure of Sortino (3, r_f). Here, we can see the choice of target return has an import effect on the results of ranking. With the different target return, the results are much different. When we choose $\alpha = 2$ or 3, the results of ranking are a little different, but still closed. Therefore, we think the level of investor risk tolerance is not significant to the results of ranking when we have assumed the investors are risk aversion. Moreover, we also see that the funds ranked last almost have no change despite any measures used.

Sharpe ratio and Sortino (2, r_f), Sortino (3, r_f), BRVaR-r_f

All of these ratios take risk free return as the target return. From the results, we can find that the ranking is only a little changed with the Sharpe ratio and Sortino (2, r_f), Sortino (3, r_f), BRVaR-r_f. So we judge that the different risk measures among standard deviation, LPM and BRVaR have not significant effect on the results of ranking.

Sharpe ratio and Sortino (2, r_m), Sortino (3, r_m), BRVaR-r_m

All of these ratios take market return as the target return. From the results, we find that the ranking changes a lot with the Sharpe ratio and Sortino (2, r_m), Sortino (3, r_m), BRVaR-r_m. When combining with the above analysis, it is easy to find that is because Sharpe ratio use risk free return, but other ratios use market return. Therefore, we find the choice of target return has an important effect on ranking. The results of Sortino (2, r_m), Sortino (3, r_m) and BRVaR-r_m are not much different because they use the same target return. Again, we find that the risk measures among these three different approaches have no significant effect on ranking. Moreover, we also see that the funds ranked last almost have not changed despite any measures used.

BRVaR measures

From the results, we find that the ranking changes a lot when using BRVaR-r_f and BRVaR-r_m. Again, it is easy to see that target return has significant effect on the results of ranking. There is no change in the funds ranking last despite any measures used.

To sum up, the choice of target returns has significant effect on the ranking to open-end funds with different measures. The choice of the level of investor risk tolerance has not significant to the results of ranking when we have assumed that the

investors are risk aversion. For the choice of risk measures, there is not much difference on ranking under MV, LPM and VaR approaches. Moreover, the funds ranked last almost have no change despite any measures used.

Sortino & Satchell (2001) state when downside risk is calculated in the correct manner, it actually captures the risk of this market better than the traditional mean standard deviation analysis. However, in this paper, the results of ranking of Sharpe ratio and Sortino ratios when taking risk free return as the target return are closed, but they use the different risk measures. This indicates the risk measurement between mean-variance and downside-risk approaches are not critical to the ranking. We think this is because most of the excess returns of funds are negative, thus the measures between standard deviation and downside risk are closed. Therefore, the ranking between these two measures will not be significant.

5.3.2. The Results of Closed-end Funds

From Appendix 8, we can see that there is not much difference in the results of ranking among all the ratios. Although there is a little difference in ranking for some funds, these measures have no significant effect on the results. This indicates the choice of target return, the level of investor risk tolerance and risk measures have no important effect on the results of ranking.

It is interesting that this conclusion is a little different from that of open-end funds. We conclude that target returns have a significant effect on the ranking of open-end funds, but it is not the case for closed-end funds. We think this is due to the different benchmarks have been used for these two funds. As we stated before, most the Sharpe ratios of these two types of funds are negative. However, the Jenson's alphas of open-end funds are almost positive, but less than 50% of closed-end funds are negative. When choosing market return, which will result in greater positive excess returns for open-end funds, but greater negative excess returns for closed-end funds. Then, the excess of returns for open-end funds will change a lot when risk free returns or market returns used. However, for closed-end funds, most of them are still negative despite risk free returns or market returns are used. All of the funds that have positive excess returns will all rank at the top. Therefore, the choice of target returns will have a significant effect on ranking to open-end funds. As a result, the results of ranking of open-end funds are affected by the choice of target returns, but not for closed-end funds.

5.4. Efficient Frontier

For doing a compensative comparison with these three approaches, we construct the efficient frontier to investigate their differences. We use the bond index and closed-end funds index to construct the efficient frontier. When $\alpha = 2$, and also use the mean of portfolio as the target return, LPM_2 becomes the traditional semi-variance

measure. Under the normal distribution, MV approach and $MLPM_2$ approach will have the same efficient frontiers. Therefore, firstly, we test the normality of returns of bonds, funds and the portfolio with 50% bonds and 50% funds.

Table 5-5. Results of Normality Test

	Rbond	Rfund	Rp
Skewness	-1.86	1.15	1.06
Kurtosis	18.39	8.78	8.38
Jarque-Bera	6256.03	966.29	833.43
Probability	0.00	0.00	0.00

From Table 5-5, we can see that all of the skewness is not equal to zero, and kurtosis is larger than 3. Further, form the values of Jarque-Bera, they are very significant, and the probability values are also zero. Therefore, we reject the null hypothesis, and make the conclusion that all of the returns are not normally distributed.

We use bond index and closed-end fund index to create a portfolio, to make a fair comparison, we only use the $MLPM_2$ risk measure and take the means of portfolios as the target returns, because it is like variance, is a second-order measure in which deviations from some return level are being squared. For the VaR approach, we only choose the simple method to calculate, the VaR value is equal to $1.65*\sigma$ at 95% confidence interval.

Figure 5-2. Efficient Frontiers with Three Different Approaches

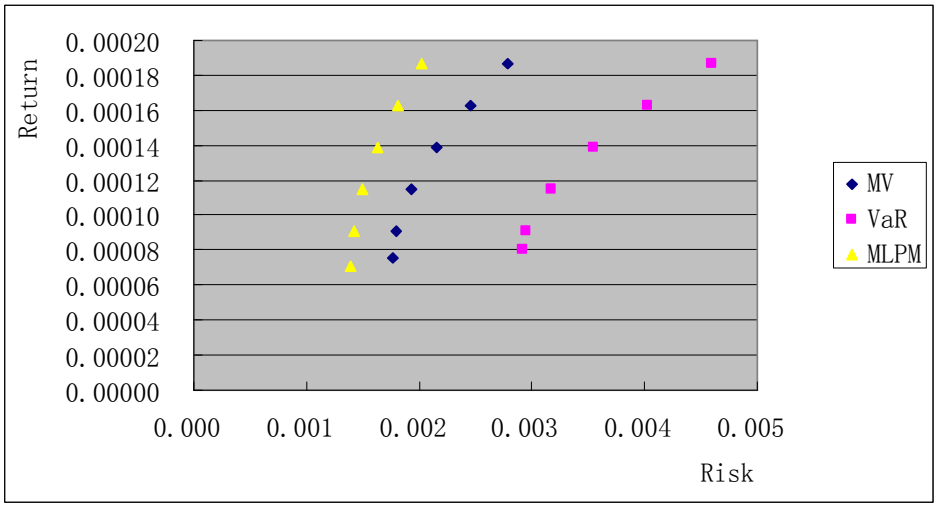


Figure 5-2 shows the efficient frontier with these three approaches. Since we have tested that the returns of bonds and funds are not normally distributed, we can also see that the efficient frontiers of $MLPM_2$ and MV are not coincide. We can find that

$MLPM_2$ efficient frontier lies outside, MV efficient frontier is inside of $MLPM_2$ opportunity se and VaR efficient frontier is inside of MV opportunity set. Therefore, we conclude that $MLPM_2$ approach is most efficient, then MV approach, at last is VaR approach because with the same level of expected return, $MLPM_2$ approach provided more downside protection than those determined using a MV and VaR approaches. Hallow(1991) also come to the conclusion that MV efficient frontier lies inside the $MLPM_2$ opportunity set, and $MLPM_2$ model is more efficient than MV model.

The VaR approach, to a great extent, is decided by the confidence interval. In our case, it is 95% confidence interval. And the critical value is 1.65 with one side. However, if we choose 80% confidence interval, then the critical value is 0.84, as a results, we can come to the conclusion that VaR is outside of the MV opportunity set. However, we think it is not meaningful to have a lower confidence interval, since a higher confidence interval has been usually required.

From the analysis of efficient frontier, we can see that these three approaches are very different. The MLPM approach is more efficient than MV and VaR approaches. Since MLPM approach can lower risk while keeping even improving upon the level of expected returns offered by MV and VaR approaches. Therefore, MLPM approach offers the potential for portfolios that are more attractive than MV and VaR approaches.

From the test to the all returns series, we find all of them are not normally distributed. From the analysis of efficient frontiers, we also find MLPM approach is more efficient. Therefore, the downside risk approach would be better to measure the real risk. However, from the point view of ranking, we cannot find that there is a significant effect on ranking with these three approaches.

5.5. Summary to the Results

From the results of test of normality, we find that all of the returns of open-end funds and closed-end funds are not normally distributed. With open-end funds, there are 29.63% of funds in which their skewness skewed to the left. Most of these are bond and mixed funds. Whereas with closed-end funds, there are 22.22% of funds skewed to the left. Most of them are small and medium size funds.

From the results of mutual funds performance, to open-end funds, there are 4 funds out of 27 funds that have the positive ratios, this indicates that 14.81% funds' returns are higher than the risk free return. There are 26 funds out of 27 that have positive Jenson's alphas, this indicates that 96.3% funds beat the market. We think that the performance of open-end funds is good when compared to our benchmark which is composed of 80% stocks and 20% government bonds. There is not much difference in the ranking between Sharpe ratios and Treynor ratios. Moreover, the bond funds have better performance than stock funds and mixed funds.

Regarding to closed-end funds, there are 3 funds out of 36 funds that have the positive ratios, which indicate that 8.33% funds' returns are higher than the risk free return. There are 15 funds out of 36 that have positive Jenson's alphas, this indicates that 41.67% funds beat the average performance of closed-end funds. E Fund Management Company has achieved the best performance. The ranking results of Sharpe ratios and Treynor ratios are closed. Moreover, we also reach our conclusion that the small size funds have better performance.

From the results of comparison with different measures, we find that with open-end funds, the choice of target returns has significant effect on the ranking with different measures. But the choice of the level of investor risk tolerance is not significant to the results of ranking when we have assumed the investors are risk aversion. For the choice of risk measures, there is not much difference in ranking under MV, LPM and VaR approaches. Moreover, the funds ranking last almost have no change despite any different measures used.

There is not much difference in the results of ranking among all the ratios with closed-end funds. Therefore the choices of target returns, the level of investor risk tolerance and risk measures have no significant effect on the ranking. We think that the different results about the effect of target returns are because the different benchmarks have been used. The choice of target returns has a significant effect to open-end funds is due to the greater positive excess returns produce when choosing market returns as the target returns. However, when risk free returns have been used, it produces more negative returns. There is not much difference with closed-end funds despite risk free returns or market returns are used.

From the analysis of efficient frontier, we can see that these three approaches are very different. $MLPM_2$ efficient frontier lies outside, MV efficient frontier is inside of the $MLPM_2$ opportunity set, and VaR efficient frontier is inside of MV opportunity set. Therefore, the MLPM approach is more efficient than MV and VaR approaches because it provides more downside protection.

6. Conclusions

In this paper, we investigate the performance of China's mutual funds in the past several years by using mean-variance, downside-risk and value-at-risk approaches. We find that most of the Sharpe ratios, Treynor ratios, Sortino ratios and VaR measures are negatively rather than positively signed because of the depression of China's stock market during the period. There are 14.81% open-end funds' returns that are higher than the risk free return for open-end funds, and 8.33% closed-end funds' returns are higher than the risk free return. There is not much difference both open-end funds and closed-end funds in the ranking between Sharpe ratios and Treynor ratios.

For open-end funds, the funds performance is better than our benchmark index, which is composed of 80% stocks and 20% government bonds. So we think that portfolios of open-end funds can well diversify the risk, and the performance is good. The bond funds have better performance than stock and mixed funds. Regarding closed-end funds, there are 15 funds out of 36 that have positive Jenson's alphas, this indicates that 41.67% of funds beat the average performance of closed-end funds. E Fund Management Company has achieved the best performance. We also come to our conclusion that the small size funds have better performance.

The different results about the effect of target returns between open-end funds and closed-end funds are due to the different benchmarks are used, then it results the different market returns. When choose market returns as the target returns, the excess returns will be very different between these two types of funds. Obviously, the funds that have positive excess returns will always rank in the top even in different measure. We therefore can see the ranking on open-end funds changes a lot with different measures. However, this is not the case to closed-end funds, so the ranking results of closed-end funds are the real results when we judge the different measures to funds. As a result, from our empirical analysis we compare the Sharpe ratio with other measures evaluating the performance, we think the different measures have no significant effect on the ranking results of China mutual funds.

Although there are many theoretic advantages for downside risk, such as it is not based on the normal distribution and only taking the loss as the real attitude to the risk. We also find that all the returns series is not normally distributed and from the analysis of efficient frontier, we can also see that the asset allocation under MLPM approach is the more efficient and it provides more downside protection than MV and VaR approaches. Intuitively, the MLPM approach should be better than other approaches to measure funds performance, but it will not affect the results of ranking. All performance measures produce similar rankings and thus result in an identical evaluation of the investments whatever which of the considered performance measures one chooses to evaluate the funds performance. There is no significant

effect on ranking despite any different measures used.

One limitation of our paper is that most returns of funds are negative, and so are the excess returns. Maybe this is the reason that we have the evidence that all of the measures have no significant effect on our sample funds. Especial for the results between MV and downside-risk approaches. We can try to analyze the funds performance with different measures by using the data from another country, and make a comparison to China in our future research.

References

Articles:

1. Bawa, Vijay S. (1975), "Optimal Rule for Ordering Uncertain Prospects." *Journal of Financial Economics*,2, pp.95-121.
2. Dowd, K (1999), "A Value at Risk Approach to Risk-return Analysis." *The Journal of Portfolio Management*, pp. 60-67.
3. Fiserburn, P. C. (1977), "Mean-risk Analysis with Risk Associated with Below-target Returns." *The American Economic Review*, 67, pp.116-126.
4. Grootveld,H.& Hallerbach, W. (1999), "Variance vs. Downside risk: Is there Really That Much Difference? " *European Journal of Operational Research*, 114, pp. 304-309.
5. Harlow, W.V. (1991), "Asset Allocation in A Downside-Risk Framework." *Financial Analysis Journal*, Sept.-Otc, pp. 28-40.
6. Israelsen, Craig L. (2005), "A Refinement to the Sharpe Ratio and Information Ratio." *Journal of Asset Management*, Vol 5, Number 6, April 2005, pp. 423-427.
7. Jensen, M. (1968), "The Performance of Mutual Funds in The Period 1945-1964." *Journal of Finance*, Vol.23, pp. 389-416.
8. Jorion, Pillippe., "Value at Risk: The New Benchmark for Controlling Market Risk", Mcgra w—hill. 1997.
9. Markowitz, Harry M.,(1952) "Portfolio Selection." *The Journal of Finance*, 7(1), pp.77-91.
10. Markowitz, Harry M. (1956)"The Optimization of a Quadratic Function Subject to Linear Constraints." Naval Research Logistics Quarterly, v3, 111-133.
11. Markowitz, Harry M., "Portfolio Selection. (First Edition). New York: John Wiley and Sons, 1959
12. McLeod & Vuuren (2004), "Interpreting The Sharpe Ratio When Excess Returns Are Negative." *Investment Analysis Journal*. No.59, pp.15-20.
13. Murry, Scott(1999), "Benchmark-relative Value at Risk." *Derivatives Quarterly*, Summer, pp.37-45.
14. Nawrocki, David N.(1999), "A Brief History of Downside Risk Measures." J*ournal of Investing*, Fall, pp.9-25.
15. Rom, Brian M. & Ferguson, Kathleen W. (1994), "Post-Modern Portfolio Theory Comes of Age." *The Journal of Investing*, Fall, pp.11-17.
16. Roy, Andrew D. (1952), "Safety First and the Holding of Assets." *Econometrics* 20, pp. 431-449.
17. Sharpe. W, (1964), "Capital Asset Prices: A Theory of Market Equilibrium." *Journal of Finance*, pp. 425-442
18. Sortino, Frank A. & Robert Van Der Meer (1991), "Downside Risk." J*ournal of Portfolio Management,* 17(4), pp.27-32.
19. Sortino Frank A. & Satchell Stephen E., "Managing Downside Risk in Financial

Markets: Theory, Practice and Implementation." First published 2001.
20. Silver, Lloyd (1993), "Risk Assessment for Security Analysis." *Technical Analysis of Stocks and Commodities*, January 1993, pp.74-79.
21. Treynor,J.L.(1965)., How to Rate Management Investment Funds." *Harvard Business Review*, Jan/Feb 1965, Vol, pp.63-75.
22. Treynor, J. L. & Black, F. (1973) 'How to Use Security Analysis to Improve Portfolio Selection', *Journal of Business*, 46, January, pp.66–88.

Chinese Articles:

1. China Merchants Securities, "Mutual Fund Factbook of China", *Fund Research*, 2005.(2).
2. Shen Weitao & HuangXingluan (2001), "An Empirical Research to Funds Performance." *Economics Research Journal*，2001.(9).
3. Wang Zhicheng (2000), "A Comparison of Funds Performance Measures." *Journal of Finance and Economics*, 2000.(3).
4. Xu Yonghong & Zhang Yang (2004), "The Effect of Time Selection to Mutual Funds Performance" *Securities Market Herald*, 2004.(10).
5. Zhangxin & Du Shuming (2002)，"Can China's Mutual Funds Performance Beat Market?" *Journal of Finance*，2002.(1).

Internet Sources:

http://www.cnfund.cn/
http://www.chinafund.cn
http://www.pbc.gov.cn/
http://cn.morningstar.com/
http://www.valuegood.com/

Appendixes

Appendix 1 –The Basic Information of China's Closed-end Funds

Serial No.	Fund Code	Fund Name	Fund Type	Fund Management Company	Custodian Bank	Date of go public	Place of Listing	Maturity	Scale billion
1	184688	Kai Yuan Fund	Stock-Growth Fund	China Southern Fund Management Co.,Ltd	ICBC	1998-4-7	SZSE	15	2.0
2	500001	Jin Tai Fund	Stock-Balance Fund	Guo Tai Asset Management Co.,Ltd	ICBC	1998-4-7	SHSE	15	2.0
3	500008	Xing Hua Fund	Stock-Growth Fund	China Fund Management Co.,Ltd	CBC	1998-5-8	SHSE	15	2.0
4	500003	An Xin Fund	Stock-Growth Fund	Hua An Fund Management Co.,Ltd	ICBC	1998-6-26	SHSE	15	2.0
5	500006	Yu Yang Fund	Stock-Balance Fund	Bo Shi Fund Management Co.,Ltd	ABC	1998-7-30	SHSE	15	2.0
6	184689	Pu Hui Fund	Stock-Growth Fund	Peng Hua Fund Management Co.,Ltd	BCs	1999-1-27	SZSE	15	2.0
7	500002	Tai He Fund	Stock-Balance Fund	Harvest Fund Management Co.,Ltd	CBC	1999-4-20	SHSE	15	2.0
8	184690	Tong Yi Fund	Stock-Growth Fund	Chang Sheng Fund Management Co.,Ltd	ICBC	1999-4-21	SZSE	15	2.0
9	184691	Jin Hong Fund	Stock-Growth Fund	Da Cheng Fund Management Co.,Ltd	BC	1999-5-18	SZSE	15	2.0
10	500005	Han Sheng Fund	Stock-Growth Fund	Fullgoal Fund Management Co.,Ltd	ABC	1999-5-18	SHSE	15	2.0
11	500009	An Shun Fund	Stock-Balance Fund	Hua An Fund Management Co.,Ltd	BCs	1999-6-22	SHSE	15	3.0
12	184692	Yu Long Fund	Stock-Growth Fund	Bo Shi Fund Management Co.,Ltd	ABC	1999-6-24	SZSE	15	3.0
13	184693	Pu Feng Fund	Stock-Index Fund	Peng Hua Fund Management Co.,Ltd	ICBC	1999-7-30	SZSE	15	3.0
14	500018	Xing He Fund	Stock-Index Fund	China Fund Management Co.,Ltd	CBC	1999-7-30	SHSE	15	3.0
15	184698	Tian Yuan Fund	Stock-Growth Fund	China Southern Fund Management Co.,Ltd	ICBC	1999-9-20	SZSE	15	3.0
16	184695	Jing Bo Fund	Stock-Growth Fund	Da Cheng Fund Management Co.,Ltd	ABC	1999-10-22	SZSE	15	1.0
17	500007	Jing Yang Fund	Stock-Growth Fund	Da Cheng Fund Management Co.,Ltd	ABC	1999-10-22	SHSE	15	1.0
18	500016	Yu Yuan Fund	Stock-Growth Fund	Bo Shi Fund Management Co.,Ltd	ICBC	1999-10-28	SHSE	15	1.5
19	184699	Tong Sheng Fund	Stock-Balance Fund	Chang Sheng Fund Management Co.,Ltd	BC	1999-11-26	SZSE	15	3.0
20	500011	Jin Xin Fund	Stock-Growth Fund	Guo Tai Asset Management Co.,Ltd	CBC	1999-11-26	SHSE	15	3.0
21	184701	Jing Fu Fund	Stock-Index Fund	Da Cheng Fund Management Co.,Ltd	ABC	2000-1-10	SZSE	15	3.0
22	500015	Han Xing Fund	Stock-Balance Fund	Fullgoal Fund Management Co.,Ltd	BCs	2000-1-10	SHSE	15	3.0
23	184696	Yu Hua Fund	Stock-Growth Fund	Bo Shi Fund Management Co.,Ltd	BCs	2000-4-24	SZSE	15	0.5
24	184702	Tong Zhi Fund	Stock-Growth Fund	Chang Sheng Fund Management Co.,Ltd	BC	2000-5-15	SZSE	15	0.5
25	184705	Yu Ze Fund	Stock-Growth Fund	Bo Shi Fund Management Co.,Ltd	ICBC	2000-5-17	SZSE	15	0.5
26	184703	Jin Sheng Fund	Stock-Growth Fund	Guo Tai Asset Management Co.,Ltd	CBC	2000-6-30	SZSE	10	0.5
27	500010	Jin Yuan Fund	Stock-Growth Fund	China Southern Fund Management Co.,Ltd	ICBC	2000-7-11	SHSE	15	0.5
28	184708	Xing Ke Fund	Stock-Growth Fund	China Fund Management Co.,Ltd	BCs	2000-7-18	SZSE	15	0.5
29	500021	Jin Ding Fund	Stock-Growth Fund	Guo Tai Asset Management Co.,Ltd	CBC	2000-8-4	SHSE	10	0.5
30	500025	Han Ding Fund	Stock-Growth Fund	Fullgoal Fund Management Co.,Ltd	ICBC	2000-8-17	SHSE	15	0.5
31	184718	Xing An Fund	Stock-Growth Fund	China Fund Management Co.,Ltd	BC	2000-9-20	SZSE	15	0.5
32	500035	Han Bo Fund	Stock-Growth Fund	Fullgoal Fund Management Co.,Ltd	CBC	2000-10-17	SHSE	15	0.5
33	184710	Long Yuan Fund	Stock-Balance Fund	China Southern Fund Management Co.,Ltd	ICBC	2000-10-18	SZSE	15	0.5
34	184712	Ke Hui Fund	Stock-Growth Fund	E Fund Management Co.,Ltd	BCs	2001-6-20	SZSE	15	0.8
35	184713	Ke Xiang Fund	Stock-Growth Fund	E Fund Management Co.,Ltd	ICBC	2001-6-20	SZSE	15	0.8
36	500029	Ke Xun Fund	Stock-Growth Fund	E Fund Management Co.,Ltd	BCs	2001-6-20	SHSE	15	0.8

CBC-Construction Bank of China
ICBC-Industrial and Commercial Bank of China
BC-Bank of China
ABC-Agriculture Bank of China
BCs-Bank of Communications
CMB-China Merchants Bank
CEB-China Everbright Bank
SZSE-Shenzhen Stock Exchange
SHSE -Shanghai Stock Exchange

Appendix 2 –The Basic Information of China's Open-end Funds

Serial No.	Fund Code	Fund Name	Fund Type	Fund Management Company	Custodian Bank	Date of Establishment	Initial Scale billion
1	040001	Hua An Creation	Stock Fund	Hua An Fund Management Co.,Ltd	BCs	2001-9-21	5.00
2	202001	China Southern Growth	Stock Fund	China Southern Fund Management Co.,Ltd	ICBC	2001-9-28	3.49
3	000001	China Growth	Stock Fund	China Fund Management Co.,Ltd	CBC	2001-12-18	3.24
4	020001	Golden Eagle Growth	Stock Fund	Guo Tai Asset Management Co.,Ltd	BCs	2002-5-8	2.23
5	206001	Peng Hua Growth	Stock Fund	Peng Hua Fund Management Co.,Ltd	ICBC	2002-5-24	3.98
6	100016	Fullgoal Dynamic	Mixed Fund	Fullgoal Fund Management Co.,Ltd	ABC	2002-8-16	4.62
7	110001	E Fund Growth	Mixed Fund	E Fund Management Co.,Ltd	BC	2002-8-23	4.68
8	161601	Rong Tong Balance	Stock Fund	Rong Tong Fund Management Co.,Ltd	CBC	2002-9-13	2.22
9	080001	Chang Sheng Growth	Stock Fund	Chang Sheng Fund Management Co.,Ltd	ABC	2002-9-18	4.90
10	202101	China Southern Bond	Bond Fund	China Southern Fund Management Co.,Ltd	ICBC	2002-9-20	3.17
11	213001	Bao Ying Hong Li	Stock Fund	Bao Ying Fund Management Co.,Ltd	ABC	2002-10-8	3.05
12	050001	Bo shi Value	Mixed Fund	Bo Shi Fund Management Co.,Ltd	CBC	2002-10-9	1.45
13	001001	China Bond	Bond Fund	China Fund Management Co.,Ltd	BCs	2002-10-23	5.13
14	070001	Harvest Growth	Stock Fund	Harvest Fund Management Co.,Ltd	BC	2002-11-5	2.00
15	040002	Hua An 180	Stock Fund	Hua An Fund Management Co.,Ltd	ICBC	2002-11-8	3.09
16	090001	Da Cheng Value	Stock Fund	Da Cheng Fund Management Co.,Ltd	ABC	2002-11-11	2.60
17	180001	Yin Hua Predominance	Mixed Fund	Yin Hua Fund Management Co.,Ltd	BC	2002-11-13	1.68
18	519180	Tian Tong 180	Stock Fund	Tian Tong Asset Management Co.,Ltd	BC	2003-3-15	1.93
19	121001	Rong Hua Bond	Bond Fund	UBS SDIC Fund Management Co.,Ltd	CEB	2003-4-16	2.59
20	162201	He Feng Growth	Stock Fund	ABN AMRO Xiangcai Fund Management Co.,Ltd	BCs	2003-4-25	1.02
21	162202	He Feng Cycle	Stock Fund	ABN AMRO Xiangcai Fund Management Co.,Ltd	BCs	2003-4-25	0.63
22	162203	He Feng Balance	Stock Fund	ABN AMRO Xiangcai Fund Management Co.,Ltd	BCs	2003-4-25	0.98
23	217003	China Merchants Bond	Bond Fund	China Merchants Fund Management Co.,Ltd	CMB	2003-4-28	1.03
24	217002	China Merchants Banlance	Mixed Fund	China Merchants Fund Management Co.,Ltd	CMB	2003-4-28	0.90
25	217001	China Merchants Stock	Stock Fund	China Merchants Fund Management Co.,Ltd	CMB	2003-4-28	2.59
26	090002	Da Cheng Bond	Bond Fund	Da Cheng Fund Management Co.,Ltd	ABC	2003-6-12	2.15
27	210001	Golden Eagle Selection	Stock Fund	Golden Eagle Asset Management Co.,Ltd	BC	2003-6-16	1.52

Appendix 3 –The Test of Normality of Open-end Funds

	Fund Name	Skewness	Kurtosis	Jarque-Bera	Probability
Stock Funds	Hua An Creation	0.2573	8.9769	727.2658	0.0000
	China Southern Growth	0.1517	9.6877	905.6803	0.0000
	China Growth	0.8155	7.3350	433.5074	0.0000
	Golden Eagle Growth	0.3380	8.5377	628.9436	0.0000
	Peng Hua Growth	0.9065	7.1427	413.2371	0.0000
	Rong Tong Balance	0.6326	7.0506	363.9124	0.0000
	Chang Sheng Growth	0.7168	7.0022	365.2230	0.0000
	Bao Ying Hong Li	-0.2075	10.5969	1169.7650	0.0000
	Harvest Growth	0.5197	6.8664	323.9222	0.0000
	Hua An 180	0.8881	7.5431	480.8460	0.0000
	Da Cheng Value	-0.6157	18.1576	4673.5550	0.0000
	Tian Tong 180	1.0389	6.4876	333.0547	0.0000
	He Feng Growth	0.1715	10.1620	1038.9490	0.0000
	He Feng Cycle	0.1309	7.9106	488.6819	0.0000
	He Feng Balance	0.8520	6.8667	360.8206	0.0000
	China Merchants Stock	0.4112	10.1739	1053.6770	0.0000
	Golden Eagle Selection	0.8710	7.3230	438.9876	0.0000
Mixed Funds	Fullgoal Dynamic	0.8380	7.0713	391.7206	0.0000
	E Fund Growth	0.5386	6.2414	235.7712	0.0000
	Bo shi Value	0.5885	6.2470	241.0477	0.0000
	Yin Hua Predominance	-0.1570	7.3672	387.4052	0.0000
	China Merchants Banlance	-3.6565	57.6645	61467.5100	0.0000
Bond Funds	China Southern Bond	0.1347	8.6448	645.3781	0.0000
	China Bond	-3.4686	32.8316	18956.4100	0.0000
	Rong Hua Bond	-3.3187	53.1345	51683.2400	0.0000
	China Merchants Bond	-1.8334	16.8087	4125.0090	0.0000
	Da Cheng Bond	-1.8081	16.6740	4042.7840	0.0000

Appendix 4 –The Test of Normality of Closed-end Funds

	Fund Name	Skewness	Kurtosis	Jarque-Bera	Probability
Large Size Funds	An Shun Fund	-0.4173	6.5079	106.7207	0.0000
	Yu Long Fund	0.3983	4.0186	13.7266	0.0010
	Pu Feng Fund	0.4098	4.5008	24.0029	0.0000
	Xing He Fund	0.1804	5.2180	41.4507	0.0000
	Tian Yuan Fund	0.4662	4.7108	31.1590	0.0000
	Tong Sheng Fund	0.4142	4.4373	22.5905	0.0000
	Jin Xin Fund	0.4900	4.3542	22.9373	0.0000
	Jing Fu Fund	0.5087	3.8678	14.6763	0.0007
	Han Xing Fund	0.3230	4.6434	25.5939	0.0000
Medium SizeFunds	Kai Yuan Fund	0.3943	4.8924	34.4988	0.0000
	Jin Tai Fund	0.3577	3.9132	11.0448	0.0040
	Xing Hua Fund	-0.5682	7.1452	151.6375	0.0000
	An Xin Fund	-2.1766	21.8029	3057.6070	0.0000
	Yu Yang Fund	0.2352	4.2731	15.1200	0.0005
	Pu Hui Fund	0.2942	5.1097	39.3762	0.0000
	Tai He Fund	-2.2226	22.3467	3234.5430	0.0000
	Tong Yi Fund	-1.0543	12.6793	805.5223	0.0000
	Jin Hong Fund	0.5781	4.5904	31.7343	0.0000
	Han Sheng Fund	0.3899	4.6775	28.0902	0.0000
	Jing Yang Fund	0.4990	5.2481	49.6596	0.0000
	Yu Yuan Fund	0.3040	5.0439	37.3250	0.0000
	Jing Bo Fund	0.3283	3.7315	7.9305	0.0190
Small Size Funds	Ke Hui Fund	-0.7750	9.9631	417.7023	0.0000
	Ke Xiang Fund	-0.1378	6.2330	86.4210	0.0000
	Ke Xun Fund	0.5309	4.6977	32.9121	0.0000
	Yu Hua Fund	0.5247	4.4737	26.8672	0.0000
	Tong Zhi Fund	0.5858	4.6941	34.8274	0.0000
	Yu Ze Fund	0.1411	4.2215	12.9013	0.0016
	Jin Sheng Fund	-0.0856	4.7456	25.2527	0.0000
	Jin Yuan Fund	0.5483	4.3368	24.5381	0.0000
	Xing Ke Fund	0.5654	4.9474	41.6277	0.0000
	Jin Ding Fund	0.2005	4.1542	12.2552	0.0022
	Han Ding Fund	0.7207	5.0010	49.9184	0.0000
	Xing An Fund	0.7083	5.5393	69.3991	0.0000
	Han Bo Fund	0.4829	5.4390	56.4845	0.0000
	Long Yuan Fund	0.2924	6.9525	131.0368	0.0000

Appendix 5 –The Performance of Open-end Funds

	Fund Name	Sharpe ratio	R	Treynor ratio	R	Jenson's alpha	Sortino(2,Rf)	R	BRVaR-Rf	R
Stock Funds	Golden Eagle Growth	0.00570534	1	0.00007086	1	0.00063457	0.00853678	1	0.00466077	1
	Harvest Growth	0.00492053	3	0.00005840	3	0.00070301	0.00741732	3	0.00434541	2
	He Feng Balance	-0.00000029	8	-0.00002526	8	0.00058642	-0.00000019	6	-0.00000032	5
	He Feng Growth	-0.00000081	10	-0.00006619	10	0.00053100	-0.00000055	10	-0.00000097	7
	Chang Sheng Growth	-0.00000110	12	-0.00009259	13	0.00049861	-0.00000072	11	-0.00000126	9
	China Southern Growth	-0.00000126	14	-0.00010195	14	0.00047847	-0.00000087	14	-0.00000152	11
	China Merchants Stock	-0.00000131	15	-0.00010906	15	0.00046864	-0.00000089	15	-0.00000154	12
	Da Cheng Value	-0.00000147	17	-0.00011820	16	0.00043065	-0.00000104	17	-0.00000180	17
	Hua An Creation	-0.00000175	18	-0.00014342	18	0.00048220	-0.00000120	18	-0.00000203	19
	China Growth	-0.00000185	19	-0.00016457	20	0.00047549	-0.00000122	19	-0.00000195	18
	He Feng Cycle	-0.00000187	20	-0.00015454	19	0.00054572	-0.00000130	20	-0.00000214	20
	Peng Hua Growth	-0.00000295	21	-0.00025644	21	0.00035563	-0.00000195	21	-0.00000323	21
	Rong Tong Balance	-0.00000335	22	-0.00028090	22	0.00027390	-0.00000229	22	-0.00000386	22
	Hua An 180	-0.00000490	23	-0.00046332	25	0.00027482	-0.00000326	23	-0.00000454	23
	Bao Ying Hong Li	-0.00000538	25	-0.00045201	24	0.00013801	-0.00000386	27	-0.00000609	27
	Tian Tong 180	-0.00000546	26	-0.00050676	27	0.00013477	-0.00000361	25	-0.00000530	24
	Golden Eagle Selection	-0.00000549	27	-0.00047760	26	0.00006668	-0.00000374	26	-0.00000604	26
Mixed Funds	E Fund Growth	0.00285178	4	0.00003471	4	0.00058658	0.00429633	4	0.00233697	3
	China Merchants Banlance	-0.00000105	11	-0.00007632	11	0.00028403	-0.00000082	12	-0.00000161	15
	Yin Hua Predominance	-0.00000122	13	-0.00008810	12	0.00040982	-0.00000085	13	-0.00000165	16
	Fullgoal Dynamic	-0.00000139	16	-0.00012383	17	0.00039162	-0.00000092	16	-0.00000158	14
	Bo shi Value	-0.00000505	24	-0.00044422	23	0.00034373	-0.00000345	24	-0.00000532	25
Bond Funds	China Southern Bond	0.00513251	2	0.00006211	2	0.00027247	0.00759858	2	0.00193493	4
	China Merchants Bond	-0.00000007	5	-0.00000329	5	0.00004467	-0.00000005	5	-0.00000043	6
	China Bond	-0.00000025	6	-0.00001317	6	-0.00003283	-0.00000021	7	-0.00000155	13
	Da Cheng Bond	-0.00000029	7	-0.00001781	7	0.00009004	-0.00000023	8	-0.00000098	8
	Rong Hua Bond	-0.00000071	9	-0.00004561	9	0.00017391	-0.00000055	9	-0.00000143	10

Appendix 6 –The Performance of Closed-end Funds

	Fund Name	Sharpe ratio	R	Treynor ratio	R	Jenson's alpha	Sortino(2,Rf)	R	BRVaR-Rf	R
Large Size Funds	Yu Long Fund	-0.00003032	17	-0.00146983	17	-0.00021261	-0.00002148	17	-0.00001397	15
	Tian Yuan Fund	-0.00003074	18	-0.00148886	18	-0.00023918	-0.00002160	18	-0.00001430	16
	An Shun Fund	-0.00003528	23	-0.00155743	21	-0.00056260	-0.00002700	23	-0.00002871	31
	Pu Feng Fund	-0.00003924	27	-0.00191301	27	-0.00077190	-0.00002855	26	-0.00001705	22
	Han Xing Fund	-0.00004035	28	-0.00197584	28	-0.00062293	-0.00002958	28	-0.00001629	19
	Jin Xin Fund	-0.00004356	29	-0.00202385	29	-0.00075591	-0.00003138	29	-0.00002812	30
	Xing He Fund	-0.00004490	30	-0.00204171	30	-0.00071196	-0.00003289	30	-0.00003221	32
	Tong Sheng Fund	-0.00004563	31	-0.00215296	32	-0.00097021	-0.00003330	31	-0.00002685	28
	Jing Fu Fund	-0.00004821	33	-0.00233795	34	-0.00086009	-0.00003436	33	-0.00002252	26
Medium Size Funds	Yu Yuan Fund	-0.00002260	10	-0.00102703	9	0.00010839	-0.00001588	11	-0.00001625	18
	Jing Yang Fund	-0.00002582	13	-0.00124877	13	-0.00089347	-0.00001798	13	-0.00001226	12
	Han Sheng Fund	-0.00002651	14	-0.00130620	15	0.00004921	-0.00001870	15	-0.00000962	6
	Yu Yang Fund	-0.00003210	19	-0.00150666	19	-0.00038557	-0.00002339	20	-0.00001973	25
	Kai Yuan Fund	-0.00003327	20	-0.00159477	22	-0.00030738	-0.00002367	21	-0.00001724	23
	Jin Hong Fund	-0.00003359	21	-0.00162331	23	-0.00013573	-0.00002331	19	-0.00001646	20
	Jin Tai Fund	-0.00003414	22	-0.00164375	24	-0.00034254	-0.00002437	22	-0.00001695	21
	Pu Hui Fund	-0.00003682	24	-0.00177507	25	-0.00069375	-0.00002713	24	-0.00001840	24
	Xing Hua Fund	-0.00003872	25	-0.00151239	20	-0.00049206	-0.00002952	27	-0.00004074	33
	Jing Bo Fund	-0.00004599	32	-0.00220300	33	0.00018790	-0.00003369	32	-0.00002395	27
	An Xin Fund	-0.00005294	34	-0.00205320	31	-0.00092236	-0.00004287	34	-0.00005600	35
	Tong Yi Fund	-0.00005656	35	-0.00236112	35	-0.00105993	-0.00004410	35	-0.00005246	34
	Tai He Fund	-0.00006296	36	-0.00251772	36	-0.00097676	-0.00005115	36	-0.00006367	36
Small Size Funds	Ke Hui Fund	0.02390489	1	0.00056361	1	0.00191657	0.03351206	1	0.02664740	1
	Ke Xiang Fund	0.01380337	2	0.00031165	2	0.00164126	0.01996398	2	0.01739019	2
	Ke Xun Fund	0.00481387	3	0.00010074	3	0.00140803	0.00745181	3	0.00900924	3
	Yu Ze Fund	-0.00000610	4	-0.00027576	4	0.00100122	-0.00000424	4	-0.00000447	4
	Yu Hua Fund	-0.00001714	5	-0.00079738	5	0.00025521	-0.00001170	5	-0.00001137	8
	Xing Ke Fund	-0.00001837	6	-0.00088794	6	0.00038375	-0.00001249	6	-0.00000873	5
	Tong Zhi Fund	-0.00001902	7	-0.00089530	7	0.00026553	-0.00001298	7	-0.00001144	9
	Jin Sheng Fund	-0.00002168	8	-0.00101028	8	0.00033272	-0.00001588	12	-0.00001380	13
	Han Bo Fund	-0.00002181	9	-0.00104297	10	0.00001153	-0.00001528	8	-0.00001202	11
	Xing An Fund	-0.00002277	11	-0.00109458	11	0.00037978	-0.00001535	9	-0.00001184	10
	Jin Yuan Fund	-0.00002281	12	-0.00110078	12	0.00026434	-0.00001563	10	-0.00001116	7
	Han Ding Fund	-0.00002660	15	-0.00127364	14	-0.00000783	-0.00001813	14	-0.00001390	14
	Jin Ding Fund	-0.00002895	16	-0.00139605	16	0.00003568	-0.00002084	16	-0.00001438	17
	Long Yuan Fund	-0.00003923	26	-0.00179954	26	-0.00015389	-0.00002840	25	-0.00002788	29

Appendix 7 –Results with Different Measures to Open-end Funds

Fund Name	Sharpe ratio	R	Sortino(2,Rf)	R	Sortino(2,Rm)	R	Sortino(3,Rf)	R	Sortino(3,Rm)	R	BRVaR-Rf	R	BRVaR-Rm	R
Golden Eagle Growth	0.00570534	1	0.00853678	1	0.16244566	4	0.00572700	1	0.10298661	2	0.00466077	1	0.06942850	5
China Southern Bond	0.00513251	2	0.00759858	2	0.16361411	2	0.00501226	3	0.10282107	3	0.00193493	4	0.07262144	1
Harvest Growth	0.00492053	3	0.00741732	3	0.16396645	1	0.00526466	2	0.09848630	5	0.00434541	2	0.06948325	4
E Fund Growth	0.00285178	4	0.00429633	4	0.16054283	5	0.00310528	4	0.09962957	4	0.00233697	3	0.07093502	2
China Merchants Bond	-0.00000007	5	-0.00000005	5	0.12134943	11	-0.00000009	5	0.07808717	10	-0.00000043	6	0.05423820	12
China Bond	-0.00000025	6	-0.00000021	7	0.10807324	16	-0.00000040	8	0.06976875	12	-0.00000155	13	0.04829970	18
Da Cheng Bond	-0.00000029	7	-0.00000023	8	0.12240768	10	-0.00000040	7	0.08040777	9	-0.00000098	8	0.05496575	9
He Feng Balance	-0.00000029	8	-0.00000019	6	0.16345832	3	-0.00000025	6	0.10524168	1	-0.00000032	5	0.06979123	3
Rong Hua Bond	-0.00000071	9	-0.00000055	9	0.11076349	14	-0.00000116	11	0.05935780	16	-0.00000143	10	0.05265008	15
He Feng Growth	-0.00000081	10	-0.00000055	10	0.12914217	8	-0.00000086	9	0.07148429	11	-0.00000097	7	0.05692420	8
China Merchants Banlance	-0.00000105	11	-0.00000082	12	0.10745657	17	-0.00000175	17	0.05050366	22	-0.00000161	15	0.05278071	13
Chang Sheng Growth	-0.00000110	12	-0.00000072	11	0.13192982	7	-0.00000099	10	0.08184718	8	-0.00000126	9	0.05811196	7
Yin Hua Predominance	-0.00000122	13	-0.00000085	13	0.10492110	19	-0.00000129	13	0.05933510	17	-0.00000165	16	0.04755230	19
China Southern Growth	-0.00000126	14	-0.00000087	14	0.11533002	13	-0.00000133	14	0.06830161	13	-0.00000152	11	0.05265961	14
China Merchants Stock	-0.00000131	15	-0.00000089	15	0.12107147	12	-0.00000134	15	0.06602507	14	-0.00000154	12	0.05484677	10
Fullgoal Dynamic	-0.00000139	16	-0.00000092	16	0.13982895	6	-0.00000123	12	0.08525552	6	-0.00000158	14	0.06233595	6
Da Cheng Value	-0.00000147	17	-0.00000104	17	0.10950038	15	-0.00000182	19	0.05377183	21	-0.00000180	17	0.05113873	16
Hua An Creation	-0.00000175	18	-0.00000120	18	0.10494449	18	-0.00000181	18	0.05871803	19	-0.00000203	19	0.04837505	17
China Growth	-0.00000185	19	-0.00000122	19	0.12811249	9	-0.00000165	16	0.08216258	7	-0.00000195	18	0.05479906	11
He Feng Cycle	-0.00000187	20	-0.00000130	20	0.09947145	20	-0.00000194	20	0.05908130	18	-0.00000214	20	0.04546991	20
Peng Hua Growth	-0.00000295	21	-0.00000195	21	0.09697931	21	-0.00000257	21	0.06473651	15	-0.00000323	21	0.04220673	21
Rong Tong Balance	-0.00000335	22	-0.00000229	22	0.08205206	22	-0.00000314	22	0.05434658	20	-0.00000386	22	0.03672260	22
Hua An 180	-0.00000490	23	-0.00000326	23	0.06542180	23	-0.00000438	23	0.04154652	23	-0.00000454	23	0.02958045	23
Bo shi Value	-0.00000505	24	-0.00000345	24	0.05669381	24	-0.00000469	25	0.03595701	24	-0.00000532	25	0.02628388	24
Bao Ying Hong Li	-0.00000538	25	-0.00000386	27	0.04293743	26	-0.00000607	27	0.02534370	26	-0.00000609	27	0.02014893	26
Tian Tong 180	-0.00000546	26	-0.00000361	25	0.04555542	25	-0.00000456	24	0.02867058	25	-0.00000530	24	0.02103735	25
Golden Eagle Selection	-0.00000549	27	-0.00000374	26	0.03799821	27	-0.00000498	26	0.02446371	27	-0.00000604	26	0.01764604	27

Appendix 8 –Results with Different Measures to Closed-end Funds

Fund Name	Sharpe ratio	R	Sortino(2,Rf)	R	Sortino(2,Rm)	R	Sortino(3,Rf)	R	Sortino(3,Rm)	R	BRVaR-Rf	R	BRVaR-Rm	R
Ke Hui Fund	0.02390489	1	0.03351206	1	0.16325828	3	0.02030175	1	0.07148586	3	0.02664740	1	0.08316770	3
Ke Xiang Fund	0.01380337	2	0.01996398	2	0.17030131	2	0.01321813	2	0.08182744	2	0.01739019	2	0.08451077	2
Ke Xun Fund	0.00481387	3	0.00745181	3	0.36416128	1	0.00545140	3	0.22584012	1	0.00900924	3	0.11754690	1
Yu Ze Fund	-0.00000610	4	-0.00000424	4	0.12073120	4	-0.00000583	4	0.05415515	5	-0.00000447	4	0.06009910	4
Yu Hua Fund	-0.00001714	5	-0.00001170	5	0.06695822	6	-0.00001555	5	0.03767061	7	-0.00001137	8	0.02915035	6
Xing Ke Fund	-0.00001837	6	-0.00001249	6	0.10251314	5	-0.00001668	6	0.07095458	4	-0.00000873	5	0.03798003	5
Tong Zhi Fund	-0.00001902	7	-0.00001298	7	0.05475559	8	-0.00001710	7	0.02849467	9	-0.00001144	9	0.02629886	7
Jin Sheng Fund	-0.00002168	8	-0.00001588	12	0.03922737	10	-0.00002220	12	0.01889889	11	-0.00001380	13	0.02007929	9
Han Bo Fund	-0.00002181	9	-0.00001528	8	0.02746296	11	-0.00002081	10	0.01902885	10	-0.00001202	11	0.01120754	12
Yu Yuan Fund	-0.00002260	10	-0.00001588	11	0.02742803	12	-0.00002200	11	0.01440770	12	-0.00001625	18	0.01361400	11
Xing An Fund	-0.00002277	11	-0.00001535	9	0.05556887	7	-0.00002039	8	0.03824423	6	-0.00001184	10	0.02186275	8
Jin Yuan Fund	-0.00002281	12	-0.00001563	10	0.04559527	9	-0.00002050	9	0.03008954	8	-0.00001116	7	0.01940775	10
Jing Yang Fund	-0.00002582	13	-0.00001798	13	0.01467092	13	-0.00002427	14	0.01096625	13	-0.00001226	12	0.00563620	13
Han Sheng Fund	-0.00002651	14	-0.00001870	15	0.00014118	14	-0.00002514	15	0.00009591	14	-0.00000962	6	0.00005572	14
Han Ding Fund	-0.00002660	15	-0.00001813	14	-0.00000005	15	-0.00002379	13	-0.00000008	15	-0.00001390	14	-0.00000013	15
Jin Ding Fund	-0.00002895	16	-0.00002084	16	-0.00000023	16	-0.00002801	16	-0.00000036	16	-0.00001438	17	-0.00000055	16
Yu Long Fund	-0.00003032	17	-0.00002148	17	-0.00000082	17	-0.00002835	17	-0.00000120	17	-0.00001397	15	-0.00000202	17
Tian Yuan Fund	-0.00003074	18	-0.00002160	18	-0.00000108	18	-0.00002886	18	-0.00000183	18	-0.00001430	16	-0.00000225	18
Yu Yang Fund	-0.00003210	19	-0.00002339	20	-0.00000192	22	-0.00003141	20	-0.00000334	22	-0.00001973	25	-0.00000405	22
Kai Yuan Fund	-0.00003327	20	-0.00002367	21	-0.00000170	21	-0.00003203	21	-0.00000306	21	-0.00001724	23	-0.00000350	20
Jin Hong Fund	-0.00003359	21	-0.00002331	19	-0.00000118	19	-0.00003053	19	-0.00000201	19	-0.00001646	20	-0.00000264	19
Jin Tai Fund	-0.00003414	22	-0.00002437	22	-0.00000169	20	-0.00003204	22	-0.00000273	20	-0.00001695	21	-0.00000378	21
An Shun Fund	-0.00003528	23	-0.00002700	23	-0.00000411	27	-0.00003991	26	-0.00000834	29	-0.00002871	31	-0.00000758	27
Pu Hui Fund	-0.00003682	24	-0.00002713	24	-0.00000294	25	-0.00003670	23	-0.00000427	26	-0.00001840	24	-0.00000609	25
Xing Hua Fund	-0.00003872	25	-0.00002952	27	-0.00000534	31	-0.00004479	32	-0.00001063	31	-0.00004074	33	-0.00000963	28
Long Yuan Fund	-0.00003923	26	-0.00002840	25	-0.00000260	24	-0.00004023	27	-0.00000392	24	-0.00002788	29	-0.00000573	24
Pu Feng Fund	-0.00003924	27	-0.00002855	26	-0.00000294	26	-0.00003761	24	-0.00000413	25	-0.00001705	22	-0.00000624	26
Han Xing Fund	-0.00004035	28	-0.00002958	28	-0.00000248	23	-0.00003937	25	-0.00000344	23	-0.00001629	19	-0.00000561	23
Jin Xin Fund	-0.00004356	29	-0.00003138	29	-0.00000532	30	-0.00004079	28	-0.00000925	30	-0.00002812	30	-0.00001059	31
Xing He Fund	-0.00004490	30	-0.00003289	30	-0.00000640	33	-0.00004569	33	-0.00001243	33	-0.00003221	32	-0.00001193	33
Tong Sheng Fund	-0.00004563	31	-0.00003330	31	-0.00000618	32	-0.00004394	30	-0.00001214	32	-0.00002685	28	-0.00001150	32
Jing Bo Fund	-0.00004599	32	-0.00003369	32	-0.00000453	29	-0.00004387	29	-0.00000601	27	-0.00002395	27	-0.00001007	30
Jing Fu Fund	-0.00004821	33	-0.00003436	33	-0.00000440	28	-0.00004423	31	-0.00000618	28	-0.00002252	26	-0.00000963	29
An Xin Fund	-0.00005294	34	-0.00004287	34	-0.00001337	34	-0.00007660	35	-0.00003050	34	-0.00005600	35	-0.00002298	34
Tong Yi Fund	-0.00005656	35	-0.00004410	35	-0.00001399	35	-0.00007208	34	-0.00003211	35	-0.00005246	34	-0.00002418	35
Tai He Fund	-0.00006296	36	-0.00005115	36	-0.00001716	36	-0.00009143	36	-0.00003991	36	-0.00006367	36	-0.00002936	36