

Corporate Governance as a Mediating Channel in the CSR-Market Power Relationship: A PLS-SEM and Random Forest Approach in Ghanaian Industries

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Abstract

This study examines whether corporate governance mediates the relationship between corporate social responsibility and market power in Ghanaian industries. Using firm-level panel data from 2015 to 2021, the analysis combines partial least squares structural equation modelling with random forest regression to capture both theory-driven mediation pathways and non-linear predictive patterns. The findings show that corporate social responsibility is strongly associated with improved corporate governance quality, reflected in board size, board independence, board gender diversity, and audit committee strength. However, neither corporate governance nor the indirect corporate social responsibility-governance-market power pathway has a statistically meaningful effect on market power. Random forest results confirm that governance and corporate social responsibility variables contribute modestly to predicting market power, with board gender diversity, firm size, and corporate social responsibility intensity emerging as the leading predictors. The evidence suggests that corporate social responsibility in Ghana functions primarily as a mechanism for strengthening internal governance, legitimacy, stakeholder trust, and organisational resilience rather than as a direct source of competitive dominance.

Keywords

Corporate Governance, Corporate Social Responsibility, Market Power, Herfindahl-Hirschman Index, Partial Least Squares Structural Equation

1. Introduction and Motivation

Corporate social responsibility (CSR) has evolved from a peripheral philanthropic add-on to a strategic capability that shapes firms' legitimacy, competitiveness, and long-term survival. Rising stakeholder expectations, intensifying regulatory scrutiny, and mounting social and environmental risks mean that firms are increasingly evaluated not only on financial performance, but also on how they create and distribute value to a broad set of stakeholders (Al Amosh and Khatib, 2025; Vil-lacampa-Porta et al., 2025; Yoo, 2025). Empirical work generally supports a positive, but context-dependent, association between CSR and firm performance (Li, 2025; Oduro et al., 2025; Xie et al., 2025; Margolis et al., 2009). In emerging economies, CSR is also seen as a mechanism for addressing institutional voids and building trust where formal enforcement and public provision may be limited (Ettalibi et al., 2025; Shakil et al., 2025; Zhou et al., 2025; Amponsah-Tawiah and Dartey-Baah, 2011).

Recent studies suggest that CSR may influence firms' competitive positioning by improving reputation, stakeholder loyalty, access to capital, and legitimacy (Ali et al., 2025; Brueninghaus et al., 2025; Lin, 2024). Well-designed CSR initiatives can enhance brand equity and customer attachment, thereby improving a firm's bargaining position in product and capital markets (Adewole, 2024; Gidage and Bhide, 2024; Zambon, 2024). However, the evidence is not uniform. Some studies report positive CSR-competition links only under boundary conditions such as strong customer awareness or reputational capital (Flammer, 2015; Servaes and Tamayo, 2013), whereas others document weak, null, or negative effects when CSR is symbolic, misaligned with core capabilities, or excessively costly (Shah and Shome, 2025; Wadhwa and Sahoo, 2025). These mixed findings highlight the need to open the "black box" between CSR and market outcomes and to identify organisational mechanisms that may transmit CSR into competitive advantage.

Corporate governance is a plausible mechanism in this relationship. Board structures and monitoring systems shape strategic priorities, allocate resources to CSR initiatives, and align managerial decisions with stakeholder interests (Adib et al., 2021; Bhat et al., 2024; Ledi et al., 2025; Osei et al., 2025). Board independence and diversity are associated with stronger stakeholder orientation and more extensive CSR reporting (Alajmi et al., 2025; Amin and Yahaya, 2025; García-Sánchez et al., 2020), while audit committee strength and board size can improve oversight quality and reduce opportunistic CSR behaviour (Hunjra et al., 2025; Velte, 2025; Kuzey et al., 2024; Kamran et al., 2023). Yet governance can also dilute the strategic value of CSR when boards are fragmented, overextended, or constrained by dominant insiders.

The theoretical link between governance and market power requires careful

specification. Internal governance structures do not necessarily increase market power through direct pricing dominance. Rather, governance may influence competitive positioning indirectly by strengthening strategic coordination, improving access to external finance, reducing information asymmetry, enhancing reputation, and improving long-term adaptability. These mechanisms may support firm differentiation and resilience; however, they may not automatically translate into market control in industries where pricing power is shaped by regulation, legacy concentration, sectoral entry barriers, and macroeconomic conditions. This distinction is central to the present study.

The Ghanaian setting provides a relevant but under-researched context. CSR in Ghana and wider sub-Saharan Africa is expanding, yet the literature remains dominated by descriptive studies of disclosure and philanthropy, with limited attention to firm-level strategic outcomes (Abukari and Abdul-Hamid, 2018; Tenakwah, 2022; Saeed et al., 2025). Corporate governance codes have been strengthened in recent years, but ownership is often concentrated and boards display heterogeneous levels of independence and gender diversity (Adeabah et al., 2019; Adenutsi et al., 2025). These features create rich variation in CSR practices and governance quality while raising questions about whether CSR can translate into market power in an emerging-market institutional environment.

Theoretically, the study is grounded primarily in stakeholder theory (Freeman, 1984) and the resource-based view (Wernerfelt, 1984), complemented by legitimacy and institutional perspectives (DiMaggio and Powell, 1983; Dowling and Pfeffer, 1975). Stakeholder theory posits that firms create value by managing relationships with customers, employees, regulators, investors, and communities. The resource-based view suggests that CSR practices, when embedded in credible governance systems, may become valuable and difficult-to-imitate organisational capabilities. Legitimacy and institutional theories further imply that CSR and governance may help firms secure social approval and conform to evolving regulatory expectations.

Against this background, this study investigates whether corporate governance mediates the relationship between CSR and market power in Ghanaian industries. Methodologically, it adopts a hybrid approach combining partial least squares structural equation modelling (PLS-SEM) (Hair, 2014; Hair et al., 2017; Wold, 1974) with random forest machine-learning techniques (Breiman, 2001; Liaw and Wiener, 2002). PLS-SEM allows CSR, corporate governance, and market power to be modelled within a unified mediation framework, while random forest regression provides a non-parametric robustness check capable of capturing non-linearities and interaction effects.

2. Materials and Methods

2.1. Data and Sources

The study employs a panel dataset comprising firms listed on the Ghana Stock Exchange (GSE) and selected large firms registered with the Ghana Investment

Promotion Centre (GIPC) that satisfied disclosure and data availability requirements between 2015 and 2021. This revised definition resolves the distinction between the formal listed-firm sample and the broader GIPC-registered firms initially described in the earlier version. The sample therefore reflects firms operating under formal governance and reporting frameworks within Ghanaian industries.

Data were obtained from annual reports, financial statements, corporate governance disclosures, CSR reports, and publicly available sectoral documents. The sample covers manufacturing, services, agro-processing, and extractive industries. The final analytical dataset comprises 266 firm-year observations and includes measures of CSR, corporate governance, market power, and firm-level control variables.

2.2. Variable Measurement

CSR was operationalised using a Corporate Social Responsibility Index (CSRI), constructed from firm-level disclosures covering environmental, social, employee-related, and community engagement activities. The index follows a weighted additive scoring procedure consistent with prior CSR measurement practices in emerging-market and African contexts.

Corporate governance was captured using board and oversight indicators widely used in governance-performance research: board size (BOS), board independence (BOI), board gender diversity (BOGD), and audit committee strength (AUDCS). Board size was measured as the number of directors serving on the board. Board independence was measured as the proportion or number of non-executive or independent directors. Board gender diversity was measured using the Blau heterogeneity index or the proportion of female directors. Audit committee strength was captured using a composite score reflecting audit committee size, independence, meeting frequency, and financial expertise.

Market power was proxied using the Herfindahl-Hirschman Index (HHI), computed from firm-level sales shares relative to total industry sales obtained from publicly available industry reports, sectoral statistics, and regulatory publications. This broader industry denominator mitigates the risk of underestimating concentration that may arise when concentration indices are calculated only from the sampled firms.

For industry j in year t , the HHI is computed as:

$$HHI_{jt} = \sum_{i=1}^{N_j} s_{ijt}^2, \quad (1)$$

where s_{ijt} is firm i 's sales share in industry j at time t , and N_j denotes the number of firms operating in the relevant industry. A higher HHI indicates greater concentration and a less competitive market structure.

Although HHI is traditionally an industry-level concentration metric, it is used here to represent the competitive structure and relative dominance conditions surrounding firms in Ghanaian industries. The study is therefore concerned with the market environment within which firms operate rather than a direct measure

of firm-specific mark-up. Alternative firm-specific measures such as the Lerner Index were considered; however, consistent data on marginal costs and firm-level price-setting behaviour were unavailable across the sampled sectors. Future research may extend this analysis using mark-ups, market share, price-cost margins, or Lerner-type indicators.

2.3. Empirical Modelling Strategy

The study employs a hybrid methodological approach combining PLS-SEM and random forest regression. PLS-SEM provides a theory-driven mediation framework, whereas random forest offers a flexible predictive robustness check.

2.3.1. PLS-SEM Mediation Framework

PLS-SEM was adopted because it is suitable for modelling complex relationships involving latent constructs, non-normal data, and small-to-medium samples. CSR serves as the exogenous predictor, corporate governance as the mediator, and market power as the endogenous outcome.

The structural mediation model is specified as:

$$CG_{it} = \alpha_0 + \alpha_1 CSR_{it} + \mathbf{X}'_{it} \boldsymbol{\gamma} + \varepsilon_{it}, \quad (2)$$

$$MP_{it} = \beta_0 + \beta_1 CSR_{it} + \beta_2 CG_{it} + \mathbf{X}'_{it} \boldsymbol{\delta} + u_{it}, \quad (3)$$

where CG_{it} denotes corporate governance, MP_{it} denotes market power, CSR_{it} denotes the CSR index, and $\mathbf{X}_{it}$ represents firm-level controls.

The baseline models include firm size, firm age, and audit committee strength as control variables because these variables are consistently observable across firms and are theoretically linked to governance quality and CSR engagement. Financial controls such as leverage, return on assets, return on equity, and capital intensity were considered; however, substantial missingness and reporting inconsistencies across firms and industries limited their inclusion in the final estimations. The omission is therefore acknowledged as a limitation, and future research should incorporate richer financial controls where consistently available.

The indirect effect is defined as:

$$IE = \alpha_1 \beta_2. \quad (4)$$

Mediation is supported when CSR significantly predicts corporate governance, corporate governance significantly predicts market power, and the bootstrapped indirect effect is statistically significant. Indirect effects were tested using non-parametric bootstrapping with 5000 replications.

2.3.2. Random Forest Robustness Analysis

To complement the PLS-SEM findings, a random forest regression model was estimated with market power as the dependent variable:

$$MP_{it} = f_{RF}(CSR_{it}, BOS_{it}, BOI_{it}, BOGD_{it}, AUDCS_{it}, FIRS_{it}, FIRAGE_{it}) + \eta_{it}, \quad (5)$$

where $f_{RF}(\cdot)$ represents the ensemble prediction function generated from

bootstrap-aggregated decision trees. Variable importance was assessed using percentage increase in mean squared error and increase in node purity.

2.4. Data Transformation and Diagnostics

Prior to estimation, firm size was log-transformed to reduce skewness and improve scale comparability across firms. In addition, extreme observations for firm size and market power were winsorised at the 1st and 99th percentiles to mitigate the influence of outliers on both the PLS-SEM and random forest estimations. These transformations were undertaken before model estimation and diagnostic assessment.

For PLS-SEM, reliability and validity were assessed using Cronbach's alpha, composite reliability, average variance extracted, cross-loadings, Fornell-Larcker criterion, and heterotrait-monotrait ratios. Structural diagnostics included variance inflation factors, coefficients of determination, effect sizes, predictive relevance, and bootstrapped significance testing. For random forest, hyperparameters were tuned through cross-validation, and model performance was assessed using out-of-bag error, mean squared error, root mean squared error, explained variance, and variable importance (Figure 1).

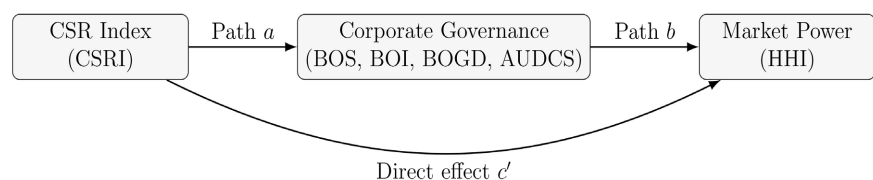


Figure 1. Conceptual mediation model linking CSR, corporate governance, and market power.

3. Empirical Results and Discussion

3.1. Descriptive Statistics and Correlation Analysis

Table 1 reports descriptive statistics for the main variables. CSR engagement is highly uneven, with CSRI recording a mean of 11.79 and substantial dispersion. Board size averages 15.99 directors, while board independence and board gender diversity show relatively lower dispersion. HHI shows strong right-skewness, indicating that a small number of firms operate in highly concentrated industry environments. Because firm size and market power exhibit extreme skewness, the estimation models use log-transformed firm size and winsorised values for firm size and HHI as described in Section 2.4.

Table 2 presents the correlation matrix. CSRI is positively associated with board size, board independence, board gender diversity, and audit committee strength, suggesting that firms with stronger governance arrangements tend to disclose or undertake more CSR activities. In contrast, HHI shows weak correlations with CSR and governance indicators, indicating the need for multivariate mediation and non-linear robustness analysis.

Table 1. Descriptive statistics of key variables.

Variable	<i>n</i>	Mean	SD	Median	Min	Max	Skew	Kurtosis	SE
CSRI	266	11.79	16.50	3.36	0.00	86.92	2.04	3.94	1.01
BOS	266	15.99	3.89	17.00	6.00	21.00	-1.08	0.52	0.24
BOI	266	6.76	1.24	7.00	3.00	10.00	-0.09	0.63	0.08
BOGD	266	4.36	0.59	4.50	2.50	6.00	-0.24	1.23	0.04
HHI	266	0.53	0.72	0.32	0.00	6.64	4.05	24.34	0.04
AUDCS	266	4.63	1.33	5.00	1.00	7.00	-0.68	-0.38	0.08
FIRS	266	151.46	628.00	6.98	0.05	5437.02	6.39	43.67	38.51
FIRAGE	266	45.84	36.02	37.00	4.00	163.00	1.48	1.78	2.21

Table 2. Correlation matrix of CSR, governance, market power, and control variables.

Variable	CSRI	BOS	BOI	BOGD	HHI	AUDCS	FIRS	FIRAGE
CSRI	1.000	0.340	0.281	0.254	0.177	0.382	0.124	0.066
BOS	0.340	1.000	0.261	0.252	0.151	0.626	0.125	-0.035
BOI	0.281	0.261	1.000	0.800	0.046	0.264	0.178	-0.079
BOGD	0.254	0.252	0.800	1.000	-0.079	0.259	0.178	0.022
HHI	0.177	0.151	0.046	-0.079	1.000	0.153	-0.093	0.055
AUDCS	0.382	0.626	0.264	0.259	0.153	1.000	0.159	0.081
FIRS	0.124	0.125	0.178	0.178	-0.093	0.159	1.000	-0.025
FIRAGE	0.066	-0.035	-0.079	0.022	0.055	0.081	-0.025	1.000

3.2. Measurement Model Assessment

Table 3 reports Cronbach's alpha, composite reliability, and average variance extracted. CSR and market power are single-indicator constructs; hence reliability statistics take the value of 1.000 by construction and should be interpreted cautiously. The corporate governance construct demonstrates acceptable internal consistency and convergent validity.

Table 3. Measurement model assessment.

Construct	Cronbach's α	Composite reliability	AVE
CSR Index	1.000	1.000	1.000
Corporate Governance	0.736	0.835	0.534
Market Power	1.000	1.000	1.000

3.3. Structural Model Results

Table 4 presents the PLS-SEM structural results. CSR has a positive and statistically significant effect on corporate governance, indicating that CSR-intensive firms tend to exhibit stronger governance structures. The direct effect of CSR on market power is positive but marginal, while the governance-market power path is

statistically insignificant. The indirect CSR-governance-market power pathway is small and statistically insignificant.

Table 4. PLS-SEM structural model results.

Path	Coefficient	<i>t</i> -value	<i>p</i> -value	Effect size (<i>f</i> ²)
CSR → CG	0.437	10.363	<0.001	0.236
CG → MP	0.072	1.195	0.232	0.004
CSR → MP	0.145	1.947	0.052	0.018
CSR → CG → MP	0.031	1.187	0.235	–

3.4. Model Fit and Discriminant Validity

Table 5 summarises explained variance, goodness-of-fit, and variance inflation factors. CSR explains 19.1% of the variance in corporate governance, while CSR and corporate governance jointly explain only 3.5% of the variance in market power. VIF values are well below conventional thresholds.

Table 5. Model fit and collinearity diagnostics.

Construct	<i>R</i> ²	GOF	VIF range
Corporate Governance	0.191	0.246	≈1.24
Market Power	0.035	0.246	1.24 - 1.24

Tables 6-8 present cross-loadings, the Fornell-Larcker matrix, and HTMT ratios. The governance indicators load most strongly on the corporate governance construct, and HTMT values remain below conservative thresholds.

Table 6. Cross-loading matrix.

Indicator	CSR	CG	MP
CSRI	1.000	0.437	0.177
BOS	0.340	0.821	0.151
BOI	0.281	0.634	0.046
BOGD	0.254	0.601	–0.079
AUDCS	0.382	0.837	0.153
HHI	0.177	0.135	1.000

Table 7. Fornell-Larcker discriminant validity matrix.

Construct	CSR	CG	MP
CSR	1.000	0.437	0.177
CG	0.437	0.731	0.135
MP	0.177	0.135	1.000

Table 8. HTMT discriminant validity assessment.

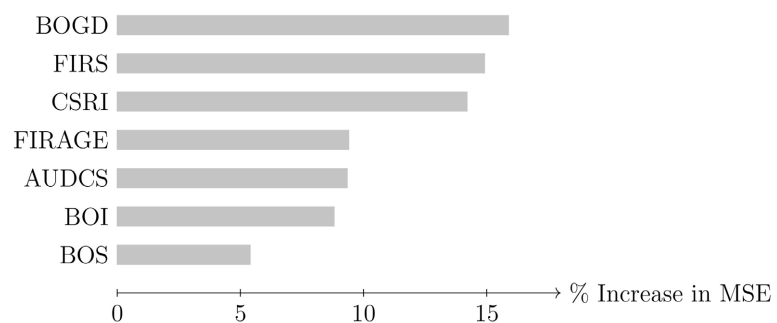
Construct	CSR	CG	MP
CSR	1.000	0.491	0.177
CG	0.491	1.000	0.235
MP	0.177	0.235	1.000

3.5. Random Forest Robustness Analysis

Figure 2 reports random forest variable-importance rankings for market power. This is consistent with the Random Forest analysis, where HHI is used as the dependent variable and the variable-importance measures are reported in **Table 9**.

Table 9. Random forest variable importance for market power.

Variable	% Increase in MSE	Increase in node purity
BOGD	15.883	14.111
FIRS	14.913	26.892
CSRI	14.202	24.785
FIRAGE	9.399	21.124
AUDCS	9.338	10.769
BOI	8.806	8.762
BOS	5.398	11.125

**Figure 2.** Random forest variable-importance rankings for market power.

3.6. Discussion

The results provide a nuanced view of how CSR, governance, and market power interact in Ghanaian industries. CSR is positively associated with stronger governance structures, supporting the argument that CSR and governance co-evolve as complementary dimensions of responsible corporate behaviour (Jo and Harjoto, 2011; Harjoto et al., 2015; Walls et al., 2012). This finding is consistent with stakeholder theory and the resource-based view, which suggest that CSR may catalyse board-level oversight, stakeholder responsiveness, and non-financial risk management.

However, the central mediation hypothesis is not supported. Neither the direct effect of governance on market power nor the indirect CSR-governance-market power pathway is statistically significant. This finding clarifies that governance may strengthen legitimacy, monitoring quality, and strategic credibility without necessarily creating direct pricing dominance. In Ghanaian industries, market power appears to be shaped more strongly by structural market conditions, regulation, legacy concentration, and sectoral entry barriers than by firm-level CSR and governance arrangements alone.

The random forest results reinforce this interpretation. Although board gender diversity, firm size, and CSR intensity contribute to predicting market power, the overall explanatory power remains moderate. Thus, CSR and governance may be better understood as instruments of organisational quality, legitimacy, and resilience rather than as guaranteed pathways to market concentration or competitive dominance.

4. Conclusion and Policy Implications

This study investigated whether corporate governance mediates the relationship between CSR and market power in Ghanaian industries using a hybrid PLS-SEM and random forest approach. Drawing on a panel of GSE-listed firms and selected disclosure-compliant GIPC firms, the analysis yields three conclusions.

First, CSR is strongly and positively associated with corporate governance quality. Firms with higher CSR intensity tend to have larger, more independent, and more gender-diverse boards, as well as stronger audit committees. Second, the evidence does not support the claim that corporate governance mediates a strong CSR effect on market power. The direct effect of CSR on market power is small and marginal, the effect of governance on market power is statistically insignificant, and the indirect pathway is negligible. Third, the combined PLS-SEM and random forest evidence suggests that CSR functions more as an internal governance and legitimacy-enhancing mechanism than as a direct driver of market dominance.

For boards and managers, the findings imply that CSR and governance investments should be justified primarily in terms of transparency, stakeholder trust, improved oversight, risk management, and long-run resilience rather than immediate increases in pricing power or industry dominance. For regulators, the results underscore the importance of strengthening corporate governance codes, CSR disclosure standards, and market transparency while maintaining strong competition and sector-specific regulation. For investors, CSR and governance indicators should be interpreted as signals of organisational quality and long-term orientation rather than as automatic guarantees of superior market control.

The study has limitations. CSR and market power are captured using composite and concentration-based indicators, and data limitations prevented the inclusion of complete financial controls such as leverage, profitability, and capital intensity. Future research may employ richer CSR scales, firm-level mark-up indicators,

alternative competition measures, and comparative African datasets to examine when CSR-governance configurations translate into tangible competitive advantages.

Data Availability Statement

The data used for this study are available from the corresponding author upon reasonable request.

Author Contributions

Conceptualisation, Timothy A. Ayamga and Albert A. Ashiagbor; methodology, Albert A. Ashiagbor and Kojo A. Essel Mensah; formal analysis, Albert A. Ashiagbor; writing—original draft preparation, Timothy A. Ayamga and Albert A. Ashiagbor; writing—review and editing, Kojo A. Essel Mensah, Paul A. Mudah, and Christine Avortri. All authors have read and agreed to the final version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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