J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

Impact of Capital Structure on Financial Performance: A Comparative Panel Data Analysis of Cement and Steel Industries in India

Urwashi Soni
[1]Research Scholar, Department of Business Administration, Sambalpur University,
Urwashisoni101@gmail.com

Dr. Biswajit Satpathy
[2]Professor (Retd.), Department. of Business Administration, Sambalpur University

Abstract

Capital structure remains a key determinant of firm performance, particularly in capital-intensive sectors. This study investigates the relationship between capital structure and financial performance in the cement and steel industries in India using panel data regression techniques. The analysis is based on a balanced panel of 30 listed firms (15 cement and 15 steel companies) over the period 2015–2024. Capital structure is represented by debt-to-assets, debt-to-equity, and equity-to-assets ratios, while financial performance is measured using return on assets, return on equity, net profit margin, and current ratio. Firm size is taken as a control variable.

Empirical estimation is carried out using pooled OLS, fixed effects, and random effects models. Model selection is based on standard specification tests and robustness ensured through diagnostic procedures. The results reveal that capital structure represent a statistically significant impact on firms' financial performance; however, the effect is not uniform across industries. In the cement industry, debt, particularly the debt-to-equity ratio has a consistently negative association with performance, indicating the adverse effects of excessive debt. In contrast, the steel industry shows a strong positive relationship between equity financing and performance, suggesting the importance of financial flexibility in a more volatile environment.

The findings highlight the industry-specific nature of financing decisions and contribute to the literature by providing comparative evidence from two major infrastructure sectors in India.

Keywords
Capital Structure; Financial Performance; Panel Data Regression; Cement Industry; Steel Industry.

1. Introduction

Capital structure decisions are among the most critical financial choices faced by firms, as they determine the mix of debt and equity used to finance operations and investments. These decisions directly influence a firm's profitability, liquidity, and overall financial stability. An appropriate capital structure can enhance firm performance by reducing the cost of capital and improving operational efficiency, whereas excessive reliance on debt may increase financial risk and reduce profitability. Therefore, examining the relationship between capital structure and

financial performance has remained a central issue in corporate finance research. Theoretical perspectives such as the Modigliani and Miller propositions, Trade-off Theory, Pecking Order Theory, and Agency Theory provide different explanations regarding how debt affects firm value and profitability. Despite extensive empirical research, the nature and magnitude of this relationship remain context-specific and vary across industries and economic environments.

In emerging economies like India, capital structure decisions demonstrate greater importance due to evolving financial markets, regulatory changes, limited access to low-cost capital, and sector-specific investment requirements. Industrial sectors that are highly capital intensive tend to depend more on external financing, making the relationship between leverage and financial performance more pronounced. However, this relationship is not uniform across industries, as it is shaped by operational characteristics, market conditions, and risk exposure.

The Indian industrial sector, particularly the cement and steel industries, are among the most significant contributors to India's infrastructural development, economic growth, and industrial expansion. Both sectors require substantial capital investment and operate under cyclical demand conditions, yet they differ significantly in terms of market conditions, cost structures, and financing patterns. Therefore, a comparative examination of these two industries provides a meaningful framework to understand how capital structure affects financial performance under varying industrial conditions. The present study aims to analyse and compare the impact of capital structure on the financial performance of cement and steel companies in India, thereby contributing to sector-specific corporate finance literature. Understanding the impact of capital structure on financial performance in these sectors is particularly relevant for managers, investors, and policymakers. An optimal capital structure can strengthen profitability and liquidity positions, while inappropriate leverage may weaken financial stability and operational efficiency. Therefore, analysing how debt and equity components affect firm performance can provide valuable insights into financing strategies suitable for each industry.

The contribution of this study lies in its comparative analysis of capital structure and financial performance in the cement and steel industries within the Indian context. Unlike prior studies focusing on single sectors or aggregate samples, this study highlights industry-specific differences in financing behaviour and performance outcomes. The findings provide insights that support corporate financial decision-making and contribute to a better understanding of sectoral variations in capital structure.

2. Literature Review

The existing literature on capital structure and financial performance can be broadly classified into theoretical foundations, international empirical evidence, and Indian sector-specific studies. This classification helps in understanding the evolution of thought and identifying the research gap for a comparative analysis of the cement and steel industries in India.

2.1. Theoretical foundations of capital structure

The theoretical framework of capital structure originates from the seminal work of (Modigliani et al., 1958) who argued that under perfect market condition's capital structure is irrelevant to firm value and performance. This proposition was later refined by (Modigliani & Miller,1963), who incorporated corporate taxation and demonstrated that debt financing creates tax advantages, thereby making capital structure relevant in real-world situations. Further advancement was made by (Jensen & Meckling, 1976), (Jensen, 1986) through agency cost theory,

which explained that excessive reliance on debt increases conflicts between managers and shareholders, potentially reducing firm performance. Similarly, (Myers & Majiuf, 1984) developed the pecking order theory, suggesting that firms prefer internal financing, followed by debt and equity, due to information asymmetry and financing costs. These theories collectively provide the conceptual basis for analysing the relationship between leverage and financial performance.

2.2. International empirical evidence

Empirical studies conducted across countries present mixed results regarding the leverage–performance relationship. (Abor, 2005) found that short-term debt positively influences profitability while long-term debt negatively affects performance. Studies in European and emerging economies, such as (Vătavu, 2015) and (H. T. Nguyen & Nguyen, 2020), reported that higher leverage often reduces profitability. Similarly, (D. T. Nguyen, 2020) and (Ullah et al., 2020) observed negative effects of capital structure on firm performance in Vietnam and Pakistan, respectively. Research in Egypt by (Said, 2025) and in South Africa by (Dsouza et al., 2025) further highlighted the complexity of this relationship, showing mixed and non-linear effects of leverage on performance. Governance and risk-related perspectives further suggest that financial structure decisions are influenced by institutional and operational factors. For instance, (Kijkasiwat et al., 2022) found that financial leverage mediates the relationship between corporate governance and firm performance, while (Habibniya et al., 2022) demonstrated that leverage significantly influences profitability in the telecom sector. (Raj Chhetri, 2021) found that credit risk negatively affects bank performance, reinforcing the importance of financial stability. Furthermore, (Harris & Roark, 2019) indicated that firms with weaker cash flows rely more heavily on debt under risk conditions. These studies collectively indicate that capital structure decisions are context-dependent and influenced by macroeconomic and institutional factors.

Comparative international evidence further strengthens the argument that capital structure decisions vary across industries. (Mohammad & Bujang, 2020) examined Malaysian construction, finance, and plantation sectors and highlighted that industry characteristics significantly shape financing strategies and performance outcomes. (Lamichhane & Dhungel, 2024) who analysed Nepalese manufacturing firms and reported that debt-to-equity positively influences financial performance, while excessive use of long-term debt and debt-to-assets negatively affects return on capital and net profit margin. The study emphasizes the need for maintaining an optimal capital structure by controlling long-term debt utilization.

2.3. Evidence from Indian and manufacturing sectors

In the Indian context, several studies have examined the determinants and implications of capital structure. (Handoo & Sharma, 2014) identified profitability, size, asset tangibility, and tax considerations as significant determinants of leverage decisions. Sector-focused research has provided more specific insights. For example, (Babbar,2024) reported a negative relationship between debt–equity ratio and profitability in the Indian cement industry, while (Dakua, 2019) highlighted profitability, liquidity, and firm size as important determinants of leverage in the steel sector. (Pal, 2022) found that both short- and long-term debt negatively affect firm performance across manufacturing sectors, including cement and steel, although interest coverage ratio and non-debt tax shields improve profitability.

Other Indian studies also present mixed findings. (Singh & Bagga, 2019) observed a positive relationship between capital structure and profitability among listed firms, whereas (Farhan et

al., 2020) reported a negative effect of debt on performance in the service sector. (Tripathi, 2023) demonstrated that firm age and size significantly moderate the leverage–performance relationship. In addition, (Sharma, 2025) found that leverage generally reduces performance in Indian manufacturing firms, although favourable economic conditions and CSR disclosure mitigate this effect.

2.4. Sectoral and methodological contributions

Several studies contribute by focusing on specific industries and methodological approaches. (Ogbulu et al., 2018) reported mixed effects of leverage on performance in cement firms, while (Myšková & Hájek, 2017) emphasized the importance of combining financial ratios with qualitative disclosures for performance assessment. (Demirel & Eskin, 2017) linked environmental factors with financial structure decisions, and (Prekazi et al., 2023) confirmed a strong association between capital structure and firm performance in commercial firms. These contributions highlight that capital structure decisions vary across industries due to operational and structural differences.

Overall, the reviewed literature indicates that capital structure plays an important role in determining financial performance, but its impact varies across sectors, firm characteristics, governance quality, and macroeconomic conditions. While numerous studies have examined capital structure in manufacturing industries and separately in cement and steel sectors, limited research has undertaken a comparative analysis between these two industries in India. Therefore, a systematic comparative study of capital structure and financial performance in the cement and steel industries is necessary to provide sector-specific insights and fill the existing research gap.

3. Research Methodology

3.1 Research Design

The present study adopts a comparative panel data approach to examine the impact of capital structure on financial performance in the cement and steel industries in India. Panel data methodology is appropriate as it combines cross-sectional (firm-level) and time-series (year-wise) dimensions, thereby increasing degrees of freedom, reducing multicollinearity among variables, and controlling for unobserved heterogeneity across firms.

The sample consists of 30 listed companies, including 15 firms from the cement industry and 15 firms from the steel industry in India, resulting in a balanced panel of 300 firm-year observations over the study period. The analysis is based on firm-year panel data. The data include several extreme observations, which are common in financial ratio measures. Instead of removing the dataset, all variables are winsorized at the 1st and 99th percentiles (2% level) to mitigate the influence of extreme values while retaining the full sample size (Habibniya et al., 2022) .

To determine the appropriate panel data model, specification tests such as the F-test, Breusch–Pagan LM test, and Hausman test are employed. By employing panel data regression techniques using the STATA software package, over a ten-year period, the study evaluates how different measures of debt influence financial performance. The comparative approach further enables the identification of whether the impact of capital structure is consistent across both industries or varies due to industry-specific characteristics.

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

3.2 Data Source and Sample Selection

The study relies on secondary data collected from the EMIS database and the annual reports of the selected companies. The study covers a period of ten years from 2015 to 2024, enabling the analysis of both short-term and long-term trends in capital structure and financial performance. Firms are selected based on data availability, continuity of operations, and completeness of financial information over the study period. Only those firms with consistent reporting across all ten years are included to ensure the reliability and robustness of panel estimations.

3.3 Variables of the Study

This study aims to analyse and compare the impact of capital structure on the financial performance of selected cement and steel industries in India using firm–year panel data. In this study, capital structure variables are treated as independent variables, while financial performance indicators are considered dependent variables. Firm size is included as a control variable and is measured as the natural logarithm of total assets, which helps to reduce scale variability and control for structural differences among firms.

Category	Variables	Ratio	Description
Independent Variable	Debt-to-Asset Ratio	Total Debt/Total Asset	Proportion of assets financed through debt
	Debt-to-Equity Ratio	Total Debt/Total Equity	Proportion of debt relative to shareholders' equity
	Equity-to-Asset Ratio	Total Equity/Total Asset	Proportion of assets financed through equity
Dependent Variable	Return on Assets	Net Profit/Total Asset	Measures asset efficiency.
	Return on Equity	Net Profit / Shareholder's Equity	Reflects return to investors.
	Net Profit Margin	Net Profit/Sales	Indicates overall profitability after all expenses
	Current Ratio	Current Assets / Current Liabilities	Indicates financial liquidity.
Control Variable	Firm Size	Log of Total Assets	Controls size effect.

Table 1: Variable of the study

The selection of variables is supported by prior empirical studies. Capital structure variables such as debt–equity ratio, debt–asset ratio, and equity–asset ratio have been widely used in studies including (Dsouza et al., 2025), (Khan & Qasem, 2024), and (Nguyen et al., 2023), (Alalade et. al., 2021).Financial performance indicators such as return on assets, return on equity, net profit margin, and current ratio are commonly employed measures as seen in (Ahmed et al., 2023),(Kartika et al., 2023) and (Sike et al., 2023) In addition, firm size is included as a control variable, consistent with studies such as (Khan & Qasem, 2024) and (Nguyen et al., 2023).

3.4 Hypothesis

In order to examine impact of capital structure on financial performance, the study formulates the following hypotheses based on the selected variables.

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

Cement Industry

- H_{01} -Capital structure has no significant impact on ROA in cement industry
- H_{11} - Capital structure has a significant impact on ROA in cement industry
- H_{02} - Capital structure has no significant impact on ROE in cement industry
- H_{12} - Capital structure has a significant impact on ROE in cement industry
- H_{03} - Capital structure has no significant impact on NPM in cement industry
- H_{13} - Capital structure has a significant impact on NPM in cement industry
- H_{04} - Capital structure has no significant impact on CR in cement industry
- H_{14} - Capital structure has a significant impact on CR in cement industry

Steel Industry

- H_{01} -Capital structure has no significant impact on ROA in steel industry
- H_{11} - Capital structure has a significant impact on ROA in steel industry
- H_{02} - Capital structure has no significant impact on ROE in steel industry
- H_{12} - Capital structure has a significant impact on ROE in steel industry
- H_{03} - Capital structure has no significant impact on NPM in steel industry
- H_{13} - Capital structure has a significant impact on NPM in steel industry
- H_{04} - Capital structure has no significant impact on CR in steel industry
- H_{14} - Capital structure has a significant impact on CR in steel industry

3.5 Research Model

To test our hypothesis, the following panel model was adopted.

Financial Performance=f (Capital Structure, Control Variables)

$$FP_{it} = \alpha + \beta_1 DA_{it} + \beta_2 DE_{it} + \beta_3 EA_{it} + \beta_4 \text{Firm Size}_{it} + \varepsilon_{it}$$

Where:

- = firm
- = time period
- FP_{it}= financial performance indicators (ROA, ROE, NPM, CR)
- ε_{it} = error term

Separate models were estimated for each financial performance variable and for each industry to enable comparative analysis.

3.6 Estimation Technique and Model Selection

The study employs three panel estimation techniques: pooled ordinary least squares (OLS), fixed effects (FE), and random effects (RE) models. To determine the most appropriate model, a series of specification tests are conducted.

The F-test is used to assess the presence of fixed effects, while the Breusch–Pagan Lagrange Multiplier (LM) test evaluates the suitability of the random effects model over pooled OLS. The Hausman test is applied to select between fixed and random effects models based on estimator consistency and efficiency.

3.7 Diagnostic Tests

To ensure the reliability and validity of the regression results, several diagnostic tests are conducted using the STATA software package. Multicollinearity is examined using the Variance

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

Inflation Factor (VIF), where values below the threshold (VIF < 10) indicate no serious multicollinearity issues (Gujarati & Porter, 2009).

Serial correlation is tested using the Wooldridge test for panel data (Wooldridge, 2002). The null hypothesis states no serial correlation in the panel model regression, while the alternative hypothesis states the presence of serial correlation in the panel model regression.

Heteroskedasticity is assessed using the Breusch–Pagan test for random effects models (Breusch & Pagan, 1979), modified Wald test for fixed effects models (Wooldridge, 2013) and White test (White, H. ,1980) for OLS. If the presence of heteroskedasticity or serial correlation is detected, appropriate corrective measures, such as the use of clustered standard errors, are applied to ensure reliable statistical inference (Arellano, 1987); (Wooldridge, 2012).

3.8 Flow of Analysis

The sequence of analytical steps adopted in the study is presented through a flowchart, illustrating the progression from data collection and processing to descriptive analysis, efficiency evaluation, relationship analysis, regression modelling, diagnostic testing, and final interpretation.

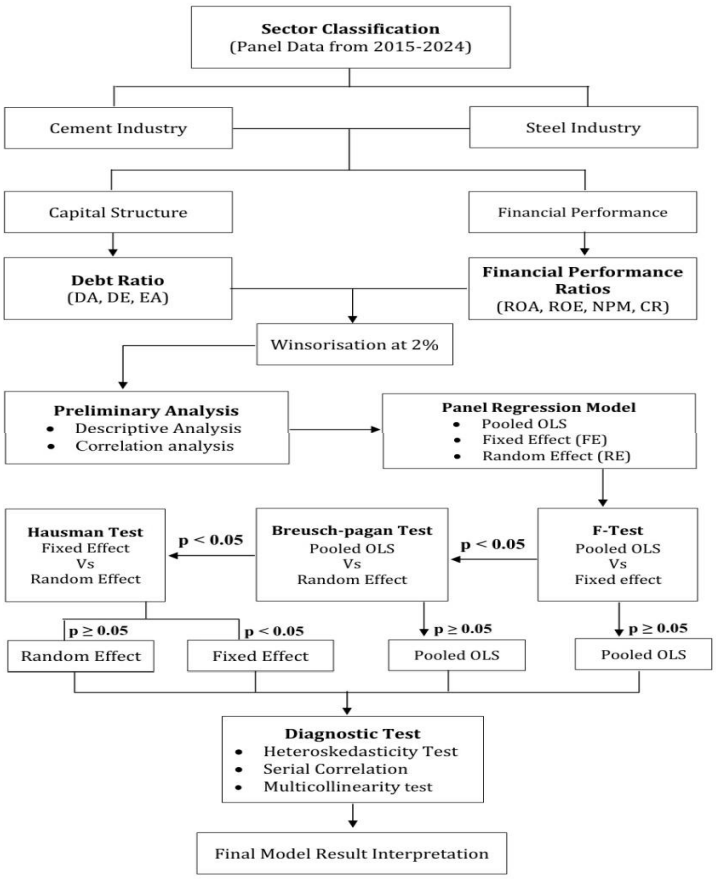


Figure: Flow of Analysis
Source-Compiled by the Author

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

4. Results and Discussion

4.1 Cement Industry

4.1.1. Descriptive Statistics of Cement Industry

Variable	Obs.	Mean	Std. Dev.	Min	Max
DA	150	0.26	0.14	0.00	0.50
DE	150	0.65	0.54	0.00	2.14
EA	150	0.56	0.22	0.23	1.30
ROA	150	0.05	0.03	-0.01	0.13
ROE	150	0.09	0.06	-0.03	0.23
NPM	150	0.07	0.05	-0.01	0.17
CR	150	1.09	0.43	0.42	2.30
Firm Size	150	3.87	0.49	2.98	4.91

Table 1- Descriptive statistics of the variables
Source-Compiled by the Author

Table 1 presents the descriptive statistics of the variables for the cement industry. The average debt-to-assets ratio (DA) is 0.26, which shows that firms rely moderately on debt for financing their assets. The debt-to-equity ratio (DE) has a mean value of 0.65, but with relatively high variation, indicating that firms differ considerably in their financing choices. The equity-to-assets ratio (EA) suggests that a significant portion of assets is financed through equity, reflecting a balanced capital structure overall. With respect to financial performance, the mean return on assets (ROA) is 0.05, while return on equity (ROE) and net profit margin (NPM) are 0.09 and 0.07, respectively. The negative minimum values for these variables indicate that some firms faced losses during certain periods, although the overall performance remains positive on average. The current ratio (CR), with an average of 1.09, indicates that firms generally maintain sufficient liquidity to meet short-term obligations, though not at a very high level. Firm size shows moderate variation, suggesting the presence of both smaller and larger firms in the sample. Overall, the data reflects moderate use of debt, stable profitability, and reasonable variation across firms, which provides a suitable base for further analysis.

4.1.2. Correlation Analysis of Cement Industry

	DA	DE	EA	ROA	ROE	NPM	CR	Firm Size
DA	1							
DE	0.9088	1						
EA	-0.7360	-0.7605	1					
ROA	-0.4066	-0.4826	0.4239	1				
ROE	-0.0808	-0.1778	0.1797	0.8990	1			
NPM	-0.5123	-0.5685	0.4575	0.8494	0.6973	1		
CR	-0.3519	-0.4243	0.3870	0.3302	0.1789	0.3261	1	
Firm Size	-0.3036	-0.2646	0.0695	-0.1266	-0.2733	0.2640	0.0523	1

Table 2- Correlation Analysis of Cement Industry
Source-STATA

Pearson correlation coefficients are computed in order to identify the strength and the direction of the relationship between capital structure and financial performance in the study. The findings (Table-2) indicate that the debt-related variables, namely DA and DE, are negatively associated with financial performance. Specifically, DA shows a moderate negative correlation with ROA

(-0.407) and NPM (-0.512), while its relationship with ROE is relatively weak (0.081). Similarly, DE is negatively correlated with ROA (-0.483) and NPM (-0.569), with a weaker negative association observed with ROE (-0.178). These results suggest that higher debt is generally linked with lower profitability in the cement industry. In contrast, the EA show a positive relationship with financial performance indicators. EA is positively correlated with ROA (0.424), ROE (0.180), and NPM (0.458), indicating that firms with a higher proportion of equity financing tend to achieve better profitability. Overall, the correlation results suggest that greater dependence on debt financing is associated with lower financial performance, while a stronger equity base is related with improved profitability in the cement industry. These relationships provide initial insights, which are further examined through regression analysis in the subsequent sections.

4.1.3. Panel Regression Model of Cement Industry

To examine the impact of capital structure on financial performance, panel regression models are estimated using pooled OLS, fixed effects, and random effects methods followed by a series of specification tests.

i. Impact of Capital structure on ROA (Model 1)

Independent Variable-ROA			
Variables	**OLS**	**FE**	**RE**
DA	0.027 (0.532)	0.055 (0.342)	0.048 (0.349)
DE	–0.038 (0.001)	–0.049 (0.002)	–0.047 (0.001)
EA	0.010 (0.554)	0.008 (0.640)	0.008 (0.620)
Firm Size	-0.018 (0.001)	–0.019 (0.258)	–0.018 (0.055)
Constant	0.130 (0.000)	0.135 (0.029)	0.135 (0.001)
R^2	0.3054	0.264 (within)	0.264
Observations	150	150	150
No. of Firms	15	15	15
F-test (FE)	—	7.58 (0.00)	—
LM Test	—	—	98.42 (0.000)
Hausman Test			0.29 (.9902)
Final Model			**Random Effect**

Table 3- Impact of Capital structure on ROA of Cement Industry
Source-Compiled by the Author

The results of the F-test (Table 3) for fixed effects are statistically significant ($F = 7.58$, $p = 0.00$), indicating that the fixed effects model is preferred over the pooled OLS model. This suggests the presence of unobserved firm-specific effects. Further, the Breusch–Pagan Lagrange Multiplier (LM) test yields a significant result ($\chi^2 = 98.42$, $p = 0.000$), supporting the use of the random effects model over pooled OLS. This confirms that panel estimation is more appropriate than simple pooled regression. To choose between fixed and random effects, the Hausman test is conducted. The test result is insignificant ($\chi^2 = 0.29$, $p = 0.9902$), indicating that there is no systematic difference between the fixed and random effects estimators. Therefore, the random effects model is considered more efficient and selected as the final model for the analysis.

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

ii. Impact of Capital structure on ROE (Model 2)

Independent Variable-ROE			
Variables	**OLS**	**FE**	**RE**
DA	0.157 (0.056)	0.267 (0.020)	0.228 (0.020)
DE	–0.061(0.005)	–0.107 (0.000)	–0.094 (0.000)
EA	0.013 (0.707)	0.005 (0.889)	0.003 (0.926)
Firm Size	-0.038 (0.000)	–0.049 (0.130)	–0.043 (0.016)
Constant	0.231 (0.000)	0.280 (0.020)	0.260 (0.000)
R^2	0.1633	0.1571 (within)	0.1570
Observations	150	150	150
No. of Firms	15	15	15
F-test (FE)	—	6.79 (0.00)	—
LM Test	—	—	76.66 (0.000)
Hausman Test			1.8 (.7732)
Final Model			**Random Effect**

Table 4- Impact of Capital structure on ROE of Cement Industry
Source-Compiled by the Author

In Table 4, The F-test for fixed effects is statistically significant (F = 6.79, p = 0.00), indicating that the fixed effects model is preferred over the pooled OLS model. This suggests the presence of unobserved firm-specific effects. Further, the Breusch–Pagan Lagrange Multiplier (LM) test yields a significant result (χ^2 = 76.66, p = 0.000), supporting the use of the random effects model over pooled OLS. This confirms that panel estimation is more appropriate than simple pooled regression. To choose between fixed and random effects, the Hausman test is conducted. The test result is insignificant (χ^2 = 1.8, p = 0.7732), indicating that there is no systematic difference between the fixed and random effects estimators. Therefore, the random effects model is considered more efficient and selected as the final model for the analysis.

iii. Impact of Capital structure on NPM (Model 3)

Independent Variable-NPM			
Variables	**OLS**	**FE**	**RE**
DA	0.037 (0.519)	0.195(0.016)	0.137 (0.050)
DE	–0.047 (0.002)	–0.084(0.000)	–0.072 (0.000)
EA	0.025 (0.283)	0.017(0.478)	0.018 (0.423)
Firm Size	0.014 (0.047)	–0.011(0.670)	0.008 (0.500)
Constant	0.023 (0.560)	0.105 (0.211)	0.038 (0.467)
R^2	0.3054	0.2089 (within)	0.2026
Observations	150	150	150
No. of Firms	15	15	15
F-test (FE)	—	6.87 (0.00)	—
LM Test	—	—	76.8 (0.000)
Hausman Test			2.35 (.6719)
Final Model			**Random Effect**

Table 5- Impact of Capital structure on NPM of Cement Industry
Source-Compiled by the Author

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

In Table 5, The F-test for fixed effects is found to be statistically significant (F = 6.87, p = 0.00), indicating that the fixed effects model is more appropriate than the pooled OLS model and suggesting the existence of unobserved firm-specific effects. The Breusch–Pagan Lagrange Multiplier (LM) test also produces a significant result (χ^2 = 76.8, p = 0.000), supporting the use of the random effects model over pooled OLS and confirming the relevance of panel data estimation. The Hausman test is then applied to select between fixed and random effects models. The test result is insignificant (χ^2 = 2.35, p = 0.6719), indicating that there is no systematic difference between the estimators. Hence, the random effects model is considered more efficient and is selected as the final model for further analysis.

iv. Impact of Capital structure on CR (Model 4)

Independent Variable-CR			
Variables	**OLS**	**FE**	**RE**
DA	0.712 (0.217)	2.902 (0.001)	2.096 (0.003)
DE	–0.404 (0.008)	–0.893 (0.000)	–0.703 (0.000)
EA	0.334 (0.159)	0.322 (0.201)	0.362 (0.117)
Firm Size	-0.022 (0.756)	–0.074 (0.748)	–0.001 (0.996)
Constant	1.065 (0.007)	1.024 (0.234)	0.804 (0.106)
R^2	0.2001	0.1745 (within)	0.1695
Observations	150	150	150
No. of Firms	15	15	15
F-test (FE)	—	6.2 (0.00)	—
LM Test	—	—	58.25 (0.000)
Hausman Test			7.47 (.1132)
Final Model			**Random Effect**

Table 6- Impact of Capital structure on CR of Cement Industry
Source-Compiled by the Author

In table 6, The F-test for fixed effects is statistically significant (F = 6.2, p = 0.00), indicating that the fixed effects model is preferred over the pooled OLS model and suggesting the presence of firm-specific effects. The Breusch–Pagan Lagrange Multiplier (LM) test also yields a significant result (χ^2 = 58.25, p = 0.000), supporting the use of the random effects model over pooled OLS and confirming the appropriateness of panel estimation. The Hausman test is conducted to choose between fixed and random effects models. The test result is insignificant (χ^2 = 7.47, p = 0.1132), indicating that there is no systematic difference between the estimators. Therefore, the random effects model is considered more efficient and is selected as the final model for the analysis.

4.1.4. Diagnostic test of Cement Industry

After the selection of the appropriate panel data model, diagnostic tests are conducted to ensure the reliability and validity of the regression results. These include tests for multicollinearity, serial correlation, and heteroskedasticity test.

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

i. Multicollinearity Test

Variable	VIF	1/VIF
DE	6.44	0.155293
DA	6.15	0.162591
EA	2.59	0.385946
Firm Size	1.17	0.853651
Mean VIF	4.09	

Table 7- VIF Test of Cement Industry
Source-Compiled by the Author

To examine the presence of multicollinearity among the independent variables in the regression models, the Variance Inflation Factor (VIF) test is performed. The VIF values for all variables are found to be below the commonly accepted threshold of 10, indicating that multicollinearity is not severe. Specifically, the VIF values for the debt-to-equity ratio (6.44) and debt-to-assets ratio (6.15) are relatively higher compared to other variables, reflecting a moderate degree of association between these measures of leverage. In contrast, the VIF values for equity-to-assets ratio (2.59) and firm size (1.17) are low, indicating no multicollinearity concerns for these variables. The mean VIF value of 4.09 further confirms that multicollinearity is within acceptable limits. Therefore, all variables are retained in the model, and the regression results are interpreted with due caution.

ii. Serial Correlation Test

Industry	Model	1	2	3	4
Cement	Serial correlation	43.61	22.45	50.516	3.01
	p-value	0.000	0.0003	0.0000	0.1047

Table 8- Serial Correlation Test of Cement Industry
Source-Compiled by the Author

The presence of serial correlation in the panel data is examined using the Wooldridge test. The results in Table 8 indicate that serial correlation is present in most of the models. Specifically, the test statistics for Models 1, 2, and 3 are statistically significant ($p < 0.05$), confirming the presence of serial correlation in the error terms. However, for Model 4, the test result is insignificant ($p = 0.1047$), indicating the absence of serial correlation in that model. Overall, the findings suggest that serial correlation is a concern in the majority of the models, which may affect the efficiency of the estimators.

iii. Heteroskedasticity Test

Industry	Model	1	2	3	4
Cement	Heteroskedasticity	4.93	0.02	7.11	8.44
	p-value	0.026	0.8783	0.0077	0.0037

Table 9- Heteroskedasticity Test of Cement Industry
Source-Compiled by the Author

The presence of heteroskedasticity in the cement industry is examined using the Breusch–Pagan test. This test determines the level of consistency of variance in panel data. In Table 9, the results

indicate that heteroskedasticity is present in most of the models. Specifically, Model 1 (ROA) shows a statistically significant result (p = 0.026), indicating the presence of heteroskedasticity. Similarly, Model 3 (NPM) and Model 4 (CR) also exhibit statistically significant results (p = 0.0077 and p = 0.0037, respectively), confirming that the variance of the error terms is not constant in these models. However, Model 2 (ROE) does not show evidence of heteroskedasticity, as the test result is statistically insignificant (p = 0.8783), indicating homoskedasticity in this model. Overall, the findings suggest that heteroskedasticity is present in the majority of the models in the cement industry.

To address these issues, clustered standard errors are employed in the final model estimation. This approach corrects for both serial correlation and heteroskedasticity, thereby ensuring more reliable and robust inference.

4.1.5 Final Regression Result of Cement Industry

Based on the results of the model selection tests, the random effects model is selected as the most appropriate specification. To address issues of serial correlation and potential heteroskedasticity, the models are estimated using standard errors clustered at the firm-year level (Table 10).

The findings indicate that the impact of capital structure on financial performance varies across different measures of performance. The DA shows a positive but insignificant effect on ROA (p = 0.311), suggesting that the proportion of assets financed through debt does not significantly influence asset-based profitability. However, DA has a positive and statistically significant impact on ROE (p = 0.007) and net profit margin (p = 0.015), indicating significance at the 1 percent and 5 percent levels, respectively and suggesting that higher debt contributes positively to shareholder returns and operating profitability. Its effect on CR is positive and is weakly significant at 10% level (p = 0.096). In contrast, the DE indicate a consistent negative and statistically significant impact across all performance measures. Specifically, DE negatively affects ROA (p = 0.013), ROE (p = 0.002), NPM (p = 0.000), and CR (p = 0.018), indicating significance at the 5 percent and 1 percent levels and suggesting that higher reliance on debt relative to equity adversely affects both profitability and liquidity. This indicates that excessive debt may increase financial risk and reduce overall firm performance in the cement industry.

Variable	Model 1	Model 2	Model 3	Model 4
DA	0.048 (0.311)	0.228 (0.007) ***	0.137 (0.015) **	2.096 (0.096) *
DE	−0.047 (0.013) **	−0.094 (0.002) ***	−0.072 (0.000) ***	−0.703 (0.018) **
EA	0.008 (0.681)	0.003 (0.900)	0.018 (0.497)	0.362 (0.406)
Firm Size	−0.018 (0.063) *	−0.043 (0.004) ***	0.009 (0.484)	−0.001 (0.997)
Constant	0.135 (0.000) ***	0.260 (0.000) ***	0.038(0.402)	0.804 (0.231)
Within R^2	0.2640	0.1570	0.2026	0.1695
Final Model Used	RE	RE	RE	RE
Observations	150	150	150	150
No. of Firms	15	15	15	15

(*Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.10)

Table 10- Final Regression Results of Cement Industry

Source-Compiled by the Author

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

The EA shows a positive but statistically insignificant relationship with ROA (p = 0.681), ROE (p = 0.900), NPM (p = 0.497), and CR (p = 0.406), indicating that equity financing does not have a significant effect on performance. Firm size has a negative and statistically significant impact at the 1 percent level on return on equity (p = 0.004), suggesting that larger firms may experience lower returns to shareholders. However, its effect on ROA (p = 0.063) is weakly significant, indicating significance at the 10 percent level, NPM (p = 0.484), and CR (p = 0.997) is not statistically significant.

The within R^2 values range from 0.1570 to 0.2640, indicating that approximately 15.7 percent to 26.4 percent of the variation in financial performance is explained by the model. This reflects a moderate level of explanatory power. This suggests that while capital structure and firm size contribute to explaining firm performance, other factors beyond capital structure also influence firm performance.

Overall, the results highlight that among the capital structure variables, the debt-to-equity ratio plays the most significant role, with a consistently negative impact on financial performance. In contrast, the effect of the debt-to-assets ratio varies across models, while equity financing does not show a statistically significant influence.

4.1.6 Interpreting Leverage Dynamics

The results from the final regression model show an important difference in how various measures of leverage affect financial performance in the cement industry. The debt-to-assets ratio (DA) shows a positive and statistically significant impact on performance measures such as ROE and NPM, while its effect on other indicators is not statistically significant. In contrast, the debt-to-equity ratio (DE) shows a consistent negative and statistically significant impact across all measures of financial performance.

This difference suggests that the effect of debt depends on how it is measured. When debt is considered in relation to total assets (DA), it reflects the use of borrowed funds in business operations, which may support profitability. In such cases, firms may benefit from the tax advantages of debt and better financial discipline. However, when debt is high relative to equity (DE), it increases financial risk and the burden of repayment, which negatively affects firm performance.

Overall, the results indicate that a moderate level of debt can be beneficial, but excessive reliance on debt relative to equity can harm financial performance. This suggests that firms need to maintain an optimal level of leverage, where the benefits of debt are balanced against the risks associated with higher financial obligations.

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

4.2. Steel Industry

4.2.1 Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
DA	150	0.42	0.29	0.03	1.32
DE	150	0.74	3.69	-15.37	13.45
EA	150	0.31	0.31	-0.57	0.75
ROA	150	0.03	0.08	-0.21	0.27
ROE	150	0.10	0.35	-1.31	1.21
NPM	150	0.02	0.10	-0.25	0.24
CR	150	1.12	0.55	0.28	2.87
Firm Size	150	3.70	0.96	1.77	5.31

Table 11- Descriptive statistics of the variables
Source-Compiled by the Author

The descriptive statistics for the steel industry are presented in Table 11. The results indicate relatively higher variability in capital structure compared to the cement industry. The mean value of the debt-to-assets ratio (DA) is 0.42, suggesting a greater reliance on debt financing. The debt-to-equity ratio (DE) shows substantial dispersion, reflecting significant differences in financing patterns across firms. The equity-to-assets ratio (EA) also exhibits variation, indicating differences in the use of internal financing. In terms of financial performance, the average return on assets (ROA) is 0.03, while return on equity (ROE) and net profit margin (NPM) are 0.10 and 0.02, respectively. The presence of negative minimum values across these indicators suggests that firms experienced periods of financial distress, highlighting the volatile nature of the steel industry. The current ratio (CR), with a mean of 1.12, indicates moderate liquidity levels, although variation across firms suggests differing short-term solvency positions. Firm size also shows noticeable dispersion, reflecting the presence of both relatively small and large firms in the sample.

4.2.2. Correlation Analysis

	DA	DE	EA	ROA	ROE	NPM	CR	Firm Size
DA	1							
DE	-0.116	1						
EA	-0.888	0.156	1					
ROA	-0.569	0.090	0.616	1				
ROE	-0.023	-0.449	0.016	0.327	1			
NPM	-0.592	0.058	0.625	0.887	0.300	1		
CR	-0.407	-0.038	0.454	0.473	0.163	0.315	1	
Firm Size	-0.221	-0.012	0.261	0.046	-0.114	0.250	-0.435	1

Table 12- Correlation Matrix of Steel Industry
Source-STATA

Table 12 reflects the correlation results between capital structure and financial performance variables for the steel industry. The findings indicate that the DA is negatively associated with financial performance measures. Specifically, DA shows a moderate negative correlation with return on assets (–0.569) and net profit margin (–0.592), suggesting that higher reliance on debt is linked with lower profitability. However, its relationship with return on equity is weak (–0.023),

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

indicating a limited impact on shareholder returns. In contrast, the DE show a mixed relationship with performance indicators. DE shows a negative correlation with return on equity (–0.449), indicating that higher leverage reduces shareholder returns, while its association with return on assets (0.090) and net profit margin (0.058) is weak and positive, suggesting no strong relationship. The EA demonstrates a positive association with financial performance. EA is positively correlated with return on assets (0.616) and net profit margin (0.625), indicating that firms with higher equity financing tend to perform better in terms of profitability. However, its relationship with return on equity is weak (0.016), suggesting a limited influence on shareholder returns. Overall, the correlation results suggest that higher dependence on debt financing is generally associated with lower financial performance, while a stronger equity base is linked with improved profitability in the steel industry. These relationships provide initial insights, which are further examined through regression analysis in the subsequent sections.

4.2.3 Panel Regression Model

To examine the impact of capital structure on return on assets, panel regression models are estimated using pooled OLS, fixed effects, and random effects. To identify the most appropriate model, the study employed the F-test, Breusch–Pagan Lagrange Multiplier (LM) test, and Hausman test.

i. Impact of Capital structure on ROA (Model 1)

Independent Variable-ROA			
Variables	**OLS**	**FE**	**RE**
DA	-0.027 (0.496)	-0.035(0.577)	-0.028 (0.524)
DE	0.000 (0.872)	0.001 (0.598)	0.000 (0.950)
EA	0.150 (0.000)	0.230 (0.000)	0.162 (0.000)
Firm Size	-0.011 (0.069)	–0.011 (0.693)	–0.011 (0.098)
Constant	0.037 (0.279)	0.018 (0.868)	0.036 (0.345)
R^2	0.395	0.3712 (within)	0.3691(within)
Observations	150	150	150
No. of Firms	15	15	15
F-test (FE)	—	2.00 (0.0221)	—
LM Test	0.35 (0.2767)	—	—
Hausman Test	—	11.63 (0.0203)	—
Final Model		**Fixed Effect**	

Table 13- Impact of Capital structure on ROA of Steel Industry
Source-Compiled by the Author

As shown in Table 13, The F-test for fixed effects is statistically significant (F = 2.00, p = 0.0221), indicating that the fixed effects model is preferred over the pooled OLS model. This suggests the presence of unobserved firm-specific effects. The Breusch–Pagan Lagrange Multiplier (LM) test is found to be insignificant (χ^2 = 0.35, p = 0.2767), indicating that the random effects model is not preferred over pooled OLS. To choose between fixed and random effects, the Hausman test is conducted. The test result is statistically significant (χ^2 = 11.63, p = 0.0203), indicating that there is a systematic difference between the estimators. Therefore, the fixed effects model is considered more appropriate and is selected as the final model for the analysis.

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

ii. Impact of Capital structure on ROE (Model 2)

Independent Variable-ROE			
Variables	**OLS**	**FE**	**RE**
DA	0.022 (0.909)	-0.375 (0.199)	0.022 (0.909)
DE	–0.044 (0.000)	–0.037 (0.000)	–0.044 (0.000)
EA	0.164 (0.368)	0.377 (0.185)	0.164 (0.367)
Firm Size	-0.056 (0.044)	–0.175 (0.196)	–0.056 (0.042)
Constant	0.282 (0.084)	0.818 (0.103)	0.282 (0.081)
R^2	0.231	0.2954(within)	0.1991(within)
Observations	150	150	150
No. of Firms	15	15	15
F-test (FE)	—	2.47 (0.0039)	—
LM Test	0.00 (1.000)	—	—
Hausman Test	—	28.34 (0.000)	—
Final Model		**Fixed Effect**	

Table 14- Impact of Capital structure on ROE of Steel Industry
Source-Compiled by the Author

As shown in Table 14, the F-test for fixed effects is statistically significant (F = 2.47, p = 0.0039), indicating that the fixed effects model is preferred over the pooled OLS model. This suggests the presence of unobserved firm-specific effects. The Breusch–Pagan Lagrange Multiplier (LM) test is found to be insignificant (χ^2 = 0.00, p = 1.000), indicating that the random effects model is not preferred over pooled OLS. The Hausman test result is statistically significant (χ^2 = 28.34, p = 0.000), indicating that there is a systematic difference between the estimators. Therefore, the fixed effects model is considered more appropriate and is selected as the final model for the analysis.

iii. Impact of Capital structure on NPM (Model 3)

Independent Variable-NPM			
Variables	**OLS**	**FE**	**RE**
DA	-0.058 (0.207)	-0.014 (0.848)	-0.058 (0.205)
DE	–0.001 (0.634)	0.000 (0.997)	–0.001 (0.633)
EA	0.139 (0.002)	0.231 (0.002)	0.139 (0.002)
Firm Size	0.009 (0.160)	–0.058 (0.094)	0.009 (0.158)
Constant	-0.029 (0.452)	0.172 (0.178)	-0.029 (0.451)
R^2	0.4068	0.2625 (within)	0.2381(within)
Observations	150	150	150
No. of Firms	15	15	15
F-test (FE)	1.15 (0.3199)	—	—
LM Test	0.000(1.000)	—	—
Final Model	**Pooled OLS**		

Table 15- Impact of Capital structure on NPM of Steel Industry
Source-Compiled by the Author

As shown in Table 15, the F-test for fixed effects is found to be statistically insignificant (F = 1.15, p = 0.3199), indicating that the fixed effects model is not preferred over the pooled OLS model

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

Further, the Breusch–Pagan Lagrange Multiplier (LM) test is also insignificant (χ^2 = 0.00, p = 1.000), suggesting that the random effects model is not preferred over pooled OLS. Since both the fixed effects and random effects models are not supported by the specification tests, the pooled OLS model is considered appropriate and is selected as the final model for the analysis.

iv. Impact of Capital structure on CR (Model 4)

Independent Variable-CR			
Variables	**OLS**	**FE**	**RE**
DA	0.058 (0.800)	0.908 (0.006)	0.473 (0.083)
DE	–0.022 (0.012)	–0.024 (0.004)	–0.024 (0.004)
EA	1.192 (0.000)	2.327 (0.000)	1.726 (0.000)
Firm Size	-0.349 (0.000)	–0.107 (0.476)	–0.343 (0.000)
Constant	2.029 (0.000)	0.430 (0.440)	1.670 (0.000)
R^2	0.5546	0.264 (within)	0.4575(within)
Observations	150	150	150
No. of Firms	15	15	15
F-test (FE)	—	4.7 (0.00)	—
LM Test	—	—	13.31 (0.0001)
Hausman Test		16.83 (.0021)	
Final Model		**Fixed Effect**	

Table 16- Impact of Capital structure on CR of Steel Industry
Source-Compiled by the Author

In Table 16, the F-test for fixed effects is statistically significant (F = 4.7, p = 0.00), indicating that the fixed effects model is preferred over the pooled OLS model. This suggests the presence of unobserved firm-specific effects. The Breusch–Pagan Lagrange Multiplier (LM) test is also statistically significant (χ^2 = 13.31, p = 0.0001), supporting the use of the random effects model over pooled OLS and confirming the relevance of panel estimation. The Hausman test result is statistically significant (χ^2 = 16.83, p = 0.0021), indicating that there is a systematic difference between the estimators. Therefore, the fixed effects model is considered more appropriate and is selected as the final model for the analysis.

4.2.4. Diagnostic test after model selection

After the selection of the appropriate panel data model, diagnostic tests are conducted to ensure the reliability and validity of the regression results. These include tests for multicollinearity, serial correlation, and heteroskedasticity test.

i. Multicollinearity Test

Variable	**VIF**	**1/VIF**
DE	4.91	0.20
DA	4.75	0.21
EA	1.08	0.93
Firm Size	1.03	0.97
Mean VIF	**2.94**	

Table 17- VIF Test of Steel Industry
Source-Compiled by the Author

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

The VIF values for all variables are below the commonly accepted threshold of 10, indicating that multicollinearity is not severe. Specifically, the VIF values for the DE ratio (4.91) and DA ratio (4.75) are relatively higher compared to other variables, reflecting a moderate degree of association between these measures of leverage. In contrast, the VIF values for the EA ratio (1.08) and firm size (1.03) are low, indicating no multicollinearity concerns for these variables. The mean VIF value of 2.94 further confirms that multicollinearity is within acceptable limits. Therefore, all variables are retained in the model, and the regression results are interpreted with due caution.

ii. Serial Correlation Test

Industry	Model	1	2	3	4
Steel	Serial correlation	0.017	13.5	0.92	39.273
	p-value	0.8967	0.0025	0.3537	0.0000

Table 18- Serial Correlation Test of Steel Industry
Source-Compiled by the Author

The results indicate that serial correlation is present in some of the models. Specifically, Model 2 and Model 4 show statistically significant results (p = 0.0025 and p = 0.0000), confirming the presence of serial correlation in the error terms for these models. However, Model 1 and Model 3 do not exhibit serial correlation, as the test results are statistically insignificant (p = 0.8967 and p = 0.3537), indicating the absence of serial correlation in these models. Overall, the findings suggest that serial correlation is present in selected models in the steel industry, which may affect the efficiency of the estimators.

Heteroskedasticity Test

Industry	Model	1	2	3	4
Steel	**Heteroskedasticity**	12729.56	9000.54	30.7	114.04
	p-value	0.000	0.000	0.0435	0.000

Table 19- Heteroskedasticity Test of steel Industry
Source-Compiled by the Author

The steel industry reflects strong evidence of heteroskedasticity across all models. The test statistics are highly significant for Models 1, 2, and 4 (p = 0.000), while Model 3 is also statistically significant (p = 0.0435). This indicates that the variance of the error terms is not constant and reflects greater variability across firms. Serial correlation is observed in Models 2 and 4 (p = 0.0025 and p = 0.0000), while Models 1 and 3 do not exhibit serial correlation, as the results are statistically insignificant.
Thus, the diagnostic results suggest that issues of both heteroskedasticity and serial correlation are present in steel industry. To correct these issues and ensure more reliable and robust inference, clustered standard errors are employed in the final model estimation.

4.2.5. Final Model Result of Steel Industry

Based on the results of the model selection tests, the appropriate models—fixed effects for ROA, ROE, and CR, and pooled OLS for NPM—are selected for the analysis. To address issues of heteroskedasticity and serial correlation, the models are estimated using standard errors clustered at the firm level.

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

The findings indicate that the impact of capital structure on financial performance varies across different measures of performance. The DA shows a negative but statistically insignificant effect on ROA (p = 0.663) and NPM (p = 0.168), suggesting that debt financing does not significantly influence profitability in these dimensions. It also shows a negative and weakly significant effect on ROE (p = 0.097), indicating significance at the 10 percent level. However, DA has a positive and statistically significant impact on CR (p = 0.023), indicating significance at the 5 percent level and suggesting that higher asset-based leverage may improve short-term solvency in the steel industry. The DE shows a mixed and generally weak impact on financial performance. It has an insignificant effect on ROA (p = 0.608) and NPM (p = 0.733). However, it exhibits a negative and weakly significant effect on ROE (p = 0.083) and CR (p = 0.068), indicating significance at the 10 percent level suggesting that higher leverage relative to equity may adversely affect shareholder returns and liquidity.

Variable	ROA	ROE	NPM	CR
DA	-0.035 (0.663)	-0.375 (0.097) *	-0.058(0.168)	0.908 (0.023) **
DE	0.001 (0.608)	-0.037 (0.083) *	–0.001 (0.733)	–0.024 (0.068) *
EA	0.230 (0.003) ***	0.377 (0.003) ***	0.139 (0.003) ***	2.327 (0.000) ***
Firm Size	–0.011 (0.727)	-0.175 (0.037) **	0.009 (0.254)	–0.107 (0.749)
Constant	0.018 (0.865)	0.818 (0.035) **	-0.029 (0.403)	0.430 (0.720)
Within R^2	0.3712	0.2954	0.4068(R-square)	0.4833
Final Model Used	FE	FE	OLS	FE
Observations	150	150	150	150
No. of Firms	15	15	15	15

(*Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.10)
Table 20- Final Regression Results of Steel Industry
Source-Compiled by the Author

The EA emerges as the most consistent and significant variable across all models. It has a positive and statistically significant impact on ROA (p = 0.003), ROE (p = 0.003), NPM (p = 0.003), and CR (p = 0.000), all significant at the 1 percent level. This indicates that a higher proportion of equity financing is associated with improved financial performance and stronger liquidity position in the steel industry. Firm size shows a negative and statistically significant effect on ROE (p = 0.037), indicating significance at the 5 percent level suggesting that larger firms may experience lower returns to shareholders. However, its effect on ROA (p = 0.727), NPM (p = 0.254), and CR (p = 0.749) is statistically insignificant.

The R^2 values range from 0.2954 to 0.4833, indicating that approximately 29.5 percent to 48.3 percent of the variation in financial performance is explained by the model. This reflects a moderate to relatively high level of explanatory power, suggesting that capital structure plays an important role in influencing firm performance in the steel industry.
Overall, the results highlight that EA plays a dominant and positive role in determining financial performance, whereas debt-related measures show weaker and less consistent effects. This suggests that steel firms benefit more from equity financing compared to debt financing.

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

4.2.6. Interpreting Leverage Dynamics

The results from the final regression models indicate a different pattern in the relationship between capital structure and financial performance in the steel industry. The equity-to-assets ratio (EA) shows a positive and statistically significant impact across all measures of financial performance, indicating that firms with higher equity financing tend to perform better. In contrast, the debt-related variables, namely debt-to-assets ratio (DA) and debt-to-equity ratio (DE), do not show a consistent or strong influence on performance.

This pattern suggests that steel firms rely more on equity financing to maintain financial stability. The positive impact of EA indicates that internally generated funds and a stronger equity base support both profitability and liquidity. On the other hand, the weaker and less consistent effects of debt indicate that excessive reliance on borrowing may not provide clear benefits in this industry.

Overall, the results suggest that, unlike the cement industry, the steel industry benefits more from equity-based financing rather than debt. This highlights that firms in this sector tend to prioritize financial flexibility and stability, especially in the presence of uncertain market conditions.

5. Comparative Analysis: Cement vs Steel Industry

This section provides a comparative evaluation of the impact of capital structure on financial performance across the cement and steel industries in India. The analysis is based on the results obtained from panel data regression models estimated separately for each sector. By examining differences in the magnitude, direction, and significance of the estimated coefficients, the study aims to identify how industry-specific characteristics influence the relationship between financing decisions and firm performance.

The differences in the impact of capital structure across the cement and steel industries can be explained by the nature of these sectors. In the cement industry, the stable and consistent demand for infrastructure development in India during the period 2015–2024 allows firms to rely more on debt financing in a relatively stable environment. In contrast, the steel industry is more exposed to fluctuations in global commodity prices and input costs, making it more volatile. Due to this uncertainty, steel firms tend to rely more on equity financing and internal funds to maintain financial flexibility and reduce risk during market fluctuations.

The results show that the effect of capital structure is not the same in both industries. In the cement industry, the DE emerges as the most influential variable, showing a consistent and statistically significant negative impact on all measures of performance i.e., ROA, ROE, NPM, and CR. This indicates that higher use of debt is associated with lower financial performance of firms. The DA shows mixed effects, while the EA does not reflect a significant influence. In contrast, the steel industry shows a different pattern, where the EA emerges as the most dominant variable. It shows a positive and statistically significant impact on all performance measures. This indicates that higher equity financing enhances both profitability and liquidity in the steel sector. On the other hand, the debt-related variables (DA and DE) show weaker and inconsistent results, with some effects being insignificant or only marginally significant.

There is also a difference in the type of models selected. In the cement industry, the random effects model is mostly preferred, suggesting that firm-specific differences are relatively weaker and that the results are more generalizable across firms. In contrast, the steel industry largely follows the fixed effects model, which indicates that firm-specific characteristics play an important role in explaining performance. The diagnostic results further support this difference. The steel industry shows strong evidence of heteroskedasticity and partial presence of serial correlation, indicating higher variability and instability in firms' financial performance. In contrast, the cement industry also reflects heteroskedasticity in most models, but comparatively fewer issues of serial correlation, suggesting relatively more stable financial behaviour. Overall, the comparative analysis suggests that the impact of capital structure depends on the nature of the industry. Debt financing plays a more critical role in determining performance in the cement industry, while equity financing is more important in the steel industry. Thus, the findings highlight the importance of considering industry characteristics while making financing decisions, as the optimal capital structure may vary across sectors.

These findings can be explained using established capital structure theories. The negative impact of the DE ratio in the cement industry supports the Trade-off Theory, which suggests that excessive use of debt increases financial risk and associated costs, thereby reducing firm performance beyond an optimal level. In contrast, the strong positive influence of the EA ratio in the steel industry is consistent with the Pecking Order Theory, where firms prefer internal financing and equity over debt due to lower financial risk and information asymmetry. The results also indicate that the effect of capital structure varies across industries, highlighting that financing decisions are influenced by industry characteristics and firm-specific conditions.

6. Hypothesis Acceptance / Rejection Table

The following table presents the results of hypothesis testing for the impact of capital structure on financial performance in the cement and steel industries. The acceptance or rejection of the hypotheses is determined based on the overall significance of the regression models**.** when the model is statistically significant ($p \leq 0.05$), as indicated by the F-statistic (for fixed effects and pooled OLS models) and the Wald chi-square statistic (for random effects models), which reflect the joint influence of capital structure variables on financial performance; otherwise, it is not rejected. Individual coefficient estimates are further examined to identify the direction and key drivers of the relationship.

Cement Industry

Hypothesis	Dependent Variable	Result	Decision
H01	ROA	Model significant; DE (–)	Reject Ho
H02	ROE	Model significant; DE (–), DA (+)	Reject Ho
H03	NPM	Model significant; DE (–), DA (+)	Reject Ho
H04	CR	Model significant; DE (–), DA marginal(+)	Reject Ho

J Euro Eco His.
ISSN : 0391-5115
Volume 7, Issue 3 (2026)
THE JOURNAL OF EUROPEAN ECONOMIC HISTORY

Steel Industry

Hypothesis	Dependent Variable	Result	Decision
H01	ROA	Model significant; EA (+)	Reject Ho
H02	ROE	Model significant; EA (+), DE (marginal –)	Reject Ho
H03	NPM	Model significant; EA (+)	Reject Ho
H04	CR	Model significant; EA (+), DA (+), DE (–)	Reject Ho

Table 21- Hypothesis Acceptance / Rejection Table
Source-Compiled by the Author

The results of the hypothesis testing indicate that null hypotheses are rejected for all measures of financial performance in both industries, as the regression models are found to be statistically significant. This confirms that capital structure has a significant impact on financial performance. However, the nature and direction of this impact differ across industries. In the cement industry, debt-related variables, particularly the debt-to-equity ratio, play a more dominant role, whereas in the steel industry, equity-based financing emerges as the most influential factor. These findings highlight the importance of considering industry-specific factors while making financing decisions.

7. Conclusion

This study examined the impact of capital structure on financial performance in the cement and steel industries in India using panel data regression analysis. The results show that capital structure has a significant impact on financial performance in both industries. However, the nature and direction of this impact differ across sectors.

In the cement industry, debt-related measures, particularly the DE ratio, have a consistent and negative effect on financial performance. This suggests that higher debt reduces profitability and liquidity, indicating that excessive debt may not be beneficial for firms in this sector. In contrast, the steel industry shows a different pattern, where equity-based financing plays a more important role. The EA ratio has a strong positive impact on all performance measures, indicating that firms with higher equity financing tend to perform better in terms of profitability and liquidity. Debt variables, on the other hand, show weaker and less consistent effects. The results also reveal differences in model selection and diagnostic outcomes between the two industries. The cement industry is largely explained by the random effects model, indicating relatively lower firm-specific heterogeneity, whereas the steel industry is better captured by fixed effects models, reflecting the importance of firm-specific characteristics. Diagnostic tests indicate the presence of heteroskedasticity in both sectors, along with partial evidence of serial correlation, particularly in the steel industry.

These findings have important implications for financial decision-making. Firms should adopt industry-specific financing strategies, as the optimal mix of debt and equity varies across sectors. While cement firms need to manage debt levels carefully, steel firms may benefit from a stronger equity base. Investors and policymakers should also consider these sectoral differences in their decisions. However, the study is subject to certain limitations. The analysis is based on a relatively limited sample and relies primarily on accounting-based financial ratios, which may

be influenced by firm-specific reporting practices. Although panel data techniques and clustered standard errors are employed to improve the reliability of the estimates, the possibility of endogeneity arising from potential reverse causality between capital structure and financial performance cannot be entirely ruled out. Furthermore, the study does not incorporate macroeconomic variables or qualitative factors that may also affect firm performance. Future research may address these limitations by using advanced econometric techniques such as dynamic panel models, expanding the sample, and incorporating macroeconomic variables and firm-level qualitative factors to provide deeper insights.

Reference

1) (Alalade et.al, 2018). Capital Structure and Corporate Financial Performance: Evidence from Nigerian Cement Companies. Archives of Business Research, 6(3). https://doi.org/10.14738/abr.63.4275
2) Abor, J. (2005). The effect of capital structure on profitability: an empirical analysis of listed firms in Ghana. Journal of Risk Finance, 6(5), 438–445. https://doi.org/10.1108/15265940510633505
3) Ahmed, A. M., Nugraha, D. P., & Hágen, I. (2023). The Relationship between Capital Structure and Firm Performance: The Moderating Role of Agency Cost. https://doi.org/10.3390/risks
4) Arellano, M. (1987). PRACTITIONERS' CORNER: Computing Robust Standard Errors for Within-groups Estimators. Oxford Bulletin of Economics and Statistics, 49(4), 431–434. https://doi.org/10.1111/j.1468-0084.1987.mp49004006.x
5) Breusch, T. S., & Pagan, A. R. (1979). A Simple Test for Heteroscedasticity and Random Coefficient Variation. In Source: Econometrica (Vol. 47, Number 5).
6) Dakua, S. (2019). Effect of determinants on financial leverage in Indian steel industry: A study on capital structure. International Journal of Finance and Economics, 24(1), 427–436. https://doi.org/10.1002/ijfe.1671
7) Demirel, E., & Eskin, İ. (2017). International Journal of Energy Economics and Policy Relation between Environmental Impact and Financial Structure of Cement Industry. International Journal of Energy Economics and Policy |, 7(1), 129–134. www.econjournals.com
8) Dsouza, S., Kathavarayan, K., Mathias, F., Bhatia, D., & AlKhawaja, A. (2025). Leveraging Success: The Hidden Peak in Debt and Firm Performance. Econometrics, 13(2). https://doi.org/10.3390/econometrics13020023
9) Farhan, N. H. S., Tabash, M. I., Alsamhi, M. H., & Yahya, A. T. (2020). The relationship between capital structure and firm performance: empirical evidence from Indian service sector. In Int. J. Sustainable Economy (Vol. 12, Number 2).
10) Gujarati, D. N., & Porter, D. C. (2009). BasicEconometrics.
11) Habibniya, H., Dsouza, S., Rabbani, M. R., Nawaz, N., & Demiraj, R. (2022). Impact of Capital Structure on Profitability: Panel Data Evidence of the Telecom Industry in the United States. Risks, 10(8). https://doi.org/10.3390/risks10080157
12) Handoo, A., & Sharma, K. (2014). A study on determinants of capital structure in India. IIMB Management Review, 26(3), 170–182. https://doi.org/10.1016/j.iimb.2014.07.009

13) Harris, C., & Roark, S. (2019). Cash flow risk and capital structure decisions. Finance Research Letters, 29, 393–397. https://doi.org/10.1016/j.frl.2018.09.005
14) Jensen, M. C. (1986). Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. In American Economic Review (Vol. 76, Number 2). http://papers.ssrn.com/abstract=99580.
15) Jensen, M. C., & Meckling, W. H. (1976). Theory Of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. In Journal of Financial Economics (Vol. 3).
16) Kartika, A., Irsad, M., Setiawan, M., & Sudiyatno, B. (2023). The relationship between capital structure, firm performance and a firm's market competitiveness: Evidence from Indonesia. Investment Management and Financial Innovations, 20(1), 88–98. https://doi.org/10.21511/imfi.20(1).2023.09
17) Khan, S., & Qasem, A. (2024). Are the firms' capital structure and performance related? Evidence from GCC economies. Cogent Business and Management, 11(1). https://doi.org/10.1080/23311975.2024.2344749
18) Kijkasiwat, P., Hussain, A., & Mumtaz, A. (2022). Corporate Governance, Firm Performance and Financial Leverage across Developed and Emerging Economies. Risks, 10(10). https://doi.org/10.3390/risks10100185
19) Lamichhane, P., & Dhungel, B. D. (2024). Capital Structure and Financial Performance of Manufacturing Companies in Nepal. Journal of Mathematics Instruction, Social Research and Opinion, 3(2), 239–250. https://doi.org/10.58421/misro.v3i2.251
20) Modigliani, F., Merton & Miller, H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. In The American Economic Review (Vol. 48, Number 3).
21) Modigliani, F. and Miller, M.H. (1963) Corporate Income Taxes and the Cost of Capital: A Correction. American Economic Review, 53, 433-443.
22) Mohammad, H. S., & Bujang, I. (2020). Capital Structure and Financial Performance: Evidence from Three Malaysian Industries. In International Journal of Business and Society (Vol. 21, Number 3).
23) Myers, S. C., & Majiuf, N. S. (1981). Corporate Financing and Investment Decisions When Firms Have Information the Investors Do Not Have.
24) Myšková, R., & Hájek, P. (2017). Comprehensive assessment of firm financial performance using financial ratios and linguistic analysis of annual reports. Journal of International Studies, 10(4), 96–108. https://doi.org/10.14254/2071-8330.2017/10-4/7
25) Nguyen, D. T. (2020). The effect of financial structure on business performance of industrial enterprises listed in Vietnam. Accounting, 6(7), 1297–1304. https://doi.org/10.5267/j.ac.2020.8.021
26) Nguyen, H. T., & Nguyen, A. H. (2020). The impact of capital structure on firm performance: Evidence from Vietnam. Journal of Asian Finance, Economics and Business, 7(4), 97–105. https://doi.org/10.13106/JAFEB.2020.VOL7.NO4.97
27) Nguyen, S. La, Pham, C. D., Truong, T. Van, Phi, T. Van, Le, L. T., & Vu, T. T. T. (2023a). Relationship between Capital Structure and Firm Profitability: Evidence from Vietnamese Listed Companies. International Journal of Financial Studies, 11(1). https://doi.org/10.3390/ijfs11010045

28) Nguyen, S. La, Pham, C. D., Truong, T. Van, Phi, T. Van, Le, L. T., & Vu, T. T. T. (2023b). Relationship between Capital Structure and Firm Profitability: Evidence from Vietnamese Listed Companies. International Journal of Financial Studies, 11(1), 45. https://doi.org/10.3390/ijfs11010045
29) Pal, S. (2022). Influence of Capital structure on Firm Performance: Empirical Evidence from Indian Manufacturing Industry. International Journal of Business Management and Finance Research, 5(2), 100–110. https://doi.org/10.53935/26415313.v5i2.244
30) Prekazi, Y., Bajrami, R., & Hoxha, A. (2023). The impact of capital structure on financial performance. International Journal of Applied Economics, Finance and Accounting, 17(1), 1–6. https://doi.org/10.33094/ijaefa.v17i1.1002
31) Raj Chhetri, G. (2021). Effect of Credit Risk Management on Financial Performance Of Nepalese Commercial Banks. In Journal of Balkumari College (Vol. 10, Number 1). http://balkumaricollege.edu.np/journal
32) Babbar, A., & Singh, N. (2024). The Relationship between Capital Structure and Financial Performance of Cement Industry in India. Retrieved https://museonaturalistico.it
33) Said, S. (2025). The Impact of Capital Structure on Firm Performance: Empirical Evidence from Egypt. OALib, 12(02), 1–16. https://doi.org/10.4236/oalib.1112839
34) Sharma, A. (2025). Capital Structure and Firm Performance in Different Economic Condition. Issue, 3(23). https://doi.org/10.36690/2674
35) Sike, R. I., Ibrahim, U. A., & Maitala, F. (2023). Capital Structure and Financial Performance: A Sectorial Analysis. WSEAS Transactions on Business and Economics, 20, 1498–1508. https://doi.org/10.37394/23207.2023.20.132
36) Singh, N. P., & Bagga, M. (2019). The Effect of Capital Structure on Profitability: An Empirical Panel Data Study. Jindal Journal of Business Research, 8(1), 65–77. https://doi.org/10.1177/2278682118823312
37) Tripathi, M. (2023). Capital Structure and Firm Performance: An Empirical Study of Indian Companies using Age and Size as Moderators (Vol. 16). www.pbr.co.inhttps://orcid.org/0000-0003-0441-6081
38) Ullah, A., Pinglu, C., Ullah, S., Zaman, M., & Hashmi, S. H. (2020). The nexus between capital structure, firm-specific factors, macroeconomic factors and financial performance in the textile sector of Pakistan. Heliyon, 6(8). https://doi.org/10.1016/j.heliyon.2020.e04741
39) Vătavu, S. (2015). The Impact of Capital Structure on Financial Performance in Romanian Listed Companies. Procedia Economics and Finance, 32(15), 1314–1322. https://doi.org/10.1016/s2212-5671(15)01508-7
40) White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrica, 48(4), 817–838.
41) Wooldridge, J. M. (2010). Econometric Analysis of Cross Section and Panel Data.
42) Wooldridge, J. M. (2012). Introductory Econometrics.