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ANALYSIS AND CLASSIFICATION OF COMPANIES ON TEHRAN STOCK EXCHANGE WITH INCOMPLETE INFORMATION

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Abstract. Due to uncertainty and large number of companies in financial market, it has become difficult to choose the right stock to investments. Identifying and classifying stocks using fundamental criteria help investors to better understand the risks involved in selecting companies and better manage their own capital, thereby rapidly and accurately choose their preferred stock and make more secure profit. The main concern that capital market investors are facing difficulty to choosing the right stock despite the uncertainties in the market. Uncertainties in the market that lead to incomplete information are presented in this article to complete the reciprocal preference relation method. The purpose of this paper is to present a method for completing information to reduce the uncertainties in the market and finally classify companies in each industry based on fundamental criteria. The classification method used is acceptability/reject ability which is based on distance fuzzy analysis yields more accurate results. Finally, a case study on one of the most critical industries in Tehran Stock Exchange is presented to show the effectiveness of the proposed approach.

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1. Introduction

A major challenge that most investors face in stock market is choosing the stock with the best price at the best time possible [7, 31]. Fuzzy classification helps investors to make better and faster selection of stocks in the Stock Exchange market considering their capital and the risk of stocks [11, 32]. This choice is made using technical or fundamental analysis [1, 34, 44]. There are many analytical approaches for decision making in stock market, which are categorized in two groups: technical analysis and fundamental analysis [8, 34]. We shall discuss these two groups in the following paragraphs.

Keywords. acceptability, reject ability, stock market, classification.

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Technical analysis of stocks. Technical analysis is the study of past price movements to predict future prices using charts which demonstrate prices over time. This method is applicable to stocks, indices or commodities in which the price is influenced by the forces of supply and demand. In fact, technical analysis tries to predict future prices using iterative patterns such as recurring and continuing movements as well as indicators [1,34,44].

Fundamental analysis. This is a method of measuring securities value by examining key financial and economic factors including revenue and profitability or even the effectiveness of the company's management which affect future prices. This approach is based on a key assumption that the performance of a company's stock can fully reflect its operating conditions [3,8,31,34].

Fuzzy methods have been used in many studies, including classification problems, examples of which are given below.

Syed Abou Iltaf Hussai *et al.* [19] presented a strong multi-criteria decision model which evaluated alternatives versus criteria based on distance-based methods (PIVIFN) considering the uncertain nature of the decision makers. Other fuzzy decision-making problems included Neha Ghorui *et al*'s work which used combined fuzzy AHP and topsis methods to select a location for a store in India, taking into account various influential criteria in re-selection [17]. Applying Fuzzy Regression Analysis Method, Al-Dini *et al.* [3] showed that, in Khodro, Iran EPS (earnigs per share) and DPS (dividend per share) are correlated to the stock prices.

Sayumwe and Amroune [40] and Warrad [1, 47] proved that fundamental factors could be used to predict future stock price. Emir *et al.* [12] and Ayodele *et al.* [6] proposed an integrated model comprising of fundamental and technical factors which could provide a better prediction of stock prices rather than fundamental or technical factors alone can do [7].

Existing literature in Forex, Egyptian and Turkish stock market showed that combination of technical and fundamental analysis could provide a more accurate classification of stocks and prediction of price movements than technical or fundamental analysis individually [8].

In economic order quantity, Maity *et al.* [25] concluded that in cases with ambiguity, fuzzy methods yield better (more reliable) results than other methods do [25]. Due to the complexity of the market and the impact of a wide variety of conditions on stock classification, different criteria are needed in order to evaluate and compare companies, and consequently there will be a multi-criteria problem [15,22]. In this study, the criteria for evaluating companies mostly include fundamental analysis factors, however, because of the benefits of technical analysis, one of the criteria has been devoted to technical analysis and presented as experts' opinions of stocks. Moreover, due to the uncertainty in stock market [13,27], large number of companies in the market and a variety of technical analysis methods [4], experts are unable to assign precise ratings to some companies and as a result there is incomplete information in the experts' opinions and the information is completed applying the RPR method [51].

After the information is completed, a new classification method, a modified version of the method proposed by Tchangani [42] based on distance fuzzy method, is presented which eliminates the two major flaws in Tchangani's method [42].

Since stock selection should be done at as little time as possible and there are a large number of companies in the market, motivation for this research is to provide a suitable method for investors to choose stocks from different companies as quickly as possible. This work is innovative in the method used which is improved version of the Tchangani's method. The new method can be used in various decision-making contexts. Moreover, at the end of the article, the classification of petrochemical companies in the Tehran Stock Exchange considering incomplete information is presented so that people can make a better decision in their investment.

In this article, at first criteria specified by the stock market experts are defined and in the second part, a method is provided to complete incomplete information in the experts' ratings. After completing the information in the input matrix, in the third section, a new distance fuzzy method for classification is presented and eventually in the last section, the case study of the problem in petrochemical companies in Tehran exchange market is examined. The steps of the method are shown in the Figure 1 given as below.

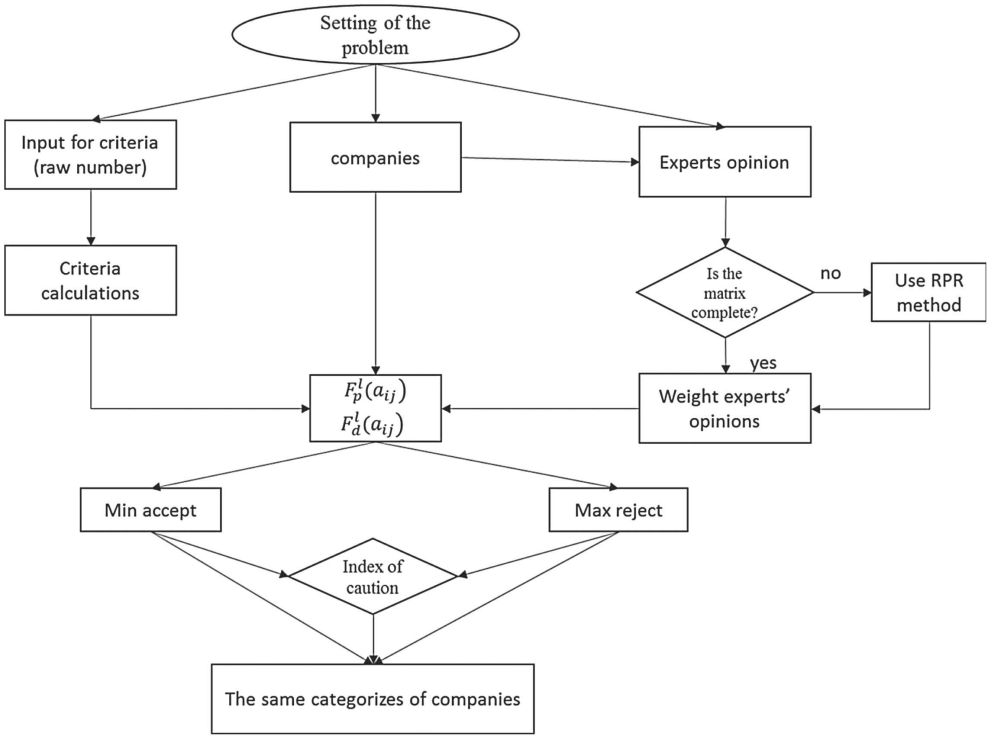

FIGURE 1. Steps of classifying alternatives based on criteria.

TABLE 1. Effective criteria list in share.

Number	Criteria	Sub-dimension	References
1	Return on assets	ROA	[20, 23, 37, 48]
2	Dividend payout ratio	DPR	[14, 18, 35]
3	Operating cash flow	OCASH	[4, 33]
4	Sales volatility	SV	[27, 28, 36]
5	Accounts receivable growth	AR	[38, 45]
6	Gross profit margin growth	GP	[9, 49]
7	Quick ratio	QR	[39, 46, 48]
8	Asset turnover	AT	[2, 5, 21]
9	Expert's opinion	EO	[7, 8]

2. CRITERIA FOR EVALUATING/EXAMINE COMPANY

The Stock Exchange Experts identified eight of the most fundamental criteria for evaluating and rating companies on the Stock Exchange. The technical and psychological perspective of the experts has been identified as the last criterion due to its high importance in selection of stocks.

These 9 criteria are listed in Table 1:

Now each of these criteria evaluate:

(1) **Return on assets**: ROA is a profitability ratio that provides how much profit a company is able to generate from its assets. In other words, it gives an investor an idea as to how efficient a company's management is

at using its assets to generate earnings. ROA is highly industry-dependent. When it is used as a criterion to evaluate a company X, it should be compared with the company's ROA in previous years or ROAs for similar companies. The higher ROA ratio is better because it shows that a company can make more earnings from less investment. The formula is defined as follows:

$$\text{ROA} = \frac{\text{Net Income}}{\text{Average total assests}}. \tag{1}$$

(2) **Dividend payout ratio (DPR)**: the dividend payout ratio is the ratio of the total amount of dividends paid out to shareholders relative to the net income of the company. It is the percentage of earnings paid to shareholders in dividends.

$$\text{DPR} = \frac{\text{Dividends}}{\text{Net income for the same period}}. \tag{2}$$

(3) **OCASH**: operating cash flow is a measure of cash flow provided by the principal operations and business activities which generate revenue for the company and not by any other source of cash in balance sheet. OCASH is commonly presented in cash flow statement.

(4) **Sales volatility**: this ratio shows the rate of increase or decrease in sales in similar periods and is measured by the following formula:

$$\text{SV} = \frac{S_n - S_{n-1}}{S_{n-1}} \times 100. \tag{3}$$

In the above formula S_n shows the amount of sale in the given period n.

(5) **Accounts receivable growth (AR)**: accounts Receivable is any amount of money, generated from the sale of goods or services or loans, owed by customers for purchases made on credit. The amount of account receivable growth is calculated by the following formula.

$$\text{ARG} = \frac{\text{AR}_n - \text{AR}_{n-1}}{\text{AR}_{n-1}} \times 100. \tag{4}$$

In this formula, AR_n indicates the amount of accounts receivable in the period n.

(6) **Gross profit margin growth**: gross profit is the total revenue minus the costs associated with producing and selling its products, or the costs associated with providing its services. Gross profit appears on a company's income statement and can be calculated by subtracting the cost of goods sold (COGS) from revenue (sales). The gross profit determines the efficiency of a company in using its labor and equipment. Gross profit is used to calculate gross profit margin. Gross profit margin is calculated by subtracting cost of goods sold (COGS) from total revenue and dividing that number by total revenue. In other words, it measures how efficiently a company uses its materials and labor to produce and sell products profitably. Therefore, we can examine company's efficiency over time measuring gross profit margin growth. The gross profit margin varies widely from industry to industry. Gross profit margin growth is calculated by the below formula.

$$\text{GPMG} = \frac{\text{GPM}_n - \text{GPM}_{n-1}}{\text{GPM}_{n-1}} \times 100. \tag{5}$$

In this formula, GPM_n indicates gross profit in the period n.

(7) **Quick Ratio (QR)**: QR is a type of liquidity ratio which measures the ability of company to meet its short-term liabilities. It is calculated by dividing current assets (excluding inventory and prepaid expenses) by current liabilities. The quick ration 1 indicates the proper situation of the company to pay off its current liabilities. A company that has a quick ratio less than 1 may not be able to fully pay off its current liabilities in the short term, while a company having a quick ratio higher than 1 can instantly convert its current liability into cash.

$$\text{QR} = \frac{\text{Cash} + \text{Accounts Receivable}}{\text{Current Liabilities}} \tag{6}$$

(8) **Asset turnover**: The asset turnover ratio is an efficiency ratio that measures a company's ability to generate sales from each dollar of company asset. The ratio is calculated by dividing the net sales into total assets.

$$\text{Asset turnover} = \frac{\text{Net sales revenue}}{\text{Average total assets}} \times 100. \tag{7}$$

(9) **Expert's opinion**: one of the most critical factors in stock analysis is expert's opinion in stock market. There are a number of techniques used in technical analysis such as price action and analysis using indicator or reversal patterns or both of them. However, since analysts apply a combination of different techniques to select stocks, it is not possible to compare pairwise combinations of technical methods. Therefore, experts are asked to rate companies (technical analysis of companies) based on a pairwise comparison. These ratings are presented in the following matrix:

$$\text{EO}_i = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1m} \\ a_{21} & a_{22} & \dots & a_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nm} \end{bmatrix} \tag{8}$$

a_{mn} represents the priority of alternative m over n.
EO_i represents the opinions of expert i.

3. Solution method

In this section, a method for completing information of experts' ratings is presented and then, a method for classifying alternatives is proposed.

As explained in the Introduction section, due to the stock market uncertainties, large number of companies in the market and a variety of technical analysis ways and the lack of knowledge about some specific companies or stocks, there is incomplete information which is considered as input for the problem.

Since experts rate the stocks based on pairwise comparisons, it is possible that the experts do not have sufficient knowledge of some companies and are unable to rate some of the companies due to the uncertainty that exists. In this uncertain situation, experts are being asked to put variable x instead of accurate rating of some companies then variable x is calculated using the following method which is illustrated in the following steps:

3.1. Calculating unknown values:

The expert's opinions are expressed in linguistic terms and since linguistic opinions cannot be evaluated. The following fuzzy Table 2 is used to convert linguistic comments to numbers firstly [50]. There are many methods for fuzzy numbers, including triangular fuzzy and pentagonal fuzzy, but in this paper the simple fuzzy method is used to show other aspects of research [26, 29, 30].

Firstly, the matrix table is set up for incomplete pairwise comparisons as follows, and then the incomplete information will be obtained using the reciprocal preference relation (RPR) [10, 51]. The incomplete information matrix in which some values are unknown due to the lack of time or the uncertainty on pairwise recognition is defined as follows:

$$\Gamma = (\Gamma_{ij})_{n\times n} = \begin{array}{c} \begin{matrix} A_1 & A_2 & \dots & A_n \end{matrix} \\ \begin{bmatrix} 0.05 & \gamma_{12} & \dots & \gamma_{1n} \\ \gamma_{21} & 0.5 & \dots & \gamma_{2n} \\ x & . & . & . \\ . & . & . & . \\ . & . & . & . \\ \gamma_{n1} & \gamma_{n2} & \dots & 0.5 \end{bmatrix} \end{array} \begin{matrix} A_1 \\ A_2 \\ . \\ . \\ . \\ A_n \end{matrix} \tag{9}$$

TABLE 2. Evaluation of linguistic term.

Item	Value
Extremely poor	0.1
Very poor	0.2
Poor	0.3
Slightly poor	0.4
Fair	0.5
Slightly good	0.6
Good	0.7
Very good	0.8
Extremely good	0.9

Reciprocal preference relation is represented by $\Gamma = (\gamma_{ij})_{n\times n}$. Entry γ_{ij} of matrix $\Gamma = (\Gamma_{ij})_{n\times n}$ is the degree of superiority of alternative i over j. Therefore, $\gamma_{ii} = 0.5$ indicates that the two alternatives are identical and have no superiority over each other Similarly, $\gamma_{ij} > 0.5$ shows the superiority of alternative i over j. The variable γ_{ij}, which represents an unknown value, is placed in the array if there is no rating for the specific alternative [51].

The unknown value of γ_{ij} is calculated by applying below formula and by using an intermediate element Z_k with the assumption $i < k < j$:

$$m\gamma_{ij}^{k} = \frac{\gamma_{ik}.\gamma_{kj}}{\gamma_{ik}.\gamma_{kj} + (1-\gamma_{ik})(1-\gamma_{kj})}. \tag{10}$$

Consequently, if there is any ambiguity in experts' opinions and the lack of sufficient information, the unknown values can be calculated applying the method described above. As mentioned above, expert opinions are presented in paired comparisons. The AHP method [16] is used to obtain expert opinion for each company separately.

Having completed the input information, the classification method used in the article will be introduced.

3.2. A new approach to classification

This study addresses the problems in select ability/reject ability method presented by Tchangani [42] and finally proposes a new solution. The Tchangani approach has two major flaws that hamper classification results. The problems will be discussed in detail later in this section.

In Multi Criteria Decision Making (MCDM) problems, there are several alternatives and criteria in order to classify those alternatives according to defined boundaries [10, 41].

In the context of this article, the finite set $A = \{a_1, a_2, \ldots, a_i\}$ represents alternatives and $G = \{g_1, g_2, \ldots, g_j\}$ represents the criteria. Finally, the information matrix of multi-criteria problem is defined as follows:

$$R(a_{ij}) = \begin{matrix} \\ a_1 \\ \vdots \\ a_i \end{matrix} \begin{matrix} \begin{matrix} g_1 & g_2 & \cdots & g_j \end{matrix} \\ \begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1j} \\ a_{21} & a_{22} & \ldots & a_{2j} \\ \vdots & \vdots & \vdots & \vdots \\ a_{i1} & a_{i2} & \ldots & a_{ij} \end{bmatrix} \end{matrix}. \tag{11}$$

As we can see in the above matrix, a_{ij} represents the rating of i based on the criterion j.

The categories are defined using boundary set $B = \{b_1, b_2, \ldots, b_l\}$ in a way that area around each boundary is assigned to a specific category chosen from the category set $C = \{c_1, c_2, \ldots, c_l\}$. The classification is nominal so the categories in set C are sorted from the worst category, c_1, to the best one, c_l (Fig. 2)

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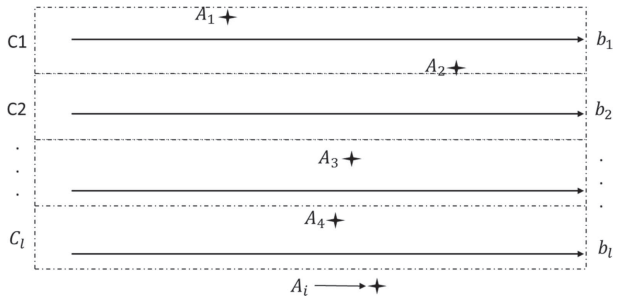

FIGURE 2. Schematic image of the placement of alternatives in the relevant categories.

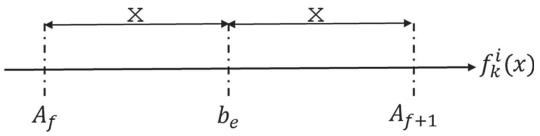

FIGURE 3. Two points at the same distance from the boundary.

3.3. Flaws in the Tchangani's method of acceptability/reject ability nominal classifications

Tchangani presents a method based on acceptability/reject ability for nominal classifications by some specific criteria [42]. This approach can be useful in simple cases but in complicated ones, it cannot provide proper result. The Tchangani method has two major flaws as follows:

(1) As you can observe in the Figure 3 alternatives A_f and A_{f+1}, $f \in [1, i]$, are located at the same distance above and below the boundary b_e, $e \in [1, l]$ and have the same properties relative to the boundary b_e. In Tchangani's method, the value of acceptability function assigned to the alternative below the boundary is zero and to the alternative with the same property but above the boundary is nonzero. Moreover, the value of reject ability function assigned to the alternative below the boundary is nonzero and to the alternative with the same property but above the boundary is zero. Therefore, one the major flaws in this method is that it assigns two different values to the two alternatives with the same properties.
(2) The second flaw in the Tchangani method is related to the three classification techniques called maximum acceptability, minimum reject ability and the maximum index of caution. According to Tchangani, in most cases, the three classification techniques do not provide the same answer for the same alternative.

4. PROPOSED METHODOLOGY

In this method, for each element a_{ij} of the matrix $R(a_{ij})$, select ability and reject ability functions replace the rejection and acceptance functions of the Tchangani's method respectively.

$$F_d^l(a_{ij}) = \left| \frac{a_{ij} - b_i}{\text{Max}(b_i) - \text{Min}(b_i)} \right| \tag{12}$$

$$F_p^l(a_{ij}) = 1 - F_d^l(a_{ij}). \tag{13}$$

In the above formulas, the acceptability function $F_p^l(a_{ij})$ shows the proximity of the alternative a_{ij} to the boundary b_l and the reject ability function $F_d^l(a_{ij})$ shows the degree of remoteness of the alternative a_{ij} to the boundary b_l. According to the formulas presented, the degree of remoteness of each alternative to any boundary in any criteria

is based on the total distance in that criterion. Therefore, if two alternatives are at the same distance from both sides of a boundary, they receive the same score eliminating the first flaw of the Tchangani's method.

As we can see in the above formula, the sum of the acceptability and reject ability functions for alternative a_{ij} to the boundary b_l always equals one.

The classification method is presented in the next section of this paper.

4.1. Methods of classification

Three techniques namely minimum acceptability, maximum reject ability and the minimum index of caution are applied to classify alternatives.

4.1.1. Method minimum acceptability

Now, the first classification method which is based on the remoteness of a specific alternative to the boundary is proposed.

The following equation is used to classify alternative based on the minimum value of this index.

$$C^{*}_{(a_i)} = \text{Min}\left(\frac{\sum_{j=1}^{n} F_d^l(a_{ij})}{\sum_{l=1}^{l}\sum_{j=1}^{n} F_d^l(a_{ij})}\right). \tag{14}$$

In the above formula, the low value of the acceptability function shows that there are more similar properties relative to the boundary.

4.1.2. Method maximum reject ability

Remoteness degree of each alternative to any boundary is considered in order to classify alternatives. The following formula represents the best classification chosen with regard to degree of remoteness.

$$C^{**}_{(a_i)} = \text{Max}\left(\frac{\sum_{j=1}^{n} F_p^l(a_{ij})}{\sum_{l=1}^{l}\sum_{j=1}^{n} F_p^l(a_{ij})}\right). \tag{15}$$

In the above formula, the high value of the reject ability function shows that there are more similar properties relative to the boundary.

4.1.3. Method minimum index of caution

Using the two previous methods, each alternative is assigned to a classification with the minimum index of caution as follows.

$$C^{***}_{(a_i)} = \text{Min}\left(\frac{C^{*}_{(a_{ij})}}{C^{**}_{(a_{ij})}}\right). \tag{16}$$

5. Case study

Controlling and reducing the risk are important things that investors should pay attention to it. Choosing stocks with the right fundamental criteria from any industry can help investors make better decisions in buying stocks. In this way, even risk averse investors who have chosen stocks with inappropriate fundamentals have the opportunity to reduce the capital and consequently reduce the risk.

Investors intend to choose their portfolio to invest more on financially strong companies specially in critical and risky times of financial market to minimize their losses if the market falls. Moreover, classification of companies into different categories allows investors to be aware of the amount of risk they take for their investment.

Since the criteria for such classification assess fundamental aspects of companies listed in Tehran Stock Exchange, comparison of the two companies of different industries will not be rational, so to have a more accurate classification, it is better to compare companies with their own industry group.

TABLE 3. Petrochemical companies listed on the Tehran Stock Exchange.

Number	Company name	4-digit code	Number	Company name	4-digit code
1	NORI Petrochemical	NORI	15	Sina Chem.Ind	SHSI
2	Shiraz Petr	PSHZ	16	S*Iran Chem. Ind	SSIN
3	Iran Amlah	AMLH	17	Loabiran	LEAB
4	Jam Pilen	JPPC	18	Doode Sanati	DODE
5	Iran Carbon	CRBN	19	Fars Chem. Ind	SHFS
6	Kermanshah Petr	PKER	20	Goltash	GTSH
7	Khorasan Petro	KRSN	21	Pars Int. Mfg	BMPS
8	Behshahr Ind	SHOY	22	NiroCholor	NKOL
9	PARS Petrochemical	PARS	23	Paksho	PASH
10	Shazand Petr	PARK	24	Fanavaran Petr	PFAN
11	Paxan	PAKS	25	S*Ir.Inv.Petr	IPTR
12	Pardis Petr	PRDZ	26	Khark Petr	PKHA
13	Tamin Petro	PTAP	27	Petro. Inv	PETR
14	Khalij Fars	PKLJ	28	S*Parsian Oil&Gas	PASN

TABLE 4. Input information of companies in Stock Exchange Market from codal website (prices in Rial).

Share	NP[1]	OE[2]	Liability	EPS[3]	DPS[4]	OCS[5]	SLY[6]	SPY[7]	ARLY[8]	ARPY[9]	GPMLY[10]	GPMPY[11]	Cash
NORI	21 153 931	37 824 697	64 457 573	7051	6500	8 573 438	141 536 726	91 057 961	59 780 361	41 488 821	9 914 642	13 181 244	3 842 435
PSHZ	6 448 061	5 738 389	43 736 214	1264	0	5 738 545	27 194 039	17 409 623	8 216 470	3 474 508	12 916 672	7 267 755	681 998
AMLH	990 293	1 376 570	581 860	4716	4400	1 112 479	1 864 656	1 127 676	90 657	72 865	1 167 692	604 385	301 192
JPPC	6 515 706	8 746 338	2 633 150	3258	3250	6 901 400	17 923 320	11 821 853	616 710	254 687	5 899 488	3 584 216	3 924 603
CRBN	638 639	1 712 736	1 677 627	1836	1400	521 763	4 912 069	2 698 413	494 609	795 741	1 234 137	636 060	153 614
PKER	5 137 506	9 944 167	4 796 846	1456	600	3 374 597	10 236 593	5 702 984	3 046 540	812 484	6 408 623	2 924 913	1 473 514
KRSN	5 589 480	7 637 089	1 118 566	3123	2700	4 029 111	9 508 850	5 593 240	1 577 746	705 181	5 816 315	2 931 850	2 736 538
SHOY	829 018	2 459 334	589 178	829	720	589 666	791 635	731 854	1 322 412	922 689	791 635	731 854	95 752
PARS	58 977 638	68 389 949	22 053 451	9830	9300	14 431 219	95 765 540	66 596 612	62 633 687	33 345 905	30 572 667	20 863 766	10 535 502
PARK	12 796 356	23 936 637	14 770 455	1588	1500	14 960 925	53 001 593	28 918 962	3 302 161	2 298 095	12 858 133	6 628 315	2 839 410
PAKS	945 271	2 082 709	1 984 851	1751	875	665 449	5 295 627	3 789 065	1 592 282	1 581 741	1 556 085	562 642	290 661
PRDZ	23 509 679	33 469 425	31 938 277	2345	1700	6 370 320	51 895 084	34 033 862	29 871 309	10 824 268	25 356 360	17 454 624	1 278 344
PTAP	35 289 228	140 963 447	6 587 813	433	400	16 667 299	36 827 238	18 548 581	48 766 068	28 080 892	36 633 516	18 399 665	1 630 851
PKLJ	98 602 936	253 014 225	315 904 489	1078	360	183 330\06	99 548 717	49 936 800	429 524 403	321 375 265	98 620 433	49 388 535	5 683 437
SHSI	105 617	356 538	188 831	3439	800	21 228	622 085	267 300	121 536	45 482	200 198	55 918	22 133
SSIN	3 381 365	11 834 142	2 861 647	762	600	4 339 586	9 644 690	7 128 783	2 561 473	4 271 998	3 307 815	2 173 012	2 594 039
LEAB	1981	215 969	662 782	12	2	47 842	354 495	463 342	399 635	498 626	59 513	63 468	13 554
DODE	222 401	568 007	464 789	469	50	74 216	1 717 908	1 036 304	207 426	316 094	347 552	166 239	25 865
SHFS	5852	680 913	675 591	9	50	42 554	1 362 648	940 590	265 011	242 080	181 898	120 737	52 354
GTSH	776 941	1 561 668	622 143	1554	800	330 974	2 583 089	1 844	812 242	615 629	1 121 757	675 134	53 016
BMPS	11 322	555 902	1 233 833	22	3	44 684	1 893 110	1 517 786	808 341	593 434	339 116	244 819	134 853
NKOL	626 990	1 201 258	763 804	1254	1000	603 812	1 702 449	675 617	302 775	139 760	830 996	221 912	238 048
PASH	4 911 962	6 301 116	6 141 052	4052	3000	891 648	14 099 141	7 818 848	6 076 195	3 863 895	5 759 301	2 900 944	198 538
PFAN	15 355 398	17 683 358	7 441 046	16 164	16 000	10 787 137	26 505 008	11 990 576	8 763 571	3 468 486	15 853 153	6 274 615	40 952
IPTR	5 125 194	31 893 651	44 719 870	256	150	5 733 725	5 299 729	2 539 337	37 004 909	17 881 513	5 169 040	2 453 341	862 436
PKHA	25 488 187	31 984 778	12 208 508	12 744	10 000	14 089 835	29 622 110	16 800 401	15 221 995	7 571 202	19 899 746	9 738 558	7 059 726
PETR	18 143	3 047 439	3 188 387	10	0	33 398	1 170 253	555 602	2 057 185	1 210 168	970 151	240 916	62 264
PASN	21 985 993	85 178 127	17 215 909	543	400	8 441 824	23 466 719	23 834 493	26 298 504	19 859 114	23 371 373	23 748 298	2 366 290

Notes. [1]Net profit. [2]Owners equity. [3]Earning per share. [4]Dividend per share. [5]Operational cash flow. [6]Sales in last year. [7]Sales in previous years. [8]Accounts receivable in last year. [9]Accounts receivable in previous years. [10]Gross profit margin in last year. [11]Gross profit margin in previous year.

The petrochemical industry is one of the parent and employment-generating industries that play a key role in the economy of developing countries. Following Table 3 represents the names of 28 petrochemical companies listed on the Tehran Stock Exchange.

TABLE 5. Final ratings assigned to companies by experts.

SHARE	Expert 1	Expert 2	Expert 3	SHARE	Expert 1	Expert 2	Expert 3
NORI	1.103929	0.966699	0.838854	SHSI	0.940334	0.953629	1.161442
PSHZ	0.854958	0.803381	0.901509	SSIN	1.041619	0.982178	0.99775
AMLH	1.026163	0.837747	0.815728	LEAB	1.012506	1.037701	0.977865
JPPC	1.072022	0.933165	0.944906	DODE	0.96852	1.017513	0.999705
CRBN	1.039826	0.767545	0.98984	SHFS	1.004703	1.122502	1.131807
PKER	0.919788	0.991404	1.090312	GTSH	1.066545	1.068756	0.994515
KRSN	1.1477	0.924154	0.865086	BMPS	1.05597	1.18171	1.017293
SHOY	0.841944	1.099368	0.846256	NKOL	1.034833	1.053018	1.10194
PARS	1.005281	1.008965	1.129392	PASH	0.996868	1.088398	1.088561
PARK	0.98419	0.929048	1.01595	PFAN	0.959239	1.058601	1.142363
PAKS	0.93112	0.996583	0.97405	IPTR	1.041505	1.064159	0.973959
PRDZ	1.044616	0.990174	1.027739	PKHA	1.001224	0.938952	1.105402
PTAP	0.968043	1.058969	1.012259	PETR	0.928197	1.090463	0.993379
PKLJ	0.913947	0.93392	0.901702	PASN	1.094408	1.101297	0.960435

TABLE 6. Assigning weight to experts.

Experts	Expert 1	Expert 2	Expert 3
w	0.4	0.3	0.3

Initially, data of each company in Tehran Stock Exchange is gathered to complete input matrix based on the information published on the comprehensive database of all listed companies (www.codal.ir). Fundamental data which is used as input information is listed in Table 4.

The experts' opinions have been obtained by pairwise comparisons between companies in petrochemical industry. Since for each expert there is a 28-by-28 matrix, all of the matrixes are not displayed. However, the matrix of the opinions of the first expert is shown in the Appendix A as an instance.

As presented in the experts' opinions table available in Appendix A, the first expert is unable to express a comparative opinion between the company of AMLH and PARS and therefore sets x instead of the value. The unknown value x is calculated by the following formula and by using the fifth middle index.

$$\begin{aligned}\gamma_{39}^{5} &= \frac{\gamma_{35} \times \gamma_{59}}{\gamma_{35} \times \gamma_{59} + (1-\gamma_{35})(1-\gamma_{59})} \\ &= \frac{0.2 \times 0.3}{0.2 \times 0.3 + (1-0.2)(1-0.3)} \\ \gamma_{39}^{5} &= 0.097.\end{aligned} \tag{17}$$

The opinions of other experts will be completed applying the presented method, if any incomplete information is observed, and eventually the final ratings of each expert will be obtained with the help of AHP method, which is given in the Table 5 as follows.

Since each expert has its own weight, we have weighted them with the help of professionals and according to the Table 6.

After specifying the experts' opinions criteria, applying the information in the codal website given in Table 4 and the formulas presented in the criteria section, the criteria final table is identified as follows. Calculations are not given in the article due to the clarity.

TABLE 7. The boundaries of criteria for the companies in chemical industry.

SHARE	ROA	DPR	OCASH	DEL SELL	DELL AR	DEL GPM	QR	AT	expert opinion
b_1	50	300	1 000 000	1000	150	150	400	100	1.1
b_2	30	200	600 000	600	70	70	300	50	1
b_3	20	100	300 000	200	30	30	150	30	0.9
b_4	0.2	0	20 000	−80	−30	−20	15	6	0.8

TABLE 8. Degree of proximity to the boundary b_1.

SHARE	ROA	DPR	OCASH	DEL SELL	DELL AR	DEL GPM	QR	AT	FM
NORI	0.06541	0.07697	0.85867	0.09718	0.06538	0.11424	0.08695	0.04536	0.04325
PSHZ	0.08248	0.11111	0.53725	0.09710	0.00835	0.04724	0.10957	0.05323	0.09131
AMLH	0.00126	0.07656	0.01275	0.09616	0.07752	0.03712	0.09600	0.00566	0.07166
JPPC	0.01619	0.07417	0.66909	0.09757	0.00485	0.05582	0.06567	0.06797	0.03991
CRBN	0.06953	0.08287	0.05422	0.09444	0.11595	0.03658	0.10429	0.05305	0.05809
PKER	0.03380	0.09585	0.26923	0.09470	0.07714	0.02019	0.08825	0.03612	0.03984
KRSN	0.03088	0.07909	0.34344	0.09568	0.01621	0.03374	0.00413	0.01017	0.03857
SHOY	0.05088	0.07894	0.04652	0.10204	0.06585	0.09270	0.04597	0.08751	0.06649
PARS	0.03393	0.07607	152281	0.09837	0.03838	0.06762	0.01969	0.00696	0.02088
PARK	0.03780	0.07613	158287	0.09431	0.06562	0.03661	0.10344	0.04365	0.04549
PAKS	0.05971	0.09260	0.03793	0.09879	0.09218	0.01736	0.08806	0.03569	0.05050
PRDZ	0.03136	0.08426	0.60888	0.09748	0.01603	0.06845	0.08729	0.02442	0.02844
PTAP	0.05820	0.07690	177634	0.09274	0.04712	0.03327	0.10534	0.08870	0.03386
PKLJ	0.07289	0.09874	196519	0.09266	0.07182	0.03289	0.7568	0.09752	0.06805
SHSI	0.06835	0.10250	0.11097	0.08923	0.01063	0.07060	0.09348	0.01663	0.03309
SSIN	0.06022	0.08195	0.37864	0.09925	0.11731	0.06391	0.06345	0.04063	0.03310
LEAB	0.11105	0.10494	0.10795	0.10530	0.10485	0.10211	0.09745	0.07052	0.03345
DODE	0.06351	0.10716	0.10496	0.09611	0.11381	0.02675	0.10095	0.07841	0.03979
SHFS	0.11059	0.09465	0.10855	0.09826	0.08675	0.06493	0.10188	0.00054	0.00808
GTSH	0.03218	0.09204	0.07585	0.09876	0.07288	0.05480	0.07530	0.02161	0.02015
BMPS	0.11015	0.10606	0.10831	0.10034	0.07024	0.07286	0.09338	0.00683	0.00663
NKOL	0.04037	0.08158	0.04492	0.08724	0.02059	0.08135	0.09501	0.01580	0.01466
PASH	0.02348	0.08369	0.01228	0.09462	0.05725	0.03364	0.08595	0.01574	0.01784
PFAN	0.02480	0.07445	110965	0.09043	0.00164	0.00174	0.08129	0.00650	0.02075
IPTR	0.01619	0.07417	0.66909	0.09757	0.00485	0.05582	0.06567	0.06797	0.03991
PKHA	0.06953	0.08287	0.05422	0.09444	0.11595	0.03658	0.10429	0.05305	0.05809
PETR	0.11091	0.11111	0.10959	0.09150	0.04939	0.09980	0.09626	0.09602	0.03836
PASN	0.06365	0.08383	0.84374	0.10304	0.07258	0.09908	0.06739	0.09111	0.01619

Each criterion has a different boundary; it is not correct to consider the same boundary for each criterion. Therefore, a specific boundary is defined for each criterion. Boundaries of the criteria obtained by the professionals are given in Table 7 as follows.

Applying the information of criteria numbers for each company and Table 7 and in acceptability function (14) the proximity of each alternative to the each defined boundary is calculated. The results for the boundary b_1 is shown in Table 9. The calculations for boundaries b_2, b_3 and b_4 are omitted here because the calculations for these boundaries are the same as those for boundary b_1.

The values of the acceptability function for the information in Table 8 represents the proximity of each company to the b_1 boundaries. In fact, the value of the reject ability function is equal to the distance of the acceptability function value to one. That is why it is not mentioned here.

TABLE 9. Categorizing companies with minimum acceptability.

SHARE	b_1	b_2	b_3	b_4	SHARE	b_1	b_2	b_3	b_4
NORI	0.27645	0.24109	0.22364	0.25877	SHSI	0.27196	0.24209	0.21181	0.27414
PSHZ	0.29343	0.24179	0.22231	0.24384	SSIN	0.30391	0.21994	0.20697	0.26919
AMLH	0.27129	0.22690	0.21893	0.35645	LEAB	0.49009	0.26327	0.15163	0.09500
JPPC	0.23118	0.22957	0.25081	0.31261	DODE	0.35513	0.24562	0.19011	0.20913
CRBN	0.36049	0.22836	0.17986	0.26433	SHFS	0.30891	0.24264	0.21199	0.23647
PKER	0.22426	0.20241	0.21438	0.35923	GTSH	0.33394	0.20004	0.15908	0.30694
KRSN	0.19665	0.21361	0.25248	0.34548	BMPS	0.37858	0.25750	0.17382	0.19011
SHOY	0.46268	0.17586	0.10087	0.25777	NKOL	0.24218	0.19594	0.21926	0.34261
PARS	0.23704	0.23402	0.24713	0.28130	PASH	0.24593	0.19233	0.21008	0.35166
PARK	0.25625	0.23894	0.24401	0.27457	PFAN	0.21927	0.24091	0.24811	0.29171
PAKS	0.30515	0.22140	0.18599	0.29261	IPTR	0.23118	0.22957	0.23942	0.29983
PRDZ	0.25084	0.22872	0.23259	0.28687	PKHA	0.36049	0.22836	0.17043	0.24072
PTAP	0.25547	0.23365	0.24106	0.26796	PETR	0.38077	0.24312	0.18800	0.18811
PKLJ	0.27404	0.24580	0.23065	0.24764	PASN	0.29306	0.23967	0.21361	0.25365

TABLE 10. Categorizing companies with maximum proximity remoteness.

SHARE	b_1	b_2	b_3	b_4	SHARE	b_1	b_2	b_3	b_4
NORI	0.24548	0.25152	0.25451	0.24849	SHSI	0.24858	0.25051	0.25247	0.24844
PSHZ	0.24476	0.25099	0.25324	0.25101	SSIN	0.24494	0.25282	0.25404	0.24820
AMLH	0.24891	0.25118	0.25329	0.24662	LEAB	0.23803	0.24934	0.25490	0.25773
JPPC	0.25284	0.25308	0.25160	0.24248	DODE	0.24362	0.25027	0.25363	0.25248
CRBN	0.24399	0.25118	0.25432	0.25050	SHFS	0.24620	0.25048	0.25245	0.25087
PKER	0.25266	0.25491	0.25366	0.23877	GTSH	0.24602	0.25237	0.25431	0.24730
KRSN	0.25541	0.25369	0.24972	0.24118	BMPS	0.24330	0.24961	0.25397	0.25312
SHOY	0.24154	0.25295	0.25605	0.24945	NKOL	0.25046	0.25316	0.25180	0.24459
PARS	0.25367	0.25453	0.25088	0.24091	PASH	0.25021	0.25290	0.25201	0.24488
PARK	0.24817	0.25323	0.25334	0.24526	PFAN	0.22796	0.25772	0.26060	0.25373
PAKS	0.24697	0.25157	0.25334	0.24813	IPTR	0.25284	0.25308	0.25160	0.24248
PRDZ	0.24989	0.25279	0.25235	0.24497	PKHA	0.24399	0.25118	0.25432	0.25050
PTAP	0.24816	0.25549	0.25332	0.24303	PETR	0.24186	0.25043	0.25386	0.25385
PKLJ	0.24151	0.25148	0.25721	0.24980	PASN	0.24319	0.25163	0.25575	0.24942

Now it is time to categorize companies in petrochemical industry using three methods explained previously.

Method 1 (minimum acceptability): this technique actually shows the final proximity of the sum of the criteria of each alternative in one boundary to the other boundaries. The value of acceptability function is obtained by formula (14).

Method 2 (maximum reject ability): in this technique each alternative belongs to a set with maximum distance to the related boundary. The remoteness is calculated by formula (15).

Method 3 (minimum index of caution): in this technique, using the output of the previous techniques, the ratio of proximity to remoteness is calculated by formula (16).

The outputs of this methods for petrochemical industry are presented in Tables 9–11.

In this section, we review the results provided previously and determine which companies belong to which category. The Table 12 demonstrates the related classification for each alternative based on the methods discussed previously.

TABLE 11. Categorizing companies with minimum index of caution.

SHARE	b_1	b_2	b_3	b_4	SHARE	b_1	b_2	b_3	b_4
NORI	1.12618	0.95850	0.87855	1.04175	SHSI	1.09405	0.96638	0.83896	1.10345
PSHZ	1.19887	0.96334	0.88110	0.96270	SSIN	1.24075	0.86993	0.81470	1.08456
AMLH	1.08988	0.90333	0.73272	128225	LEAB	2.05892	1.05587	0.59487	0.36863
JPPC	0.91434	0.90709	0.95161	1.23650	DODE	1.45773	0.98144	0.74956	0.82831
CRBN	1.47744	0.90915	0.67014	0.96094	SHFS	1.25471	0.96870	0.83972	0.94258
PKER	0.88759	0.79404	0.84566	150279	GTSH	1.35733	0.79264	0.62555	1.24116
KRSN	0.76992	0.84200	101227	1.39715	BMPS	1.55600	1.03160	0.68440	0.75106
SHOY	1.91549	0.69523	0.38161	1.05732	NKOL	0.96697	0.77399	0.87078	1.40079
PARS	0.93442	0.91942	0.98404	1.17080	PASH	0.98290	0.76050	0.83360	1.43606
PARK	1.03257	0.94358	0.94171	1.08551	PFAN	0.96190	0.93478	0.95210	1.14967
PAKS	1.23559	0.88007	0.74751	1.14489	IPTR	0.91434	0.90709	0.95161	1.23650
PRDZ	1.00378	0.90478	0.91969	1.17714	PKHA	1.47744	0.90915	0.67014	0.96094
PTAP	1.02944	0.91452	0.94788	1.11413	PETR	1.57431	0.97082	0.74059	0.74101
PKLJ	1.13469	0.97742	0.89258	1.00312	PASN	1.20508	0.95248	0.83521	1.01696

TABLE 12. Categorizing companies in petrochemical industry.

SHARES	min acceptability	max reject ability	min index of caution	SHARES	min acceptability	max reject ability	min index of caution
NORI	b_3	b_3	b_3	SHSI	b_3	b_3	b_3
PSHZ	b_3	b_3	b_3	SSIN	b_3	b_3	b_3
AMLH	b_1	b_1	b_1	LEAB	b_4	b_4	b_4
JPPC	b_1	b_1	b_1	DODE	b_3	b_3	b_3
CRBN	b_3	b_3	b_3	SHFS	b_3	b_3	b_3
PKER	b_2	b_2	b_2	GTSH	b_3	b_3	b_3
KRSN	b_1	b_1	b_1	BMPS	b_3	b_3	b_3
SHOY	b_3	b_3	b_3	NKOL	b_2	b_2	b_2
PARS	b_2	b_2	b_2	PASH	b_2	b_2	b_2
PARK	b_3	b_3	b_3	PFAN	b_1	b_1	b_1
PAKS	b_3	b_3	b_3	IPTR	b_2	b_2	b_2
PRDZ	b_3	b_3	b_3	PKHA	b_3	b_3	b_3
PTAP	b_2	b_2	b_2	PETR	b_4	b_4	b_4
PKLJ	b_3	b_3	b_3	PASN	b_3	b_3	b_3

In this part of the article, the results are reviewed and which company belongs to which class is determined. In Table 12, it is observed that the three methods have the same result.

6. The classification results

As shown in the Table 12, PETR and LEAB have the most similar properties to the boundary 4 so they are classified in category C_4. In the same manner, AMLH, PFAN, KRSN and JPPC are assigned to the category C_1. 16 companies are closer to the boundary C_3 and therefore are assigned to the category C_2. Eventually, the remaining six companies which have the same properties with the boundary 2 are classified in category C_2.

To validate the method proposed in this section, AMLH from Class 1 and LEAB from class 4 are chosen to analyze. At first glance at the Petrochemical industry's final criteria Table 12, this category is noticed. AMLH

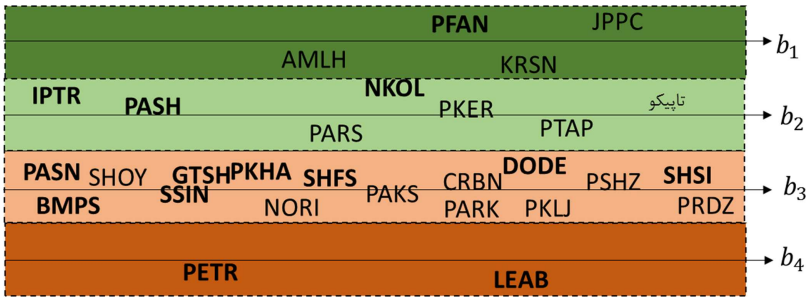

FIGURE 4. Schematic form of classification of Petrochemical companies in Tehran Stock Exchange Market.

company experienced a significant increase in sales volatility compared to the same period last year while in the same period LEAB company experienced decrease in sales volatility.

Also, by considering other criteria, it can be realized that AMLH's OCASH is more than twenty-three times the amount of OCASH in the LEAB company. Moreover, in other criteria such as net profit which is considered as one of the most important profitability in AMLH, this value is higher than the value calculated for the LEAB. Therefore, the proposed method, which adopts all the criteria presented, is considered the most appropriate classification. The same applies to other companies.

PKER and CRBN, assigned to class 2 & 3, respectively, can be a good example. Despite it's strength in dividend-to-profit ratio and increased volatility in sales over two consecutive periods as well as an increase in the AT criteria, CRBN's performance is poorer compared to PKER's when considering other criteria. All of these factors put CRBN in class C_3. The schematic diagram (Fig. 4) classifies the Petrochemical companies by fundamental and financial ratios.

7. Managerial insight

One of the main concerns of the managers is to choose one alternative from several alternatives. Due to various criteria and ambiguity in the decision making environment, this has become a dilemma for the managers. In Tchangani's method the outputs of all three methods introduced for decision-making is not the same, so the managers be confused. Also, in some cases that the alternative is places on the boundary, the Tchangani's method fails to give an output. In the proposed method, all the errors in Tchangani's method have been eliminated and a more accurate and comprehensive method of classification have been provided. Moreover, specifically in stock market, investors have to face with a variety of criteria and a large number of alternatives, each of which is very time consuming to review and may take many trade opportunities from investors. Therefore, a method which can classify companies in the shortest time possible based on criteria that are of particular importance to the investor is very valuable.

8. Conclusion

This study aimed to classify companies at petrochemical industry in the intuitive fuzzy environment using the proposed similarity approach under uncertain environment and despite incomplete information in experts' opinions. Petrochemical industry is one of the most important and critical industries in Stock Exchange Market. Considering the fact that fundamental criteria are crucial in determining the future of a company, criteria are selected from the factors involved in the firm's foundation. Moreover, since the experiences and opinions of experts in the capital market are crucial and essential, a specific criterion is dedicated to experts' opinions.

In this study, one of the nominal similarity methods proposed by Tchangani is analyzed and then the flaws in the method are explained. One of the flaws of the Tchangani's method is that it does not equal the similarity of

the two alternatives, one at the top and the other at the bottom of the boundary. In addition, Tchangani assigned the value zero to the alternative below the boundary regardless of the alternative's distance from the boundary. Moreover, in some cases, infinite quantities are observed at the point where the boundary is located, leading to different outputs for the three techniques in Tchangani's classification method and eventually to confusion in choosing the company to invest in. The proposed method in the intuitive fuzzy environment eliminates the flaws in Tchangani's method despite uncertainty and incomplete information.

The information in the Figure 4 can be used in several ways, including:

(1) Risk-averse investors can invest in companies around the boundary b_1.
(2) The progress of companies can be compared through changing the period of input information from year to month and studying the changes made to the figure as a result of these changes.
(3) Companies around the boundary b_4 which are not currently in a good situation to invest should be considered in order to make a long-term investment when they have good vision and reasonable prices.

Selecting the stocks and comparing the companies in each industry, as well as identifying the amount of risk involved, requires identification and classification of the companies in each industry.

There are three types of time investment in terms of time in the capital market, including short, medium and long term, each of which has its own criteria. Changing the criteria presented in this study, researchers can evaluate companies on the basis of short, medium and long term investment.

Considering the future vision of each company and the viability of these prospects, long-term investments can be made in companies which are in lower categories and are currently less expensive.

In addition, the risk of investment in each class should be determined so that investors can choose categories to invest in based on the amount of risk they can take.

By changing the input criteria of the problem, researchers can apply the classification method presented in this paper in different contexts. Researchers are also advised to use triangular or trapezoidal fuzzy inputs to convert the input information into a fuzzy environment. Researchers are also advised to use triangular or trapezoidal fuzzy inputs to convert input information into a fuzzy environment. In addition, if there is no specific boundary in their field, they can use the area instead of the boundary.

Appendix A.

See Table A.1.

TABLE A.1. Expert one's pairwise comparison of the companies.

Share	NORI	PSHZ	AMLH	JPPC	CRBN	PKER	KRSN	SHOY	PARS	PARK	PAKS	PRDZ	PTAP	PKLJ	SHSI	SSIN	LEAB	DODE	SHFS	GTSH	BMPS	NKOL	PAKS	PFAN	IPTR	PKHA	PETR	PASN
NORI	0.5	0.3	0.6	0.9	0.3	0.7	0.8	0.9	0.5	0.7	0.9	0.6	0.6	0.1	0.2	0.9	0.3	0.7	0.4	0.4	0.7	0.2	0.4	0.7	0.6	0.6	0.3	0.5
SHZ	0.7	0.5	0.8	0.2	0.3	0.6	0.2	0.2	0.4	0.3	0.3	0.5	0.2	0.4	0.3	0.3	0.3	0.4	0.3	0.6	0.3	0.8	0.7	0.5	0.3	0.7	0.2	0.6
AMLH	0.4	0.2	0.5	0.7	0.2	0.9	0.7	0.2	X	0.6	0.2	0.3	0.6	0.8	0.6	0.4	0.8	0.3	0.6	0.7	0.7	0.7	0.3	0.4	0.7	0.4	0.8	0.4
PPC	0.1	0.8	0.3	0.5	0.7	0.3	0.3	0.8	0.7	0.9	0.8	0.2	0.2	0.9	0.9	0.3	0.7	0.7	0.8	0.3	0.2	0.4	0.7	0.8	0.4	0.5	0.5	0.5
CRBN	0.7	0.7	0.8	0.3	0.5	0.2	0.8	0.3	0.3	0.3	0.7	0.5	0.7	0.5	0.3	0.2	0.6	0.4	0.4	0.4	0.8	0.7	0.6	0.8	0.7	0.3	0.6	0.3
PKER	0.3	0.4	0.1	0.7	0.8	0.5	0.1	0.6	0.6	0.4	0.3	0.3	0.3	0.6	0.9	0.6	0.5	0.3	0.3	0.3	0.3	0.6	0.3	0.3	0.7	0.6	0.6	0.6
KRSN	0.2	0.8	0.3	0.7	0.2	0.9	0.5	0.7	0.3	0.7	0.3	0.2	0.9	0.8	0.7	0.7	0.4	0.7	0.8	0.7	0.6	0.4	0.9	0.2	0.5	0.6	0.7	0.7
SHOY	0.1	0.8	0.8	0.2	0.7	0.4	0.3	0.5	0.2	0.2	0.6	0.7	0.2	0.6	0.8	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.7	0.7	0.3
PARS	0.5	0.6	$1-X$	0.3	0.7	0.4	0.7	0.8	0.5	0.4	0.4	0.6	0.3	0.2	0.6	0.6	0.2	0.6	0.3	0.5	0.3	0.4	0.6	0.6	0.3	0.7	0.4	0.6
PARK	0.3	0.7	0.4	0.1	0.7	0.6	0.3	0.8	0.6	0.5	0.3	0.3	0.5	0.3	0.3	0.5	0.9	0.5	0.7	0.5	0.3	0.5	0.3	0.7	0.6	0.4	0.5	0.7
PAKS	0.1	0.7	0.8	0.2	0.3	0.7	0.7	0.4	0.6	0.7	0.5	0.3	0.6	0.3	0.4	0.6	0.2	0.4	0.3	0.4	0.7	0.6	0.7	0.2	0.3	0.3	0.6	0.4
PRDZ	0.4	0.5	0.7	0.8	0.5	0.7	0.8	0.3	0.4	0.7	0.7	0.5	0.5	0.9	0.2	0.5	0.4	0.2	0.5	0.6	0.3	0.3	0.6	0.5	0.3	0.4	0.7	0.6
PTAP	0.4	0.8	0.4	0.8	0.3	0.7	0.1	0.8	0.7	0.5	0.4	0.5	0.5	0.1	0.6	0.3	0.6	0.4	0.4	0.3	0.6	0.7	0.3	0.3	0.5	0.8	0.4	0.4
PKLJ	0.9	0.6	0.2	0.1	0.5	0.4	0.2	0.4	0.8	0.7	0.7	0.1	0.9	0.5	0.1	0.4	0.4	0.7	0.3	0.4	0.6	0.4	0.5	0.8	0.4	0.3	0.2	0.3
SHSI	0.8	0.7	0.4	0.1	0.7	0.1	0.3	0.2	0.4	0.7	0.6	0.8	0.4	0.9	0.5	0.4	0.3	0.5	0.6	0.3	0.6	0.4	0.4	0.5	0.4	0.3	0.3	0.5
SSIN	0.1	0.7	0.6	0.7	0.8	0.4	0.3	0.6	0.4	0.5	0.4	0.5	0.7	0.6	0.6	0.5	0.2	0.4	0.8	0.8	0.3	0.8	0.6	0.7	0.5	0.2	0.7	0.2
LEAB	0.7	0.7	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.1	0.8	0.6	0.4	0.6	0.7	0.8	0.5	0.7	0.2	0.3	0.3	0.3	0.7	0.4	0.6	0.6	0.4	0.3
DODE	0.3	0.4	0.7	0.3	0.6	0.7	0.3	0.6	0.4	0.5	0.6	0.8	0.6	0.3	0.5	0.6	0.3	0.5	0.4	0.2	0.2	0.6	0.3	0.3	0.8	0.6	0.8	0.4
SHFS	0.6	0.7	0.4	0.2	0.6	0.7	0.2	0.7	0.7	0.3	0.7	0.5	0.6	0.7	0.4	0.2	0.8	0.6	0.5	0.3	0.2	0.2	0.6	0.8	0.7	0.5	0.4	0.4
GTSH	0.6	0.2	0.3	0.7	0.6	0.7	0.3	0.7	0.5	0.5	0.6	0.4	0.7	0.6	0.7	0.2	0.7	0.8	0.7	0.5	0.6	0.5	0.3	0.5	0.6	0.3	0.6	0.5
BMPS	0.3	0.3	0.3	0.8	0.2	0.7	0.4	0.7	0.7	0.7	0.3	0.7	0.4	0.4	0.4	0.7	0.7	0.8	0.8	0.4	0.5	0.5	0.6	0.2	0.5	0.4	0.7	0.6
NKOL	0.8	0.5	0.3	0.6	0.3	0.4	0.6	0.7	0.6	0.5	0.4	0.7	0.3	0.6	0.6	0.2	0.7	0.4	0.8	0.5	0.5	0.5	0.4	0.8	0.3	0.6	0.4	0.4
PAKS	0.6	0.7	0.7	0.3	0.4	0.7	0.1	0.7	0.4	0.7	0.3	0.4	0.7	0.5	0.6	0.4	0.3	0.7	0.4	0.7	0.4	0.6	0.5	0.1	0.5	0.5	0.5	0.6
PFAN	0.3	0.3	0.6	0.2	0.2	0.7	0.8	0.8	0.4	0.3	0.8	0.5	0.7	0.2	0.5	0.3	0.6	0.7	0.2	0.5	0.8	0.2	0.9	0.5	0.3	0.5	0.2	0.4
IPTR	0.4	0.8	0.3	0.6	0.3	0.3	0.5	0.7	0.7	0.4	0.7	0.7	0.5	0.6	0.6	0.5	0.4	0.2	0.3	0.4	0.5	0.7	0.5	0.7	0.5	0.7	0.7	0.4
PKHA	0.4	0.4	0.6	0.5	0.7	0.4	0.4	0.3	0.3	0.6	0.7	0.6	0.2	0.7	0.7	0.8	0.4	0.4	0.5	0.7	0.6	0.4	0.5	0.5	0.3	0.5	0.2	0.6
PETR	0.7	0.2	0.2	0.5	0.4	0.4	0.3	0.3	0.6	0.5	0.4	0.3	0.6	0.8	0.7	0.3	0.6	0.2	0.6	0.4	0.3	0.6	0.5	0.8	0.3	0.8	0.5	0.2
PASN	0.5	0.2	0.6	0.5	0.7	0.4	0.3	0.7	0.4	0.3	0.6	0.4	0.6	0.7	0.5	0.8	0.7	0.6	0.6	0.5	0.4	0.6	0.4	0.6	0.6	0.8	0.8	0.5

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