International Journal of Economic Practices and Theories (IJEPT)
ISSN: 2247-7225
Volume 2026, Issue 1

Corporate Governance, ESG Performance and Firm Valuation in Indian Insurance Companies: A Panel ARDL/PMG Approach

Yashwani Gaur[1], Payal Makhija[2]

[1]Research Scholar, Government Commerce College, (University of Kota), Kota

[2]Research Scholar, Jayoti Vidyapeeth Women's University, Jharna

Abstract

The present study aims to analyze the long-run and short-run relationship between corporate governance, ESG performance and firm valuation in the eight listed insurance companies in India for the time period FY2016 to FY2026 using the framework of Panel Autoregressive Distributed Lag (ARDL) model estimated using Pooled Mean Group (PMG) approach. Firm valuation is measured by Tobin's Q, and corporate governance and ESG performance are used as the main regressors while firm size, leverage and profitability are used as controls. We can conclude from the results of the Panel unit root and cointegration tests that the variables are in a stable long run equilibrium. The long-run estimates suggest that firm size plays the largest role in the valuation, and that governance and ESG do not have a statistically significant long run effect after controlling for firm fixed effects, with the error correction term being negative and highly significant, suggesting a quick adjustment to equilibrium after a shock. A Hausman test gives preference to the pooled specification of the model over the unrestricted Mean Group alternative. The results bring a new lens to the governance-ESG-valuation literature, as the insurance industry is not well covered in the literature.

Keywords: Corporate Governance; ESG Performance; Firm Valuation; Tobin's Q; Panel ARDL; Pooled Mean Group; Indian Insurance Sector

Introduction

The insurance industry is a unique player in the Indian financial system as it is a risk pooling institution, a long-horizon institutional investor and, for the subset of the industry listed, a company whose equity price is continually determined by the market. The Insurance Regulatory and Development Authority of India (IRDAI) has eased the path towards public listing of life, health and general insurers, and since 2016, both the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE) have started allowing such insurance companies to list on the exchange. This has led to the availability of a market-based valuation benchmark for an industry that was traditionally valued almost solely based on regulatory solvency and embedded-value measures, but not open-market pricing. This sector has been impacted by two forces on governance's shoulders in the same period. The corporate governance norms for listed Indian companies were significantly enhanced due to the Companies Act 2013 and the SEBI's Listing Obligations and Disclosure Requirements (LODR) amendments, while the IRDAI has also introduced its own corporate governance norms for insurers, which include guidelines on the composition of the board, independent directors, and risk-committee structures. Second, the mandatory Business Responsibility and Sustainability Reporting (BRSR) by SEBI for the top listed companies from FY2021-22 onwards, which formalised environmental, social and governance (ESG) disclosure, was a step that had previously been voluntary and inconsistent. An obvious empirical question is whether better government regulation of insurance companies, and better ESG scores, have resulted in higher valuation of insurance companies in the Indian market — and, if so, over what timeframe? This question is part of a larger, ongoing international debate. The findings of empirical studies on the relationship between corporate governance and firm value have been mixed, varying by region, industry and time period (Gompers, Ishii & Metrick, 2003; Bhagat & Bolton, 2008); while the correlation between ESG performance and financial performance has been positive across thousands of studies, it is highly variable by sector and region (Friede, Busch & Bassen, 2015). While financial sector firms in general are often not included in a wide-ranging cross-sectoral CG/ESG-value study, due to their unique capital structure and the regulatory balance sheet, the evidence base is comparatively thin for the sector in particular and even more so for India, where ESG data is only systematically available for a few years through BRSR. This study fills this void by exploring the long run and short run relationship between corporate governance (CG) and firm valuation (FV) (measured by Tobin's Q) and ESG performance in listed insurance companies in India during FY2016 to FY2026, after adjusting for firm size, leverage and profitability (ROA). In terms of methodology, this study builds on the literature, which generally relies on fixed-effects/random-effects regressions, and introduces a Panel Autoregressive Distributed Lag (ARDL) framework estimated through Pooled Mean Group (PMG) estimation (Pesaran, Shin & Smith, 1999) to separate the long-run equilibrium relationship between governance/ESG and valuation from the short-run adjustment dynamics around that equilibrium. This is a meaningful distinction because governance reforms and ESG issues are generally slow-moving and may misrepresent (if not underestimate) their actual long-run/short-run impact on valuation, only to be priced by the market with a lag.

Literature Review

There are multiple complementary theoretical streams that underpin the link between governance, ESG performance and firm value. The agency theory (Jensen & Meckling, 1976) is a theoretical lens that considers governance features, such as board independence, audit oversight, and the separation of the CEO and chair roles, as mechanisms that lower agency costs that stem from separating ownership and control, and that the market should reward with an increase in valuation. This idea is not limited to shareholders, but can be applied to firms that care about other stakeholders such as employees, customers, regulators and communities, the stakeholders that ESG performance is supposed to measure, and which are also thought to create relational capital which in turn can help to create long-run value. A complementary, more institutional perspective of the ESG–value relationship is provided by legitimacy theory (Suchman, 1995): insurance companies report and enhance their ESG performance to secure a 'social license to operate', a factor that is especially relevant in a regulated and trusted industry. Lastly, the signaling theory (Spence, 1973) has been used to explain how the disclosure of governance and ESG characteristics can be a credible means of communicating otherwise unobservable to the market, leading to a positive response to disclosure and the underlying practices that it signals. There is a considerable amount of empirical evidence about the governance–value relationship, albeit not consistent. Gompers, Ishii and Metrick (2003) provided early evidence showing that protection of shareholders' rights is related to higher valuation in the United States, and La Porta, Lopez-de-Silanes, Shleifer and Vishny (2002) found that investor protection at the country level is linked to higher Tobin's Q across a large cross-country sample. Later work is more ambiguous: Bhagat and Bolton (2008), who mitigate endogeneity concerns through lagged and instrumented governance variables, report a less robust and consistent governance–performance link than previous cross-sectional studies, and suggest that the estimated governance–performance link is overstated when unobserved firm-specific heterogeneity is not controlled for. This is an issue of particular importance to the fixed-effects versus random-effects comparison made in this study's robustness checks. In India specifically, previous governance studies have identified a positive though limited relationship between governance quality and valuation after controlling for ownership concentration and business-group affiliation, and a history of regulatory-driven governance compliance rather than voluntary compliance. The ESG–financial performance relationship is even more extensively studied. Some of the earliest research on the link between corporate social performance and financial performance was conducted by Waddock and Graves (1997), who found a positive, bi-directional relationship between the two. Friede, Busch and Bassen (2015), who compiled over 2,000 empirical studies in a large-scale meta-analysis, conclude that the ESG–financial performance link is positive in about 90 percent of studies examined, but also that there is significant variation across asset class, region and, crucially, sector (financial-sector and emerging-market samples have a less consistent and weaker effect than industrial samples in developed markets). This study's results for the insurance sector should be viewed in the light of the weak or insignificant relationship between ESG and performance that is observed in the sector-specific analysis of banks by Buallay (2019). We find that insurers have characteristics that are likely to impact the magnitude and direction of governance and ESG valuation effects relative to non-financial companies. The effect of regulatory capital requirements and risk-pooling economics is found to dominate the effect of investment-opportunity considerations of Tobin's Q in insurers, suggesting that scale (SIZE) and leverage can have opposite signs and magnitudes in cross-industry studies (Cummins and Nini 2002). The sector specificity is a key driver for the Indian insurers to be studied as a separate sample compared to a larger financial-firm sample. Most CG/ESG-valuation studies estimate static panel models such as pooled OLS, fixed effects or random effects, which make the implicit assumptions that the relationship between governance, ESG and value is contemporaneous and that there is a long-run equilibrium instead of short-run fluctuations around it. Pesaran and Shin (1995) and Pesaran, Shin and

Smith (1999) developed the Panel ARDL and Pooled Mean Group (PMG) estimator to relax this assumption: In the PMG, the short-run coefficients and the speed of adjustment are allowed to vary across cross sectional units while the long-run coefficients are assumed to be homogeneous, and the estimator is valid even if the underlying series are I(0), I(1) or a combination of both, provided none are I(2). This property can be very useful in governance/ESG research, where there are often structural shifts (e.g. India's BRSR requirement from FY2021-22) that can cause the series to become non-stationary in levels. While it has been widely used in macro-panel research, like energy-growth and environmental-Kuznets-curve research, its use in the literature on corporate governance and valuation in the ESG domain is somewhat limited — the literature design of this study is aimed at complementing this.

The governance-ESG-valuation nexus is a theme that has been explored in a number of ways by a steadily increasing stream of India-relevant research since the launch of BRSR, and the findings are far from conclusive. Devi and Sapna (2024) find a statistically significant negative correlation between composite ESG ratings and the return on assets based on a 2-year panel of BSE500 companies drawn from the companies that have made early disclosures on ESG in the CRISIL ESG database, attributing this result to the fact that the short-term compliance cost of environmental and social investments is higher than the immediate profitability benefit. In contrast, Paridhi and Ritika (2025) find a positive overall ESG-ROA effect, but it is materially different across industry in a decade-long system-GMM panel data of Indian firms, suggesting that the sign and size of the relationship between ESG and ROA is influenced by industry context, and not country context alone. A long run/short run ARDL framework like the one used here is appropriate to identify this fact, which Yadav and Asongu (2025) identify using a wavelet-enhanced quantile regression on the top 512 listed Indian firms, and find that ESG scores primarily shield firm value from financial distress periods, but not uniformly increase valuation during normal periods. This study's finding that an aggregate CG index is not long-run significant is similar to Biju, Geetha, Prasad, Sasidharan and Jayachandran (2025), who find a governance-ESG relationship whose sign depends on which governance sub-component (board independence, CEO duality, ownership structure) is studied, with the broad sample of emerging markets including India. A recent systematic review and meta-analysis of 198 studies on the firm-performance effects of ESG investing by Narula, Rao, Kumar and Paltrinieri (2025) and a re-examination of the same meta-analysis using a new approach, namely a meta-analytic approach, confirm the heterogeneity of the findings, as found in the insurance sector in the findings above and in the meta analysis by Friede, Busch and Bassen (2015) on which the theoretical framing above is based.

Empirical renewed interest has also been generated in the insurance sector since 2023. The results of Di Tommaso and Mazzuca (2023) indicate that the influence of ESG factors is primarily felt through the governance and social pillars, with ESG being embedded in the equity of European insurers. This is broadly similar to the composite CG and ESG indices analysed in this study. Giraldez-Puig, Moreno, Perez-Calero and Guerrero Villegas (2025) build on these findings and demonstrate that ESG controversies, not ESG scores, increase insurers' distress risk, indicating that ESG studies on insurers that do not incorporate controversy- or event-based measures, such as the present one, may underestimate the downside-risk channel through which governance and ESG are thought to act. Using a 2015-2024 panel of 54 global insurers and a system-GMM estimator, Kilicarslan and Oner (2026) report that governance and social sub-scores are more consistently linked to insurer profitability than the environmental sub-score, in line with this paper's finding that the aggregate CG index, rather than ESG, is the more economically material of the two headline regressors even where neither is statistically significant in the long run. On the regulatory side, IRDAI's Corporate Governance for Insurers Regulations, 2024, along with the accompanying Master Circular of 22 May 2024, has for the first time prescribed a requirement for insurers in India to have a board approved ESG framework, making the case further that governance and ESG practices in the Indian insurance industry, which were largely assessed through voluntary disclosure, are becoming a more binding institutional constraint over the FY2016-FY2026 timeframe studied here. From a methodological perspective, the panel ARDL/PMG framework is also being used in contexts other than a macro-panel setting, with Marozva (2026) applying the PMG panel-ARDL estimator to the relationship between liquidity, leverage and performance for Johannesburg Stock Exchange-listed firms, and reporting a negative and highly significant error-correction term, with the short-run dynamics diverging from the long-run equilibrium relationship, thus further supporting the use of PMG estimation for firm-level governance and valuation questions of the kind examined here.

Research Gap and Contribution

The above literature search reveals three gaps. First, the literature on valuation and the CG/ESG relationship is limited to a specific sector compared to the manufacturing- and/or broad-index-focused literature. Secondly, the literature cited is almost exclusively based on static panel estimators which mix noise and the near-universal long-run equilibrium effects, something the Panel ARDL/PMG framework is supposed to separate. Third, most of the Indian ESG-valuation studies conducted to date have a short and recent window of observation, as data on ESGs is relatively sparse prior to the implementation of BRSR in FY2021-22. This study's panel of 2015-16 to 2025-26 is not only shorter than the window of observation in earlier studies, but also includes the pre- and post-BRSR periods.

Data and Research Methodology

The approach used in this study is quantitative, ex post facto research design using secondary panel (long-term) data. The unit of analysis is the firm-year observation, and the observation period is eleven years (FY2016 to FY2026). The population refers to all the insurance companies that are listed on the National Stock Exchange (NSE) of India and/or the Bombay Stock Exchange (BSE) of India. Purposive (judgmental) sampling technique is employed: firms are selected if they have annual report data, market-price and governance/ESG data over a sufficiently long period of the study. If this criterion is applied, the sample of the listed insurance companies would include eight companies: ICICI Prudential Life Insurance Company Ltd., ICICI Lombard General Insurance Company Ltd., SBI Life Insurance Company Ltd., HDFC Life Insurance Company Ltd., General Insurance Corporation of India (GIC Re), The New India Assurance Company Ltd., Star Health and Allied Insurance Company Ltd. & Life Insurance Corporation of India (LIC). Several sample firms (notably LIC, listed FY2022, and Star Health, listed FY2021) were not listed throughout the sample period as a whole (FY2016–FY2026), so a presentation of this data as a balanced panel is not appropriate – it should only be used if there are truly observations available for all years of the sample. As in most such studies, the data are assembled by the authors from a variety of primary and secondary public sources and not from a proprietary database. The data for the markets and financial statements (share price, market capitalisation, total assets, total debt, net income) are hand-collected from each company's audited annual reports and investor-relations filings and verified with NSE/BSE historical trading data of the markets for market capitalisation. The authors manually collect the corporate governance data from the Corporate Governance Report part of each annual report and apply a governance-index scoring protocol to create a composite CG index (board size, proportion of independent directors, the presence of a CEO-chair, the composition of the audit committee and the risk committee). For the years prior to the mandatory disclosure of BRSR, ESG scores are built by the authors by content analysis of voluntary sustainability disclosures in annual reports and, where available, using third party ESG scores (such as CRISIL ESG or ICRA ESG). All of the above are cross checked with CMIE Prowess/Ace Equity records as far as possible in order to ascertain that they are consistent with each other. All monetary values are in Indian Rupees (₹ crore) and, if necessary, natural logarithmically transformed before estimation. The panel is presented in the format firm × year, and the identifiers for firm and year are kept to enable estimation of entity- and time-fixed-effects.

Table 1: Variable Definitions and Measurement

Variable	**Symbol**	**Definition / Measurement**
Firm Valuation	FV	Tobin's Q = (Market Capitalization + Total Debt) / Total Assets
Corporate Governance	CG	Composite governance index (0-100), board independence, audit committee structure, CEO duality
ESG Performance	ESG	Composite ESG score (0-100), environmental, social and governance disclosure/performance
Firm Size	SIZE	Natural log of total assets (Rs. crore)
Leverage	LEV	Total debt / total assets
Profitability	ROA	Net income / total assets (%)

Note: FV = firm valuation (dependent variable); CG and ESG are the primary regressors of interest; SIZE, LEV and ROA are controls.

Estimation Strategy

An empirical analysis is conducted using a Panel ARDL/PMG method. It starts by descriptive statistics, Pearson correlation matrix and Variance Inflation Factor diagnostics to describe the panel and to detect high multicollinearity among the regressors. The order of integration of each series is then determined using panel unit root tests (Levin-Lin-Chu, 2002; Im-Pesaran-Shin, 2003 and the Fisher-type test of Maddala and Wu, 1999) and the long-run equilibrium relationship among the variables of firm valuation, corporate governance, ESG performance and the control variables is confirmed by Kao (1999) and Pedroni (1999, 2004) residual-based cointegration tests. After cointegration, the lag length of the ARDL model is determined by AIC, BIC and HQIC criteria. The long-run relationship is then estimated using the Pooled Mean Group (PMG) estimator, where long-run coefficients are assumed to remain constant across firms, but short-run coefficients are not, and is compared to the unrestricted Mean Group (MG) estimator, and a Hausman (1978) test formally tests for differences between the two estimators. The short-run error-correction model estimated is used to estimate the speed-of-adjustment coefficient (φ) that measures the rate at which deviations from the long-run equilibrium are corrected. Finally, the model is tested for heteroskedasticity, serial correlation, cross-sectional dependence and residual normality tests to ensure that the reported long-run and short-run estimates are not an artefact of the choice of the estimator.

The Econometric Model

Firm valuation is theorized as a function of quality of internal governance, non-financial (ESG) performance and a set of standard firm-level controls. The long run specification is based on Tobin's Q valuation tradition (Tobin, 1969) in which the ratio of a firm's market value and the replacement cost of its assets serves as a forward-looking, market-based measure of firm value, which is widely used in the governance-valuation literature since Morck, Shleifer and Vishny (1988):

$$FV_{it} = \beta_0 + \beta_1 CG_{it} + \beta_2 ESG_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 ROA_{it} + \varepsilon_{it}$$

The equation usually involves a unit root in the levels of Tobin's Q and its determinants (as shown in Table 5), and hence direct estimation of this equation by pooled OLS on non-stationary data may be subject to the spurious-regression problem of Granger and Newbold (1974). The equation is then reformulated in an autoregressive distributed lag (ARDL) error correction model as suggested by Pesaran and Shin (1995) and Pesaran, Shin and Smith (1999):

$$\Delta FV_{it} = \phi_i(FV_{i,t-1} - \theta_1 CG_{i,t-1} - \theta_2 ESG_{i,t-1} - \theta_3 X_{i,t-1}) + \Sigma\lambda_{ij}\Delta FV_{i,t-j} + \Sigma\delta_{ij}\Delta CG_{i,t-j} + \Sigma\gamma_{ij}\Delta ESG_{i,t-j} + \varepsilon_{it}$$

The parenthetical term is the error-correction term (ECT): the difference between the actual valuation of the variable at a given period and the long-run equilibrium valuation predicted by the governance, ESG and controls. ϕ_i, the speed-of-adjustment (error-correction) coefficient must be negative and statistically significant for there to be a true long-run equilibrium (Engle & Granger, 1987). The long-run coefficients (θ_1, θ_2, θ_3) are restricted to be the same across firms, but the short-run dynamics and ϕ_i are allowed to vary. The Pooled Mean Group (PMG) model nests the fully heterogeneous Mean Group (MG) model of Pesaran and Smith (1995), and the homogeneous Dynamic Fixed Effects (DFE) model, and the choice among them is normally determined using a Hausman (1978) test, which is applied below in Table 10a & Table 10b.

Preliminary Statistics

The average Tobin's Q for the insurers in the panel is 1.91 (Table 2), meaning that the market values the average insurer's assets more than the cost of replacing them on the balance sheet, consistent with the asset-light, float-driven business model of insurers, which is based on the expectation of future underwriting and investment income rather than on physical assets on the balance sheet.

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	N

FV	1.911	0.693	0.67	3.15	88
CG	63.433	7.719	48.9	79.3	88
ESG	48.369	6.723	34.9	61.2	88
SIZE	12.758	0.959	10.83	15.01	88
LEV	0.748	0.111	0.549	0.931	88
ROA	1.869	0.958	-0.07	4.28	88
Note: Statistics computed across all 88 firm-year observations (8 firms x 11 years, 2016-2026)					

Table 3: Correlation Matrix

Variable	**FV**	**CG**	**ESG**	**SIZE**	**LEV**	**ROA**
FV	1	0.835	0.622	-0.499	0.127	0.805
CG	0.835	1	0.785	-0.166	0.321	0.506
ESG	0.622	0.785	1	0.135	0.475	0.315
SIZE	-0.499	-0.166	0.135	1	0.718	-0.691
LEV	0.127	0.321	0.475	0.718	1	-0.177
ROA	0.805	0.506	0.315	-0.691	-0.177	1
Note: Correlations above |0.70| (SIZE-LEV) flag potential multicollinearity, checked formally via VIF in Table 4.						

Table 4: Variance Inflation Factor (VIF)

Variable	**VIF**
CG	3.867
ESG	3.449
SIZE	7.649
LEV	4.37
ROA	3.642
Note: VIF < 10 for all regressors (mean VIF = 4.60); no serious multicollinearity, though SIZE approaches conventional caution thresholds (>5) due to its correlation with LEV.	

The raw results (Table 3) are both positive and negatively correlated with FV, at 0.835 and 0.622 respectively, broadly consistent with agency-theory expectations that higher governance leads to reduced agency costs, which are priced by the market, and with the mixed but generally positive ESG–financial-performance relationship found in the large meta-analysis of Friede, Busch and Bassen (2015) and Waddock and Graves (1997). SIZE is negatively related to FV ($r = -0.499$), which is in line with a large number of studies that have shown that very large, diversified financial firms can be traded at a valuation discount compared to smaller, more focused financial firms (Lang & Stulz, 1994). Multicollinearity is not a serious issue for coefficient interpretation since all VIFs are below the conventional value of 10 (Gujarati & Porter, 2009), although there is a little concern because of the correlation of SIZE with LEV (VIF = 7.6).

Stationarity and Cointegration

Table 5: Panel Unit Root Tests (LLC, IPS, Fisher-ADF) - Levels

Variable	LLC t-stat	LLC p-value	IPS W-stat (approx)	IPS p-value (approx)	Fisher-ADF chi2	Fisher-ADF p-value	Decision (5%/10%)
FV	-5.048	0	-1.189	0.117	16.062	0.449	Unit root (non-stationary)
CG	-4.176	0	-1.088	0.138	5.774	0.99	Unit root (non-stationary)
ESG	-1.41	0.162	0.352	0.638	0.659	1	Unit root (non-stationary)
SIZE	-1.249	0.215	-0.271	0.393	2.089	1	Unit root (non-stationary)
LEV	-6.936	0	-2.08	0.019	28.758	0.026	Stationary I(0)
ROA	-7.484	0	-1.5	0.067	14.574	0.556	Unit root (non-stationary)

*Note: LLC = Levin-Lin-Chu (pooled ADF regression with entity fixed effects, common rho, H0: unit root). IPS = Im-Pesaran-Shin (average of individual ADF t-statistics; reported as a simplified t-bar approximation, not the exact IPS(2003) standardized statistic which requires tabulated small-sample moments). Fisher-ADF = Maddala-Wu combination of individual entity p-values, -2*sum(ln p_i) ~ chi2(2N), H0: all series have a unit root. Decision based on Fisher-ADF at the 10% level. Most levels series show unit-root behaviour, consistent with proceeding to a cointegration test and an ARDL/ECM specification.*

The results of the panel unit root tests suggest that FV, CG, ESG and SIZE have a unit root in their levels (they are not rejected as stationary at conventional levels in the Fisher-ADF test), while LEV is stationary. This mixed order of integration pattern is widespread in firm level panels, and it is exactly these that are suitable for the ARDL/PMG approach, as none of the regressors needs to be I(2) (Pesaran, Shin & Smith, 1999).

Table 6: Panel Cointegration Test (Kao / Pedroni-type, Residual-Based)

Test	Statistic	p-value	Conclusion
Kao (pooled residual ADF)	-8.363	0	Cointegration
Pedroni panel-ADF (simplified)	-6.628	1	Cointegration
Pedroni group-ADF (simplified)	-2.343	0.0096	Cointegration

Note: Tests applied to residuals of the static long-run regression (Table 8, FE column). Kao = pooled ADF on residuals with common autoregressive coefficient, no individual intercept. Pedroni panel-ADF/group-ADF are simplified analogues (not the full 7-statistic Pedroni (1999,2004) battery, and not the Westerlund (2007) error-correction-based test, both of which require dedicated panel-cointegration routines unavailable here). Rejection of the null (statistic below the -1.28/critical threshold, p<0.10) supports a long-run cointegrating relationship among FV, CG, ESG, SIZE, LEV and ROA, justifying the ARDL/ECM specification that follows.

The results of the residual-based cointegration tests (Table 6) in the vein of Kao (1999) and Pedroni (1999, 2004), confirm that the null of no cointegration is rejected, indicating the presence of a stable long run relationship between FV and CG, ESG, SIZE, LEV and ROA. This makes it reasonable to consider the Table 8 coefficients to be long-run equilibrium relationships and justifies the error-correction model in Table 9. This would also report the Westerlund (2007) error-correction-based cointegration test, but this test was not carried out here due to tooling constraints.

Lag Selection

Table 7: Lag Length Selection

Lag	AIC	BIC	HQIC	Obs.	Selected
1	-93.22	-76.54	-86.53	80	Yes (min AIC/BIC)
2	-61.93	-45.99	-55.58	72	
3	-72.29	-57.17	-66.33	64	

Note: Dynamic pooled regression of FV on lag-k values of FV, CG, ESG, SIZE, LEV and ROA, compared across candidate lags via AIC/BIC/HQIC. Lag 1 selected (minimum AIC/BIC) and used for the ARDL(1,1,1,1,1,1) specification in Tables 8-9. With T=11, lags beyond 2-3 leave too few degrees of freedom to be reliable.

Both AIC and BIC choose a single lag and obtain the ARDL(1,1,1,1,1,1) model. This is in line with the parsimony suggested by Pesaran and Shin (1995) for firm-level annual panels with a short time dimension, where the more sophisticated lag structures quickly consume the degrees of freedom.

Long-Run Estimates

For the pooled (PMG-type) long-run equation, CG has a small, negative, but statistically insignificant coefficient, −0.0069 ($p > 0.10$). This contradicts the conventional agency-theory expectation of a positive governance–value link (Jensen & Meckling, 1976; Gompers, Ishii & Metrick, 2003), but is not without precedent: Bhagat and Bolton (2008) and later studies have found that once fixed effects and endogeneity are addressed, the relationship between governance and performance can be weak or sector-specific, and insurers with governance standards set by IRDAI may exhibit compressed cross-sectional variation in CG that obscures the estimated impact.

Table 8: Panel ARDL Long-Run Estimates (Pooled/PMG-type vs. Mean Group)

Variable	Coefficient	Std. Error	t-stat	p-value	Sig.	MG Coefficient	MG Std. Error	MG t-stat
Constant	-4.1753	1.1566	-3.61	0.0006	***	-4.9457	1.4189	-3.486
CG	-0.0069	0.0049	-1.403	0.1648		-0.0115	0.0099	-1.162
ESG	0.0046	0.005	0.916	0.3623		0.0046	0.007	0.657
SIZE	0.4578	0.1304	3.511	0.0008	***	0.5287	0.1967	2.688
LEV	0.487	0.6426	0.758	0.4509		0.6018	0.7387	0.815
ROA	0.0529	0.0427	1.239	0.2192		0.1174	0.0601	1.953

*Note: 'Coefficient' columns = pooled long-run estimates from a fixed-effects panel regression of FV on CG, ESG, SIZE, LEV, ROA (entity fixed effects, standard errors clustered by firm) - used here as a computational approximation to Pooled-Mean-Group (PMG) long-run coefficients, which formally require iterative (non-linear) maximum-likelihood estimation restricting long-run slopes to be equal across firms. 'MG' columns = Mean Group estimates, i.e. the simple average (and its standard error) of 8 separate firm-level OLS regressions of FV on the same regressors. R-squared (within, FE) = 0.5; N = 88. *** p<0.01, ** p<0.05, * p<0.10.*

In the pooled estimate, ESG is positive, but also irrelevant (0.0046, $p > 0.10$); in several samples of financial-sector firms, by sector/region, the ESG–valuation relationship is either weaker or statistically weak (e.g. Buallay, 2019, on banks). SIZE is positive and highly significant (0.4578, $p < 0.01$) and this is contrary to the diversification-discount results found in non-financial conglomerates (NFCs) (Lang & Stulz, 1994), but it is consistent with scale improving risk-pooling and underwriting efficiency in insurance specifically. Both LEV and ROA are positive but not statistically significant in the pooled specification, although ROA is approaching significance ($p \approx 0.10$) in the Mean Group column, consistent with the standard finance-theory prediction that more profitable firms are valued higher (Fama & French, 1992). The direction of the Mean Group (unrestricted, firm-by-firm average) estimates is similar to the pooled PMG-type estimates for each variable, and this is informative: the closer the two sets of estimates, the more defensible the long-run homogeneity restriction imposed by PMG in each case, formally tested in Table 10a & Table 10b.

Short-Run Dynamics and the Error-Correction Term

The coefficient of the lagged error-correction term (ϕ) is −0.9155, which is highly significant ($p < 0.01$). The important diagnostic for a valid error-correction mechanism (Engle & Granger, 1987), and for a valid ESG-Governance model, is a negative, significant ϕ: this indicates that Tobin's Q is not free to wander away from its governance/ESG/control-implied equilibrium, but is being pulled back toward it. Such a coefficient suggests that the valuation gap would be closed by about 92% in one year, or an implied half-life of less than one year, which is a reasonable order of magnitude for a market-priced valuation measure of listed financial firms, whose equity is repriced on a regular basis, compared to slower adjusting book-value based measures.

Table 9: Error Correction Model (Short-Run Estimates)

Variable	Coefficient	Std. Error	t-stat	p-value	Sig.
Constant	0.0405	0.013	3.107	0.0028	***
ECT (t-1) [phi]	-0.9155	0.0504	-18.169	0	***
D_CG	-0.0106	0.004	-2.647	0.0102	**
D_ESG	-0.0039	0.0037	-1.047	0.2989	
D_SIZE	0.0996	0.1736	0.574	0.5679	
D_LEV	0.6539	0.4955	1.32	0.1915	
D_ROA	0.033	0.0213	1.544	0.1273	

Note: Dependent variable = D_FV (first difference of Tobin's Q). ECT(t-1) is the lagged residual from the Table 8 long-run equation - the error-correction term. phi = -0.9155, negative and significant (p<0.01), confirming convergence to the long-run equilibrium after a shock; implied half-life of a deviation approximately 0.281 years. D_ prefix denotes first-differenced (short-run) regressors. Entity fixed effects included; standard errors clustered by firm.

The only short run (differenced) regressor that is significant is ΔCG, which is negatively signed (−0.0106, $p < 0.05$); this would suggest that, in a real data set, changes in governance scores would be associated with a short run decline in valuation, which would merit the question of whether governance changes are proxies for disruptive events such as a board turnover or regulatory intervention that markets price negatively prior to any longer run benefit.

Hausman Test: PMG vs. MG

Table 10a: Hausman Test: Estimation

Variable	PMG coef.	MG coef.	Difference	chi2 contrib.

CG	-0.0069	-0.0115	-0.0046	0.282
ESG	0.0046	0.0046	0.0001	0
SIZE	0.4578	0.5287	0.071	0.232
LEV	0.487	0.6018	0.1148	0.099
ROA	0.0529	0.1174	0.0644	2.318

Table 10b: Hausman Test: PMG vs. MG

Statistic	**Value**
Hausman chi2	2.932
df	5
p-value	0.7105
Conclusion	Fail to reject H0: PMG preferred (efficient & consistent)

Note: H0: PMG and MG estimates are not systematically different (i.e., the homogeneity restriction on long-run slopes imposed by PMG is valid) -> PMG is efficient and consistent. H1: MG is consistent, PMG is inconsistent. Statistic computed as a simplified diagonal-covariance Hausman statistic, sum_k (b_MG,k - b_PMG,k)^2 / (Var(b_MG,k) - Var(b_PMG,k)), chi2 with 5 df (standard practice uses the full variance-covariance matrix; the diagonal approximation is used here given the small cross-section, N=8). Result favours the pooled (PMG-type) long-run specification used in Table 8/9.

The Hausman (1978) test examining differences in long-run coefficients for pooled (PMG-type) and Mean Group estimates of systematic differences does not reject the null (χ^2 = 2.93, df = 5, p = 0.71). Within the framework Pesaran, Shin, and Smith (1999) construct for this test in the ARDL/PMG context, not rejecting the null supports the long-run homogeneity restriction. This implies that the pooled PMG-type estimates provided in Table 8 are both consistent and more efficient than the unrestricted Mean Group estimates, and hence the most appropriate estimates for interpreting the long-run relationship.

Diagnostic Tests

Table 11: Diagnostic Tests

Test	**Statistic**	**p-value**	**H0**	**Conclusion**
Breusch-Pagan (heteroskedasticity)	2.803	0.7303	Homoskedasticity	Fail to reject H0 (homoskedastic)
Wooldridge-type (serial correlation)	0.227	0.821	No serial correlation	Fail to reject H0 (no serial corr.)
Pesaran CD (cross-sectional dependence)	-1.351	0.1767	Cross-sectional independence	Fail to reject H0 (CS independent)
Jarque-Bera (normality of residuals)	5.854	0.0536	Normal residuals	Fail to reject H0 (normal)

Note: Tests applied to residuals of the Table 8 long-run (FE) regression. Breusch-Pagan tests H0 of homoskedasticity against the regressors. The Wooldridge-type test regresses residuals on their own first lag pooled across firms (H0: no first-order serial correlation) - a simplified analogue of the full Wooldridge (2002) panel-data *serial-correlation test. Pesaran CD tests H0 of cross-sectional independence using average pairwise residual correlations across the 8 firms over 11 years. Jarque-Bera tests H0 of normally distributed residuals.*

The residuals from the long-run equation indicated the absence of heteroskedasticity (Breusch-Pagan, $p = 0.73$), no first-order serial correlation (Wooldridge-type test, $p = 0.82$), and no cross-sectional dependence (Pesaran, 2004, CD test, $p = 0.18$). Further, the residuals also indicated a marginally accepted normality (Jarque-Bera, $p = 0.054$). These results suggest the estimated model perform well statistically, and the standard errors would be adequate for inference on this panel.

Robustness

Table 12: Robustness Checks

Variable	FE (baseline)	RE	Pooled OLS
Constant	-4.1753***	2.7890***	1.9335***
CG	-0.0069	0.0202***	0.0357***
ESG	0.0046	0.0193***	0.0127**
SIZE	0.4578***	-0.3641***	-0.3919***
LEV	0.4870	1.6863***	2.3431***
ROA	0.0529	0.1561***	0.1847***

*Note: Long-run coefficients re-estimated under Fixed Effects (baseline, Table 8), Random Effects, and Pooled OLS. A standard Hausman (FE vs. RE) specification test gives chi2 = 35.172 (p = 0.000001), rejecting RE in favour of Fixed Effects as the baseline specification - consistent with entity-specific unobserved heterogeneity (e.g., firm-level business-mix or legacy governance differences) being correlated with the regressors. *** p<0.01, ** p<0.05, * p<0.10. All computations performed in Python (pandas, statsmodels, linearmodels, scipy) on the panel dataset collected by the authors.*

Random Effects and Pooled OLS sign reversals for CG, SIZE and LEV, against Fixed Effects baseline, and a standard Hausman (1978) test strongly favored Fixed Effects over Random Effects ($\chi^2 = 35.17$, $p < 0.001$). The large, divergent estimations is itself a substantial and important finding. This identifies that time-invariant firm heterogeneity, (i.e.: legacy ownership structure, business-line mix, or historical governance cultures) in the regression is correlated and governs ESG coefficients. This confirms the corporate-governance literature on the importance of endogeneity as the governing challenge for correct estimation in governance-performance regressions (Wintoki, Linck & Netter, 2012).

Conclusion

This research studied the short- and long-term impacts of corporate governance, ESG performance and their firm valuation on listed Indian insurance companies during the period FY2016 to FY2026. This was done using the Panel ARDL/Pooled Mean Group, which differentiates between equilibrium effects and short run effect adjustments. Panel unit root and cointegration tests have established the validity of ARDL-ECM over static panel regressions, showing a long-run stable connection among the variables. The long-run results showed that firm size was the primary valuation driver. Additionally, the controlled firm-fixed effects showed that there were no significant long-run impacts of corporate governance and ESG performance. If this finding, were in fact, accurate, it would align within the context of the evidence in specific sectors (Cummins & Nini, 2002; Buallay, 2019). The negative, large and significant error-correction coefficient suggested that the firm valuation would quickly correct any deviation away from long-run equilibrium, in line with the continuously-priced nature of listed equity. The Hausman test supported the Pooled (PMG) long-run specification over the unrestricted Mean Group alternative; the follow-up tests showed no significant issues of either heteroskedasticity, autocorrelation, or cross-sectional dependence in the residuals. There are important factors for insurance-sector boards and regulators to consider. Market valuation examples for insurers suggest that, although ESG and governance are important, the elements of governance and ESG may be realized in risk, cost, and resiliency in ways that do not manifest in a simple, direct valuation model. Issues in this study are the small number of firms, the inconsistent availability of ESG data prior to India's Fiscal Year 2021-22 Business Responsibility and Sustainability Reporting (BRSR) mandate, and potential endogeneity concerns of governance variables (Wintoki, Linck & Netter, 2012). Sample size should be broadened in the future, and reported governance should be based on instruments.

References

[1] Bhagat, S., & Bolton, B. (2008). Corporate governance and firm performance. Journal of Corporate Finance, 14(3), 257–273.

[2] Buallay, A. (2019). Is sustainability reporting (ESG) associated with performance? Evidence from the European banking sector. Management of Environmental Quality, 30(1), 98–115.

[3] Cummins, J. D., & Nini, G. P. (2002). Optimal capital utilization by financial firms: Evidence from the property-liability insurance industry. Journal of Financial Services Research, 21(1–2), 15–53.

[4] Debnath, A., Bisht, R., Rathod, M., & Iqbal, D. S. (2024). The Interdependent Relationship between Interest and Non-Interest Income of Indian Banks: A Study of Diversification of Income, Risk, and Traditional vs. Non-Traditional Banking Activities. *The Interdependent Relationship between Interest and Non-Interest Income of Indian Banks: A Study of Diversification of Income, Risk, and Traditional vs. Non-Traditional Banking Activities (September 20, 2024)*.

[5] Debnath, A., Panwar, M., Jategaonkar, S., Rathod, M., Neema, R., & Iqbal, S. A. (2024). Green Investors' Strategies And Their Role In Supporting Sustainable Development Through Impact Investing. *AFRICAN JOURNAL OF BIOMEDICAL RESEARCH*, 4675-4683.

[6] Debnath, A., & Iqbal, S. A. A Conceptual Framework for Understanding Open Banking: A Financial Innovation Approach.

[7] Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. Econometrica, 55(2), 251–276.

[8] Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. Journal of Finance, 47(2), 427–465.

[9] Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. Journal of Sustainable Finance & Investment, 5(4), 210–233.

[10] Gompers, P., Ishii, J., & Metrick, A. (2003). Corporate governance and equity prices. Quarterly Journal of Economics, 118(1), 107–156.

[11] Granger, C. W. J., & Newbold, P. (1974). Spurious regressions in econometrics. Journal of Econometrics, 2(2), 111–120.

[12] Gujarati, D. N., & Porter, D. C. (2009). Basic econometrics (5th ed.). McGraw-Hill.

[13] Hausman, J. A. (1978). Specification tests in econometrics. Econometrica, 46(6), 1251–1271.

[14] Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. Journal of Econometrics, 115(1), 53–74.

[15] Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), 305–360.

[16] Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. Journal of Econometrics, 90(1), 1–44.

[17] Lang, L. H. P., & Stulz, R. M. (1994). Tobin's q, corporate diversification, and firm performance. Journal of Political Economy, 102(6), 1248–1280.

[18] La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (2002). Investor protection and corporate valuation. Journal of Finance, 57(3), 1147–1170.

[19] Levin, A., Lin, C.-F., & Chu, C.-S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. Journal of Econometrics, 108(1), 1–24.

[20] Maddala, G. S., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. Oxford Bulletin of Economics and Statistics, 61(S1), 631–652.

[21] Marozva, G. (2026). Firm performance, liquidity and capital structure nexus: Evidence from the PMG panel-ARDL approach. Risks, 14(3), 61.

[22] Morck, R., Shleifer, A., & Vishny, R. W. (1988). Management ownership and market valuation: An empirical analysis. Journal of Financial Economics, 20, 293–315.

[23] Narula, R., Rao, P., Kumar, S., & Paltrinieri, A. (2025). ESG investing & firm performance: Retrospections of past & reflections of future. Corporate Social Responsibility and Environmental Management, 32(1), 1096-1121.

[24] Paridhi, & Ritika. (2025). Impact of ESG disclosures on corporate financial performance: An industry-specific analysis of Indian firms. Business Strategy & Development, 8(1), e70055.

[25] Pawnar, M., Debnath, A., Khandelwal, A., Rathore, S., & Kaur, D. (2026). Behavioural Factors Influencing Retail and Digital Banking: A Comprehensive Bibliometric Analysis.*International Journal of Economic Practices and Theories*, *2026*, 655-674.

[26] Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. Oxford Bulletin of Economics and Statistics, 61(S1), 653–670.

[27] Pedroni, P. (2004). Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. Econometric Theory, 20(3), 597–625.

[28] Pesaran, M. H. (2004). General diagnostic tests for cross section dependence in panels. CESifo Working Paper No. 1229.

[29] Pesaran, M. H., & Shin, Y. (1995). An autoregressive distributed-lag modelling approach to cointegration analysis. DAE Working Paper No. 9514, University of Cambridge.

[30] Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. Journal of the American Statistical Association, 94(446), 621–634.

[31] Rathod, M., Kumari, S., Kujur, P., Bisht, R., Paul, S., & Debnath, A. (2024). Impact of DIIs and FIIs on the Indian Stock Market. *African Journal of Biomedical Research*.

[32] Tobin, J. (1969). A general equilibrium approach to monetary theory. Journal of Money, Credit and Banking, 1(1), 15–29.

[33] Waddock, S. A., & Graves, S. B. (1997). The corporate social performance–financial performance link. Strategic Management Journal, 18(4), 303–319.

[34] Westerlund, J. (2007). Testing for error correction in panel data. Oxford Bulletin of Economics and Statistics, 69(6), 709–748.

[35] Wintoki, M. B., Linck, J. S., & Netter, J. M. (2012). Endogeneity and the dynamics of internal corporate governance. Journal of Financial Economics, 105(3), 581–606.

[36] Yadav, A., & Asongu, S. (2025). The role of ESG performance in moderating the impact of financial distress on company value: Evidence of wavelet-enhanced quantile regression with Indian companies. Business Strategy and the Environment, 34(3), 2782-2798.