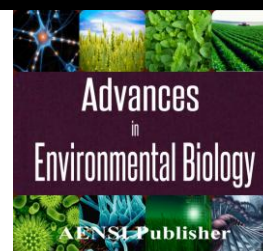




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## Portfolio Optimization Using Particle Swarm Algorithm and Compare it with the Random Walk Model

<sup>1</sup>Elham Farajmandi and <sup>2</sup>Dr. Bijan Abedini

<sup>1</sup> Department of Management, Qeshm Branch, Islamic Azad University, Qeshm, Iran

<sup>2</sup> Assistant Professor of Financial Accounting, Department of Accounting, Hormozgan University, Hormozgan, Iran

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### ABSTRACT

The main objective of this study was to clarify the portfolio return and risk of cumulative formation algorithm using the random walk model. The research is due to the nature of the field and the library. Research is from the target application. In terms of library research methods, descriptive view of the nature and method of research is the modeling and optimization. In terms of research, data collection Ali places the events of the past because the information is used. The study sample listed companies Tehran Stock Exchange (318) is based on a random sample of 174 companies have been selected. Due to the risk and performance model of particle swarm algorithm is put in. The basket 200 is considered the 20 categories, each category and for each portfolio consists of 10 portfolio risk, the yield was determined. The results below are based on the assumption that the efficiency of particle swarm algorithm selection retarded portfolios random selection difference there has been significant acceptance and evaluation of the amount of placental more efficient portfolio selection algorithm, particle swarm. This hypothesis is based on the particle swarm algorithm retarded selected portfolio risk and there is a random selection is accepted and assessed value pairs lower risk portfolio selection method is the particle swarm algorithm.

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## INTRODUCTION

Daily efforts to improve the analysis of financial markets in the world take place. Efforts to improve the analysis of stocks, particularly in the various stock markets are very high, led to the emergence of new methods. In addition to the procedures set out to find the answer to maximizing profits in the financial markets. Particle aggregation algorithms, neural networks, fuzzy logic, and other models are all examples of these methods. Assume in this study is that the Due to the dynamic behavior of a stock, particle aggregation algorithm, a useful tool to help the investor's portfolio. The research topic "Choosing a portfolio of shares of companies listed in Tehran Stock Exchange Model meta-heuristic optimization algorithms" is. Entering the capital market and the use of new tools in order to gain more efficiency, a step in the direction of the market is efficient.

#### History of research:

Bulian [28] financial performance of business sectors related to DOD examined using DEA. The DEA analysis of financial ratios measured with each other and came to the conclusion that the mentioned methods complement each other are

Lee *et al.* [34] in a study entitled "The combination of multi-criteria decision making techniques (MCDM) To select stocks based on the Gordon model perspective "effective measures identified in the share price. They are effective measures in this study is based on three key elements Gordon model with respect to the review of the literature was obtained. Effective measures on three main criteria Gordon model (projected dividend discount rate growth rate), including industry outlook, earnings, operating cash flow, payment of dividends, market beta, risk free return rate of earnings growth and dividend growth rates were.

Edirisinghe *et al.* [3] in a study entitled "Portfolio Selection is based on financial strength indicator using data envelopment analysis" of a series of financial ratios financial strength and solidarity in order to estimate the efficiency of shares of the criteria, (SPM). Ratios financial taken in this study are located in six categories at the leaf profitability measures (including accounts receivables turnover, inventory turnover, inventory turnover), operational efficiency (including accounts receivables turnover, inventory turnover, inventory turnover) measures of liquidity (current ratio,

**Corresponding Author:** Dr. Bijan Abedini, Assistant Professor of Financial Accounting, Department of Accounting, Hormozgan University, Hormozgan, Iran

quick ratio and Debt-to-equity ratio) measures of leverage (including leverage ratio, the ratio of total debt to total assets ratio of total debt to equity), measures the company's vision (The ratio of price to earnings ratio of market value to book value) and growth factors (including revenue growth rate, growth rate, net income and earnings per share growth rate).

Prayer and Study examines an adulterous Amharic in predicting the behavior of stock returns in the Tehran Stock Exchange listed companies as well as doing the predicted output deals with the use of artificial neural networks.

The study of neural networks with different learning functions was used. The (MLP) Synthetic Multilayer Perceptron structure results indicate that:

*Time series of daily stock returns of firms and memory is not a random process:*

Artificial neural networks are capable of forecasting daily returns the appropriate error rate [15].

Blessed with a raft of Islam in his article to improve portfolio performance is based on the number of returns based on the wear of the funding is based on the productivity of the capital of Tehran Stock Exchange Finally the role of pay and productivity of capital in the number of returns based on the disk, as they are effective.

Shahrestani [20] in this paper, by combining theories of Markowitz and Sharpe, and propose a new model introduces a more comprehensive model of Markowitz would be more efficient than the traditional boundaries. The share of market risk to reward Sharp that theory does not assume any level of risk portfolios, has been placed at the lowest possible level .

*Methods:*

According to the research of the month it will be based on Don and library. Research from the target application in terms of library research method, is described. Due to the fact that the target this deployment model is proposed as a method of research is objective.

*The sample:*

The population of firms are active sampling method is simple random sampling. The number of companies in the sample with a sample size calculations and formulas Cochran is selected.

The study sample firms listed in Tehran Stock exchange (318) is, according to Cochran's formula 5% error, the number of 174 companies was selected.

*Statistical methods:*

- Collection companies who have chosen to exchange the necessary conditions for 318 the remaining companies were selected
- Sample of 174 companies, and select Exchange
- Calculate the daily returns of the companies
- Calculate the variance of daily returns as a risk indicator
- Calculate the average daily returns as output index
- Calculate the variance covariance matrix of existing shares (174 companies)
- Specify the input and output variables in the model (dependent variable selection methods, portfolio risk and return and help determine the optimum weights of shares to be created, because it uses the weights to achieve the best portfolio will be formed .) Finally, using any of the methods 20 Group portfolios is created, each group consisted of 10 portfolio risk and return is calculated baskets and risk of return of each group is given.

*Hypotheses*

- Association of cumulative portfolio returns using an algorithm and a random walk model is significantly different.
- Cumulative risk portfolio formation algorithm using random walk model is significantly different.

The results of hypothesis

**Table 1:** Variable names.

Variable	Name
RETPSO	Return Method PSO
RETRAND	Return randomly
RISKPSO	Risk Materials PSO
RISKRAND	The risk of accidental

**Table 2:** Descriptive statistics of variables.

Variables	Count	Minimum	Maximum	Average	Standard deviation
	Statistics	Statistics	Statistics	Statistics	Statistics
RETPSO	20	0.0551	0.2709	0.168358	.0553273
RETRAND	20	-0.1346	2.026	0.043967	.0742394
RISKPSO	20	0.0932	0.2657	0.186108	.0468351
RISKRAND	20	0.1502	0.4806	0.307300	.0866843

Check the above table shows the number of categories of portfolio is 20. The minimum efficiency model PSO To 551% this model yields while minimizing negative random 0.1346. At this stage it is clear that the model PSO because the lower the better PSO Far more than the random model. The maximum efficiency model PSO to 0.2709 that is, while the average of the random 0.2026. At this stage it is also clear that the model PSO is better because top model PSO more than a random model. The mean and standard deviation of two variables can be stated that the average efficiency of PSO to 0.1683 the amount of random 0.0439 which is less than the yield of PSO. On this basis we can say that the model output PSO there is some more random method. The standard deviation of the model PSO 0.055 to 0.074 is also equal to the lesser of the amount.

Check table shows descriptive statistics, minimize risk model PSO to 0.93 the risk is that the random model is 0.150. At this stage it is clear that the risk model PSO is lower because of the lower model PSO Far less than the random model. The maximum risk model PSO to .265 while minimizing the risk of random models .480. At this stage it is also clear that the risk model PSO is lower because the top model PSO It is also less than the random model. The mean and standard deviation of the risk variables can be stated that the average risk of PSO186 the amount of random .307 greater than the risk of PSO. On this basis we can say that the risk model PSO Value is less than the random method. SD risks posed by model PSO Is equal to 0.046 which is less than the amount 0.086. To check the efficiency of the graph can be used

The performance of particle swarm algorithm retarded portfolio choice and there is a random selection.

$H_0$ : Particle swarm algorithm and a random selection of portfolio returns, there is a significant difference.

$H_1$ : Between efficiency and particle swarm algorithm randomly selected portfolio there is a significant difference.

**Table 3:** The average difference between the.

	The paired difference					T	Significant level.
	Average	Standard deviation	Standard deviation of the mean squared error	Difference			
				Low Level	Top		
RETRAND - RETPSO	-0.1243911	.0867298	.0193934	-0.1649819	-0.0838003	-6.414	0
RISKRAND - RISKPSO	.1211921	.1049264	.0234623	.0720850	.1702992	5.165	0

Given that a significant level of sig the default for each is less than 0.05  $H_1$  that the relationship between portfolios returns made by the algorithm of random particles and there are significant differences from each other be accepted and assumed its opposite  $H_0$  the portfolio's returns rejected.

The risk portfolio and particle swarm algorithm randomly selected retarded there is a significant difference.

$H_0$ : Particle swarm algorithm and a random selection of portfolio risk, there is a significant difference.

$H_1$ : Particle swarm algorithm and a random selection of portfolio risk, there is a significant difference.

Given that a significant level sig for each smaller than 0.05 the assumption is  $H_1$  That the relationship between portfolio returns made by the algorithm of random particles and there are significant differences from each other be accepted and assumed its opposite  $H_0$  the portfolio's returns rejected.

According to the t-statistic for each pair of surveys can be stated that due to the negative (minus 6.4) yields that T is less random and based on positive T (positive 5.1) in the second row or the second pair assess the risk Cart is random. Study on the correlation between returns and risks of the procedure have been observed that the difference between the two methods can verify it again. Table correlation between returns and risks provided by the confidence level is 95% was rejected.

**Table 4:** Correlation between two variables.

Variable	Count	Solidarity	Significant level.
RETRAND & RETPSO	20	.128	.591
RISKRAND & RISKPSO	20	-0.160	.500

### Results:

Portfolio Selection Using innovative algorithms ensure a high level of accuracy that can be achieved using this algorithm examines the high volume of shares and the optimal portfolios with minimum risk and maximum efficiency chose. Difference in this study and similar studies that have been done in this area, it is using a new portfolio selection algorithm performed better than before is that in all the. It is in line with other research that can be developed that model than previous models have advantages such as higher speed, more efficiency and less risk. The portfolio selection model in the market to fund other investors' proposal will.

Results can also be examined from two different perspectives. From the perspective of technical analysis and results discussion from a technical perspective can provide a new technique for doing this is by far the capital market participants can ensure that the can be selected using a new tool to their portfolio.

From an analytical perspective, there Met heuristic new step in providing optimal portfolio that can combine fundamental analysis and application portfolio to be used dynamically.

*Practical suggestions:*

The use of innovative algorithms and compare them to select the optimal portfolio is important in selecting the optimal portfolio of top companies and the use of these algorithms in terms of accuracy and in terms of cost and time cost is. In this study, the efficiency frontier for comparison algorithms use the same risk level that is proposed to be used to enhance the accuracy comparison of the efficient frontier.

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