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A risk-return based model to measure the performance of portfolio management

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A B S T R A C T

The primary concern in all portfolio management systems is to find a good tradeoff between risk and expected return and a good balance between accepted risk and actual return indicates the performance of a particular portfolio. This paper develops "A-Y Model" to measure the performance of a portfolio and analyze it during the bull and the bear market. This paper considers the daily information of one year before and one year after Iran's 2013 precedential election. The proposed model of this paper provides lost profit and unrealized loss to measure the portfolio performance. The proposed study first ranks the resulted data and then uses some non-parametric methods to see whether there is any change because of the changes in markets on the performance of the portfolio. The results indicate that despite increasing profitable opportunities in bull market, the performance of the portfolio did not match the target risk. As a result, using A-Y Model as a risk and return base model to measure portfolio management's performance appears to reduce risks and increases return of portfolio.

1. Introduction

Capital markets as a crucial part of financial system play essential role in economic development (Markowitz, 1952, 1968). Most popular financial institutions such as mutual funds, hedge funds and exchange-traded funds help investors make appropriate financial decisions (Zhou & Yin, 2003; Briec et al., 2004). Investment in such institutions may increase the diversification of investors' portfolio and decrease their risks. However, the most important issue is to select the best investment opportunity based on the performance of institutions. On the other hand, management of such institutions needs to evaluate the performance of their portfolio management. In the recognition that investment management is an on-going process, the performance of actively-managed portfolios needs to be monitored and evaluated to ensure that funds under management are efficiently invested in order to satisfy the mandate specified in the policy statement (Hsieh & Hodnett, 2013). Therefore, evaluating portfolio performance has become an essential topic for the portfolio managers, investors and almost all of players in the financial markets. Portfolio performance evaluation serves two issues: the determination of whether investment objectives are met and the degree to which these objectives are, or are not surpassed.

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While the objectives are hopefully the same for all parties associated with the management of portfolio, the desired information is not always identical. The investor is interested in the performance of a portfolio in the broader context of all investor assets. A manager, on the other hand, is concerned with a narrow set of objectives dictated by the investor (Singer, 1996). The question of how to evaluate the performance of a fund is far from being academic. Many funds with outstanding profits during their life have collapsed, and investors are more and more interested in the other dimensions of fund performance such as risk (Jagric et al., 2007). In a reward–risk framework, the investors either maximize the reward for a fixed risk or minimize the risk for a fixed reward. Moreover, the investors optimize their performance several times maximizing the reward for unity of risk and this strategy still yields an efficient portfolio in terms of reward and risk called a market portfolio (Stoyanov et al., 2007). Sharpe's Index (Sharpe, 1964, 1998) incorporates information determined by the return/ risk of the portfolio or other investment that is evaluated. Sharpe's performance measurement considers the total risk of the portfolio. Sharpe's performance model is normally stated as a risk premium/total risk. This shows the demanded additional return over investors' risk free interest rate when compared the total risk of the portfolio (Türegün & Kaya, 2014). This paper develops a reward-risk based performance model and examines the implementation of the proposed model using some real market data.

One of the most important factors in measuring the performance of any portfolio is associated with weighting of individual securities within the portfolio (Sadjadi et al., 2011). The weight that a portfolio manager assigns to a given security in a portfolio can make a contribution to return that is just as important as the security selection and investment timing decisions (Block & French, 2002). It is now well established that the construction of optimal hedge fund portfolios requires techniques that reach well beyond traditional mean variance analysis (Lamm, 2003). If mutual fund managers are interested in equal weighting, then the relevance of using a value-weighted index such as the S&P 500 as a performance benchmark might be suboptimal. Just how much mutual fund managers actually slant their portfolios towards equal or value weighting is a question to be answered empirically (Block & French, 2002). Current convictions are that different investment styles perform at various stages of the market cycle. Specifically, active manager's claim that performance is better in bear markets rather than in bull markets. During the bull market, majority of the value managers underweighted the technology sectors and subsequently underperformed the market. Cycling into the bear market, those very same value managers significantly outperformed. Hence, assuming market efficiency does not hold and that mutual funds can outperform the market, questioning at which points in the market cycle they outperform is logical with such recent situations as mentioned above (Hamidani, 2004). Qamruzzaman (2014) evaluated the performance of 32 growth-oriented mutual funds on the basis of monthly returns compared with benchmark returns. He used various risk adjusted performance measures and reported that, over the research period selected mutual funds indicated positive monthly return and upward trend compared with market return. Various risk return measures indicate similar performance indication with exception of few mutual funds scheme due to market return in inconsistent with return from mutual funds i.e., negative market return. It can be concluded that, the growth-oriented mutual funds have not performed better than their respect to volatility most of the funds have not performed better. Growth oriented mutual funds are expected to offer the advantages of diversification, market timing and selectivity. For broadening the depth of the capital market, it is necessary to float more mutual funds since these are good tools of mobilizing savings and providing investment opportunities to small savers. Wu (2014) examined the interaction between mutual fund performance and portfolio turnover and reported that active trading could influence on fund performance, but underperforming funds could also be traded actively to perform well. Petronio et al. (2014) discuss the portfolio selection problem using performance measures and introduce a new performance measure consistent with the choices of non-satiable risk-averse investors. In this paper, we introduce a portfolio performance model and evaluate the efficiency of model in bear and bull market.

2. The proposed study

Khodaei Valahzaghard and Ansar (2013) developed Khodaei-Ansar (KA) Model to measure the performance of foreign currency portfolio management. For the proposed model of this paper, we develop K-A Model and propose a new Ansar-Yekezare (AY) model to meet stock market restrictions. A-Y Model allocates stocks to portfolios to optimize them in a reward–risk framework. The following notation summarizes details of our survey,

The proposed model of this paper uses the following model to measure lost Profit that presents the difference between performance of selected portfolio and best possible performance,

$$\min \quad \frac{\sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n}\left(\omega_i \times \omega_j \times \delta_{ij}\right)}}{\sum_{i=1}^{n}\omega_i \times r_i}$$

subject to

$$\sum_{i=1}^{n}\omega_i \times r_i > 0 \qquad (1)$$

$$\sum \omega_{ij} = 1$$

where δ_{ij} is the variance between two firms, ω_i and ω_j are weights of firm i and firms j, respectively. In addition, r_i is the return of firm i. The proposed model of this paper uses the following to measure unrealized loss that presents the difference between performance of selected portfolio and the worst possible performance,

$$\text{A-Y Statistics} = \begin{cases} \dfrac{\text{risk}}{\text{return - risk}} & \text{return} > \text{risk} \\ \dfrac{\text{-1}}{\text{risk/(return-risk)}} & \text{return} \le \text{risk} \end{cases} \qquad (2)$$

Therefore, we solve the following optimization problem,

$$\max A-Y = \begin{cases} \dfrac{\sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n}\left(w_i w_j \delta_{ij}\right)}}{\sum_{i=1}^{n} w_i r_i - \sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n}\left(w_i w_j \delta_{ij}\right)}} & \text{if } \sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n}\left(w_i w_j \delta_{ij}\right)} < \sum_{i=1}^{n} w_i r_i \\ -1 \Big/ \dfrac{\sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n}\left(w_i w_j \delta_{ij}\right)}}{\sum_{i=1}^{n} w_i r_i - \sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n}\left(w_i w_j \delta_{ij}\right)}} & \text{otherwise} \end{cases}$$

subject to (3)

$$\sum \omega_{ij} = 1$$

The performance of the portfolio management is determined as follows,

$$\text{Portfolio management performance} = \frac{\text{Unrealized loss}}{\text{Unrealized loss +lost profit}} \qquad (4)$$

3. The results

We have applied the proposed model of this paper on data collected from Tehran Stock Exchange. We compare results before and after recent presidential election in order to have better understanding on A-Y Model's process. Fig. 1 shows the summary of risk for optimal portfolio, selected portfolio and negative optimal portfolio. In addition, Fig. 2, demonstrates the return for optimal, selected and negative optimal portfolios. As we can observe from the results of Fig. 2, investment opportunities have been increased after the presidential election. The implementation of the Kolmogorov–Smirnov test on our data has indicated that most observations were not normally distributed and we, therefore, use Wilcoxon (Wilcoxon, 1945) and Mann–Whitney tests (Mann & Whitney, 1947) to examine the performance of the proposed study.

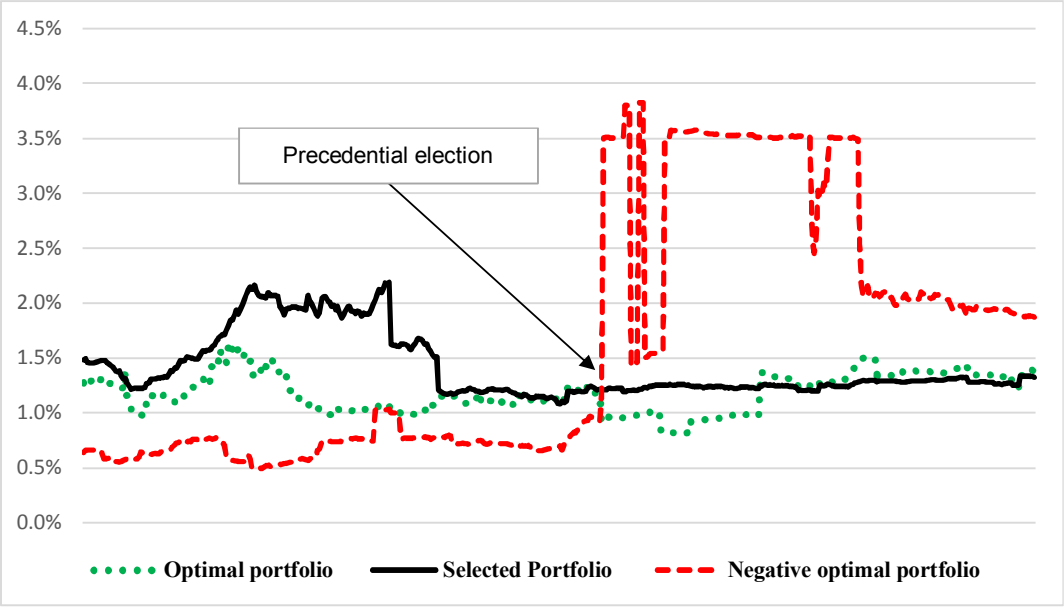

Fig. 1. The risk measure for optimal, selected and negative optimal portfolios

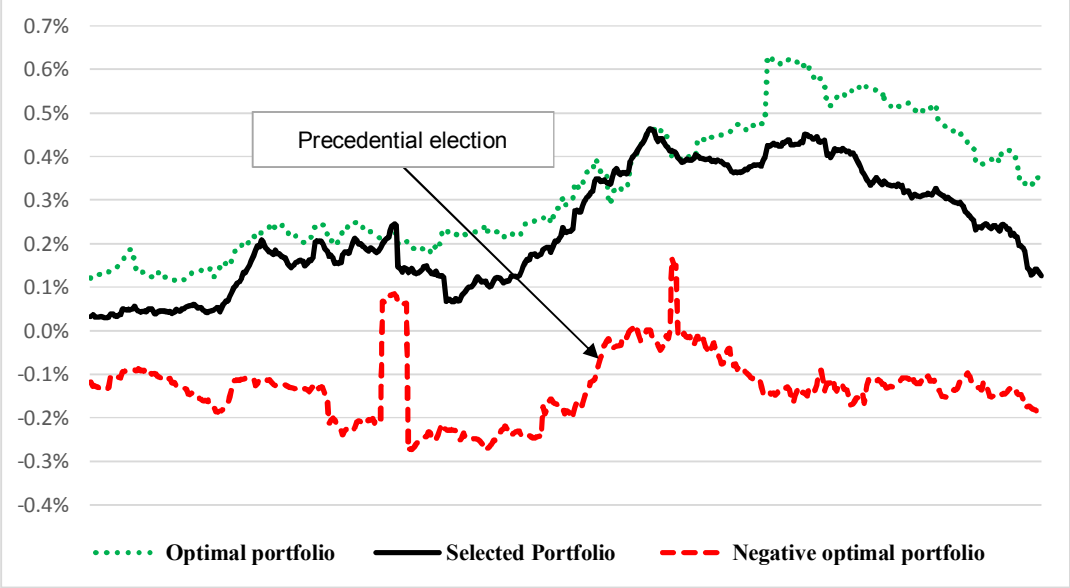

Fig. 2. The return measure for optimal, selected and negative optimal portfolios

In order to have better understanding on unrealized loss and lost profit, we compare actual and predicted performance. Fig. 3 summarizes the results of our findings on unrealized loss. As we can observe, actual unrealized loss represented more volatile data than the predicted ones. Fig. 4 demonstrates the trend of actual and predicted loss profit. As we can observe from the results of Fig. 3 and 4, actual unrealized loss and lost profit are more volatile than the predicted ones. We have compared the mean of predicted versus actual performance using Mann–Whitney test and Table 1 demonstrates the results of our findings.

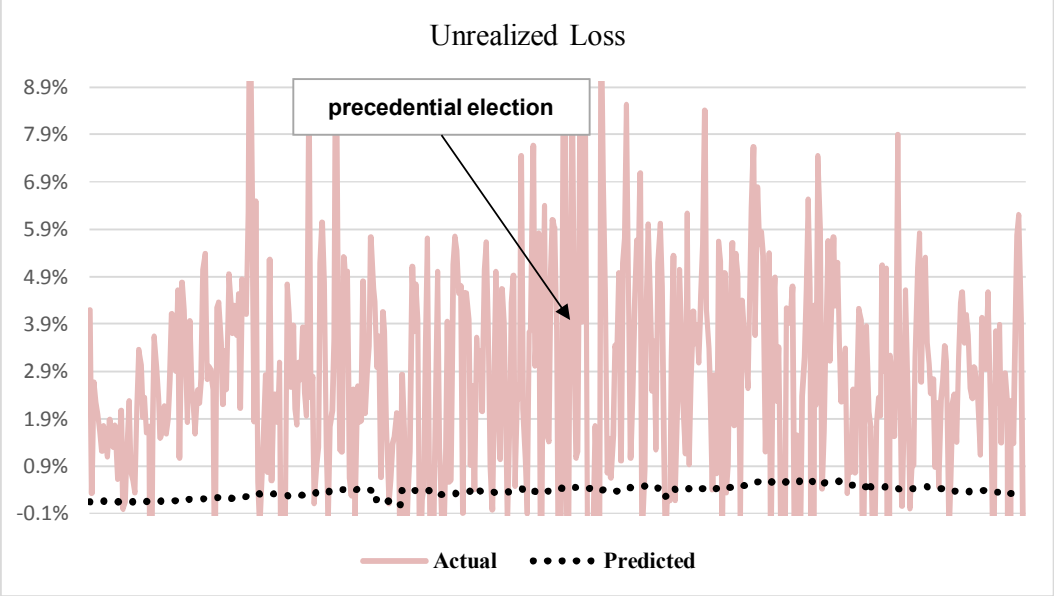

Fig. 3. Unrealized loss, predicted versus actual

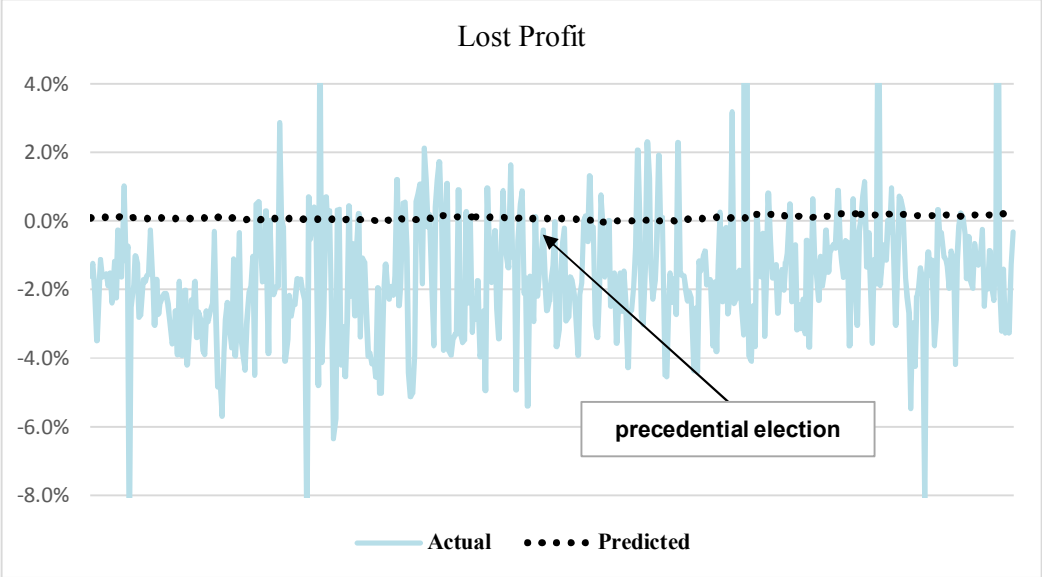

Fig. 4. The trend of actual and predicted loss profit

Table 1
The summary of Mann–Whitney test on difference between actual and predicted information

	Period	N	z	Sig.	Result
Coefficient of Variation	Before election	240	-2.80	0.005	Confirmed
	After election	240			
A-Y statistics	Before election	240	-6.17	0.000	Confirmed
	After election	240			

As we can observe from the results of Table 1, the null hypotheses in two cases are rejected when the level of significance is one percent that shows there is some difference between investment opportunities before and after presidential election in bear and bull market. Table 2 shows the results of Wilcoxon test before and after the presidential event.

As we can observe from the results of Table 2, in most cases, Wilcoxon test has rejected the null hypothesis and we can confirm that there was a difference between the data before and after presidential election. In addition, after presidential election, actual return has increased and coefficient of variation has been decreased. Now, we are able to examine the effects of portfolio management performance before and after presidential election using Mann–Whitney test. Table 3 presents the results of comparing the mean ranks for predicted performance measured by A-Y method. According to the results of Table 3, there is a meaningful difference between mean ranks of the predicted performance before and after presidential election. Similarly, Table 4 presents the results of comparing mean ranks for the actual performance measured by A-Y method.

Table 2
The summary of Wilcoxon test

				N	Mean rank	Z	Sig.	Result
Return	Unrealized loss	Before election	Predicted	240	129			
			Actual	240	54	-12.1	0.000	Confirmed
		After election	Predicted	240	132			
			Actual	240	163	-11.1	0.000	Confirmed
	Lost profit	Before election	Predicted	240	45			
			Actual	240	133	-12.00	0.000	Confirmed
		After election	Predicted	240	72			
			Actual	240	127	-11.4	0.000	Confirmed
Coefficient of Variation	Unrealized loss	Before election	Predicted	240	66			
			Actual	240	125	-12.3	0.000	Confirmed
		After election	Predicted	240	141			
			Actual	240	119	-11.5	0.000	Confirmed
	Lost profit	Before election	Predicted	240	126			
			Actual	240	79	-11.3	0.000	Confirmed
		After election	Predicted	240	126			
			Actual	240	115	-1.2	0.245	Not Confirmed

Table 3
The summary of mean ranks for predicted A-Y model

Period	N	Mean rank	z	Sig.	Result
Before presidential election	240	134.5	-16.9	0.000	Confirmed
After presidential election	240	346.5			

Table 4
The summary of mean ranks for actual A-Y model

Period	N	Mean rank	z	Sig.	Result
Before presidential election	240	230.6	-1.57	0.118	Not Confirmed
After presidential election	240	250.4			

According to the results of Table 4, there is not any meaningful difference between mean ranks of the actual performance before and after presidential election. Therefore, we reach a conclusion that presidential election had no impact on risk-reward portfolio management performance.

4. Conclusion

This paper has presented a new method to measure the performance of a portfolio and analyzed it during the bull and the bear market. The study considered the daily information of one year before and one year after Iran's 2013 precedential election. The proposed model of this paper provided lost profit and unrealized loss to measure the portfolio performance. The proposed study first ranked the resulted data and then applied some non-parametric methods to see whether there was any change because of the changes in markets on the performance of the portfolio. The results have indicated that despite increasing profitable opportunities in bull market, the performance of the portfolio did not match the target risk. As a result, using the proposed A-Y Model as a risk and return base model to measure portfolio management's performance has appeared to reduce risks and increases return of portfolio.

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