Agricultural Marketing and Commercialization Journal
8(1), 109-121, 2024, ISSN Print: 2676640X, ISSN online: 2676-7570

Modeling criteria for determining and commercializing the optimal portfolio of agricultural stocks in Tehran Stock Exchange

Sina Shirtavani[1], Mahdi Homayounfar *[2], Keyhan Azadi[3], Amir Daneshvar[4]

Received: 27 Nov 2023/ Revised: 03 Feb 2024/ Accepted: 30 Mar 2024/ Published: 01 Jun 2024
© Islamic Azad University (IAU) 2024

Abstract

Investing in financial markets and using investment opportunities in the capital market is clearly one of the most important issues in achieving sustainable economic growth and development, especially in developing countries. Therefore, it is important that the criteria for determining the optimal stock portfolio in the Tehran Stock Exchange market are specified and researchers use a standard index to determine the optimal stock portfolio so that commercialization patterns of agricultural stocks can be modeled and determined. Based on this, the present study was designed with the aim of answering the question of what are the effective criteria in measuring the risk and return of the portfolio of agricultural stocks in the Tehran Stock Exchange. The method of conducting the current research was a field survey using a survey of 30 managers of companies active in the field of agriculture in the Tehran Stock Exchange market. The data collection tool was a researcher-made questionnaire, and the data analysis tool was Spss version 23, Topsys Fazi and Lisrel version 5.8. The results of the data analysis showed that the most important appropriate criteria in determining the optimal stock portfolio are profitability, growth, risk, liquidity and market criteria in the order of first, second, third, fourth and fifth priority. Also, the appropriate model for determining the optimal portfolio risk of agricultural stocks included: financial and systematic risk, commercial risk, and market price, as well as the appropriate model for determining the optimal portfolio return of agricultural stocks included: profitability, growth, and... Liquidity.

Keywords: Modeling, optimal portfolio criteria, agricultural stocks and stock market.

Introduction

One of the indicators of a healthy economy is its ability to convert surplus liquidity and available savings into investment, generate wealth and create values. In this connection, the capital market is a good instrument to direct surplus liquidity towards these ends, and if this market is broadened, it'll enable the public to involve in and collaborate with it entirely. An optimal capital market is one where investors operate with full knowledge and this helps the market play its role in creating values for people and aiding the production cycle at a macro-economic level (Naeemi et al., 2022). A prosperous and

[1] PhD Candidate, Department of Industrial-Financial Management, Rasht Branch, Islamic Azad University, Rasht, Iran,
[2] Department of Industrial Management, Rasht Branch, Islamic Azad University, Rasht, Iran, https://orcid.org/0000-0002-0490-7481, Email: Homayounfar@iaurasht.ac.ir
[3] Department of Accounting, Rasht Branch, Islamic Azad University, Rasht, Iran,
[4] Department of Information Technology Management, Electronic Branch, Islamic Azad University, Tehran, Iran.

active capital market has always been internationally recognized as an indicator of nations' development. The major issue that faces investors in these markets is how to decide over selecting securities to invest and form a stock portfolio (Abadian & Shajari, 2016). When making investment decisions, investors simultaneously consider "risk" and "return" from investment options. These two major dimensions in investment, namely risk and return, are no doubt the most important options, if not the only dimensions influencing investment decisions. In essence, what is interpreted as a rational behavior appears to be nothing except for a focus on these two dimensions in analyzing investment opportunities. By the same token, investors form stock portfolios and minimize risks at a certain level of returns. To this aim, it is highly important for financial firms and activists of the capital market to investigate and measure adverse risks at a certain level of returns (Payetakhti-Uskouei et al., 2019). One of the main problems with the previous models in determining a stock portfolio was the failure to consider multiple indicators of evaluating the efficiency of stock portfolios; hence, to address this, multi-criteria decision approaches, together with predictive models, need to be used (Mohammadi et al., 2016). Meanwhile, the main problem of determining the risk and return of the stock portfolio is the necessary criteria for measuring these indicators, although there is no certainty about how to determine the criteria of these two main structures. Based on this, the current research aims to answer the question that what are the main effective criteria in determining and measuring the risk and return of the portfolio of agricultural stocks in the Tehran Stock Exchange and their commercialization model? For this purpose, this study was also conducted with the aim of developing a model of criteria for determining the optimal agricultural stock portfolio in the Tehran Stock Exchange.

Effective factors in determining the optimal agricultural stock portfolio in the stock exchange

Considering the critical role of Stock Exchanges in the social and economic development, the national Stock Exchange Organization is entrusted with a cumbersome duty to meet its objectives; for this, it requires to use all its capacity to fulfil national ideals. A saving as a main source of capital in a Stock Exchange plays a key role in meeting the goals of this organization. In this connection, real-person families constitute one of the main sources of offering saving in the stock and security market, which may help positively realize the philosophy of developing the organization in Iran (Davoudi & Sadri, 2018). Previous research findings indicated that in companies with valuable investment opportunities, the optimal investment level is higher than that of companies with low-quality investment opportunities, because companies expect more returns from valuable investment opportunities (Alali & Tolga, 2019). Investments are divided into real and financial. The first investment generally involves tangible assets such as land, machinery and equipment, while the second

involves written contracts on a piece of paper such as ordinary securities.

Many factors affect the risk and return of investing in any financial product. Factors affecting the risk and return of investment in financial products are divided into three micro-macro and non-economic factors, which are briefly reviewed below (Shayestehfar, 2023).

Macro-level Factors

As indicated by the CAPM model, these factors affect market risks and the effect of those factors on market risks, labeled as systematic risks, is measured by examining price changes of each product depending on price changes of the marketplace. These factors include the following:

Government Policies

As a regulator and policymaker, the government plays a key role in the capital market, and its measures and interventions with the economy, industry, and commerce also influence investments in financial products. This means that the more the government's intervention in the economy, the more the systematic risk and the less investment in financial products. For example, if the government decides to compensate for its budget deficit by issuing bonds, the price and interest rate of the bonds offered will increase, which will result in reducing security prices and increasing interest rates (Alali & Tolga, 2019).

Cultural and Social Factors

In developed nations, the capital market is referred to as a market that attracts public involvement. In under-developed or developing nations, however, a smaller percentage of the public are engaged in the market due to the lack of a relevant culture; meanwhile, if conditions are met laid and real attractions are made, public savings can be directed towards this market, which can raise national income, reduce inflation, allocate existing liquidity in the production market and increase investment and relative welfare in society (Alali & Tolga, 2019).

Industry Status

Various industries and its companies, under the influence of domestic and foreign political, economic, social and even geographical conditions, can enjoy prosperity or suffer from stagnation. On the other hand, the more emphasis is placed on intermediary and consumption industries and the more these industries depend on foreigners, the more the systematic risk will be, which thus reduce investment in industries (Rajabi & Bagheri, 2023).

Economic Conditions and Commercial-Financial Cycles

A decrease in the interest rate can be an effective factor in increasing the return on investments. As the interest rate decreases, investment costs also decrease, which increases the return on investment. The issue is more noticeable when the interest rate is determined based on supply and chain mechanisms, because if this decreased interest rate does not enjoy good instruments to regulate its consequences, it may increase the investment rate; however, these investments are more likely to end up in non-

productive and sometimes destructive sections of the economy (Tronzano, 2022).

On the other hand, an increase in the interest rate increases the risk of interest rate fluctuations, because fixed-interest bond prices decrease, also. If the holder of these bonds sells them before maturity, he will sustain losses. An increase in the expected inflation rate also influences the investment in financial products, as the increase of the expected inflation rate increases the expected return rate of physical assets compared to financial assets (financial products), with the physical assets replacing financial assets in stock portfolios (Tronzano, 2022).

Micro-level Factors

These factors cause changes to the risk that does not pertain to the general market conditions and pertains to corporate status, alone.

Literature Review

In their study, entitled "Optimization of stock portfolios (applying the at-risk value model on cross-efficiency)", (Kazemi Mian Gaskari et al., 2017) concluded that replacing the variance with the adverse risk indicator may sound an improvement. In this study, financial statement-based data envelopment analysis was used for providing cross-efficiency. Accordingly, the at-risk value, which is a major adverse risk indicator, is adjusted over this new criterion and helps determine optimal weights in the portfolio via a linear model solution. The performance of this proposed method was calculated for 185 companies listed on the Tehran Stock Exchange from 2011 to 2015, using the Sharpe Criterion. The result was then compared to Markowitz's market basket performance and the method performance on the cross efficiency. The Sharpe criterion demonstrated better performance than other methods. In a study, "Application of DEMATEL technique and network analysis process in prioritizing factors affecting stock selection at Tehran Stock Exchange", (Ebrahimi & Khorshidi, 2016) found that risk criteria including capital gains, liquidity, dividends, free floating stocks, stock information credibility, stock proportions, financial ratios, and market trends were considered as the most important criteria for investors' preference over selecting stocks. Findings revealed that the above-mentioned factors fall under the so-called *effect* factors. In terms of significance, the factors of capital gains, liquidity, dividends, free floating stocks, stock information credibility, stock proportions, financial ratios, and market trends take respective ranks, with the priorities respectively pertaining to the oil industry, no risk bonds, the steel industry and finally the auto industry. (Mohammadi et al., 2016), investigated the effects of stock migration over the stock portfolio return, concluding that their study could complement the study by Fama, French, Khan-Ahmadi and Tehrani. Results from testing the first, second and third hypotheses indicated no significant relationship between stock migration and returns confirmed. Meanwhile, assuming the significance of the fourth hypothesis's intercept, the wealth of stockholders is concluded to increase with investing in stocks of the companies that have

experienced migration from a smaller to a larger size in two consecutive cycles. In an article, entitled "Prioritization and optimization of portfolios comprising stocks at the Tehran Stock Exchange using multi-criteria decision-making models and ideal planning", (Mehdizadeh et al., 2016) first selected 40 stocks from the Tehran Stock Exchange. The criteria included the average return, the return variance, the return skewness, the return kurtosis, the stock beta, earnings per share (EPS) and price-to-earnings (P/E). The methods used in the study included the AHP for determining the weight of each criterion in decision-making, the VICOR and TOPSIS methods for prioritizing the stocks, and finally the ideal planning method for optimizing the stock portfolios. The findings of the study suggested that the VICOR and the TOPSIS method were in the same direction. The most important criteria studied were the average return and the return variance. In a study, entitled "Fuzzy approach in stock portfolio optimization with flexible constraints", (Khanjarpanah et al., 2015) presented a new model based on modern portfolio theory, while adding such constraints as the number of stocks and the flexibility of weights of the stocks in the portfolio. Applying the constraint of stock weight flexibility creates a state where there are flexibility and uncertainty in satisfying the constraint, as fuzzy relations are used to model the flexibility. Besides the mentioned uncertainty, the stock return also suffers from a cognitive uncertainty. Therefore, the fuzzy approach was used to address the uncertainty, as both types of flexible and possible planning, subsets of the fuzzy planning, were used to convert the model into a simple problem. To solve the model and evaluate it, as many as 30 companies listed on the Tehran Stock Exchange were used and their one-month return was investigated. The findings of the presented models indicated that a higher profit could be gained at a low risk by selecting a reasonable portfolio, at a lower confidence level. In a study, entitled "Optimal Portfolio Allocation between Global Stock Indexes and Safe Haven Assets: Gold versus the Swiss Franc (1999–2021)", (Tronzano, 2022), found that assuming equal or "optimal" weights of the portfolio, simulating the at-risk value confirms the results within a multivariate asset framework, whereas multiple dummy regressions offer more support in this regard. Since the better hedging assets and the safe-haven Swiss franc may continue into the future, the main policy implications of the article will be more relevant. Asset allocation strategies, in the meantime, gives the Swiss franc a relatively greater weight in the global stock portfolio.

In a study, (Eduardo et al., 2020) using evolutionary computation to infer the decision maker's preference model in presence of imperfect knowledge: a case study in portfolio optimization. They suggested that it was usually difficult to select the parameter values of the models representing decision-makers' preferences. As a result, inaccuracy, pessimism and authoritarianism could be inevitable. Furthermore, such selections cannot be made by the most satisfactory traditional decision-making at a reasonable time. For this, a novel voting method based on the genetic algorithm was presented that best dealt with the incomplete knowledge. The second state is using interval numbers that show all the

possible values obtained by the parameters. The evaluation of the method yielded a greater ability in reproducing the adjustments selected by the decision maker. Finally, as the method proposed by the article complemented the previous works of authors about the most satisfactory decision-making over stock portfolios, a case study was provided in this regard. We also used the differential evolution to achieve the most satisfactory sample work. Findings showed that the best sample efficiency is achieved when using the selected method, and the novel approach is concluded to yield an interesting alternative to available methods.

In a study, "Portfolio allocation with the TODIM method", (Alali & Tolga, 2019) demonstrated that in the proposed method using the variance method, the correlation and return calculated for various observational periods were used as a decision-making criterion for the U.S. Stock Exchange data. In sum, 440 various adjustments were used for analyzing the effects of various parameters in the TODIM. According to the results of the tested period, better configurations of the TODIM were selected. In the validation stage, it was empirically shown that TODIM adjustment-based portfolios could yield more significant results than Sharpe's results in terms of weight importance. Meanwhile, TODIM may still be regarded as a choice better than the MVP for the investors sensitive to the risk of focus and financial flow costs.

Methods and Materials

The present research had a basic goal by presenting a suitable model for introducing portfolio optimization criteria in the portfolio optimization problem. From the practical point of view, this research was conducted with the aim of providing a portfolio optimization model for the agricultural sector in the Tehran Stock Exchange. Two methods of documentary and library studies and a survey of stock exchange experts were used in data collection. From the point of view of management, the current research is of a quantitative type and the data provided by stock exchange experts has been used. In this research, library method and researcher-made questionnaire were used to collect data. The managers of the companies admitted to the Tehran Stock Exchange form the statistical population and answered the researcher's questionnaire to determine the criteria for decision making in the stock portfolio. The sampling method in this research is targeted and the statistical sample size includes 30 managers of Tehran Stock Exchange companies. The selected companies were introduced with S1, S2, S3, etc. This study was conducted in the summer of 2020, when trading days were divided into morning and afternoon. Also, the time period from 2011 to 2019 was examined for a detailed examination of investors' decision making. The data collection tool included a researcher-made questionnaire that helped determine the indicators of the decision-maker regarding the stock portfolio, as well as SPSS (version 23) and fuzzy TOPSIS software. Also, TOPSIS fuzzy type multi-criteria decision making calculations were used to determine the necessary indicators of portfolio optimization in Tehran Stock

Exchange. The (Figure 1) shows the method of conducting the study.

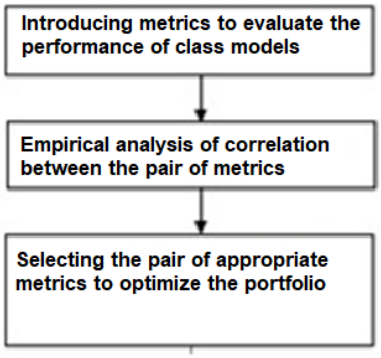

Figure 1. Study administration phase diagram

Results

Individual Characteristics of Directors of Tehran Stock Exchange

(Table 1) shows that the majority of the Stock Exchange directors are 40-50 years old (53.34%), have a history of 15-20 years of work (66.67%) and hold M.A. degrees (63.34%).

Table 1. Individual Characteristics of Directors of Tehran Stock Exchange (Study respondents)

Variable	Classes	Frequency	Valid percentage
Age (year)	Under 40	10	33.32
	40-50	16	53.34
	Over 50	4	13.34
	Total	30	100
History of working at the Stock Exchange (year)	Under 15	5	16.66
	15-20	20	66.67
	Over 20	5	16.67
	Total	30	100
Education	B.A.	9	30
	M.A.	19	63.34
	PhD	2	6.66
	Total	30	100

Source: Study findings

Determining the appropriate criteria for the optimal stock portfolio of the agricultural sector

Expert surveys and multi-criteria decision-making techniques were used to determine the appropriate criteria for determining the optimal stock portfolio of the agricultural sector. Also, exploratory factor analysis was used to determine the appropriate metrics and criteria for determining the optimal stock portfolio. The findings of exploratory factor

analysis along with Bartlett and KMO tests are presented in (Table 2). At the 99% confidence level, the examined samples were sufficient to perform exploratory factor analysis. (Table 3) shows that based on the weights obtained from each of the main criteria for selecting the optimal portfolio of agricultural shares, profitability, growth, risk, liquidity and market criteria are placed in the first, second, third, fourth and fifth priorities respectively. Have taken. Choosing the optimal stock portfolio in Tehran Stock Exchange with cumulative variance percentage of 98.27%. In other words, the best stocks in Tehran Stock Exchange refer to stocks that bring the most profitability, growth and liquidity and reduce investment risk and market price.

Table 2. Sufficiency test of sampling for performing exploratory factor analysis

Rew	Tests	Weights
Sufficiency test of sampling	Bartlett's	291.97
	KMO	0.93
	P-Value(sig).	0.00001**

Source: Study findings/ **: significance at 1% error

Table 3. Weights obtained for the selection criteria of the optimal portfolio of agricultural stocks in Tehran Stock Exchange

Main criteria	Sub-criteria	Weights	Variance percentage	Percentage
Profitability	Earnings per share	0.1177	34.29	1
	Net profit margin	0.0597		
	Dividend payout ratio	0.1407		
	Return on equity	0.0692		
	Average	0.096825		
Growth	Earnings per share growth rate	0.0353	32.45	2
	Operating profit growth rate	0.0887		
	Potential growth rate	0.1192		
	Average	0.081066		
Market	Book to market ratio	0.0373	5.41	5
	Price-to-earnings per share ratio	0.0117		
	Price to sales ratio	0.0287		
	Averages	0.0259		
Risk	Systematic risk	0.0436	16.24	3
	Business risk	0.0658		
	Financial risk	0.0525		
	Average	0.05396		
Liquidity	Current ratio	0.0336	9.88	4

	Future ratio	0.0576		
	Cash ratio	0.0217		
	Average	0.03763		

Source: Study findings

Sentimental Analysis of the Prioritization of the Criteria for Determining the Optimal Portfolio of agricultural stocks Using Multi-Criteria Decision-Making Method

The fuzzy TOPSIS technique was used to confirm the results of the previous stage. (Table 4) gives the relative coefficient and prioritization of the criteria determined at the prior stage to be used to calculate the risk and return of the portfolio. Findings show that the criteria of profitability (a relative coefficient of 0.876), growth (a relative coefficient of 0.832), risk (at a relative coefficient of 0.798), liquidity (at a relative coefficient of 0.758) and the market (at a relative coefficient of 0.741) respectively held the first, second, third, fourth and fifth priorities.

Table 4. Relative coefficient of the priorities of the criteria for determining the optimal portfolio at the Tehran Stoc Exchange

Criteria	Relative coefficient	Priority
Profitability	0.876	1
Growth	0.832	2
Risk	0.798	3
Liquidity	0.758	4
Market	0.741	5

Source: Study findings

Determining the Criteria of Risk and Return of the Optimal Stock Portfolio of agricultural stocks at the Stock Exchange

After determining the appropriate criteria for determining the optimal stock portfolio, it is critical to determine appropriate indicators to calculate each of the risk and return constructs, based on the concept of the optimal stock portfolio, which is maximizing the expected return at a certain level of risk or minimizing the expected risk at a certain level of return. Hence, respondents were surveyed and confirmatory factor analysis were used to determine each of risk and return criteria indicators.

In the first stage, researchers hypothesized that return indicators included profitability, growth and liquidity, and risk indicators included financial, systematic, commercial risks and market prices. This hypothesis was tested by using confirmatory factor analysis. (Table 5) shows that the indicators determined for the portfolio returns at the Tehran Stock Exchange enjoyed good fit. Thus, (Figure 2) illustrates that the indicators of profitability (at a factor load of 0.49 and Standard T of 2.32), growth (at a factor load of 0.44 and Standard T of 2.21), and liquidity (at a factor load of 0.64 and Standard T of 2.43) held significant effects at 99%

confidence level in determining the optimal stock portfolio.

Table 5. Fit indicators of the scale of the indicators of the portfolio return at the Tehran Stock Exchange

Characteristic	Standard	Estimated
$X2/_{df}$ **ratio**	$3X2/_{df}<$	1.75
RSMEA	0.08<RSMEA	0.042
GFI	9/0>GFI	0.99
AGFI	0.9>AGFI	0.94
CFI	0.9>CFI	0.96
N FI	0.9>NFI	0.95

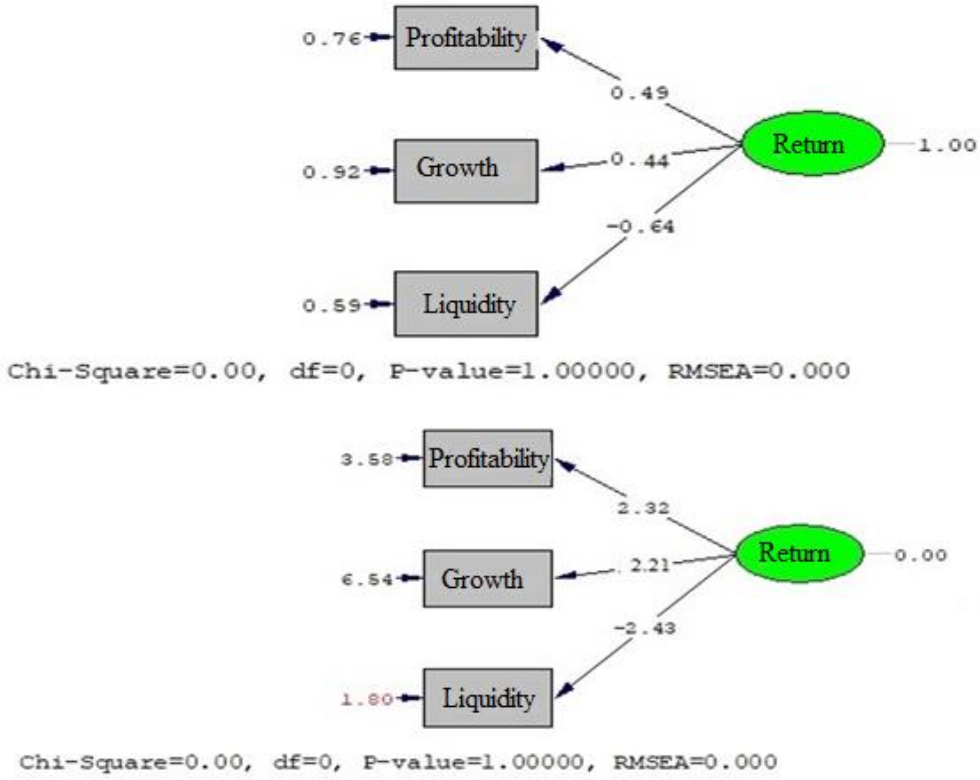

Figure 2. Diagram of factor load and Standard T of return indicators

(Table 6) shows that the indicators determined for the portfolio risk at the Tehran Stock Exchange enjoy good fit. Thus, (Figure 3) illustrates that the indicators of commercial risk (at a factor load of 0.98 and Standard T of 4.32), financial and systematic risk (at a factor load of 0.99 and Standard T of 3.98) and market price (at a factor load of 0.55 and Standard T of 2.77) held significant

effects in determining the optimal portfolio risk at the 99% confidence level.

Table 6. Fit indicators of the scale of the indicators of the portfolio return at the Tehran Stock Exchange

Characteristic	Standard	Estimated
$X2/_{df}$ ration	$3 X2/_{df}<$	1.85
RSMEA	0.08<RSMEA	0.032
GFI	0.9>GFI	0.93
AGFI	0.9>AGFI	0.94
CFI	0.9>CFI	0.97
N FI	0.9>NFI	0.98

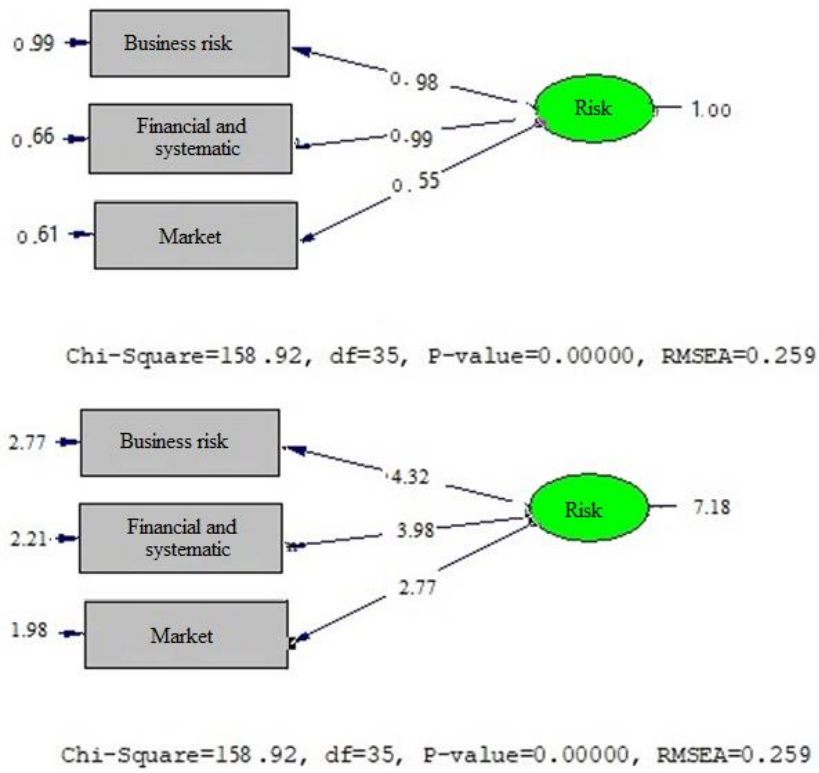

Figure 3. Diagram of factor load and Standard T of risk indicators

Discussion and Conclusion

Stock portfolios that incur the lowest risks for the expected certain return form a front called the efficient front. This study investigated which criteria should be used to determine the optimal portfolio in calculating the portfolio risk and return. For this, this study

determined the model of the criteria determined for the optimal portfolio at the Tehran Stock Exchange market. In the meantime, multi-criteria decision-making results showed that that the most important criteria to determine the optimal stock portfolio were those of profitability, growth, risk, liquidity and market, respectively ranking first, second, third, fourth and fifth. Confirmatory factor analysis results also showed that the criteria of profitability, growth and liquidity, as well as the criteria of risk including financial, systematic and commercial risks, and market price should be used in determining the portfolio return, at a 1% error level. Future research is suggested to use the criteria obtained in this study and relevant optimal stock portfolio prediction methods to estimate the efficiency level of the optimal stock portfolio, and to test the results.

References

- Naeemi N. & Zeraatgari R. & Rezaei G. (2022). Presenting a model of determinants of venture investment using the Soccer League Competition Algorithm (SLCA). Agricultural Marketing and Commercialization Journal, 6(2): 1-22.
- Abadian M. & Shajari H. (2016). Multi-criteria method for selecting the optimal stock portfolio using fundamental analysis variables at petrochemical companies listed onthe stock exchange. Journal of Financial Engineering and Securities Management, (26):1-25.
- Payetakhti-Uskouei SA. & Hadipour H. & Abagheri H. (2019). Optimal stock portfolio using the at-risk value criterion: Evidence from Tehran Stock Exchange. Scientific-Quarterly-Financial Accounting Empirical Studies, 15(61): 157-178.
- Mohammadi D. & Hashem-Nia Sh. & Rahmani Firouzjaei M. (2016). Investigating the effect of stock migration on the return of the stock portfolio. Financial Management Strategy, 4(4): 64-87.
- Davoudi SM. & Sadri A. (2018). Comparing meta-heuristic algorithms in providing the optimal multi-period stock portfolio model based on the at-risk value criteria. Journal of Stock Exchange, 11(41): 121-152.
- Dominic, Q. and M. Sherris. (2012). Portfolio Selection for Insurance Linked Securities: An Application of Multiple Criteria Decision Making. UNSW Australian School of Business Research Paper No. AIPAR 2012/4
- Alali F. & Tolga AC. (2019). Portfolio allocation with the TODIM method. Expert Systems with Applications, 124(1): 341-348.
- Shayestehfar S. (2023). The test of the Fama-MacBeth model to measure the relationship between the expected investment risk metrics and the expected rate of return for knowledge-based companies active in the Tehran Stock Exchange. Agricultural Marketing and Commercialization Journal, 7(1): 94-105.
- Rajabi M. & Bagheri A. (2023). Test of the effect of speculative price bubble and cost of capital on the relative net profit of the group of banks and credit institutions listed on the Tehran Stock Exchange. Agricultural Marketing and Commercialization Journal, 7(1): 131-146.
- Tronzano, M. (2022). Optimal Portfolio Allocation between Global Stock Indexes and Safe Haven Assets: Gold versus the Swiss Franc (1999–2021). J. Risk Financial Manag, 15(1): 241-256.
- Kazemi Mian Gaskari M. & Yakideh KH. & Gholizadeh Mohammad H. (2017). Optimization of stock portfolios (applying the at-risk value model on cross-efficiency). Financial Management Strategy 2(5): 159-183.
- Ebrahimi M. & Khorshidi W. (2016). Application of DEMATEL technique and network analysis process in prioritizing

factors affecting stock selection at Tehran Stock Exchange. Title of the publication, 1 (4): 29-52.

- Mehdizadeh P. & Hosseinzadeh Kashan A. & Rafiei F. (2016). Prioritization and optimization of portfolios comprising stocks at the Tehran Stock Exchange using multi-criteria decision-making models and ideal planning. International Conference on Industrial Engineering and Management, Tehran, Conference Permanent Secretariat.
- Khanjarpanah H. & Pishawaei H. & Jabbarzadeh. A. (2016). Fuzzy approach in stock portfolio optimization with flexible constraints. Journal of Action in Research and its Applications, 13(4): 39-54.
- Eduardo F. & Navarro. & Solares E. & Coello CC. (2020). Using evolutionary computation to infer the decision maker's preference model in presence of imperfect knowledge: A case study in portfolio optimization. Swarm and Evolutionary Computation, 54(1): 100648-60.