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Araştırma Makalesi (Research Article)

The Research on the Factors Affecting the Capital Structure of Cement Companies

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Abstract

Cement is a basic binder of concrete, which is the most consumed building material in the world after water. Therefore, cement, which is important in a wide range of areas, has gained strategic importance in recent years with the emergence of issues such as environmental sustainability, use of new and innovative technologies and energy efficiency. Cement factories operating in Türkiye carry out production according to TS EN standards harmonized with European standards. Türkiye's cement sector attracts attention with its strong investments, export-oriented strategy and ability to adapt to economic conditions. In this context, the financial soundness and sustainability of cement companies play a critical role in the future of the sector and economic stability. This study aims to examine the factors affecting the capital structure of 13 cement companies traded in Borsa İstanbul between 2014-2023 using panel data analysis. The results obtained from the study showed that the variables of current ratio and return on assets negatively affect the capital structure of cement companies, while company size, tangible assets/total assets and current assets/total assets variables positively affect the capital structure of companies. It is thought that these findings will help companies operating in the cement industry to increase their sustainability, evaluate their financial soundness and make strategic decisions.

Keywords: Cement Sector, Capital Structure, Panel Data Analysis, Financial Ratios.

JEL Codes: L16, G32, C23, M40.

Çimento Şirketlerinin Sermaye Yapısına Etki Eden Faktörlere Yönelik Bir Araştırma

Öz

Çimento, dünyada sudan sonra en çok tüketilen yapı malzemesi olan betonun, temel bir bağlayıcısıdır. Bu yüzden geniş bir yelpazede önem arz eden çimento, son yıllarda çevresel sürdürülebilirlik, yeni ve inovatif teknolojileri kullanımı ile enerji verimliliği gibi konuların öne çıkmasıyla stratejik bir öneme sahip olmuştur. Türkiye'de faaliyet gösteren çimento fabrikaları Avrupa standartları ile uyumlaştırılmış TS EN standartlarına göre üretim gerçekleştirmektedirler. Türkiye'nin çimento sektörü, güçlü yatırımları, ihracat odaklı stratejisi ve ekonomik koşullara uyum sağlama yeteneği ile dikkat çekmektedir. Bu bağlamda, çimento şirketlerinin finansal sağlamlığı ve sürdürülebilirliği, sektörün geleceği ve ekonomik istikrar açısından kritik bir rol oynamaktadır. Bu çalışma, 2014-2023 döneminde Borsa İstanbul'da işlem gören 13 çimento şirketinin sermaye yapısını etkileyen faktörleri panel veri analizi kullanarak incelemeyi amaçlamaktadır. Çalışmadan elde edilen sonuçlar, cari oran ve aktif kârlılığı değişkenlerinin çimento şirketlerinin sermaye yapısını olumsuz yönde etkilediğini, şirket büyüklüğü, maddi duran varlıklar/toplam aktifler ve dönen varlıklar/toplam aktifler değişkenlerinin ise şirketlerin sermaye yapısını olumlu etkilediğini göstermiştir. Bu bulguların çimento sektöründe faaliyet gösteren şirketlerin sürdürülebilirliklerini artırmalarına, finansal sağlamlıklarını değerlendirmelerine ve stratejik kararlar almalarına yardımcı olacağı düşünülmektedir.

Anahtar Sözcükler: Çimento Sektörü, Sermaye Yapısı, Panel Veri Analizi, Finansal Oranlar.

JEL Kodları: L16, G32, C23, M40.

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1. INTRODUCTION

Cement, as the basic binder of concrete, is the most consumed building material in the world, after water. The cement and concrete industry, which is directly related to global population growth and economic growth, is an important industrial branch serving the construction sector. In the last decade, world cement production averaged 4.1 billion tons annually. Since the beginning of the 21st century, a decrease in the population growth rate and GDP growth rate has been observed in developed countries. This decrease also indicates a decrease in cement consumption. On the other hand, total cement consumption has increased in developing countries that have accelerated infrastructure investments in the last 20 years (PwC Türkiye, 2024).

Although cement production and sales started in the world in 1878, Türkiye's introduction to the cement industry was mainly achieved in 1912 with the initiative of the private sector. The fact that it started 34 years late is due to the fact that water lime production was not sufficient and these years coincided with the collapse of the Ottoman Empire.

Cement, which is the main input of the construction industry, one of the locomotive sectors of the Turkish economy, plays a key role in industrial and infrastructure development. Türkiye has an important position in the world in cement production and consumption and accounts for approximately 2% of the global market. Türkiye's geographical location and economic dynamics are among the important factors supporting the growth of the cement industry. The cement sector is a cornerstone for the construction industry in Türkiye to continue its activities and accelerate economic development. In addition to its direct effects, contributing to employment in the construction sector, introducing a strategic product that has no substitutes to the market, and playing a critical role in making the building stock and basic infrastructures durable in Türkiye, which is located in the earthquake zone, are the main reasons why it is the cornerstone of the cement industry in Türkiye (TürkÇimento, 2024).

Türkiye, Europe's largest cement producer, is the world's largest cement exporter as of 2022. According to Turkish Statistical Institute (TÜİK) data, the total export amount of the cement sector decreased by 12% to 27.2 million tons. 18.7 million tons of the exports in question consisted of cement and 8.5 million tons of clinker. In 2022, the total exports of the cement industry increased by 22.3% on a value basis, reaching 1.5 billion dollars. With these data, Türkiye will rank second in the world in total exports in terms of tons in 2022; When we consider it in terms of value and only cement exports, it has become the world's leading exporter. The cement sector is a cornerstone for the construction industry in Türkiye to continue its activities and accelerate economic development. In addition to its direct effects, contributing to employment in the construction sector, introducing a strategic product that has no substitutes to the market, and playing a critical role in making the building stock and basic infrastructures in Türkiye, which is located in the earthquake zone, durable, are the main reasons why it is the cornerstone of the cement industry in Türkiye (TürkÇimento, 2024).

The aim of this study is to analyze the factors affecting the capital structure of cement companies and to provide information on the financial management strategies of companies operating in the cement sector. The study is important in determining which financial instruments cement companies will use to achieve their sustainable growth targets and how they will optimize their capital structures. In addition, it is thought that understanding the dynamics of cement markets and how companies will adapt to these dynamics will make significant contributions to the practices in the sector.

2. LITERATURE REVIEW

Proença et al. (2014) investigated the factors affecting the capital structure of SMEs in Portugal, and data on 12,857 SMEs were obtained from the Amadeus database in the 2007-2010 period. According to the research results, liquidity, asset structure and profitability variables are the variables that have the most impact on the capital structure decisions of enterprises. According to the negative

relationship between profitability and borrowing rates, it shows that SMEs in Portugal first prefer internal resources and then turn to external resources in order to avoid risk to finance their investments, and this result supports the financing hierarchy theory.

Abdioğlu and Deniz (2015) investigated the factors affecting the capital structure of 188 companies operating in different sectors within the manufacturing industry traded on BIST in the five-year period after the 2008 financial crisis. In the study, the dependent variable of capital structure is represented by leverage ratio, while the independent variables are represented by asset structure, ROA, size, liquidity ratio, growth opportunity, operating leverage, fluctuation in sales and non-debt tax shield. As a result of the analysis, a significant and negative relationship was detected between ROA, acid test ratio, asset structure and financial leverage, while a significant and positive relationship was found with fluctuations in sales. On the other hand, the study did not find a statistically significant relationship between size, operating leverage, growth opportunity, non-debt tax shield and financial leverage.

Mohammad and Gharaibeh (2015) used financial data between 2009 and 2013 to determine the factors affecting the capital structure of 215 companies operating in Kuwait. In the study, where the financial leverage ratio represents the capital structure, firm age, firm size, liquidity, ROE, asset structure and ownership structure were also used as independent variables. As a result of the study, a positive and significant relationship was found between firm age, firm size, liquidity and asset structure and financial leverage ratio.

Arsov and Naumoski (2016) aimed to determine the factors affecting the capital structures of 173 companies operating in Croatia, Serbia and Macedonia between 2008 and 2013 and listed on the stock exchange. In the study, firm size, asset structure, asset profitability and ownership structure were determined as independent variables. The results showed that there is a positive and significant relationship between total debt ratio and asset structure and firm size. There was no negative and significant relationship with return on assets and no significant relationship with ownership structure.

Güner (2016) aimed to determine the factors affecting the capital structures of 131 publicly traded companies operating in Türkiye between 2008 and 2014. While the capital structure was measured by the financial leverage ratio in the study, firm size, growth opportunity, non dept tax shield, profitability and liquidity ratio were determined as the factors affecting the capital structure. As a result of the analysis, a significant and negative relationship was revealed between financial leverage and firm size, growth opportunity, profitability and liquidity ratio.

In the study conducted by Pratheepan and Weerakoon Banda (2016), data between 2003 and 2012 of 55 companies whose shares were traded on the Sri Lanka Colombo Stock Exchange were analyzed using the panel data method. While the capital structure, which is the dependent variable in the study, is represented by the financial leverage ratio, the independent variables are firm size, growth opportunity, non dept tax shield and asset structure. As a result of the analysis, a significant and positive relationship was detected between firm size and growth opportunity and leverage ratio, while no significant relationship was detected with asset structure and non-debt tax shield.

Matias and Serrasqueiro (2017) investigated business-specific factors affecting the capital structure of SMEs in different regions of Portugal. Between 2007 and 2011, 11,016 SMEs were analyzed using the variables of profitability, business size, asset structure, business age and growth opportunities. Dependent variables were included in the analysis as total debt ratio, medium and long-term debt ratio and short-term debt ratio. According to the research results, while size is an important variable for SMEs, the negative relationship between profitability and debt ratios supports the financing hierarchy theory. Profitability and asset structure were determined to be the best variables explaining total debt, and a positive relationship was found between growth opportunities and debt ratios.

Daskalakis et al. (2017) examined 17,317 SMEs between 2004 and 2014 with the Generalized Method of Moments (GMM) in their study investigating the relative importance of business-specific capital structure determinants and macroeconomic variables of SMEs in Greece when

macroeconomic conditions change. While there is a positive relationship between credit expansion and leverage ratios among macroeconomic variables, no significant relationship was found between inflation and leverage, a weaker and negative relationship with interest rates before the crisis, and a strong positive relationship during the crisis. A non-significant or non-constant relationship was found between all internal variables except asset structure and cash-rich businesses.

Versmissen and Zietz (2017) examined real estate investment trusts operating in the USA between 1993 and 2013 and investigated whether there was a target debt ratio for their capital structures using the generalized method of moments. Within the scope of the research, the effects of firm size, growth opportunities, profitability, tangible asset structure, stock market performance, firm structure and median debt ratio on capital structure were examined. Consistent with the balancing theory, a positive relationship has been determined between firm size, fixed asset ratio and financial leverage ratio.

Topaloğlu (2018) used panel data analysis methods in his study to determine the factors affecting the capital structures of companies operating in Türkiye between 2007 and 2015. As a result of the analysis, a significant and negative relationship was determined between liquidity ratio, asset structure and asset return ratio and financial leverage, while a positive relationship was determined with firm size.

Anh and Phuong (2018) examined the data of 642 companies operating in Vietnam for the period 2009-2015 using the panel data analysis method. While the leverage ratio was the dependent variable representing the capital structure in the study, foreign, corporate and public ownership structure, capital share of the largest shareholder, firm age and PD/DD variables were used as independent variables. As a result, no statistical effect of foreign, corporate or public ownership on the capital structure could be determined.

Şahin (2020) analyzed the determinants of the capital structure of energy companies traded on BIST between 2009-2019. The results reveal that interest, exchange rate, industrial production index and tangible assets have a significant impact on the capital structure.

Yücedağ Erdinç and Sayılgan (2020) included 134 businesses operating in Borsa İstanbul between 2009 and 2017 in order to comparatively analyze the relationship between the factors affecting the capital structure of small and medium-sized manufacturing sector enterprises registered in Borsa İstanbul and the capital structure decisions of the enterprises. They are grouped according to their asset size. According to the results obtained from the research, it was determined that the liquidity variable was the most contributing variable among the business-specific variables, and the exchange rate was the most contributing variable among the macroeconomic variables.

According to the results of this study, in which Kempa et al. (2021) analyzed the factors affecting the capital structure of companies operating in the field of renewable and non-renewable energy, it is stated that the developed banking sector and environmental policies are effective on the capital structure.

Özer et al. (2022) investigated the impact of firm-specific and macroeconomic factors on capital structure in their study. 223 publicly traded companies operating in the BIST technology, industrial and services sector between 1987 and 2017 were included in the scope of the study. According to the findings, the capital structures of companies are affected by factors such as the company's liquidity, asset structure, profitability, size, market interest rates and stock market development level.

Ateşoğlu Çoşkun and Nakit (2022) used the 2012-2017 period data of companies operating in different sectors in Borsa İstanbul in their study where they examined the effects of ownership structure on capital structure. According to panel data analysis results, foreign ownership reduces financial leverage. Companies with high institutional ownership or high free float use more leverage.

Çelik and Hepşen (2023) examined the data for the period 2013-2022 using the panel data analysis method in their study in which they aimed to determine the factors affecting the capital structures of real estate investment trusts operating in Türkiye. While the financial leverage ratio was used as the

dependent variable in the study, the independent variables were classified as firm-specific, financial market-specific and macroeconomic factors. According to the results of the research, it has been revealed that there is not only a single theory explaining the factors affecting the capital structures of companies, and that different theories can be evaluated together according to company-specific factors, developments in financial markets and macroeconomic conditions.

Doğan and Erdoğan (2024) aimed to examine the factors affecting the capital structure of 26 energy companies traded in Borsa İstanbul. In the study, data of energy companies for the period 2019-2023 were analyzed using panel data analysis methods. The results obtained from the study showed that the variables current ratio, return on assets and the ratio of tangible assets to total assets negatively affect the capital structure of energy companies, while the profit/sales ratio before interest and tax affects the capital structure of companies positively.

In addition, the dynamics of Türkiye's cement industry and the unique characteristics of cement companies traded in Borsa İstanbul are important elements that distinguish this study from other similar studies. In this study, the dynamics specific to Türkiye's cement sector will be discussed in detail.

Finally, the data set and analysis methods used in this study also make a unique contribution. The data set, covering the years 2014-2023, will allow strategic inferences to be made for possible future crisis situations, as it includes the pandemic period and its aftermath. In this context, this study will provide a better understanding of the factors affecting the capital structure of cement companies and provide a new perspective to the literature.

3. DATASET and METHOD

This study, which analyzes the capital structure of cement companies traded in Borsa İstanbul (BIST), investigates the data of 13 companies in the sector in the 2014-2023 period using the panel data analysis method. Information about the variables used in the study is presented in Table 1.

Table 1. Variables Used in the Study

Variables	Calculation
LVR	Total Liabilities/Total Assets
SIZE	Logarithm of Total Assets
CUR	Current Assets / Short-Term Liabilities
ROA	Net Profit/Total Assets
TFA	Tangible Assets/Total Assets
CAT	Current Assets/Total Assets

In the study, panel data analysis was used to analyze the factors affecting the capital structure of cement companies. Model number 1 below was used to determine the relationship between variables in the relevant analyses.

$$LVR_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 CUR_{it} + \beta_3 ROA_{it} + \beta_4 TFA_{it} + \beta_5 CAT_{it} + \varepsilon_{it} + \mu_{it} (1)$$

The subscript "i" in Equation 1 refers to the cement companies used in the study as 1,2,3,….26, and the subscript "t" refers to the period range of the study as 2014-2023. LVR shows the change in the capital structure of cement company "i" at time "t". "β_0" is the fixed parameter of the model, SIZE is the company size, CUR is the current ratio of the companies, ROA is the return on assets of the companies, TFA is the tangible assets/total assets ratio of the companies and finally CAT is the current assets/total assets of the companies. represents the rate. In addition, "ε_{it}" in the model refers to the stochastic error term and finally "μ_{it}" refers to the error component occurring according to unit or time.

3.1. Findings

In this part of the study, the analysis results obtained using panel data models are presented. Descriptive statistics of the variables used in the study are given in Table 2.

Table 2. Descriptive Statistics

Variable	Obs.	Mean	Median	Max	Min.	Std. Dev.	Skew.	Kurt.
LVR	130	42,94	38,31	53,72	9,27	21,08	0,66	2,75
SIZE	130	9,06	9,12	10,58	7,73	0,61	-0,06	2,89
CUR	130	1,71	1,44	4,86	0,15	1,04	1,03	3,41
ROA	130	0,08	0,07	0,40	0,00	0,08	1,18	4,44
TFA	130	39,97	38,56	74,15	6,05	17,05	0,09	2,11
CAT	130	0,42	0,39	0,88	0,11	0,18	0,63	2,71

Table 3 shows the correlation table between the dependent and independent variables used in the study. According to the results, there is a negative relationship between the LVR variable and the CUR, ROA, TFA and CAT variables. In other words, the fact that the debts of cement companies are increasing means that the companies' current ratio, return on equity, tangible asset level and current asset level decrease. When the results in Table 3 are examined, it is seen that the highest correlation between the variables is -69% between LVR and CUR.

Table 3. Correlation Analysis

	LVR	SIZE	CUR	ROA	TFA	CAT
LVR	1,0000					
SIZE	0,0534	1,0000				
CUR	-0,6847	-0,1584	1,0000			
ROA	-0,4930	0,3327	0,3238	1,0000		
TFA	-0,0999	-0,2231	0,4594	0,1766	1.0000	
CAT	0,3342	0.1156	-0,3614	-0,3882	-0,6791	1.0000

Unit root tests are critical to determine whether data are stationary in time series analysis. Stationarity refers to the situation where the statistical properties of a time series, such as mean and variance, do not change over time. In non-stationary series, these statistical properties change over time, and this may negatively affect the accuracy of analyzes and predictions (Gujarati, 2003). Additionally, spurious regression problems arise when non-stationary time series are subjected to regression analysis; these problems can lead to misleading results (Granger & Newbold, 1974: 116). Therefore, unit root tests are necessary to determine whether the series are stationary or not.

Additionally, unit root tests are also used to analyze long-run equilibria of time series data and their responses to economic shocks. While stationary series tend to return to their mean value in the long run, non-stationary series may deviate from their long-term trends; this is important for understanding the long-term effects of economic policies and shocks (Nelson & Plosser, 1982: 159). Therefore, unit root tests are a critical tool to obtain accurate and reliable results in time series analysis. In Table 4, the unit root test of the variables was investigated with the Philips-Perron unit root test (Philips & Perron, 1988: 340). According to the results in Table 4, it is seen that all variables are stationary at first difference.

Table 4. Unit Root Tests (Philips-Perron)

	At First Difference						
		LVR	SIZE	CUR	ROA	TFA	CAT
With Constant	t-Statistic	0.7912	0.7053	0.0674	0.9277	0.0444	0.2428
	Prob.	***0.0000*** ***	***0.0000*** ***	***0.0000*** ***	***0.0000*** ***	***0.0000*** ***	***0.0001*** ***
With Constant & Trend	t-Statistic	0.7787	0.8899	0.0108	0.9979	0.0483	0.3071
	Prob.	***0.0000*** ***	***0.0002*** ***	***0.0000*** ***	***0.0000*** ***	***0.0000*** ***	***0.0010*** ***
Without Constant & Trend	t-Statistic	0.1457	0.7671	0.0113	0.2925	0.0035	0.0564
	Prob.	***0.0009*** ***	***0.0004*** ***	***0.0000*** ***	***0.0000*** ***	***0.0000*** ***	***0.0030*** ***

In the study, the Robust Least Squares estimator, which is a method resistant to the cross-section dependence and auto-correlation problems identified as a result of assumption tests, was used (Koç & Akdeniz, 2008: 77; Ece, 2018: 315; Kesebir & Yıldırım, 2019: 1585). Within the scope of the study, 2014-2023 cement company data were analyzed and the results are presented in Table 5 below.

In Table 5, the factors affecting the capital structure of cement companies are examined using the Robust Least Squares method. While applying Robust Least Squares analysis, Huber (1973)'s M-Estimation method were used. Outliers were detected only in the independent variables in the study. According to the results, there is a negative relationship between LVR and CUR and ROA variables, and a positive and significant relationship between SIZE, TFA and CAT variables ($p<0.05$). In other words, increasing the current ratio and return on asset ratio of companies in the energy sector reduces the use of liabilities in assets. On the other hand, increasing company size and the ratio of current assets within total assets increases the use of liabilities. Finally, 61.49% of the capital structure of companies operating in the cement sector is explained by the independent variables used in the model.

Table 5. Robust Least Squares Estimator Results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
SIZE	3740722,00	0.676958	5525781,00	0.0000
CUR	-1542249,00	1107495,00	-1392556,00	0.0000
ROA	-5774141,00	1485910,00	-3885929,00	0.0001
TFA	0.631168	0.079255	7963780,00	0.0000
CAT	3284000,00	7898268,00	4157874,00	0.0000
Robust Statistics				
R-squared	0.614944	Adjusted R-squared		0.602622
Rw-squared	0.743874	Adjust Rw-squared		0.743874
Akaike info criterion	1125639,00	Schwarz criterion		1303191,00
Deviance	15014.06	Scale		1190239,00
Rn-squared statistic	2131948,00	Prob(Rn-squared stat.)		0.000000

5. CONCLUSION

Analysis of capital structures of cement companies is very important to understand the financial soundness and sustainability of companies. On the other hand, determining the factors affecting the capital structures of cement companies will guide both companies and policy makers in making strategic decisions. This study, which aims to analyze the factors affecting the capital structure of cement companies, was carried out using the data of 13 cement companies operating in Borsa İstanbul between 2014 and 2023. In the study, the factors affecting the capital structure of the cement sector were examined in detail.

According to the results obtained from the study, it was determined that the capital structure of cement companies was negatively affected by the current ratio and asset profitability ratio variables, while the company size, tangible assets/total assets and current assets/total assets variables were positively affected. The current ratio, which is one of the important factors that determine the capital structure of companies, expresses the liquidity situation of companies and affects their borrowing tendencies. In order to manage liquidity effectively, it is important for cement companies to maintain a certain current ratio level. In this regard, regulators can help companies manage their short-term debt by introducing liquidity standards. Additionally, companies can be encouraged to increase financial stability by providing training and consultancy services on liquidity management.

Return on assets ratio is another important factor that shows how effectively companies use their assets. Companies with high return on assets generally need less debt. Therefore, cement companies should be encouraged to adopt strategies that increase their profitability. They can be supported to invest in innovative and efficiency-enhancing projects through tax incentives and subsidies. At the same time, increasing government support for R&D activities can enable companies to remain competitive and profitable in the long term.

In order to control the financial risks that high debt brings, companies may need to monitor their borrowing policies more strictly under the supervision of regulatory institutions. In this context, it may be considered to determine upper limits on borrowing rates and to introduce additional regulations in case these limits are exceeded. Policy recommendations and strategies should be developed by taking into account the financial risks as well as the opportunities brought by this situation. It is of great importance for the long-term financial soundness of the cement industry that regulatory institutions, investors and company managers make conscious and sustainable decisions by taking these dynamics into account.

The tangible assets/total assets ratio shows how efficiently companies use their assets. Companies with a high ratio of tangible assets can reduce their need for debt by using their assets effectively. In this regard, tax advantages that encourage companies' investments in tangible assets can be provided. At the same time, the development of asset management strategies can be supported by providing training programs and consultancy services so that companies can use their assets more efficiently.

As a result, cement companies need to take strategic steps in liquidity management, increasing profitability, operational efficiency and asset management in order to improve their capital structures. Investors, managers and other relevant stakeholders can make more informed and sustainable decisions by taking these financial indicators into account. These steps are of great importance for the financial soundness and sustainability of the cement industry. When the results obtained from the study were compared with the results of similar studies in the literature, Delcoure (2007), Thippayana (2014) and Alipour et al. (2017) appears to be similar to the results obtained from their study. This result can be expressed as the current ratio of companies has a greater impact on the capital structure during the pandemic period.

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