JOURNAL OF
BUSINESS AND MANAGEMENT
Vol. 2, No.1, 2013: 66-77

CONSTRUCTING OPTIMAL PORTFOLIO FROM FIRST STATE'S MUTUAL FUNDS PERIOD 2009-2011

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Abstract-*The goal of this thesis is to construct an optimal portfolio based on Markowitz's modern portfolio theory from First State Investments Indonesia's mutual funds. The time horizon of this thesis is from the beginning of 2009 until the end of 2011. There are 3 optimal portfolios that have been created. Those 3 are Maximum Return portfolio, Minimum Stadev portfolio, and Maximum Sharpe Ratio portfolio. The creation of those 3 portfolios was helped by the MS Excel Solver add-ins to determine the weights of each mutual fund in a portfolio. Then those 3 portfolios compared to each other and the market with some performance measurements like Sharpe ratio, Treynor ratio, and Jensen's Alpha. The calculation creates a result that the best performance achieved from those 3 portfolios is the Maximum Sharpe Ratio portfolio because the portfolio generates the highest Sharpe ratio. The highest Sharpe ratio according to Markowitz is the most optimal portfolio. That portfolio exceeds the market in terms of performance with 0.0674% average daily return and 0.5640% average daily standard deviation. This thesis focuses only for the NAV of 6 First State Investments Indonesia's mutual funds, JCI historical data, and BI rate from 2009 until 2011. The outcome of this thesis is an investment to the Maximum Sharpe Ratio portfolio which has the best performance according to Markowtiz's modern portfolio theory among the other portfolios, mutual funds, and the market from 2009 until 2011. There are changes in the NAV, JCI's closing prices, and BI rate to support the proposed optimal portfolio strategy. This research creates an optimal portfolio based on Markowitz's modern portfolio theory of First State Investments Indonesia's mutual funds for investors.*

Keywords: Optimal Portfolio, Mutual Fund, First State Investments Indonesia, 2009-2011.
Category: Finance; Performance Management.

Introduction

In the beginning of year 2003, the price development of Indeks Harga Saham Gabungan (IHSG) or Jakarta stock exchange Composite Index (JCI) was increasing slowly because it has been noticed by many investors as a good investment. At that moment, Indonesia was strong in the economics fundamentally. In the effect of this condition, JCI increased greatly from 400 to the highest point 2,800 in 2008. That's 700% in just 5 years.

Sadly, after that there was a global financial crisis in 2008 that affects countries all over the world. The impacts of this crisis were the bankruptcy of many financial institutions, banks forced to bailout, and the weakening of all capital market. This global financial crisis was the worst crisis after the crisis in 1930 or known as 'The Great Depression' that caused by the World War 2. In Indonesia, it was the second crisis since crisis in 1998. In the start of year 2009, countries that have great fundamental economy including Indonesia recover significantly fast. JCI's price continued to increase from 1,100 to 4,000 in just 3 years. So in 8 years, from 2003 to 2012, JCI has average of growth around 112.5% per year. This means the capital market or companies in Indonesia are fundamentally strong and will easily recover if there's a global crisis that not affects the Indonesian economy.

This condition makes many Indonesian and foreign investors to invest in Indonesia rather than keeping their money in the bank shrinking. Although in the condition that many investors called 'bullish', to put money in the capital market without thinking is selfish. Although it looks profitable, there's a great chance that it can turn into loss if one don't have the principles. It needs a strong knowledge and experience to jump in the capital market.

Therefore, there are institutions that offer people who don't have much knowledge, experience or time in the capital market to be invested by these institutions. The service is in a form of a product which is called reksa dana or mutual fund. Investors can acquire this mutual fund by purchase the investment unit of the institution. This fund is managed by certified investment manager in the form of portfolio consist of stocks, bonds, money market, or mixed. It's all according to the investment manager's strategy and type of the fund.

Generally, there are more advantages of having mutual fund rather than buying stocks or bonds. One of the examples is investors can save energy and time, because the money that they invested in a mutual fund is managed by professionals who have a license and acknowledgement from Badan Pelaksana Pasar Modal or BAPEPAM-LK. The other advantage is mutual fund is very liquid. It means the money that has been invested in the mutual fund can be converted into cash on all time based on the institution's policy. Moreover, the mutual fund even more liquid than some stocks. Mutual fund also known for it's practicality. It doesn't need much money to invest in mutual fund and it can be acquired in almost every bank.

A brief about mutual fund, it's also has a lot of kind from the investment's portfolio view. Usually, there are 4 kinds of mutual fund in the market. There are fixed income fund, stock fund, balanced fund, and money market fund. From 4 of those mutual funds, the risk and gain are different against each other. Like the stock fund, usually it has more gain and more volatile than the fixed income fund.

From the explanation above, mutual fund can be categorized as a considerable product for people who don't have the knowledge and time to invest in the capital market. To acquire this product, it can be purchased in many institutions and one of them is First State Investments Indonesia. First State Investments Indonesia is a company from Commonwealth Bank of Australia group that control management asset business. In December 2011, Colonial First State Global Asset Management or CFSGAM has managed an asset over US$ 144,2 billion. Moreover, First State Investments Indonesia also got an award for the best investment manager in 2007 from Bisnis Indonesia Award and the best mutual fund in the same year for the category of 1 year performance of mutual fund from Majalah Investor.

Before conducting an analysis on this thesis, the author wants to see if one of these mutual funds can exceed the market's performance. So the author calculates the average daily return and standard deviation from 6 of First State Investments Indonesia's mutual funds and the market. The table below shows the result:

Table 1.1 Average Daily Returns and Standard Deviation of First State Investments Indonesia's mutual funds and the market

Individual Mutual Fund		
Asset	Return μ	Stadev σ
Bond fund	0.0569%	0.4856%
Balance fund	0.0574%	0.6194%
Multistrategy fund	0.1015%	1.3253%
Sectoral fund	0.1130%	1.6397%
Dividend Yield fund	0.1044%	1.5845%
Value Select fund	0.1086%	1.5932%
The Market		
Asset	Return μ	Stadev σ
JCI	0.12344%	1.42355%

Based on the table above, none of the First State Investments Indonesia's mutual funds can exceed the market's return. To overcome this problem, these mutual funds must be turned into a portfolio to reduce the risk and hopefully increase the returns too.

So, for this thesis, the author wants to calculate and analyze the performance of First State Investments Indonesia's mutual funds and construct an optimal portfolio based on the goal of Markowitz's modern portfolio theory. The goal of this theory is to maximize the return based on a given level of risk. If the results are better, it will act as a consideration before the investors invest their money into First State Investments Indonesia's mutual funds. In the other hand, this thesis also intends to socialize about First State Investments Indonesia's mutual funds for investors and public to increase their interest and awareness.

Literature review

A. Mutual Fund

The first thing to understand this thesis clearly is to know what the definition of mutual fund is. There are a lot of definitions of mutual fund. According to Mark Mobius, Mutual Fund is a company that pools money from a group of people with common investment goals to buy securities such as stocks, bonds, money market instruments, a combination of these investments, or even other funds.

To measure mutual fund, it has a unit of account in the form of NAV or Net Asset Value. NAV is the net worth of mutual fund which also the purchase and selling price that the investors must acknowledge. Usually, NAV is seen in units. To calculate mutual fund's NAV/unit is to divide the current market value of a fund's holdings minus the fund's liabilities and operational costs by the number of units that has been owned by the investors at that time. NAV usually counted once per day and the price depends on transactions of the mutual fund within the day.

There are many types of mutual funds on the market today. They are varies based on the objectives of the investment manager. Each mutual fund determined which best suits for many kinds of investors with different financial needs, investment objectives, and their risk profile. In Indonesia, the most common types of mutual funds include:

1. Money Market Funds

This type of mutual fund only invests in short-term debt of one year or less. The objective is to maintain the capital liquidity. It means that the money market funds are extremely liquid and mostly created for an investor's portfolio that requires safety principal or conservative risk profile. The characteristics of money market funds are low risk, potentially gives higher investment outcome than deposit, and the return will vary with short-term interest rates.

2. Fixed income Funds

This type of mutual fund invests at least 80% assets in the form of bonds. Therefore, fixed income fund is also called bond fund. Investors who purchase bond fund usually seek stable and current income along with preservation of capital. This fund also had relatively higher risk than money market fund. Bond funds are made up of individual bond issues, so they are subject to the same types of risk associated with individual bonds such as credit risk, call risk, interest rate risk, and reinvestment risk. In general, the characteristics of fixed income funds are relatively low risks, give steady income, and relatively give higher investment outcome than money market fund.

3. Stock Funds

Stock fund is also called equity fund. This fund invests its assets at least 80% in the forms of equity or stocks just like its name. Usually, most of the stocks will be mature companies that have less potential for capital appreciation but it will be more stable than growth companies. This fund may also include stocks from industries which traditionally pay higher dividends than other sectors. Because of stock fund portfolio mainly dominated by stocks, then its risk is higher than 2 other funds before but gives higher investment outcome.

4. Mixed or Balanced Funds

This type of fund invests its assets in the forms of both equity and bond without any limit or determined composition. It's made mostly for moderate risk profile investors. It is less volatile than the stock fund, the management is more flexible, and the outcome is higher than fixed income fund. Usually, its portfolio will vary with the market conditions and decisions made by the investment manager. The objective of this fund is to even out market advances and declines.

B. Risk and Return

Rate of Return

When there's a risk, there must be something in return. In finance, usually it called the rate of return. According to Wikipedia.com, rate of return is the ratio of money gained or lost on an investment relative to the amount of money invested. It stated that it is the ratio of money gained or lost, so it doesn't means that rate of return is always a profit, it could be a loss. To calculate the rate of return, there are 2 ways, and those are:

1. Arithmetic Return

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$$r_{arith} = \frac{(P_1 - P_o)}{P_0}$$

2. Logarithmic Return

$$r_{log} = \ln\left(\frac{P_1}{P_0}\right)$$

Where:

P_o = beginning price of an asset

P_1 = ending price of an asset

Standard Deviation and Variance

Referring to Investopedia.com, standard deviation is a measure of dispersion of a set of data from its mean. The more spread apart the data or volatile, the higher the deviation and vice versa. It is usually used as a gauge for the amount of expected volatility. The difference between standard deviation and variance is in the formula. Variance is the square of standard deviation. The reason standard deviation is mainly used is because the result is in the same unit as the mean which make interpretation easy. The formula of standard deviation is given below:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} (r_i - \bar{r})^2}{n-1}}$$

Where:
σ = standard deviation
r_i = return for outcome i
$\bar{r}$ = average return
n = total number of outcomes

Beta Coefficient

Referring to book by Ross, Westerfield, and Jordan, (Corporate Finance Fundamentals), beta coefficient tells us how much systematic risk a particular asset has relative to an average asset. The average asset usually is the overall financial market and in this case it is JCI. The formula for beta coefficient is given below:

$$\beta = \frac{\text{Cov}\,(R_i,\ R_m)}{\text{Var}\,(R_m)}$$

β = beta
Cov (x,y) = covariance of the component x and y
Var (x) = variance of the component x
R_i = return on investment
R_m = return on market

Covariance

Covariance is simply measure how 2 variables change together. A positive covariance means that the 2 variables move together in the same direction. A negative covariance is negative, the 2 variables move in the opposite direction. To make a diversified portfolio, it is best to add some assets that have low covariance or even negative with each other. The more diversified one portfolio is, it means that the portfolio's risk is minimalized. The formula for covariance is given below:

$$Cov_{(x,y)} = \frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})$$

Where:
Cov (x,y) = covariance of the component x and y
x_i = asset x return for outcome i
$\bar{x}$ = average return of asset x
y_i = asset y return for outcome i
$\bar{y}$ = average return of asset y
n = total number of outcomes

Portfolio Return

According to Investopedia.com, portfolio return is the monetary return experienced by a holder of a portfolio. Two things that affect the portfolio return are the weight of each asset in the portfolio and their return. The formula for portfolio return is given below:

$$E(r_p) = \sum_{i=1}^{n} w_i E(r_i)$$

Where:

= The number of assets in portfolio

= Weight of asset *i* int the portfolio

= Return of the portfolio

= Return of asset *i*

= Expected of the variable

Portfolio Standard Deviation

Portfolio standard deviation measures the risk and volatility of a portfolio contains some individual asset. There are 3 variables that affect the calculation. Those variables are the weight of each asset, standard deviation of each asset, and the correlation between assets. The formula for portfolio standard deviation is given below:

$$\sigma p = \sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j Cov(r_i, r_j)}$$

Where:

= Variance of portfolio p

= Weight/Proportion of the funds in asset i

= Weight/Proportion of the funds in asset j

C. Tools for Measuring Portfolio's Performance

Markowitz's Modern Portfolio Theory

Markowitz's Modern Portfolio Theory (MPT) is a theory in finance which developed by Harry Markowitz. According to Kaplan, it is the representation of an efficient portfolio that gives the highest return at any given level of risk. A portfolio can be considered as efficient portfolio if there is no other portfolio that gives higher expected return with the same or lower risk. According to this theory, the key to construct a portfolio that gives the highest return at any given level of risk is on the weight of the assets in the portfolio. It means that the modern portfolio theory seeks the highest Sharpe ratio a portfolio can has. So the goal of the theory is to construct an optimal portfolio with combination of various assets that generates the highest Sharpe ratio.

Sharpe Ratio

According to Gitman in his book, (Fundamentals of Investing), Sharpe's measure is a measure of portfolio performance that gives the risk premium per unit of total risk, which is measured by the portfolio's standard deviation of return. The Sharpe ratio is used to characterize how well the return of an asset compensates the investor for the risk taken. High Sharpe ratio number means that the asset gives more return for the same risk, so the higher the better.

This is what the formula looks like:

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$$S_p = \frac{\bar{r}_p - \bar{r}_f}{\sigma_p}$$

Where:
$\bar{r}_p$ = Average return of the portfolio
$\bar{r}_f$ = Average return of the risk free asset
σ_p = Standard deviation of the portfolio

Treynor Ratio

According to Gitman's book, (Fundamentals of Investing), Treynor's measure is a measure of portfolio performance that gives the risk premium per unit of non-diversifiable risk, which is measured by the portfolio's beta. The Treynor ratio is used to calculate returns over and above what would be generated by a risk-free investment. Whenever the Treynor ratio is high, it shows that the investor received high yields for each unit of market risk.

This is what the formula looks like:

$$\alpha_p = (\bar{r}_p - \bar{r}_f)/\beta_p$$

Where:
$\bar{r}_p$ = Average return of the portfolio
$\bar{r}_f$ = Average return of the risk free asset
β_p = Beta of the portfolio

Jensen's Alpha

According to Gitman, (Fundamentals of Investing), Jensen's alpha is a measure of portfolio performance that uses the portfolio's beta and CAPM to calculate its excess return, which may be positive, zero or negative. The Jensen's Alpha measures how much of the portfolio's rate of return is attributable to the manager's ability to deliver above-average returns, adjusted for market risk. The higher the ratio, the better the risk-adjusted returns.
Here is the formula for a better view:

$$\alpha_p = \bar{r}_p - \left[\bar{r}_f + \beta_p (\bar{r}_M - \bar{r}_f)\right]$$

Where:
$\bar{r}_p$ = Average return of the portfolio
$\bar{r}_f$ = Average return on the risk free assets
$\bar{r}_M$ = Average return of the market
β_p = Beta of the portfolio

Methodology

The objectives of this thesis are to construct an optimal portfolio based on the Markowitz's modern portfolio theory containing First State Investments Indonesia's mutual funds that surpass the market's performance. The tool that will help to construct the portfolio is MS Excel Solver add-ins.

The historical NAV of First State Investments Indonesia's required by a request to their management. For the JCI's adjusted closed prices, it was collected from Finance.yahoo.com. The time frame is from the beginning of 2009 until the end of 2011. The BI rate collected from their website bi.go.id.

To analyze the data, it has several of calculations in the process with the application of MS Excel to calculate the risk and return of each individual mutual fund and the optimal portfolio. Most of the calculations are using matrix multiplication which has been proved to be the same as calculating manually. To create the optimal portfolio based on Markowitz's modern portfolio theory, the author used the MS Excel's analysis tool. MS Excel Solver add-ins determines each mutual fund's weights to achieve the optimal portfolio. The last analysis is to measure the performance of the optimal portfolio and the market. This analysis is done by calculating their Sharpe ratio, Treynor ratio, and Jensen's Alpha. Then their performance will be compared to each other.

Data Analysis

D. Data Collection

The mutual funds which were analyzed in this thesis are the mutual funds from First State Investments Indonesia. Generally, there are 9 mutual funds launched by First State Investments Indonesia. In detail, there's 1 from fixed income mutual fund, 1 from money market mutual fund, 2 from mixed mutual fund, and 5 from stock fund. In this thesis, the author only selected 6 from 9 of the mutual funds because their launch periods are not the same so it cannot be compared to each other. Those mutual funds are:

Table 4.1
First State Investment Indonesia's Mutual funds from January 2009 – December 2011

Geometric Return	2009	2010	2011
First State Indonesian Bond Fund	0.0500743%	0.0574992%	0.0628149%
First State Indonesian Balanced Fund	0.1008125%	0.0407476%	0.0318633%
First State Indonesian Multistrategy Fund	0.1948151%	0.0934664%	0.0187597%
First State Indoequity Sectoral Fund	0.2387780%	0.1041982%	-0.0003709%
First State Indoequity Dividend Yield Fund	0.2194675%	0.0996420%	-0.0026020%
First State Indoequity Value Select Fund	0.2382227%	0.0825857%	0.0087258%
Jakarta Composite Index	0.2249425%	0.1468930%	0.0016736%

The Historical daily data or NAV of each mutual fund were required from the company itself. For comparison, the author selected one of Bursa Efek Indonesia's (BEI) stock market, JCI or IHSG because it has the movement of all stock prices that listed in BEI. So, JCI can be categorized to be the indicator of the First State Investments Indonesia's mutual funds.

E. Data Analysis

The first thing to do is to calculate the return from each mutual fund for each year. In order to do that, the author calculates the arithmetic return from their NAV first to gain what is needed for the calculation of geometric average return. The use of geometric return is because it calculates the average rate per period on an investment that is compounded over multiple periods. To conclude the analysis, the table below is the daily average return of each First State Investments Indonesia's mutual fund including JCI:

Table 4.2. The Daily Geometric Average Returns of First State Investments Indonesia's Mutual funds and JCI

No.	Mutual Fund's Name	Type of Mutual Fund
1	First State Indonesian Bond Fund	Fixed Income Fund
2	First State Indonesian Balanced Fund	Mixed Fund
3	First State Indonesian Multistrategy Fund	Mixed Fund
4	First State Indoequity Sectoral Fund	Stock Fund
5	First State Indoequity Dividend Yield Fund	Stock Fund
6	First State Indoequity Value Select Fund	Stock Fund

From the data above, the highlighted numbers are the return of mutual fund or composite index that got the highest return in each period. In 2009, the highest daily return achieved by FSI Sectoral Fund in the stock fund type with 0.2387780%. In 2010, unfortunately no mutual funds can top the JCI average daily return. In 2011, the FSI Bond Fund reaches top return of the year with 0.0628149%.

However, these numbers are just the average or mean from all of the return, not the actual daily return in each year consistently. That's when standard deviation takes place. It's a measurement that tells us how big the daily return dispersion from its average. If the standard deviation is high, it means the daily return is spread widely from its average and defines as a volatile asset. The author summarized the standard deviation yearly. The next table shows the standard deviation of all mutual funds and composite index:

Table 4.3. The Daily Standard Deviations of First State Investments Indonesia's Mutual funds and JCI

Standard Deviation	2009	2010	2011
First State Indonesian Bond Fund	0.6175597%	0.2982903%	0.4926226%
First State Indonesian Balanced Fund	0.8023253%	0.4677094%	0.5445013%
First State Indonesian Multistrategy Fund	1.3352005%	1.1845429%	1.4449272%
First State Indoequity Sectoral Fund	1.6584252%	1.3993183%	1.8325907%
First State Indoequity Dividend Yield Fund	1.7394847%	1.3784716%	1.6190386%
First State Indoequity Value Select Fund	1.7316485%	1.4267032%	1.6104192%
Jakarta Composite Index	1.5136325%	1.2650024%	1.4803853%

From the table above, it's common sense that the fixed income fund had the lowest standard deviation of all. It's because the NAV movement of fixed income is very little and stable, so the volatility and the dispersion are low too. For the other standard deviations, they were quietly normal for a mixed and stock fund.

After calculated the standard deviation, the author calculated the beta coefficient for the importance of calculating the Treynor ratio later. The beta also tells us how much systematic risk an asset has relative to an average asset like JCI in this case. The table below shows the annual and total beta coefficient of each mutual fund:

Table 4.4. The Annual Beta Coefficient of First State Investments Indonesia's Mutual Funds

First State Investments Indonesia's Mutual Funds		
Asset	Return	Stadev
	μ	σ
Bond fund	0.0569%	0.4856%
Balance fund	0.0574%	0.6194%
Multistrategy fund	0.1015%	1.3253%
Sectoral fund	0.1130%	1.6397%
Dividend Yield fund	0.1044%	1.5845%
Value Select fund	0.1086%	1.5932%

From the table above, the beta coefficient of each mutual fund generally are positive. It means every mutual fund's price move with the market or JCI. Beta coefficient lower than 1 like FSI Bond Fund, Balance Fund, and Multistrategy Fund are prove that their price move with the market but less volatile. The other 3 mutual funds that categorized as a stock fund, generally, are a little higher than 1 in 2009 and 2010. It means that their price movements are similar with the market but a little more volatile. It can provide a possibility of a higher rate of return but with more risk in hand.

F. Constructing the Optimal Portfolio

To construct the optimal portfolio based on Markowitz's modern portfolio theory, each mutual fund's daily average return and standard deviation from 2009 to 2011 are needed. The formulas are the same, but in this case, all of the 3 years returns are included. The table below shows the average returns and standard deviations:

Table 4.7. The daily average returns and standard deviations of First State Investments Indonesia's Mutual Fund from 2009 to 2011

Beta Coefficient	2009	2010	2011	Total Beta
First State Indonesian Bond Fund	0.118401455	0.065342428	0.110692834	0.101191147
First State Indonesian Balanced Fund	0.325464769	0.355079184	0.17758622	0.280109597
First State Indonesian Multistrategy Fund	0.849777224	0.919879981	0.418822501	0.713118097
First State Indoequity Sectoral Fund	1.072137869	1.087176652	0.41489295	0.839266128
First State Indoequity Dividend Yield Fund	1.114690296	1.067022054	0.450501643	0.862480021
First State Indoequity Value Select Fund	1.113998287	1.105928495	0.455420042	0.874309071

For the calculation of optimal portfolio, the author calculates it with Microsoft Excel Solver add-ins to help the author determining the weight of each mutual fund in a portfolio. The picture in the below is the display of Microsoft Excel Solver add-ins:

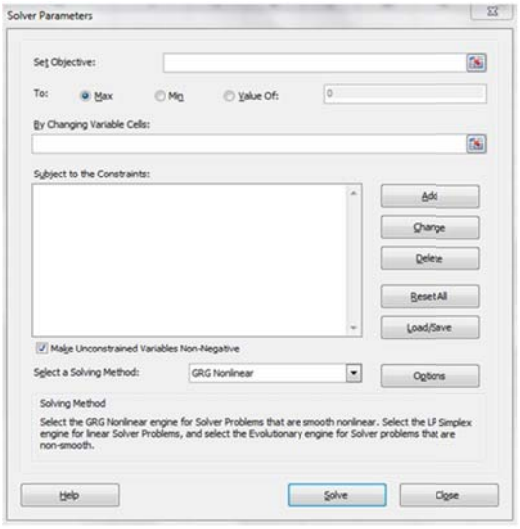

Figure 4.1. Microsoft Excel Solver add-ins Display

In the picture above, there are 4 points that can be set. The first point is the objective cell. In this case, it is the portfolio's return cell, standard deviation cell, and Sharpe ratio cell. The second point is an option that can set the objective cell to maximize, minimize, or even a certain value. The third point is the cells that can change to fulfill the objective. In this case, it is the weight of each mutual fund in the portfolio. The last point is the constraints or rules or criteria which can be applied to the calculation. For example, the author put a constraint that the portfolio's total weight must be 100%, so if the mutual funds' weights are summed, it adds up to 100%. Another example is to constraint the changing variable cells in order not to result below 0 or in other words force sell. Because in mutual fund, there is no force sell.

The author wants to make 3 portfolios with 3 different types. The first type is the portfolio which has a maximum return with a standard deviation less or equal than the lowest standard deviation a single mutual fund had. The second type is the portfolio which has a minimum standard deviation with a return equal or higher than the highest return a single mutual fund had. The third type is the portfolio which has a maximum Sharpe ratio.

Optimal Portfolio with a Maximum Return

To calculate the first type portfolio, the author puts the portfolio's return in the objective cell and set it to max because the objective is to maximize the return. Then the author set each of the mutual fund weight to be the variables that can change in order to reach the objective. The constraints that have been made are the portfolio's weight is equal to 100%, the changing variables cannot go lower than 0, and the standard deviation of the portfolio cannot be higher than the lowest standard deviation of a single mutual fund. In this case, that mutual fund is the FSI Bond Fund with a 0.4856% standard deviation. With all of that data, the solver generates a portfolio like the table below:

Table 4.8. The Optimal Portfolio with a Maximum Return

	Maximum Return
Var. Constrain	Stadev σ <=
Val. Constrain	0.4856%
Bond fund	75.37%
Balance fund	17.90%
Multistrategy fund	0.66%
Sectoral fund	6.07%
Dividend Yield fund	0.00%
Value Select fund	0.00%
Σw	100.00%
Return μ	0.0607%
Stadev σ	0.4856%

Optimal Portfolio with a Minimum Standard Deviation

The calculation is pretty much the same with the previous one for the second type portfolio. There are only slight of changes in the objective cell and the constraints. To construct the second type portfolio, the author wants to minimize the standard deviation, which is the objective cell, with a return higher or equal than the highest return in a single mutual fund. That mutual fund is the FSI sectoral fund with a 0.1130% average daily return. The result of the portfolio is shown in the table below:

Table 4.9. The Optimal Portfolio with a Minimum Standard Deviation

	Minimun Stadev
Var. Constrain	Return μ >=
Val. Constrain	0.1130%
Bond fund	0.00%
Balance fund	0.00%
Multistrategy fund	0.00%
Sectoral fund	100.00%
Dividend Yield fund	0.00%
Value Select fund	0.00%
Σw	100.00%
Return μ	0.1130%
Stadev σ	1.6397%

Optimal Portfolio with a Maximum Sharpe Ratio

For the third portfolio's calculation, the objective for this optimal portfolio is a maximum Sharpe ratio. The constraint that still applied is the portfolio's weight must be 100% with all mutual funds' weight combined. With only that, the next table shows the optimal portfolio with a maximum Sharpe ratio:

Table 4.10. The Optimal Portfolio with a Maximum Sharpe Ratio

	Maximum Sharpe Ratio
Var. Constrain	-
Val. Constrain	-
Bond fund	78.46%
Balance fund	0.00%
Multistrategy fund	13.12%
Sectoral fund	8.41%
Dividend Yield fund	0.00%
Value Select fund	0.00%
Σw	100.00%
Return μ	0.0674%
Stadev σ	0.5640%
Sharpe ratio $\mu-\mu_{rf}/\sigma$	0.072143598

G. Performance Comparison

Sharpe Ratio

Generally, Sharpe ratio is measuring the ratio of one asset's return to its deviation. To calculate the ratio, it needs the risk premium and standard deviation of one asset. The higher the Sharpe ratio, the better one asset's performance is. The figure below shows the annually Sharpe ratio off all mutual funds and the composite index:

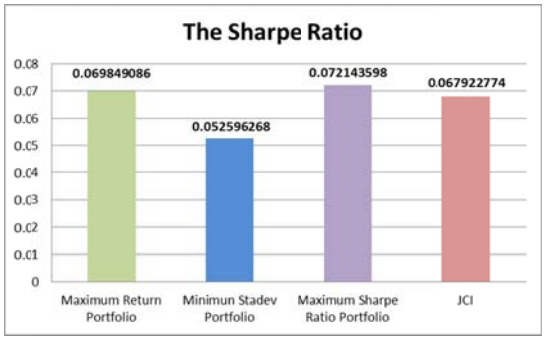

Figure 4.2 .Portfolios' and Market's Sharpe Ratio

From the figure 4.2, the Maximum Sharpe Ratio portfolio has the highest annual Sharpe ratio of all. It even tops the market. It means that the best ratio between a portfolio return and its standard deviation is achieved by the Maximum Sharpe Ratio portfolio. It's also means that the portfolio achieved the goal of Markowitz's modern portfolio theory.

Jensen's Alpha

To calculate the risk-adjusted performance, it needs the portfolio's return and then subtract it by Capital Asset Pricing Model (CAPM) return. It mainly tells how much the return of the portfolio is above or below market return. If the result is positive, it means that the return is above the market return. The figure below shows us the Jensen's Alpha of each portfolio:

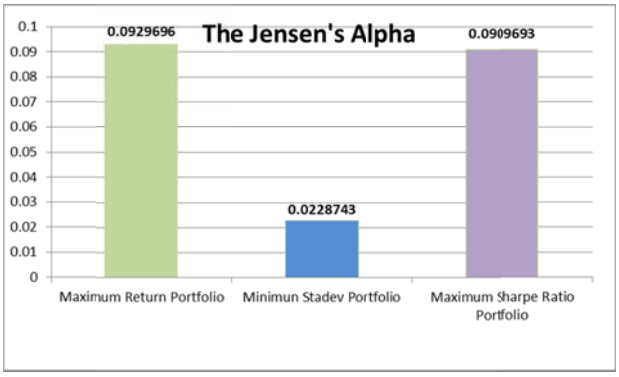

Figure 4.3. Portfolios' Jensen's Alpha

Based on the figure above, all of the portfolios have a positive value. That means all of these portfolios could earn excess return or beat the market. The highest value that a portfolio has is the Maximum Return portfolio and followed by the Maximum Sharpe Ratio portfolio and then the Minimum Standard Deviation portfolio.

Treynor Ratio

The calculation for Treynor ratio is almost the same with the Sharpe ratio's formula. The difference is in the Treynor ratio's formula, the denominator is replaced by the portfolio's beta. So this calculation is based on the systematic risk. To gain the beta of the portfolio, the betas for each mutual fund in the portfolio are added up according to their weight in it. But it is different with the JCI beta. The beta of JCI is 1 because it is the market. The figure below shows the Treynor ratio of each mutual fund:

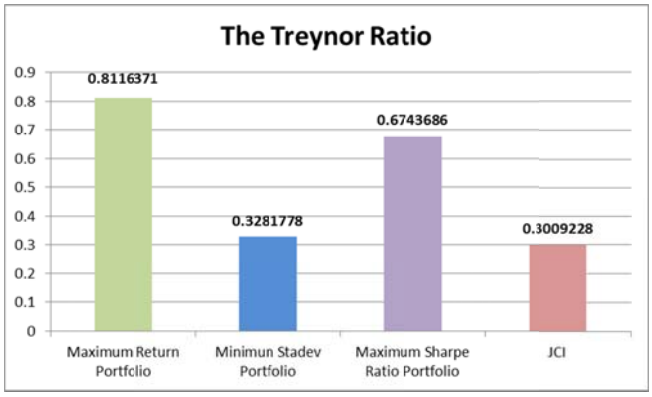

Figure 4.4. Portfolio's and Market's Treynor Ratio

Based on the figure above, it is clearly described all of the portfolios are superior to the market. The highest Treynor ratio is achieved by the Maximum Return Portfolio followed by the Maximum Sharpe Ratio and Minimum Stadev portfolio which left the market behind. Based on the positive results, these portfolios are more responsive to the change of price than the market has.

Conclusion and recommendation

Conclusion

After analyzing the risk and return of 6 mutual funds from First State Investments Indonesia and the composite index, mostly, the 3 years average daily return of each First State Investments Indonesia's mutual funds are below the daily return of the market. For the daily standard deviation, generally,

each mutual fund that contain mostly of stock have larger standard deviation than the market. The mutual funds that belong to the balance fund and fixed income fund have lower standard deviation than the market. Because the individual mutual funds cannot surpass the performance of the market, the author constructs 3 optimal portfolios to achieve and prove the Markowitz's modern portfolio theory. Those portfolios are Maximum Return portfolio, Minimum Standard Deviation portfolio, and Maximum Sharpe Ratio portfolio. Each of them has their own characteristic based on their name.

The first portfolio, the Maximum Return portfolio has a maximum daily average return with a standard deviation equal with the lowest standard deviation of a single mutual fund. It contains a 75.37% of FSI Bond Fund, 17.90% of FSI Balance Fund, 0.66% of FSI Multistrategy Fund, and a 6.07% of FSI Sectoral Fund. The portfolio generates 0.0607% average daily return and 0.4856% average daily standard deviation.

The second portfolio is the Minimum Standard Deviation portfolio. It has a minimum daily average standard deviation with a return equal with the highest return of a single mutual fund. It contains 100% of FSI Sectoral fund. The portfolio generates 0.1130% average daily return and 1.6397% average daily standard deviation.

The last portfolio is the Maximum Sharpe Ratio portfolio. This portfolio has a maximum Sharpe ratio that a portfolio of 6 mutual funds can have. It contains 78.46% of FSI Bond fund, 13.12% of Multistrategy fund, and 8.41% of FSI Sectoral fund. The portfolio generates 0.0674% average daily return and 0.5640% average daily standard deviation.

From those portfolios, the author compares them and the composite index to each other with 3 performance measurement annually. Those 3 measurements are Sharpe ratio, Jensen's Alpha, and Treynor ratio. The first measurement indicates that the portfolio that has the highest Sharpe ratio is the Maximum Sharpe Ratio portfolio. The second measurement indicates that the portfolio that has the highest Jensen's Alpha is the Maximum Return portfolio which only slightly differs with the Maximum Sharpe Ratio portfolio. The last measurement indicates that the portfolio that has the highest Treynor ratio is also the Maximum Return portfolio followed by the Maximum Sharpe portfolio.

From those 3 measurements, although 2 of them are topped by the Maximum Return portfolio, the goal of the Markowitz's modern portfolio is to achieve the highest return with at any given level of risk. So the most optimal portfolio from First State Investments Indonesia's mutual funds is the Maximum Sharpe Ratio portfolio.

Recommendation

In this section, the author will give some recommendation for the readers, investors, and further studies based on this thesis:

1. For the readers or investors who want to invest their money but don't have the time to manage an asset or don't have the skills and knowledge about the capital market, the author recommend them to invest their money into the First State Investments Indonesia's mutual funds especially to the Maximum Sharpe Ratio portfolio that has been calculated by the author. From the author's analysis, the performance of the Maximum Sharpe Ratio portfolio surpasses the market and fulfills the goal of Markowitz's modern portfolio theory which has the highest Sharpe ratio of all. The portfolio generates 0.0674% average daily return and 0.5640% average daily standard deviation. The Maximum Sharpe Ratio portfolio consists of 78.46% of FSI Bond fund, 13.12% of FSI Multistrategy fund, and 8.41% of FSI Sectoral fund. From the past performance, it is proved

that the mutual funds are good and stable to be very profitable. To create a portfolio from that, it will reduce the risk and exceed the market's performance.

2. For the future studies, this thesis is limited only to represents the optimal portfolio in the past time because it only used the historical data. So this research didn't give the future return. To create an optimal portfolio for the future investment, the author recommends constructing the optimal portfolio with the same calculation but with the forecasted mutual fund's NAV, JCI's closing prices, and BI rate so the results will be better for the future investment.

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