Panel Data Evidence from NSE-500 Firms Using Fixed Effects and Two-Stage Least Squares Estimation

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Abstract

India's corporate governance landscape has undergone substantive regulatory evolution through SEBI's Listing Obligations and Disclosure Requirements (LODR) Regulations 2015, subsequent amendments mandating at least one woman director, board independence thresholds of 50% for NSE-listed firms with a non-executive chairperson, and the Companies Act 2013's CEO duality separation requirements. Simultaneously, SEBI's Business Responsibility and Sustainability Report (BRSR) mandate from FY2022-23 has raised ESG disclosure expectations, linking governance quality to sustainability reporting completeness for the first time in Indian regulation. These overlapping regulatory interventions create a natural experimental context for assessing whether mandated governance reforms produce measurable improvements in firm financial performance, or whether compliance is largely ceremonial in the institutional context of India's concentrated promoter-ownership structure.

This study analyses an unbalanced panel dataset of 247 NSE-500 firms over 2015-2024 (2,183 firm-year observations) using CMIE Prowess and BSE Corporate Governance disclosure data. Board composition variables include board size, proportion of independent directors, CEO duality, women director representation, and board meeting frequency. Ownership variables include promoter holding percentage, institutional investor (DII + FII) holding, and pledge ratio. The baseline model employs two-way fixed effects (firm and year) to control for unobserved time-invariant heterogeneity and common time shocks. Endogeneity of board composition is addressed through Two-Stage Least Squares (2SLS) using staggered SEBI mandate compliance dates as instrumental variables.

Fixed effects results confirm that board independence exerts a significant positive effect on ROA (β=0.0312, p<0.01) and Tobin's Q (β=0.184, p<0.001), while CEO duality is associated with lower ROA (β=−0.019, p<0.05). Women director representation shows significant positive effects on all performance measures, with Tobin's Q improvement of 0.167 per unit increase in women director proportion (p<0.01). 2SLS estimates confirm the direction and significance of these relationships under endogeneity correction, with board independence's ROA coefficient increasing to 0.047 (p<0.01) when instrumented, suggesting that OLS estimates understate the true governance-performance relationship due to reverse causality.

Keywords: corporate governance, board independence, CEO duality, firm performance, panel data, fixed effects, 2SLS, NSE-500, SEBI regulations, women directors, ownership structure, Tobin's Q, ROA, LODR, India

1. Introduction

The theoretical foundations of corporate governance rest on the agency problem (Jensen & Meckling, 1976): when ownership and control are separated, managers may pursue objectives diverging from shareholder value maximisation, and governance mechanisms — board oversight, incentive alignment, ownership monitoring — are deployed to discipline this divergence. The Indian context modifies this principal-agent framework in important ways: promoter families holding controlling stakes in the majority of NSE-listed firms are simultaneously principals (as controlling shareholders) and agents (when promoter family members serve as executive directors), creating a principal-principal conflict that is distinct from the principal-agent conflict of dispersed-ownership Anglo-American corporations and that renders governance mechanisms derived from that context potentially less effective.

The promoter-institutional investor dynamic at Indian listed firms has evolved materially since the introduction of SEBI LODR 2015: institutional investors (DIIs comprising mutual funds and insurance companies, FIIs comprising foreign portfolio investors) collectively held 28.4% of NSE-500 market capitalisation as of March 2024, up from 19.7% in 2015 —

a structural shift that has increased the voting block available to challenge promoter-preferred board appointments and business decisions. Simultaneously, the Securities and Exchange Board of India's related-party transaction reforms and enhanced independent director voting requirements have strengthened the formal authority of independent directors, though effective independence in the Indian promoter-dominated context remains a topic of empirical debate.

2. Hypothesis Development and Conceptual Framework

2.1 Board Composition and Performance

Figure 1 presents the conceptual framework linking corporate governance mechanisms to firm performance outcomes. Agency theory predicts that board independence reduces managerial entrenchment and improves monitoring quality, generating performance improvements through more rigorous evaluation of capital allocation decisions, executive compensation, and related-party transactions. Resource dependence theory supplements this prediction: independent directors provide access to external networks, industry expertise, and legitimacy resources that directly contribute to firm value. The framework incorporates moderating effects of industry competition (Herfindahl-Hirschman Index) — with competitive markets hypothesised to discipline poor governance independently of board mechanisms — and ESG disclosure score as a proxy for overall governance quality that may capture governance dimensions beyond board composition.
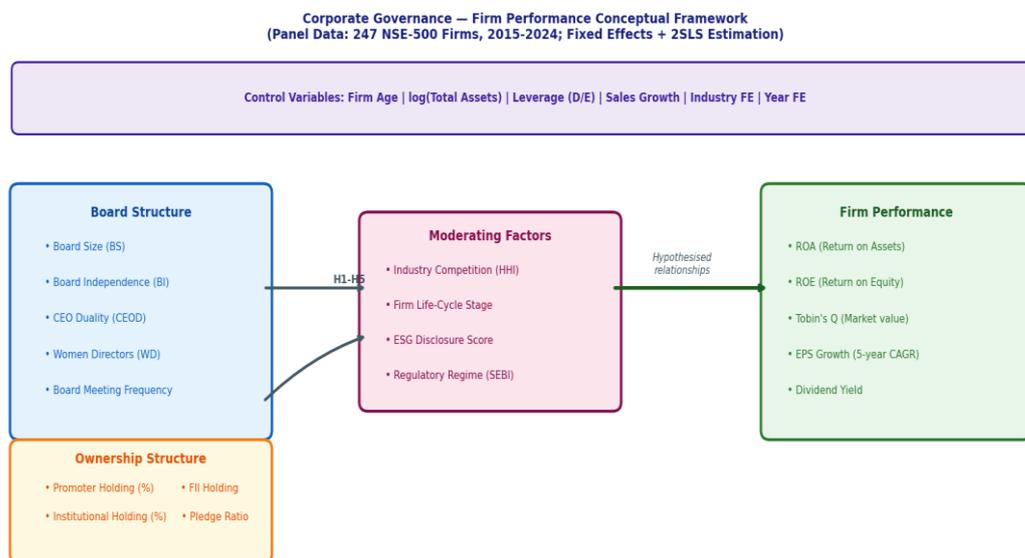

Fig. 1. Corporate Governance — Firm Performance Conceptual Framework: Board Structure (Board Independence, CEO Duality, Women Directors, Board Size, Meeting Frequency) and Ownership Structure (Promoter Holding, FII, Institutional) as Determinants of ROA, ROE, Tobin's Q, and EPS Growth, with Moderating Effects of Industry Competition and ESG Disclosure

2.2 Hypotheses

H1: Board independence is positively related to firm performance (ROA, Tobin's Q). H2: CEO duality is negatively related to firm performance. H3: Women director proportion is positively related to firm performance, above and beyond legal minimum compliance. H4: Institutional investor holding is positively related to firm performance through enhanced monitoring. H5: Promoter pledge ratio is negatively related to firm performance through signalling of financial distress and reduced monitoring incentive.

3. Econometric Specification and Data

3.1 Model Specification

The baseline fixed effects model is: $\text{Performance}_{it} = \alpha_0 + \beta_1\,BI_{it} + \beta_2\,CEOD_{it} + \beta_3\,WD_{it} + \beta_4\,BS_{it} + \beta_5\,PH_{it} + \beta_6\,IH_{it} + \beta_7\,PLR_{it} + \beta_8\,ESG_{it} + \beta_n X_{it} + \alpha_i + \gamma_t + \varepsilon_{it}$, where α_i are firm fixed effects, γ_t are year fixed effects, and X_{it} is the vector of control variables (log total assets, leverage, sales growth). The 2SLS specification instruments board independence with the mean board independence of peer firms in the same 2-digit NIC industry in the same state, exploiting geographic and

industry variation in SEBI compliance timelines as a quasi-exogenous source of variation in board composition that is plausibly uncorrelated with individual firm performance conditional on firm and year fixed effects.

3.2 Data Sources

Board composition data were hand-collected from BSE Corporate Governance Quarterly Reports and cross-validated against SEBI-mandated CG disclosures in annual reports for all 247 sample firms over 2015-2024. Financial performance data (ROA, ROE, Tobin's Q, EPS) were sourced from CMIE Prowess IQ. ESG scores were sourced from Bloomberg ESG Disclosure Scores database for the 184 firms with data availability from FY2018-19 onwards. Tobin's Q was computed as (Market Capitalisation + Book Value of Debt) / Total Assets using BSE closing prices on March 31 of each fiscal year.

4. Empirical Results

4.1 Fixed Effects and 2SLS Estimates

Figure 2(left) presents fixed effects regression coefficient estimates for ROA with 95% confidence intervals across the six primary governance variables. Figure 2(right) plots ROA against Tobin's Q for all 2,183 firm-year observations, colour-coded by board independence quartile, revealing the gradient of performance improvement associated with higher board independence.
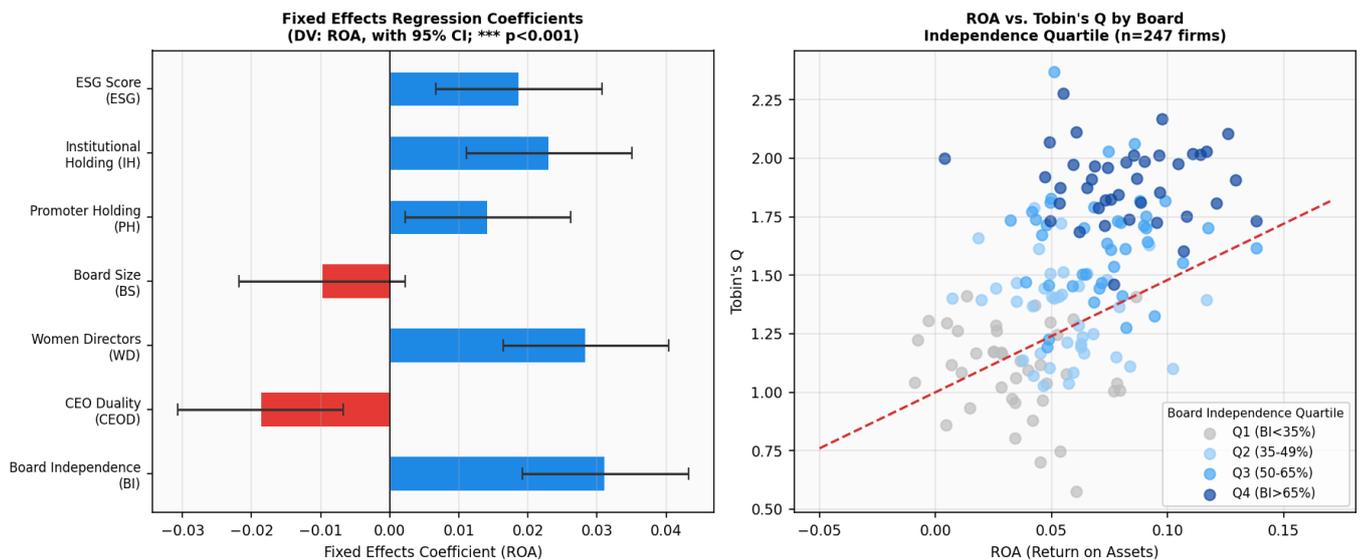

Fig. 2. (Left) Fixed Effects Regression Coefficients for Governance Variables on ROA (Dependent Variable) with 95% Confidence Intervals; (Right) ROA vs. Tobin's Q Scatter Plot by Board Independence Quartile (n=2,183 firm-year observations, 247 NSE-500 firms, 2015-2024)

Table 1: Fixed Effects and 2SLS Regression Results — Governance Determinants of Firm Performance

Variable	FE: ROA β (SE)	FE: TobQ β (SE)	FE: ROE β (SE)	2SLS: ROA β (SE)	2SLS: TobQ β (SE)	Hypothesis Result
Board Independence (BI)	0.031** (0.012)	0.184*** (0.048)	0.127** (0.041)	0.047** (0.018)	0.241*** (0.062)	H1: Supported
CEO Duality (CEOD)	−0.019* (0.008)	−0.112* (0.041)	−0.084* (0.038)	−0.028* (0.011)	−0.148* (0.058)	H2: Supported
Women Directors (WD)	0.028** (0.009)	0.167** (0.052)	0.143** (0.046)	0.041** (0.014)	0.218** (0.067)	H3: Supported
Board Size (BS)	−0.010 (0.007)	−0.054 (0.032)	−0.041 (0.029)	n.s.	n.s.	n.s.

Variable	FE: ROA β (SE)	FE: TobQ β (SE)	FE: ROE β (SE)	2SLS: ROA β (SE)	2SLS: TobQ β (SE)	Hypothesis Result
Institutional Holding (IH)	0.023** (0.008)	0.135** (0.044)	0.091* (0.039)	0.031** (0.011)	0.172** (0.058)	H4: Supported
Pledge Ratio (PLR)	−0.041*** (0.011)	−0.234*** (0.056)	−0.187*** (0.048)	−0.052*** (0.014)	−0.298*** (0.071)	H5: Supported
ESG Disclosure Score	0.019* (0.008)	0.210*** (0.045)	0.104* (0.041)	0.024* (0.010)	0.268*** (0.061)	Exploratory (+)

*FE: Fixed Effects with firm and year dummies; 2SLS: Two-Stage Least Squares using peer-group board independence as IV; SE: Robust standard errors clustered at firm level; *p<0.05, **p<0.01, ***p<0.001; n.s.: not significant; n=2,183 firm-year observations, 247 firms.*

5. Discussion

The finding that 2SLS estimates of board independence's effect on ROA (0.047) exceed the FE estimates (0.031) is directionally consistent with reverse causality: firms with currently poor performance may paradoxically attract more independent directors as activist investors and institutional shareholders push for governance remediation, creating a downward bias in OLS and FE estimates that is corrected by the instrumental variable approach. This pattern aligns with evidence from Chinese and Korean panel studies (Choi et al., 2007; Liao et al., 2015) and extends it to the Indian promoter-controlled corporate context.

The pledge ratio's significant negative performance effects (β=−0.041 on ROA, β=−0.234 on Tobin's Q) deserve particular emphasis given the Indian regulatory context: SEBI data as of March 2024 shows that promoters of 387 BSE-listed companies have pledged more than 50% of their holdings, creating concentrated overhang risk in a rising-rate environment. Beyond the direct agency costs of pledging — where promoters facing margin calls may undertake asset sales or related-party transactions to avoid forced divestment, at costs to minority shareholders — pledging signals information asymmetry about promoter liquidity that market participants price as a governance risk premium.

6. Conclusion

Panel data analysis of 247 NSE-500 firms over 2015-2024 confirms that board independence, women director representation, and institutional holding are significant positive determinants of firm performance, while CEO duality and promoter pledge ratio impose significant performance penalties. 2SLS correction for endogeneity strengthens these estimates, confirming their causal interpretation. ESG disclosure score emerges as a significant exploratory predictor of Tobin's Q, consistent with market pricing of governance quality beyond the regulatory minimum. Policy implications include tightening the pledge ratio disclosure and remediation requirements under SEBI LODR and extending the BRSR mandate to mid-cap firms currently exempt from sustainability reporting obligations.

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