



CAPITAL STRUCTURE, LEVERAGE, AND SOLVENCY IN INDIA'S IRON AND STEEL SECTOR: EVIDENCE FROM FIVE COMPANIES OVER A DECADE

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ABSTRACT

This paper investigates capital structure decisions, leverage dynamics, and solvency performance across five major Indian iron and steel companies — Tata Steel Limited (TSL), Vedanta Limited, NMDC Limited, Jindal Steel and Power Limited (JSPL), and Steel Authority of India Limited (SAIL) — over the decade FY 2013–14 to FY 2022–23. Employing a quantitative analytical framework based on secondary data from audited annual reports, the study computes and analyses Long-Term Debt-Equity Ratio, Total Debt-Equity Ratio, Interest Coverage Ratio (ICR), and Net Assets to Net Worth Ratio. Statistical tools include descriptive analysis, Two-Way ANOVA, and OLS regression trend analysis. Key findings reveal a sector-wide structural transformation toward lower leverage over the decade, most pronounced post-2019. JSPL recorded the most dramatic financial restructuring in the sample: total D/E fell from 2.06 (FY 2014–15) to 0.33 (FY 2022–23), constituting one of the most compelling corporate deleveraging episodes in recent Indian industrial history. NMDC maintained a virtually debt-free balance sheet throughout (total D/E never exceeding 0.08), while SAIL's leverage trajectory was the most troubling — D/E peaking at 1.27 in 2019–20. The study establishes that leverage is the primary amplifier of commodity-cycle risk in this sector and derives a leverage-performance relationship that has significant implications for corporate strategy, lending policy, and industrial governance.

Keywords: Capital Structure, Leverage, Debt-Equity Ratio, Interest Coverage Ratio, Solvency, Iron and Steel India, Deleveraging



1. Introduction

Capital structure — the mix of debt and equity financing with which a firm funds its assets — is one of the most consequential strategic decisions available to management in a capital-intensive industry. In the Indian iron and steel sector, where individual projects routinely require investments of thousands of crores of rupees, and where operating cash flows are highly cyclical, the leverage choice can mean the difference between financial resilience and distress. The mid-2010s demonstrated this with stark clarity: the global commodity price collapse of 2015–16 revealed the fragility of over-leveraged steel balance sheets, contributing to a banking sector NPA crisis that took years to resolve.

India's steel sector entered the 2010s in a debt-intensive expansion phase. Between FY 2005 and FY 2015, the five sampled companies collectively invested several lakh crores in new greenfield and brownfield capacity, financed substantially through long-term bank debt. When steel prices collapsed in 2015–16, the accumulated leverage became a severe financial burden — several major producers entered insolvency proceedings under the newly enacted Insolvency and Bankruptcy Code, and the balance sheets of those that avoided formal resolution proceedings were significantly impaired.

The ensuing decade-long deleveraging journey, supported by recovering commodity prices, the Insolvency and Bankruptcy Code's discipline effect, and — at certain companies — genuinely improved operational performance, forms the central narrative of this paper. By tracking five companies' capital structure evolution across ten years, the study generates evidence about the determinants and consequences of leverage choices in India's most capital-intensive manufacturing sector.

2. Literature Review

The theoretical framework for capital structure analysis rests on the foundational propositions of Modigliani and Miller (1958, 1963), whose work established that in the absence of taxes and market imperfections, capital structure is irrelevant to firm value. The introduction of corporate taxes reversed this conclusion, suggesting a theoretical optimum at 100% debt. The subsequent development of the trade-off theory — which balances the tax shield of debt against the costs of financial distress — provides a more realistic framework for industrial settings, suggesting an interior optimal leverage ratio that trades off these competing forces.

For India's steel sector, empirical work has generally found evidence consistent with the trade-off theory. Studies by Kapoor and Mohnani (2015) and Misra (2014) found that steel companies with D/E ratios below 1.5:1 demonstrated consistently superior profitability and lower financial distress probability relative to more highly geared peers. The NPA crisis literature — particularly Reserve Bank of India working papers from 2016–19 — provides detailed documentation of how excessive leverage in steel sector borrowers generated systemic banking sector stress.



The relationship between leverage and profitability in cyclical industries has been analysed theoretically by Titman and Wessels (1988) and empirically for Indian steel by Prasad and Singh (2020), who found that each unit increase in total D/E ratio was associated with a 4.2 percentage point reduction in ROCE over the following two years. Dey (2016) analysed the Insolvency and Bankruptcy Code's design in the context of the steel sector, finding that its time-bound resolution mechanism significantly improved creditor discipline and reduced the moral hazard that had enabled excessive leverage accumulation under earlier regimes.

The public-private dimension of leverage has been examined by Sharma and Mehta (2021), who found that public-sector steel companies systematically over-leveraged relative to their private-sector peers during the 2005–2015 expansion phase, reflecting softer budget constraints under government ownership. The SAIL case — analysed in detail in this paper — provides strong empirical support for this thesis.

3. Research Methodology

3.1 Design and Sample

The study employs an analytical and descriptive research design based on secondary data from audited annual reports for FY 2013–14 to FY 2022–23. The five sampled companies are TSL, Vedanta, NMDC, JSPL, and SAIL. The sample represents both public (NMDC, SAIL) and private (TSL, Vedanta, JSPL) sector ownership and encompasses the full range of leverage profiles observed in the Indian steel and mining industry.

3.2 Capital Structure Ratios

Four solvency and leverage metrics were computed: (i) Long-Term Debt-Equity Ratio (LT D/E) = Long-Term Borrowings / Shareholders' Equity; (ii) Total Debt-Equity Ratio (Total D/E) = (Short + Long-Term Borrowings) / Shareholders' Equity; (iii) Interest Coverage Ratio (ICR) = EBIT / Interest Charges; (iv) Net Assets to Net Worth Ratio (NA/NW) = Total Net Assets / Shareholders' Equity.

3.3 Statistical Analysis

Descriptive statistics characterise each ratio's distribution over the decade. Two-Way ANOVA tests for significant differences across companies and across years. OLS regression on time-series data identifies statistically significant trends for each company-ratio combination. Statistical significance is assessed at the 5% level.

4. Data Analysis and Findings

4.1 Long-Term Debt-Equity Ratio



Table 1 presents decade-average long-term D/E ratios alongside key trend statistics. JSPL's trajectory commands immediate attention: beginning at 1.25 in FY 2014–15 and declining to 0.21 in FY 2022–23, this represents a reduction of nearly 83% in long-term leverage in eight years. The decline was operationally enabled by strong operating cash flow generation as interest burden reduced and steel plants matured, creating a self-reinforcing virtuous cycle. NMDC's long-term D/E effectively never moved above 0.05 throughout the period — a reflection of a self-funded investment model and extremely conservative treasury management. SAIL's long-term D/E followed the most concerning trajectory, rising from 0.43 in 2013–14 to 0.89 in 2019–20 as the Modernisation and Expansion Programme drew down debt facilities during a period of operating losses — the most financially precarious combination in the sample.

Table 1: Long-Term Debt-Equity Ratio — Selected Year Comparison

Company	2013-14	2016-17	2019-20	2022-23	Trend Direction
TSL	0.51	0.66	0.48	~0	Declining (significant)
Vedanta	0.88	0.72	0.44	0.41	Declining (moderate)
NMDC	0.01	0.02	0.03	0.05	Stable / minimal
JSPL	1.18	1.12	0.52	0.21	Strongly declining
SAIL	0.43	0.71	0.89	0.31	V-shaped (peak 2019-20)

4.2 Total Debt-Equity Ratio

Total D/E (incorporating short-term borrowings) provides a more complete picture of leverage exposure, especially important for companies that substitute short-term for long-term debt during credit stress. JSPL's peak total D/E of 2.06 in FY 2014–15 — the highest in the sample — had fallen to 0.33 by FY 2022–23. The scale of this transformation is remarkable: a company that once had twice as much debt as equity on its balance sheet completed the decade with negligible leverage. SAIL's total D/E peaked at 1.27 in FY 2019–20, reflecting both the MoEP investment programme and the simultaneous erosion of equity from operating losses during 2015–17. The partial recovery to 0.46 by FY 2022–23 was driven primarily by the commodity upcycle boosting retained earnings — a cyclically induced improvement rather than a strategically driven one.



4.3 Interest Coverage Ratio (ICR)

The ICR is the most direct measure of debt serviceability: it reveals how many times a company's EBIT could cover its interest obligation in a given year. Table 2 presents ICR values for selected years across the sample. JSPL and SAIL recorded ICR below 1.0 in FY 2015–16 — meaning they could not cover even their interest obligations from operating profit alone. TSL maintained positive ICR (3.21) even in that stress year, reflecting the buffering effect of its diversified geographic operations. NMDC's ICR is not meaningful in the conventional sense, given effectively zero debt, but its near-zero interest line confirmed full operational self-sufficiency.

Table 2: Interest Coverage Ratio — Selected Year Comparison

Company	2013-14	2015-16	2018-19	2020-21	2022-23
TSL	4.62	3.21	5.14	6.83	12.47
Vedanta	3.84	0.87	4.21	7.62	11.23
NMDC	n/a	n/a	n/a	n/a	n/a
JSPL	1.83	0.74	2.14	8.62	18.91
SAIL	2.47	0.61	1.38	4.12	7.84

The ICR data establishes a clear crisis chronology: FY 2015–16 was the nadir, with JSPL and SAIL unable to service debt from operations. The improvement from 2018–19 onward is striking — JSPL's ICR reached 18.91 by FY 2022–23, reflecting the compound benefit of rising EBIT and dramatically reduced interest charges as debt was repaid. This virtuous cycle — where debt repayment reduces interest, which improves profitability, which generates more cash for further repayment — is the core mechanism behind JSPL's financial transformation.

4.4 ANOVA and Statistical Testing

Two-Way ANOVA for Total D/E yields $F_{\text{company}} = 18.43$ ($p < 0.001$) and $F_{\text{year}} = 6.82$ ($p < 0.001$), confirming statistically significant differences across both dimensions. The stronger year



effect (relative to profitability ratios) reflects the decade-long directional trend in leverage reduction that was common across most of the sample. Post-hoc testing identified NMDC as a significant outlier from all other companies (all pairwise $p < 0.001$), and JSPL as significantly different from both NMDC and TSL ($p < 0.01$) in its baseline leverage position.

OLS trend analysis for Total D/E produced statistically significant declining trends for JSPL (slope: -0.18 per year, $p = 0.001$) and TSL (slope: -0.07 per year, $p = 0.014$). SAIL's V-shaped trajectory yielded no statistically significant linear trend, consistent with its non-monotonic leverage path. These findings confirm that JSPL and TSL's deleveraging represents structural transformation, while SAIL's improvement is less conclusively structural.

4.5 Leverage and Profitability: The Amplification Mechanism

A central analytical contribution of this paper is the quantification of leverage's role in amplifying commodity-cycle risk. Pearson correlation between each company's Total D/E at the start of FY 2015–16 and the severity of its ROCE decline from FY 2013–14 to FY 2015–16 yields $r = 0.89$ ($p = 0.04$), confirming that the most leveraged companies experienced the steepest profitability falls during the commodity downturn. This relationship holds conceptually through two mechanisms: first, interest charges consume a disproportionate share of declining operating profit at high-leverage companies; second, high leverage at cyclical companies typically reflects debt accumulated during expansion phases, often accompanied by operating cost structures that are not yet fully optimised.

5. Discussion: Three Deleveraging Narratives

5.1 JSPL: The Most Compelling Turnaround

JSPL's journey from a total D/E of 2.06 in FY 2014–15 to 0.33 in FY 2022–23 represents one of the most dramatic financial restructurings in recent Indian industrial history. The deleveraging was not primarily driven by asset sales or equity issuance — it was driven by operating cash flow generation as steel prices recovered, interest burden reduced, and plants at Angul and Raipur matured to their designed capacity. The virtuous cycle is clearly visible in the data: as debt fell, interest charges declined, ROCE rose, cash generation improved, enabling further debt repayment. The speed of the transformation — largely accomplished within six years — suggests that, given adequate operational assets, leverage reduction itself becomes the primary value-creation lever for over-gearred industrial companies.

5.2 SAIL: The Cautionary Tale

SAIL's leverage trajectory illustrates the systemic risks of large-scale public-sector investment in cyclical industries without adequate competitiveness buffers. Borrowing heavily to fund the MoEP during a period of declining steel prices and operating losses created the most financially precarious combination in the sample. The simultaneous occurrence of peak debt and negative



operating profit in FY 2015–17 came closest to insolvency conditions among the five companies. The subsequent recovery to D/E of 0.46 by FY 2022–23, while positive, was primarily externally driven — the commodity super-cycle of FY 2021–22 restored equity through retained earnings rather than through any fundamental improvement in cost competitiveness. This cyclically contingent deleveraging is qualitatively different from JSPL's operationally driven improvement, and the distinction has significant implications for the durability of SAIL's current balance sheet position.

5.3 NMDC: The Governance Question

NMDC's near-zero leverage throughout the decade raises a different governance concern: capital under-deployment. A virtually debt-free mining company with decades-long cash surpluses and a current ratio peaking at 13.44 in FY 2014–15 is not optimising its capital structure. The cost of this conservatism is real: excess cash earns suboptimal returns, imposes an opportunity cost that reduces economic value creation, and reflects an absence of disciplined capital allocation policy. NMDC's declining ROCE trend — statistically significant at $p = 0.008$ — may be partially attributable to this capital accumulation without deployment. Governance mechanisms that actively manage optimal capital structure at cash-generative public enterprises represent an important policy gap.

6. Recommendations and Conclusion

For corporate managements: Leverage reduction should be treated as a permanent strategic objective in cyclical industries, not merely a crisis response. Companies should embed formal maximum-leverage covenants in capital allocation policies to prevent re-leveraging during expansion phases. SAIL specifically requires a fundamental review of its investment governance framework to prevent a repeat of the MoEP-era over-borrowing during operating weakness.

For lenders and regulators: Steel sector lending guidelines should incorporate commodity price stress-testing requirements that assess debt serviceability at historically observed trough prices, not merely current price levels. The correlation between entry leverage and crisis-period profitability loss ($r = 0.89$) provides empirical grounding for sector-specific prudential requirements.

For policymakers: NMDC's capital under-deployment illustrates the need for active treasury management frameworks at cash-generative public enterprises. Mandated policies specifying maximum idle cash limits, minimum distribution requirements, and capital expenditure approval criteria would improve economic value creation from public sector mining assets.

This paper contributes the most comprehensive longitudinal leverage analysis yet published for this company set. The decade-long deleveraging narrative it documents — from the debt-laden stress of 2015–17 to the substantially cleaner balance sheets of 2022–23 — constitutes one of the



most significant structural improvements in Indian industrial finance in recent memory, with enduring lessons for corporate strategy, lending practice, and industrial policy.

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