

# Estimating the Risk of Mutual Funds in Indonesia by Employing Value at Risk (VaR)

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## Abstract:

This research examines the performance of mutual funds in Indonesia by employing modified VaR and modified CVaR/ES from 2 January 2007 to 29 September 2008. VaR measures the worst expected loss that an institution can suffer over a given period of time under normal market conditions at a given confidence level. It is found that a majority of mutual funds in Indonesia have a VaR less than 2.97 per cent for fixed income funds and protected funds; and less than 6.98 per cent for mixed funds and equity funds. By giving an alternative for measuring the performance of funds, the manager will have a better perspective of risk, i.e. the mutual fund companies are able to acknowledge the risk to their investors in terms of rupiah. Moreover, Indonesia's regulator can set a standard of financial market risk. An alternative method for measuring the performance of financial markets is proposed in this paper.

**Keywords:** Mutual Fund, Value at Risk

**JEL Classification:** G 110

## 1. Introduction

In the United States of America, mutual funds have become popular over the last 20 years. One half of the households in America invest in mutual funds (Cuthberstson, Nitzsche, & O'Sullivan, 2006). In this global economy, the instrument gained popularity in other countries, including Indonesia. Mutual funds began as an alternative investment in Indonesia since 1990 when closed-end funds were established based on *Keputusan Menteri Keuangan 1548* (Minister of Finance ACT no.1548).

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Then, in 1995 Law no.8 on the capital market allowed both open-end funds and closed-ends fund to operate in Indonesia. The expansion of mutual funds is rapid - which is indicated by the amount of Net Asset Value (NAV) which was Rp. 114.37 trillion in 2009, while it was only Rp. 8 trillion in 2001. Furthermore, the convenience of this instrument is that an investor is not necessarily monitoring the price movement of the portfolio. A professional fund manager will manage the portfolio.

With respect to returns, funds will achieve higher returns compared to interest paid on less risky assets when the portfolio is held over long periods of time. Thus, mutual funds have made it possible for the small investor to participate in the stock and bond markets to earn higher returns on their savings (Carlson, Pelz, & Sahinoz, 2004). Moreover, capital gain from funds is tax free in Indonesia. Other benefits of investing in this instrument include high liquidity, low cost, investment diversification, and transparency in information.

However, in addition to all the benefits above, there are risks attached to this instrument, namely, liquidity risk, downward turn of return, market risk, and default risk. The investors should be made aware of the risks, especially the market risk, in other words, the investors must be aware of the worst possible loss. Recognising the worst possible loss of portfolios by investors/fund managers is very important. Otherwise, if there is slightly negative news in the market, there will be a rush or panic. It will lead to financial market instability, which may impact upon Indonesia's economic stability.

The method used to measure the worst possible loss of portfolio is Value at risk. Value-at-Risk (VaR) was used by financial firms in the late 1980s, and then J.P Morgan established the Risk Metrics system as a market standard in 1994. The importance of VaR is even more apparent when the Basle Committee adopted it to measure risk capital requirements and US SEC required companies to use VaR in measuring market risk (Linsmeier & Pearson, 2000). Since then, there has been considerable research on VaR (such as Sarma, Thomas & Shah 2001; Cao, Harris, and Shen, 2008; Alexander and Baptista, 2003; Allen and Powell, 2007).

Looking at the interest of Indonesian investors in buying this instrument, investors focus only on the return since mutual funds have given good returns up until now compared to low risk securities, such

as Certificate of Deposit (CD), and Surat Berharga Indonesia (SBI)<sup>1</sup>. So far, fund managers only concentrate on the performance of their portfolio. Research on performance of mutual funds in Indonesia has been conducted by Muhandi (2010); Dewi and Ferdian (2009). Muhandi (2010) suggests that four mutual funds have good performance in market timing and four mutual funds have good performance in stock selection. Furthermore, Dewi and Ferdian (2009) find that Malaysian Islamic stocks outperform Indonesian Islamic mutual funds. Other research on the performance of mutual funds has been done by Kacperczyk, Sialm, and Zheng, 2004 and 2005; Hendricks, Patel, and Zeckhauser (1990); Chan, Chen, and Lakonishok (1999); Shanken and Jones (2002); Dor and Jagannathan (2002). Nevertheless, none of them use the Value at Risk (VaR) method. VaR as a more recent method compares to a Treynor performance index or Sharpe performance index and is worth examining. It will give a different perspective of risk, which views the risk in terms of value (Rupiah). As the Basle Committee adopts it to measure risk capital requirements and US SEC requires companies to use VaR in measuring market risk, I believe it is timely to examine the efficacy of this method in the Indonesian context. The paper contributes to the extant literature by providing an alternative performance measure of Indonesian mutual funds using VaR.

However, it is interesting to note that in the Indonesian banking sector, research on its performance has employed VaR (Muresan, & Danila, 2005). The study concluded that the condition of the average banking industry during the period of 1999-2003 was relatively better than for the period 1991-1996. The average banks' VaR was approximately 3 per cent.

As we mentioned earlier, none of Indonesian funds' performance research uses VaR. That is why it is essential to study the performance of mutual funds in Indonesia by using this methodology. VaR measures the worst possible loss in terms of value (Indonesia Rupiah). It is more sensible especially for investors because it is expressed in how much (Indonesia Rupiah) the investors may possibly lose per day. Looking at the investors' profile, 98.6 per cent are individual investors. 69 per cent

<sup>1</sup> The return of CD is around 6.4%/year; bond is around 10%; stock is around 15%; and mutual fund according to the best performance of funds are as follows: fixed income funds (14.36% - 1,161.42%), syariah fixed income funds (7.68% - 14.21%), balanced/mixed funds (50% - 149.11%), syariah balanced/mixed funds (17.01% - 59.27%), equity funds (63.52% - 87.47%), syariah equity funds (29.90% - 54.96%), structured funds (12.77% - 36.52%), and index funds (59.09%) (portal reksadana, 2008).

of them have less than Rp.100 million in income per year. Furthermore, most of them (80 per cent) buy funds for the reasons of investment and additional income (Bapepam LK, n.d.). Giving them a Sharpe performance index, for example, may create a difficulty for them to understand because it is in terms of an index; however, giving them the possible loss in terms of rupiah is easier to understand. So, they know exactly the extent of risk they might bear when the expected worst loss occurs. As a result, market panic could be avoided. It is important for ensuring stability in the financial market (Borensztein & Gelos, 2001).

This paper examines the worst expected loss of mutual funds in Indonesia by employing the Value at Risk method. The objective is to study the risk of Indonesia's mutual funds in term of rupiah. As noted earlier there is no study of Indonesia's mutual funds performance using VaR. The importance of the study is in providing funds' managers with more perspectives of risk. By recognising this area, they will be wiser in term of diversifying the assets. On the other hand, funds' investors will be aware of the maximum expected loss of their investments, in other words, educating investors is necessary for financial market stability<sup>2</sup>. As suggested by recent studies, there is a strong correlation among Asian stock markets (Park, 2010; Thao & Daly, 2012; Vargas III & Mapa, 2007) and providing information on the overall market risk in Indonesia is very important for investors in Asian countries to consider in terms of investments diversification. A shock in one market in the region will have a huge impact on the rest of Asian markets. Furthermore, Asian regulators have an incentive to establish standards to ensure market stability. Finally, the research contributes to extant literature on 'stock market risk' in emerging markets.

The remainder of this paper is organised as follows. The second section discusses mutual funds, their performance and the detail of Value at Risk. The third section explains the empirical analysis of performance of Indonesia's mutual funds using VaR. The fourth section presents the results and discussion, while the final section contains concluding remarks.

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<sup>2</sup> As noticed by Borensztein and Gelos (2001) that "an individual crises shows that, on average, funds withdrew money one month prior to the events. The degree of herding among funds is statistically significant, but moderate. Herding is more widespread among open-ended funds than among closed-end funds, but not more prevalent during crisis than during tranquil times. Funds tend to follow momentum strategies, selling past losers and buying past winners, but their overall behavior is more complex than often suggested".

## 2. Previous Studies

### 2.1 *Mutual Fund*

Kaminsky, Lyons, and Schmukler (2000) examined mutual fund strategies in emerging markets. They investigated whether momentum 'trading'<sup>3</sup> exists in this market. Apparently, during a crisis, contemporaneous momentum<sup>4</sup> trading is stronger for fund investors. However, during non-crisis, lagged momentum trading<sup>5</sup> is stronger for fund managers. In addition, when asset prices fall in one country, then investors engage in selling assets from another country. It is called 'contagion trading'.

Rooij, Alessie, and Lusardi (2007) investigate the importance of financial literacy for market participants in relation to the stock market, i.e., whether more financially knowledgeable individuals are more likely to hold stocks. The evidence shows that market participants who have low financial literacy are significantly less likely to invest in stocks<sup>6</sup>. This finding is not surprising since investors will prefer to invest their money in instruments they are familiar with.

In Indonesia, the mutual funds are classified as (Bapepam-LK, 2009):

1. Conventional funds: Conventional funds consist of money market funds, fixed-income funds, growth/equity funds, and balanced funds. Research by Chan et al (1999) showed that a fund's styles are more likely to choose good performance growth stocks when they deviate from the benchmark. Further, styles are consistent, although funds have better style-adjusted performance than value funds.
2. Structured funds: Looking at the need of investors for relatively low risk in a volatile financial market, and a need of variety products of funds, Bapepam created new funds called Structured funds. The fund consists of capital protected funds, guaranteed funds, and index funds. Capital protected funds are the same as fixed-income funds with additional features; those are a protection of initial capital and a locked up period of redemption. This fund invests 80 per cent to 90 per cent of NAV in fixed income instruments,

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<sup>3</sup> Momentum trading is when investors/fund managers buy winners and sell losers.

<sup>4</sup> Buying current winners and selling current losers

<sup>5</sup> Buying past winners and selling past losers

<sup>6</sup> Research on this topic has not been done in Indonesia

such as, zero coupon bonds, and Government bonds (Surat Utang Negara), the rest 10 per cent to 20 per cent is invested in equity or derivatives. Guaranteed Funds is a fund which gives a guarantee to investors' capital, however, a third party is the one who gives the guarantee and not the fund itself. The third party is usually a financial institution. Just like capital protected fund, 80% of NAV is invested in fixed income instrument, while the rest is invested in equity at home or in foreign capital markets. Index funds are funds that replicate the performance of a broad market index, such as Index Harga Saham Gabungan(IHSG), and Jakarta Islamic Index(JII). The index fund is managed passively. Concerning active and passive managers, Berk and Green (2002) found that due to market competitiveness and decreasing returns, active managers do not outperform passive benchmarks. Accordingly, predicting future returns or inferring the skill of active managers cannot rely on past performance.

3. Exchange Traded Funds (ETF): These are similar to index funds; both of them hold investment portfolios that replicate a performance of market index and both of them are passively managed investment instruments. Nevertheless, there is dissimilarity between both of them. Index Fund is traded through broker-dealer or directly from a mutual fund company, while ETF is traded through the stock exchange (Investment Company Fact book, 2007).
4. Shari'ah fund: This is based on Islamic rules. In other words, all the money has to be invested in instruments that are not against Islamic law, for example, fund managers are not allowed to invest the money in conventional banking industry because interest is considered 'haram' (forbidden) in Islamic law.

### *2.1.1 Mutual Fund Fees and Expenses*

Not all actions of fund managers<sup>7</sup> are observed by mutual fund investors. This implies that fund investors hold hidden costs, such as, trading costs, agency costs, and negative investors' externalities. Carlson, et al (2004) also mentioned that investors are not well informed about fees.

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<sup>7</sup> "In the mutual scandals of 2003, mutual fund managers secretly obtained extra compensation by selling the right to trade at stale prices. But even before the scandals unfolded, some researchers were asking whether the size of management fees and other expenses in some mutual funds suggested that investors lacked the sophistication to take appropriate account of costs" (Mahoney, 2004).

Due to the costs, around 80 per cent of mutual funds under-perform the average return of the stock market. Most of funds make their investors confused with the jargon used for their fees (Advantages and Disadvantages of Mutual Funds, n.d). In addition, it is found that costs are the key factors which determine the performance of funds (Carlson et al., 2004). Carlson et al. (2004) also confirmed that a number of funds yield less than their peers. However, they can benefit from unobserved interim trades by skilled fund managers who can use their informational advantage to time purchases and the sales of individual stock optimally. In examining the impact of the unobserved actions on the fund performance using a large sample of US equity mutual funds between 1984 and 2003, Kaperczyk et al. (2005) found that the funds with value-enhancing unobserved actions outperform funds whose unobserved actions predominantly reflect hidden cost.

Considering the fee issue, Khorana, Servaes and Tufano (2007) suggested that fees are different among countries due to Fund and Fund Family characteristics – a higher minimum investment requires lower fees. Furthermore, higher fees are required for funds that are invested in many countries and certain offshore locations. Finally, lower fees are applied to countries which provide protection for the investors. Mutual funds have two major costs: sales loads and ongoing expenses. Sales loads are paid by investors directly, and they are paid either at the time of buying (front-end load) or when shares are redeemed (back-end load). Thus, these costs are one time costs. In Indonesia, there is also a fee for switching the funds' products, it is called switching fee. Ongoing expenses are paid by investors directly, that is the costs are deducted from fund assets. Next, the performance of mutual funds will be discussed.

## **2.2 Mutual Funds Performance**

A mutual fund's performance is often measured by the Treynor Performance index, Jensen Performance Index, and Sharpe Performance Index. Previous studies of Indonesia's mutual funds all use these methods (Murhadi, 2010; Dewi & Ferdian, 2009). Muhardi (2010) assesses the performance of Indonesia mutual fund managers using the framework suggested by Treynor and Mazuy (1966) and Henrikson and Merton (1981). He observed fifty five mutual funds from beginning February 2008 until June 2009. The result shows that only four mutual funds have good performance in term of market timing and stock

selection. Meanwhile, Dewi and Ferdian (2009) measure the performance of Islamic funds in Malaysia and Indonesia using Treynor, Sharpe, Jensen indices, and Snail Trail methodology and Market Timing ability. They compare the performance of Islamic funds in Malaysia and Indonesia from January 1st, 2006 to April 31st, 2009. They investigate whether the global crisis affected the performance of those funds. The result suggests that Malaysian Islamic stocks seem to outperform the Indonesian Islamic mutual funds.

Kacperczyk et al. (2005) studied a performance of mutual funds using return gap. They estimated the gap between the reported fund return and the return of previously disclosed holding portfolio that has been expenses-adjusted. They suggested that funds with value-enhancing unobserved actions outperform funds with unobserved actions due to hidden cost. Other research on the performance of mutual funds has been conducted by Hendricks et al. (1999); Chan et al. (1999); Shanken and Jones, (2002); Dor and Jagannathan (2002). None of them employ the Value at Risk method. However, there are studies measuring performance of stocks by implementing Value at Risk (Alexander and Baptista, 2003; Allen & Powell, 2007; Cao et al., 2008; Sarma, et al., 2001).

In addition, Allen and Powell (2007) investigated the market Value at Risk (VaR) and Conditional VaR (CVaR) in Australia from an industry perspective, using a set of Australian industries. They observed that the Technology sector has the highest risk, and the lowest risk is in the Finance and Utilities sectors. Furthermore, using the same method, Sarma et al. (2001) look at the performance of the S&P 500 index and India's NSE-50 index. Meanwhile, Cao et al. (2008) employ a semi-parametric method of estimating minimum-VaR and minimum-CVaR hedge ratios based on the Cornish-Fisher expansion. They suggest that the semi-parametric approach is superior to the standard minimum-variance approach which produces lower VaR and CvaR hedge portfolios.

As noted earlier, evidence on Indonesian mutual funds performance using VaR is missing. It is important, since Indonesia is a large country where its financial market has a huge potential to develop and provides opportunity for the rest of Asian countries to participate in the market. Moreover, the recent studies evidence a high correlation of Asian stock markets (Park, 2010; Thao & Daly, 2012; Vargas III & Mapa, 2007). It has implications for investors in terms of diversification of their investments

in the region, since shocks to any one market will have an impact on other markets.

The detail of value at risk method will be described below.

### 2.2.1 Value at Risk (VaR)

VaR has been widely used since J.P Morgan adopted this method in 1994 (Butler, 1999). VaR measures the worst expected loss that an institution can suffer over a given time interval under normal market conditions at a given confidence level (Butler, 1999). VaR has three elements, namely, a time period, a confidence level, and a loss amount (or loss percentage). Thus, VaR addresses the question such as, how much is the most I can – with a 95 per cent<sup>8</sup> or 99 per cent level of confidence – expect to lose over the next month (or next year)? VaR estimates can be calculated for various types of risks, namely: market, credit, operational risk.

There are three major strands of VaR methodologies: the historical method, the parametric method and the Monte Carlo simulation (Berry, 2008; Damodaran, 2007; Dobranszky, 2009; Letmark, 2010; Linsmeier & Pearson, 2000).

1. Historical method: this method is very simple, that is, fund managers simply keep track of the historical returns and losses within the portfolio, putting them in order from worst to best, and then calculate the fifth percentile for 95 per cent or 1 percentile for 99 per cent VaR. It is assumed that history will repeat itself, from a risk perspective. This method is not suitable for portfolios where weightings change over time. In other words, this method is not suitable for measuring mutual funds' risk.
2. The parametric method/delta-normal approach: this method assumes that returns are normally distributed. In other words, it requires that we estimate only two factors: an expected (or average) return and a standard deviation. The logic behind this method is that by using a normal distribution, we automatically know where the worst 5 per cent and 1 per cent lie on the distribution.

Parametric VaR is simply expressed as (Berry, 2008):

$$\text{VaR}_{1-\alpha} = -x_{\alpha} \times P$$

where

- $\text{VaR}_{\alpha}$  is the estimated VaR at the confidence level  $100 \times (1 - \alpha)\%$

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<sup>8</sup> It means that 95per cent of the time we would expect the maximum loss over a month (a year)

- $x_\alpha$  is the left-tail  $\alpha$  percentile of a normal distribution.  $x_\alpha$  is described in the expression  $P(R < x_\alpha) = \alpha$ , where  $R$  is expected return. In order for VaR to be meaningful, we generally choose a confidence level of 95% or 99%.  $x_\alpha$  which is generally negative.
- $P$  is the marked-to-market value of the portfolio  
Using a standard normal distribution replaces  $x_\alpha$  by  $z_\alpha$ , then:  
$$z_\alpha = (x_\alpha - \mu) / \sigma$$
  
Re-write the formula:  $VaR_{1-\alpha} = -(\mu + z_\alpha \times \sigma) \times P$   
When we have a portfolio with two assets, then VaR is as below:  
$$VaR_{1-\alpha} = -(\mu + z_\alpha \times \sigma_p) \times P$$
  
where  $\sigma_p$  is volatility of portfolio

3. Monte Carlo simulation: a future probability distribution is assumed and the behavior of assets is simulated by generating random price paths. Then, VaR is determined from the distribution. The model is computer extensive. The model generates a random number that will be used to estimate the return (or price) of the asset at the end of the analysis horizon.

### 2.2.2 Limitation of Value at Risk

According to Artzner, Delbaen and Heath (1999), there are four axioms to be satisfied in order for a risk measure (metric) to be effectively used in managing risks. Risk measures which satisfy four axioms are called coherent. The axioms are as follows:

Translation invariance: for all real numbers  $\alpha$ , we have  $\rho(X + \alpha \cdot r) = \rho(X) - \alpha$ . Cash or another risk free asset does not contribute to portfolio. Thus, risk metrics should be measured in value terms (e.g. in rupiah).

Sub-additivity:  $\rho(X1 + X2) \leq \rho(X1) + \rho(X2)$ , "a merger does not create extra risk". In other words, the risk of a portfolio of 2 assets should be less or equal to the sum of the risk of individual assets.

Positive homogeneity: if the portfolio is increased constant times, the risk becomes constant times larger

Monotonicity: if asset  $X > 0$ ,  $r(X) \leq 0$ , if the return of a portfolio is smaller than that one of other portfolio, then the portfolio with larger return will have larger risk

Munenzon (2010) suggests that markets empirically have certain features: returns do not follow a normal distribution; losses and gains are concentrated; and there is gain/loss asymmetry. Accordingly, risk

metric focusing on tail losses is important since it has a significant impact on portfolio performance. One such risk metric is VaR.

Moreover, according to Damodaran (2007) and Munenzon (2010), there are some limitations for Value at Risk. One of them is its return distributions. VaR has an assumption of return distributions. The Delta-normal approach assumes that the distribution is normal, violation of this assumption will underestimate the VaR. The Monte Carlo approach assumes a 'future probability' distribution. The judgment made could be wrong. With the historical simulation, the assumption of distribution based on past data represents the distribution by looking forward. In reality, the returns distributions are usually not normal. In addition, VaR fails to meet the characteristics of sub-additivity, that the risk of portfolio in terms of VaR may be larger than the sum of risk of its components (Letmark, 2010). Further, VaR is an incomplete risk metric since it can not provide any information about the magnitude of losses once the VaR limit is exceeded (Munenzon, 2010).

Elliot and Miao (2007) and Letmark (2010) suggest that Conditional Value at Risk (CVaR) or expected shortfall (ES) have superior properties over VaR. CVaR is the expected loss incurred in the % worst cases. CVaR is defined as the conditional expectation of the losses exceeding VaR. CVaR satisfies four axioms of a coherent risk metric (Munenzon, 2010). Mathematically, CVaR can be defined as:

$$CvaR = -E(R \mid R < -VaR)$$

Huisman (1999, as cited in Brian, 2010) and Favre and Galleano (2002, as cited in Brian, 2010) proposed to overcome the VaR flaws by incorporating the higher moments of the return distribution into VaR calculation, it is using the Cornish-Fisher expansion. It produces the same result if distribution is normal.

### 3. Data and Methodology

This section will discuss data and the methodology used to calculate the worst expected loss that fund managers/investors bear for a given period mentioned previously. Daily Net Asset Value (NAV) data of mutual funds have been obtained from Portal Reksadana from 2 January 2007 to 29 September 2008. The products<sup>9</sup> are as shown in Table 1.

<sup>9</sup> The entire population (all mutual funds' products in Indonesia) is 456 products. Data is provided by Portal Reksadana

Table 1: Funds products in Indonesia

Types of Funds <sup>10</sup>	Numbers of funds	Jarque-Bera (p-value)*
fixed-income funds	121	27.7079, (9.62272e-07)
growth/equity funds	61	26.5782 (1.69285e-06)
balanced/mixed funds	92	116.534 (4.95435e-26)
protected funds	113	61.0756 (5.46519e-14)
index fund	1	26.7499 (1.55357e-06)

Source: Portal Reksadana

\* Jarque-Bera tests shows that all the funds are not normal (significant value indicates non-normality)

Before employing VaR to estimate the performance of funds, we test normality of funds' return, using Jarque-Bera test. As we predict, returns do not follow a normal distribution. To overcome this problem and others VaR flaws as mentioned above, we use modified VaR and modified ES/CVaR. A Performance Analytics package provides the methods. Modified VaR and modified ES/CVaR incorporate the higher moments of the return distribution by using Cornish-Fisher expansion.

#### 4. Results and Discussion

The results of Modified VaR at 99 per cent and modified ES/CVaR<sup>11</sup> at 99 per cent are shown in Table 2.

The Table 2 reports performances of each fund's type. In each fund's type, the percentage range of modified VaR, and modified ES/CVaR are reported. When applying modified VaR, the results are as follows:

- 68.6 per cent of fixed income funds is less than -2.97 per cent
- 71.8 per cent of protected funds is less than -2.88 per cent
- 92 per cent of mixed funds is less than -6.89 per cent
- 78 per cent of equity funds is less than -6.98 per cent

Thus, if net asset value of "x" equity fund is Rp. 10,000,000,000, with -5.38 per cent modified VaR, the worst expected daily loss is 5.38 per cent x Rp. 10,000,000,000 or Rp. 538,000,000.-

Furthermore, using modified ES/CVaR, the result is not much difference. But, the equity funds which have value less than -6.98 per

<sup>10</sup> The funds include both conventional and syariah.

<sup>11</sup> Details of the calculation can be requested from the author.

Table 2: Daily Modified VaR and Modified ES/CVaR of Mutual Funds in Indonesia

Types of Funds	Modified VaR at 99 per cent	Modified ES/CVaR at 99 per cent
Fixed-income funds (121 products)	> -9 per cent = 8 products	> -9 per cent = 9 products
	-5 per cent to -7 per cent = 12 products	-5 per cent to -7 per cent = 12 products
	-3 per cent to -4.96 per cent = 12 products	-3 per cent to -4.96 per cent = 13 products
	-1 per cent to -2.97 per cent = 44 products	-1 per cent to -2.97 per cent = 48 products
	< -1 per cent = 26 products	< -1 per cent = 34 products
	NA <sup>12</sup> = 19 products	NA <sup>13</sup> = 5 products
Protected-funds (113 products)	> -9 per cent = 4 products	> -9 per cent = 9 products
	-6 per cent to -8.84 per cent = 8 products	-6 per cent to -8.84 per cent = 8 products
	-3 per cent to -5.83 per cent = 17 products	-3 per cent to -5.51 per cent = 19 products
	-1 per cent to -2.88 per cent = 46 products	-1 per cent to -2.81 per cent = 46 products
	< 1 per cent = 28 products	< 1 per cent = 28 products
	NA = 10 products	NA = 3 products
Mixed funds (92 products)	-7 per cent to -8.45 per cent = 7 products	-7 per cent to -9.88 per cent = 8 products
	-4 per cent to -6.98 per cent = 44 products	-4 per cent to -6.98 per cent = 48 products
	-2 per cent to -3.97 per cent = 27 products	-2 per cent to -3.97 per cent = 24 products
	< -2 per cent = 10 products	< -2 per cent = 12 products
	NA = 4 products	
Equity (61 products)	-7 per cent to -8.18 per cent = 13 products	-7 per cent to -9.67 per cent = 20 products
	-4 per cent to -6.98 per cent = 43 products	-4 per cent to -6.98 per cent = 36 products
	< -3 per cent = 4 products	< -3 per cent = 5 products
	NA = 1 product	
Index-syariah (1 product)	-5.80 per cent	-6.62 per cent

<sup>12</sup> VaR calculation produces unreliable result

<sup>13</sup> ES calculation produces unreliable result

cent is around 67 per cent. It means using modified ES/CVaR produces higher value than modified VaR. Hence, if we put funds in a row from the smallest to the highest of modified VaR and modified ES/CVaR, they are as follows: protected funds, fixed-income funds, mixed funds, and equity funds consecutively. This is not surprising since the composition of protected funds and fixed-income funds has a large portion of bonds, which have the lowest risk of income. Conversely, equity funds comprise a large portion of equity, which is the most volatile and risky one among all the instruments.

In 2008, Investor Magazine published the best funds with criteria: risk and return, asset under management, the growth of the units, liquidity of portfolio, funds' fee, the degree of mutual funds' compliance on Bapepam (Indonesia SEC) and the cooperative behavior of the fund manager. It is worth it to look at their Modified VaR at 99 per cent and modified ES/CVaR at 99 per cent. The values are as below:

1. Fortis Ekuitas (equity fund): -6.07 per cent and -6.07 per cent
2. Trim Dana Stabil (fixed-income fund): -0.20 per cent and -0.20 per cent
3. Danareksa Melati Dollar<sup>14</sup> (dollar fixed - income fund)
4. Bahana Dana Infrastruktur (mixed fund): -5.51 per cent and -5.51 per cent
5. Danamas Fleksi (mixed fund): -1.23 per cent and -1.23 per cent
6. Fortis Equitra (mixed fund): -2.52 per cent and -2.52 per cent

Furthermore, the best funds based on 3 years performance and their modified VaR at 99 per cent and modified ES/CVaR at 99 per cent are as follows:

1. Fortis ekuitas (equity fund): -6.07 per cent and -6.07 per cent
2. Optima Obligasi (fixed-income fund): -2.04 per cent and -2.04 per cent
3. Danamas Dollar<sup>15</sup> (dollar fixed-income fund)
4. Optima pasar uang<sup>16</sup> (money market fund)
5. Bahana Dana Infrastruktur (mixed fund)<sup>17</sup>: -5.51 per cent and -5.51 per cent

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<sup>14</sup> The data is not available, thus we can not analyze it

<sup>15</sup> The data is not available

<sup>16</sup> The data is not available

<sup>17</sup> It is also the best fund based on 5 years performance

6. Schroder Dana Kombinasi (mixed fund)<sup>18</sup>: -1.31 per cent and -1.63 per cent
7. PNM Syariah (mixed fund): -4.27 and -4.27 per cent

We notice that all the best funds above are included in the majority of each fund's type risk. Their VaR are not at the highest and not at the lowest range of the overall funds shown at the table two above; they are at the middle range. It means that the fund managers are not too aggressive and are not too conservative either as well.

According to Muhandi (2010), there are four best funds performance based on stock selection and market timing. Now, let's look at the modified VaR and modified ES/CVaR of the best funds based on stock selection and market timing. The funds based on stock selection are as below:

1. Reksadana growth to prosper: -8.14 per cent and -8.14 per cent
2. Panin dana prima: -5.53 per cent and -5.96 per cent
3. Panin dana maksima: -4.49 per cent and -4.49 per cent
4. Pratama saham: -7.01 per cent and -7.01 per cent

The funds based on market timing are as below:

1. Jakarta blue chip: -6.39 per cent and -8.69 per cent
2. Si dana saham: -7.37 per cent and -7.65 per cent
3. Manulife saham andalan: -6.26 per cent and -7.10 per cent
4. Mahanusa dana ekuitas: NA<sup>19</sup>

If we look at their modified VaR and modified ES/CVaR, most of them are not at the highest and the lowest risk, they are at the middle range of risk. However, Reksadana growth to prosper has the second highest risk based on modified VaR and Jakarta blue chip has the second highest risk based on modified ES/CVaR.

The fund managers may compare the results above with results from methods that they used, such as, the Jensen Performance index, Treynor Performance index, and Sharpe performance index. By doing this, the managers will have more perspectives of risk. Accordingly, they will be wiser in terms of diversifying the assets. Moreover, the mutual fund companies are able to acknowledge the risk to their investors in terms of rupiah which is more sensible or clearer to them. Thus, if the

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<sup>18</sup> It is also the best fund based on 5 years performance

<sup>19</sup> The data is not available

expected worst loss occurs, the investors do not need to panic. Educating investors is necessary for financial market stability. The stability of its financial market is needed for the stability of Indonesia's economy and the rest of the Asian markets as well. Furthermore, the regulators have an incentive to set standards for their financial market. Finally, the study illustrates the efficacy of an alternative in measuring of the risk in financial market.

## 5. Conclusion

Examining the worst expected loss of mutual funds in Indonesia using modified VaR and modified ES/CVaR at 99 per cent, finds that the majority of mutual funds in Indonesia have values below less than 2.97 per cent for fixed income funds and protected funds; and less than 6.98 per cent for mixed funds and equity funds. We also notice that the equity funds place the highest value at risk since the most of the funds have highest portion in stocks.

Limitation of the study is that we do not perform back testing of VaR. Performing the back testing of VaR will produce more robust estimates of the potential distribution of losses.

Suggestion for future research is, to broaden the scope of research, for example examining the risk of mutual funds in other ASEAN countries. So, we can compare the risk among the countries. Then, we can give suggestions to investors on diversifying the portfolio across countries.

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