

Forecasting Thai Mutual Fund Performance with Kalman Filtering

ABSTRACT

This paper is evaluates the use of Kalman filtering method to forecast mutual fund performance. Monthly equity funds and market returns are observed for five years during January 2003 to December 2008 as an observation data and one year later as out-of-sample data. The equity fund performance is measured by using OLS method through risk-adjust model which is concerning market return, size, book-to-market, momentum, and liquidity factor. Later on, the Kalman filtering is applied through risk-adjusted model in order to predict every parameter. The alpha and beta of each equity fund is estimated in the final. For persistence in fund performance, the results show that equity funds which have a good performance in the past trend to have a better return in the next period. Moreover, the asset management firms who have many handling number of equity funds lead to have a good performance by gaining the benefits of diversification among various stocks. After applying the Kalman filtering method to predict future return during year 2008, the forecasting return of equity funds can reflect alphas and betas close to out-of-sample data. It confirms that applying Kalman filtering method through risk-adjusted model can be use as an another alternative to predict future return. However, the prediction result may be high if there is structural change in the market.

I. INTRODUCTION

Recently, global economy trends to be higher fluctuation due to continuously increased in commodity product prices and demand, such as oil, rice and sugar, political instability and competitiveness from global market. These are caused cost of living to be higher for consumers. All these external factors affect individual investors which have limited resource to survive and still need to maximize their return on investment under the high inflation environment.

These recent trends are forced individual to design his/her personal finance and retirement plan which each individual has tendency to carefully decide the proper investment sources. Nowadays, there are many sources for investment in the money market such as the traditional way as bank deposit, fixed-income security market, stock market and mutual fund which investors will select according to their risk preference. Meanwhile, the traditional source of personal investment is deposit in both international and domestic bank which trends to have downward deposit rate during inflation rate increasing circumstance, the investment volume in other sources are rising. These force investors to always make the best decision for their wealth allocation.

Obviously, the investment on mutual funds is growing day by day. This investment source becomes an increasingly effective instrument for both retail and institution investors because all assets are pooled and managed by fund managers who have financial knowledge, in-depth information, and time for market watch. Therefore, they are being able to generate higher return through investors. Moreover, retail investors who have a tiny investment capital would be able to invest in mutual fund.

There are several types of mutual funds which are classified by Association of Investment Management Companies (AIMC). Each fund has different level of risk depending on its underlying asset. Normally, fixed-income investment has lower risk than investing on equity. For the risky asset as equity, Thai equity fund have continuously grown for 136.28 times within the

past five years. Thus, the more precisely predicted the performance of mutual fund, the gainer of return on investment.

There are many indexes to measure mutual fund performance such as Sharpe ratio, Treynor ratio, Jensen alpha, Capital Asset Pricing Model (CAPM), the Arbitrage Pricing Theory (APT), Data Envelopment Analysis (DEA), Free Disposal Hull (FDH) method, etc. The appropriate tool for equity fund performance measure is still doubtful to find out the most attractive modeling for measured and predicted equity fund return. Nowadays, many article is mention the prediction method by using Kalman filtering Method. The Kalman filtering is applied as a prediction tool for forecasting parameter in the next period. This technique is utilized in several areas such as an aerospace engineering, science, economics and finance. Furthermore, The Kalman filtering is applied in order to predict mutual funds performance in the next period based on past performance.

This research intends to find out “whether the prediction model of mutual fund performance can precisely estimate by using out of sample period testing through mutual funds’ alpha and beta”. The research aims:

1. To examine persistence in fund performance.
2. To apply Kalman filtering method in forecasting fund performance.
3. To test validation of forecasting with out-of-sample data.

In this research, the monthly return of equity funds in Thailand will be measured over two periods. First, the monthly return during January 2003 to December 2007 is collected as observations to stimulate the model and estimate mutual funds’ alpha and beta. Second, the monthly return during January 2008 to December 2008 is collected as out-of-sample data to compare the accurateness of the predicted return which based on the historical data. Moreover, the monthly returns of SET and government bond are used as benchmarking of market and risk free

through the regression model respectively. Equity funds performance will be organized and measured by an ordinary least square (OLS) and Kalman filter model through a risk-adjusted model in the past five year window. The accuracy of estimation on mutual funds' return will be analyzed. Finally, the recommendation to investors for attractive equity fund is proposed according to the research finding. Consequently, investors can be appropriately made decision.

Mutual funds performance measurement method is reviewed in the next section. After that, data description and research methodology is clarified. Finally, the estimation of mutual fund performance is discussed and summarized in the section fourth and fifth respectively.

II. LITERATURE REVIEW

In order to discover the outperform equity fund, the effective measurement of mutual funds' performance is needed. Recently, there are many numerical indexes are widely used in the practice for mutual funds' performance measurement. The most well-known measure is reward-to-volatility ratio or Shape ratio (Sharpe, 1966). Moreover, reward-to-volatility ratio or the portfolio's β (Treyner, 1965) becomes the popular tool in order to measure an expected excess return of the portfolio and a risk indicator. Since 1952, Markowitz introduced The Capital Asset Pricing Model (CAPM) that relatively concerns excess return and its volatility. Jensen (1968) developed alpha (α) as the difference between the actual excess portfolio return and the estimated or expected excess benchmark return. Last but not least, the benchmarking of CAPM on the Arbitrage Pricing Theory (APT) model by Admati and Ross (1985). These numerical ratios are commonly used in practice to evaluate the performance funds by the past return but they may not ensure the same return paths in the future. Timmermann and Granger (2004) stated that behavioral changes over time can cause a model that fit a subject in one time interval to fail in another. As a result many of the estimated parameter used to forecast the future return may reflect misspecification error than the reality.

Later on, a large number of studies suggested the several contemporary ways to measure performance of mutual funds due to the estimation problem of using a single statistical model for all available funds or no one statistical model is likely to fit every fund (Zhang et al., 2007; Malkiel B., 1995). Basso and Funari (2000) suggest that data envelopment analysis (DEA), which is proposed by Charnes et al. (1978), in order to indicate mutual fund performance indexes that can taken into account in several input such as different risk measures and investment cost. In addition, a robust nonparametric approach is used by Daraio and Simar (2005) for benchmarking comparisons in portfolio analysis by Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH) method. Many paper said that the mutual fund performance are applied by related with

characteristics of mutual funds (Prather et al., 2004). The significant positive abnormal returns using raw returns by four-factors adjusted return model. (Shanthikumar and Frieder, 2007)

There are numerous traditional measures (i.e. Sharpe ratio, Treynor ratio, Jensen's alpha, etc.) which can be roughly measures but not appropriate for dynamic condition that multi-factors influencing as existing. Zhang et.al (2007) stated that there are estimation errors using a statistical model only. Therefore, the state space form is introduced. The state space form is an enormously powerful tool which opens the way to handling a wide range of time series models (Harvey, 1990). Kalman filter may be applied and turn leads to algorithms for prediction and smoothing. Back testing such Kalman filter model is applied into a statistical model in order to reduce this estimation error. However, the interesting measure is combination of a well known single factor OLS model by using a Kalman filter model in order to improve a penal data model's ability and benefit to time variation which can forecast mutual funds' ability through alpha and beta more precisely.

III. METHODOLOGY

In this section, the research methodology is clarified into four parts. First, the source and rationale of modeling data is described. The concept of CAPM is introduced as an analytical tool for alpha and beta measuring. The application of CAPM is adjusted based on Fama-French model by adding additional variables into the regression. Finally, the Kalman filtering approach is applied on risk-adjusted model in order to forecast the future alpha and beta.

Data

Association of Investment Management Companies (AIMC) gives a definition on mutual fund is “an investment vehicle for retail investors who may have restrictions on limitation of investment volume that cannot diversify through various securities, lack of financial knowledge and experiences or lack of time for market catch up”. Therefore, mutual fund becomes an efficient investment tool which has management system and target on best return on investment under risk acceptance. Moreover, AIMC classify mutual fund by three categories including types of selling/buying, investment policy and special funds. For types of selling and buying, there are closed-end fund and open-end fund. Closed-end fund is fixed amount of shares and duration of fund. The investors have to hold and trade until the maturity date only. Not like open-end fund, there is no restriction on amount of shares and duration of funds. Fund manager can issue additional shares as appropriated. Investors can trade shares an time. For fund classification by investment policy, there are ten funds including:

1. Equity fund: is the fund that has investment policy for investing in equity minimum 65 percent of all net asset value of the fund. In general, the equity fund is riskier than other funds. This matches with risk taker investor with long term investment.

2. General fixed income Fund: is the fund for deposit or other securities. This type of fund normally has lower risk than others. So, it is appropriated with low risk taking investors.
3. Long-term fixed income fund: is the fund that has portfolio duration greater than one year. This fund is suitable for low risk taking investors and can hold for a long term of investment.
4. Short-term fixed income fund: is the fund that has portfolio duration less than one year. This fund is suitable for low risk taking investors and can hold only in a short term of investment period.
5. Balanced fund: is fixed investment portion which can invest in equity security not greater than 65 percent as ceiling and lower than 35 percent of total net asset value as floor. This type of fund is suitable for medium level of risk taking investors.
6. Flexible portfolio fund: gives flexible for fund managers to invest in any securities and adjust their port according to the situation. There is no restriction on ceiling and floor of investment portion. This type of fund is suitable for medium level of risk taking investors.
7. Fund of funds: is fund that has a policy to invest in mutual fund not lower than 65 percent of total net asset value. This type of fund captures the benefits of diversification through various securities.
8. Warrant fund: is issued for the warrant on stocks, bonds, and funds' shares which should not lower than 65 percent of total net asset value. Therefore, this type of fund would be the riskiest funds.

9. Sector fund: has limited investment only in the same sector as indicated by The Stock Exchange of Thailand (SET) which is not lower than 65 percent of total net asset value. This type of fund relies on a particular sector. Therefore, this fund would be riskier than other equity funds.
10. Money market fund: has investment policy only on short term bond which is similar with the short-term fixed income fund. The money market would have the minimum risk than other funds and suit for low risk taking investors.

On the firm side, information up to march 2008, there are twenty one asset management public company limited taking care of one 1,104 funds with 1,524.66 billion Baht of net asset value.

[Table I is here]

In this section, the market and equity fund data are the major used to assess fund performance. The interesting of equity fund is that the equity funds invest majorly on stock security which is risky asset. Therefore, the precisely predicted the mutual fund performance is, the more return investors can earn. Hence, the research data is observed by monthly basis for two periods within six years rolling window. First, the market and equity fund monthly data is for five years during January 2003 to December 2008 as observations and one year later as out-of-sample information.

On market data aspect, the monthly return on SET is observed and defined as MKT to represent the movement of the overall market according to the observation period. Moreover, LB096A from government bond is selected as risk free benchmarking. LB096A is the most appropriate bond that matches with the market and equity fund variables. This government bond has the issue term for seven year and will be matured by 21 June 2009 with fixed 4.625 coupon rate of return.

On the other side, all equity fund data is provided by Association of Investment Management Companies (AIMC) and The Securities and Exchange Commission (SEC). The monthly returns of Thai equity funds are observed in two periods, in-the-sample and out-of-sample. The return of all equity funds during observation and out of sample period are collected not only the growth funds but also the new coming and dead funds in order to eliminate the survivorship bias to the model.

[Table II is here]

In general mutual fund of domestic source of funds, there are balance funds, equity fund, fund of funds, flexible portfolio fund, money market fund, fixed income fund, non-special purpose real estate fund and special purpose real estate fund. We can see that overall mutual fund market is growing.

[Figure 1 and 2 is here]

As shown in figure 1 and 2, the equity funds have grown for 136.28 times within the past five years and numbers of funds are raising 135 percent from year 2003 to be 233 funds in year 2008.

[Figure 3 is here]

Figure 3 shows the summary of equity fund age profile. There are three major group of aging, sustainable, new and drop out fund. The equity fund that that there are 58% of total equity fund that can sustain for entire observation period. There are 31.1% that issuing during the observation period. Most of them issued in year 2004. There are 10.7% of total equity fund which is drop out from the equity market. Most of drop out fund is in year 2004.

[Table III is here]

Table III shows list of all mutual fund in Thailand arranging by fund code which are used for the research model.

The Asset Pricing Model

In order to measure the equity funds' risk and return, The Capital Asset Pricing Model (CAPM) is applied. The concept of CAPM is introduced by Sharpe (1964) and Lintner (1965) to capture anomaly returns by interpreting the relationship between risk and expected return as shown in equation 3.1. The main idea behind CAPM is that there are two concerns of investors, time value of money and risk. First, they have to analysis and compensate their investment by time value of money that they can gain based on the minimum rate or risk free rate. Second, the compensation for additional risk or measuring as beta which comparing the funds' return to the market and risk free over the period of time.

$$r_a - r_f = \alpha + \beta_a(r_m - r_f) \quad (3.1)$$

Where r_a is the equity fund return, r_f is risk free rate and r_m is the expected market return.

Risk-Adjusted Model

Moreover, a single factor model of CAPM which is comparing with the market as a whole may not give a perfect r-square fit. The CAPM is adapted by adding additional factors to a regression model. The well known approach is the three factor model developed by Gene Fama and Ken French. Fama and French considered that size (SML) and value premiums (HML) of the market are also influencing to the asset return as shown in equation 3.2. Thus, they added two factors into the regression model to reflect the exposure of the asset return. For size factor, they

divided into small and big market capital. For value premiums, Fama and French call a value stocks for high book-to-market price ratio and growth stocks for their opposites.

$$r_a - r_f = \alpha + \beta_1(r_m - r_f) + \beta_2 \text{SMB} + \beta_3 \text{HML} \quad (3.2)$$

However, the research also measures the pricing abilities of Fama-French model with liquidity and momentum factor. The general idea of liquidity and return relationship is that when market has high fluctuation in price, market volatility will be higher. Then, the liquidity of the market (LIQ) will be higher too. Therefore, the expected return from the investors would be greater accordingly. The impact of the model return on liquidity is captured by the level of market price and trading volume. Next, the momentum effect is considered into the Fama-French model with the winners-minus-losers (WML), which concerns the effects of past returns to future returns. A very useable strategy for investors is buying past winners and selling past losers.

The regression to measure the equity funds' return by concerning market return, size, book-to-market ratio, momentum, and liquidity effect is illustrated in equation 3.3.

$$r_{i,t} = \alpha_i + \beta_i^{MKT} MKT_t + \beta_i^{SMB} SMB_t + \beta_i^{HML} HML_t + \beta_i^{WML} WML_t + \beta_i^{LIQ} LIQ_t + \varepsilon_t \quad (3.3)$$

According the equation 3.3, we comparing the effect of equity fund return on the left hand side by the market effects on the right hand side in order to know that how return on each fund reflects the market movement. An excess return on equity fund is measured as dependent variable where MKT, SMB, HML, WML and LIQ is observed as independent variables. MKT is market return on SET. SMB is abbreviated from Small minus Big representing the size factor of the market where small and big is separated by the fiftieth percentile of the market capital on stocks. HML is abbreviated from High minus Low representing the book-to-market factor of the market where high is the seventy fifth percentile and low is the twenty fifth of the book-to-market respectively. Next factor is a momentum factor. Winner minus Loss (WML) is a variable to measure market momentum whether has an effect to the fund's performance. WML is measured

by the fiftieth percentile of the prior year return. Finally, the liquidity factor (LIQ) is measured in order to find the price impact of the market to the fund's performance by concerning price and trading volume on market.

The Kalman Filtering Model

The Kalman filtering is a variably used method for predicting variables by applying the model in the state space form. The Kalman filtering is an analytical tool since the early 1960's when Kalman introduced the method as a different approach to statistical prediction and filtering (Wells, 1996). The Kalman filtering is a recursive procedure for estimating a state vector throughout a dynamic condition which can be applied into engineering, economics and also finance (Harvey, 1991). The Kalman filtering enables to continuously estimate a state vector as new observations which can be used to calculate the further estimations. In this research, the equity fund returns are observed and continuously estimate for the future return in the next period. According to the Kalman filtering method, there are two major equations to estimating the excess equity fund returns including the transition equation and observation equation. The transition equation is used to calculate the market factor in the next period which comprises of MKT, SMB, HML, WML, LIQ and equity fund returns as shown in equation 3.4. The coefficient (ϕ) of each variable is measured based on the observation period first. Subsequently, the MKT, SMB, HML, WML, LIQ and equity fund returns are predicted for the next period until the end of 2008.

The transition equation

$$X_t = \Phi X_{t-1} + v_t$$

$$\begin{bmatrix} X_{1t} \\ \cdot \\ \cdot \\ X_{nt} \end{bmatrix} = \begin{bmatrix} \Phi_{10} & \cdot & \cdot & \Phi_{1m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \Phi_{n0} & \cdot & \cdot & \Phi_{nm} \end{bmatrix} \begin{bmatrix} X_t \\ \cdot \\ \cdot \\ X_{t-p} \end{bmatrix} + \begin{bmatrix} v_{1t} \\ \cdot \\ \cdot \\ v_{nt} \end{bmatrix} \quad (3.4)$$

Where x is MKT, SMB, HML, WML, LIQ, and equity funds' Return (R_i). After we find MKT_t, SMB_t, HML_t, WML_t, LIQ_t, and R_{it} for entire year 2008, the observation equation is applied to find out the relative between equity fund returns relative to market movement as shown in equation 3.5.

The observation equation

$$Y_t = C_t X_t + \varepsilon_t$$

$$\begin{bmatrix} Y_{1t} \\ \cdot \\ \cdot \\ Y_{at} \end{bmatrix} = \begin{bmatrix} C_{10} & \cdot & \cdot & C_{1m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ C_{n0} & \cdot & \cdot & C_{nm} \end{bmatrix} \begin{bmatrix} X_t \\ \cdot \\ \cdot \\ X_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \cdot \\ \cdot \\ \varepsilon_{at} \end{bmatrix} \quad (3.5)$$

Due to the relative of equity funds' beta with multi-factors, observation equation has to adjust along with the relative risks including MKT_t, SMB_t, HML_t, WML_t, and LIQ_t. The adjusted model to find equity funds' beta in out-of-sample is shown in equation 3.6.

$$\begin{aligned}
\begin{bmatrix} R_{it} \\ \cdot \\ \cdot \\ R_{at} \end{bmatrix} &= \begin{bmatrix} \alpha_{it} \\ \cdot \\ \cdot \\ \alpha_{at} \end{bmatrix} + \begin{bmatrix} C_{MKT,10} & \cdot & \cdot & C_{MKT,1m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ C_{MKT,n0} & \cdot & \cdot & C_{MKT,nm} \end{bmatrix} \begin{bmatrix} MKT_t \\ \cdot \\ \cdot \\ MKT_{t-p} \end{bmatrix} + \begin{bmatrix} C_{SMB,10} & \cdot & \cdot & C_{SMB,1m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ C_{SMB,n0} & \cdot & \cdot & C_{SMB,nm} \end{bmatrix} \begin{bmatrix} SMB_t \\ \cdot \\ \cdot \\ SMB_{t-p} \end{bmatrix} + \\
&\begin{bmatrix} C_{HML,10} & \cdot & \cdot & C_{HML,1m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ C_{HML,n0} & \cdot & \cdot & C_{HML,nm} \end{bmatrix} \begin{bmatrix} HML_t \\ \cdot \\ \cdot \\ HML_{t-p} \end{bmatrix} + \begin{bmatrix} C_{WML,10} & \cdot & \cdot & C_{WML,1m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ C_{WML,n0} & \cdot & \cdot & C_{WML,nm} \end{bmatrix} \begin{bmatrix} WML_t \\ \cdot \\ \cdot \\ WML_{t-p} \end{bmatrix} + \begin{bmatrix} C_{LIQ,10} & \cdot & \cdot & C_{LIQ,1m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ C_{LIQ,n0} & \cdot & \cdot & C_{LIQ,nm} \end{bmatrix} \begin{bmatrix} LIQ_t \\ \cdot \\ \cdot \\ LIQ_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{it} \\ \cdot \\ \cdot \\ \varepsilon_{at} \end{bmatrix} \quad (3.6)
\end{aligned}$$

At the end of year 2008, each equity funds' beta is calculated according to the equation 3.6. We can spot the positive and negative market factors affecting the equity funds' return.

IV. RESULT AND DISCUSSION

This section would majorly separate into four sections. First is on observation period, mutual fund performance through the alpha and beta estimations is measured since January 2003 in order to find the persistence in fund performance. All equity funds were run by using OLS method for alpha and beta estimation in each fund. Then, best and worst fund performance would rank by funds' alpha. Second, the mutual fund performance is predicted by applied Kalman filtering model for one more year. After that, the relative between past and prediction performance would be measured to find out the persistence of fund performance. Finally, the validation of Kalman Filtering testing will be done with out-of-sample data.

Past Performance

Past performance of each equity fund during January 2003 to December 2007 is measured by regressive OLS for α , β_{MKT} , β_{SMB} , β_{HML} , β_{WML} , β_{LIQ} . The result of best ten outperform equity fund rank by alpha is shown in table IV including FAM EEF, K-SET50, 1AMSET50, AYFLTF50, M-S50, UOBSAS10, MAXEQ, SCIF, KEQLTF and KDLTF respectively.

NPAT-PRO, ONEUB4, DYNAMIC, IBP,N-SET, MGE, ONE-PRO, ONE-D, BERMF, and RKEC respectively. Amazingly, There are three asset management firm that have more than two funds ranking in top ten performance. Kasikorn Asset Management Co., Ltd. has three out performing funds. UOB Asset Management (Thai) Co., Ltd. and MFC Asset Management PCL. have two out performing funds. We can see that most of the funds are significant in alpha and market beta with 99% level of confidence where an average on R-square is 0.5292 and the range is in between 0.0186 to 0.9859.

[Table IV is here]

Overall, equity funds have negatively fluctuated to the market size. This may imply that although the size of stocks in portfolio on equity fund is very small, they can gain positive return to the equity funds by investing more on risky asset that has a greater expected returns. On the other hand, the worst ten performances of equity funds are NPAT-PRO, ONEUB4, DYNAMIC, IBP, N-SET, MGE, ONE-PRO, ONE-D, BERMF and RKEC respectively. Obviously, UOB Asset Management (Thai) Co., Ltd. holding four not so well performance funds. Most of the funds have significant on alpha and market return factor with 99% level of confidence. It means that return on equity funds rely on the movement of the market and ability of fund managers.

According to the result, we may recommend the investors to invest on the best equity fund based on the historical performance which is FAM EEF fund having α equals to 0.0100, β_{MKT} equals to 1.0982, β_{SMB} equals to -0.0134, β_{HML} equals to -0.0194, β_{WML} equals to 0.0102, and β_{LIQ} equals to 0.0055.

Not only fund performance, this research intends to find out the firm performance. There are twenty-one asset management firms managing funds but conducting in equity fund only sixteen firms. The best three firm is SCIA, ASSET FUND, and ABERDEEN. The most excellent firm on performance ranking by alpha is Siam City Asset Management Co.,LTD. which has α equals to 0.0001717, β_{MKT} equals to -0.6132403, β_{SMB} equals to 1.4800943, β_{HML} equals to 0.4572017, β_{WML} equals to -0.0037058, and β_{LIQ} equals to 0.3912. In overall, most fund managers can beat the market by having a positive on alpha. We can see that the firm that have a core financial business on asset management (not extend to retail banking, etc.) such as SCIA, Asset Fund and Aberdeen trend to have a good in fund performance.

[Table V is here]

From the result of table 5, MFC Asset Management PCL., SCB Asset Management Co., Ltd., and Kasikorn Asset Management Co., Ltd. are the top three companies that holding the majority

of equity funds which are 25, 15 and 13 equity funds respectively. These three firms also have the excellent performance. MFC Asset Management PCL. has α equals to 0.0000202, β_{MKT} equals to -0.0872527, β_{SMB} equals to 0.1837526, β_{HML} equals to 0.0567861, β_{WML} equals to -0.0290303, and β_{LIQ} equals to 0.0498. SCB Asset Management Co., Ltd. has α equals to 0.0000372, β_{MKT} equals to -0.1399457, β_{SMB} equals to 0.3226235, β_{HML} equals to 0.0996554, β_{WML} equals to -0.0432018, and β_{LIQ} equals to 0.0844. Kasikorn Asset Management Co., Ltd. has α equals to 0.0000387, β_{MKT} equals to -0.1587630, β_{SMB} equals to 0.3495819, β_{HML} equals to 0.1080293, β_{WML} equals to -0.0624292, and β_{LIQ} equals to 0.0951. The major reason because of those firms who have the majority number of funds may gain the benefits of diversification and eliminate the unsystematic risks from their portfolios.

Prediction Performance

The prediction of equity fund performance is measured by applying Kalman filtering method into the risk-adjusted model for one more year. The estimation period is during January 2008 to December 2008. Table VI shows the best and worst performance of equity funds. The empirical result illustrates that K-EQUITY, TISCOEDF, RKF4, RKF2, RKF-HI2, 1S-LTF, 1AMSET50, RKF3, 1SG-LTF, and KEQLTF are the best ten equity funds that would outperform by forecasting.

[Table VI is here]

There are four funds in top ten funds ranking from Kasikorn Asset Management Co., Ltd. However, the K-EQUITY has the greatest return among others which has α equals to 0.0271, β_{MKT} equals to 1.5035, β_{SMB} equals to 0.2421, β_{HML} equals to -0.1064, β_{WML} equals to -0.3551, and β_{LIQ} equals to -0.5123. In average, overall funds has α equals to -0.0585 and have size, book-to-

market, momentum and liquidity as negative factors where beta equal to 0.4898, -2.8348, -0.8813, -0.7596, -0.7742 respectively.

Persistence in Fund Performance

In order to investigate the persistence of equity funds to answer the key question which is “whether funds that had good performance before will outperform in the future or not?” Therefore, the relative return of equity funds from the past and predicting performance should be quantified.

[Table VII is here]

Table VII illustrates the relative performance of equity funds between past performance and forecasting performance of the best 10 outperform equity funds. We can see that most of equity fund that outperform in the prediction period has a good performance from the past or being position that above fifty percentile of the overall funds. There are 51.3% of equity fund which has a persistence in performance by maintaining their position above 50 percentile for outperform funds and below 50 percentile for not so well performance. This may support the reason of momentum factor which is the funds that being a winner in the past would affect the current performance too.

[Table VIII is here]

In the same manner for the bottom rank of equity funds, table VIII shows that most of the equity funds that have not so good performance having negative effects from the past. From the worst twenty funds, most of them have a poor performance before or being a loser (position less than 50 percentile) of overall funds.

Validation of Kalman Filtering Testing

Finally, the validation of Kalman filtering for equity fund return is testing in order to judge the accuracy of the prediction model. The Kalman filtering is applied for monthly asset return during January 2008 to December 2008. The alpha and beta results from Kalman filtering will assign as prediction value. At the same time, the actual fund and market return is collected as out-of-sample in order to check and benchmark the precisely. The equity funds' alpha and beta of out-of-sample is calculated by using OLS method.

[Table IX is here]

The table IX shows the estimation error ($\Delta\alpha$) between the prediction and out-of-sample value of alpha. The fund is rank by absolute range of the estimation error differences from the minimum to maximum. The most precisely estimated is SCBLT2 from SCBAM which has the absolute range of alpha ($|\Delta\alpha|$) equals to zero. An average absolute range differs from the actual by out-of-sample 0.0115 which effecting an average fund return by 0.8521% where maximum and minimum ranges are 0.0000 and 0.0585 which effecting maximum and minimum fund return by 1.8192% and 0 % respectively.

V. SUMMARY

This research established that equity funds are growing and becoming a well-liked investment source. Equity fund is one of the risky funds which have high volatility. Therefore, the more accuracy of the equity funds' return prediction is the more beneficial to investors in order to gain maximum return from the investment. This research aims to examine persistence in fund performance. In this objective, the results show that there are 51.3% persistence in fund performance. The equity funds which have a good performance in the past would trend to have a better return in the next period. The reason is that the fund manager may build management skills and familiar with stock market with right market timing. According to the past five years, the result states that FAM EEF fund is the most attractive fund for investors. Moreover, the asset management firms who have a core financial business on asset management (not extend to retail banking, etc.) trend to have a good in fund performance. This may come from the accumulate knowledge and experience on asset investment.

After applying the Kalman Filtering method for future return prediction during year 2008, the K-EQUITY fund is the most attractive fund which has the greatest return among others. By applying this method, the forecasting return of equity fund is applicable as an another alternative of forecasting by testing with out-of-sample data. The result shows that the Kalman filtering approach can predict future performance which have the average error estimation on alpha equals to 0.0115 and effects the fund average return by 0.8521%. In conclusion, the Kalman Filtering method is applicable for forecasting Thai mutual fund performance. However, the prediction result may be high if there is structural change in the market.

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Table I

List of all Asset Companies in Thailand

1	ABERDEEN	Aberdeen Asset Management Co., Ltd.
2	ASSETFUND	Asset Plus Fund Management Co., Ltd.
3	AYF	Ayudhya Fund Management Co., Ltd.
4	BBLAM	BBL Asset Management Co., Ltd.
5	BTAM	CIMB Thai Bank PCL.
6	FAM	Finansa Asset Management Co., Ltd.
7	ING FUNDS	ING Funds (Thailand) Co., Ltd.
8	KASSET	Kasikorn Asset Management Co., Ltd.
9	KTAM	Krung Thai Asset Management PCL.
10	MAMT	Manulife Asset Management Co., Ltd.
10	MFC	MFC Asset Management PCL.
12	ONEAM	One Asset Management Co., Ltd.
13	PHILLIPASSET	Phillip Asset Management Co., Ltd.
14	PRIMAVEST	PrimaVest Asset Management Co., Ltd.
15	SCBAM	SCB Asset Management Co., Ltd.
16	SCIA	Siam City Asset Management Co., Ltd.
17	SEAMICOASSET	SEAMICO Asset Management Co., Ltd.
18	THANACHART FUND	Thanachart Fund Management Co., Ltd.
19	TISCOASSET	TISCO Asset Management Co.,Ltd.
20	TMBAM	TMB Asset Management Co.,Ltd.
21	UOBAM	UOB Asset Management (Thai) Co., Ltd.

Table II

Net Asset Value (NAV) and number of all registration of funds in Thailand

	(NAV unit: billion Baht)											
	2003		2004		2005		2006		2007		2008	
	NAV	Funds	NAV	Funds	NAV	Funds	NAV	Funds	NAV	Funds	NAV	Funds
Domestic Source of Funds	695.32	418	658.59	509	949.83	671	1,212.82	797	1,601.27	899	1,519.63	1097
General Mutual Fund	440.21	319	456.92	382	775.39	584	1,040.70	716	1,426.41	821	1,353.43	1020
Special Mutual Fund	255.12	99	173.61	93	174.44	87	172.12	81	174.87	78	166.20	77
International Source of Funds	31.89	14	24.04	14	13.98	10	9.68	10	10.21	9	5.04	7
Total Registration of Funds	727.21	432	682.62	523	963.81	681	1,222.49	807	1,611.48	908	1,524.66	1104

Table III

List of all Mutual Fund in Thailand Arranging by Fund Code

Type	Fund name	Fund Code
Equity Fund - SET	1 A.M. SET 50 Fund	1AMSET50
Equity Fund - SET	1 A.M. Valued Stock Fund-Dividend Fund	1VAL-D
Equity Fund - SET	Aberdeen Growth Fund	ABG
Equity Fund - SET	Aberdeen Siam Leaders Fund	ABSL
Equity Fund - SET	Aberdeen Small Cap Fund	ABSM
Equity Fund - SET	Adkinson Growth Open-Ended Fund	AGF
Equity Fund - SET	Asia Panpol Fund	APF
Equity Fund - SET	AYF Star Capital Fund	AYFSCAP
Equity Fund - SET	AYF Dividend Stock Fund	AYFSDIV
Equity Fund - SET	AYF Star Equity Fund	AYFSEQ
Equity Fund - SET	Bualuang Capital Open-End Fund	BCAP
Equity Fund - SET	Bualuang Infrastructure Open-End Fund	B-INFRA
Equity Fund - SET	Buakaew Open-End Fund	BKA
Equity Fund - SET	Buakaew 2 Open-End Fund	BKA2
Equity Fund - SET	Buakaew Income Fund	BKD
Equity Fund - SET	Bangkok Metropolitan Open-Ended Fund	BMBF
Equity Fund - SET	Sub Bualuang Open-End Fund	B-SUB
Equity Fund - SET	Bualuang Thanakom Open-End Fund	BTK
Equity Fund - SET	Bualuang Top-Ten Fund	BTP
Equity Fund - SET	Dynamic Eastern One Open-Ended Fund	DE-1
Equity Fund - SET	AYF Star Dynamic Fund	DYNAMIC
Equity Fund - SET	IFCT Ruam Thoon Fund	IRT
Equity Fund - SET	JUMBO 25 Fund	JB25
Equity Fund - SET	K Equity Fund	K-EQUITY
Equity Fund - SET	K Flexible Equity Fund	K-FEQ
Equity Fund - SET	Kiatnakin Fund	KKF
Equity Fund - SET	Krungsri-PrimaVest Equity Fund	KPE
Equity Fund - SET	Kamrai Permpoon Open-ended Fund	KPLUS
Equity Fund - SET	Kamrai Permpoon Open-ended Fund 2	KPLUS2
Equity Fund - SET	The Krung Thai Dividend Selected Fund	KTSF
Equity Fund - SET	Krung Thai-Trinity Fund	KTTN
Equity Fund - SET	K Valued Stock Fund	K-VALUE
Equity Fund - SET	MAX Equity Fund	MAX EQ
Equity Fund - SET	Manulife Strength Core Equity Fund	MS-CORE EQ
Equity Fund - SET	Manulife Strength Equity Value Fund	MS-EQ VALUE
Equity Fund - SET	Thanachart Fundamental Plus	NF-PLUS
Equity Fund - SET	N-SET Fund	N-SET
Equity Fund - SET	ONE Plus One Fund	ONE+1
Equity Fund - SET	ONE Multiple Growth Fund	ONE-G
Equity Fund - SET	ONE Prime Fund	ONE-PR
Equity Fund - SET	ONE - UB 3 Fund	ONEUB3
Equity Fund - SET	OM-SIN Provincial Development Capital Fund	OSPD
Equity Fund - SET	Primavest Equity Dividend Fund	PEF
Equity Fund - SET	PI-BOON SAB Dividend Fund	PISD

Type	Fund name	Fund Code
Equity Fund - SET	PERM POON SAB - Dividend Fund	PPSD
Equity Fund - SET	The Ruang Khao Equity Class	RKEC
Equity Fund - SET	The Ruang Khao 2 Fund	RKF2
Equity Fund - SET	The Ruang Khao 3 Fund	RKF3
Equity Fund - SET	The Ruang Khao 4 Fund	RKF4
Equity Fund - SET	The Ruang Khao High Income Fund	RKF-HI
Equity Fund - SET	The Ruang Khao High Income 2 Fund	RKF-HI2
Equity Fund - SET	RUAM PATTANA Two Open-Ended Fund	RPF2
Equity Fund - SET	ROONG ROJ Open-Ended Fund	RRF1
Equity Fund - SET	SUB ANAN Open-End Fund	SAN
Equity Fund - SET	SCB DHANA ANANTA Open End Fund	SCBDA
Equity Fund - SET	SCB Dividend Stock Open End Fund	SCBDV
Equity Fund - SET	SCB Munkhong Open End Fund	SCBMF
Equity Fund - SET	SCB Munkhong 2 Open End Fund	SCBMF2
Equity Fund - SET	SCB Munkhong 3 Open End Fund	SCBMF3
Equity Fund - SET	SCB Munkhong 4 Open End Fund	SCBMF4
Equity Fund - SET	SCB Munkhong 5 Open End Fund	SCBMF5
Equity Fund - SET	SCB Permpol Munkhong Open End Fund	SCBPMO
Equity Fund - SET	SCB Set Index Open-Ended Fund	SCBSET
Equity Fund - SET	SCB Taweesub Open End Fund	SCBTS
Equity Fund - SET	SCB Taweesub 2 Open End Fund	SCBTS2
Equity Fund - SET	SCB Taweesub 3 Open End Fund	SCBTS3
Equity Fund - SET	SINCHADA Open-Ended Fund	SCDF
Equity Fund - SET	Siam City Fund	SCIF
Equity Fund - SET	Siam City Two Fund	SCIF2
Equity Fund - SET	SINPINYO Four Open-Ended Fund	SF4
Equity Fund - SET	SINPINYO Five Open-Ended Fund	SF5
Equity Fund - SET	SINPINYO Seven Open-Ended Fund	SF7
Equity Fund - SET	SINPINYO Eight Open-Ended Fund	SF8
Equity Fund - SET	SINPATTANA Open-Ended Fund	SPF
Equity Fund - SET	SIN PAITON Open-End Fund	SPT
Equity Fund - SET	SUB SOMBOON Fund	SSB
Equity Fund - SET	STANG DAENG Open-Ended Fund	STD
Equity Fund - SET	STANG DAENG Two Open-Ended Fund	STD2
Equity Fund - SET	SYRUS Momentum Fund	SYRUS-M
Equity Fund - SET	TCM Equity	TCMEQF
Equity Fund - SET	Thai Dragon Fund	TDF
Equity Fund - SET	Thai-Euro Open-end Fund	TEF
Equity Fund - SET	The TFAM Equity Fund	TFEQ
Equity Fund - SET	THANA One Fund	THANA1
Equity Fund - SET	TISCO Equity Dividend	TISCOEDF
Equity Fund - SET	TISCO Equity Growth	TISCOEGF
Equity Fund - SET	THANAPHUM Open-Ended Fund	TNP
Equity Fund - SET	THEERASUB Open-Ended Fund	TS
Equity Fund - SET	UNITED Open-Ended Fund	UNF
Equity Fund - SET	UDOM SAB - Dividend Fund	USD
Equity Fund - SET	UDOM SAB - Dividend 2 Fund	USD2

Table IV

Past performance of top and bottom ten equity funds during January 2003 to December 2007

The risk-adjusted model which is applied from Fama-French three factor model to measure funds' performance is:

$$r_{i,t} = \alpha_i + \beta_i^{MKT} MKT_t + \beta_i^{SMB} SMB_t + \beta_i^{HML} HML_t + \beta_i^{WML} WML_t + \beta_i^{LLIQ} LIQ_t + \varepsilon_t$$

where $r_{i,t}$ and MKT are returns on Thai equity funds and market in the period t with excess the risk free rate. SMB is representing the size factor of the market. HML is representing the book-to-market factor of the market. Winner Minus Loss (WML) is a momentum factor to measure market momentum whether has an effect to the fund's performance. Finally, the liquidity factor (LIQ) is measured in order to find the price impact of the market to the fund's performance.

Panel A: Top 10 Fund Performance									
Decile	Fund	Firm	α	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}	β_{LIQ}	ε
1	FAM EEF	FAM	0.0100***	1.0982***	-0.0134	-0.0194	0.0102	-0.0055	0.0049
2	K-SET50	KAsset	0.0073***	1.0719***	-0.0221	-0.0028	0.0025	0.0423	0.0036*
3	1AMSET50	ONEAM	0.0072***	1.0713***	0.0135	-0.0077	0.0082	-0.0137	0.0064
4	AYFLTF50	AYF	0.0065***	1.0645***	-0.0206	-0.0045	0.0051	0.0077	0.0037
5	M-S50	MFC	0.0046***	1.0442***	-0.0321	0.0040	0.0017	-0.0007	0.0054
6	UOBSAS10	UOBAM	0.0042**	1.0350***	-0.0286	0.0021	0.0056	-0.2506	0.0055*
7	MAX EQ	SCIA	0.0041***	1.0428***	-0.0023	-0.0033	0.0111	0.0190	0.0055*
8	SCIF	MFC	0.0038***	1.0385***	-0.0291	0.0048	0.0014	0.0016	0.0047
9	KEQLTF	KAsset	0.0037**	1.0265***	-0.0405	0.0199	0.0092	0.0078	0.0060
10	KDLTF	KAsset	0.0033**	1.0210***	-0.0466**	0.0214	0.0104	0.0086	0.0060
Overall		Max	0.2238	-0.1303	-0.6893	1.2621	1.1320	-0.6615	1.2504
		Average	0.1044	-0.0503	0.4168	0.3528	0.1554	-0.1541	0.2437
		Min	0.2155	0.0147	1.3353	1.4265	1.1573	0.0829	1.3674
Panel B: Bottom 10 Fund Performance									
Decile	Fund	Firm	α	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}	β_{LIQ}	ε
224	RKEC	KAsset	-0.0546**	0.4479	0.5604	0.7189**	-0.3672	1.0002***	0.1552
225	BERMF	BBLAM	-0.0559**	0.3956	0.4361	0.3994*	-0.2256	0.5713***	0.1220
226	ONE-D	ONEAM	-0.0618	0.0649*	0.3504	-0.3722	-0.0550*	-0.5365	0.1499
227	ONE-PRO	ONEAM	-0.0690**	0.2311	0.5733	0.4989*	-0.3255	0.5530**	0.1515
228	MGE	MFC	-0.0696***	0.1127	0.2477	-0.1192	0.0097	-0.1675	0.0655*
229	N-SET	THANACHART	-0.0697**	0.2681	0.3566	0.4160*	-0.1827	0.5393**	0.1318
230	IBP	PRIMAVEST	-0.0739**	0.2351	0.3688	0.4179*	-0.2336	0.5312**	0.1332
231	DYNAMIC	AYF	-0.0810**	0.1549	0.4216	0.4032	-0.2469	0.5235**	0.1333
232	ONEUB4	ONEAM	-0.0957	0.1073	1.4265	1.1573*	-0.8318	1.3674**	0.2155
233	NPAT-PRO	ONEAM	-0.1303*	0.6893	1.2621	1.1320	-0.6615	1.2504*	0.2238

where * is 90% level of confidence, ** is 95% level of confidence, and *** is 99% level of confidence

Table V

Firm Performance in The Past Five Years (2003-2008)

Rank	Firm	No.of Funds	α	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}	β_{LIQ}	ε
1	SCIA	3	0.0001717	-0.6132403	1.4800943	0.4572017	-0.0037058	0.3912	0.0062896
2	ASSETFUND	2	0.0001405	-0.4955316	1.2034868	0.3717407	-0.1417400	0.3169	0.0052461
3	ABERDEEN	5	0.0001211	-0.4338839	1.0443227	0.3225743	0.0089905	0.2744	0.0044711
4	PRIMAVEST	2	0.0000905	-0.3622035	0.8224982	0.2541762	0.0098323	0.2250	0.0027497
5	AYF	5	0.0000900	-0.3311358	0.7822947	0.2416746	0.0005647	0.2085	0.0032066
6	KTAM	2	0.0000751	-0.2970151	0.6795173	0.2099799	-0.0050873	0.1851	0.0023354
7	FAM	1	0.0000431	-0.1740973	0.3931392	0.1214958	-0.2469016	0.1079	0.0012939
8	KAsset	13	0.0000387	-0.1587630	0.3495819	0.1080293	-0.0624292	0.0951	0.0012204
9	SCBAM	15	0.0000372	-0.1399457	0.3226235	0.0996554	-0.0432018	0.0844	0.0013504
10	THANACHART FUND	9	0.0000341	-0.1430145	0.3086922	0.0954066	-0.0153599	0.0853	0.0010680
11	ONEAM	12	0.0000323	-0.1343235	0.2932141	0.0906162	-0.0915265	0.0803	0.0010010
12	UOBAM	6	0.0000311	-0.1316916	0.2843401	0.0878788	-0.0770158	0.0783	0.0009307
13	BBLAM	10	0.0000246	-0.1164302	0.2303763	0.0712277	-0.0226479	0.0649	0.0006762
14	MFC	25	0.0000202	-0.0872527	0.1837526	0.0567861	-0.0290303	0.0498	0.0006106
15	TISCOASSET	4	-0.0000002	-0.0029744	-0.0022332	-0.0006952	0.0174885	-0.0020	0.0000022
16	ING FUNDS	1	-0.0000002	-0.0052338	-0.0027274	-0.0008483	0.0120392	-0.0020	0.0000030

Table VI
Top and Bottom Ten Fund Performance in The Prediction Years (2008)

Panel A: Top 10 Fund Performance									
Decile	Fund	Firm	α	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}	β_{LIO}	ε
1	K-EQUITY	KAsset	0.0271	1.5035***	0.2421***	-0.1064***	-0.3551***	-0.1523***	0.0360
2	TISCOEDF	TISCOAsset	0.0186	1.3109***	0.0853***	0.6724***	-0.4228***	-0.0419***	0.0471
3	RKF4	KAsset	0.0135	1.1750***	0.1622***	0.0096***	-0.2206***	-0.0519***	0.0162
4	RKF2	KAsset	0.0134	1.1745***	0.1639***	0.0108***	0.0211***	-0.0534***	0.0162
5	RKF-HI2	KAsset	0.0134	1.1683***	0.1610***	0.0239***	-0.2089***	-0.0543***	0.0165
6	1S-LTF	ONEAM	0.0134	1.4989***	-0.4762**	-0.1049**	-0.1040*	-0.2613***	0.0126
7	1AMSET50	ONEAM	0.0133	1.4311***	-0.3304***	-0.0671***	-0.1199***	-0.2189***	0.0138
8	RKF3	KAsset	0.0133	1.1719***	0.1648***	0.0087***	0.0896***	-0.0471***	0.0164
9	1SG-LTF	ONEAM	0.0132	1.5157***	-0.5293***	-0.1213***	-0.1101***	-0.2742***	0.0123
10	KEQLTF	KAsset	0.0129	1.4850***	-0.5745**	-0.2199**	0.0213**	-0.2558***	0.0137
Overall	Max		0.0271	1.7643	0.4611	1.0704	0.9159	0.0344	0.0541
	Average		-0.0585	0.4898	-2.8348	-0.8813	-0.7596	-0.7742	-0.0064
	Min		-0.0050	1.1199	-0.2088	-0.0166	-0.1058	-0.1481	0.0152
Panel B: Bottom 10 Fund Performance									
Decile	Fund	Firm	α	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}	β_{LIO}	ε
224	AYFLTFDI	AYF	-0.0253	1.6656***	-2.2910**	-0.8374**	-0.1931***	-0.6270***	0.0070
225	MAX DIV	SCIA	-0.0300	1.7643***	-2.8348**	-0.8813**	-0.2530***	-0.7742***	-0.0064
226	ABSM	ABERDEEN	-0.0319	1.6812***	-2.4729***	-0.6706***	-0.2800***	-0.6531***	0.0020
227	KPLUS2	UOBAM	-0.0381	0.5684***	-0.0872***	-0.1605***	-0.4710***	-0.1488***	0.0380
228	KKF	UOBAM	-0.0382	0.7073***	-0.3576***	-0.2450***	-0.7326***	-0.2342***	0.0374
229	KPLUS	UOBAM	-0.0382	0.5681***	-0.0839***	-0.1548***	-0.4827***	-0.1489***	0.0379
230	APF	MFC	-0.0384	0.7104***	-0.3688***	-0.2485***	-0.7596***	-0.2354***	0.0372
231	TDF	UOBAM	-0.0384	0.5668***	-0.0881***	-0.1631***	-0.7393***	-0.1485***	0.0380
232	MGE	MFC	-0.0569	0.5227***	0.4611***	1.0704***	0.0455***	-0.1867**	0.0450
233	FAM EEF	FAM	-0.0585	0.4898***	-0.5289**	-0.6244**	-0.4455***	-0.2492***	0.0541

where * is 90% level of confidence
 ** is 95% level of confidence
 *** is 99% level of confidence

Table VII

The Best 10 Persistence in Equity Fund Performance Ranking by the Forecasting Alpha

Decile (forecasting)	Fund	Firm	α	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}	β_{LIQ}	ε
1	K-EQUITY	KAsset	0.027128	1.503479	0.242091	-0.10644	-0.3551	-0.15235	0.035966
	Past Decile	108	-0.0485	0.4974	0.3906	0.3747	-0.2476	0.5842	0.122659
2	TISCOEDF	TISCOASSET	0.018558	1.310914	0.085267	0.672446	-0.42284	-0.0419	0.047107
	Past Decile	38	-0.0169	0.8073	0.1540	-0.2102	0.0326	-0.0951	0.06596
3	RKF4	KAsset	0.013513	1.175007	0.16219	0.009571	-0.22056	-0.05188	0.016196
	Past Decile	44	-0.0183	0.7754	0.1360	-0.2002	0.0105	-0.0843	0.065607
4	RKF2	KAsset	0.013418	1.17446	0.163894	0.010777	0.021135	-0.05341	0.016179
	Past Decile	46	-0.0185	0.7740	0.1348	-0.1989	0.0107	-0.0843	0.065585
5	RKF-HI2	KAsset	0.013403	1.168347	0.161028	0.023877	-0.20889	-0.05426	0.016493
	Past Decile	47	-0.0185	0.7723	0.1325	-0.2001	0.0111	-0.0855	0.065616
6	1S-LTF	ONEAM	0.013371	1.498891	-0.4762	-0.10491	-0.10399	-0.26128	0.012607
	Past Decile	14	0.0017	1.0155	-0.0016	-0.0064	-0.0124	-0.2196	0.005858
7	1AMSET50	ONEAM	0.013317	1.431102	-0.33039	-0.06712	-0.11987	-0.21887	0.013826
	Past Decile	3	0.0072	1.0713	0.0135	-0.0077	0.0082	-0.0137	0.0064
8	RKF3	KAsset	0.013262	1.171858	0.164841	0.008735	0.089588	-0.0471	0.016436
	Past Decile	43	-0.0183	0.7766	0.1340	-0.1988	0.0119	-0.0846	0.065596
9	1SG-LTF	ONEAM	0.013226	1.515709	-0.52933	-0.12133	-0.11009	-0.27417	0.012345
	Past Decile	17	0.0024	1.0184	-0.0026	0.0148	-0.0187	0.0048	0.006556
10	KEQLTF	KAsset	0.012868	1.48503	-0.57451	-0.21986	0.021295	-0.25584	0.013679
	Past Decile	9	0.0037	1.0265	-0.0405	0.0199	0.0092	0.0078	0.0060

Table VIII

The Worst 10 Persistence in Equity Fund Performance Ranking by the Forecasting Alpha

Decile (forecasting)	Fund	Firm	α	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}	β_{LIQ}	ε
1	AYFLTFDI	AYF	-0.02535	1.665593	-2.29101	-0.83737	-0.19313	-0.62699	0.00699
	Past Decile	108	-0.0284	0.6421	0.1166	-0.0798	-0.0078	-0.0103	0.009997
2	MAX DIV	SCIA	-0.02996	1.764281	-2.83478	-0.88127	-0.25298	-0.77421	-0.00639
	Past Decile	38	-0.0366	0.5583	0.0582	-0.0108	-0.0017	-0.0254	0.008232
3	ABSM	ABERDEEN	-0.03191	1.681172	-2.47286	-0.67059	-0.28001	-0.65315	0.00201
	Past Decile	44	-0.0435	0.4749	0.0343	-0.0489	0.0173	-0.5211	0.011402
4	KPLUS2	UOBAM	-0.03811	0.568359	-0.08725	-0.16046	-0.47103	-0.14884	0.038017
	Past Decile	46	-0.0188	0.7679	0.1494	-0.1574	0.0074	-0.0831	0.065819
5	KKF	UOBAM	-0.03821	0.707258	-0.35759	-0.24497	-0.7326	-0.23423	0.037359
	Past Decile	47	-0.0489	0.4921	0.4144	0.4164	-0.2603	0.5793	0.122436
6	KPLUS	UOBAM	-0.03823	0.568127	-0.08392	-0.15475	-0.48275	-0.14889	0.037858
	Past Decile	14	-0.0018	0.9659	-0.0304	0.0114	-0.0062	-0.0019	0.004405
7	APF	MFC	-0.03836	0.710431	-0.3688	-0.24854	-0.75956	-0.23536	0.037241
	Past Decile	3	-0.0488	0.4938	0.4130	0.4141	-0.2590	0.5800	0.122444
8	TDF	UOBAM	-0.03837	0.566757	-0.08808	-0.16306	-0.73927	-0.14849	0.037996
	Past Decile	43	-0.0190	0.7675	0.1551	-0.1543	-0.0010	-0.0838	0.065796
9	MGE	MFC	-0.05691	0.522709	0.461144	1.07044	0.045503	-0.18666	0.044963
	Past Decile	17	-0.0696	0.1127	0.2477	-0.1192	0.0097	-0.1675	0.0655
10	FAM EEF	FAM	-0.05851	0.489774	-0.52891	-0.62435	-0.44546	-0.24921	0.054149
	Past Decile	9	0.0100	1.0982	-0.0134	-0.0194	0.0102	-0.0055	0.0049

Table IX

The greatest and lowest range of estimation testing with out-of-sample during year 2008

Panel A: Top 10 Lowest Range											
Rank	Fund	Firm	$\Delta\alpha$	$\Delta\alpha$	$\Delta\beta_{MKT}$	$\Delta\beta_{SMB}$	$\Delta\beta_{HML}$	$\Delta\beta_{WML}$	$\Delta\beta_{LIQ}$	$\Delta\epsilon$	ΔR_i
1	SCBLT2	SCBAM	0.0000	0.0000	1.5176	-0.9167	-0.3220	-0.0187	-0.3537	0.0061	0.0000%
2	SCBMF5	SCBAM	0.0002	0.0002	1.0149	0.2278	0.0888	-0.2240	-0.0403	0.0135	0.0008%
3	N-SET	THANACH ART FUND	0.0002	-0.0002	1.1135	-0.0781	0.0036	-0.2463	-0.1112	0.0133	0.0008%
4	INGTEF	ING FUNDS	0.0004	-0.0004	1.0122	0.1808	0.1290	0.0437	-0.0615	0.0166	0.0011%
5	SCBMF4	SCBAM	0.0004	0.0004	1.0159	0.2260	0.0917	-0.2119	-0.0400	0.0136	0.0014%
6	SPT	THANACH ART FUND	0.0007	-0.0007	0.9903	0.2016	0.1877	-0.3304	-0.0337	0.0153	0.0029%
7	SCBTS2	SCBAM	0.0007	0.0007	1.0199	0.2341	0.0930	-0.1981	-0.0411	0.0135	0.0029%
8	SCBTS	SCBAM	0.0008	0.0008	1.0205	0.2370	0.0891	-0.2280	-0.0405	0.0135	0.0035%
9	NF-PLUS	THANACH ART FUND	0.0008	-0.0008	1.2748	-0.4879	-0.0860	-0.1985	-0.2183	0.0116	0.0037%
10	SCBLT2	SCBAM	0.0010	0.0010	1.5176	-0.9167	-0.3220	-0.0187	-0.3537	0.0061	0.0042%
Overall	Min		0.0000	-0.0585	0.4898	-2.8348	-0.8813	-0.7596	-0.7742	-0.0064	0.0000 %
	Average		0.0115	-0.0050	1.1199	-0.2088	-0.0166	-0.1058	-0.1481	0.0152	0.8521%
	Max		0.0585	0.0271	1.7643	0.4611	1.0704	0.9159	0.0344	0.0541	1.8192%
Panel B: Bottom 10 Greatest Range											
Rank	Fund	Firm	$\Delta\alpha$	$\Delta\alpha$	$\Delta\beta_{MKT}$	$\Delta\beta_{SMB}$	$\Delta\beta_{HML}$	$\Delta\beta_{WML}$	$\Delta\beta_{LIQ}$	$\Delta\epsilon$	ΔR_i
224	K-EQUITY	KAsset	0.0271	0.0271	1.5035	0.2421	-0.1064	-0.3551	-0.1523	0.0360	1.1341%
225	MAX DIV	SCIA	0.0300	-0.0300	1.7643	-2.8348	-0.8813	-0.2530	-0.7742	-0.0064	1.1362%
226	ABSM	ABERDEEN	0.0319	-0.0319	1.6812	-2.4729	-0.6706	-0.2800	-0.6531	0.0020	1.1493%
227	KPLUS2	UOBAM	0.0381	-0.0381	0.5684	-0.0872	-0.1605	-0.4710	-0.1488	0.0380	1.1521%
228	KKF	UOBAM	0.0382	-0.0382	0.7073	-0.3576	-0.2450	-0.7326	-0.2342	0.0374	1.1548%
229	KPLUS	UOBAM	0.0382	-0.0382	0.5681	-0.0839	-0.1548	-0.4827	-0.1489	0.0379	1.1554%
230	APF	MFC	0.0384	-0.0384	0.7104	-0.3688	-0.2485	-0.7596	-0.2354	0.0372	1.1594%
231	TDF	UOBAM	0.0384	-0.0384	0.5668	-0.0881	-0.1631	-0.7393	-0.1485	0.0380	1.1602%
232	MGE	MFC	0.0569	-0.0569	0.5227	0.4611	1.0704	0.0455	-0.1867	0.0450	1.8149%
233	FAM EEF	FAM	0.0585	-0.0585	0.4898	-0.5289	-0.6244	-0.4455	-0.2492	0.0541	1.8192%

Figure I

Net Asset Value (NAV) of balance fund, equity fund, fund of funds, flexible portfolio fund, money market fund, fixed-income fund, non-special purpose real estate fund, and special purpose real estate fund during year 2003 – 2008

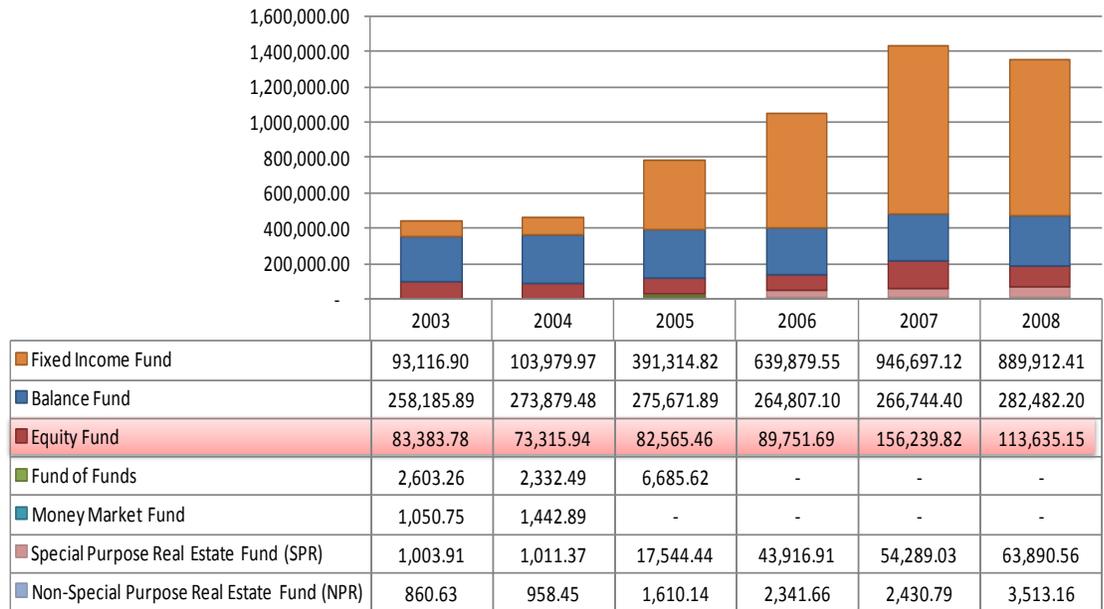


Figure II

Number of Equity Funds

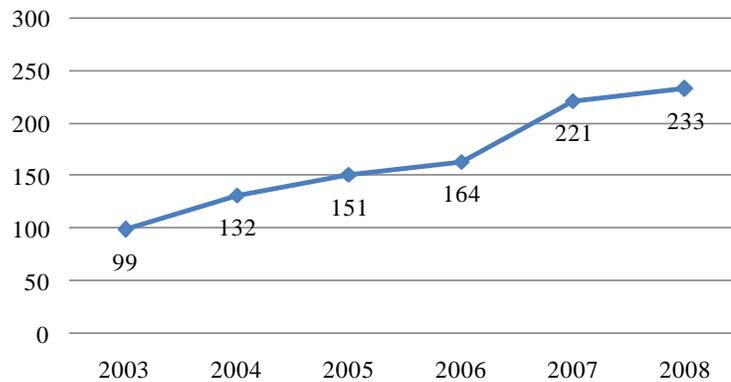


Figure III

The summary of equity fund age profile

Age of equity funds which have three groups including :

1. the sustainable fund that can hold for entire period which is six years
2. the new fund that issued during the observation period and
3. the drop out fund which dropped out from the equity fund market during the observation period.

Summary	No.	%
Sustainable Fund	135	58.0%
New Fund	73	31.3%
Issue in Year 2003	12	5.3%
Issue in Year 2004	41	17.6%
Issue in Year 2005	20	8.4%
Issue in Year 2006	0	0.0%
Issue in Year 2007	0	0.0%
Issue in Year 2008	0	0.0%
Drop Out Fund	25	10.7%
Dropped in Year 2003	7	3.1%
Dropped in Year 2004	9	3.8%
Dropped in Year 2005	2	0.8%
Dropped in Year 2006	5	2.3%
Dropped in Year 2007	2	0.8%
Dropped in Year 2008	0	0.0%
Total Fund	233	100.0%

