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A novel application of grey principal component analysis to determine stockholder's approach towards financial ratios

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In this paper we try to determine the stockholder's desire approach to financial ratios using a combination of principal component analysis and grey theory. Grey principal component analysis (GPCA) handles poor information reduces dimensions of variables and gives an appropriate score to each company. Here we employ GPCA to identify more appropriate strategies of normalizing data curves to reduce the discrepancy between the GPCA-ranking and return-ranking, hence determining the approaches of stockholders of listed pharmaceutical firms of Tehran Stock Exchange (TSE) regarding financial ratios.

JEL Classifications: C21, G10, L65

Keywords: Performance evaluation, grey principal component analysis, MCDM, pharmaceutical industry, market desire

Introduction

Investment decisions, at micro and macro levels, call for meticulous examination of investment opportunities. This examination is possible only through evaluation of those opportunities. Accurate evaluation can take place when we have a valid understanding of the past and the ability to plan for and predict future.

In the MCDM field, performance evaluation has been one of the popular topics of research. Evaluating investment opportunities has always enabled investors to make preponderant decisions. There has been many new methods in recent years to help investors with thereupon purport, such as rough set theory (Feng, Liu, and Tzeng, 2007), fuzzy theory (Dweiri and Kablan, 2006), neural networks (Selamat and Omatu, 2004), etc. However, as the lion's share of the methods presented in this field is very intricate and involves a bundle of data ingression, methods which can work more respondently with limited available information have a clear advantage.

Many researchers have employed grey systematic analysis extensively in different studies. For instance, using the grey incidence analysis, Tu, Lin, and Feng (2001) evaluated proposals of immensely colossal supermarkets in Taiwan. Lee and Tung (2007) employed grey relations to anticipate the financial crisis of the steel corporations in Taiwan. Wang (2008) evaluated an airline's financial performance by applying grey relation analysis, fuzzy sets and TOPSIS while Lee and Tung (2010) made use of Grey Factor Analysis to evaluate the performance of listed biotechnology corporations in Taiwan. Also, Falah and Araghi used GFA model to determine the more befitting methods of normalizing information curves in order to determine the desires of stockholders.

By looking more closely, we can see that almost all of these and other similar studies have used variables without noticing their effects on the project's value. In other words, they

haven't determined whether a specific variable has a positive or negative ramification on the selected goal of the project. In this paper, we try to figure out which methods of normalization of variables deliver results that are closer to the market ranking (companies' return ranking) so that we can identify the stockholder's perspective towards financial ratios and rank the corporations more fittingly. Here we use financial ratios as variables and examine the listed corporations of the pharmaceutical industry. The result of this study can help investors and stockholders with their decision making process.

Variable selection

As an inextricable part of the evaluation process, we try to use all the major financial ratios to obtain more information. Selected ratios were chosen from similar researches and prominent books of the field of financial management (Kung and Wen, 2007; Lee and Tung, 2010; Ross, Westerfield, and Jordan, 2002). We selected 29 crucial variables (see Table 1 in Appendix).

Methodology

Grey Absolute Degree of Incidence (GADI) is a method of system analysis which employs the area between the curves of two information sequences to gain a similar degree (Tung & Lee, 2009). There is no specific sample size as a limit and no urge for the assumption of a specific ratio distribution as a result of the emphasis on the geometric similarity. The revised GADI proposed by Tung and Lee (2009) is formed as follows:

Suppose there are m indicators of evaluation and n companies. We present the information sequences as $x_i = (x(1), x(2), \ldots, x(n)), i = 1,2,\ldots,m$. We have to make them standard by engaging the following formulas as a result of different scales of information sequences (Wu and Chen, 1999):

1. If bigger-better is the assumption:

$$x_i^*(k) = \frac{x_i^0(k) - \min x_i^0(k)}{\max x_i^0(k) - \min x_i^0(k)} \tag{1}$$

2. If it is smaller-better:

$$x_i^*(k) = \frac{\max x_i^0(k) - x_i^0(k)}{\max x_i^0(k) - \min x_i^0(k)} \tag{2}$$

3. If it is nominal-better:

$$x_i^*(k) = 1 - \frac{\left| x_i^0(k) - OB \right|}{\max.\left\{ \max.\left[x_i^0(k) \right] - OB, OB - \min.\left[x_i^0(k) \right] \right\}} \tag{3}$$

OB is the value of appropriate target. Here we use average of the data as OB.

Choosing the felicitous principle for data normalizing can be very consequential. This study endeavors to determine the more appropriate principle from the investor's perspective using the GPCA model. Firstly, the company's return-rank is acquired. The

company's return-rank is the average of their returns between March 20, 2011 and March 20, 2013. Then the culled variables are split into 7 subsets according to their idiosyncrasies (Table 1) and afterwards we perform 7 experiments to determine the more befitting principle for each of them. In each experiment, all the three principles are employed for one subset in 3 different scenarios and nominal (mean)-better principle for other subsets. Finally, we rank the companies in each scenario by applying the GPCA model and calculate the sum of absolute differences between the GPCA rank of each company and its return-rank. We consider the smallest sum of absolute difference as the more appropriate principle in each experiment. The result of all experiments is shown in Table 7.

Definition 1 (Tung and Lee, 2009). The revised GADI matrix elements are acquired as follows:

$$r_{ij} = \frac{1+|S_i|+|S_j|}{1+|S_i|+|S_j|+d(|S_i - S_j|} \tag{4}$$

Where, $S_i = \sum_{k=2}^{n-1} X_i^0(k) + \frac{1}{2}X_i^0(n)$ and $d(S_i, S_j) = \sum_{k=2}^{n} |X_i^0(k) - X_j^0(k)|$. Here, r_{ij} have the following characteristics:

- $0 < r_{ij} \leq 1$
- $r_{ij} = r_{ji}$
- $r_{ii} = 1$
- only the geometric shapes of X_i and X_j can affectr_{ij}
- X_i and X_j are parallel, $r_{ij} = 1$.

And GADI matrix (R) is formed as follows:

$$\mathrm{R} = \begin{bmatrix} 1 & \mathrm{r}_{12} & \dots & \mathrm{r}_{1m} \\ \mathrm{r}_{21} & 1 & \dots & \mathrm{r}_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ \mathrm{r}_{m1} & \mathrm{r}_{m2} & \dots & 1 \end{bmatrix} \tag{5}$$

Because R is a symmetric matrix, we can consider it as a correlation matrix.

Grey Principle Component Analysis (GPCA)

Definition 2. Imagine $Y_i, i = 1,2,...,m$ is the linear combinations of $X, Y_i = y_i^t X$. $GreyCov(Y_i, Y_j) = y_i^t R y_j$ is the grey covariance of Y_i and Y_j and $Grey\,\mathrm{var}(Y_i) = y_i^t R y_i$ is the grey variance of Y_i (Tung and Lee, 2009).

According to researchers (Johnson and Wichern, 1982) $GreyCov(Y_i, Y_j) = e_i^t R e_j$ and $Grey\,\mathrm{var}(Y_i) = e_i^t R e_i$ provided that (e) is the corresponding eigenvectors of selected eigenvalues (λ) and as a result of Kaiser's rule, we select eigenvectors whose eigenvalues are bigger than 1.

We use the eigenvector as weight and calculate the score of the j-th company from the i-th principle component as follows:

$$pc_i(j) = \sum_{k=1}^{m} e_{ik} X_k(j), \forall i, j \quad (6)$$

Finally, we count the total score of the j-th company using the formula bellow:

$$PC_j = \sum_{i=1}^{t} \frac{\lambda_i}{\Lambda} pc_i, \Lambda = \sum_{i=1}^{t} \lambda_i \quad (7)$$

Evaluation and case study analysis

In this study, an attempt is made to determine the stockholder's approach in regard to selected financial ratios in the listed companies of the pharmaceutical industry from 2011 to 2013. To make them homogeneous, some limitations were applied:

1. Availability of audited financial statements from 2011 to 2013
2. The fiscal year Ending on March 20 (the end of the Iranian solar year)
3. Corporations being in the pharmaceutical industry with the exception of investment companies.

After establishing the mentioned boundaries, 21 companies remain as follows: Aburaihan Pharmaceutical, Damloran Razak Pharmai, Sina Darou, Amin Pharmaceutical, Darou Pakhsh Pharmaceutical Mfg., Iran Daru, Zahravi Pharmaceutical, IPPC, Alborz Darou, Osveh Pharmacy, Jaber Ebn Hayyan, Razak, Temad, Sobhan Darou, Cosar Pharmaceutical, Exir Pharmaceutical, Pars Darou, Farabi Pharmaceutical, Darou Pakhsh Pharma Chem, Rouzdarou Pharmaceutical, and Loghman Pharmaceutical and Hygienic. We postulate that through analyzing the yearly financial statements of the companies, performance evaluation is attainable. The financial information used in this paper (annual financial statements from2011 to 2013) is accessible in the comprehensive database of all listed companies of Tehran Securities Exchange (www.codal.ir).

As an example, tables of the state "liquidity ratios, smaller-better principle and other groups, nominal-better principle for 2011" are provided. Evaluation process is as follows:

- **Step 1.** Calculate the selected financial ratios.
- **Step 2.** Choose the appropriate standardization principle: we split the ratios into 7 subsets (Table 1) and perform 7 examination. Each exam determine the more befitting standardization principle for one of the 7 subsets. In each exam, we take the nominal-better principle for 6 subsets and alter the principle of the 7th subset according to (1)-(3). So in each examination, we have 3 states which make 21 states altogether. We choose the first state and normalize the financial ratios using the selected principle for the selected subset and nominal-better principle for other subsets (Table 2).
- **Step 3.** Build matrix R or GADI: Calculating r_{ij} and building R matrix according to (4) and (5) (Table 3).
- **Step 4.** Calculate the eigenvalue, eigenvector of R and choose the eigenvectors eigenvalues greater than 1 (Kaiser Principle), (Table 4).
- **Step 5.** Calculate the scores and ranks of the companies using (6) and (7), (Table 5).
- **Step 6.** Repeat steps 3 to 5 for all the other years and calculate the average score for each company. Rank the companies and compute the sum of absolute differences between the calculated rank of the companies and their return rank within the industry and put the absolute difference sum in Table 6.

- **Step 6.** Repeat the steps 3 to 6 for the other 20 states and complete Table 7. Then we choose the minimum state of each examination as the selected principle for the related ratios.

Results

The GPCA model integrates the benefits of grey theory and Principal Component Analysis. This model can be used as a way to evaluate companies or management performance by investors. In this paper of course, we used the model and proposed a new method to select standardization principles from an investor's perspective.

To test our method with the GPCA, we examined the performance of 21 listed companies of the pharmaceutical industry by processing their financial information for three years in 7 exams. Results show that the appropriate standardization principle in the exams "Financial Leverage ratios 1, Profitability Ratios, and Growth ratios" are "bigger-better principle" while the only exam with a favor for "smaller-better principle" is "Liquidity ratios". However, exams "Turnover ratios 1, Turnover ratios 2, Financial Leverage ratios 2"does not have a definite principle for their encompassed factors as there is more than 1 minimum answer available. With the absence of other explanatory info, we believe that the presented results show the desire of stockholders of this industry towards the selected financial ratios.

It's worth noting that the presented results are for Iran's pharmaceutical industry within the years 2011-2013 and can vary in different times and places. Also, it's clear that the factors used in this study cannot possibly hold the entire effective information on the return of the selected companies. But the use of this method is to get appropriate results within the available data. It's obvious that if we could have accessed new information about other effective factors, it could have changed the result of this research noticeably.

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Appendix

TABLE 1. SELECTED FINANCIAL RATIOS

CATEGORY	RATIOS	
Liquidity ratios 1	Z1	Cash Ratio
	Z2	Current Ratio
	Z3	Quick Ratio
	Z4	Interval measure
	Z5	Net working capital to total assets
Financial Leverage ratios 1	Z6	Debt to Equity
	Z7	Long-Term Debt Ratio
	Z8	Total Debt Ratio
Financial Leverage ratios 2	Z9	Times Interest Earned Ratio
Turnover ratios 1	Z10	Inventory Turnover
	Z11	Fixed asset turnover
	Z12	Receivables Turnover
	Z13	Total asset turnover
	Z14	Current asset turnover
	Z15	NWC Turnover
Turnover ratios 2	Z16	Days' Sales In Inventory
	Z17	Days' sales in receivables
	Z18	Operating cycle
Profitability Ratios	Z19	Gross Profit Margin
	Z20	Operational Profit Margin
	Z21	Return On Equity
	Z22	Return On Assets
	Z23	EBIT Margin
	Z24	Profit Margin
	Z25	Financial Leverage Index
Growth ratios	Z26	Assets Growth
	Z27	Equity's Growth
	Z28	Net Profit Growth
	Z29	Sales Growth

TABLE 1. GADI MATRIX (LIQUIDITY RATIOS, SMALLER-BETTER PRINCIPLE FOR 2011)

1	0.64	0.62	0.56	0.52	0.61	0.46	0.54	0.36	0.52	0.52	0.34	0.57	0.60	0.58	0.54	0.52	0.53	0.56	0.49	0.43	0.54	0.43	0.39	0.42	0.67	0.40	0.62	0.53
0.64	1	0.73	0.68	0.48	0.61	0.49	0.53	0.35	0.51	0.53	0.33	0.59	0.58	0.65	0.49	0.50	0.54	0.58	0.51	0.46	0.56	0.41	0.36	0.40	0.74	0.41	0.68	0.59
0.62	0.73	1	0.76	0.44	0.61	0.53	0.56	0.41	0.56	0.57	0.38	0.61	0.62	0.69	0.55	0.49	0.56	0.59	0.55	0.48	0.60	0.47	0.42	0.44	0.76	0.46	0.72	0.61
0.56	0.68	0.76	1	0.40	0.65	0.61	0.60	0.45	0.59	0.59	0.43	0.64	0.63	0.75	0.55	0.50	0.62	0.65	0.60	0.50	0.63	0.50	0.45	0.48	0.82	0.51	0.72	0.65
0.52	0.48	0.44	0.40	1	0.48	0.23	0.39	0.16	0.34	0.32	0.11	0.44	0.45	0.45	0.27	0.14	0.34	0.51	0.39	0.25	0.45	0.21	0.12	0.16	0.62	0.19	0.59	0.42
0.61	0.61	0.61	0.65	0.48	1	0.61	0.79	0.52	0.63	0.61	0.45	0.65	0.63	0.73	0.58	0.60	0.65	0.68	0.65	0.57	0.72	0.58	0.54	0.68	0.78	0.50	0.70	0.66
0.46	0.49	0.53	0.61	0.23	0.61	1	0.53	0.37	0.61	0.58	0.36	0.63	0.56	0.72	0.48	0.34	0.60	0.63	0.59	0.43	0.61	0.48	0.37	0.42	0.76	0.48	0.68	0.64
0.54	0.53	0.56	0.60	0.39	0.79	0.53	1	0.51	0.57	0.58	0.39	0.63	0.63	0.68	0.54	0.47	0.63	0.65	0.62	0.52	0.72	0.53	0.48	0.57	0.77	0.43	0.69	0.61
0.36	0.35	0.41	0.45	0.16	0.52	0.37	0.51	1	0.50	0.51	0.34	0.58	0.59	0.58	0.40	0.21	0.49	0.68	0.65	0.38	0.70	0.48	0.37	0.35	0.74	0.38	0.63	0.55
0.52	0.51	0.56	0.59	0.34	0.63	0.61	0.57	0.50	1	0.62	0.46	0.61	0.61	0.69	0.66	0.42	0.61	0.67	0.64	0.53	0.67	0.63	0.56	0.56	0.77	0.52	0.75	0.67
0.52	0.53	0.57	0.59	0.32	0.61	0.58	0.58	0.51	0.62	1	0.50	0.64	0.67	0.69	0.58	0.48	0.63	0.64	0.63	0.54	0.65	0.61	0.55	0.52	0.79	0.56	0.69	0.71
0.34	0.33	0.38	0.43	0.11	0.45	0.36	0.39	0.34	0.46	0.50	1	0.48	0.47	0.53	0.32	0.18	0.47	0.54	0.57	0.31	0.52	0.40	0.28	0.25	0.74	0.40	0.64	0.56
0.57	0.59	0.61	0.64	0.44	0.65	0.63	0.63	0.58	0.61	0.64	0.48	1	0.76	0.75	0.63	0.48	0.66	0.70	0.68	0.57	0.74	0.58	0.54	0.57	0.79	0.55	0.69	0.67
0.60	0.58	0.62	0.63	0.45	0.63	0.56	0.63	0.59	0.61	0.67	0.47	0.76	1	0.70	0.64	0.51	0.65	0.71	0.69	0.56	0.72	0.61	0.56	0.54	0.77	0.53	0.68	0.67
0.58	0.65	0.69	0.75	0.45	0.73	0.72	0.68	0.58	0.69	0.69	0.53	0.75	0.70	1	0.63	0.59	0.73	0.70	0.67	0.61	0.74	0.67	0.62	0.61	0.84	0.61	0.73	0.72
0.54	0.49	0.55	0.55	0.27	0.58	0.48	0.54	0.40	0.66	0.58	0.32	0.63	0.64	0.63	1	0.34	0.54	0.62	0.58	0.44	0.65	0.50	0.40	0.42	0.74	0.44	0.71	0.60
0.52	0.50	0.49	0.50	0.14	0.60	0.34	0.47	0.21	0.42	0.48	0.18	0.48	0.51	0.59	0.34	1	0.56	0.51	0.45	0.31	0.53	0.37	0.25	0.23	0.72	0.28	0.61	0.54
0.53	0.54	0.56	0.62	0.34	0.65	0.60	0.63	0.49	0.61	0.63	0.47	0.66	0.65	0.73	0.54	0.56	1	0.64	0.63	0.52	0.69	0.64	0.58	0.54	0.79	0.53	0.69	0.67
0.56	0.58	0.59	0.65	0.51	0.68	0.63	0.65	0.68	0.67	0.64	0.54	0.70	0.71	0.70	0.62	0.51	0.64	1	0.84	0.62	0.74	0.63	0.59	0.63	0.77	0.60	0.74	0.73
0.49	0.51	0.55	0.60	0.39	0.65	0.59	0.62	0.65	0.64	0.63	0.57	0.68	0.69	0.67	0.58	0.45	0.63	0.84	1	0.59	0.72	0.62	0.57	0.61	0.79	0.59	0.74	0.72
0.43	0.46	0.48	0.50	0.25	0.57	0.43	0.52	0.38	0.53	0.54	0.31	0.57	0.56	0.61	0.44	0.31	0.52	0.62	0.59	1	0.67	0.48	0.39	0.37	0.77	0.51	0.77	0.72
0.54	0.56	0.60	0.63	0.45	0.72	0.61	0.72	0.70	0.67	0.65	0.52	0.74	0.72	0.74	0.65	0.53	0.69	0.74	0.72	0.67	1	0.68	0.67	0.62	0.81	0.63	0.73	0.74
0.43	0.41	0.47	0.50	0.21	0.58	0.48	0.53	0.48	0.63	0.61	0.40	0.58	0.61	0.67	0.50	0.37	0.64	0.63	0.62	0.48	0.68	1	0.71	0.44	0.80	0.48	0.68	0.65
0.39	0.36	0.42	0.45	0.12	0.54	0.37	0.48	0.37	0.56	0.55	0.28	0.54	0.56	0.62	0.40	0.25	0.58	0.59	0.57	0.39	0.67	0.71	1	0.32	0.79	0.37	0.67	0.60
0.42	0.40	0.44	0.48	0.16	0.68	0.42	0.57	0.35	0.56	0.52	0.25	0.57	0.54	0.61	0.42	0.23	0.54	0.63	0.61	0.37	0.62	0.44	0.32	1	0.75	0.33	0.67	0.58
0.67	0.74	0.76	0.82	0.62	0.78	0.76	0.77	0.74	0.77	0.79	0.74	0.79	0.77	0.84	0.74	0.72	0.79	0.77	0.79	0.77	0.81	0.80	0.79	0.75	1	0.76	0.81	0.83
0.40	0.41	0.46	0.51	0.19	0.50	0.48	0.43	0.38	0.52	0.56	0.40	0.55	0.53	0.61	0.44	0.28	0.53	0.60	0.59	0.51	0.63	0.48	0.37	0.33	0.76	1	0.73	0.68
0.62	0.68	0.72	0.72	0.59	0.70	0.68	0.69	0.63	0.75	0.69	0.64	0.69	0.68	0.73	0.71	0.61	0.69	0.74	0.74	0.77	0.73	0.68	0.67	0.67	0.81	0.73	1	0.79
0.53	0.59	0.61	0.65	0.42	0.66	0.64	0.61	0.55	0.67	0.71	0.56	0.67	0.67	0.72	0.60	0.54	0.67	0.73	0.72	0.72	0.74	0.65	0.60	0.58	0.83	0.68	0.79	1

TABLE 2. SELECTED EIGENVALUES AND THEIR CORRESPONDING EIGENVECTOR (LIQUIDITY RATIOS, SMALLER-BETTER PRINCIPLE FOR 2011)

eigenvalue	17.17	1.47													
accumulation	0.59	0.64													
eigenvector 1	0.34	0.37	0.29	0.19	0.45	0.10	-0.01	0.05	-0.24	-0.09	-0.08	-0.21	0.01	0.01	0.02
eigenvector 2	0.17	0.17	0.18	0.19	0.12	0.20	0.17	0.19	0.16	0.19	0.19	0.14	0.20	0.20	0.21
eigenvector 1	0.02	0.25	-0.04	-0.06	-0.16	-0.08	-0.11	-0.26	-0.28	-0.08	-0.01	-0.16	0.01	-0.09	
eigenvector 2	0.17	0.14	0.19	0.21	0.20	0.17	0.21	0.18	0.16	0.16	0.24	0.16	0.22	0.21	

TABLE 3. SCORE AND RANK (LIQUIDITY RATIOS, SMALLER-BETTER PRINCIPLE FOR 2011)

Company	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
Score	1.27	0.90	1.52	0.79	1.05	1.05	1.05	1.04	0.78	1.00	0.98
Rank	8	18	4	20	10	12	11	13	21	15	16

TABLE 4 (cont-d). SCORE AND RANK (LIQUIDITY RATIOS, SMALLER-BETTER PRINCIPLE FOR 2011)

Company	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
Score	1.19	0.84	0.96	1.52	1.35	1.39	1.04	1.64	1.32	1.59
Rank	9	19	17	3	6	5	14	1	7	2

TABLE 6. CALCULATION OF ABSOLUTE DIFFERENCE (LIQUIDITY RATIOS, SMALLER-BETTER PRINCIPLE)

Company	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
2011	1.27	0.90	1.52	0.79	1.05	1.05	1.05	1.04	0.78	1.00	0.98
2012	0.90	0.82	1.40	0.66	1.01	0.83	1.17	0.96	0.67	0.65	0.95
2013	1.11	1.32	1.33	0.78	1.21	0.94	1.13	1.67	0.68	0.81	1.07
Average score	1.09	1.02	1.42	0.74	1.09	0.94	1.11	1.22	0.71	0.82	1.00
GFA rank	10	13	3	20	11	18	9	6	21	19	15
Return rank	3	6	5	16	8	11	18	2	13	7	9
Absolute difference	7	7	2	4	3	7	9	4	8	12	6

TABLE 6 (cont-d). CALCULATION OF ABSOLUTE DIFFERENCE (LIQUIDITY RATIOS, SMALLER-BETTER PRINCIPLE)

Company	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	Sum
2011	1.19	0.84	0.96	1.52	1.35	1.39	1.04	1.64	1.32	1.59	
2012	1.05	1.07	0.95	1.16	1.60	1.20	1.04	1.17	0.96	1.68	
2013	1.03	1.10	1.07	1.43	1.50	0.96	0.82	1.24	1.19	1.40	
Average score	1.09	1.01	0.99	1.37	1.48	1.18	0.97	1.35	1.16	1.56	
GFA rank	12	14	16	4	2	7	17	5	8	1	
Return rank	4	1	20	21	14	10	15	12	19	17	
Absolute difference	8	13	4	17	12	3	2	7	11	16	162

TABLE 5. APPROPRIATE PRINCIPLE FOR EACH CATEGORY (LIQUIDITY RATIOS, SMALLER-BETTER PRINCIPLE)

Category	Nominal Better	Smaller Better	Bigger Better	Appropriate principle
Liquidity ratios	178	162	168	Smaller-Better
Financial leverage ratios 1	178	174	166	Bigger-Better
Financial leverage ratios 2	178	178	182	Nominal/ Smaller-Better
Turnover ratios 1	178	162	162	Smaller/ Bigger-Better
Turnover ratios 2	178	184	178	Nominal/ Bigger-Better
Profitability ratios	178	178	158	Bigger-Better
Growth ratios	178	190	152	Bigger-Better