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ASSIGNING RANK AND WEIGHTS TO THE ALTERNATIVES AND CONSTRUCTING OPTIMAL PORTFOLIO IN THE TEHRAN STOCK EXCHANGE BY TRIANGLE METHOD[*]

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Since the introduction of the stock exchange in the Iranian financial market, one of the most pressing problems for managers and investors has been determining the optimal portfolio for yielding and investing money. There are several methods for rating and weighing that provide varied outcomes. This study proposes a novel approach for ranking alternatives and comparing them without knowing the weight of the criteria. This research aims to examine the Triangle technique in the Iranian capital market using two types, TS (Triangle Surface) and TV (Triangle Vector). This study provides a novel technique to accommodate and assist investors in selecting the optimum portfolio. All portfolio estimates were based on Tehran stock market data from 2014 to 2021.

According to the findings, this strategy can create an efficient portfolio with a higher return on bank interest and the market index.

Keywords: Portfolio, MCDM[1], Decision Matrix, Normalizing, Heron's formula

Introduction

Well-structured complicated situations and clear consideration of numerous factors lead to more informed and better conclusions. Since the inception of the contemporary multiple-criteria decision-making discipline in the early 1960s, there have been significant breakthroughs in this subject. The advantage of the MCDM approach is that they examine both qualitative and quantitative characteristics. Many solution strategies are included in MCDM, including simple additive weighting (SAW), weighted product (WP), and AHP[2] (Mohammadinejad Pashaki, Mohammadbagher and Jafari 3). A decision matrix is a collection of values in rows and columns that allow an analyst to systematically find, assess, and grade the performance of connections between sets of values and information. The matrix is useful for analyzing vast amounts of decision factors and determining the relative importance of each item. The decision matrix is useful because it may be used for a wide range of decisions. It is most successful, however, when you or your team is evaluating several possibilities or criteria that must be reduced down to one final pick (Team 1).

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[1] Multi-Criteria Decision-Making
[2] Analytical Hierarchy process

Scientific novelty

This work suggests and assesses a novel high-efficiency approach to Multi-Criteria Decision Making (MCDM). This work provides a novel approach for estimating the rank of alternatives and weighting called Triangle, which presents in two types: Triangle Surface (TS) and Triangle Vector (TV). The Triangle technique can weight alternatives and create successful portfolios that outperform the bank interest and stock market index. This approach performs similarly to other MCDM methods.

Structure

The rest of this paper is structured as follows. The Triangle approach is proposed in the next part after reviewing some concepts that are required for this study. Section 4 applies the Triangle technique to real-world situations of two categories, TS and TV. Section five depicts the outcomes of real-world issues and compares TS and TV, after which they are completely compared to the bank deposit and stock market index, and the weights of criteria established in the TV and TS methods are used to identify the weight of alternatives and portfolio results. Section 6 contains the findings and recommendations for future study.

Literature review

This section defines concepts that you should be aware of for understanding the Triangle Method. These concepts include computing vector lengths, Rumina normalization, the similarity between two vectors, decision matrix, and calculating triangle perimeter and area.

Calculate criteria

The criteria utilized in this paper are described in this part. *Return*, *Reliability*, and *Risk* have been the criterion.

Return is the most crucial idea while making investing decisions. Each share or portfolio of shares provides the bearer with a specific return if kept for a specific period and then sold. Price adjustments and ownership advantages are included in this return.

We require a measure of the return on these investments to appropriately evaluate investments. Instead of using prices, most financial studies utilize asset return (Beattie 1).

$$\text{Percentage of Stock Return} = \frac{\text{Real Price of last trading day} - \text{Real Price of } first\ trading\ day\ of\ the\ year}{\text{Real Share price on the } first\ trading\ day\ of\ the\ year} \times 100 \tag{1}$$

Reliability The capacity of the equipment to operate without malfunction is emphasized in the subfield of reliability engineering, which is part of systems engineering. The capacity of a system or component to perform as intended for a predetermined amount of time is referred to as Reliability. The capacity of a system or component to operate at a specific time or period is how reliability is commonly defined (Institute of Electrical and Electronics Engineers).

The likelihood of success at a given moment is how the reliability function is theoretically defined. This likelihood is calculated using thorough analysis, prior data sets, reliability testing, and reliability modelling, among other methods. In reliability projects, availability, testability, maintainability, and maintenance are frequently referred to as components of "reliability

engineering." The cost-effectiveness of systems is frequently significantly influenced by reliability.

Numerous sciences employ the majority of the techniques used to compute reliability standards. This research employs the following method (Jahan Biglari 282):

$$MDF = \frac{\sum(Fail\ days)}{total\ number\ of\ trading\ days} \quad (2)$$

Risk is the idea of future uncertainty about the departure from anticipated earnings or results. Risk is a measure of how much uncertainty an investor is willing to accept in order to make a profit from their investment. Risks come in a variety of forms and come from various circumstances.

A measure of how an individual asset moves (on average) when the entire stock market rises or falls is known as the beta (also known as the market beta or beta coefficient) in finance. Therefore, when a modest amount of an asset is introduced, beta is a good indicator of how much risk the asset adds to the market portfolio. Thus, beta is often referred to as the systematic risk, market risk, or hedging ratio of an asset. Beta does not reflect individual risk. The beta equation is as follows (Kenton 1):

$$\beta = \frac{Cov(r_p, r_b)}{Var(r_b)} \quad (3)$$

Where **Cov** is the covariance between portfolio returns (r_p) and market returns (r_b) and **Var** is the variance of market returns.

2.2. Compute return of a portfolio

$$Portfolio\ return = \sum_{i=1}^{m} w_i r_i \quad (4)$$

Each alternative's return is represented by the letters r_i, w_i, and m, and its weight in the portfolio is represented by the letter m (Esajian 1).

2.3 Length of vector

We begin with Euclidean distance, which is the most widely used unit of measurement. It is a measurement of distance that is best described as the length of a line segment that connects two places. The distance is determined using the Pythagorean Theorem from the points' Cartesian coordinates; therefore, the calculation is rather simple (Brownlee 1).

$$D_{eucl}(p - q) = \sqrt{\sum_{i=1}^{n}(p_i - q_i)^n} \quad (5)$$

Assuming that q_i is the origin of the coordinate system and equals zero, the length of a vector is given by equation (6) as follows:

$$D_{eucl}(v) = \sqrt{\sum_{i=1}^{n}(p_i)^2}$$

(6)

2.4 Rumina Is one of the techniques for normalizing the decision matrix. One method for normalizing the decision matrix is Rumina. There are several criteria with both positive (benefit) and negative (loss). The Rumina approach has been put out as a normalization technique in this area. Divide each criterion's value for positive criteria by the greatest value for that criterion. Also, for negative criteria, the smallest value of the criteria is divided by each criterion's value (Habibi 1).

$$n_{ij} = \begin{cases} \dfrac{x_{ij}}{max\ x_{ij}}, & C_j > 0 \\ \dfrac{min\ x_{ij}}{x_{ij}}, & C_j < 0 \end{cases}$$

(7)

2.5 Decision matrix

A decision matrix is a list of values in rows and columns that allow an analyst to systematically identify, analyze, and rate the performance of relationships between sets of values and information. Elements of a decision matrix show decisions based on certain decision criteria.

$$DM = \begin{matrix} A_i \\ A1 \\ \vdots \\ Am \end{matrix} \begin{pmatrix} C1 & \dots & Cn \\ a_{11} & \dots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \dots & a_{mn} \end{pmatrix}$$

(8)

A_{ij} is the score of option i in relation to criterion j where $A_1, A_2,..., A_m$ is a set of viable alternatives, $C_1, C_2,..., C_n$ is a set of decision-making criteria ("When to Use a Weighted Decision Matrix" 1).

2.6 Triangle perimeter and area

The area of a triangle may be calculated in geometry using Heron's formula, also known as Hero's formula, and named after the Hero of Alexandria when the lengths of all three sides are known. There is no need to first determine the angles or other distances in the triangle, unlike other triangle area formulas.

According to Heron's formula, a triangle whose sides are lengths a, b, and c has an area of

$$S = \sqrt{p(p-a)(p-b)(p-c)}$$

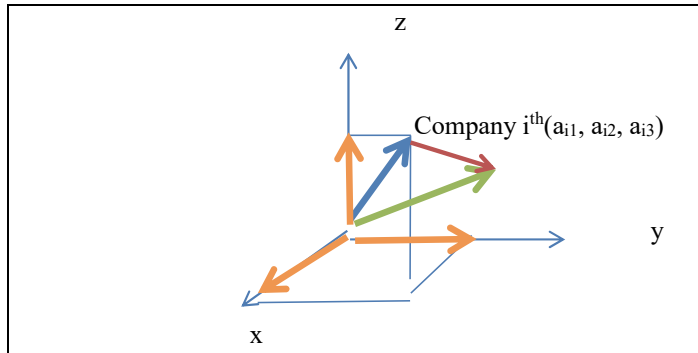(9)

And p is (Kendig 402),

$$p = \frac{a+b+c}{2}$$

(10)

Let **a, b, c** be the sides of the triangle and θ the angle **a, b** sides. Applying the law of cosines, we get

$$c^2 = a^2 + b^2 + 2ab \cos \theta \quad (11)$$

3. Triangle method

Each alternative in a decision matrix can be a vector in three dimensions since it is based on three criteria. *Return*, *reliability*, and *risk* are the requirements.

Figure 1 Triangle Method

In the illustration above, the green vector represents the best alternative, the red one represents the distance between each alternative and the best one, and the blue vector represents a company as an alternative. The length of the red vector constructs the first type of triangle method, which we will refer to as Triangle V (TV), and the other type is the Triangle Surface, which displays the area between these three vectors that formed a triangle, i.e. (TS).

4. A real-world example

With a case study from the actual world, this section describes the Triangle approach. This essay seeks to give an example of the approach in the actual world. We applied this methodology at the Tehran Stock Exchange for 20 businesses to determine the actual price of each trading day taking into account capital increases, DPS, and trading commissions. Twenty firms were included as options in the choice matrix, and the three criteria were return, reliability, and risk. The twenty companies were chosen from the Tehran Stock Exchange listed in the Appendix.

4.1 Decision matrix

As an illustration, this decision matrix used values belonging to 1397. The table below is the decision matrix related to 1397. The aim of this part is only the expression Triangle method.

Table 1 example of decision matrix in the Tehran Stock Exchange

DECISION MATRIX 1397 PER YEAR							
Company	Return	Reliability	RISK	Company	Return	Reliability	RISK
Iran Mineral P.	55.863	0.390	-0.677	Sobhan Pharm.	-5.011	1.000	1.064
Behbahan Cement	-12.664	0.973	-0.614	Iran Mobil Tele	30.115	0.504	0.573
Dadeh pardazi Iran co	15.865	0.237	1.283	Chadormalu	31.688	0.712	1.081
Fanavaran Petr.	54.682	0.589	0.069	Iran Khodro	0.755	1.000	1.563
S*North Drilling	-48.540	1.000	0.181	Khouz. Steel	57.449	0.310	1.142
S*IRI Marine Co.	-1.458	1.000	0.596	S*I. N. C. Ind.	65.427	0.500	0.757
Butane Group	49.162	0.813	0.770	Azar Refract.	-39.058	0.845	-0.411
Shahroud Sugar	5.874	0.131	2.083	S*Tehran Const.	-26.378	1.000	-1.258
Yazd Jooshkab	6.575	0.315	0.796	MAPNA	-11.279	1.000	0.839
Sahand Rubber	7.722	0.292	1.021	S*Mellat Bank	-10.531	1.000	0.393

The real-world example

In this section, the Triangle approach is explained with a practical example. This essay seeks to give an example of the approach in the actual world. This strategy was used by 20 firms for this purpose on the Tehran Stock Exchange. Twenty organizations were offered as choices in the selection matrix along with the three criteria of *Return*, *Reliability*, and *Risk*.

Table 2 calculating the data needed to use the Triangle method

Company	Return	Reliability	Risk	Length of Alternatives	$M_{altenatives}$*A*	$Cos\Theta$
Iran Mineral P.	0.36508	0.11656	-0.1550	0.4134	0.09	0.326451
Behbahan Cement	-0.08276	0.29097	-0.1406	0.3336	-0.09	-0.42539
Dadeh pardazi Iran co	0.10368	0.07088	0.2939	0.3197	0.19	0.913207
Fanavaran Petr.	0.35736	0.17604	0.0158	0.3987	0.17	0.653512
S*North Drilling	-0.31723	0.29901	0.0415	0.4379	-0.10	-0.37033
S*IRI Marine Co.	-0.0095	0.29901	0.1366	0.3289	0.07	0.345076
Butane Group	0.3212	0.24302	0.1763	0.4398	0.23	0.818448
Shahroud Sugar	0.0383	0.03917	0.4773	0.4805	0.25	0.796788
Yazd Jooshkab	0.0429	0.09415	0.1824	0.2097	0.11	0.810478
Sahand Rubber	0.0504	0.08726	0.2339	0.2548	0.14	0.835615
Sobhan Pharm.	-0.0327	0.29901	0.2437	0.3872	0.11	0.458874
Iran Mobil Tele	0.1968	0.15079	0.1312	0.2805	0.15	0.847793
Chadormalu	0.2070	0.21283	0.2478	0.3868	0.22	0.866519

Iran Khodro	0.0049	0.29901	0.3582	0.4667	0.18	0.616883
Khouz. Steel	0.3754	0.09261	0.2617	0.4669	0.29	0.964292
S*I. N. C. Ind.	0.4275	0.14950	0.1735	0.4851	0.27	0.871852
Azar Refract.	-0.2552	0.25264	-0.0941	0.3713	-0.14	-0.60489
S*Tehran Const.	-0.1723	0.29901	-0.2883	0.4498	-0.20	-0.69139
MAPNA	-0.0737	0.29901	0.19236	0.3631	0.07	0.308909
S*Mellat Bank	-0.0688	0.29901	0.08997	0.3198	0.03	0.122903
A*	0.42759	0.03917	0.47734	0.6420		

$A*$ is the best alternative base on the best value of criteria, and the $\boldsymbol{\Theta}$ is the angle between each alternative and $A*$, both of them are essential data for using the Triangle method.

Table 3 calculating sides of the triangle

Company	c^2	c	a	b	Company	c^2	c	a	b
Iran Mineral P.	0.409	0.640	0.41	0.64	Sobhan Pharm.	0.334	0.577	0.39	0.64
Behbahan Cement	0.705	0.840	0.33	0.64	Iran Mobil Tele	0.185	0.430	0.28	0.64
Dadeh pardazi Iran co	0.139	0.373	0.32	0.64	Chadormalu	0.131	0.362	0.39	0.64
Fanavaran Petr.	0.236	0.486	0.40	0.64	Iran Khodro	0.260	0.510	0.47	0.64
S*North Drilling	0.812	0.901	0.44	0.64	Khouz. Steel	0.052	0.228	0.47	0.64
S*IRI Marine Co.	0.374	0.612	0.33	0.64	S*I. N. C. Ind.	0.104	0.323	0.49	0.64
Butane Group	0.143	0.378	0.44	0.64	Azar Refract.	0.838	0.915	0.37	0.64
Shahroud Sugar	0.151	0.389	0.48	0.64	S*Tehran Const.	1.013	1.006	0.45	0.64
Yazd Jooshkab	0.237	0.487	0.21	0.64	MAPNA	0.400	0.632	0.36	0.64
Sahand Rubber	0.203	0.451	0.25	0.64	S*Mellat Bank	0.464	0.681	0.32	0.64

The sides of the triangle are a, b and c. The length of each alternative is $\boldsymbol{a}$, and also, $\boldsymbol{b}$ is the length of A*, and c is the distance between them.

Triangle Surface

The table below displays the distance between each option and the optimal vector $A*$ by earlier sections, and it was created using formulae (9, 10, and 11) to calculate the distance, the weight of the alternatives, and the return of this portfolio for 1397 (2018).

Each company has three attributes (*Return*, *Reliability,* and *Risk*), then

$$a = \sqrt{(Return)^2 + (Reliability)^2 + (Risk)^2}$$
$b = A^* =$ *(The best of Return, the best of Reliability, the best of Risk)*
$$c = \sqrt{c^2} = \sqrt{a^2 + b^2 + 2ab\cos\theta}$$

Table 4 calculating return of Triangle surface

1397	P	S	Rumina	Weight	Return
Iran Mineral P.	0.84783	0.12544	0.314384	0.029219	5.34
Behbahan Cement	0.90786	0.09692	0.406922	0.03782	8.18
Dadeh pardazi Iran co	0.66764	0.04181	0.943078	0.08765	1.09
Fanavaran Petr.	0.76358	0.09687	0.407103	0.037836	4.88
S*North Drilling	0.99060	0.13058	0.302019	0.02807	10.41
S*IRI Marine Co.	0.79152	0.09909	0.397979	0.036988	1.14
Butane Group	0.73027	0.08111	0.486194	0.045187	3.03
Shahroud Sugar	0.75586	0.09320	0.423146	0.039327	7.57
Yazd Jooshkab	0.66978	0.03943	1	0.092941	0.87
Sahand Rubber	0.67410	0.04492	0.877907	0.081593	5.01
Sobhan Pharm.	0.80357	0.11043	0.357131	0.033192	1.40
Iran Mobil Tele	0.67664	0.04775	0.82583	0.076753	0.88
Chadormalu	0.69570	0.06197	0.636337	0.059142	9.36
Iran Khodro	0.80947	0.11791	0.334481	0.031087	0.21
Khouz. Steel	0.66859	0.03969	0.993431	0.09233	7.02
S*I. N. C. Ind.	0.72517	0.07626	0.517102	0.04806	4.71
Azar Refract.	0.96450	0.09491	0.415531	0.03862	4.77
S*Tehran Const.	1.04934	0.10431	0.378078	0.035139	4.89
MAPNA	0.81882	0.11086	0.355742	0.033063	2.66
S*Mellat Bank	0.82148	0.10186	0.387154	0.035982	9.17
SUM			10.75955	1	92.60

Triangle Vector

Triangle *V* is the distance between each alternative and the best vector A*, and according to previous parts, the table below shows the alternatives' weight and return of the portfolio in 1397 (2018) after normalizing.

Table 5 calculating return of Triangle vector

Company	Rumina	Weight	Return TV
Iran Mineral P.	0.356449855	0.038020578	4.24
Behbahan Cement	0.271634408	0.028973773	4.80
Dadeh pardazi Iran co	0.610863401	0.065157495	1.35
Fanavaran Petr.	0.469126376	0.050039173	4.95
S*North Drilling	0.253200966	0.027007577	5.91
S*IRI Marine Co.	0.372809609	0.039765584	0.92

Butane Group	0.602519799	0.064267528	3.88
Shahroud Sugar	0.586307667	0.062538267	9.55
Yazd Jooshkab	0.467814263	0.049899217	0.82
Sahand Rubber	0.505514669	0.053920515	5.17
Sobhan Pharm.	0.39485625	0.04211718	1.21
Iran Mobil Tele	0.529780561	0.056508827	0.95
Chadormalu	0.629390156	0.067133643	12.25
Iran Khodro	0.447234848	0.047704122	0.21
Khouz. Steel	1	0.106664591	14.25
S*I. N. C. Ind.	0.706043806	0.075309874	7.03
Azar Refract.	0.249208541	0.026581727	2.56
S*Tehran Const.	0.226635623	0.024173996	2.41
MAPNA	0.360790797	0.038483603	2.10
S*Mellat Bank	0.335000863	0.03573273	6.67
SUM	9.37518246	1.00	91.25

Results and discussion

This section displays the results of utilizing the Triangle technique to weigh alternatives for six years, comparing them to the market index and bank interest, and using four Triangle modes to calculate the return on each portfolio. These portfolios compare to one another and display the findings in charts. These charts aid in determining which strategy performs best.

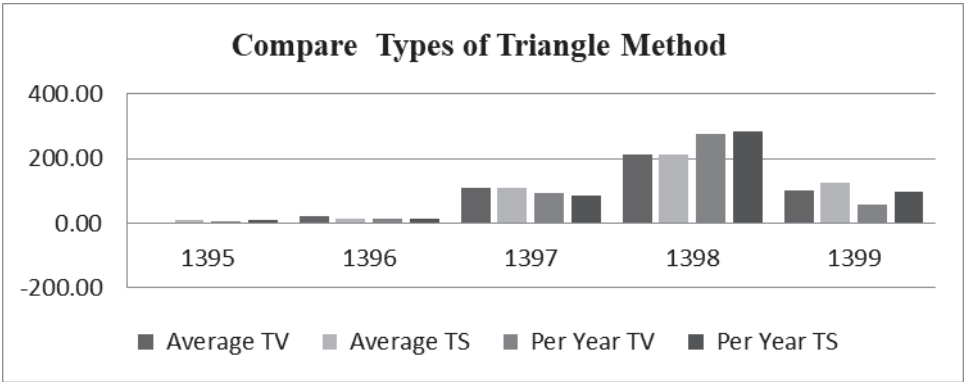*Figure 2 the results of the annual return of each type of Triangle*

Figure 2 illustrates the types of calculating criteria and Triangle modes. The results show the return of Triangle modes for five years.

Figure 3 the results of the method in comparison with the market index and bank interest after five years
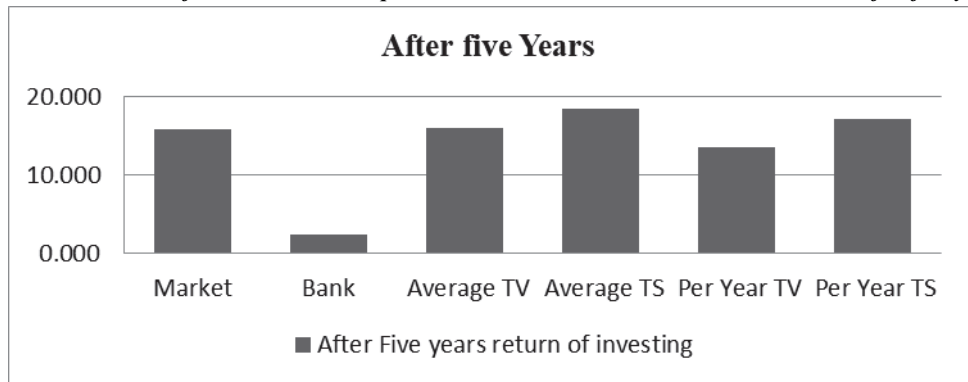

Figure 3 shows the performance modes of Triangle and compares them with the market index and the interest of the bank. The results show that the return of most of the Triangles' modes after five years is better than the market index and bank interest.

According to the results, the recommended portfolio constructed with the Triangle method for 1400 is recommended in the below table (6). This method recommended only one company for investing based on three criteria *return, reliability and risk*. The criteria are calculated with *average* mode, and the type of Triangle has been *TS*.

Table 6 the Triangle recommendation for 1400

Triangle Surface 1400 Criteria Average	
Company	*Weight*
Iran Mineral P.	*1.00*

Conclusion and future research

Choosing the ideal portfolio for yielding and investing money has been one of the most pressing challenges for managers and investors. There are several strategies for rating and weighing alternatives, each of which has different outcomes. The purpose of this research is to provide the Triangle approach for assigning weight to alternatives with and without knowing the weight of the criteria.

The majority of the paper is devoted to articulating the Triangle method algorithm in content analysis, citing an example to further understand the approach, and lastly, implementing this method and comparing it to the existing data analysis method. The validity of the method's results in relation to the market index and bank interest was then examined and assessed.

According to the data, a portfolio constructed by TS that its decision matrix's criteria are calculated by Average mode has the highest performance in Tehran stock market. This type of Triangle method was the best adjustment that made it more efficient.

Future study is needed to compare this method to TOPSIS, AHP, and other MCDM methods, as well as survey the performance of this method in various markets and adjust the number of criteria

or normalizing methods used to normalize the decision matrix. Also, a researcher can do all the above-mentioned things by knowing the weight of the criteria again.

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Appendix

Company Name	Industry	Symbol
Iran Mineral P.	Production of zinc sheets and ingots	FRVR1
Behbahan Cement	Production of type I, II & V gray cement	SBHN1
DPI Dadeh pardazi Iran co	DPI can be present and act on all fields concerning information and communications technology	DADE1
Fanavaran Petr.	Manufacturing, commissioning and extraction of methanol units, acetic acid and carbon monoxide to meet the needs of domestic and export target markets	PFAN1
S*North Drilling	A leading company in oil and gas well drilling	HSHM1
S*IRI Marine Co.	Purchasing, operating, renting, leasing and selling any type of ship and vessel for any purpose, including freight and passenger transport, refueling and the like.	KSHJ1

	Undertaking any activity complementary to the activities subject to paragraph 1 above, such as the construction, operation or rental of port facilities, offshore structures and facilities related to the construction and repair of ships and vessels, and all types of cargo and passenger terminals.	
Butane Group	*Production, import and purchase of various installation products, gas appliances, home appliances, parts and raw materials - manufacture and operation of production equipment and machinery - establishment, rent and management of factories in or outside the country - distribution, sale and export of products Above.*	*BOTA1*
Shahroud Sugar	*Production of sugar from sugar beet and refining of raw sugar to white sugar and selling them.*	*SHKR1*
Yazd Jooshkab	*Manufacturer of cables with rubber and silicone insulation*	*JOSH1*
Sahand Rubber	*Rubber liner - Conveyor belt - Roller cover - Rubber parts - Flooring*	*SHND1*
Sobhan Pharm.	*Pharmaceutical Holding*	*DSOB1*
Iran Mobil Tele	*The biggest mobile operator in the country in both call and mobile internet*	*HMRZ1*
Chadormalu	*The subject of the company is: a- Main topics - Exploration and exploitation of iron ore mines and production of concentrate from it and production of pellets, production of iron ore (lamp over), production of steel products b- Sub-topics - installation and commissioning, maintenance, repairs, inspection Technical, service of machinery equipment required by the company*	*CHML1*
Iran Khodro	*Establishment, construction and management of factories in any place, inside or outside the country in order to produce and supply all kinds of cars and means of transportation.*	*IKCO1*
Khouz. Steel	*The main topics include smelting, casting and rolling operations of ferrous metals and alloy steels to produce standard geometric sections. Sub-topics include supply and production of spare parts, renovation and factory management, business operations, investment in companies related to the subject of the company.*	*FKHZ1*
S*I. N. C. Ind.	*Exploration, extraction and exploitation of Iranian copper mines*	*MSMI1*
Azar Refract.	*Production of various shaped and amorphous refractory products*	*NSAZ1*
S*Tehran Const.	*Mass construction and real estate investments*	*NSTH1*
MAPNA	*Construction of power plant equipment and ....*	*MAPN1*
S*Mellat Bank	*1- Opening and maintaining current Gharz al-Hasna deposit accounts, savings and short-term and long-term investment deposit accounts and other similar accounts, and issuing various types of licensed cards and issuing various types of deposit certificates. 2- Granting all kinds of financial and credit facilities to natural and legal persons in the form of current laws of the country*	*BMLT1*

ԱՄՓՈՓՈՒՄ

Այլընտրանքների համար վարկանիշների և կշիռների հատկացումը և Թեհրանի ֆոնդային բորսայում օպտիմալ պորտֆելի կառուցումը եռանկյունու մեթոդով

Արաշ Ջահան Բիգլարի,
Երևանի Եվրոպական համալսարանի ասպիրանտ
Երևան, Հայաստանի Հանրապետություն

Իրանի ֆինանսական շուկայում ֆոնդային բորսայի ներդրումից ի վեր մենեջերների և ներդրողների համար ամենաահրատապ խնդիրներից մեկը եղել է փողի եկամտաբերության և ներդրման օպտիմալ պորտֆելի որոշումը: Գոյություն ունեն գնահատման և կշռման մի քանի մեթոդներ, որոնք ապահովում են տարբեր արդյունքներ: Այս ուսումնասիրությունն առաջարկում է այլընտրանքային տարբերակները դասակարգելու և դրանք համեմատելու նոր մոտեցում՝ առանց չափանիշների կշիռք իմանալու: Այս հետազոտությունը նպատակ ունի ուսումնասիրել Եռանկյունի տեխնիկան Իրանի կապիտալի շուկայում՝ օգտագործելով երկու տեսակի՝ TS (եռանկյունի մակերես) և հեռուստացույց (Եռանկյունի վեկտոր): Այս ուսումնասիրությունը տրամադրում է նոր տեխնիկա՝ ներդրողներին հարմարեցնելու և օգնելու օպտիմալ պորտֆելի ընտրության հարցում: Պորտֆելի բոլոր գնահատումները հիմնված են Թեհրանի ֆոնդային շուկայի տվյալների վրա՝ 2014-2021 թվականներին: Ըստ բացահայտումների՝ այս ռազմավարությունը կարող է ստեղծել արդյունավետ պորտֆել՝ բանկային տոկոսների և շուկայական ինդեքսից ավելի բարձր եկամտաբերությամբ: Հետագա ուսումնասիրությունն անհրաժեշտ է այս մեթոդը TOPSIS, AHP և MCDM այլ մեթոդների հետ համեմատելու համար, ինչպես նաև՝ հետազոտել այս մեթոդի կատարողականը տարբեր շուկաներում և կարգավորել որոշման մատրիցը նորմալացնելու համար օգտագործվող չափանիշների կամ նորմալացման մեթոդների քանակը: Նաև հետազոտողը կարող է անել վերը նշված բոլոր գործերը՝ կրկին իմանալով չափանիշների կշիռք:

Բանալի բառեր` պորտֆոլիո, MCDM, որոշման մատրիցա, նորմալացում, Հերոնի բանաձև

РЕЗЮМЕ

Присвоение рангов и весов альтернативам и построение оптимального портфеля на Тегеранской фондовой бирже методом треугольника

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С момента появления фондовой биржи на иранском финансовом рынке одной из самых актуальных проблем для менеджеров и инвесторов стало определение оптимального портфеля для получения и вложения денег. Существует несколько методов оценки и взвешивания, дающих разные результаты. В этом исследовании предлагается новый подход к ранжированию альтернатив и их сравнению без знания веса критериев. Это исследование направлено на изучение метода треугольника на иранском рынке капитала с использованием двух типов: TS (поверхность треугольника) и TV (вектор треугольника). В этом исследовании представлена новая методика, помогающая инвесторам в выборе оптимального портфеля. Все

оценки портфеля были основаны на данных фондового рынка Тегерана с 2014 по 2021 год. Согласно результатам, эта стратегия может создать эффективный портфель с более высокой доходностью по банковским процентам и рыночному индексу. Дальнейшие исследования необходимы для сравнения этого метода с TOPSIS, AHP и другими методами MCDM, а также для изучения эффективности этого метода на различных рынках и корректировки количества критериев или методов нормализации, используемых для нормализации матрицы решений. Кроме того, исследователь может сделать все вышеперечисленное, зная еще раз веса критериев.

Ключевые слова: портфель, MCDM, матрица решений, нормализация, формула Герона.