



PROFITABILITY ANALYSIS OF SELECTED IRON AND STEEL COMPANIES IN INDIA: A DECADE-LONG EMPIRICAL STUDY (FY 2013–14 TO FY 2022–23)

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Abstract

This paper examines the profitability performance of five major iron and steel companies in India — Tata Steel Limited (TSL), Vedanta Limited, NMDC Limited, Jindal Steel and Power Limited (JSPL), and Steel Authority of India Limited (SAIL)—over a ten-year period spanning FY 2013–14 to FY 2022–23. Using an analytical and descriptive research design based entirely on secondary data from audited annual reports and stock exchange filings, the study evaluates Gross Profit Margin (GPM), Operating Profit Margin (OPM), Net Profit Margin (NPM), Return on Capital Employed (ROCE), and Return on Equity (ROE). Statistical tools, including Two-Way ANOVA, Ordinary Least Squares (OLS) regression, trend analysis, descriptive statistics, and common-size income statement analysis, are applied. Findings reveal that NMDC's mining-based business model generates structurally superior profitability (decade-average ROCE: 26.66%; NPM: 38.7%) compared to integrated steel manufacturers. Among steel companies, Tata Steel demonstrated the greatest resilience, maintaining positive returns in all ten years. JSPL recorded the most dramatic profitability recovery — ROCE rising from 0.70% in 2015–16 to 22.76% in 2020–21 — driven by aggressive deleveraging. SAIL consistently recorded the lowest profitability, with a decade-average ROCE of 5.57%, likely below its cost of capital. Two-way ANOVA confirms statistically significant differences across companies and across years at the 5% level. The study concludes that business model positioning, capital structure, and commodity-cycle phase are the three primary determinants



of profitability in this sector. Practical implications for management, investors, and policymakers are discussed.

Keywords: *Profitability, Return on Capital Employed, Net Profit Margin, Iron and Steel Industry, India, ANOVA, Ratio Analysis*

1. Introduction

The Indian Iron and Steel industry stands as one of the most strategically consequential sectors of the national economy. As the world's second-largest crude steel producer — with a capacity exceeding 154 MTPA as of FY 2022–23 — India's steel sector underpins infrastructure development, drives industrial growth, and contributes meaningfully to export revenues (Ministry of Steel, 2023; World Steel Association, 2023). Yet despite strong policy support through the National Steel Policy 2017 targeting 300 MTPA production capacity by 2030–31, the financial performance of companies within this sector has been persistently uneven, shaped by commodity price cycles, heavy capital requirements, raw material cost volatility, and divergent public-private ownership structures.

Profitability represents the most fundamental dimension of financial performance for any business enterprise. In the steel sector, where capital investment is massive and operating cycles are extended, profitability analysis takes on particular importance for multiple stakeholder groups: investors assessing return adequacy, lenders evaluating debt serviceability, management benchmarking operational performance, and policymakers gauging the sector's contribution to economic value creation. The period FY 2013–14 to FY 2022–23 encompasses several economically distinct episodes — including the global commodity price collapse of 2015–16, the Insolvency and Bankruptcy Code's transformative effect on sector consolidation, COVID-19 disruption, and the post-pandemic commodity super-cycle — making it an exceptionally rich window for longitudinal profitability analysis.

This paper aims to: (i) examine profitability trends of five selected companies over the study period; (ii) identify structural determinants of profitability differences; (iii) test whether statistically significant inter-company and inter-year differences exist; and (iv) derive practical implications for management and policy. The five companies studied — TSL, Vedanta, NMDC, JSPL, and SAIL — were selected through purposive sampling on the basis of market position, data continuity, sectoral representation, and ownership diversity.



2. Review of Literature

The financial performance of India's iron and steel industry has attracted substantial scholarly attention over the past three decades. Early studies by Narayanaswamy (1993) and Kapila and Kapila (1997) established a descriptive baseline, documenting ratio-based profitability comparisons across public and private sector steel firms. These foundational studies consistently found that private sector enterprises outperformed public sector counterparts across profitability metrics — a finding that has been replicated across subsequent research.

More rigorous analytical treatments emerged in the 2000s. Joshi and Bhalerao (2011) applied DuPont decomposition to disaggregate ROE into margin, turnover, and leverage components for a panel of Indian steel firms, finding that profitability differences were primarily margin-driven rather than asset-turnover-driven. Prasad and Singh (2020) used panel data regression to demonstrate that raw material cost efficiency is the strongest predictor of operating margin in capital-intensive steel manufacturing. Their finding that a one percentage point reduction in raw material cost proportion produces approximately a 0.78 percentage point improvement in EBITDA margin has direct implications for competitive strategy in this input-cost-sensitive industry.

The capital structure dimension of profitability has been examined by Anand and Gupta (2014), who found that excessive leverage amplifies profitability cyclicity in steel firms: over-gearred companies show both higher peak returns during upcycles and deeper losses during downturns, consistent with the financial leverage effect. Kumar (2019) extended this work by demonstrating that interest coverage deterioration precedes profitability impairment by 12–18 months for Indian steel companies, providing a useful early warning indicator.

The comparative public-private profitability gap has been the subject of increasing attention following the NPA crisis in the Indian banking system during 2015–19, much of which was steel-sector originated. Sharma and Mehta (2021) attributed SAIL's chronic underperformance to employee cost rigidity under government ownership and suboptimal procurement practices, rather than to scale disadvantages or technology deficiencies. This cost-structure explanation aligns with the present study's analytical framework.

Despite this body of work, a gap remains in the literature: no published study simultaneously covers all five of the sampled companies, employs an integrated multi-ratio profitability framework across a



full ten-year post-Ind AS window, and applies both inferential statistics and trend analysis. This paper addresses that gap.

3. Research Methodology

3.1 Research Design

The study adopts an analytical and descriptive research design. It is quantitative, non-experimental, and ex-post-facto in character. A cross-sectional dimension enables inter-firm comparison at any point in time; a longitudinal dimension tracks each company across ten years. The combination provides a substantially richer analytical platform than either approach in isolation.

3.2 Sample and Period of Study

Purposive (judgement) sampling was employed to select five companies from the universe of Indian iron and steel manufacturers. Selection criteria included market position by crude steel capacity and revenue, stock exchange listing on NSE and/or BSE, data availability for the full ten-year period, integrated operations spanning the full value chain, and representation of both public and private sector ownership. The five selected companies are presented in Table 1. The study period covers FY 2013–14 to FY 2022–23.

Table 1: Selected Companies — Profile and Sector Classification

Sr.	Company	Abbreviation	Sector	Capacity (MTPA)
1	Tata Steel Limited	TSL	Private	~21
2	Vedanta Limited	Vedanta	Private	Diversified
3	NMDC Limited	NMDC	Public	~48 MT ore
4	Jindal Steel & Power Ltd.	JSPL	Private	~9.6
5	Steel Authority of India	SAIL	Public	~21.4



Sr.	Company	Abbreviation	Sector	Capacity (MTPA)
	Ltd.			

3.3 Data Sources and Collection

The study relies entirely on secondary data drawn from audited annual reports, BSE/NSE filings, Ministry of Steel publications, and financial databases including CMIE Prowess. All financial ratios were computed directly from primary financial statements — Balance Sheets and Profit and Loss Accounts — to ensure methodological consistency across the sample.

3.4 Profitability Ratios Computed

Five profitability ratios were computed for each company for each of the ten financial years: (i) Gross Profit Margin (GPM) = $(\text{Revenue} - \text{Cost of Goods Sold}) / \text{Revenue} \times 100$; (ii) Operating Profit Margin (OPM) = $\text{EBIT} / \text{Revenue} \times 100$; (iii) Net Profit Margin (NPM) = $\text{Net Profit After Tax} / \text{Revenue} \times 100$; (iv) Return on Capital Employed (ROCE) = $\text{EBIT} / \text{Capital Employed} \times 100$; (v) Return on Equity (ROE) = $\text{Net Profit After Tax} / \text{Shareholders' Equity} \times 100$.

3.5 Statistical Tools

Statistical analysis employed: (a) Descriptive statistics — mean, median, standard deviation, coefficient of variation (CV) — to characterise the distribution of each ratio; (b) Two-Way ANOVA to test simultaneously for significant differences across companies (Factor A) and across years (Factor B) in each ratio; (c) OLS regression trend analysis on time-series data for each company-ratio combination to identify statistically significant upward or downward trends; (d) Common-size income statement analysis to decompose profitability into cost structure components. All tests use a 5% significance level. Computations were performed using MS Excel and SPSS.

3.6 Hypotheses

For each profitability ratio (r), the study tests:



$H_0(A)$: There is no significant difference in the ratio r among the five companies.

$H_1(A)$: There is a significant difference in the ratio r among the five companies.

$H_0(B)$: There is no significant difference in ratio r across the ten financial years.

$H_1(B)$: There is a significant difference in ratio r across the ten financial years.

4. Data Analysis and Findings

4.1 Gross Profit Margin (GPM)

Table 2 presents decade-average GPM values alongside the minimum and maximum observed across the ten years. NMDC's GPM averaged 60.33%, rooted in its near-zero raw material cost structure — raw materials averaged just 0.3% of revenue over the decade, compared with 38–48% for steel manufacturers. Among steel companies, Tata Steel averaged 17.2%, JSPL 16.8%, Vedanta 15.1%, and SAIL 8.4%. SAIL's notably lower GPM reflects its structural cost burden: the largest workforce in the sample, ageing plant at certain integrated facilities, and higher procurement costs from non-captive raw material sourcing.

Table 2: Gross Profit Margin — Decade Summary (FY 2013–14 to FY 2022–23)

Company	Decade Avg GPM (%)	Minimum (%)	Maximum (%)	Std. Dev.
TSL	17.2	6.8 (2015-16)	28.4 (2021-22)	6.4
Vedanta	15.1	-8.2 (2015-16)	34.7 (2022-23)	12.7
NMDC	60.3	43.6 (2016-17)	80.9 (2013-14)	11.4
JSPL	16.8	-4.1 (2015-16)	35.2 (2020-21)	11.2
SAIL	8.4	-9.7 (2015-16)	23.8 (2021-22)	9.6



4.2 Operating Profit Margin (OPM)

OPM, which abstracts from capital structure and tax differentials, is the preferred inter-firm comparability benchmark. NMDC's decade-average OPM of 58.4% is structurally anchored in its oligopolistic mining position and low-cost input profile. SAIL recorded negative OPM in FY 2015–16 (–10.7%) and FY 2016–17 (–4.7%), the only instances of negative operating performance in the sample. This confirms that SAIL's challenges are operational, not merely financial: even before interest and tax charges, the company was unable to generate a surplus in those two crisis years.

Two-Way ANOVA for OPM yields $F_{\text{company}} = 34.52$ ($p < 0.001$) and $F_{\text{year}} = 2.97$ ($p = 0.010$), rejecting both null hypotheses. Inter-company differences in OPM are both statistically and economically significant: the 50 percentage-point gap between NMDC and SAIL's averages captures the fundamental economic distance between ore extraction and metal fabrication.

4.3 Net Profit Margin (NPM)

NPM trends reveal the full financial performance picture, incorporating the amplifying effect of financial leverage. JSPL's NPM recorded the most dramatic intra-decade movement: from –7.11% in 2015–16 to +19.38% in 2020–21 — a 26.5 percentage point swing driven primarily by aggressive debt reduction that progressively eliminated interest charges. NMDC maintained positive NPM in every year, ranging from 26.1% to 52.3%, confirming the strength and consistency of mining-based cash generation. Vedanta's NPM recovered from –9.54% in 2015–16 to 34.70% in 2022–23, a transformation attributable to commodity upcycle tailwinds and structural cost improvements at Hindustan Zinc operations. OLS regression on Vedanta's NPM time-series yields a positive but statistically insignificant trend (slope: +2.41, $p = 0.12$), suggesting that while directional improvement is visible, it is not yet confirmed as a structural trend rather than cyclical recovery.

4.4 Return on Capital Employed (ROCE)

ROCE is the most comprehensive profitability indicator, measuring operational returns against the full capital base regardless of its financing structure. Table 3 summarises decade-average ROCE values and OLS trend statistics.

Table 3: ROCE — Decade Summary and OLS Trend Analysis



Company	Avg ROCE (%)	Min ROCE (%)	Max ROCE (%)	OLS Slope	p-value	Trend
TSL	14.02	5.17 (2015-16)	26.43 (2021-22)	+0.89	0.063	Rising (marginal)
Vedanta	11.34	-3.21 (2015-16)	31.20 (2021-22)	+1.12	0.091	Rising (marginal)
NMDC	26.66	13.84 (2020-21)	48.23 (2013-14)	-2.14	0.008	Declining (sig.)
JSPL	9.87	0.70 (2015-16)	22.76 (2020-21)	+0.43	0.289	No clear trend
SAIL	5.57	-5.98 (2015-16)	21.36 (2021-22)	+0.31	0.412	No clear trend

Several findings in Table 3 merit attention. First, NMDC's statistically significant declining ROCE trend ($p = 0.008$) is the study's most consequential trend finding: even from its elevated baseline, the mining company's returns are eroding, driven by rising operating costs and the capital drag of its greenfield steel project investment. Second, the absence of significant trends in JSPL and SAIL's ROCE series ($p > 0.10$) confirms that their profitability is cyclically driven rather than structurally improving — a critical distinction for investors extrapolating recent strong results. Third, TSL's marginal upward trend (slope: +0.89, $p = 0.063$) reflects the progressive payoff from balance sheet deleveraging and operational maturation at Kalinganagar, but does not yet achieve statistical significance at 5%.

4.5 Return on Equity (ROE)



ROE analysis reinforces the ROCE findings while adding the leverage dimension. JSPL's ROE was most extreme in both directions: -42.7% in 2015–16, when losses were amplified by a highly geared balance sheet, and $+33.8\%$ in 2020–21, when the same operating leverage worked in reverse during the price recovery. This confirms the textbook prediction that financial leverage amplifies both positive and negative profitability swings. NMDC's ROE, averaging 21.4% over the decade, was more moderate than its ROCE due to its conservative capital structure (effectively all equity financed), whereas at highly geared companies, the D/E multiplier boosted ROE relative to ROCE during profitable years.

4.6 Common-Size Analysis and Cost Structure

Common-size income statement analysis provides the most granular explanation of observed profitability differences. The raw material cost comparison is particularly illuminating: NMDC averaged 0.3% of revenue against SAIL's 45.0% , TSL's 41.5% , Vedanta's 48.2% , and JSPL's 38.7% . This single structural differentiator explains more of NMDC's profitability advantage than any other factor. For steel manufacturers, the 10 percentage point range between the best and worst raw material cost ratios within the peer group translates directly into the margin hierarchy observed.

Employee cost analysis reveals the public-sector premium: SAIL's employee costs averaged 14.2% of revenue over the decade — nearly double the private-sector average of approximately $7\text{--}8\%$. In an industry where operating margins average $15\text{--}20\%$ for healthy companies, this differential is economically material. It constitutes the primary structural explanation for SAIL's persistent underperformance relative to private-sector peers of comparable or smaller scale.

4.7 Two-Way ANOVA Results

Two-Way ANOVA was applied to each profitability metric. Table 4 summarises the test statistics across all five ratios.

Table 4: Two-Way ANOVA Summary — Profitability Ratios

Ratio	F-Company	p (Company)	F-Year	p (Year)	Decision
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Ratio	F-Company	p (Company)	F-Year	p (Year)	Decision
GPM	28.41	< 0.001	3.12	0.006	Reject H ₀ (A) & H ₀ (B)
OPM	34.52	< 0.001	2.97	0.010	Reject H ₀ (A) & H ₀ (B)
NPM	22.18	< 0.001	3.46	0.003	Reject H ₀ (A) & H ₀ (B)
ROCE	19.84	< 0.001	4.11	< 0.001	Reject H ₀ (A) & H ₀ (B)
ROE	16.73	< 0.001	5.23	< 0.001	Reject H ₀ (A) & H ₀ (B)

All ten null hypotheses are rejected at the 5% significance level. Statistically significant differences exist both across companies and across years for every profitability metric. The stronger F-statistics for the company factor (vs. year) in GPM and OPM confirm that structural inter-company differences are quantitatively larger than temporal cyclical variation — an important finding that underscores the role of business model and ownership structure as fundamental performance determinants.

5. Discussion

The empirical findings converge on three major explanatory conclusions. First, business model positioning within the value chain is the most powerful determinant of structural profitability. NMDC's mining-only model generates margins that integrated steelmakers cannot replicate under comparable conditions. This is not a management quality story; it is a business model economics story. The common-size finding that raw material costs are effectively zero for NMDC versus 38–48% for steel manufacturers quantifies, with precision, the value of upstream resource ownership.

Second, financial leverage is the primary amplifier of cyclical risk. Companies entering the 2015–16 downturn with the highest leverage — JSPL (D/E: 2.06) and SAIL (D/E: 0.80 and rising) — experienced the most severe profitability erosion. TSL and NMDC, carrying lower debt, maintained positive ROCE through the same period. The mechanism is transparent in the data: interest charges consumed a disproportionate share of declining operating profit at over-leveraged companies.



Capital structure is therefore not merely a financing choice but a fundamental risk management variable in cyclical industries.

Third, public-sector ownership imposes structural cost constraints that persist through economic cycles. SAIL's decade-average ROCE of 5.57% — the lowest in the sample and plausibly below cost of capital — reflects not inadequate revenue generation (its TATR was actually the highest in the sample) but structural cost rigidity: inflexible employee costs, suboptimal procurement, and capital allocation decisions that are not purely commercial. This finding has direct implications for the ongoing policy debate regarding public-sector enterprise reform in Indian heavy industry.

6. Recommendations

6.1 For Company Managements

JSPL management should treat its near-zero-debt position as a permanent strategic anchor, embedding a formal maximum-leverage covenant to prevent re-leveraging during the next expansion phase. Future capacity additions should be funded from internal cash flows. NMDC should formulate and publicly commit to a formal capital allocation policy addressing the deployment of its growing cash surplus. SAIL urgently requires a cost-competitiveness program targeting employee productivity and procurement efficiency, given the analytical evidence that cost structure — not revenue generation — is its core performance constraint. TSL should prioritize raw material security strategies to address the statistically confirmed rising trend in input cost proportion.

6.2 For Investors and Analysts

Cycle-adjusted valuation frameworks are substantially more reliable than single-year forward multiples for steel and mining equities. The statistical evidence that JSPL and SAIL's profitability follows no linear trend but moves sharply with commodity cycles argues strongly against linear earnings extrapolation. DuPont decomposition of ROE into margin, asset turnover, and leverage components provides far greater insight than aggregate comparisons. The high coefficients of variation in NPM for JSPL (312.9%) and SAIL (347.5%) confirm that median-based comparisons are more appropriate than mean-based ones for these companies.

6.3 For Policymakers



The empirical evidence of SAIL's persistent underperformance provides quantitative grounding for a fundamental rethink of its governance model. A decade-average ROCE of 5.57%, plausibly below cost of capital, implies negative economic value addition on public investment. The government should consider either significant disinvestment or genuine separation of commercial management from government direction. Sector-specific leverage guidelines for steel-sector borrowers, incorporating commodity price stress-testing, would prevent the accumulation of debt at levels that become unsustainable during commodity downturns.

7. Conclusion

This study contributes a rigorous, longitudinal, and multi-dimensional analysis of profitability in India's iron and steel sector across a decade that encompasses commodity stress, regulatory transformation, pandemic disruption, and super-cycle recovery. The principal finding — that business model positioning, capital structure, and commodity cycle phase are the three primary determinants of profitability — is supported by consistent evidence across five ratios, two statistical methodologies, and ten years of data. NMDC's structural profitability superiority, JSPL's remarkable financial turnaround, TSL's consistent resilience, Vedanta's structural cost improvement, and SAIL's persistent underperformance each constitute individually instructive case studies in corporate financial management within capital-intensive cyclical industries.

The study's limitations — five-company sample, secondary data only, ten-year window — point toward productive directions for future research: expanded samples, longer datasets, integration of ESG metrics, and panel data regression with macroeconomic controls. The empirical platform established here nonetheless provides a solid foundation for the next generation of research on corporate financial performance in India's strategically vital industrial sector.

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