

The Comparative Performance Analysis of Turkish Real Sector: VOKOR Method

 İnanç A. Sözer

Istanbul Commerce University, Turkey

Received: August 13, 2021

Accepted: November 3, 2021

Published: December 30, 2021

Abstract: In the economic literature, it is shown that an important factor that increases volatility in business cycles is the disability of companies to criticize the cycle in advance and the lack of management capacity suitable for the current period. As a result of globalization in the developing world, businesses need to measure their financial performance at regular intervals to be able to carry out their decision-making, planning and auditing functions in an increasingly competitive environment. This study aims to analyse 25 non-financial sectors' performance data using the VIKOR method in Turkey for 2009–2019. The results regarding the performance of the companies have been evaluated considering the business cycle periods. According to the findings, the most successful companies diverged in periods of stability and crisis, while companies with a low performance show similar tendencies for all periods.

Keywords: Real Sector, Financial Performance, VIKOR

JEL Classification: L25, L52, M21

1. Introduction

Monitoring and evaluating the performance of firms/sectors in business cycles, especially in times of crisis, is important in recent conditions where competition is quite high. Despite the existence of a well-established body of literature on financial sector performance when business cycles, specific research into this issue in the non-financial (real) sectors only began in recent term. However, determining the business cycles and the condition of the real sector in these periods are at least as essential as the financial sector. The reason behind of these the real sector has an intense relationship with other sectors. The impact of any problem that may arise in the real sector may be higher, especially due to its bidirectional relationship with the financial sector. Firms/sectors individual performances along with the determination of the positions according to performances in their group will also contribute to their competitiveness. It seems clear the determination of firms/sectors' performance in different cycles of the business is contributed to reducing the effects of vulnerabilities and/or problems that may consist of during these periods.

It is observed that corporates has been exposed to significant damages due to various cyclical phases experienced in the last 10 years in Turkey. The weaknesses of the banking sector in the crisis period and the relatively high profitability of the banking sector came to the fore during the expansion period, mainly the real sector's inability to recognize the cyclical phases and the weakness of the institutional capacity that required risk management principles. In order to have a stronger real sector and to reduce the economic damage in the business cycles, it is important to examine the changes in the strategies and performance of the real sector according to the cycles in Turkey.

In this study, the data of 25 real sectors operating in Turkey in the 2009–2019 period were analyzed using the VIKOR method. The results regarding the performance of the companies have been evaluated by considering the business cycles periods. According to the findings, the most successful companies diverge in periods of stability and crisis, while companies with low performance show similar trends for all periods.

2. Performance Calculation with VIKOR Method in Turkish Economy

The VIKOR method has been developed for multi-criteria optimization of complex systems. Sets the consensus ranking list, consensus solution, and weight stability ranges for the choice stability of the compromise solution obtained with the initial (given) weights. This method focuses on sorting and selecting from a range of alternatives in the presence of conflicting criteria. It presents a multi-criteria ranking index based on the "proximity" measure specific to the "ideal" solution (Opricovic & Tzeng, 2004).

The stages of the VIKOR method are as follows (Opricovic & Tzeng, 2004; Opricovic & Tzeng, 2007):

Stage 1: Determination of ideal solutions the best (f_i^*) and the worst (f_i^-) values of the whole evaluation criterion, and if the criterion i is a criterion expressing "benefit" in terms of evaluation, for $i = 1, 2, \dots, n$; f_i^* and f_i^- expressed as follows:

$$f_i^* = \max f_{ij} \text{ ve } f_i^- = \min f_{ij}$$

Stage 2: S_j (maximum group benefit) and R_j (opposing opinion minimum individual regret) values of all evaluation units

$$S_j = \sum \frac{[w_i(f_i^* - f_{ij})]}{(f_i^* - f_i^-)} \text{ ve } R_j = \max \frac{w_i(f_i^* - f_{ij})}{(f_i^* - f_i^-)}$$

it is calculated as. Here w_i denotes the weights of the criteria.

Step 3: Q_j values for the whole evaluation unit;

$$Q_j = \frac{v(S_j - S^*)}{(S^- - S^*)} + \frac{(1-v)(R_j - R^*)}{(R^- - R^*)}$$

it is calculated as.

Used in the formula, $S^* = \min S_j$ and $S^- = \max S_j$, while $R^* = \min R_j$ and $R^- = \max R_j$. The v value in the formula shows the weight of the strategy that will provide the maximum group benefit, while the $(1 - v)$ value shows the weight of the minimum regret with the opposite view. In general, the value of v is used as 0.5 in studies.

Step 4: The Q_j , S_j , R_j values obtained as a result of the calculations are ranked, and the lowest among the Q_j values is determined as the best choice among the alternative values.

In the study, all sectors belonging to the period of 2009–2019 were ranked using the VIKOR method according to the relevant criteria. standings for the 2009–2019 period, the rankings of the sectors were obtained using VIKOR methods to examine the 25 sector criteria subject to the study together. Work equally weighted criteria adopted and fifth inputs using the method of step VIKOR was obtained financial performance rankings for the second output and risk. This part of the study is illustrated and VIKOR data of 2013 steps.

Table 1. Performance Criteria

Criterion	Code
Sectoral Real Growth Rate	inp1
Equity / Total Assets Ratio (%)	inp2
Short Term External Sources/ Total External Sources(%)	inp3
Stock Turnover (Times)	inp4
Receivable Turnover Rate (Times)	inp5
Operating Profit (Loss) / Net Sales Ratio (%)	Out1
Cash Rate (%)	Out5
Short Term Risks / Total Sector Risks	Risk

First of all, the effect of the criteria in the decision matrix on the sector performance was evaluated as positive and negative, and the best and worst values were determined for the relevant criteria.

Table 2. Ideal Solution Best (f_i^*) and Worst (f_i^-) Values

Best value	20.80	28.50	84.90	9.70	7.80	6.00	11.50	0.17
Worst value	1.35	68.00	45.90	4.10	2.90	1.10	1.80	0.66

The decision matrix is normalized by taking the best and worst values obtained into account.

Table 3. Short codes of sectors

Code	Sectors
S1	Manufacture of wood and of products, except furniture
S2	Manufacture of basic metals
S3	Information and Communication
S4	Manufacture of machinery and equipment n.e.c.
S5	Manufacture of leather and related products
S6	Other manufacturing
S7	Education
S8	Manufacture of electrical equipment
S9	Real estate activities
S10	Manufacture of food products
S11	Manufacture of textiles
S12	Trade
S13	Construction
S14	Manufacture of paper and paper products
S15	Manufacture of rubber and plastic products
S16	Printing and reproduction of recorded media
S17	Manufacture of chemicals and chemical products
S18	Repair and installation of machinery and equipment
S19	Professional, scientific and technical activities
S20	Manufacture of fabricated metal products, except machinery and equipment
S21	Manufacture of other non-metallic mineral products
S22	Manufacture of furniture
S23	Manufacture of motor vehicles, trailers and semi-trailers
S24	Agriculture, forestry and fishing
S25	Manufacture of textiles

Table 4. Normalization Values for Criteria

Sectors	inp1	inp2	inp3	inp4	inp5	out1	out5	risk
S1	0.71	0.10	0.25	0.73	0.92	0.41	0.88	0.52
S2	0.77	0.22	0.14	0.27	0.59	0.41	0.55	0.75
S3	0.61	0.85	0.26	0.54	0.22	0.33	0.02	0.26
S4	0.67	0.27	0.08	0.45	0.53	0.22	0.36	0.55
S5	0.61	0.18	0.00	0.77	0.82	0.49	0.42	0.85
S6	0.00	0.58	0.39	0.91	0.88	0.57	0.67	1.00
S7	0.74	0.59	0.58	0.00	0.00	1.00	0.36	0.23
S8	0.58	0.21	0.09	0.39	0.76	0.37	0.45	0.63
S9	0.95	1.00	1.00	0.91	0.49	0.49	0.72	0.00
S10	0.76	0.23	0.32	0.46	1.00	0.61	0.93	0.80
S11	1.00	0.15	0.08	0.57	0.57	0.53	0.68	0.91
S12	0.75	0.18	0.24	0.71	0.53	0.76	0.76	0.85
S13	0.33	0.19	0.40	1.00	0.69	0.43	1.00	0.63
S14	0.42	0.17	0.14	0.66	0.55	0.45	0.44	0.60
S15	0.70	0.10	0.14	0.59	0.73	0.47	0.73	0.71
S16	0.89	0.33	0.21	0.61	0.76	0.39	0.57	0.66
S17	0.92	0.24	0.19	0.68	0.24	0.39	0.74	0.82
S18	0.05	0.39	0.12	0.54	0.33	0.35	0.30	0.88
S19	0.45	0.79	0.35	0.71	0.37	0.00	0.00	0.02
S20	0.36	0.17	0.17	0.46	0.45	0.35	0.59	0.75
S21	0.53	0.21	0.32	0.66	0.82	0.43	0.80	0.48
S22	0.52	0.00	0.13	0.86	0.53	0.57	0.96	0.66
S23	0.61	0.34	0.17	0.34	0.67	0.27	0.55	0.35
S24	0.95	0.44	0.79	0.79	0.35	0.76	0.90	0.60
S25	0.72	0.25	0.18	0.50	0.69	0.37	0.51	0.75

The weighted decision matrix values were obtained by determining the weights of the criteria to have equal importance and multiplying the weights with the normalized values.

Table 5. Weighting of the Normalized Decision Matrix

Sectors	inp1	inp2	inp3	inp4	inp5	out1	out5	Risk
S1	8.86	1.30	3.14	9.15	11.48	5.10	10.95	6.51
S2	9.59	2.69	1.79	3.35	7.40	5.10	6.83	9.34
S3	7.58	10.57	3.30	6.70	2.81	4.08	0.26	3.31
S4	8.34	3.35	0.96	5.58	6.63	2.81	4.51	6.86
S5	7.58	2.25	0.00	9.60	10.20	6.12	5.28	10.66
S6	0.00	7.22	4.84	11.38	10.97	7.14	8.38	12.50
S7	9.30	7.34	7.24	0.00	0.00	12.50	4.51	2.88
S8	7.20	2.56	1.15	4.91	9.44	4.59	5.67	7.94
S9	11.85	12.50	12.50	11.38	6.12	6.12	9.02	0.00
S10	9.47	2.91	4.01	5.80	12.50	7.65	11.60	9.99
S11	12.50	1.87	0.99	7.14	7.14	6.63	8.51	11.43
S12	9.35	2.31	3.04	8.93	6.63	9.44	9.54	10.60
S13	4.17	2.41	4.97	12.50	8.67	5.36	12.50	7.93
S14	5.26	2.12	1.73	8.26	6.89	5.61	5.54	7.45
S15	8.71	1.20	1.79	7.37	9.18	5.87	9.15	8.83
S16	11.18	4.18	2.56	7.59	9.44	4.85	7.09	8.25
S17	11.53	2.97	2.44	8.48	3.06	4.85	9.28	10.22
S18	0.62	4.87	1.51	6.70	4.08	4.34	3.74	11.06
S19	5.62	9.84	4.39	8.93	4.59	0.00	0.00	0.26
S20	4.51	2.09	2.08	5.80	5.61	4.34	7.35	9.37
S21	6.59	2.63	3.94	8.26	10.20	5.36	10.05	5.97
S22	6.55	0.00	1.57	10.71	6.63	7.14	11.98	8.19
S23	7.58	4.21	2.08	4.24	8.42	3.32	6.83	4.41
S24	11.84	5.47	9.94	9.82	4.34	9.44	11.21	7.49
S25	8.96	3.10	2.28	6.25	8.67	4.59	6.31	9.38

Finally, S, R, and Q values were obtained with the calculation methods used in the VIKOR method. The sectors are not listed according to the values obtained.

Table 1. S, R and Q scores

Sectors	Scores		
	S	R	Q
S1	56.50	11.48	0.70
S2	46.10	9.59	0.33
S3	38.60	10.57	0.34
S4	39.04	8.34	0.08
S5	51.69	10.66	0.53
S6	62.43	12.50	0.90
S7	43.78	12.50	0.64
S8	43.46	9.44	0.28
S9	69.50	12.50	1.00
S10	63.94	12.50	0.92
S11	56.21	12.50	0.81
S12	59.84	10.60	0.64
S13	58.50	12.50	0.85
S14	42.87	8.26	0.13
S15	52.10	9.18	0.37
S16	55.14	11.18	0.64
S17	52.83	11.53	0.65
S18	36.91	11.06	0.38
S19	33.63	9.84	0.19
S20	41.15	9.37	0.24
S21	53.00	10.20	0.50
S22	52.78	11.98	0.71
S23	41.09	8.42	0.12
S24	69.55	11.84	0.92
S25	49.55	9.38	0.35

Considering the ranking created for the 2009–2019 period, 25 sectors were examined in five different groups. The sectors in the first group are the first 5 sectors that show the best performance according to the Q value, and the sectors in the fifth group are the sectors that have the lowest performance among these 25 sectors for the year examined.

3. Performance of Sectors in Stability Periods

In the study, the recovery period is 2010, the expansion period is 2012–2013 and the peak period is 2013. Therefore, the 2010–2013 period is a period of stable growth in terms of sectors.

The machinery and equipment manufacturing sector, which was in the 1st group in 2010, was the best performing sector in 2011 and 2013. The manufacture of motor vehicles, trailers and semi-trailers, which had the best performance in 2010, was in the 1st group in the period of 2011–2013, but it is observed that this sector fell to the 4th group in 2012 due to the problems caused by the sector itself. Machinery and equipment manufacturing, paper manufacturing, and thanks to the Government huge incentives professional, scientific and technical activities are consistently in the 1st group, and in 2013, it was determined that the 20th sector was again in the 1st group as it was in 2013. Also, it was determined that the performance of the manufacture of basic metals and electrical equipments in the analysed period was fluctuating but between the 1st group and the 2nd group. While the sectors with the worst performance for the relevant period were other manufacturing and real estate sectors, education, construction, and agriculture sectors consistently fall into 5 groups. The machinery sector, which was ranked 5th in 2010 in the post-crisis period, showed a good performance and rose to the 2nd group in 2012.

4. Performance of Sectors in Contraction Periods

In this study, the years 2014 and 2017 are considered as a recession period. When the ranking of the sectors in this period is examined, it is seen that the machinery and equipment manufacturing sector, which has not been classified elsewhere, is in the 1st group, which also performs best in contraction periods. Apart from this, it is seen that the machinery sector, which was in the 5th group in 2010, has increased its performance, it is in the 1st group in 2014 and it has maintained its performance steadily. 2 and 3 in the previous period, the group located in the leather products to enhance the performance in the years 2016 to 2017 and it was determined that began to take place in Group 1. The sectors with the worst performance in the period analysed were other manufacturing and real estate, as was the case during the period of stability. Again, in this period, manufacture of wood and of products (except furniture), basic metals, education, construction, registered media, and agriculture sectors were in the 5th group.

Table 8. Sector Rankings Regarding the 2014–2017 Contraction Period

	2014				2015				2016				2017			
	Sector	S	R	Q	Sector	S	R	Q	Sector	S	R	Q	Sector	S	R	Q
GROUP I	S4	3	1	1	S14	4	1	1	S4	4	1	1	S23	1	2	1
	S19	1	5	2	S4	5	2	2	S18	3	2	2	S4	5	1	2
	S8	4	2	3	S18	2	3	3	S5	1	5	3	S18	4	4	3
	S15	9	4	4	S19	1	4	4	S20	7	4	4	S5	10	3	4
	S18	2	10	5	S23	3	9	5	S15	8	3	5	S15	7	5	5
GROUP II	S16	13	3	6	S20	7	8	6	S23	6	10	6	S20	6	6	6
	S14	8	7	7	S25	11	7	7	S19	2	11	7	S19	2	9	7
	S20	7	8	8	S8	12	6	8	S2	11	6	8	S8	9	8	8
	S3	5	9	9	S3	6	14	9	S25	10	7	9	S25	12	7	9
	S23	6	11	10	S17	10	10	10	S8	15	8	10	S21	14	10	10
GROUP III	S25	14	6	11	S21	18	5	11	S1	9	13	11	S3	3	17	11
	S5	11	13	12	S2	8	13	12	S17	16	9	12	S11	17	11	12
	S21	16	12	13	S5	17	11	13	S3	5	17	13	S22	8	14	13
	S1	15	15	14	S12	19	12	14	S11	12	14	14	S16	13	16	14
	S17	19	14	15	S11	9	18	15	S21	17	15	15	S1	16	15	15
GROUP IV	S12	18	16	16	S15	15	16	16	S12	21	12	16	S12	18	13	16
	S22	12	18	17	S22	13	19	17	S10	20	16	17	S10	20	12	17
	S10	20	17	18	S7	14	20	18	S14	13	20	18	S2	15	20	18
	S7	10	21	19	S16	16	20	19	S7	14	20	19	S14	11	22	19
	S11	17	20	20	S10	24	15	20	S22	19	18	20	S17	19	19	20
GROUP V	S2	21	21	21	S24	21	17	21	S16	18	20	21	S7	22	21	21
	S24	23	19	22	S1	20	20	22	S13	22	20	22	S13	21	22	22
	S13	22	21	23	S13	22	20	23	S6	23	20	23	S24	24	18	23
	S9	24	21	24	S6	23	20	24	S24	24	19	24	S6	23	22	24
	S6	25	21	25	S9	25	20	25	S9	25	20	25	S9	25	22	25

5. Performance of Sectors During Global Crisis

In the study, the years 2009–2018 and 2019 are evaluated as a crisis period. During this period, the period of stability and contraction of the sector than previously seen fluctuating and watch as they turn in mid-performance in terms of the sectors of the crisis into an opportunity. For example, it was determined that the information and communication sector was in the first group is 2009, while the manufacture of rubber&plastic and textile sectors were included in the first group in the 2018–2019 period. On the other hand, the motor vehicles sector, which had the best performance in 2017 and whose overall performance was between the first and second groups, was also in the first group in 2019. While real estate was the sector with the worst performance in this period, the construction, paper, non-metallic, furniture, and agriculture sectors were also in the fifth group.

Table 9. Sector Rankings Regarding the Crisis Period of 2009–2018–2019

	2009				2018				2019			
	Sector	S	R	Q	Sector	S	R	Q	Sector	S	R	Q
GROUP I	S8	2	1	1	S4	1	1	1	S16	8	1	1
	S19	1	6	2	S18	2	3	2	S25	3	4	2
	S3	3	7	3	S15	7	2	3	S15	5	2	3
	S16	5	5	4	S23	4	5	4	S4	6	3	4
	S17	4	9	5	S19	9	4	5	S23	9	5	5
GROUP II	S15	10	3	6	S25	6	6	6	S20	4	7	6
	S20	9	4	7	S3	3	14	7	S8	7	8	7
	S2	19	2	8	S8	5	11	8	S19	12	6	8
	S25	13	8	9	S21	15	7	9	S3	2	14	9
	S4	7	10	10	S20	8	12	10	S17	11	13	10
GROUP III	S23	8	13	11	S16	13	8	11	S18	1	18	11
	S21	12	11	12	S11	10	13	12	S11	13	12	12
	S10	14	12	13	S17	11	15	13	S22	16	10	13
	S5	11	15	14	S12	17	9	14	S12	17	11	14
	S7	6	20	15	S1	12	16	15	S10	18	9	15
GROUP IV	S12	20	14	16	S10	21	10	16	S5	14	15	16
	S1	17	18	17	S2	14	20	17	S14	10	20	17
	S24	22	16	18	S6	20	18	18	S2	15	20	18
	S18	15	20	19	S5	19	19	19	S1	20	16	19
	S11	16	20	20	S14	16	20	20	S7	19	20	20
GROUP V	S22	18	20	21	S7	18	20	21	S6	22	17	21
	S6	23	19	22	S22	22	20	22	S21	21	20	22
	S13	24	17	23	S24	24	17	23	S24	23	19	23
	S14	21	20	24	S13	23	20	24	S13	24	20	24
	S9	25	20	25	S9	25	20	25	S9	25	20	25

6. Conclusion

Nowadays, as businesses challenge a competitive environment with each passing day, they are radically changing the management strategies of the information age companies, the way they do business, and the way taking risks. In this competitive environment, enterprises should regularly measure their financial performance and determine their positions in the system to carry out their decision-making, planning, and supervision functions healthily and effectively. In this context, the data of 25 real sectors operating in Turkey were analysed from 2009 to 2019 by using the VIKOR method and the performance rankings for the sectors were created.

According to the model results; it consistently shows one of the best performances in all cyclical phases of the production of machinery and equipment, which has currently managed by international companies, based on high value-added technology are also concentrated. Thanks to having the institutional capacity to be mainly due to exports and foreign capital-intensive and have been transferred from developed countries, this sector is considered that this sector is so good. Although anti-cyclical (education, food) sectors are at the top of the rankings due to weaknesses that surfaced in other sectors during contraction periods, it is noteworthy that sectors such as construction cannot improve their financial performance even if their turnover increases expansion periods. Financial weaknesses in the education sector, where a structural break was experienced in 2013, and agriculture sector are observed at every stage. There are some distinct divergences among the sectors not only in terms of results but also according to the level of explanatory variables (criteria). This situation highlights the need to expand the institutional capacities of all sectors. Accordingly, it reveals the necessity to make the budget projection discipline, which is carried out weekly in the financial sector and monitored monthly in holdings, applicable to all sectors. Although the weaknesses according to the cycle differ from sector to sector, ensuring a common discipline will significantly increase the management ability for companies.

References

- Opricovic, S., & Tzeng, G. H. (2004). Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. *European journal of operational research*, 156(2), 445–455.
- Opricovic, S., & Tzeng, G. H. (2007). Extended VIKOR method in comparison with outranking methods. *European journal of operational research*, 178(2), 514–529.