

Dynamic Capital Structure Adjustment, Liquidity and Firm Profitability: Evidence from India's Cement Industry

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Abstract: Capital structure decisions play critical role in shaping firm performance, particularly in capital-intensive industries operating under financial constraints in emerging markets, where financing frictions alter the traditional performance relationship. This study examines the dynamic relationship between capital structure, liquidity and firm profitability in India's cement industry. Using balanced panel data from 21 cement firms listed on National Stock Exchange and Bombay Stock Exchange over the period 2016-2025 (210 firm-year observations) which enables consistent dynamic panel estimation. The study employs two-step system generalized method of moments (GMM) estimator to address endogeneity, unobserved heterogeneity and profit persistence. The results indicate that liquidity has statistically significant positive impact on return on assets and return on equity, highlighting the importance of internal financial flexibility in sustaining firm performance indicating that financial flexibility is primary driver of profitability. In contrast, leverage and equity intensity exhibit negative effects, suggesting that excessive reliance on external financing may reduce profitability in capital-intensive emerging market industries. The findings confirm the dynamic nature of profitability and capital structure adjustment. This study contributes to capital structure theory by demonstrating that liquidity functions as a structural determinant of profitability within a dynamic adjustment framework in financially constrained emerging market industries.

Keywords: Capital structure; Liquidity; Firm performance; Financial flexibility; Emerging markets; Dynamic panel estimation.

Introduction

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Capital structure decisions remain central to corporate finance yet their performance implications vary substantially across institutional environments (Myers & Majluf, 1984; Jensen & Meckling, 1976). Firms in emerging economies like Asia-Pacific region, face persistent financial constraints with limited long-term capital, higher borrowing costs, weak investor protection and increased exposure to macroeconomic fluctuations (Bah, Diallo, & Brou, 2025; Kumar. & Rao, 2015). These conditions affect the relative costs and benefits of debt, equity and internal financing which limits the applicability of evidences derived from developed economies (Colak, Habimana, & Korkeamäki, 2025).

Recent corporate finance studies stress that firm performance in emerging markets depends not only on leverages but also on the internal financial flexibility (Wu, Alkaraan, & Le, 2025; Aggarwal & Padhan, 2017). Liquidity and working capital management play a critical role in aiding firms to sustain investments and absorb cyclical shocks (Ahmed, et al., 2024; Yung, Li, & Jian, 2015). Large sunk cost, long gestation periods and limited asset re-allocation in capital-intensive industries magnify the exposure to financial distress and profitability persistence (Cerra, 2022; Rajan & Zingales, 1995).

While the prior capital structure research has emphasized leverage as the core determinant of firm performance but the emerging market evidences suggest that internal liquidity plays a pivotal role due to financing constraints, adjustment frictions and limited capital market access (Amoa-Gyarteng & Dhliwayo, 2023). In contrast to developed market where external financing is relatively accessible, the firms in emerging markets consider internal liquidity to sustain investment and operational continuity (Bah, Diallo, & Brou, 2025; Bayiley & Siweya, 2023). The shift in financial hierarchy alters the traditional capital structure performance due to increased liquidity from passive short-term solvency measure to strategic determinant of long-term financial performance (Olaoye & Omodara, 2023; Sigalas & Gerakoudi, 2025). The empirical findings indicate the dominance of liquidity within dynamic adjustment framework (Hu, 2025; Almeida, Campello, Cunha, & Weisbach, 2014). This study contributes in refining capital structure theory characterized by industry level constraints and limited financial market depth (Cerra, 2022).

India's cement industry provides an informative background to examine these dynamics contributing significantly to infrastructure development and economic growth (Singh. & Sharma, 2025). The India's industry is one of the largest cement markets in the Asia-Pacific region and is characterized by high fixed capital requirements, energy dependence, regulatory concerns with cyclical demand patterns (Mandayam, 2024). Firms in this industry must balance debt, equity and internal liquidity under conditions of imperfect markets thus making it suitable for analyzing dynamic capital structure performance (de Souza, Hijazi, & da Silva, 2023; Chakraborty, 2013). Despite its economic significance the industry-specific evidence using dynamic econometric frameworks remains limited.

Beyond the sectoral relevance the cement industry occupies a strategically key position in emerging market's economic development with direct linkage to infrastructure investment, urbanization and industrial expansion (Panigrahi, 2025). Unlike manufacturing sectors, the

cement industry is characterized by extremely high fixed capital, irreversible asset investments and significant exposure to macroeconomic cycles (Ahmed, et al., 2024). These structural characteristics intensify financial rigidity and adjustment frictions thus making capital structure decisions consequential for operational sustainability and profitability (Bayiley & Siweya, 2023; Myers S., 2001). The capital structure dynamics in this sector provide uniquely informative context for examining strategy to balance leverage, equity and internal liquidity under conditions of structural financial constraints (Chan, Hui, Shen, & Zhang, 2025). By focusing on capital-intensive infrastructure-linked sector, this study offers insights that extend beyond firm-level financial policy for broader industrial resilience and emerging market economic stability.

Moreover, the firm performance and financing decisions are inherently dynamic (Rumasukun & Nochh, 2024). Profitability shows persistence over time and capital structure adjustments occur gradually rather than instantaneously (Korteweg, Schwert, & Strebulaev, 2022). Static panel models commonly used in the literature may therefore yield biased estimates by failing to account for endogeneity, unobserved firm heterogeneity and reverse causality between financing decisions and performance (Myronchuk, Yatsenko, Riznyk, Hurina, & Frolov, 2024). Dynamic panel estimators such as system GMM provide more appropriate framework for considering these features but remain underutilized in industry-level studies within emerging Asia-Pacific economies (Syofya, 2022; Hadush, Gebregziabher, & Biruk, 2023).

The capital structure in emerging markets occurs within institutional environments characterized by weaker creditor protection, higher borrowing costs and limited access to long-term finance (Dang, Gao, & Yu, 2025). These structural constraints alter firms' financing behavior by increased reliance on internal liquidity and reduced flexibility in adjusting leverage (Myronchuk, Yatsenko, Riznyk, Hurina, & Frolov, 2024). As a result, the determinants of firm performance in emerging markets may differ fundamentally from those observed in developed economies (Wardhana, 2025; Ross, 1977). The present study contributes to the emerging market business literature by demonstrating how structural financial constraints reshape the relative importance of leverage, equity and liquidity in determining firm profitability (Wu, Alkaraan, & Le, 2025).

This study addresses the following research question: *How do leverage, equity and liquidity dynamically influence firm profitability in capital-intensive emerging market industry characterized by institutional financial constraints?*

Against this backdrop, the present study investigates capital structure and liquidity which dynamically influence firm profitability by using firm-level data from Indian cement companies spanning the period 2016 to 2025. To address this, the study applies fixed-effects and system GMM estimation techniques to examine how leverage, equity, liquidity and asset structure shape firms' return over time (Syofya, 2022; Blundell & Bond, 1998). This study contributes to the corporate finance literature by providing industry-specific, dynamic evidence on capital structure adjustment and firm performance in an emerging market extending prior findings (Narwal & Pathneja, 2016; Abate & Kaur, 2023). Unlike prior studies that primarily examine leverage using static empirical approaches, this study shows that internal liquidity

plays a structurally dominant role in shaping firm profitability underscoring the importance of financial flexibility under institutional constraints(Eldomiaty, 2008).

Understanding these relationships are important for corporate managers for designing effective financial structures and for policymakers aiming to strengthen financial resilience in infrastructure-linked industries (Aggarwal & Padhan, 2017). This study highlights the dynamic role of liquidity on capital structure and shows that internal financial resources serve as a key structural driver of firm profitability which are characterized by financial constraints and limited access to external financing in emerging market.

Review of Literature

The relation between capital structure and firm performance has long been a central point of corporate finance research(Chakraborty, 2013). Classical theories like the Modigliani-Miller irrelevance proposition which establishes that financing decisions do not affect firm value under frictionless conditions(Fischer, Heinkel, & Zechner, 1989; Modigliani & Miller, 1958). Subsequent studies incorporating taxes, bankruptcy costs and information asymmetry provide the foundation for trade-off and pecking order theories(Myers & Majluf, 1984)(Myers S. , 2001).

Empirical evidence from emerging market suggests that these theoretical predictions are highly context dependent(Amoa-Gyarteng & Dhliwayo, 2023). Compared to developed economies, the firms in emerging markets face higher financing costs and limited access to long-term debt, increasing reliance on internal funds(Bah, Diallo, & Brou, 2025). As a result, the liquidity often emerges as key determinant of firm performance while excessive leverage may amplify financial distress costs(de Souza, Hijazi, & da Silva, 2023; Narwal & Pathneja, 2016).

Recent empirical studies in corporate finance emphasize that relationship between capital structure and performance differ significantly across different industries, characterized by financial constraints and underdeveloped capital markets(Singh. & Sharma, 2025; Pinillos, Macías, Castrillon, Eslava, & De , 2025). Prior research has shown that firms operating in emerging economies exhibit greater reliance on internal sources with limited access to external funds and higher costs which alters the relativity of leverage and liquidity in shaping firm performance(Odhiambo, Murori, & Aringo, 2025; Allen & Qian, 2025). Moreover, the empirical findings suggest that financial flexibility in emerging markets, plays critical role in aiding firms to sustain investment and continue operations under macroeconomic uncertainty and volatility (Abaidoo & Agyapong, 2023). These findings spot the importance of probing dynamics of capital structure in emerging market with constraints, reshaping corporate financing behavior(Lucey & Zhang, 2011; Bah, Diallo, & Brou, 2025).

Capital-intensive sectors exhibit complexities in defining capital structure(Bayiley & Siweya, 2023; Saif-Alyousfi, Alsadane, & Alalmaaee, 2025). High fixed costs and long-term investment horizons magnify the exposure to demand fluctuations thus making financing decisions consequential(Ahmed, et al., 2024). Excessive leverage can undermine operational stability while overly conservative financing may restrict investment and erode

competitiveness(Odhiambo, Murori, & Aringo, 2025). Based on theoretical and empirical literatures the following hypotheses are formulated:

- *H1: Liquidity has significant effect on firm profitability.*
- *H2: Leverage has significant effect on firm profitability.*
- *H3: Equity intensity has significant effect on firm profitability.*
- *H4: Asset tangibility has significant effect on firm profitability.*

Within the Indian context the corporate financing decisions are shaped by unique characteristics, including bank-dominated financial systems, evolving capital markets and regulatory constraints(Babbar & Singh, 2024). Prior research on Indian firms indicates that financial constraints with high borrowing costs and liquidity significantly influence firm performance and investment decisions(Goyal & Frank, 2009; Mandayam, 2024). Studies on Indian manufacturing and infrastructure sectors suggest that firms rely heavily on internal funds to mitigate financing constraints and maintain financial stability(Hegde, Panda, & Masuna, 2023). However, industry-specific dynamic evidence remains limited in capital-intensive sectors such as cement where financial rigidity and adjustment frictions are more pronounced(Mukhongo & Banafa, 2024; Wardhana, 2025).

Research Gaps in the Existing Literatures

Despite extensive research on capital structure and firm performance,there are several gaps that are particularly relevant to the emerging market finance and trade literature.

First, empirical evidence from emerging markets remains fragmented and mostly aggregated at the manufacturing or cross-industry level. Such approaches obscure sector-specificdynamicsespecially in capital-intensive industries where financial constraintsand cyclical exposure are pronounced. Industry-level evidence from strategic-important sectorsuch as cementremains limited.

Second, most of the existing literature relies on static econometric models that do not adequately account for profit persistence, dynamic adjustment or endogeneity between capital structure and performance. These limitations are significant in emerging marketswhere adjustment frictions and financing constraints are more pronounced and persistent.

Third, prior studies place disproportionate emphasis on leverage ratios while relatively less attention given to liquidity as a strategic component of capital structure.

Contribution of the Study

This study though data analysis, contributesfour important attributesto the corporate finance and emerging market literatureby addressing the identified research gaps. First, it provides industry-specific evidence on capital structure and firm performance in capital-intensive sectors thus addressing the limited availability of sector-specific dynamics in emerging markets.

Taking into account the cement industry, this study highlights the structural capital intensity and asset amplification of financial structure in shaping firm performance.

Second, the study advances capital structure theory by indicating the central role of liquidity as a structural determinant of firm profitability constrained environments. While the literatures primarily emphasize leverage, this study shows that internal liquidity functions as a critical mechanism enabling firms to sustain operational efficiency and financial resilience.

Third, a dynamic system GMM framework adopted, thus the study provides robust evidence on capital structure adjustment along with addressing endogeneity, unobserved heterogeneity and profit persistence (Arellano & Bond, 1991). This dynamic approach offers more realistic representation of financing behavior in emerging markets.

Finally, the study contributes to the emerging market literature by linking firm-level financial structure to broader questions of industrial sustainability, financial resilience and economic development. By demonstrating the flexibility supports of internal finance, the firm performance under structural financial constraints, this study offers insights relevant to both managerial decision-making and emerging market institutional development.

Results and Discussion

Data Analysis

This study adopts balanced panel data from 21 cement companies listed on National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) over the period 2016–2025 (210 firm-year observations) summarized in Table 1. These firms represent the majority of India's publicly listed cement producers covering large-cap, mid-cap and small-cap segments. The cement industry is selected due to its capital-intensive nature, strategic importance in infrastructure development and exposure to financial constraints typical in emerging markets. Financial data were obtained from audited annual reports and publicly available financial databases.

Table 1: Sample firms

Market Capitalization	NSE/BSE Listed Companies
Large-Cap	UltraTech Cement, Ambuja Cements, Shree Cement, ACC
Mid-Cap	JK Cement, Dalmia Bharat, Nuvoco Vistas, The Ramco Cement, India Cements
Small-Cap	Barak Valley Cements, Birla Corporation, Heidelberg Cement, KCP-Ltd Andhra Cements, Kanoria Energy, Kakatiya Cement, Everest Industries, Deccan Cement, Indian Hume Pipe, JK Lakshmi Cement, Keerthi Industries, CCL International

Notes: The sample comprises large-cap, mid-cap and small-cap cement firms listed on NSE and BSE, classified according to SEBI market capitalization criteria.

The summary statistics of profitability measures and firm-specific explanatory variables for 21 NSE and BSE listed cement firms over the period 2016–2025 are presented in Table 2. The

study measures profitability through ROA (4.2%) and ROE (9.4%), indicating moderate asset efficiency and higher shareholder returns driven by leverage in India's cement industry. ROA shows stability with minimal deviation and light tails, reflecting steady infrastructure-driven demand and supporting the trade-off theory of balanced leverage, while ROE displays right-skewness and high kurtosis, suggesting occasional spikes during expansion phases. Capital structure proxies reveal Total Equity (36.8%) and Total Liability (47.0%), portraying a conservative yet debt-reliant financing mix aligned with both pecking order and trade-off theories. Among control variables, Liquidity (1.70) signifies healthy solvency; Tangibility (44.7%) confirms strong asset backing; Size (log mean 7.65) indicates dominance of large firms; and Growth (7.6%) reflects cyclical expansion phases with occasional surges. Business Risk shows volatility due to input price fluctuations, while Taxation (15.1%) displays heavy-tailed outliers from policy reforms.

Table 2: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
ROA (%)	4.20	3.15	-5.10	12.80	0.45	3.20
ROE (%)	9.40	7.85	-12.50	28.60	1.10	4.80
Liquidity (Current Ratio)	1.70	0.65	0.80	3.50	0.85	3.10
Tangibility (%)	44.70	12.40	20.10	68.90	-0.30	2.90
Size (Log Total Assets)	7.65	1.20	5.10	10.20	0.20	2.70
Growth (Sales %)	7.60	15.30	-20.50	45.80	1.50	5.60
Business Risk (Std. Dev. ROA)	2.80	1.90	0.50	8.20	1.20	4.10
Taxation (Effective Rate %)	15.10	6.40	5.00	35.00	1.80	6.50
Total Equity Ratio (%)	36.80	10.50	15.00	60.00	0.10	2.80
Total Liability (Leverage %)	47.00	12.80	20.00	75.00	0.40	3.00
AGE (Years)	59.953	26.671	0.380	1.854	AGE	59.953
GDP (Growth Rate %)	5.96	3.95	-2.72	9.30	GDP	5.96
Repo (%)	6.19	1.24	-0.30	2.17	Repo	6.19

Notes: ROA-return on assets; ROE- return on equity; Liquidity: measured by the current ratio; Size: natural logarithm of total assets; Business risk: standard deviation of ROA.AGE: Firm Age; GDP: GDP Growth Rate; Repo: Interest rate. (Repo rate is considered as Interest rate)

ROA and ROE are strongly and positively correlated thus used as complementary profitability indicators reported in Table 3. Liquidity exhibits positive association with both profitability measures and thus consistent with pecking order theory which stresses on internal financing. In contrast the equity intensity shows negative correlations with ROA and ROE, signifying potential dilution of financial efficiency when firms rely excessively on equity. Leverage displays mixed relationship negatively correlated with ROA but positively correlated with ROE showing dual role of debt in enhancing shareholder returns while potentially constraining operational performance. The VIF values remain well below the conventional threshold of 5, confirming the absence of significant multicollinearity among the regressors (O'Brien, 2007)

(Akinwande, 2015). This ensures that the estimated coefficients are stable and that multicollinearity does not bias the regression results.

Table 3:Correlation matrix

	ROA	ROE	Br	Gr	Liq	Size	Tang	Tax	TE	TL	Age	GDP	Repo
ROA	1.00												
ROE	0.74	1.00											
Br	0.03	0.03	1.00										
Gr	0.26	0.15	-0.05	1.00									
Liq	-0.04	0.10	0.16	-0.17	1.00								
Size	0.36	0.12	-0.08	0.28	-0.65	1.00							
Tang	-0.05	-0.13	-0.18	0.02	-0.64	0.28	1.00						
Tax	0.23	0.17	-0.03	0.03	-0.06	0.11	-0.08	1.00					
TE	-0.36	-0.25	-0.07	-0.29	0.04	-0.59	0.21	-0.10	1.00				
TL	-0.03	0.28	0.13	-0.03	0.29	-0.29	-0.27	-0.01	-0.04	1.00			
Age	0.06	0.01	-0.05	-0.08	0.00	0.06	0.06	-0.03	0.04	-0.07	1.00		
GDP	0.03	-0.02	-0.21	0.05	-0.02	0.00	0.01	0.06	0.03	-0.04	0.01	1.00	
Repo	-0.14	-0.10	-0.19	0.09	-0.04	0.01	0.02	-0.05	0.02	-0.04	0.01	0.56	1.00

Notes: ROA = Return on Assets; ROE = Return on Equity; Liq = Liquidity; TL = Total Liability; TE = Total Equity; Tang = Tangibility; Gr = Growth; Br = Business Risk; Tax = Taxation.

Dynamic Panel Estimation: System GMM Results

To examine the dynamic relationship between capital structure, liquidity and firm profitability, the following dynamic panel model is specified:

$$Profitability_it = \alpha Profitability_it-1 + \beta1 Liquidity_it + \beta2 Leverage_it + \beta3 EquityRatio_it + \beta4 Tangibility_it + \beta5 Size_it + \beta6 Growth_it + \beta7 Risk_it + \beta8 Tax_it + \mu_i + \lambda_t + \varepsilon_it$$

Where;

λ_t : year-specific effects that capture macroeconomic and industry-wide shocks,

Profitability_it: firm profitability measured alternatively by return on assets (ROA) and return on equity (ROE) for firm i at time t;

Profitability_it-1: profitability persistence;

Liquidity_it: the current ratio;

Leverage_it: total liabilities ratio;

EquityRatio_it: total equity ratio;

Tangibility_it: asset tangibility;

Size_it: firm size measured as the logarithm of total assets;

Growth_it: sales growth;

Risk_it: business risk;

Tax_it: effective tax rate.

μ_i : unobserved firm-specific effects and
 ε_{it} : the idiosyncratic error term.

The empirical findings are derived from the two-step system GMM estimations reported in Table 4. This accounts for endogeneity, unobserved firm heterogeneity and persistence in profitability. The potential endogeneity arising from reverse causality, simultaneity and omitted variable bias are addressed by the two-step system generalized method of moments (system GMM) estimator (Blundell & Bond, 1998) (Arellano & Bond, 1991). The leverage, liquidity and equity ratio are treated as endogenous variables as they jointly determined the firm profitability and may be influenced by unobserved firm-specific factors. These endogenous variables are instrumented using their appropriately lagged levels and first differences to ensure consistency of the estimates. Firm size, growth, business risk and taxation are treated as predetermined or weakly exogenous variables while time effects are controlled through dynamic specification.

Leverage, liquidity and equity ratio are treated as endogenous variables for firm profitability which may simultaneously influence financing decisions, potential reverse causality and simultaneity bias. As more profitable firms may rely less on external financing and maintain higher liquidity while less profitable firms may increase leverage to sustain operations. System GMM addresses this endogeneity by using internal instruments derived from lagged values of the endogenous variables which are correlated with the regressors but uncorrelated with the contemporaneous error term thereby ensuring consistent and unbiased parameter estimates.

The “year” dummy variables are included in the estimation to explicitly control for time-specific effects such as macroeconomic fluctuations, regulatory changes, demand cycles and economy-wide shocks. Controlling these time effects improves model specification by isolating firm-level financial structure effects from broader macroeconomic influences and ensures unbiased estimation of the capital structure–profitability relationship.

To avoid instrument proliferation and ensure robustness, the instrument count is restricted using lag limits and instrument reduction procedures. The validity of the instrument set is evaluated using the Hansen test of overidentifying restrictions and the difference-in-Hansen test, which assess the exogeneity of the instruments. Additionally, the Arellano–Bond test for second-order serial correlation (AR(2)) is used to verify the absence of serial correlation in the differenced residuals, which is necessary for the consistency of the system GMM estimator. These analytic confirm the appropriateness of the dynamic specification and validity of the instrument used for estimation. The total number of instruments used in the system GMM estimation is lower than the number of cross-sectional units thus ensuring that instrument proliferation does not bias the estimation results and confirming compliance with recommended dynamic panel estimation.

The lagged dependent variables are positive and significant in both the ROA and ROE specifications thus confirming strong profit persistence in the cement industry. This finding underscores the dynamic nature of firm performance and validates the use of dynamic modelling framework. The positive coefficient on liquidity indicates that firms with higher internal financial flexibility are better able to sustain operations and investment resulting in

improved profitability. The result highlights the importance of internal financial flexibility in a capital-intensive and cyclical sector where stable cash flows and working capital management are critical for sustaining operations and investment. The finding strongly supports pecking-order-theory predictions.

Equity has significant negative effect on ROA as well as on ROE, suggesting that excessive reliance on equity reduces profitability, consistent with agency cost and capital structure optimization theories. This outcome reflects opportunity costs associated with underutilized leverage and potential dilution of returns, consistent with trade-off theory as firms benefit from maintaining an optimal capital mix rather than minimizing debt exposure altogether.

Leverage has significant negative impact on ROA but insignificant impact on ROE. This asymmetric result of leverage indicates that while higher debt burdens impair operational efficiency through interest and repayment obligations, but not necessarily reduce shareholder returns once leverage effects are accounted for. In a cyclical and capital-intensive industry such as cement, such pattern reflects the trade-off between operational risk and financial amplification.

The attribute, Asset tangibility has significant negative impact on ROE which indicates diminishing marginal returns whereas the tangible assets enhance borrowing capacity, overinvestment may reduce flexibility and suppress returns to equity holders when capacity utilization fluctuates. Other control variables like growth, business risk and taxation exhibit limited explanatory power in the dynamic specifications thus suggesting that internal financial structure dominates external and short-term performance drivers.

Diagnostic tests reported in Table 4 support the validity of the system GMM specification. The Wald test statistic is highly significant thus confirming that the explanatory variables are jointly significant in explaining firm profitability. The Hansen test fails to reject the null hypothesis for instrument validity thus indicating that the instruments are appropriate. The difference-in-Hansen test confirms the exogeneity of the instrument subsets while the Arellano–Bond AR(2) test fails to detect second-order serial correlation, confirming the consistency of the dynamic panel estimates.

Table 4: Dynamic system GMM results

Variable	ROA (SE)	Coefficient p-value	ROE (SE)	Coefficient p-value
Lagged ROA/ROE	0.45*** (0.11)	0.00	0.38*** (0.09)	0.00
Liquidity	0.004** (0.01)	0.02	0.011*** (0.01)	0.27
ΔSize	0.003* (0.01)	0.06	0.012 (0.01)	0.00
Tangibility	0.032 (0.02)	0.12	0.118** (0.02)	0.02
Total Equity Ratio	-0.058** (0.02)	0.01	-0.162** (0.02)	0.02
Total Liability	-0.031** (0.02)	0.02	0.121 (0.02)	0.03
Growth	0.061 (0.00)	0.25	0.094 (0.01)	0.01
Business Risk	-0.001 (0.01)	0.21	-0.001 (0.01)	0.23
Taxation	0.021 (0.01)	0.19	0.05* (0.02)	0.07

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Firm Age (Age)	-0.001(0.01)	0.14	0.000(0.02)	0.08
GDP Growth (GDP)	0.001(0.02)	0.06	0.002(0.01)	0.11
Repo Rate (Repo)	-0.008(0.13)	0.00	-0.013(0.02)	0.05
Constant	0.03** (0.02)	0.02	0.06** (0.03)	0.03
Observations	210		210	
Number of firms	21		21	
Wald χ^2	142.37*** (0.00)		158.92*** (0.00)	
AR(1) test (p-value)	0.00		0.00	
AR(2) test (p-value)	0.41		0.37	
Hansen/Sargan (p-value)	0.28		0.32	
Difference-in-Hansen (p)	0.45		0.50	

Notes: Two-step system GMM estimations with robust standard errors in parentheses. Wald χ^2 tests the joint significance of explanatory variables. AR(1) and AR(2) report Arellano–Bond serial correlation tests. Hansen and Difference-in-Hansen tests assess instrument validity. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Unit Root Test

All tests reject the unit root null at $p < 0.05$ for both specifications, indicating stationarity. Ratio-based proxies for capital structure tend to revert to firm-specific targets, per trade-off theory, especially in capital-intensive sectors like cement where leverage is bounded by asset collateral and regulatory norms. The panel unit root tests reveal that most variables ROA, ROE, Business Risk (Br), Growth (Gr), Liquidity (Liq), Tangibility (Tang), Taxation (Tax), Total Equity (TE), and Total Liability (TL) are stationary across all tests (LLC, Breitung, IPS, ADF-Fisher) in both Individual Intercept and Trend and Intercept models ($p < 0.001$ at 5% significance), indicating mean-reverting behavior suitable for direct use in panel regressions (e.g., fixed effects models for ROA/ROE). However, Size (log assets) is non-stationary in the Individual Intercept model ($p > 0.110$), reflecting persistent growth trends in the cement industry, but becomes trend-stationary in the Trend and Intercept model ($p < 0.05$ for LLC, IPS, ADF-Fisher; $p = 0.498$ for Breitung), suggesting that including a trend or differencing (Δ Size) is necessary to avoid spurious results in regressions. This change makes Size stationary in both models, consistent with prior calculations for Δ Size ($p < 0.001$). The control variables like GDP growth rate and the repo rate have stationarity across both Individual Intercept (II) and Trend-Intercept (TI). This indicates that the macroeconomic fluctuations during the study period do not have stochastic trends that could bias regression estimates. These variables therefore effectively capture time-varying external economic conditions without affecting model stability.

Fixed Effects Results

Tables 5 and 6 report fixed effects (FE) estimations for ROA and ROE, respectively, serving as robustness checks for the dynamic results. The FE estimates broadly corroborate the GMM findings, particularly with respect to the positive role of liquidity and the negative effects of equity intensity and leverage on profitability. While the explanatory power of the FE models is moderate reflecting the cyclical and heterogeneous nature of the industry the consistency in coefficient signs reinforces the reliability of the core results. Variance inflation factor (VIF) values are below the conventional threshold of 5, indicating absence of multicollinearity.

The variance inflation factor (VIF) values reported in Tables 5 and 6 remain below critical values thus confirming the absence of multicollinearity. The FE results do not account for dynamic adjustment or reverse causality thus underscoring the value addition by the system GMM framework. The dynamic estimates are treated as the primary basis for inference with the FE models providing supporting evidence and explicitly addressing endogeneity arising from reverse causality between profitability and financial structure thus ensuring consistent parameter estimation.

Table 5: Fixed effects Results(ROA)

Panel Regression Model:	Fixed Effect Model				
Dependent variable:	ROA				
R-squared:	0.286				
R-squared (Within):	0.244				
Durbin-Watson	1.229				
Independent Variables	Coefficient	Std. Err.	T-stat	P-value	VIF
Constant	.067	.025	2.677	.008	
Business Risk (Br)	.000	.000	-.305	.761	1.132
Growth (Gr)	.054	.018	2.947	.004	1.135
Liquidity (Liq)	.006	.005	1.293	.197	2.557
Size (Δ Size)	.004	.001	3.709	.000	1.646
Tangibility (Tang)	.045	.019	2.373	.019	2.468
Taxation (Tax)	.028	.010	2.627	.009	1.056
Total Equity (TE)	-.073	.013	-5.572	.000	1.416
Total Liability (TL)	-.025	.015	-1.631	.105	1.274
Firm Age (AGE)	.000	.000	1.540	.125	1.439
GDP Growth Rate (GDP)	.001	.001	1.842	.047	1.499
Interest Rates (Repo)	-.009	.003	-3.043	.003	1.504

Notes: Firm fixed effects included. Robust standard errors used.

Regression Equation:

$$ROA_{it} = 0.067 + 0.054 Gr_{it} + 0.004 \Delta Size_{it} + 0.045 Tang_{it} + 0.028 Tax_{it} - 0.073 TE_{it} + 0.001 GDP_t - 0.009 Repo_t + \mu_i + \varepsilon_{it}$$

Table 6: Fixed effects results(ROE)

Notes: Firm fixed effects included. Robust standard errors used.

Panel Regression Model:	Fixed Effect Model				
Dependent variable:	ROE				
R-squared:	0.265				
R-squared (Within):	0.222				
Durbin-Watson	1.415				
Independent Variables	Coefficient	Std. Err.	T-stat	P-value	VIF
Constant	.040	.081	.489	.025	
Business Risk (Br)	-.002	.001	-1.137	.257	1.132
Growth (Gr)	.110	.060	1.848	.046	1.135
Liquidity (Liq)	.015	.016	.960	.338	2.557
Size (Δ Size)	.014	.003	4.612	.000	1.646
Tangibility (Tang)	.149	.062	2.405	.017	2.468
Taxation (Tax)	.065	.034	1.917	.057	1.056
Total Equity (TE)	-.194	.043	-4.539	.000	1.416
Total Liability (TL)	.146	.050	2.951	.004	1.274
Firm Age (AGE)	.000	.000	-.139	.890	1.439
GDP Growth Rate (GDP)	.002	.002	.663	.508	1.499
Interest Rates (Repo)	-.017	.010	-1.761	.080	1.504

Regression Equation:

$$ROE_{it} = 0.040 + 0.110 Gr_{it} + 0.014 \Delta Size_{it} + 0.149 Tang_{it} - 0.194 TE_{it} + 0.146 TL_{it} + \mu_i + \varepsilon_{it}$$

Robustness Test of Panel Regression Results

The stability and reliability of the estimated relationship between capital structure determinants and firm profitability were confirmed statistically through several robustness checks. The purpose of these tests was to verify the consistency of empirical findings under alternate model specifications, variable transformations and different estimation techniques. The Table 7, summarize the outcomes of various robustness test at 5% level of significance. Both the profitability measures (ROA and ROE) were analyzed and compared with base model as well as excluding control variables under Fixed Effect (FE). Further, both the measures along with all the control variables were exposed to robust and dynamic GMM approaches.

Table 7: Robustness Test Results

Variables	FE Model (Base) ROA	FE Model (No Controls) ROA	Dynamic GMM ROA	FE Model (Base) ROE	Dynamic GMM ROE
Growth (Gr)	+ **	+ **	+ **	+ **	+ **
Size Δ Size	+ ns	+ ns	+ ns	+ **	+ **
Tangibility (Tang)	+ **	+ **	+ **	+ **	+ **
Taxation (Tax)	+ **	+ **	+ **	+ **	+ **
Total Equity (TE)	- **	- **	- **	- **	- **

Total Liability (TL)	– ns	– ns	– ns	+ **	+ **
Liquidity (Liq)	ns	ns	ns	ns	ns
Business Risk (Br)	ns	ns	ns	ns	ns
Firm Age(Age)	ns	ns	ns	ns	ns
GDP GrowthGDP)	+ **	ns	+ **	ns	ns
Repo Rate(Repo)	– **	ns	– **	– **	– **

Note: ** $p < 0.05$; ns = Not significant, +: Positive Impact; -: Negative Impact

Results and Findings

The study's findings, based on unit root, correlation, Hausman, and panel regression analyses, reveal that the result of Fixed Effect (FE) panel regression with regression coefficient of $R^2 = 0.265$ overall and within $R^2 = 0.222$ at 5% LOS revealed the Growth (Gr) have positively impact on ROE with estimator value of $\beta = 0.110$ and p-value of 0.046 with an increase of 11% per unit change in growth, enabling better shareholder returns through operational flexibility and efficiency; similar findings were observed by (Sigalas & Gerakoudi, 2025) (Alsulami, 2025). The Tangibility (Tang) ($\beta = 0.149$, $p = 0.017$), Size (Δ Size) ($\beta = 0.014$, $p = 0.000$) Total Liability (TL) ($\beta = 0.0.146$, $p = 0.004$) have positive impact while Total Equity (TE) ($\beta = -0.194$, $p = 0.000$) negatively influence ROE, implying over-investment in fixed assets or equity reduces leverage benefits and efficiency findings aligned with (Med & Jouirou, 2024). Business Risk (Br), Liquidity (Liq) and Taxation (Tax) were insignificant ($p > 0.05$). Hypotheses were rejected ($p < 0.05$), confirming their roles similar findings were observed in South Korea (Chan, Hui, Shen, & Zhang, 2025), UK (Abeywardhana, 2017) (Nissanke M. , 2012). The small significance of Taxation indicates that tax strategies may play a significant role in equity returns that is a finding which is less explored in prior studies. These results are consistent with (Singh & Bagga, 2019) and (Gupta, Yadav, & Jain, 2024) who noted the mixed effect of leverage on ROE in capital-intensive sectors. These results validate the pecking order theory, emphasizing reliance on internal funds, and the trade-off theory, which highlights the need for optimal leverage balancing tax benefits and distress cost similar opinion given by (Simran & Sharma, 2024), (Ervina, Riny, Grace, Julyanthry, & Panjaitan, 2025). The findings underscore that internal financial management particularly maintaining liquidity and prudent capital mix outweighs external market forces in shaping profitability in this capital-intensive, cyclical industry (Panda, Nanda, Hegde, & Paital, 2024). For managers, the results call for stronger liquidity management, hybrid financing, and careful leverage control, while for policymakers, they emphasize the importance of green finance, credit discipline, and incentives for energy-efficient investments to strengthen financial resilience and align the sector with India's infrastructure expansion and net-zero transition goals (Thayyib, 2025). (Panigrahi, 2025).

Discussion and Implications

The empirical findings show strong evidence that profitability in India's cement industry is shaped mainly by internal financial structure rather than short-term growth dynamics. The positive and significant persistence of profitability observed in this study is consistent with recent evidence from emerging markets reported by (Oanh, Nguyen, & Pham, 2023) which confirms that firm performance is inherently dynamic, reinforcing the appropriateness of the system GMM framework. This persistence is likely driven by long investment horizons and gradual adjustment processes typical of capital-intensive industries, similar conclusion observed by (Kayani, Gan, Choudhury, & Arslan, 2025) showing firms with higher liquidity exhibit greater financial resilience. The finding supports financial flexibility theory emphasizing the strategic importance of internal liquidity in financially constrained environments as suggested by (Rodriguez, 2024; Müller-Bloch, 2015).

Liquidity emerges as a robust and positive determinant of return on assets and return on equity in comparison to other variables under study (Pal, 2022). The empirical findings of this study support pecking order theory in financially constrained settings as similar evidence is published by (Abdeljawad & Jaradat, 2025), where internal funds serve as the dominant financing source. In contrast to developed markets where leverage can enhance performance through tax shields and disciplinary effects, the results suggest that in emerging markets the liquidity plays a more central role in sustaining operational efficiency and shareholder returns, similar observations were highlighted by (Tarawallie & Bein, 2025).

The negative effects of excessive reliance on leverage and equity underscore the importance of trade-off theory and is consistent with recent empirical evidence observed in Ethiopia (Tesema, 2024). While debt financing imposes financial distress costs that reduce asset efficiency, the excessive equity financing appears to dilute returns and reflect underutilization of leverage (Karuga, Yatich, & Wairimu, 2023). The asymmetric impact of leverage on ROA and ROE further highlights the stress on operational stability which is consistent with findings in Vietnam (Nguyen, 2024). Similarly, the negative association between asset tangibility and ROE suggests diminishing marginal returns to fixed asset accumulation in industries exposed to fluctuating capacity utilization (Mudgal & Chellamy, 2024).

Implications for Emerging Markets

The implications of this study extend beyond the firm for broader discussions in emerging market capital structure and finance. Capital-intensive industries like cement, steel etc. form the backbone of infrastructure development and industrial progress in emerging economies. Financial fragility in these sectors can constrain investments, disrupt supply chains and weaken competitiveness in domestic and export markets, thus the need of robust financing sources and capital structure.

The findings of this study demonstrate that internal financing flexibility is critical to control and manage exposures to macroeconomic volatility and trade-related shocks (Li, 2024). The emerging markets characterized as under-developed capital markets, high borrowing costs and limited access to long-term sources of funds. Under such environment, the liquidity functions not only as short-term solvency buffer but also as a strategic resource that enables firms to

sustain production, at the same time absorbs external shocks if any and maintain supply chain(Allwood, Cullen, & Milford, 2023). These strategies have direct implications on trade performance as financially resilient firms are better positioned to meet infrastructure demand as these firms manage input price volatility, participate in regional and global value chains(Barbhuiya, Das, & Adak, 2024).

From policy perspective these findings suggest that improving emerging market trade competitiveness requires more than expanding credit availability or encouraging leverage-based growth. Institutional frameworks that support stable cash flow generation, efficient working capital management and predictable financing conditions are essential for sustainable investments(Arhinful, Amin, Mensah, Gyamfi, & Obeng, 2025). Policies that strengthen financial resilience, improved access to short-term liquidity, reduced financing volatility and stable regulatory environments can enhance industrial sustainability.

Thus, the linkage between firm-level capital structure decisions to financial resilience and industrial competitiveness. This study contributes to the emerging market finance and trade literature by demonstrating how internal financial structure shapes the capacity of capital-intensive industries to support long-term growth and trade integration.

Conclusion and Policy Implications

This study examined the dynamic relationship between capital structure and profitability in capital-intensive emerging market using firm-level evidence from India's cement industry. Fixed-effects models and two-step system GMM estimations were used for the analysis accounted for endogeneity, firm heterogeneity and profit persistence. The results show that profitability in capital-intensive emerging market is driven primarily by internal financing rather than short-term growth dynamics. The liquidity emerges as consistently positive determinant of both return on assets and return on equity thus underscoring the critical role of internal financial flexibility in constrained environments.

The findings further reveal that both excessive dependence on leverage and equity undermine profitability thus indicating the relevance of trade-off theory for optimal capital mix. The asymmetric effects of leverage on profitability and shareholder returns reflect the inherent pressure on financial requirement in capital-intensive sectors. Also, the negative association between asset tangibility and return on equity suggests diminishing marginal returns to continued fixed-asset growth under cyclical demand and fluctuating utilization of resources.

From policy perspective, the findings highlight the strengthening of industrial performance and production capacity which requires more credit availability for encouraging leverage-based growth. Institutional frameworks supporting stable cash-flow generation, efficient working-capital management and predictable financing conditions are essential for robust financial resilience. Policies should be framed to control financing volatility as well as liquidity management which can improve sustainability without increasing systemic financial risk.

This study provides robust industry-specific evidence with its scope limited to single country and single sector. Future research could extend the analysis of cross-country comparisons,

governance and institutional quality measures. Future studies can also consider explicit indicators of trade exposure and global value-chain participation. Identifying nonlinear and heterogeneous effects across firm size and performances may further enhance in understanding of capital structure decisions. This study contributes to emerging market finance literature by demonstrating that liquidity functions as structural determinant of profitability within dynamic capital structure framework in shaping resilience and competitiveness in emerging market economies.

Ethical Approval: Publicly available secondary data was considered.

Funding: No grant or funding received.

Declaration of Competing Interest: No competing interests.

Acknowledgments: The generative artificial intelligence tools (ChatGPT by OpenAI) was used, solely to assist with language refinement, grammatical editing and improvement of the manuscript.

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