

## Determining the Optimized Portfolio of Agriculture Products in Iran Mercantile Exchange: Application of Value at Risk approach

Masoud Dehdashti <sup>1</sup>, Seyed-Ali Hosseini-Yekani <sup>2</sup>, Hamid Mohammadi <sup>3</sup>

<sup>1</sup> Department of Economics and Management, Dashtestan Branch, Islamic Azad University, Dashtestan, Iran

<sup>2</sup> Department of Agricultural Economics, Sari Agricultural Sciences and Natural Resources University, Sari, Iran

<sup>3</sup> Department of Agricultural Economics, University of Zabol, Zabol, Iran

[dehdashti@diau.ac.ir](mailto:dehdashti@diau.ac.ir)

**Abstract:** During recent decade and after considering risk management consist of financial asset, criteria for evaluating risk based on probability that we can call it value at Risk is so important. In this case, this study determines the optimized portfolio of agriculture product in Iran Mercantile Exchange for two groups of investors with average investment of 10 and 100 million Rials by using of value at Risk. Data which is used in this study is consisting of statistic of price about 150 work days for 11 products in 2011. For analyzing information, LINGO software is used and result showed that the crop of beet and edible wheat are two products which are included in all optimized portfolios. Also it is recognized that relation between VaR extend and diversity of portfolio is opposite in the way that in the lower level of risk, portfolios are more diversified than high level of risk and the relation between risk- return is advantageous for risk averse investors.

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### 1. Introduction

Today's stock market as an important tool in capital market, have specific role in economic growth, and by pricing, risk reduction, tooling of resource, and optimize allocation of asset, provide the basis for economic development [4]. In developed country, most of investment is done via financial market. Active Participation of people in stock market guarantees vitality of capital market. Most important challenges of investors in these markets is choosing appropriate stock for investment and creating optimized portfolio which is one of ways for controlling investment risk [1]. Portfolio is one of the important tools for financial management, and the purpose of creating portfolio is maximizing return via investment in different combination of stock [9]. In this case, different theory is presented by expert who consider problem of choosing portfolio from different viewpoint [1]. According to the modern theory of portfolio, assumption is that investors are risk evaders. It means that between two assets with equal efficiency rate, they choose the asset that has lower level of risk [11]. Investors which accepted modern theory of portfolio believe that they do not have power for contrast with market. Therefore, they keep different kind of stock that their return will be equal to average return of market and can reach to appropriate return rate which in near to the market return rate [11].

One of the results of modern portfolio theory is that in the complete market, there is no

limitation for borrowing buy and sell and transaction cost of investors is by extreme low, Investors tend to diversify their portfolio. This is because each extra stock that its return do not have a linear relation with existing stock, can help diversified portfolio and have an impact on reducing risk and in this way can increase utility of investors [5].

There is different ways for creating optimized portfolio in which one of this ways is using value at Risk criteria. This study tries to determine an optimized portfolio in Risk-Return framework for investment in agriculture product of Mercantile Exchange. In this way, weight of special asset in portfolio must be in what extent and if this asset should be entered the portfolio or not?

Always this question was posited for real and lawful investors that which stock they should keep in their investment portfolio? One of issue that has impact on this decision making is previous trend in efficiency stock change. Awaring from these changes create large viewpoint but in the same way summarizing large volume of information and determining the best possible combining is prerequisite of decision making. In this way, we use the model of value at Risk that by using this model, investors have possibility for right management and have an ability to achieve to the specific efficiency by lower risk.

There are many studies in determining optimized portfolio in stock exchange that we can refer to following case.

Campbell et al (2000) determined the optimized portfolio by using value at risk. Result of this study which was done in American stock markets showed that when expectation efficiency contains normal distribution, result of VaR model is similar to mean- variance model.

Yiu (2004) by using VaR and by assuming maximum utility expectation, select the optimized portfolio for risky asset and non-risky asset in two scenarios in two different level of mean and standard deviation of price. Results show that in condition of lack of practicing index limitation VaR, a constant share of portfolio value allocate to risky asset. However, by considering VaR index, by making long the investing period, the maximum investing amount in risky asset happen in low level value. Another word, by increasing period of investment, this probability that the reduction of portfolios value will be more in permissive level of VaR, increased. So in condition of long term investment, in high level of portfolio value, less investing should be done in risk asset.

Baonez et al (2006) in their study try to optimize the exchange portfolio by maximizing expected efficiency and VaR limitation. In this study for dynamic optimization, GARCH multi variant model was used. At last, performance of models was evaluated with two economic criteria and two statistic tests, and it was recognized that using GARCH multi variant model, improved allocation of exchange optimized basket.

Torkamani and Hoseini (2006) determined the optimized portfolio in Tehran stock exchange by using VaR index. In this study which was done by daily transaction statistic about 30 active companies in Tehran stock exchange in 2004, results show that high confidence of VaR requires more diversified portfolios and in addition transaction relation of risk-return in time period of studies is for interest of risk evaders and changes in specified period in model can cause change in optimized portfolio.

Shahriar and Ahmadi (2007) present a paper by topic determining the optimized investment in stock exchange market by approaching value at Risk. Since in this paper, goal of researchers has been presenting value at risk as a proper solution for measuring risk and optimized allotment investment on three portfolios, since by way of parametric approaches such as simple Variance - Covariance based on auto regressive conditional variance and Generalized auto regressive conditional variance, they use it for measuring value at risk for portfolios stock of four company and also investment optimized weight in stock of these companies in Tehran stock exchange market. Results show that it is better for investors to allocate much volume of investment to

investment share in a company that have lower probability risk and lower weight than company that has much probability risk.

Qadiri Moqadam and Rafiee Darani (2010) determine and study the optimized portfolio about active companies' share of food industry in Tehran stock exchange based on index value at risk. Also for analyzing information, mathematic integer programming and was used. In this study which was done by weekly statistic of active company's share Tehran stock exchange from January 2008 to June 2010, results show that shares of agriculture and livestock company Magsal and Salemin are in all optimized portfolio that by increasing the extend of VaR, Industrial company's share of Pars Mino entered to optimized portfolio. Other result of this study is existing direct relation between VaR and investor's return expectation and also lack of specific relation between VaR and diversity optimized portfolio.

Talebnia and Fathi (2010) a comparison evaluation for selection of optimized portfolio in Tehran stock exchange via Markowitz and value at risk models. Result of this research in period of 2001-2008 showed that optimized portfolio selection, in Iran capital market is equal via Markowitz and value at risk models. So it will be possible that professional and non- professional investors can easily use these two models.

Kiani (2011) in his study " relation between diversity of portfolio and VaR size, surveyed related risk about stock price of 17 Indian selected company that their name was registered in BSE(100). Also in this study he examined the possibility of international stock diversity, and creating investing portfolio from stock price index in emerging markets and market of developed country. Result show that diversity of portfolio in national level reduces the expected loss and additional reduction in portfolio risk happens in international diversity.

Tu et al (2011) in their study about stock markets of East Asia countries used Risk metric model and skewed student APARCH for calculating VaR index. Results showed that when efficiency in financial market have heterogeneous distribution, using skewed student APARCH model which have asymmetric component have prominence than Risk metric model.

## 2. Material and Methods

As we point out, the main goal of this study is determining optimized portfolio about different agriculture product in Iran Mercantile Exchange, which is done based on different risky scenarios and different investing level and based on VaR index and using mathematic approach.

VaR index can be define in this way that by selecting a specific portfolio, with  $X$  percent of confidence, maximum loss in  $N$  days, will be  $V$  [7]. For measuring risk of portfolio, we can use index such as Delta, Gamma, Teta, and Ro and approaches such as variance- co variance, historical data simulation, Montcarlo, linear VaR, and VaR delta gamma [6, 7]. Goal of in calculating this indices is measuring the extent of risk that it's fundamental materials is one or some of derived tools for transaction in stock market. This issue in addition to limiting application of aforementioned index makes it impossible to use them in stock market that their transaction will be in cash. In this case in recent year, one of the indices that attracts much attention in the case of risk management is VaR index which in the study we use this index [3, 7, 14].

$$\text{Max } E(V) = E(d_1) \cdot P_1 X_1 + E(d_2) P_2 X_2 + \dots + E(d_n) \cdot P_n X_n \quad (1)$$

S.t:

$$P_1 X_1 + P_2 X_2 + \dots + P_n X_n \leq TB \quad (2)$$

$$\begin{aligned} & \sigma^2(d_1) \cdot (P_1 X_1)^2 + 2\text{Cov}(d_1, d_2) \cdot P_1 \cdot P_2 \cdot X_1 \cdot X_2 + 2\text{Cov}(d_1, d_3) \cdot P_1 P_3 X_1 X_3 + \dots \\ & + 2\text{Cov}(d_1, d_n) \cdot P_1 \cdot P_n \cdot X_1 \cdot X_n + \\ & \sigma^2(d_2) \cdot (P_2 X_2)^2 + 2\text{Cov}(d_2, d_3) \cdot P_2 \cdot P_3 \cdot X_2 \cdot X_3 + \dots + 2\text{Cov}(d_2, d_n) \cdot P_2 P_n X_2 X_n + \\ & \dots + \sigma^2(d_{n-1}) \cdot (P_{n-1} X_{n-1})^2 + 2\text{Cov}(d_{n-1}, d_n) \cdot P_{n-1} \cdot P_n \cdot X_{n-1} \cdot X_n + \\ & + \sigma^2(d_n) \cdot (P_n X_n)^2 \leq (\text{VaR})^2 \cdot (T \cdot (Z(\alpha))^2) \end{aligned} \quad (3)$$

$$d_j = \frac{P_1(X_j) + P_{j-1}(X_j)}{P_{j-1}(X_j)} \quad (4)$$

### 3. Results and discussion

According to above explanation, from all accepted product which is exchanged in Iran Mercantile Exchange, 11 products were selected. Since complete price information from other product is not available, in this study we ignore other product. First we extract required data for this study from Mercantile Exchange market site<sup>1</sup> that is include daily price of different product for a period of 150 days, and  $E(d_j)$ ,  $Q^2(d_i)$ ,  $\text{cov}(d_i, d_j)$  was calculated by output series ( $d_j$ ), then the VaR criterion in three level 5%, 10% and 20% from all investment was calculate respectively for cautious people, by average risk evade and high risk evade persons and in two assumption investment level 10 million and 100 million Rial for small and middle investors in two confidence level of 99% and 95%. It is clear that optimized portfolio selection in this condition occur

The assumption is that the investor by being aware of price trend in 150 previous days intended to choose optimized portfolio for Fluctuation in 10 next days. Determining optimized portfolio model according to VaR limitation is presented in below [6]:

Equation 1 is target function which in fact is maximizing expected efficiency and in equation 1 to 3, TB is the limitation of investor's budget and  $Q^2(d_i)$  show output variance and  $\text{cov}(d_i, d_j)$  is amount of output covariance between product  $i$  and  $j$ . Also  $P$  show the price of each product and  $X$  is amount of product in optimized portfolio and  $Z(\alpha)$  is normal distribution in confidence level of 95 and 99 percent and  $T$  is period that is considered in 10 days.

in 12 scenarios. Values of  $\alpha$  parameter by using normal distribution table for level 95 and 99% is respectively 2.33 and 1.65. Results of model estimation for optimized portfolio are shown in 1 and 2 tables. In these tables we can see that all selected portfolio consist of two products such as Scum of beet and edible wheat. So buying these two products have rather lower risk and it is recommended for people with different risk degrees. Also we can see from examining the number of product in selected portfolio that selected portfolio for risk averse investors is consist of three products such as scum of beet, white sugar and edible wheat but by increasing level of risk taking, white sugar is eliminated from portfolio and it added the amount of product such as Scum of beet and edible wheat for people with middle risk taking. In fact by increasing value of VaR, diversity of product in portfolio is reduced and it tended to product with higher expected return.

<sup>1</sup><http://ime.co.ir/site/512/default.aspx>

Table 1. Results of selected Optimized Portfolio at the level of investment of 10 million Rials and confidence level of 95% and 99%

Variable	Confidence level 99%			Confidence level 95%		
	VaR=%5	VaR=%10	VaR=%20	VaR=%5	VaR=%10	VaR=%20
Corn	0	0	0	0	0	0
Animal feed	0	0	0	0	0	0
Scum of beet	1904	2023	912	1330	2469	1535
Dorem_Wheat	0	0	0	0	0	0
Cottonseed	0	0	0	0	0	0
Canola meal	0	0	0	386	0	0
White sugar	263	0	0	223	0	0
Edible wheat	227	830	1790	157	455	1251
Cottonseed	0	0	0	0	0	0
Soybean meal	0	0	0	0	0	0
Animal Feed	0	0	0	0	0	0
Expected return	9994133	9996620	9998610	9989203	10036095	9994879

Table 2. Results of selected Optimized Portfolio at the level of investment of 100 million Rials and confidence level of 95% and 99%

Variable	Confidence level 99%			Confidence level 95%		
	VaR=%5	VaR=%10	VaR=%20	VaR=%5	VaR=%10	VaR=%20
Corn	0	0	0	0	0	0
Animal feed	0	0	0	0	0	0
Scum of beet	19044	20232	9122	13299	24691	15357
Dorem_Wheat	0	0	0	0	0	0
Cottonseed meal	0	0	0	0	0	0
Canola meal	0	0	0	3866	0	0
White sugar	2643	0	0	2234	0	0
Edible wheat	2272	8306	17901	1575	4555	12516
Cottonseed meal	0	0	0	0	0	0
Soybean meal	0	0	0	0	0	0
Animal Feed	0	0	0	0	0	0
Expected return	99993688	99996174	99996679	99990175	99995795	99995514

Source: Findings of research

But for risk taking people in confidence level of 99%, the amount of Scum of beet is reduced and it will be added to amount of edible wheat which show that in higher risk level, buying the product of edible wheat is more secure than Scum of beet, also it is considered that diversity of existing product in selected portfolio for risk evaders in both level of confidence is more than people with middle and higher risk taking and the number of product in confidence level of 99% increase from three product to four product in confidence level of 95% for risk allusive and the product name " Canola meal flakes " also added to risk averse portfolio. In total, it is considered that portfolio in lower level of risk are

more diversified than higher risk level and the relation between risk level and diversity exist in portfolio is opposite.

By comparison of number of expected return in both level of investment, it is considered that by increasing the value of VaR from 5% to 20%, expected return increased trifle. For example in investment level 10 million and confidence level of 99%, by increasing the VaR from 5% to 20%, the expected return only increases 0.04 percent. This condition shows that relation between risk- return is advantageous for risk evaders. Because by selecting diversified portfolio, without considering higher

return, they reduce higher percent of risk in their transaction.

#### 4. Conclusion

This study is accepted following the selection of optimized portfolio by maximized expected return from agriculture product in Iran Mercantile Exchange by using value at risk. Selection of portfolio is done with 12 assumed scenario and its main conclusion is recommending portfolio for investors in two levels of 10 and 100 million Rials with different degree of risk, we can use this method in other level of investing and risk and for the other products in stock market. We also show in this study that relation between risk level and diversified agricultural product is opposite and relation between risk and return is advantageous for risk evaders that by ignoring the small increasing amount in expected return, they do transaction with little risk. At last it recommended that since using the risk management concepts and value at risk is increasing, required basis for developing these concepts will be provided and it is recommended that investors during decision making for optimized portfolio optimize their decision by using value at risk criteria.

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#### Corresponding Author:

Masoud Dehdashti  
Department of Economics and Management  
Dashtestan Branch, Islamic Azad University  
Dashtestan, Iran  
E-mail: [dehdashti@diau.ac.ir](mailto:dehdashti@diau.ac.ir)

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