IJBPAS, March, 2015, 4(3): 1283-1292

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

DETERMINING THE OPTIMAL PORTFOLIO BASED ON THE MAIN STANDARD COMPONENTS OF SUCCESSFUL COMPANIES IN TEHRAN STOCK EXCHANGE

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ABSTRACT

With respect to the importance of the optimal portfolio of scientific investments in Tehran Stock Exchange and the importance of investor decisiveness in the main economic decisions, the present study was aimed to determine the most optimal portfolio based on the standard components of the active companies in Tehran Stock Exchange in 2013. The present study is a descriptive-analytical research. The statistical sample of this study consists of 42 companies. The research data were collected through exploring related documents and utilizing RAHAVARD-NOVIN software in the Excel. The findings revealed that the 42 companies can grouped in five categories including oil, petrochemical, steel, bank, and investment industries. The findings revealed that every 10000 units of investment consists of 3,186 unit investment in petroleum; 2,314 units of investment in petrochemical; 1,968 units of investment in steel, 1,467 units of investment in bank, and 1,065 unit of investment in the investment industry.

Keywords: Portfolio Optimization, Main Standard Component, Tehran Stock Exchange

INTRODUCTION

There are several threats and risks in the economic activities such as change in price levels and economic rules and other effective factors in market demand and supply, lack of certainty in economic activities, and risk of such activities. During past 25 years, financial markets have been developed at international level and unpredictable changes have influenced individuals' economic behaviors and

investors' perception of market conditions. Increase in the development of economic activities and bankrupt of different businesses are the main important factors which necessitates the use of risk management techniques and its control and measurement tools. The main problem in the optimization of portfolio is selecting the best assets and stocks which have a certain risk and return. Currently, many authors attempt to expand traditional financial model in solving optimization problems. All of these models are systematic efforts to support investors in balancing between the effective factors in their selection and selection of the most optimal assets in their portfolio. The portfolio management refers to the investigation of all characteristics of portfolio such as combination of the best stocks and the best time. Indeed, the optimal portfolio is a combination of stocks which results in the least risks and the most return.

Investment can be defined as costing monetary and other resources and accepting its risks in the present time for achieving profit in the future times. Investment can be done in both financial and physical assets. Stock exchange is a market in it both sellers and buyers exchange their resources with each other under certain rules of stock exchange. The stock exchange has been established from two centuries ago. Also Tehran stock exchange has been formed in the 1967 for directing personal saves and deposits toward industrial and production investments. In this regard, portfolio refers to the sum of individuals or organizations' assets. Each stock or portfolio results in a certain amount of return. The return consists of two parts including price variation and benefits of its ownership. Return rate is used for explaining rate of increase and decrease in the investment in a certain period. It also refers to the increase or decrease in the investment value. The problem of portfolio optimization can be explained as determination of the best combination of stocks for investment.

The present study is a systematic effort to answer the following question.

What are the most optimal portfolios in Tehran stock exchange based on the main standard components?

In this regard, we should answer the following questions?

1. What are the main effective criteria in determination of the optimal portfolio based on the main standard components?
2. What is the role of each constructive components of optimal portfolio based on the main standard components?

Review of literature

Investment

Roughly speaking, investment refers to consuming accessible monies for achieving more money (profit) in the future. In other words, investment means delay in the current consumption of money for achieving more consumption in the future **(Sharpe, 1995)**. There are two main characteristics in the investment including time and risk. The importance of these factors derives from this fact that investment is done by consuming money in the present time and its outcomes are achieved in the future. Generally, investment can be done in two main forms including physical and financial investments. Physical investments refer to investment in the tangible assets such as factory land, facilities, and so on. On the other hand, financial investments include written contracts such as stock and bonds **(Sharifi, 1999)**. The investment process refers to the decision-making in selecting the best stocks and its time.

Portfolio theory

From technical perspective, a portfolio refers to a set of physical and financial investments of an investor. In other words, portfolio is the total assets of a person or organization **(Jones, 1996)**. Portfolio is a combination of investment alternatives which is done by a person or company. Portfolio management refers to selection of most appropriate prices in buying and selling stocks. Indeed, portfolio management results in fewer risks and most return for investors. A portfolio should be selected so exactly that minimizes the probability of decrease in return of assets.

Portfolio management includes different concepts such as portfolio, portfolio strategy, revaluation of portfolio, portfolio theory, Markowitz, Capital Asset Pricing Planning (CAPM), random diversity, theory of labor market, internal value, model of assets pricing, systematic risk, risk-avoiding, financial risk, financial engineering, efficient portfolio, labor market assumptions, efficient market, Beta coefficient, and so on. The purpose of portfolio management is to maximize the return and minimize risks of investments. These purposes can be grouped in two main categories.

Efficient market is a market in which price of an asset reflects all characteristics of that asset. In such a market, the information and reports of stocks are disseminated rapidly and their effect is appeared in the stock price. Markowitz is the founder of important structure which is known as modern theory of portfolio. The most important role of this theory is developing a framework for risk-

return of investor decision-making. This model can be helpful in selecting the assets and managing portfolio based on the mathematical model of risk. According to Markowitz and Sharpe, there are several limitations in the main formula of modern theory of portfolio. Finally, it should be noted that risk of investment is measured based on the variance or standard deviation in the modern theory of portfolio.

Optimal portfolio selection

After selecting portfolio based on the Markowitz model, investors should select an optimal portfolio from efficient set of portfolios. Markowitz model does not determine an optimal portfolio model, but it recognizes a set of efficient portfolios based on the expected return and risk.

Markowitz introduced portfolio concept for the first time. The efficient portfolio refers to an optimal combination of stocks with most profit and least risk. Indeed, investors can determine the efficient portfolio through recognizing expected return rate and minimizing its risks **(Jones, 1996)**.

The Markowitz model has several assumptions such as following items:

1. The investors please the return and hate the risk.
2. The investors act in their decisions rationally.
3. The investors make decisions which result in their expected return.

Therefore, investor utility is a function of expected return and risk. In other words, return and risk are two main parameters of investor decisions **(Jones, 1996)**.

Related studies

Raei (2002) in his study "development of portfolio for risk-taking investor: comparison of the neural network and the Markowitz model" employs daily returns. He found that neural networks have better outcomes than Markowitz model in both static and dynamic conditions. He also found that risk of portfolio of neural network is less than risk of the Markowitz model.

Kord (2011) studies the selection and optimization of portfolio through hyper-creative methods. His statistical population members were 50 companies of Tehran stock exchange from December of 2010 to December of 2011. For this purpose, he employed Markowitz model of average-variance. In the model, return and risk can be measured through average and variance respectively. He found that the algorithm of this study achieves convergent point in a relatively less time and results in less error.

Ghafarinejhad, Akbari, and Nosrat Makoyi (2012) in his study "optimization of

limited portfolio through neural network model" indicate that there are three main limitations in the optimization of portfolio including (1) high and low limits of selecting weight of each stock, (2) limitation of number of existing stocks in the portfolio, and (3) sum of weight of existing stocks in the portfolio is equal to 1. The results of algorithm implementation revealed that research model is able to select the best portfolio in the shortest time.

Esmali Bidgoli (2014) in his study "optimization of investment portfolio based on the value of risk-exposure through Ant Colony Algorithm (ACA)" developed a creative model for solving limited model of optimization based on the value of risk-exposure. He found that the suggested combinative algorithm is able to solve the problem of portfolio optimization based on the value of risk-exposure.

O'Neil (1991) writes the book of how to get rich through normal stocks and suggested seven criteria for investors three month income of every share, annual income of every share, system management, supply and demand, share leaders, frequency of share of financial and investment institutors, and overall market direct.

Wong, Wang, and Goh (1992) presented a Fuzzy neural system for selecting stocks. In the neural system, allocation of assets is done firstly and selection of country and stock are done in the second step.

Kdanoni (2000) in his study "effective factors in the decisions of stock investment through comparative study" studied American and Thai investors' behaviors. He found that American and Thai investors consider different factors in their investment decisions.

Sosalobo, Fazeli, and Boid (2002) in their study "optimization of investment portfolio based on the costs of linear and fixed exchanges" developed a model for optimization of investment portfolio.

Kristen (2002) in his study "the optimal portfolios through linear programming models" developed linear programing models. They also developed a problem with 5 stocks for a 12-month period and compared investment portfolios. He found that a person can act activities more than what he he/she thinks through linear programing models.

Chen, Roll, and Russ (1986) found multi-criteria models in controlling some of the nonmarket factors which lead to variation of stock prices. Also Barry, Burmystr, Rolly, and Edwin wrote several articles in developing multi-variable models from 1986 to 1988.

Salamon *et al*. (1986) developed a model in which seven variables are considered. He found that the use of multi-variable models can explain the correlation of historical data. He also found that multi-variable models can be helpful in selecting the best investment portfolios.

Speranza (1995) developed a model of mixed programing based on the actual characteristics such as exchange costs and minimum units of exchange. He tested the model in Italia stock exchange. For this purpose, he developed a creative algorithm.

Ytzhaky (1982) introduced a risk-average model through average criteria for measuring risks. **Kunooyamazaky (1991)** developed a linear programming for optimizing investment portfolio.

RESEARCH METHODOLOGY

The present study was aimed to determine the most optimal portfolio based on the standard components of the active companies in Tehran stock exchange in 2013. The present study is a descriptive-analytical research. The statistical sample of this study consists of 42 companies. The research data were collected through both library and field study methods. Another part of the research data were collected through exploring related documents and utilizing RAHAVARD-NOVIN software in the Excel.

The model

Suppose that Σ is covariance matrix of random vector for $X' = [X_1, \cdots, X_P]$. Also suppose that Σ has especial values of especial vector $(\lambda_1, e_1), (\lambda_2, e_2), \cdots, (\lambda_P, e_P)$ in which $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_P \geq \circ$. With respect to transformation of main and secondary component, the secondary component of i can be shown as following.

$$P_i = e_i' X = e_{1i} X_1 + e_{2i} X_2 + \cdots + e_{pi} X_p \quad , \quad i = 1, 2, \cdots, p$$

And

$$\operatorname{cov}(P_i, P_k) = e_i' \Sigma e_k = \circ \quad , \quad i \neq k$$

Indeed, we consider"p" as a linear combination as following.

$$P_1 = e_1' X = e_{11} X_1 + e_{21} X_2 + \cdots + e_{p1} X_p$$
$$P_2 = e_2' X = e_{12} X_1 + e_{22} X_2 + \cdots + e_{p2} X_p$$

$$P_p = e_p' X = e_{1p} X_1 + e_{2p} X_2 + \cdots + e_{pp} X_p$$

Also we have the following formula for main components of $P_1, P_2, \cdots, P_p$

$$\sigma_{11} + \sigma_{22} + \cdots + \sigma_{PP} = \sum_{i=1}^{P} \operatorname{var}(X_i) = \lambda_1 + \lambda_2 + \cdots + \lambda_P = \sum_{i=1}^{P} \operatorname{var}(P_i)$$

The total variance is equal to the sum of variables' variances or sum of especial values of covariance matrix. Indeed, each especial value is variance of the related component. Each part of coefficients vector $e_i' = (e_{1i}, \cdots, e_{ki}, \cdots, e_{Pi})$, has its merit to consideration. The value "e_{ki}" measures the importance of variable "k" in the main component "i". This means that if we

consider $P_1, P_2, \cdots, P_p$ as main components of covariance matrix Σ, then we have:

$$\rho_{P_i, X_k} = \frac{e_{ki}\sqrt{\lambda_i}}{\sqrt{\sigma_{kk}}} \qquad i, k = 1,2,\cdots, P$$

The correlation coefficient of components P_i and variables X_k should be measured. So, $(\lambda_1, e_1), (\lambda_2, e_2), \cdots, (\lambda_P, e_P)$ are couples of especial vector Σ.

Caution: in the above-mentioned models, X_k is different from 1 to 42 based on the k. it refers to the return rates of stocks of 42 members of statistical sample.

Statistical analysis

Because we have a 42*42 correlation matrix, the matrix is not shown in this section. It should be remembered that 21 variables were significant ($p \leq 0.05$) and 33 variables were significant ($p \leq 0.10$). The most correlation coefficient was correlation of X_2 ،X_3 ، X_9 ، X_{14} و X_{10}. Also a significant correlation was observed betweenX_{22}, X_{23}andX_{27} and between$X_{40}$and X_{42}.

Eigenvalues of correlation matrix

The first 5 eigen values of correlation coefficients are presented in **Table 1**. For this purpose, eigen values which are more than 1 are presented. The first components with eigenvalue more than 1 explains 23.46% of total variance and remaining 5 eigen values explain 73.63% of total variances.

Table 1: the biggest eigenvalue of correlation matrix

Eigenvalues	1	2	3	4	5
	2.8148	2.0453	1.7387	1.2965	1.0407
Ratio of total variations	0.2346	0.1704	0.1449	0.1080	0.0784
	0.2346	0.4050	0.5499	0.6580	0.7363

Table 2: the main components and their correlations

Eigenvalue vector of main components									
Variable	PC1	Variable	PC2	Variable	PC3	Variable	PC4	Variable	PC5
X_1	0.514	X6	0.546	X12	0.738	X24	0.733	X34	0.568
X_2	0.678	X7	0.710	X13	0.709	X25	0.743	X35	0.608
X_3	0.762	X8	0.607	X14	0.677	X26	0.690	X37	0.663
X_4	0.928	X9	0.555	X21	0.552	X27	0.632	X38	0.775
X_5	0.928	X10	0.507	Other eigenvalues were less than 0.50 and so were eliminated.		X28	0.635	X39	0.940
Other eigenvalues were less than 0.50 and so were eliminated.		X11	0.780			X29	0.500	X40	0.790
		X31	0.808			X30	0.522	X42	0.521
		Other eigenvalues were less than 0.50 and so were eliminated.				Other eigenvalues were less than 0.50 and so were eliminated.		Other eigenvalues were less than 0.50 and so were eliminated.	

Based on the results of **Table 2**, the first components with eigenvalue more than 1 explains 23.46% of total variance. Also the coefficient of Behran Petroleum Company is 0.514; the coefficient of Isfahan Oil Refine Company is 0.678; the coefficient of Tabriz

Oil Refine Company is 0.762; Bandar Abbas Oil Refine Company is 0.928; and Parsian Company of Gas and Oil Development is 0.928. This means that oil industry is the first company in Tehran Stock Exchange.

The second measured eigenvalue, which is variance of second main component, explains 17.04% of total variance. The eigenvalue of the second components has the most loading of Persian Gulf Petrochemical (0.546), Pardis Petrochemical Company (0.710), Shazand Petrochemical Company (0.607), Khark Petrochemical Company (0.555), Fannavaran Petrochemical Company (0.507), Shiraz Petrochemical Company (0.780), and Iran Petrochemical Company (0.808). the findings revealed that although the second main component is combined with Iran Petrochemical Company, but other Petrochemical Companies have considerable role in this area. As a result, it can be concluded that Petrochemical Company is the second company in Tehran stock exchange.

The third eigenvalue, which is the variance of main component, explained 14.49% of total variances. The eigenvalue of the second components has the most loading of Khozestan Steel Company (0.737), Mobarake Steel Company (0.709), and National Company of Iranian Cooper industries (0.552). Based on the findings, it can be said that steel industry is the third biggest company in Tehran stock exchange.

The fourth eigenvalue, which is the variance of main component, explained 10.8% of total variance. The eigenvalue of the second components has the most loading of Mellat Bank (0.733), Pasargad Bank (0.743), Iranian Saderat Bank (0.632), Ansar Bank (0.635), Tejarat Bank (0.50), Eghtesad Novin Bank (0.522). Based on the findings, it can be said that banking industry is the fourth biggest company in Tehran stock exchange.

The fifth eigenvalue, which is the variance of main component, explained 7.84% of total variances. The eigenvalue of the second components has the most loading of Sepak Investment Company (0.568), National Development Group (0.608), Atie Investment Company (0.663), Saipa Investment Company (0.715), Kharazmi Investment Company (0.940), Ghadir Investment Company (0.790), and Taamin petrochemical, gas, and oil Investment Company (0.521). Based on the findings, it can be said that investment industry is the fifth biggest company in Tehran stock exchange.

Caution: in order to measure the loading factor of main components, only the variables with eigenvalue more than 0.50 were employed and other eigenvalues were eliminated.

DISCUSSION AND CONCLUSION

The portfolio optimization model of this study was Markowitz average-variance model in which return and risk are measured through average and standard deviation. For this purpose, a new technique was used. Because there were about 50 active companies in Tehran stock exchange, they were selected for study. The findings revealed that very 10000 units of investment consists of 3186 unit investment in petroleum; 2314 units of investment in petrochemical; 1968 units of investment in steel, 1467 units of investment in bank, and 1065 unit of investment in the investments industry. The categorization can be equal or suitable for eigenvalues of each component. In other words, portfolio can be determined as following: every 10000 units of investment consists of 3186 unit investment in petroleum; 2314 units of investment in petrochemical; 1968 units of investment in steel, 1467 units of investment in bank, and 1065 unit of investment in the investments industry. The components analysis revealed that the first factors in equal to other five factors. This component is known as a market-exchange component or a market component. As shown previously, the most changes in the stock profitability derives from market activity and uncorrelated activates. Such a variation is suggested by **King (1966)**.

REFERENCES

[1] Abzari, Mahdi, Ketabi, Saeede, Abbasi, Abbas, (2005), optimization of investment portfolio through linear programming methods and offering a practical model, Journal of Shiraz University social sciences and humanity, Vol. 2.

[2] EslamiBidgoli, Gholamreza, (2008), goal programming models in selecting optimal portfolio, journal of financial researches, Vol. 13 and 14, p. 4.

[3] Amiri, Maghsod, ShariatPanahi, Banakar, Mohamad Hadi, (2010), selection of optimal portfolio through multi-criteria decision-making models, Journal of stock exchange, Vol. 11.

[4] Jones, P. Charles, (2003), investment management, translated to Persian by Reza Tehrani and Asgar Noorbakhsh, Negahe Danesh Press, Tehran, Iran.

[5] Jones, P. Charles, (2008), investment management translated to Persian by Reza Tehrani and Asgar Noorbakhsh, Negahe Danesh Press, Tehran, Iran, first edition.

[6] Khalozade, H., Amiri, N., (2006), determining optimal portfolio in Iran stock exchange based on the theory of value of risk-exposure, Journal of financial researches, Vol. 73.

[7] Raei, Reza, (2002), development of risk-taking investors through comparison of neutral network and Markowitz models, Payame Modiriat, Vol. 2, pp. 87-96.

[8] Raei, Reza, Saeidi, Ali, (2005), fundamentals of financial engineering and risk management, 6th edition, SAMT press, Tehran, Iran.

[9] Chekhlov Alenei, Vryasev Stanislav. & Zabarankin, Michael(2003). Portfolio optimization with drawdown Constraints.

[10] Chen, Wynne, Goulding, Sandoz. (2000) The application of principal component analysis and kernel density estimation to enhance process monitoring, Control Engineering Practice, 8, 531-543.