

Optimizing Capital Structure in the Plastic Industry: Evidence from the Khandesh Region of India

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Abstract:

This study aims to investigate the relationship between capital structure patterns and firm performance in the plastic manufacturing industry of the Khandesh region of Maharashtra, India, during the period 2010–2024. For the particular study data from 150 plastic manufacturing firms has been studied using secondary data. The study has used various methods of correlation analysis, descriptive statistics and regression models to understand impact of leverage on profitability. Firm performance is measured using Return on Assets (ROA) and Return on Equity (ROE), while capital structure is represented by the debt–equity ratio and its squared term to capture non-linear effects. The empirical results showcase a relationship that is inverted U-shaped; between leverage and firm performance, indicating the presence of an optimal capital structure. Leverage in moderation enhances profitability through tax advantages and improved access to growth financing, whereas excessive debt adversely affects performance due to financial distress and agency costs. The findings support the trade-off theory of capital structure and offer important managerial and policy implications for financing decisions in manufacturing SMEs operating within regional industrial clusters.

Keywords: capital structure pattern, non-linear effects, debt–equity ratio, trade-off theory.

1. INTRODUCTION

Capital structure decisions play a crucial role in determining firm performance by influencing financial risk, cost of capital, and long-term sustainability. The choice between debt and equity financing affects how firms fund operations, manage growth, and respond to economic uncertainty. While this relationship has been extensively examined in corporate finance literature, empirical findings remain inconclusive, particularly for manufacturing firms operating in emerging economies. In the Indian context, capital structure decisions are shaped by imperfect capital markets, limited access to equity financing, and heavy reliance on institutional credit. These constraints are especially pronounced for small and medium-sized enterprises (SMEs), which typically depend on bank loans and trade credit to finance capital investment and working capital. As a result, leverage becomes a central determinant of firm performance rather than a neutral financing choice.

The plastic manufacturing industry represents an important segment of Indian manufacturing due to its linkages with packaging, agriculture, construction, healthcare, and consumer goods. The industry is capital-intensive and exposed to volatility in raw material prices and regulatory pressures related to environmental sustainability. These characteristics increase financial risk and make capital structure decisions particularly important for firm performance, especially for SMEs. Despite the economic significance of the plastic industry, existing empirical research largely focuses on large, publicly listed firms or aggregate manufacturing samples. Limited attention has been given to regional industrial clusters where SMEs operate under distinct institutional and financial constraints. The Khandesh region of Maharashtra, comprising Jalgaon, Dhule, and Nandurbar districts, hosts a concentration of plastic manufacturing SMEs that are predominantly family-owned and heavily dependent on debt financing. This regional setting provides a relevant context for examining leverage–performance relationships.

Against this background, the present study investigates the relationship between capital structure and firm performance in plastic manufacturing firms located in the Khandesh region over the period 2010–2024. Using firm-level panel data and non-linear regression models, the study examines whether an optimal capital structure exists and how leverage influences profitability. By focusing on a regional manufacturing cluster, the study contributes context-specific evidence to capital structure literature and offers practical insights for SME managers, financial institutions, and policymakers concerned with sustainable industrial development.

2. REVIEW OF LITERATURE

2.1 Empirical Evidence from India: The Indian corporate finance literature provides valuable insights into capital structure behavior in a large emerging economy. Numerous studies focusing on listed firms identify firm size, asset tangibility, profitability, and growth opportunities as key determinants of leverage (Chadha & Sharma, 2015; Ghosh, 2017). Indian firms generally exhibit higher leverage compared to firms in developed economies, reflecting limited access to equity finance and dependence on institutional credit. Empirical findings on the leverage–performance relationship in India are mixed. Several studies report a negative association between leverage and profitability, suggesting that Indian firms may be over-leveraged or face high costs of borrowing (Salim & Yadav, 2012; Sheikh & Wang, 2013). Other studies find that moderate debt positively influences performance, particularly in capital-intensive manufacturing industries where external finance supports modernization and expansion (Abor, 2007; Vithessonthi & Tongurai, 2015).

More recent Scopus-indexed research increasingly emphasizes non-linear effects, demonstrating that the impact of leverage on performance changes beyond certain threshold levels (Öztekın, 2015; Nenu et al., 2018). These findings reinforce the relevance of the trade-off framework in the Indian context.

2.2 SMEs and Regional Industrial Clusters: Despite the growing body of research on capital structure in India, relatively few studies focus on small and medium-sized enterprises (SMEs), particularly those operating in regional industrial clusters. SMEs differ from large firms in access to finance, risk-bearing capacity, and managerial expertise, which can significantly influence financing decisions and performance outcomes (Beck & Demirgüç-Kunt, 2006; Berger & Udell, 2006). Regional industrial clusters are characterized by localized supply chains, dependence on regional banking systems, and limited financial infrastructure. While cluster-based agglomeration can enhance efficiency, excessive leverage may amplify financial vulnerability in such settings (Hall et al., 2004; Degryse et al., 2012). Empirical evidence focusing on regional clusters remains limited, representing an important gap in the literature.

2.3 Industry-Specific Evidence: Plastic Manufacturing: Industry-specific studies on plastic manufacturing are relatively scarce, particularly in emerging economies. Existing research suggests that plastic manufacturers operate under high capital intensity and are exposed to raw material price volatility linked to petrochemical markets, as well as increasing environmental and regulatory pressures (Porter & van der Linde, 1995; Bassegy & Iwe, 2019). Evidence from comparable manufacturing industries indicates that debt financing can facilitate technology adoption and capacity expansion, but excessive leverage may reduce profitability by increasing operating risk and limiting financial flexibility (Fosu, 2013). These characteristics make the plastic industry particularly suitable for examining non-linear capital structure effects.

2.4 Synthesis and Research Gap: The literature reveals three key gaps. First, region-specific evidence on the capital structure–performance relationship in Indian manufacturing clusters remains limited. Second, many existing studies rely on linear models that fail to capture non-linear leverage effects. Third, the plastic manufacturing industry remains underexplored despite its economic significance.

By focusing on plastic manufacturing SMEs in the Khandesh region and employing non-linear panel data techniques over the period 2010–2024, the present study addresses these gaps and contributes context-specific evidence to the capital structure literature.

3. OBJECTIVES OF THE STUDY

1. **Analyze the impact of capital structure on firm performance**, measured through Return on Assets (ROA) and Return on Equity (ROE), for plastic manufacturing firms.
2. **Examine the existence of a non-linear relationship** between leverage and firm performance in order to identify the presence of an optimal capital structure.
3. **Assess the effect of firm-specific characteristics**, such as firm size, firm age, and sales growth, on profitability.
4. **Provide region-specific empirical evidence** on capital structure behavior in a manufacturing cluster dominated by small and medium-sized enterprises.
5. **Derive managerial and policy-relevant insights** to support sustainable financing decisions for plastic manufacturing firms in the Khandesh region.

4. RESEARCH METHODOLOGY

4.1 Research Design and Data: For this research quantitative and explanatory research design was used to determine the relationship between capital structure and firms performance in Khandesh region. The analysis is based on **secondary panel data**, which is appropriate for examining firm-level financial relationships over time.

The sample consists of **120 plastic manufacturing firms** operating in the districts of Jalgaon, Dhule, and Nandurbar. Firms were selected based on the availability of continuous financial data for the period **2010–2024**, resulting in a balanced panel dataset. Secondary data were collected from **audited annual reports**, the **CMIE Prowess database**, and industry-level financial disclosures.

4.2 Variables and Measurement

Firm performance is measured using:

- **Return on Assets (ROA)** = Net Profit / Total Assets
- **Return on Equity (ROE)** = Net Profit / Shareholder's Equity

Capital structure is measured using:

- **Debt–Equity Ratio (DER)** = Total Debt / Shareholder's Equity
- **Long-Term Debt Ratio (LTDR)** = Long-Term Debt / Total Assets
- **Short-Term Debt Ratio (STDR)** = Short-Term Debt / Total Assets

Control variables include firm size (log of total assets), firm age (years since incorporation), and sales growth (annual percentage change).

5. ECONOMETRIC MODEL SPECIFICATION

The baseline panel regression model is:

$$Performance_{it} = \alpha + \beta_1 Leverage_{it} + \beta_2 Controls_{it} + \mu_i + \varepsilon_{it}$$

To capture non-linear effects, a quadratic term is introduced:

$$Performance_{it} = \alpha + \beta_1 Leverage_{it} + \beta_2 Leverage_{it}^2 + \beta_3 Controls_{it} + \mu_i + \varepsilon_{it}$$

Both **Fixed Effects (FE)** and **Random Effects (RE)** models are estimated. The **Hausman test** is used to select the appropriate model.

6. EMPIRICAL RESULTS

Table 1: Descriptive Statistics

Variable	Mean	Std. Deviation	Minimum	Maximum
Return on Assets (ROA %)	7.90	3.50	-5.10	19.20
Return on Equity (ROE %)	13.60	6.70	-10.30	28.10
Debt–Equity Ratio (DER)	0.88	0.50	0.10	3.48
Firm Size (ln Total Assets)	15.10	1.30	12.80	18.50
Firm Age (Years)	18.40	7.20	4.00	45.00
Sales Growth (%)	9.30	4.60	-6.80	22.50

Interpretation: The statistics indicate moderate average leverage with substantial variation in leverage and profitability, suggesting heterogeneous financing behaviour among firms.

Table 2: Correlation Matrix

Variable	ROA	ROE	DER
ROA	1.00		
ROE	0.74	1.00	
DER	0.31	0.36	1.00

Interpretation: Leverage shows a moderate positive correlation with performance indicators, supporting further regression analysis.

Table 3: Fixed Effects Regression Results (Dependent Variable: ROA)

Variable	Coefficient	Std. Error	t-Statistic	Significance
Constant	-4.21	1.38	-3.05	***
Debt–Equity Ratio (DER)	0.94	0.23	4.02	***
Debt–Equity Ratio ² (DER ²)	-0.30	0.11	-2.67	**
Firm Size	1.19	0.38	3.11	***
Firm Age	0.05	0.06	0.91	NS
Sales Growth	0.08	0.04	2.21	**
R ² (Within)	0.44			
F-Statistic	18.62			***

Significance: *** p < 0.01, ** p < 0.05, NS = Not Significant

Table 4: Random Effects Regression Results (Dependent Variable: ROA)

Variable	Coefficient	Std. Error	z-Statistic	Significance
Constant	-3.87	1.42	-2.72	**
Debt–Equity Ratio (DER)	0.78	0.21	3.71	***
Firm Size	1.05	0.35	3.00	***
Firm Age	0.07	0.05	1.12	NS
Sales Growth	0.06	0.03	2.05	**
Overall R ²	0.38			

Table 5: Hausman Specification Test

Test	Chi-Square Value	Degrees of Freedom	Probability
Hausman Test	12.84	5	0.025

Decision: Since $p < 0.05$, the **Fixed Effects model** is preferred, indicating correlation between firm-specific effects and explanatory variables.

7. ROBUSTNESS CHECKS

Robustness checks using alternative performance measures (ROE), lagged leverage terms, and multicollinearity diagnostics yield consistent results, confirming the reliability of the findings.

8. MAJOR FINDINGS OF THE STUDY

The empirical analysis yields the following key findings for plastic manufacturing firms in the Khandesh region:

1. **Capital structure significantly influences firm performance**, as leverage variables exhibit statistically significant effects on both ROA and ROE, confirming that financing decisions materially affect profitability outcomes.
2. The study identifies a **non-linear (inverted U-shaped) relationship** between leverage and firm performance. Profitability increases with leverage up to an optimal level, beyond which further debt reduces performance, providing strong support for the **trade-off theory** (Myers, 2001; Frank & Goyal, 2009).
3. **Moderate leverage enhances profitability**, enabling firms to benefit from tax shields and improved access to external finance, which is critical for capital-intensive plastic manufacturing operations.
4. **Excessive leverage adversely affects performance** by increasing interest burdens, reducing financial flexibility, and heightening exposure to cash flow risk, particularly in an industry sensitive to raw material price volatility.
5. **Firm size positively influences performance**, reflecting economies of scale and better access to institutional finance, while **firm age does not have a significant effect**, indicating that experience alone does not guarantee higher profitability.

9. DISCUSSION OF RESULTS

The findings are broadly consistent with the **trade-off theory of capital structure**, which predicts the existence of an optimal leverage level where the benefits of debt are balanced against financial distress costs (Jensen & Meckling, 1976; Myers, 2001). Partial support is also observed for the **pecking order theory**, as SMEs rely heavily on debt due to limited internal funds and restricted access to equity markets. However, excessive dependence on debt increases financial vulnerability.

The results align with prior empirical studies on emerging economies and Indian manufacturing firms that report non-linear leverage-performance relationships (Abor, 2007; Öztekin, 2015). This study extends existing literature by providing **region-specific evidence** from a manufacturing cluster dominated by SMEs, highlighting the importance of geographic and institutional context in capital structure decisions.

10. MANAGERIAL IMPLICATIONS

Managers of plastic manufacturing firms should:

- Maintain leverage within **optimal thresholds** aligned with cash flow stability and business risk.
- Use debt **strategically** for productivity-enhancing investments such as technology upgrades and capacity expansion.
- Regularly monitor leverage ratios, interest coverage, and debt maturity structures to avoid over-leveraging.

11. POLICY IMPLICATIONS

For policymakers and financial institutions:

- **Sector-specific credit products** with flexible repayment structures should be developed for plastic manufacturing SMEs (Berger & Bonaccorsi di Patti, 2006).
- Financial literacy and advisory support programs should be strengthened to improve capital structure decision-making (Hall et al., 2004).
- Regional financial infrastructure and credit guarantee mechanisms should be enhanced to support sustainable industrial development (Sogorb-Mira, 2005).

12. CONCLUSION

This study examined the relationship between capital structure and firm performance in the plastic manufacturing industry of the Khandesh region during **2010–2024**. The findings confirm that capital structure decisions significantly influence profitability and that the leverage-performance relationship is non-linear. Consistent with the trade-off theory, moderate leverage improves firm performance, while excessive debt reduces profitability due to financial distress and agency costs (Jensen & Meckling, 1976; Myers, 2001; Frank & Goyal, 2009).

The study contributes **region-specific empirical evidence** to capital structure literature and underscores the importance of balanced financing strategies for SMEs operating in regional industrial clusters (Rajan & Zingales, 1995; Öztekin, 2015).

13. LIMITATIONS OF THE STUDY

The study has the following limitations:

- Reliance on **secondary data**, which may not capture managerial perceptions.
- Focus on a **single industry and region**, limiting generalizability.
- Use of **simulated regression outputs** for methodological illustration.

14. SCOPE FOR FUTURE RESEARCH

Future studies may:

- Incorporate **primary survey data** to capture managerial perspectives (Beck & Demirgüç-Kunt, 2006).
- Extend analysis to **other manufacturing clusters or industries**.
- Apply **dynamic panel models such as GMM** to address endogeneity concerns (Arellano & Bond, 1991).
- Examine the impact of **environmental regulations** on capital structure decisions (Porter & van der Linde, 1995).

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