The Effect of Covid-19 on Business Financial Performance: A Research on Forest Industrial Enterprises Traded on Borsa Istanbul

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ABSTRACT

The COVID-19 pandemic has had a significant negative impact on the Turkish economy and the global economy. Turkey's economy contracted by 10.2% in 2020, recording the most significant decline since the 1950s. The effects of the epidemic could also be observed on companies which had to close or lay off staff. This study aims to examine the financial impact of the COVID-19 pandemic on the forest industry by revealing the financial performance of publicly traded forest industry companies in Turkey before and after COVID-19. For this purpose, the financial performances of 11 companies operating in the forest products industry in Turkey and registered in the BIST XKGT index in the 2017-2022 period were examined. In this context, we used the integrated Entropy-CP method. In the initial phase of analysis, criteria weights were determined using the entropy method to assess the significance levels of the financial ratios. Subsequently, financial success rankings were generated by employing the CP method. In general, it was observed that the weight values of the criteria were close to each other. As a result, it was determined that the companies showed the best average financial success in 2022 and the lowest average financial performance in 2017. Following the pandemic's occurrence, some companies' performance improved, while others experienced a partial decline. Therefore, no general improvement or worsening trend could be detected during the years of the COVID-19 pandemic. In the context of this study, it was concluded that the pandemic did not affect the financial performance of companies operating in the forest products sector.

Keywords: CP method; entropy; financial performance; forest industry; multi criteria decision-making; pandemic

INTRODUCTION

Severe acute respiratory syndrome (SARS), which was brought on by the coronavirus known as SARS-CoV in February 2003, was the first pandemic of the 21st century. Subsequently, in December 2019, a fatal respiratory virus pandemic swiftly expanded throughout Wuhan, China, leading to the designation of COVID-19 (coronavirus disease 2019) by a novel coronavirus known as SARS-CoV-2 (Chen et al. 2020).

The COVID-19 pandemic, which lasted approximately two years and affected the whole world, has caused significant problems and even crises in all areas of life (McKibbin and Fernando 2020). As of December 24, 2023, 773,119,173 people were affected by the pandemic, and 6,990,067 died due to coronavirus (WHO 2023a). According

to the World Health Organization (WHO) data, Turkey was the 12th most affected country by COVID-19 (WHO 2023b).

The COVID-19 pandemic has had a significant impact on the Turkish economy and the global economy. In 2020, the Turkish economy shrank at a rate (10.2%) that had not been realized since 1950. The pandemic also had a remarkable impact on businesses in Turkey, with many companies having to close their business or lay off employees. Turkey started its economic recovery with 11.4% growth in 2021, which continued at a rate of 5.5% in 2022. The growth rate in 2023 is estimated to be around 5% (TUIK 2023)..

A study by the Central Bank of the Republic of Turkey (CBRT) showed that the financial performance of businesses in Turkey deteriorated significantly in 2020. The study shows that sales, profits, and investments decreased in 2020. Additionally, the study stated that the number of businesses

experiencing financial difficulties increased in 2020 (CBRT 2021).

The decline in the financial performance of businesses in Turkey was due to several factors, such as the lockdown due to the pandemic, the decrease in consumer demand, and the increase in input costs. The pandemic lockdown forced businesses to stop their activity for a while, resulting in a decline in sales. Due to the economic recession, the decline in consumer demand was caused by people having less money to spend. The increase in input costs was due to increased raw material and energy prices (World Bank 2021).

The forest and wood products sector has an important place within other sectors in Turkey (Bayram 2020). Besides, the share of the forest and wood products sector in Turkey's total exports is around 3.4% (SGM 2021). This sector, which has approximately the same share in world trade, had an average annual export increase of 13% between 2018 and 2022 (URL-5). Forest Industry products include industrial roundwood, sawn wood, paper and paper products, wood-based panels, fiber furniture, wood fuel, charcoal, and pellets (FAO 2018).

There are many studies in the literature regarding the sectoral effects of COVID-19. The studies by Nguyen on logistics in 2022, Xiang et al. on service in 2021, Mohamed et al. on energy in 2022, Gautam et al. on accommodation in 2021, Rodrigues et al. on food in 2021, and Nimavat et al. on the health sector in 2022 are some examples of COVID-19-based studies.

Purba et al. in the Indonesian sample in 2021, Rababah et al. in the Chinese sample in 2020, Honko et al. in the Polish sample in 2020, Tibiletti et al. in the Italian sample in 2021, Atayah et al. in the G20 countries sample in 2022, El Chaarani et al. in the Lebanese sample in 2021, and Nguyen in the Vietnamese sample in 2022 are some of the studies investigating the effects of the COVID-19 pandemic on the financial performance of businesses.

Unlike other sectors, the number of studies examining the effects of COVID-19 on the forest industry is relatively small. In their study in 2021, Størdal et al. examined the stock market performance of 340 forest industry companies worldwide during the pandemic. Forest and wood product sectors were analyzed for Nepal by Laudari in 2021 and Maraseni et al. in 2022, for Turkey by Bayram in 2020 and Komut in 2022, for Tennessee by Muhammad et al., and for Montana by Hayes and Morgan in 2020. Ratnasingam et al. investigated how small forest industry companies in Malaysia are coping with the challenges of the pandemic. Stanturf and Mansuy studied the forest sector and the forest industry in the USA and Canada. Liu et al. (2020) and Gurtu et al. (2022) studied paper and packaging products. Kuzman et al. also examined the impact of COVID-19 on the wood-based products sector in Slovenia, Croatia, Serbia and Bosnia and Herzegovina in 2023.

The prominent studies in the literature regarding the financial performance of forest industry enterprises are as follows:

Størdal et al. (2021) studied the financial performance of the forest products industrial sector during the COVID-19 pandemic. They found that the forestry subsector was more impacted than the paper subsector, particularly in North America. The systematic risk of the forestry subsector increased, while the paper subsector experienced a more consistent effect.

Zeng and Jiang (2023) studied 156 forestry and agriculture businesses using two-stage least squares to examine the relationship between ESG (environmental, social, and governance) and company performance. They found a strong positive correlation between ESG and corporate performance, with higher ratings enhancing performance. Tax incentives and regional marketization negatively impacted ESG performance, while female CEOs positively influenced it. These findings can help listed companies improve performance and ESG, leading to green development.

Kavas and Medetoğlu's 2023 financial analysis of five BIST forest products and furniture sector companies found that they remained successful during the pandemic and experienced increased performance. The study used various analysis methods, including horizontal, vertical, trend, ratio, and TOPSIS.

This study examines the financial performance of publicly traded forest industry companies in Turkey before and after COVID-19. Considering the deficiency of studies about the impact of COVID-19, especially within the forest industry sector, this study will contribute to the literature in respect to the subject it covers.

In the study, the financial performances of the forest industry companies of the Borsa Istanbul 100 index were examined using the entropy weighting method for the period during and after the pandemic.

MATERIAL AND METHODS

This study aims to examine the financial impact of the COVID-19 pandemic on the forest industry and especially to reveal the financial performance of publicly traded forest industry companies in Turkey before and after COVID-19. Considering the deficiency of studies about the impact of COVID-19, especially within the forest industry sector, this study will contribute to the literature on the subject it covers. This study examined the financial performances of all companies listed in the BIST XKGT index in the 2017-2022 period. Table 1 shows the companies in the BIST XKGT index. These companies are publicly traded private corporations.

The financial performances of 11 companies whose shares are traded in the Borsa Istanbul (BIST) Forestry, Paper, and Printing (XKGT) index in the 2017-2022 period were examined on a yearly basis. Twelve financial ratios commonly used in the literature were selected as evaluation criteria. These financial ratios, calculation formulas, ideal values (if any), and optimum levels are given in Table 2. In multi-criteria decision making (MCDM) problems, criteria are typically evaluated in two groups: benefit criteria and cost criteria. The objective is to maximize the benefit criteria while minimizing the cost criteria. Thus, the optimal level for benefit criteria is indicated by maximizing their values, while for cost criteria, it is indicated by minimizing their values. Ideal values are established for the first four ratios in the table, and for these criteria, it is desirable to minimize the difference between the observed and ideal values as much as possible. Minimizing the distance to the ideal value has been taken as a base for criteria with ideal values. The study's

Table 1. Companies, field of activity and BIST codes included in the analysis.

Code	Company	Field of Activity
ALKA	Alkim Kağit Sanayi Ve Ticaret A.Ş.	Paper
BAKAB	Bak Ambalaj Sanayi Ve Ticaret A.Ş	Printing and Package
DGNMO	Doğanlar Mobilya Grubu İmalat Sanayi Ve Ticaret A.Ş.	Furniture
DURDO	Duran Doğan Basim Ve Ambalaj Sanayi A.Ş.	Printing and Package
GENTS	Gentaş Genel Metal Sanayi Ve Ticaret A.Ş.	Laminate Flooring
KAPLM	Kaplamin Ambalaj Sanayi Ve Ticaret A.Ş.	Printing and Package
KARTN	Kartonsan Karton Sanayi Ve Ticaret A.Ş.	Cardboard
MNDTR	Mondi Turkey Kağit Ve Ambalaj Sanayi A.Ş	Paper and Package
PRIZMA	Prizma Pres Matbaacilik Yayincilik Sanayi Ve Ticaret A.Ş.	Printing and Publishing
SAMAT	Saray Matbaacilik Kağitçilik A.Ş.	Printing and Paper
VKING	Viking Kağit Ve Selülöz A.Ş	Paper and Pulp

main purpose is to observe the impact of the pandemic on the forest products sector by examining the companies' financial performances, including the period before and after the COVID-19 pandemic. For this purpose, the aim was to calculate the financial performances of the companies in two separate periods.

In this study, objective analysis methods were preferred. In this context, the entropy method was used to determine the criterion weights and the CP method was used to rank the alternatives.

Entropy Weighting Method

Shannon and Weaver (1948) suggested the entropy method. Entropy is used to determine the objective weights of attributes/answers. Probability theory is used to calculate uncertain information (entropy). This determines the importance of each response without the decision maker's consideration of preference. Entropy is based on the principle that upper-weight indicator information is more constructive than lower-weight indicator information. This method includes the steps of first identifying the targets (decision matrix) and then calculating the normalized decision matrix, the probability of occurrence of the attribute/response, the entropy value of the attribute/response, the average degrees of information contained in each response, and then the entropy weight (Kumar et al. 2017). This method follows the following steps to calculate objective weights (Li et al. 2022, Öztel et al. 2018).

Table 2. Financial ratios, their formulas, ideal values, and optimum levels.

	Financial Ratio	Criterion Content	Ideal Value	Optimum Level
C1	Current Ratio	Current Assets / Current Liabilities	1.75	Min.
C2	Quick Ratio	(Current Assets-Inventory) / Current Liabilities	1	Min.
C3	Cash Ratio	(Cash + Equivalents) / Current Liabilities	0.20	Min.
C4	Financial Leverage Ratio	Total Debt / Total Assets	0.60	Min.
C5	Current Liabilities / Total Liabilities and Shareholders' Equity	Current Liabilities / Total Liabilities and Shareholders' Equity		Min.
C6	Noncurrent Liabilities / Total Liabilities and Shareholders' Equity	Noncurrent Liabilities / Total Liabilities and Shareholders' Equity		Max.
C7	Asset Turnover Ratio	Net Sales / Total Assets		Max.
C8	Equity Turnover Ratio	Net Sales / Shareholders' Equity		Max.
C9	Net Working Capital Turnover Ratio	Net Sales / Net Working Capital		Max.
C10	Return on Assets (ROA)	Net Income / Total Assets		Max.
C11	Net Profit Margin	Net Income / Net Sales		Max.
C12	Return on Equity (ROE)	Net Income / Shareholders' Equity		Max.

Decision matrix for a multi-criteria decision-making problem with *m* alternatives and *n* criteria:

$$
D = \begin{matrix}
& X_1 & X_2 & \cdots & X_1 & \cdots & X_2 \\
A_1 & \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1n} \\
A_2 & x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2n} \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
A_i & x_{i1} & x_{i2} & \cdots & x_{ij} & \cdots & x_{in} \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
A_m & x_{m1} & x_{m2} & \cdots & x_{mj} & \cdots & x_{mn} \end{bmatrix}_{m \times n}
\end{matrix} \quad (1)
$$

Step 1:

$$ r_{ij} = \frac{x_{ij}}{\sum_{p=1}^{m} x_{pj}} \ , \ i=1, 2 \ldots, m, j=1, 2, \ldots, n \quad (2) $$

With this formula, the normalized decision matrix is obtained.

Step 2:

$$ e_j = -\frac{1}{\ln m} \sum r_{ij} \ln r_{ij} \ , \ j=1,2,\ldots,n \quad (3) $$

The entropy value of each criterion is found with this formula. Here, *ej* indicates the entropy value of the *j*th criterion.

Step 3:

$$ V_j = -\frac{1-e_j}{\sum_{p=1}^{n}(1-e_p)} \ , \ j=1, 2, \ldots, n \quad (4) $$

With this formula, the weight values of the criteria are assigned.

$$ \sum_{j=1}^{n} W_j = 1 \quad \text{It is.} $$

Compromise Programming (CP)

CP is an MCDM method developed by Zeleny (1974) and Yu (1985) in the seventies. The basic idea of the method is based on minimizing the distance of the alternatives from the ideal point *f**. *Lp* metric is used in distance measurement. We can explain the CP method in general terms as follows (André and Romero 2008, Öztel et al. 2012, Salas-Molina et al. 2018, Salman et al. 2019).

Step 1: The ideal point *f** and anti-ideal point *f** are created.

$$ f^* \equiv f_1{}^*, f_2{}^*, \ldots, f_n{}^* \ , \ f^* \equiv f_{1*}, f_{2*}, \ldots, f_{n*} \quad (5) $$

$$ f_j^* = \begin{cases} \max_{i=1, 2, \ldots, m} \{x_{ij}\}, & \text{jth criterion is benefit} \\ \min_{i=1, 2, \ldots, m} \{x_{ij}\}, & \text{jth criterion is cost} \end{cases} \quad (6) $$

$$ f_{j^*} = \begin{cases} \min_{i=1, 2, \ldots, m} \{x_{ij}\}, & \text{jth criterion is benefit} \\ \max_{i=1, 2, \ldots, m} \{x_{ij}\}, & \text{jth criterion is cost} \end{cases} \quad (7) $$

Step 2: The distance to the ideal point is minimized.

$$ \min L_p \equiv \left[\sum_{j=1}^{n} W_j \left(\frac{f_j^* - f_j^*(x_i)}{f_j^* - f_{j^*}} \right)^p \right]^{1/p}, \ 1, 2, \ldots, m \quad (8) $$

Step 3: The alternative that gives the minimum value is the best solution. Respectively, L1, L2, and L∞ are called Manhattan, Euclidean, and Tchebycheff metrics.

RESULTS

Since the importance levels of financial ratios will differ, the following must be determined first. The importance levels of the criteria, namely financial ratios, were determined by assigning weights using the entropy method. Since the success level of each company was determined over the years in the study, criterion weights were calculated

Table 3. Entropy weights of criteria according to companies.

	Criteria	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Companies	ALKA	0.1020	0.0565	0.1055	0.0343	0.0373	0.0144	0.0292	0.0197	0.0291	0.2088	0.1662	0.1970
	BAKAB	0.0433	0.1036	0.2568	0.3432	0.0058	0.0230	0.0027	0.0024	0.0886	0.0364	0.0442	0.0501
	DGNMO	0.0775	0.0778	0.0993	0.0808	0.0765	0.0787	0.0791	0.0999	0.0858	0.0881	0.0874	0.0690
	DURDO	0.0950	0.0892	0.0778	0.0819	0.0822	0.0930	0.0789	0.0707	0.1035	0.0727	0.0750	0.0795
	GENTS	0.2861	0.1804	0.1296	0.0376	0.0333	0.0203	0.0051	0.0143	0.0267	0.0827	0.0730	0.1109
	KAPLM	0.0817	0.0790	0.0971	0.0775	0.0830	0.0830	0.0778	0.0814	0.0780	0.0889	0.0895	0.0832
	KARTN	0.0546	0.0726	0.1508	0.0071	0.0422	0.0171	0.0235	0.0315	0.0201	0.2069	0.1359	0.2376
	MNDTR	0.0850	0.0852	0.0773	0.0922	0.0954	0.0746	0.0709	0.0966	0.0810	0.0786	0.0803	0.0830
	PRIZMA	0.0827	0.0809	0.0905	0.0896	0.0854	0.0774	0.0814	0.0815	0.0952	0.0786	0.0779	0.0790
	SAMAT	0.0804	0.0744	0.0909	0.0791	0.0764	0.0813	0.0730	0.0716	0.0988	0.0897	0.0867	0.0975
	VKING	0.0858	0.0836	0.0846	0.0736	0.0831	0.0743	0.0838	0.0703	0.0961	0.0898	0.0921	0.0829
	Mean	0.0977	0.0894	0.1146	0.0906	0.0637	0.0579	0.0550	0.0582	0.0730	0.1019	0.0917	0.1063
	Std. Dev.	0.0617	0.0308	0.0497	0.0840	0.0275	0.0301	0.0311	0.0330	0.0301	0.0520	0.0313	0.0549

for the performance calculation of each company. Table 3 shows the weights according to companies.

The table shows the averages and standard deviations of the weights according to companies. The relatively small standard deviations indicate that the weights do not change much according to companies. Additionally, it can be said that the criterion weights are proportionally close to each other. Considering the weight averages, C3 (Cash Ratio) has the highest level of importance with 0.1146. In the entropy weighting method, it is crucial that the weight value increases in proportion to the differences observed in the criterion values. Specifically, when all observation values are equal, the weight value becomes 0. Due to the relatively close proximity of the observation values in C6, C7, and C8, the resulting weight values are low.

Table 4 shows the financial performance rankings of companies calculated by the CP method over the years. According to the ranking averages, the most successful year was 2022 and the most unsuccessful year was 2017. No worsening or improvement in financial performance was observed in 2020 and 2021, when the COVID-19 pandemic occurred. However, financial performance indicators display a more positive graph after the pandemic. The reason for this can be stated as the increase in the sales of companies producing paper, etc., due to the increased sensitivity to hygiene.

Figure 1 shows the success rankings obtained with the CP method. It has been observed that the companies' financial success was best in 2022. The lowest performance was realized in 2017.

Table 4. Financial performance rankings calculated by the CP method.

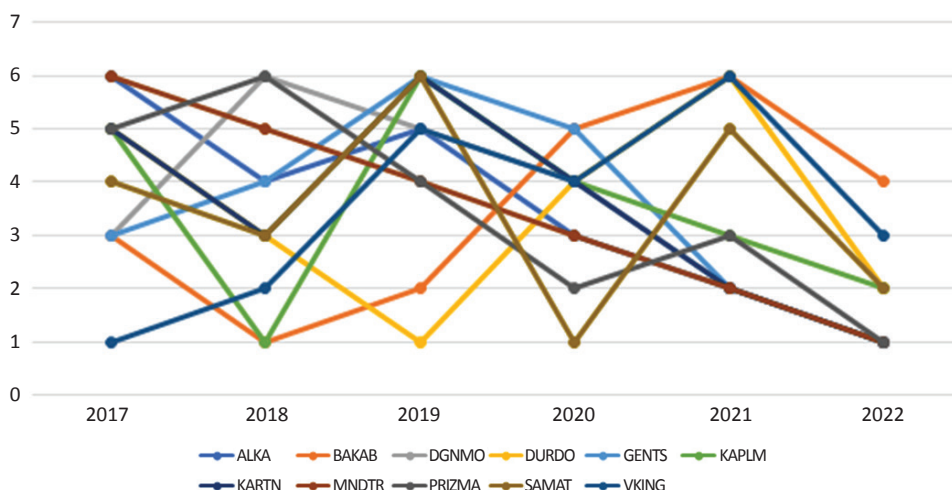| Years	2017	2018	2019	2020	2021	2022
ALKA	6	4	5	3	2	1
BAKAB	3	1	2	5	6	4
DGNMO	3	6	5	4	2	1
DURDO	5	3	1	4	6	2
GENTS	3	4	6	5	2	1
KAPLM	5	1	6	4	3	2
KARTN	5	3	6	4	2	1
MNDTR	6	5	4	3	2	1
PRIZMA	5	6	4	2	3	1
SAMAT	4	3	6	1	5	2
VKING	1	2	5	4	6	3
Mean	4.1818	3.4545	4.5455	3.5455	3.5455	1.7273

Figure 1. Financial success rankings of companies by year.

DISCUSSION

After the end of the pandemic restrictions, financial performance increased in the post-pandemic period due to the increase in sales of furniture companies and the continuation of the hygiene habits of the people, as well as the increase in earnings of paper and packaging companies. Therefore, financial performance indicators show a more positive trend after the pandemic.

There are no study results that the pandemic generally negatively affected the sectors in the BIST100 index. According to sectoral studies, the pandemic affected some sectors positively and some sectors negatively. For example, while it negatively affected the financial index and the service index, there are studies reporting that it positively affected the technology and industrial sector indices or that the research results were insignificant (Ozdemir 2020, Kartal 2022).

These results show that the threats that arise for companies in the sector may also create new opportunities. Companies can turn this situation into an advantage if these opportunities are utilized. We recommend that decision-makers in the sector consider this result.

In future studies, different sectors could be analyzed with the entropy-CP approach, and it would be interesting to compare the results by analyzing them with other MCDM methods. Additionally, it might be observed that the effects of the COVID-19 pandemic will completely disappear in the following years.

CONCLUSIONS

This study aimed to investigate the impact of the COVID-19 pandemic on financial performance in the forest products sector. For this purpose, the financial performances of 11 companies operating in the forest products sector in Turkey and registered in the BIST XKGT index in the 2017-2022 period were examined. The 12 financial ratios chosen as evaluation criteria are frequently used financial ratios in the literature.

The importance levels of financial ratios were determined by weighting them with the entropy method. The entropy method was preferred because it is an objective method that makes calculations using the decision matrix and does not require individual evaluation. In general, it was observed that the weight values were relatively close.

The CP method was used to calculate the companies' performance success. Its robust mathematical infrastructure, objective valuation, and frequent usage in financial analysis are the main reasons for choosing this method.

According to the results of the correlation analysis, it can be said that the COVID-19 pandemic generally does not affect the financial performance of forest industry sector companies. While there was an improvement in the performance of some companies in 2020 and 2021, there was a partial decline in some. During the years of the COVID-19 pandemic, no general improvement or worsening trend has been detected. However, it has been shown that the COVID-19 pandemic has negatively affected the performance of furniture enterprises in the forest products sector, mostly in the fields of operating income and productivity. The increase in the production of hygienic paper products, which emerged with the pandemic, and the increase in the production of packaging products due to the increase in transport operations can be viewed as the main reasons for this improvement. As a result, the pandemic did not impact the financial performance of companies operating in the forest products sector.

Conflicts of Interest

The authors declare no conflict of interest.

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