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Portfolio Optimization in Post Financial Crisis of 2008-2009 in the Mongolian Stock Exchange

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Abstract

In this study, we present the Mongolian stock market's performance post phenomenal financial crisis of 2008-2009, opportunities to invest and the risks problems. For analysis of the study, we used financial portfolio optimization models with restricted structure, mathematical statistic methods and financial methods. First, we considered about portfolio optimization in the Mongolian Stock Exchange using Markowitz's modern portfolio theory and Telser's safety first model. We used MSE weekly trading data chosen 50 most traded stocks out of 237 stocks listed at the MSE between 2009 and 2013. We generated 50 weeks mean-variance portfolio and safety first portfolio for 2014 and discussed. We considered weekly investment in the MSE using mean-variance portfolio and safety first portfolio. The mean-variance portfolio has the best performance of weekly portfolio return with average weekly return and cumulative return. We found stable portfolio against investing risk and did back-test the result. For prospect investors in the MSE, we suggest invest and earn high return in the MSE.

1. INTRODUCTION

The global phenomenon of financial crisis hit the all places over world. Financial recession led us to financial crisis during period of 2008 to 2009. After the financial crisis, most people and institutions are lose hope its investment in financial market. But is there any hope for investment even after great financial crisis?

In financial literature, a portfolio is considered as financial assets held by an individual or a financial institution. These financial assets constitute equities of a company, government bonds, fixed income securities, commodities, derivatives, mutual funds and exchange-traded and closed-fund counterparts.

Why do we need a portfolio? Every investor wants to invest their capital to gain high profit without risk. In financial market everybody has chance of invest to all financial assets with free choice. The composition of investments in a portfolio depends on a number of factors, among the most important being the investor's risk tolerance, investment horizon and amount invested. Imagine, investment portfolio as a pizza that is divided into pieces of varying sizes representing a variety of asset classes or types of investments to accomplish an appropriate risk-return portfolio allocation. In this case investor should think about how to maintain well-maintained portfolio. Investor should know about how to determine an asset allocation that best conforms to investor's investing goal and strategy. Before invest, investor need to take care about their personality and risk tolerance. Because more risk investor bear, portfolio will be more aggressive. In financial world, there are general to kind of investor: conservative and aggressive based on their taking risk behavior and desire. For example, a conservative investor might favor broad-based market index funds, high-grade income securities and government bonds. In other hand, a risk taker investor might invest some small cap growth stock to aggressive, high-yield bond exposure and look for real estate for her portfolio.

In recent times, investors tend to invest their capital to short range investment to shot at rich. For short range investment, investors prefer companies stocks and financial derivatives than mutual funds and exchange-traded and closed-fund counterparts. Depends on financial market's development, some market can be trade financial derivatives and short sell, but most of developing countries financial markets are not available for short selling and trade options. In this situation buying companies stocks or buying governmental bonds are optimal solution for investors. For government bond has fixed interest rate and maturity day but company stocks usually does not have maturity day and price can be very changeable to earn capital from that stock price

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change. Most part of investors more concentrated on company stocks, because they can make high profit within short range.

When the investors have constructed a portfolio of stocks one possibility is to try to improve the performance of the portfolio with Modern Portfolio Theory, which a theory of finance that attempts to maximize portfolio expected return for a given amount of portfolio risk, or equivalently minimize risk for a given level of expected return, by carefully choosing the proportions of various assets. Harry Markowitz published his paper on "Portfolio selection" in 1952 he provided the foundation for Modern Portfolio Theory as a mathematical problem. He proposed portfolio theory, which assumes that investors are risk - averse, meaning that given two portfolios that offer the same expected return, investors will prefer the less risky one. Thus, an investor will take on increased risk only if compensated by higher expected returns. Conversely, an investor who wants higher expected returns must accept more risk. The exact trade-off will be the same for all investors, but different investors will evaluate the trade-off differently based on individual risk aversion characteristics.

2. METHODOLOGY

2.1 Literature Review

In 1952, in his paper "Portfolio Selection," published in Journal of Finance, Harry Markowitz pioneered modern portfolio theory (mean-variance portfolio). This hypothesis centered on evaluating the risks and rewards of individual shares prior to Markowitz's work. Investment portfolio was the key investment concept, offering good opportunities to earn high profit with the least risk. Markowitz's important idea is that uncertainty and risk are viewed as the same.

Markowitz developed a system for explaining each investment, using unsystematic risk statistics, to compare investment options. He extended that to the stock options portfolios. He found an equation of risk-reward from expected return rate and expected risk for each investment, called an efficient frontier. Efficient frontier aims at maximizing returns while reducing risks. He laid the foundation for modern portfolio theory, the biggest contribution being the creation of an investment decision-making structured risk or return process (Mayanja, 2011).

A growing number of researchers have conducted research on the basis of a mean set of variances. One of the important features of the pareto-optimal portfolio defined by the utility function (Neumann and Morgenstern, 1953) for optimizing the expected return utility. In addition, other risk averseness mechanisms have emerged in economic theory as a basic concept (Steinbach, 2001). Tobin (1958) focused on the concept of liquidity risk aversion. He added risk-free assets for super-efficient portfolios will exploit efficient frontier portfolios and the capital market line. He considered risk averseness and risk premium-related utility feature. Sharpe's Capital Asset Pricing Model (CAPM) (Sharpe, 1964) found that it is sitting on Tobin's super-efficient portfolio, not only on an efficient frontier market portfolio. He says that because the risky asset portfolio is not dependent on an investmenter's risk preferences, i.e. all investors would be equal to the risky asset portfolio, the portfolio must be a business portfolio.

A famous CAPM model for equilibrium prices of capital assets has been developed from this assumption. In this field there are many works, including Pratt (1964), Lintner (1970), Rubinstein (1973), Kihlstrom and Mirman (1974), Kihlstrom and Mirman (1981), Fishburn and Burr Porter (1976), Duncan (1977), Ross (1981), Chamberlain (1983), Huberman and Ross (1983), Epstein (1985), Pratt and Zeckhauser (1987) and Li and Ziemba (1989). Levy and Markowitz (1979) estimated the expected utility of 149 mutual funds by a mean and return variance function and found that the ordering Portfolios are essentially the same as the order from the use of expected utility by Mean-Variance method. In related field of study, the application of utility theory in investment choice with risk averseness measures explored by Tobin (1965), Mossin (1968), Kallberg and Ziemba (1983), Kroll et al. (1984), Jewitt, (1987), Jewitt (1989), King and Jensen (1992), Kijima and Ohnishi (1993) and Kroll et al. (1995).

The demonstrated approach for portfolio optimization (Konno and Yamazaki 1991) can remove many challenges associated with the classic Markowitz model by the use of a medium absolute deviation risk function. The average absolute deviation risk model can solve a large-scale problem of optimization consisting of over 1000 holdings with a linear program instead of a quadratic program. The later proposal (Hwang et al., 2010) was made to handle open asset volatility with a medium absolute portfolio variance optimization process. The model's influence was explored using simulations. Many simulations with open computing environments with a mean optimization method for absolute deviation portfolio could be stable. The theoretical definition of coherent risk measures (Embrechts et al., 1999; Artzner et al., 2002) was introduced and developed. Hwang et al. (2010) worked on several simulations with open computing environments that could create a reliable model of absolute deviation portfolio optimization.

The problem of optimization strategies based on the mean model are often very likely to affect problem parameters; the results of subsequent optimization are not very reliable because of the business parameter estimates that are subject to statistical errors (Mayanja, 2011). The optimization of the mean variance (Chopra et al., 1993) was found to be highly sensitive to input estimate errors. Small changes in entry parameters can lead to major changes in the optimal composition of the portfolio (Best and Grauer, 1991) provided empirical and theoretical findings of optimum portfolio sensitivity and considered the relative effects on mean, variance and covariance of measurement error.

More recently, to improve portfolio optimization, it applied covariance matrices of returns in Random matrix theory. This matrix is called a random matrix consisting of random unit variance and mean zero elements. The level of concord between the distribution of the own value matrix and the distribution of the random matrix in the case of the correlation matrix represents the amount of randomness within the correlation matrix.

The next move is to investigate the consistency of actual correlation matrices utilizing real data with certainty (Sharifi et al., 2004). Laloux et al. (2000) and Plerou et al. (2002) suggested portfolio optimization filters. Sharifi et al. (2004) used random matrix theory for portfolio optimization on financial matrix with large amounts of noise on real S&P500 data.

Analysis and performance optimization of portfolios can also be applied to stochastic portfolio theory. Yu et al. (2003) surveyed stochastic programming models built to address the problems of financial optimization. In depth, a few approaches were implemented to establish realistic scenarios that are of great importance to a successful model. Parpas and Rustem (2006) considered global optimization to be based on two problems with the choice of portfolios and the generation of scenarios. They explored how to solve the financial planning problem with a stochastic algorithm to global optimality. Geyer et al. (2009) focused on multi-period portfolio optimization stochastic linear programming to solve investment problems. Deniz (2009) focused on multi-period portfolio optimization scenario generation method and researched single-period portfolio optimization scenario generation using risk value measure (Guastaroba, 2010).

In mean-variance portfolio we consider volatility as a risk, but it can be move upside and downside. Some investors are not only considers standard deviation, they willing to downside the risk, so another model had to be created. One of the models, which concentrate on bad outcomes, is safety first models. The smallest chance of generating a return below calculated rates (Roy, 1952) implemented Portfolio. What is the specified rate? Some investors may consider level of minimum level of their expected rate or other investors may consider it level of red line, which bring them loss. If R_p is portfolio return and R_L is below an investor's price, Roy's safety first criterion is the following

minimize Prob ($R_p < R_L$)

The ultimate portfolio would be one where R_L was the maximum number of standard deviations away from medium as returns were usually generated. Telser (1955) predetermines the predetermined probability α less than, or equal to specified rate Telser's safety first criterion is the following:

maximize $\bar{R}_p$
subject to Prob($R_p \le R_L$)≤α

Roy's method has been modified by predetermining the appropriate likelihood of a given rate equivalent to a predetermination of the acceptable number of defaulting levels that may result in a critical return below the medium, in order to achieve the most important return for the portfolio (Kataoka, 1962). If α is below the specified rate, then this is in the symbols:

maximize R_L
subject to Prob ($R_p < R_L$) ≤ α

The specified value of $1+R_L$, optimal portfolio must capitalize asset pricing system tangent portfolio, according to the analyses of dependence between security initial optimization and the usual mean-variance optimization (Pyle and Turnowsky, 1970).The characterizations of the first safety model of Telser and the development of the optimal solution were studied by Arzac and Bawa in 1977. They explained that when asset returns were normally, or stably distributed, Pareto could derive from the initial Telser safety model. The first security criterion was generalized (Bawa, 1978) and developed to the Stochastic Dominance criteria.

There are other cases in which security first should be taken into account for financial crisis protection. Pownall and Koedijk (1999) show that the Asian markets witnessed more dramatic returns during the Asian financial turmoil of 1997 than were indicated by conditional normality and Bae et al. (2003) concluded that for extreme negative returns, financial contagion is higher, which makes security first of all important. Engles (2004) presented the first security model of Telser with an explicit analysis approach with the assumption that risky assets are distributed elliptically. Ding and Zhang (2009) researched the first security model of

Kataoka with predictions of normal distribution and without restriction of short selling.

2.2 Portofolio optimization formulation

2.2.1 Mean-variance portfolio model

The fundamental achievement in financial investment management has been achieved by Harry Markowitz, by developing a methodology of portfolio optimization with the mean-variance Analysis method (Dangi, 2013). Harry Markowitz found the volatility of stock return as an indicator of risk. In addition, the mean-variance tradeoff determines that the investor is then supposed to receive improved returns for greater levels of risk that an investor wants to take. The relationship between the risk levels and expected returns is linear. At certain portfolio level, he wanted to minimize the variance in portfolio expected return.

2.2.2 Markowitz formulation

The Markowitz formulation for *Portfolio expected return* is given in Equation (1). Meanwhile, for Portfolio variance is given in Equation (2).

$$\bar{R}_p = \sum_{i=1}^{n} x_i \bar{r}_i \qquad \text{(Eq.1)}$$

$$\sigma_p^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} x_i x_j \sigma_i \sigma_j \rho_{ij} \quad \text{or}$$

$$\sigma_p^2 = x^T \Sigma\, x \qquad \text{(Eq.2)}$$

Nevertheless, Markowitz's theory assumes a different type of shareholder interest. It says the goal of the stakeholders is to optimize the utility function.

Max $s\bar{R}_p - (1-s)\sigma_p^2$ objective function

subject to $\sum_{i=1}^{n} x_i = 1$ budget constraint

$x_i \geq 0$ long only constraint

$x_i \leq 0.33$ ceiling constraint

This utility function is therefore the expected return portfolio, portfolio variance and the compromise between anticipated return and variance. We let s=0.5 consider the expected return and volatility of the portfolio equally. Where, absolute returns and absolute risk assessments are the investment returns considered for the above formulation. Arithmetic returns for assets are considered by the formulation as the return measure as the risk measure and standard deviation.There is short-selling not only allowed for long-selling in terms of portfolio constraint. No more weight for one security for a third of the total budget for ceiling constraint.

2.2.3 Safety first portfolio model

Telser (1955) predetermines the predetermined probability α less than, or equal to specified rate. Telser's safety first criterion is given as follows:

Max $\bar{R}_p$

Subject to Prob $(R_p \leq R_L) \leq \alpha$

We added necessary constraints of budget constraint and ceiling constraint, then the set of equations becomes:

Max $\bar{R}_p$

Subject to Prob $(R_p \leq R_L) \leq \alpha$

$\sum_{i=1}^{n} x_i = 1$

$x_i \geq 0$

Then we made an important assumption. To say something about the predetermined probability constraint, we assume that the returns are normally distributed. This means that we assume that:

$$Prob\,(R_p \leq X) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{k} e^{-\frac{1}{2}t^2}\, dt \equiv \Phi(\text{k})$$

$$\text{with} \quad k = \frac{X - \bar{R}_p}{\sigma_p}$$

With this assumption we can simplify the constraint Prob $(R_p \leq R_L) \leq \alpha$. This becomes

$$\Phi\left(\frac{R_L - \bar{R}_p}{\sigma_p}\right) \leq \alpha \rightarrow \frac{R_L - \bar{R}_p}{\sigma_p} \leq k_\alpha \text{ with}$$

$$\bar{R}_p \geq R_L - k_\alpha \sigma_p$$

When changing the determined probability constraint with parameters $\bar{R}_p$ and σ_p for the portfolio mean respectively the portfolio standard deviation, we should add the constraint of standard deviation, so our equation becomes:

Max $\bar{R}_p$

Subject to $\bar{R}_p \geq R_L - k_\alpha \sigma_p$

$\sigma_p^2 = x^T \Sigma\, x$

$\sum_{i=1}^{n} x_i = 1$

$x_i \geq 0$

In terms of portfolio constraint, there is short-selling is not allowed long-sale only. For ceiling constraint no more weight for one security one third of total budget.

2.2.4 Sortino ratio

The Sortino ratio is a difference in the sharpe ratio, which distinguishes between risky volatility and total overall volatility by using the asset's standard deviation or downside deviation, rather than the maximum standard deviation in the portfolio. The Sortino ratio is a valuable way to evaluate investment returns for the investor, analysts, and portfolio managers for a certain level of bad risk. As this formula uses just the variance of the downside as its risk metric, it deals with the issue of using total risk or standard deviation, which is important as upside volatility is of benefit to investors and is not a concern to the majority of investors.

The return will be defined as the average total return for a minimum return acceptable and the risk is defined as the default difference below the minimum acceptable return.

The distribution of Sortino is as follows:

$$Sortino\ ratio = \frac{Rp-Rf}{\sigma d}$$

Rp = Portfolio expected return
Rf= Minimum accepted return
σd= Downside standard deviation

A high Sortino ratio is strong compared to comparable portfolios or lower-return funds.

2.3 Analyzing generated portfolios

In this section we analyze our generated portfolios, mean-variance portfolio and safety first portfolio. We chose 50 most trading securities in MSE for portfolio optimization. All data downloaded from MSE official website (www.mse.mn), format as Microsoft excel. We used weekly trading historical data between 2009 and 2013 for our portfolio generation. For weekly data chosen day was every Friday's closing price, Friday closing price will next week opening price. We estimated return of each security as following formula:

$$r_i = \frac{Current\ closing\ price - Previous\ closing\ price}{Current\ closing\ price}$$

Systematic trading is most often employed after testing an investment strategy on historic data. This is known as back testing. On purpose of checking our portfolios efficiency we back tested both portfolios mean-variance and safety first portfolio. In back testing, we considered to buy Friday closing price, then ideally keep the portfolio for week to sell next Friday opening price. We needed benchmark for analyze our portfolios and we chose MSE main index MSE20 as benchmark of our analyzing.

3. RESULTS AND DISCUSSION

3.1 Mean-variance portfolio selection in the MSE

For mean-variance portfolio we equally considered about portfolio return and risk. We used s=0.5 for equal weight in portfolio return and portfolio standard deviation in mean-variance portfolio. In mean-variance portfolio short-sales are forbidden and limit to invest one stock is 33% of investment. The mean-variance portfolio selection's investment weights are for the 50 weeks. The mean-variance portfolio statistics are shown in Table 1.

Table 1 shows weekly investment result. Weekly portfolio returns performed very stable with range between 0.0107 and 0.0211. In terms of standard deviation, portfolio standard deviation performed stable with range between 0.0262 and 0.046. Our portfolio performed quite well for every week can earn 1% return but with small standard deviation around 2% - 4%. For investor it is good opportunity to invest in mean-variance portfolio.

3.2 Safety-first portfolio selection in the MSE

For safety first portfolio we considered R_L=0.003 using Mongolian government bond return rate per week and predetermined probability α equal to 0.05. In terms of constraint, there is forbidden to short-selling. The safety first portfolio selection's investment weights are for the 50 weeks. The safety first portfolio statistics for safety-first portfolio are shown in Table 2.

Table 2 reports weekly investment's result for full period of 50 weeks. Highest portfolio return equal to 0.0054 and lowest portfolio return equal to 0.0001. We chose R_L=0.003 in this portfolio, but there are some weeks could not generate portfolio return higher than acceptable rate. Safety first standard deviation performed fair stable over 50 weeks test. The highest standard deviation was performed 1.28%, which is quite reasonable standard deviation for portfolio.

3.3 Comparison between mean-variance and safety-first portfolio in the MSE

We created 2 portfolios using MSE data for over 50 weeks in 2014. In this section we compared mean-variance portfolio and safety first portfolio. For comparing we considered portfolio return and portfolio standard deviation difference (Table 3). Table 3 shows mean-variance portfolio return is significantly higher than safety first portfolio but in terms of standard deviation, safety first portfolio has lower standard deviation than mean-variance portfolio.

Figure 1 shows mean-variance portfolio returns performed significantly better than safety first portfolio for full periods. Figure 1 was considered only portfolio return, but we need to check portfolio returns with their standard deviation. For this purpose, we used Sortino ratio for compare both portfolios of mean-variance and safety first. Table 4 reports Sortion ratio results during portfolio generating period.

Table 1.
Weekly portfolio returns and standard deviations of mean-variance portfolio

Date	Mean-variance portfolio return	Mean-variance portfolio standard deviation	Date	Mean-variance portfolio return	Mean-variance portfolio standard deviation
1/3/2014	0.0174	0.0312	**6/27/2014**	0.0174	0.0362
1/10/2014	0.0166	0.0309	**7/4/2014**	0.0174	0.0397
1/17/2014	0.0176	0.0309	**7/11/2014**	0.0174	0.0397
1/24/2014	0.0191	0.0332	**7/18/2014**	0.0118	0.0384
1/31/2014	0.0206	0.0460	**7/25/2014**	0.0113	0.0412
2/7/2014	0.0215	0.0440	**8/1/2014**	0.0159	0.0282
2/14/2014	0.0211	0.0353	**8/8/2014**	0.0163	0.0334
2/21/2014	0.0193	0.0380	**8/15/2014**	0.0168	0.0331
2/28/2014	0.0184	0.0361	**8/22/2014**	0.0171	0.0379
3/7/2014	0.0172	0.0370	**8/29/2014**	0.0165	0.0334
3/14/2014	0.0165	0.0322	**9/5/2014**	0.0165	0.0335
3/21/2014	0.0145	0.0299	**9/12/2014**	0.0165	0.0335
3/28/2014	0.0158	0.0388	**9/19/2014**	0.0158	0.0289
4/4/2014	0.0142	0.0304	**9/26/2014**	0.0159	0.0289
4/11/2014	0.0156	0.0272	**10/3/2014**	0.0153	0.0329
4/18/2014	0.0160	0.0305	**10/10/2014**	0.0160	0.0327
4/25/2014	0.0168	0.0317	**10/17/2014**	0.0160	0.0327
5/2/2014	0.0167	0.0332	**10/24/2014**	0.0156	0.0311
5/9/2014	0.0176	0.0390	**10/31/2014**	0.0163	0.0321
5/16/2014	0.0164	0.0341	**11/7/2014**	0.0140	0.0323
5/23/2014	0.0158	0.0337	**11/14/2014**	0.0134	0.0262
5/30/2014	0.0152	0.0376	**11/21/2014**	0.0127	0.0266
6/6/2014	0.0164	0.0386	**11/28/2014**	0.0129	0.0267
6/13/2014	0.0156	0.0384	**12/5/2014**	0.0107	0.0235
6/20/2014	0.0156	0.0384	**12/12/2014**	0.0129	0.0269

Table 2
Weekly portfolio returns and standard deviations of mean-variance portfolio for safety first

Date	Portfolio return	Standard deviation	Date	Portfolio return	Standard deviation
1/3/2014	0.0048	0.0054	**6/27/2014**	0.0027	0.0081
1/10/2014	0.0016	0.0055	**7/4/2014**	0.0039	0.0079
1/17/2014	0.0047	0.0059	**7/11/2014**	0.0038	0.0080
1/24/2014	0.0046	0.0060	**7/18/2014**	0.0040	0.0082
1/31/2014	0.0050	0.0061	**7/25/2014**	0.0037	0.0099
2/7/2014	0.0054	0.0064	**8/1/2014**	0.0040	0.0083
2/14/2014	0.0052	0.0071	**8/8/2014**	0.0015	0.0084
2/21/2014	0.0048	0.0067	**8/15/2014**	0.0013	0.0128
2/28/2014	0.0049	0.0065	**8/22/2014**	0.0044	0.0117
3/7/2014	0.0051	0.0069	**8/29/2014**	0.0019	0.0122
3/14/2014	0.0048	0.0069	**9/5/2014**	0.0054	0.0113
3/21/2014	0.0046	0.0071	**9/12/2014**	0.0001	0.0109
3/28/2014	0.0046	0.0072	**9/19/2014**	0.0012	0.0094
4/4/2014	0.0044	0.0069	**9/26/2014**	0.0002	0.0117
4/11/2014	0.0052	0.0073	**10/3/2014**	0.0003	0.0118
4/18/2014	0.0049	0.0073	**10/10/2014**	0.0006	0.0098
4/25/2014	0.0052	0.0072	**10/17/2014**	0.0030	0.0104
5/2/2014	0.0051	0.0073	**10/24/2014**	0.0027	0.0072
5/9/2014	0.0046	0.0073	**10/31/2014**	0.0024	0.0073
5/16/2014	0.0052	0.0071	**11/7/2014**	0.0020	0.0072
5/23/2014	0.0037	0.0069	**11/14/2014**	0.0030	0.0080
5/30/2014	0.0029	0.0064	**11/21/2014**	0.003.3	0.0076
6/6/2014	0.0036	0.0069	**11/28/2014**	0.0032	0.0075
6/13/2014	0.0033	0.0066	**12/5/2014**	0.0014	0.0074
6/20/2014	0.0032	0.0066	**12/12/2014**	0.0034	0.0087

Table 3.
Statistics of mean-variance portfolio and safety first portfolio

	Mean-Variance portfolio	Safety-First portfolio
Mean return	0.016	0.0038
Standard deviation	0.0335	0.0078

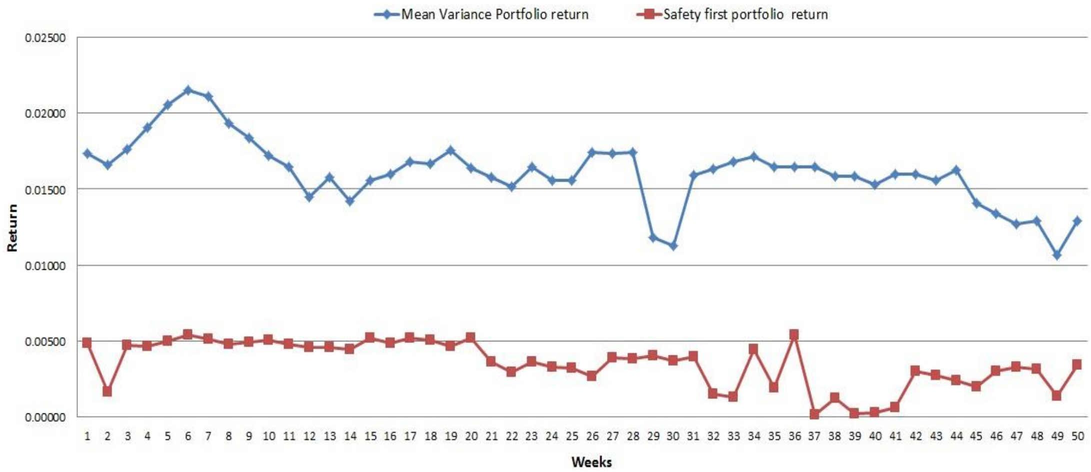

Figure 1.
Mean-variance portfolio returns vs safety first portfolio returns

Table 4.
Portfolios Sortino ratio comparison

Date	MVP Sortino ratio	SFP Sortino ratio	Date	MVP Sortino ratio	SFP Sortino ratio
1/3/2014	0.0424	0.2503	**6/27/2014**	0.0373	-0.102
1/10/2014	0.0185	-0.339	**7/4/2014**	0.0335	0.0562
1/17/2014	0.0516	0.2106	**7/11/2014**	0.0338	0.0437
1/24/2014	0.0913	0.1935	**7/18/2014**	-0.1096	0.0678
1/31/2014	0.098	0.2474	**7/25/2014**	-0.1157	0.0187
2/7/2014	0.1236	0.2975	**8/1/2014**	-0.0046	0.0596
2/14/2014	0.1428	0.2335	**8/8/2014**	0.0082	-0.2325
2/21/2014	0.0858	0.1917	**8/15/2014**	0.0222	-0.1693
2/28/2014	0.0651	0.2166	**8/22/2014**	0.0288	0.0809
3/7/2014	0.0309	0.2285	**8/29/2014**	0.0125	-0.1311
3/14/2014	0.0127	0.1857	**9/5/2014**	0.0125	0.169
3/21/2014	-0.052	0.1576	**9/12/2014**	0.0125	-0.3088
3/28/2014	-0.007	0.1502	**9/19/2014**	-0.0082	-0.242
4/4/2014	-0.0614	0.1387	**9/26/2014**	-0.0064	-0.2796
4/11/2014	-0.0168	0.2373	**10/3/2014**	-0.0219	-0.2706
4/18/2014	-0.0014	0.1919	**10/10/2014**	-0.002	-0.291
4/25/2014	0.0241	0.2345	**10/17/2014**	-0.0019	-0.047
5/2/2014	0.0192	0.2177	**10/24/2014**	-0.015	-0.1081
5/9/2014	0.0392	0.1572	**10/31/2014**	0.0064	-0.1486
5/16/2014	0.0102	0.2412	**11/7/2014**	-0.0621	-0.2039
5/23/2014	-0.0074	0.0247	**11/14/2014**	-0.1016	-0.0546
5/30/2014	-0.0239	-0.089	**11/21/2014**	-0.1261	-0.0288
6/6/2014	0.0101	0.0221	**11/28/2014**	-0.1163	-0.0445
6/13/2014	-0.0123	-0.0253	**12/5/2014**	-0.229	-0.2804
6/20/2014	-0.0123	-0.0435	**12/12/2014**	-0.117	-0.0085

Table 5
Portfolios Sortino ratio comparison

Date	Mean Variance Portfolio cumulative return	Safety first portfolio cumulative return	Date	Mean Variance Portfolio cumulative return	Safety first portfolio cumulative return
1/3/2014	0	0	**7/4/2014**	0.83849	0.15921
1/10/2014	-0.0047	-0.00373	**7/11/2014**	0.84463	0.18554
1/17/2014	0.04718	-0.01077	**7/18/2014**	0.84584	0.18898
1/24/2014	0.12152	-0.01336	**7/25/2014**	0.82476	0.19486
1/31/2014	0.17326	-0.03521	**8/1/2014**	0.83506	0.19059
2/7/2014	0.22786	-0.00005	**8/8/2014**	0.83506	0.2058
2/14/2014	0.22824	0.04498	**8/15/2014**	0.85812	0.20513
2/21/2014	0.21889	0.04756	**8/22/2014**	0.88296	0.20669
2/28/2014	0.25309	0.05389	**8/29/2014**	0.90426	0.22219
3/7/2014	0.27106	0.04879	**9/5/2014**	0.90342	0.20833
3/14/2014	0.27106	0.06711	**9/12/2014**	0.90342	0.20788
3/21/2014	0.28798	0.06871	**9/19/2014**	0.90342	0.20392
3/28/2014	0.26191	0.07034	**9/26/2014**	0.90331	0.19541
4/4/2014	0.4529	0.0822	**10/3/2014**	0.90304	0.18438
4/11/2014	0.47698	0.08129	**10/10/2014**	0.90304	0.18156
4/18/2014	0.53439	0.08743	**10/17/2014**	0.90381	0.18417
4/25/2014	0.55707	0.09333	**10/24/2014**	0.90447	0.18262
5/2/2014	0.60649	0.10226	**10/31/2014**	0.90273	0.17923
5/9/2014	0.62109	0.10648	**11/7/2014**	0.9025	0.17855
5/16/2014	0.62109	0.1101	**11/14/2014**	0.90695	0.19182
5/23/2014	0.62848	0.12009	**11/21/2014**	0.97658	0.20851
5/30/2014	0.60028	0.11347	**11/28/2014**	0.95962	0.2057
6/6/2014	0.60423	0.12103	**12/5/2014**	0.98692	0.20921
6/13/2014	0.7042	0.12389	**12/12/2014**	0.98766	0.20709
6/20/2014	0.7042	0.12428	**12/19/2014**	0.98475	0.2084
6/27/2014	0.7042	0.13838	**Total**	0.98475	0.2084

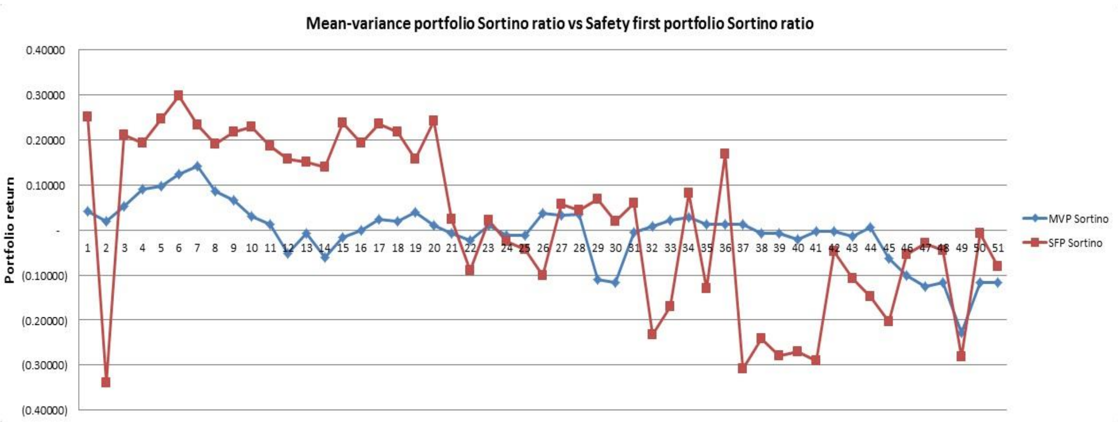

Figure 2.
Mean-variance portfolio's Sortino ratio vs safety first portfolio's Sortino ratio

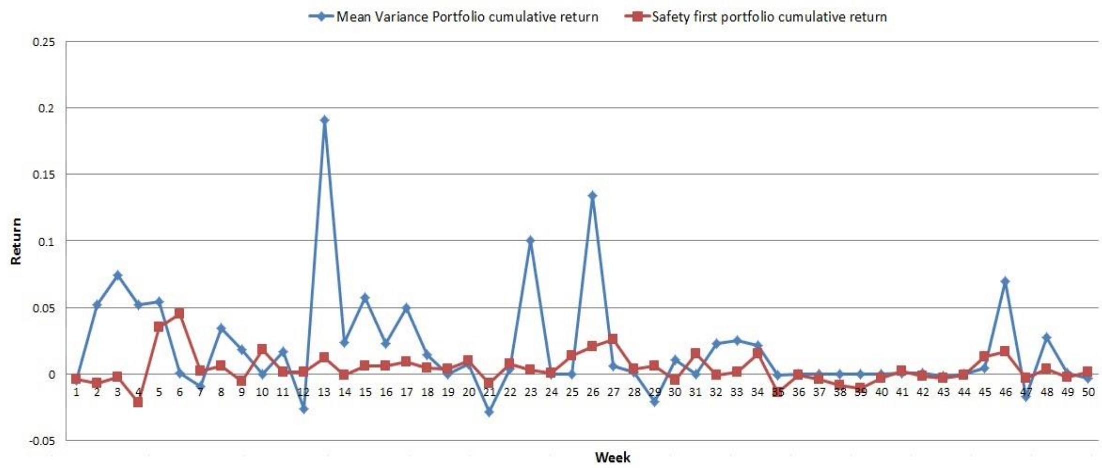

Figure 3.
Mean-variance cumulative returns vs safety first cumulative returns

Table 4 shows mean-variance portfolio Sortino ration and safety first portfolio Sortino ratio result for over full period of 50 weeks in 2014. Figure 2 shows safety first portfolio Sortino ratio us unstable but overall performed better than mean-variance portfolio Sortino ratio. About mean-variance portfolio Sortino ratio performed quite stable over full period of testing, but last 7 weeks performed not good enough. For Sortino ratio consider as investor's acceptable level of return, other word minimum acceptable return, that's can give investors to choose better portfolio. From the table investor should choose safety first portfolio for investing.

Table 5 shows cumulative returns of mean-variance portfolio and safety first portfolio. Form result mean-variance cumulative return (0.98) was significantly higher than safety first portfolio cumulative return (0.20). Over full period of test, mean-variance portfolio was dominating safety first portfolio. Meanwhile, Figure 3 shows first half of period was dominated by mean-variance portfolio cumulative returns. In the second half both portfolio cumulative returns are performed nearly 0. The mean-variance portfolio performed several times significantly high returns.

4. CONCLUSIONS

In this study, we have used the MSE historical stocks weekly trading data for the four years (2009, 2010, 2011, 2012 and 2013), to identify and analyze the MSE stock returns after the global financial recession in order to analyze and protect investors from financial risks due to misbelief after facing global phenomenon of financial crisis. We have used most traded 50 stocks in MSE which were selected, but only the best 10 stocks were used in this study to mitigate risk and control data.

In summary, we generated and tested 2 different portfolios based on risk measurement on Mongolian stock exchange. We considered weekly investment in MSE using mean-variance portfolio and safety first portfolio. The mean-variance portfolio have best performance of weekly portfolio return (with average weekly return equal to 0.016) and cumulative return (0.98) for full period of 3 January 2014 to 27 December 2014. In mean-variance portfolio we considered trade of between portfolio return and standard deviation as 0.5 for equally weighted, for safety first portfolio we used government bond return in week for minimum acceptable return. But in terms of Sharpe and Sortino ratio, safety first portfolio was performing best. For investors, who consider proportion between return and standard deviation then safety first portfolio suggested for riskless investment in MSE even after global financial crisis.

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