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ESG, Customer Equity and Shareholder Value in the Digital Economy: The Moderating Effect of AI-Enabled Digital Transformation Intensity among Listed banks in ASEAN and ECOWAS

Paul Kwasi Apreku-Djan

apreku-djan.kwasi@ktu.edu.gh

Koforidua Technical University

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ESG, Customer Equity and Shareholder Value in the Digital Economy: The Moderating Effect of AI-Enabled Digital Transformation Intensity among Listed banks in ASEAN and ECOWAS

Abstract

This study examines how environmental, social and governance (ESG) performance contributes to shareholder value in digitally transforming banking markets by identifying customer equity as a value-conversion mechanism and artificial intelligence-enabled digital transformation intensity (AI-DTI) as a strategic boundary condition. Drawing on stakeholder theory, customer equity theory and the dynamic capabilities perspective, the study investigates whether customer equity mediates the ESG–shareholder value relationship and whether AI-DTI strengthens this mechanism among listed commercial banks in ASEAN and ECOWAS economies. A quantitative explanatory longitudinal design is employed using 1,193 bank-year observations from 79 listed commercial banks over 2010–2025. ESG performance, customer equity and AI-DT are measured using multidimensional archival indicators, while shareholder value is captured through a value-based financial measure. Fixed-effects and dynamic system generalised method of moments estimations are employed to address unobserved heterogeneity, persistence and potential endogeneity, complemented by mediation, moderated-mediation and regional heterogeneity analyses. The findings show that ESG performance does not exert a statistically significant direct effect on shareholder value; instead, its effect operates significantly through customer equity. Customer equity therefore represents a critical mechanism through which sustainability performance is converted into market-based value. AI-DTI further strengthens the ESG–customer equity relationship and significantly amplifies the conditional indirect effect of ESG on shareholder value. Moreover, the moderated indirect effect differs significantly between ASEAN and ECOWAS at higher levels of AI-DTI. The study advances stakeholder and customer equity perspectives by demonstrating that ESG creates financial value primarily when translated into customer-based intangible assets and enabled by digital capabilities. The findings imply that banks should integrate ESG, customer relationship strategies and AI-enabled transformation as complementary components of value creation rather than treating them as independent strategic domains.

Keywords: ESG performance; shareholder value; customer equity; artificial intelligence; digital transformation; ASEAN–ECOWAS banking.

1. Introduction

Environmental, social and governance (ESG) considerations have moved from the periphery of corporate disclosure toward the centre of strategic decision-making, strategic value creation. Investor attention to sustainability risks, regulation and stakeholder scrutiny has increased. Recent evidence shows variation in ESG–firm-value findings associated with measurement and institutional conditions (Li et al., 2024). For banks, ESG can influence profitability, valuation and risk. Evidence from emerging-market commercial banks indicates that stronger ESG disclosure is associated with higher accounting and market performance and lower selected risks (Gangwani & Kashiramka, 2024). Yet evidence is not uniformly positive: recent ASEAN research reports that ESG engagement can impose short-term costs on bank stability, underscoring the importance of understanding the mechanisms and conditions through which ESG produces economic value (Do et al., 2024). Thus, the

contemporary question is increasingly not whether ESG matters, but how and under what conditions ESG investments are converted into shareholder value.

Customer equity is an underdeveloped mechanism. Customer equity captures the economic value of customer relationships across value, brand and relationship dimensions. In banking, customer equity is strategically important because relationships are recurrent and increasingly digital. Recent evidence from retail banking directly links ESG to customer equity, suggesting that sustainability-related conduct can shape customers' assessments of value, brand and relationships (Chow & Ho, 2024). Related evidence shows that customer satisfaction can mediate the relationship between ESG performance and firm value, indicating that customer outcomes may bridge responsible conduct and valuation (Seok et al., 2024). Nevertheless, customer equity is distinct from customer satisfaction: equity represents the cumulative economic value of customer relationships rather than a single attitudinal outcome. Treating customer equity as a mediating asset therefore provides a more economically grounded explanation of how ESG-related stakeholder value can become future revenue, retention, brand strength and value.

Artificial intelligence (AI) and digital transformation are restructuring how banks create, deliver and monetise customer value. Digital platforms, advanced analytics, machine learning, automated service systems and generative AI allow banks to personalise interactions, predict customer needs, improve responsiveness and make data-intensive decisions. Evidence indicates that banks are moving toward enterprise-level AI transformation (McKinsey, 2024). Academic evidence likewise suggests that digital transformation can enhance firm value partly through improvements in ESG performance, showing that digital capabilities can alter technology–sustainability–value relationships (Zhang et al., 2024). Consequently, AI-enabled digital transformation should not be conceptualised merely as technological expenditure; it is more appropriately viewed as an organisational capability that may determine whether firms convert intangible stakeholder resources into customer and financial value.

ASEAN provides a comparatively mature digital-banking environment alongside increasing ESG attention, whereas ECOWAS represents digitalising financial systems where financial inclusion, digital services and sustainability pressures intersect. Existing ASEAN evidence has examined ESG in relation to bank performance, ownership and stability, but rarely integrates customer equity and AI-enabled digital transformation (Nathania & Ekawati, 2024; Lerskullawat & Ungphakorn, 2024). Cross-emerging-market evidence similarly establishes an ESG–bank-value relationship but leaves open how customer-based intangible assets transmit that relationship (Gangwani & Kashiramka, 2024). The comparison tests whether this value process operates across digitalising banking environments.

The first research gap concerns the ESG–shareholder-value relationship. Although research associates ESG performance with firm value, recent reviews emphasise heterogeneous effects and the importance of institutional and measurement conditions (Li et al., 2024). Bank-specific evidence also remains mixed across emerging markets, suggesting that direct-effect models may conceal important transmission mechanisms (Gangwani & Kashiramka, 2024). A second gap concerns the mechanism linking ESG to shareholder value. Existing research has considered customer satisfaction and customer equity, but customer equity has rarely been positioned as the central

economic transmission mechanism connecting ESG performance with shareholder value in cross-regional banking markets (Chow & Ho, 2024; Seok et al., 2024). A third gap concerns the digital boundary condition. Although digital transformation has been associated with firm value and ESG outcomes, limited research explains whether AI-enabled digital transformation strengthens the conversion of ESG-related stakeholder resources into customer equity and shareholder value (Zhang et al., 2024). This omission is consequential because technological capability may determine whether sustainability investments remain reputational assets or become monetisable customer resources.

Against this background, this study asks: does ESG create shareholder value because it strengthens customer equity, and does AI-enabled digital transformation enhance the conversion of ESG-related stakeholder value into customer and financial value? Accordingly, the study examines ESG and shareholder value, ESG and customer equity, customer equity and shareholder value, customer equity as a mediator, AI-enabled digital transformation as a moderator of ESG–customer equity, and the resulting conditional indirect effect.

The study contributes to theory and practice. Theoretically, it integrates Stakeholder Theory, Customer Equity Theory and the Resource-Based View/Dynamic Capabilities perspective to conceptualise ESG as a stakeholder resource, customer equity as a value-bearing relational asset, and AI-enabled digital transformation as a capability for converting these resources into economic value. Empirically, it shifts attention from the direct ESG–value association toward an integrated mediation and moderation framework across listed ASEAN and ECOWAS commercial banks. It also conceptualises AI-enabled digital transformation as a value-conversion capability rather than another performance predictor. Managerially, the study clarifies how banks may connect ESG investment with customer relationship development and shareholder-value creation while recognising that technological capability conditions conversion.

The remainder of the manuscript develops the theoretical foundations and hypotheses, explains the research design, variables and econometric strategy, presents the empirical findings and robustness analyses, discusses theoretical and managerial implications, and concludes with limitations and directions for future research.

2. Literature Review and Hypothesis Development

2.1 Theoretical Postulates

The proposed relationships are anchored in an integrated theoretical framework combining Stakeholder Theory, Customer Equity Theory, and the Resource-Based View (RBV) and Dynamic Capabilities perspective. The integration is necessary because no single theory adequately explains the complete pathway from ESG investment to shareholder value through customer equity under conditions of AI-enabled digital transformation. Stakeholder Theory posits that firms create sustainable economic value when they effectively manage relationships with stakeholders whose resources, cooperation and support affect organisational survival and performance. ESG activities can therefore be interpreted as investments in stakeholder relationships that reduce information asymmetry, strengthen legitimacy, build trust and mitigate relational and non-financial risks. In banking, where credibility, trust and long-term relationships are fundamental to intermediation, ESG performance may constitute an

important intangible resource rather than merely a reporting obligation. Recent banking evidence indicates that the ESG–financial-performance relationship is positive on average but heterogeneous across dimensions, measures and institutional settings, reinforcing the need to identify the mechanisms through which ESG generates economic value (Prior Jiménez et al., 2026; Chakraborty et al., 2026).

Customer Equity Theory extends this argument by explaining how stakeholder-oriented investments can be translated into economically valuable customer relationships. Customer equity represents the aggregate economic value embedded in a firm's customer base, incorporating the value generated through customers' perceived benefits, brand associations and continuing relationships. From this perspective, ESG can influence customer equity because responsible environmental, social and governance practices provide signals about corporate values, reliability and long-term orientation. Customers may reward credible ESG behaviour through stronger relationships, greater loyalty and continued engagement, thereby increasing the expected future cash flows attributable to the customer base. Importantly, the empirical literature remains relatively limited. Chow and Ho (2024), using retail-banking evidence, find that ESG initiatives can influence customer attitudes and customer-equity dimensions, although the effects differ across ESG pillars. This evidence supports customer equity as a plausible mechanism while simultaneously indicating that ESG does not automatically produce customer value.

The RBV and Dynamic Capabilities perspective provides the technological explanation. RBV conceptualises valuable, difficult-to-substitute organisational resources as foundations of competitive advantage, while Dynamic Capabilities theory emphasises the ability to integrate, reconfigure and deploy resources as environments change. AI-enabled digital transformation can therefore be conceptualised as a value-conversion capability that allows banks to transform ESG-related relational resources into measurable customer and financial outcomes. AI-supported analytics, personalisation, intelligent customer service, predictive modelling and digital platforms can improve banks' ability to identify customer needs, customise offerings and sustain relationships. Recent banking research demonstrates that digital platform strategies can affect firm value, while contemporary studies identify AI-enabled service personalisation and responsiveness as important elements of digital customer relationships (Schreieck et al., 2024; Lian & Li (2025)).

The integrated framework consequently proposes that ESG provides stakeholder-oriented resources, customer equity represents the relational mechanism through which those resources acquire economic value, and AI-enabled digital transformation determines the bank's capacity to convert them efficiently into customer and shareholder value. This formulation also accommodates competing theoretical predictions. ESG can impose implementation and compliance costs, customer responses can vary across ESG dimensions, and digital transformation can require substantial investment before benefits materialise. Indeed, recent reviews document heterogeneous ESG–performance effects, while evidence from banking shows that ESG initiatives can have nonlinear or dimension-specific financial consequences (Carnevale & Drago, 2024; Seok et al., 2024). The present study therefore does not assume that ESG inherently creates shareholder value. Instead, it theorises a conditional value-creation process in which stakeholder investment is transmitted through customer equity and amplified by technological capability.

2.2 Hypothesis Development

2.2.1 ESG and Shareholder Value

Stakeholder Theory predicts that firms can create economic value by managing relationships with stakeholders whose cooperation provides resources, legitimacy and market support. ESG performance can strengthen these relationships by signalling responsible corporate behaviour, reducing stakeholder conflict and improving perceptions of organisational quality. For banks, the implications may be particularly important because the business model depends heavily on trust, reputation and the confidence of depositors, borrowers, investors and regulators. Strong ESG performance can consequently reduce reputational and regulatory exposure while strengthening the bank's intangible asset base. From an investor perspective, credible ESG performance may also signal stronger risk management and longer-term strategic orientation, thereby affecting market valuation.

Recent evidence provides qualified support. A 2026 multi-level meta-analysis of banking studies finds a small but statistically significant positive association between ESG engagement and financial performance, although the effects differ across ESG dimensions and financial-performance measures (Prior Jiménez et al., 2026). Similarly, a recent systematic review concludes that ESG generally supports firm value, while emphasising substantial contextual heterogeneity across industries, regions and theoretical perspectives (Bani-Khaled et al., 2025). Nevertheless, the value-creation argument faces an important counterposition. ESG investments can increase compliance, monitoring and implementation costs, potentially reducing short-term profitability. Banking evidence also indicates that the ESG–financial-performance relationship is not uniformly positive, with studies identifying insignificant and nonlinear relationships (Seok et al., 2024).

The theoretical resolution is that ESG should not be regarded as automatically value enhancing. Rather, its potential shareholder-value effects depend on whether stakeholder benefits are sufficiently converted into economically relevant outcomes. This study therefore expects that, on balance, stronger ESG performance is associated with higher shareholder value among listed commercial banks.

H1: ESG performance is positively associated with shareholder value among listed commercial banks in ASEAN and ECOWAS markets.

2.2.2 ESG and Customer Equity

2.2.2 ESG and Customer Equity

Stakeholder Theory and Customer Equity Theory suggest that credible ESG performance can increase the economic value of customer relationships by strengthening trust, perceived reliability and retention, thereby raising expected customer lifetime value (CLV). Empirical evidence is supportive but not uniform. Chow and Ho (2024), using 300 retail-bank customers, find that governance initiatives improve customer attitudes that subsequently explain value and relationship equity, although environmental and social initiatives are insignificant. Similarly, Elansari et al. (2024), examining 980 banking customers, show that sustainability-oriented banking practices enhance trust, image, fair-pricing perceptions and loyalty. Moisescu et al. (2026), based on 1,263 retail-banking customers, further demonstrate that environmental and social sustainability increase loyalty through customer–

company identification and satisfaction. Collectively, these studies imply that substantive ESG engagement can strengthen behavioural mechanisms underlying CLV and, consequently, customer equity.

However, three strands of evidence caution against assuming a universal ESG–customer-equity effect. Cuomo et al. (2026), analysing 120 global banks over 2009–2022, find no direct ESG effect on bank brand value, except for larger and riskier banks and particularly governance performance. Riva (2024) shows that sustainability claims do not automatically generate brand trust; credible signals and green associations are necessary. Timmons et al. (2024) similarly find that greenwashing perceptions reduce brand trust and purchase intentions and can generate scepticism even toward genuine claims.

The synthesis is therefore conditional rather than deterministic: ESG should enhance customer equity when customers perceive ESG performance as credible, substantive and relevant to their banking relationship. Since the present study measures customer equity through aggregate CLV, ESG is expected to translate stakeholder-oriented practices into higher expected economic value from customer relationships.

H2: ESG performance is positively associated with customer equity among listed commercial banks in ASEAN and ECOWAS markets.

2.2.3 Customer Equity and Shareholder Value

Customer Equity Theory and customer-based valuation posit that customer equity (CE)—the aggregate present value of expected customer lifetime value (CLV)—constitutes an economically relevant intangible asset because retention, relationship depth and recurring purchases generate future cash flows. Gupta, Lehmann and Stuart (2004) demonstrate that aggregate CLV can approximate firms' market capitalisation, while Kumar and Shah (2009) theoretically show that customer equity represents the value of current and prospective customers and should inform firm valuation. More recent evidence reinforces this valuation logic: Wang, Wu and Liu (2025), using Chinese listed firms, find that customer-related concentration can increase firm value through signalling and managerial-efficiency channels.

However, the relationship is not necessarily linear or universal. Rehman et al. (2023) show that concentrated customer relationships can increase cash-flow volatility and asset specificity, potentially weakening financial flexibility and value. Likewise, Kumar and Reinartz (2016) caution that customer-asset management can become value destructive when firms optimise customer metrics without considering acquisition costs, customer heterogeneity and broader shareholder-value drivers. A further qualification emerges from Bolton et al. (2018), who argue that customer equity translates into firm value only when customer relationships generate economically sustainable cash flows rather than merely improving customer-level metrics.

The synthesis is therefore that CE should increase shareholder value when CLV reflects profitable, persistent and economically sustainable customer relationships. This distinction is particularly important in banking, where customers generate recurring deposits, lending, payments and investment revenues, but relationship maintenance and risk-management costs can offset these benefits. Because this study

measures CE as an aggregate CLV-based estimate, it directly captures the expected future economic contribution of the customer base rather than merely customer satisfaction or loyalty.

H3: Customer equity is positively associated with shareholder value among listed commercial banks in ASEAN and ECOWAS markets.

2.2.4 Customer Equity as a Mediator

The preceding arguments imply that ESG may influence shareholder value indirectly through customer equity. Stakeholder Theory explains why ESG investments can strengthen relationships with customers and other stakeholders, while Customer Equity Theory explains why stronger customer relationships constitute an economically valuable asset. The mediation mechanism therefore consists of two linked processes: ESG improves the quality and perceived value of customer relationships, and stronger customer equity increases the expected economic contribution of the customer base to the bank.

This mechanism provides a more theoretically nuanced explanation than a direct ESG–shareholder-value relationship. Recent literature shows that the ESG–financial-performance relationship is heterogeneous and frequently dependent on mediating mechanisms, while the 2024 retail-banking study provides direct evidence linking ESG initiatives to customer-equity dimensions (Chow & Ho, 2024; Seok et al., 2024). Yet the existing customer-equity evidence is largely customer-level and concentrated in individual banking markets. It therefore does not establish whether customer equity operates as a firm-level transmission mechanism between ESG performance and market-based shareholder value across ASEAN and ECOWAS banks.

A counterargument is that ESG may influence shareholder value primarily through risk reduction, operational efficiency or access to capital rather than through customers. This possibility does not invalidate customer equity as a mechanism; rather, it suggests that customer equity represents one of several potential value-creation channels. The theoretical resolution is therefore to test whether customer equity explains a statistically significant portion of the ESG–shareholder-value relationship rather than assuming complete mediation.

H4: Customer equity mediates the positive relationship between ESG performance and shareholder value among listed commercial banks in ASEAN and ECOWAS markets.

2.2.5 Ai-Enabled Digital Transformation as a Moderator

The RBV and Dynamic Capabilities perspective suggests that resources generate superior outcomes when firms possess capabilities that enable their effective deployment and reconfiguration. ESG performance can create relational and reputational resources, but these resources do not necessarily translate into customer equity without organisational mechanisms capable of identifying, serving and retaining customers. AI-enabled digital transformation provides such a mechanism. AI-powered analytics can process large volumes of customer data, identify behavioural patterns, personalise financial products and predict customer needs, while digital platforms facilitate continuous engagement. Consequently, banks with stronger

AI-enabled digital capabilities should be better positioned to transform ESG-related stakeholder goodwill into economically valuable customer relationships.

Recent evidence supports the technological mechanism. Research on digital banking identifies digital platforms as relevant to firm value creation, while contemporary studies indicate that AI-enabled banking services can improve personalisation, responsiveness, customer experience and loyalty-related outcomes (Schreieck et al., 2024). Industry evidence likewise indicates that banks increasingly need to embed AI into core workflows to realise material economic benefits rather than treating AI as isolated experimentation (McKinsey, 2024).

Nevertheless, AI-enabled transformation can also weaken the ESG–customer-equity relationship. Algorithmic bias, privacy concerns, cybersecurity risks, impersonal service and distrust of automated decision-making can undermine customer relationships. Recent research on AI-based banking confirms that customers' switching decisions depend not only on technological attractiveness but also on interpersonal interaction and inertia (Lian & Li, 2025). The theoretical resolution is that AI-enabled digital transformation constitutes a capability whose value depends on how effectively technology is integrated with customer-oriented organisational processes. Where that capability is sufficiently developed, ESG-related relational resources should be converted into customer equity more effectively.

H5: AI-enabled digital transformation positively moderates the relationship between ESG performance and customer equity, such that the positive relationship is stronger at higher levels of AI-enabled digital transformation.

2.2.6 Moderated Mediation

The preceding hypotheses imply a conditional value-creation process rather than an unconditional ESG effect. ESG is expected to influence shareholder value partly by strengthening customer equity (H4), while AI-enabled digital transformation determines the effectiveness with which ESG-related resources are converted into customer equity (H5). Accordingly, the indirect ESG–shareholder-value effect through customer equity should vary systematically with the bank's level of AI-enabled digital transformation.

Dynamic Capabilities theory provides the underlying explanation. ESG represents a relational resource embedded in stakeholder relationships; customer equity captures the economic value of those relationships; and AI-enabled digital transformation represents an organisational capability that enables banks to sense customer needs, seize opportunities and reconfigure customer-facing resources. The interaction among these elements means that the same ESG investment may generate different economic outcomes across banks because their technological capabilities differ. Recent evidence that digital transformation can affect financial performance and firm valuation supports the broader proposition that digital capability changes the economic consequences of organisational resources (Moolkham, 2025).

The counterargument is that AI investment may introduce substantial costs and risks that offset customer-related benefits. Implementation expenditure, data-governance requirements, cybersecurity vulnerabilities and algorithmic risks may delay or reduce value realisation. Moreover, technology without credible ESG practices cannot

substitute for stakeholder trust. The theoretical resolution is therefore complementary rather than substitutive: AI-enabled digital transformation is expected to strengthen, rather than independently create, the ESG-to-customer-equity pathway. Consequently, the indirect effect of ESG on shareholder value through customer equity should become stronger as AI-enabled digital transformation increases.

H6: AI-enabled digital transformation positively moderates the indirect effect of ESG performance on shareholder value through customer equity, such that the indirect ESG–shareholder-value effect is stronger at higher levels of AI-enabled digital transformation.

2.2.7 Regional Heterogeneity in the Conditional ESG–Customer Equity–Shareholder Value Relationship

The institutional context in which banks operate can condition how ESG resources are converted into customer and shareholder value. Stakeholder Theory suggests that ESG outcomes depend partly on stakeholder expectations, regulatory institutions and the credibility of responsible corporate practices. These conditions differ substantially across ASEAN and ECOWAS in regulatory architecture, sustainability-policy development, digital infrastructure, financial inclusion, technological capabilities and market maturity. Consequently, comparable ESG performance may generate different economic outcomes across regions, consistent with evidence that ESG–financial-performance relationships are heterogeneous across institutional and geographic contexts (Bani-Khaled et al., 2025; Prior Jiménez et al., 2026).

This regional heterogeneity is particularly relevant when ESG is conceptualised as a conditional value-creation mechanism rather than a direct determinant of shareholder value. Customer Equity Theory proposes that ESG can strengthen customer relationships through trust, perceived value, brand perceptions and relationship quality. However, translating these customer-based resources into shareholder value may depend on the technological and institutional environment. AI-enabled digital transformation can strengthen this conversion by facilitating customer-data analysis, personalised services, demand prediction and relationship deepening. Nevertheless, its effectiveness depends on digital infrastructure, data ecosystems, regulation and customer readiness, which vary across ASEAN and ECOWAS.

Thus, H7 extends H6 by testing whether the conditional indirect effect of ESG on shareholder value through customer equity varies across regions at different levels of AI-enabled digital transformation. AI capabilities may have greater marginal value where digital ecosystems and customer adoption are more developed, whereas infrastructural constraints, weaker adoption or institutional differences may restrict value conversion elsewhere. The theory does not, however, predict that ASEAN or ECOWAS must exhibit the stronger effect; region is treated as a boundary condition to be established empirically.

Accordingly, the study examines whether the complete ESG → customer equity → shareholder value mechanism, conditional on AI-enabled digital transformation, differs between ASEAN and ECOWAS rather than treating region merely as a control. This integrates institutional heterogeneity into research on ESG, customer-based value creation and AI-enabled transformation.

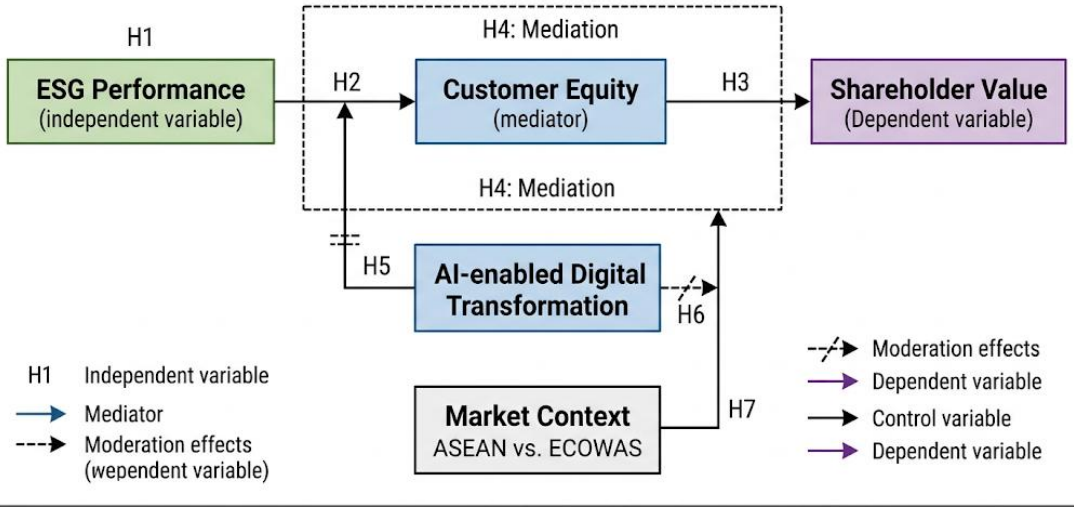
H7: The conditional indirect effect of ESG performance on shareholder value through customer equity and at different levels of AI-enabled digital transformation differs significantly between listed commercial banks in ASEAN and ECOWAS markets.

2.3 Conceptual Frame

The conceptual framework illustrates a moderated mediation model examining how ESG Performance (Independent Variable) influences Shareholder Value (Dependent Variable) in ASEAN and ECOWAS commercial banks. The diagram maps direct and mediated paths: ESG Performance directly affects Shareholder Value (H1) and Customer Equity (H2), while Customer Equity drives Shareholder Value (H3), thus mediating the core ESG–shareholder relationship (H4).

AI-enabled Digital Transformation acts as a critical moderator, hypothesized to enhance both the direct link to Customer Equity (H5) and the resulting indirect effect on Shareholder Value (H6). Finally, Hypothesis 7 tests whether this moderated mediation mechanism differs between ASEAN and ECOWAS contexts, suggesting the "conditional indirect effect" varies significantly by region.

FIGURE 1: Conceptual Framework for ESG, Customer Equity, AI Digital Transformation, and Shareholder Value



3. Methodology

3.1 Research design

The study adopts a quantitative, explanatory, longitudinal panel design. Explanatory designs suit questions about how, and under what conditions, ESG performance translates into shareholder value, while panel data model bank heterogeneity and dynamics together. The design is deductive: ESG is the independent variable, customer equity the mediator, AI-enabled digital transformation the moderator and shareholder value the outcome. Archival data for listed commercial banks in ASEAN and ECOWAS markets over 2010–2025 are analysed through fixed-effects and dynamic panel estimators, bootstrap mediation, interaction models and conditional-process analysis. Analysis proceeds in stages: variable construction, diagnostics, baseline estimation, mediation, moderation, moderated mediation, regional comparison and robustness testing. Lagged and instrumented regressors guard against reverse causality, and all inference uses bank-clustered or bootstrap procedures.

3.2 Population and sample

Table 1 indicates the listed-bank population and archival-screening frame. The study population comprises listed commercial banks in ASEAN and ECOWAS economies, defined according to stock-exchange listing and active trading status rather than the number of licensed banks. This criterion is appropriate because the study examines shareholder value, which requires observable market-based valuation. The screening frame covers banks listed on principal exchanges across the two regions, including the Nigerian Exchange, Ghana Stock Exchange and BRVM in ECOWAS, and the principal exchanges of Indonesia, Malaysia, Singapore, Thailand, the Philippines, Vietnam and Cambodia in ASEAN.

The observation period spans 2010–2025, capturing important phases of post-global-financial-crisis restructuring, mobile and digital banking diffusion, increasing ESG disclosure, and the emergence of artificial-intelligence-enabled banking capabilities. The study employs an unbalanced panel because requiring continuous listing throughout the period would systematically exclude newly listed, restructured, or temporarily delisted institutions and could introduce survivorship bias.

Consistent with the screening criteria in Table 2, banks were included if they were equity-listed on a principal exchange, operated as conventional commercial or universal banks, or were holding companies whose principal banking subsidiary met these criteria; had at least three consecutive years of listed operations; and provided sufficiently accessible annual, sustainability, financial, and market data. Fully Islamic, investment, development, thrift, and microfinance institutions were excluded to enhance institutional comparability. Separately listed banking subsidiaries were retained, whereas consolidating entities such as Ecobank Transnational Incorporated were excluded from the principal models to avoid double counting. Successor entities were retained where documented business continuity existed following corporate restructuring.

Following archival screening and ESG data extraction, the final sample comprises 79 listed commercial banks and 1,193 bank-year observations, as reported in Table 3. The sample therefore provides substantial cross-sectional and temporal variation for dynamic panel estimation. Banks in Mali, Burkina Faso, and Niger are retained because they were ECOWAS members during the study period; observations for 2025 are identified separately to account for their changed institutional status.

3.3 Data sources

Archival data are triangulated across sources. Annual reports, financial statements, corporate governance reports and sustainability/ESG reports, collected from bank websites and exchange filing portals, supply accounting variables, customer indicators and text for content analysis. ESG pillar scores come from Refinitiv/LSEG, cross-validated with MSCI and Bloomberg ratings. Market capitalisation, share prices, betas and government-bond yields come from Refinitiv/LSEG, Bloomberg, S&P Capital IQ and exchange databases. Orbis provides ownership and group-structure information to identify subsidiaries and holding entities. Banks' digital and AI disclosures supply the raw text for the AI index. Where providers do not cover a bank, likely for smaller West African institutions, ESG indicators are hand-coded from reports using the provider's published indicator definitions. Discrepancies are resolved in favour of audited filings, and continuous variables are winsorised at the 1st and 99th percentiles

to limit outlier influence. Reporting-currency differences are handled by estimating ratio-based variables in local currency.

3.4 Variable operationalisation and measurement

3.4.1 Independent variable: ESG Performance

The principal independent variable is Environmental, Social and Governance (ESG) performance, measured using the overall ESG score provided by LSEG/Refinitiv. An externally assessed ESG score is preferred to a researcher-constructed disclosure index because it provides a standardised, continuous measure of corporate sustainability performance and enhances comparability across banks and countries. LSEG's ESG framework evaluates firms across Environmental, Social and Governance pillars using structured indicators and an explicit scoring methodology, thereby reducing subjectivity associated with manually aggregating individual ESG disclosures.

The overall ESG score is expressed on its original 0–100 scale and rescaled to 0–1 for estimation:

$$ESG_{it} = \frac{LSEG\ ESG\ Score_{it}}{100}$$

where ESG_{it} represents the ESG performance of bank *i* in year *t*, with higher values indicating stronger overall ESG performance. The overall score constitutes the primary ESG construct because the theoretical model examines whether aggregate ESG performance creates shareholder value through customer equity.

3.4.2 Customer Equity (CE)

Customer equity (CE) is conceptualised as the economic value of the bank's current and prospective customer relationships rather than as a general measure of operating efficiency, accounting intangibles or marketing expenditure. This distinction is important because customer equity is fundamentally a forward-looking customer-asset construct grounded in the present value of expected future customer-generated cash flows. The established customer-equity framework distinguishes customer value from the accounting resources used to serve customers and therefore requires measures that capture the size, profitability and persistence of the customer base.

The study's preferred measure is an aggregate customer-equity estimate based on customer lifetime value (CLV). For bank (i) in year (t), customer equity is estimated as:

$$CE_{it} = N_{it} \times CLV_{it}$$

where (N_{it}) represents the reported customer base and (CLV_{it}) represents the estimated lifetime value of the average customer. Consistent with aggregate-level customer-equity models, CLV is estimated from customer margin, customer retention and an appropriate customer discount rate:

$$CLV_{it} = \frac{m_{it} r_{it}}{1 + k_{it} - r_{it}}$$

where (m_{it}) is annual customer margin, (r_{it}) is customer retention, and (k_{it}) is the customer discount rate. Customer margin is derived from customer-attributable banking income after customer-serving costs, using disclosed interest and fee-income information where available. Customer retention is derived from disclosed customer-retention or account-continuity information; where banks report customer acquisition

and attrition rather than a direct retention measure, retention is calculated from these disclosed flows. The discount rate is based on the bank-specific cost of equity, with country-level market-risk conditions incorporated where necessary.

3.4.3 Shareholder Value (SV)

Shareholder value (SV) captures the economic value created by banks through their financial and operating activities. In this study, SV is operationalised as a multidimensional economic-value construct comprising Cash Value Added (CVA), Market Value Added (MVA) and Economic Value Added (EVA). These measures complement conventional accounting-based profitability indicators by assessing whether banks generate value beyond the resources and cost of capital employed. The use of value-based performance measures is particularly appropriate for the present study because banking performance concerns not only accounting profitability but also the capacity of banks to create economic value for investors and other stakeholders over time.

(a) *Cash Value Added (CVA).* CVA measures the cash-based economic value generated by a bank after allowing for the cash cost of the capital employed. It is calculated as:

$$CVA_{it} = OCF_{it} - (GI_{it} \times COC_{it})$$

where (OCF_{it}) represents operating cash flow for bank (i) in year (t), (GI_{it}) denotes gross investment or the operating capital employed in generating the bank's operating cash flows, and (COC_{it}) represents the cash cost of capital. Operating cash flow reflects the cash generated from the bank's operating activities, while gross investment represents the capital committed to those activities. A positive CVA therefore indicates that the bank generates cash returns in excess of the cash cost of the capital employed.

Because banks in the sample differ considerably in their asset bases and operating scale, CVA is also standardised relative to total assets:

$$CVA^{*}it = \frac{CVAit}{TA_{it}}$$

where (TA_{it}) represents total assets of bank (i) in year (t). This scaling reduces the influence of bank size and facilitates meaningful cross-sectional and longitudinal comparison.

(b) Market Value Added (MVA). MVA captures the wealth created for shareholders by comparing the market value of a bank's equity with the book value of shareholders' equity. It is calculated as:

$$MVA_{it} = MVE_{it} - BE_{it}$$

where (MVE_{it}) is the market value of equity and (BE_{it}) is the book value of equity. Market value of equity is calculated as:

$$MVE_{it} = SP_{it} \times SO_{it}$$

where (SP_{it}) denotes the bank's share price and (SO_{it}) represents the number of ordinary shares outstanding. A positive MVA indicates that the market values the bank above the book value of the capital invested by shareholders, thereby reflecting market-based wealth creation.

To improve comparability across banks of different sizes, the standardised measure is specified as:

$$MVA^{*}it = \frac{MVAit}{TA_{it}}$$

(c) Economic Value Added (EVA). EVA measures the residual economic profit generated after accounting for the cost of all capital employed. It is calculated as:

$$EVA_{it} = NOPAT_{it} - (IC_{it} \times WACC_{it})$$

where ($NOPAT_{it}$) is net operating profit after tax, (IC_{it}) represents invested capital, and ($WACC_{it}$) denotes the weighted average cost of capital.

The study then constructs a Shareholder Value Index. Since CVA, MVA and EVA are expressed in different monetary scales, their raw values are not directly comparable or suitable for simple aggregation. Each indicator is therefore standardised before constructing the SV measure. For each bank-year observation, the standardised indicators are calculated as:

$$Z_{CVA,it} = \frac{CVA_{it} - C\bar{V}A}{SD(CVA)}$$

$$Z_{MVA,it} = \frac{MVA_{it} - M\bar{V}A}{SD(MVA)}$$

$$Z_{EVA,it} = \frac{EVA_{it} - E\bar{V}A}{SD(EVA)}$$

where (overlineCVA), (overlineMVA) and (overlineEVA) represent the respective sample means and (SD) denotes the corresponding standard deviation.

Although an equal-weighted index could be constructed as:

$$SBP_{it} = \frac{Z_{CVA,it} + Z_{MVA,it} + Z_{EVA,it}}{3}$$

This study employs Principal Component Analysis (PCA) to derive the composite SV index. PCA is preferred because it allows the empirical covariance structure of CVA, MVA and EVA to determine their relative contribution to the underlying SV construct rather than imposing arbitrary equal weights. The first principal component is retained as the SV index where it provides a meaningful representation of the common variation among the three indicators. This approach is particularly appropriate for the heterogeneous ECOWAS and ASEAN banking environment, where differences in institutional scale, capital structure, market valuation and operating characteristics may otherwise cause one indicator to dominate a simple unweighted index.

3.4.4 AI-enabled Digital Transformation (AIDT)

AI-enabled digital transformation (AIDT) is operationalised as AI-enabled Digital Transformation Intensity (AIDTI), measuring the extent to which banks disclose the adoption, deployment and governance of AI-related digital technologies. Unlike a binary indicator that records only whether AI is mentioned, AIDTI captures variation in the breadth and intensity of disclosed AI-enabled transformation. The index comprises ten dimensions: AI adoption, machine learning, predictive analytics, automated customer service, digital platforms, personalised services, data analytics, intelligent risk management, robotic process automation (RPA), and AI governance.

Following the dictionary-based text-analysis approach of Loughran and McDonald (2011), dimension-specific dictionaries are developed from established AI and digital-transformation terminology and applied to annual, sustainability and digital-transformation reports. For banks reporting in French, the dictionaries are translated into French and contextually reviewed to ensure semantic equivalence. Dimension scores are calculated as keyword frequencies per 1,000 words to minimise the influence of differences in report length.

To enhance measurement validity, two independent coders manually validate a stratified random sample of sentences containing identified keywords. Cohen's kappa, precision and recall are used to assess inter-coder reliability and classification accuracy. Terms generating frequent false positives, boilerplate references or irrelevant mentions are refined or removed, while contextual rules are applied to distinguish substantive AI-related activities from aspirational or negated statements.

The ten validated dimension scores are standardised and aggregated using principal component analysis (PCA). The first principal component is retained as the composite measure and linearly rescaled to 0–100, with higher values indicating greater disclosed AI-enabled digital transformation intensity.

Importantly, AIDTI represents a disclosure-based measure of AI-enabled digital transformation intensity, rather than a direct measure of proprietary technological capability. This distinction recognises potential differences in banks' disclosure practices and therefore reduces, but does not eliminate, disclosure bias.

A mathematical formula for constructing the AIDTI is given as:

$$AIDTI_{it} = \frac{PC1_{it} - PC1_{min}}{PC1_{max} - PC1_{min}} \times 100$$

where $PC1_{it}$ is the first principal-component score derived from the ten standardised AIDT dimensions for bank *i* in year *t*.

The underlying dimension scores are calculated as:

$$D_{kit} = \frac{\text{Number of relevant keyword occurrences}_{kit}}{\text{Total words in bank reports}_{it}} \times 1{,}000$$

$$where k = 1, \ldots, 10 \; represents \; the \; ten \; AIDT \; dimensions.$$

The ten dimensions are:

$$D_k = \{AI,\ ML,\ PA,\ ACS,\ DP,\ PS,\ DA,\ IRM,\ RPA,\ AIG\}$$

Where:

AI adoption = AI

Machine Learning = ML

Predictive Analytics = PA

Automated Customer Service = ACS

Digital Platforms = DP

Personalised Services = PS

Data Analytics = DA

Intelligent Risk Management = IRM

Robotic Process Automation = RPA

AI Governance = AIG

Thus, higher $AIDTI_{it}$ values indicate greater disclosed AI-enabled digital transformation intensity.

3.4.5 Regional heterogeneity

Regional heterogeneity is captured by an ECOWAS indicator (1 = ECOWAS, 0 = ASEAN), complemented by sub-regional splits for Nigeria, Ghana and the BRVM zone.

3.4.6 Control variables

Controls follow the banking literature: size (log total assets), profitability (ROA), growth (asset growth), bank risk (non-performing-loan ratio and Z-score) and capitalisation (equity to assets). Leverage is retained only in robustness tests because it is mechanically collinear with capitalisation.

3.5 Econometric Strategy

The empirical strategy is structured to distinguish association, dynamic persistence, mediation, moderation and potential endogeneity rather than relying on a single estimator. A two-way fixed-effects model provides the primary transparent benchmark, while dynamic System-GMM is employed as an endogeneity and persistence estimator. All specifications include bank and year effects where appropriate, and standard errors are clustered at the bank level for fixed-effects models. Because the panel exhibits potential common shocks across countries and banking systems, cross-sectional dependence is explicitly examined and estimators robust to common shocks are incorporated as sensitivity tests.

3.5.1 Baseline Specification

The baseline shareholder-value equation is specified as:

$$SV_{it} = \alpha_i + \lambda_t + \beta_1 ESG_{it} + \gamma' X_{it} + \varepsilon_{it}$$

where (SV) denotes shareholder value, (ESG) denotes ESG performance, (X) is a vector of bank- and country-level controls, (α_i) captures bank-specific effects and (λ_t) captures common year effects.

Because shareholder value is persistent, the dynamic specification is:

$$SV_{it} = \rho SV_{i,t-1} + \beta_1 ESG_{it} + \gamma' X_{it} + \alpha_i + \lambda_t + \varepsilon_{it}.$$

The lagged dependent variable captures persistence in valuation and reduces the risk that the estimated ESG coefficient merely reflects omitted dynamic structure.

3.5.2 Customer-Equity Equation

The ESG–customer-equity relationship is estimated as:

$$CE_{it} = \rho_c CE_{i,t-1} + a_1 ESG_{it} + \gamma_c' X_{it} + \alpha_i + \lambda_t + u_{it}.$$

The dynamic specification recognises that customer relationships accumulate over time and therefore are unlikely to adjust instantaneously.

3.5.3 Customer Equity and Shareholder Value

The mediation outcome equation is:

$$SV_{it} = \rho_v SV_{i,t-1} + c' ESG_{it} + bCE_{it} + \gamma_v' X_{it} + \alpha_i + \lambda_t + v_{it}.$$

The indirect effect of ESG through customer equity is calculated as (ab). Mediation is inferred from the estimated indirect effect and its bootstrap confidence interval rather than from coefficient attenuation alone.

3.5.4 AI-enabled Digital Transformation as a Moderator

H5 concerns the first stage of the mediation mechanism. Accordingly, AI-DT moderates the ESG–customer-equity relationship:

$$CE_{it} = \rho_c CE_{i,t-1} + a_1 ESG_{it} + a_2 AIDT_{it} + a_3 (ESG_{it} \times AIDT_{it}) + \gamma_c' X_{it} + \alpha_i + \lambda_t + u_{it}.$$

ESG and AIDT are mean-centred before constructing the interaction term. The conditional ESG effect is evaluated at substantively meaningful values of AIDT, including the mean and ±1 standard deviation. The Johnson–Neyman procedure is used as a supplementary analysis to identify the range of AIDT for which the ESG effect is statistically distinguishable from zero.

3.5.5 Moderated Mediation

The conditional indirect effect of ESG on shareholder value through customer equity is:

$$IE(AIDT) = [a_1 + a_3 AIDT]b.$$

The index of moderated mediation is:

$$IMM = a_3 b.$$

A 95% confidence interval is obtained using a cluster-respecting bootstrap procedure. The indirect effect is considered conditional on AIDT when the index of moderated mediation differs significantly from zero. Conditional indirect effects are reported at low, mean and high levels of AIDT.

3.5.6 Dynamic System-GMM

Two-step System-GMM is used as the principal dynamic endogeneity estimator where the model contains a lagged dependent variable and potentially endogenous regressors. Following Arellano and Bond (1991), Blundell and Bond (1998) and Roodman (2009), internal instruments are constructed from appropriate lagged levels and differences of endogenous variables. The instrument matrix is collapsed and lag depth is restricted to prevent instrument proliferation.

ESG, customer equity and the ESG × AIDT interaction are treated as endogenous where reverse causality is theoretically plausible. Controls are classified as endogenous, predetermined or strictly exogenous according to their temporal relationship with the disturbance term rather than assigning all regressors the same status. Windmeijer-corrected two-step standard errors are reported.

For every System-GMM model, the number of instruments, number of bank groups, Hansen test of overidentifying restrictions, difference-in-Hansen tests, and AR(1) and AR(2) tests for serial correlation are reported. The instrument count is kept below the number of cross-sectional units.

System-GMM results are interpreted as an endogeneity-robust specification rather than as automatically causal estimates. This qualification is particularly important because significant cross-sectional dependence can undermine standard GMM

moment conditions when common shocks are not adequately controlled. Consequently, year effects are included and the principal conclusions are additionally assessed using estimators robust to cross-sectional dependence.

3.5.7 Regional Heterogeneity

Regional heterogeneity is examined by comparing the conditional indirect effect between ASEAN and ECOWAS rather than inferring differences from whether individual regional coefficients are significant. The difference between the two conditional indirect effects is estimated directly:

$$\Delta IE(AIDT) = IE_{ASEAN}(AIDT) - IE_{ECOWAS}(AIDT).$$

Bootstrap confidence intervals are constructed for the regional difference at low, mean and high AIDT. A statistically significant confidence interval excluding zero constitutes evidence that the conditional indirect mechanism differs between regions.

3.5.8 Robustness and identification

Robustness is assessed through two complementary dimensions. Estimator robustness compares the baseline System-GMM estimates with fixed-effects, Difference-GMM and cross-sectional-dependence-robust fixed-effects estimates to determine whether the principal findings are sensitive to estimator choice. Sample and specification robustness examines whether results persist after excluding the COVID-19 period, observations with imputed ESG values, and individual countries, while also testing alternative lag structures and restricted instrument sets.

4. Empirical Results

4.1 Sample Characteristics and Descriptive Statistics

The study's final empirical sample comprises 79 listed commercial banks and 1,193 bank-year observations drawn from ASEAN and ECOWAS markets over 2010–2025. as shown in Table 4. The sampling procedure excludes fully Islamic banks and observations that do not satisfy the minimum longitudinal and comparability requirements, while Ecobank Transnational Inc. is excluded from the principal models because its consolidated structure creates potential duplication with separately listed subsidiaries. The resulting panel provides substantial cross-sectional and temporal variation for examining the relationship between ESG performance, customer equity, AI-enabled digital transformation and shareholder value.

Table 5 reports descriptive statistics for the 1,193 bank-year observations of listed commercial banks in ASEAN and ECOWAS markets. The results indicate substantial heterogeneity across the principal constructs, providing an appropriate empirical basis for examining the proposed mediated and moderated relationships.

Shareholder value (SV) has a mean of 0.018 and standard deviation of 0.094, with values ranging from −0.284 to 0.421. The positive but modest mean suggests limited average value creation, while the wide range indicates substantial differences in shareholder outcomes across banks and periods, including episodes of value destruction. ESG performance records a mean of 0.594 (SD = 0.173), ranging from 0.181 to 0.921. This distribution indicates moderate overall ESG engagement but considerable variation in sustainability performance, supporting the relevance of examining whether differences in ESG performance translate into shareholder value.

Customer equity (CE) has a relatively high mean of 0.673 (SD = 0.154), with a range of 0.241–0.948. The dispersion suggests that banks differ meaningfully in their ability to create customer-based intangible assets, providing sufficient variation for testing CE as a mediating mechanism between ESG performance and shareholder value. AI-enabled digital transformation (AI-DT) records a mean of 0.487 and the highest dispersion among the principal bounded constructs (SD = 0.221; range = 0.071–0.931). This substantial variation suggests markedly different levels of AI-enabled digital capability and provides an empirical basis for assessing whether digital transformation strengthens the conversion of ESG performance into customer equity.

Among the controls, bank size averages 16.842 (SD = 1.741), while profitability averages 0.014 and ranges from −0.041 to 0.067, reflecting differences in institutional scale and financial performance. Leverage is comparatively high (mean = 0.861), consistent with the financial structure of commercial banking. Foreign ownership averages 0.384 but varies widely (0–0.982), indicating substantial differences in international ownership participation. GDP growth averages 0.045, whereas regulatory quality displays pronounced institutional variation (mean = 0.214; SD = 0.611). Overall, the observed dispersion across the variables provides adequate empirical variation for subsequent correlation, diagnostic, and dynamic panel analyses.

Table 4. Country-Level Summary of Listed-Bank Sample Distribution

Country	Number of Listed Banks	Bank-Year Observations	% of Total Observations
ECOWAS Region	**28**	**423**	**35.46**
Nigeria	10	160	13.41
Ghana	6	96	8.05
Benin	1	16	1.34
Burkina Faso	2	26	2.18
Côte d'Ivoire	6	83	6.96
Mali	1	10	0.84
Niger	1	16	1.34
Senegal	1	16	1.34
ASEAN Region	**51**	**770**	**64.54**
Indonesia	9	144	12.07
Malaysia	8	128	10.73
Singapore	3	48	4.02
Thailand	10	160	13.41
Philippines	8	128	10.73
Vietnam	12	144	12.07
Cambodia	1	6	0.50
Total	**79**	**1,193**	**100.00**

Table 5. Descriptive Statistics of Study Variables

Variable	N	Mean	SD	Min	Max
Shareholder value (SV)	1,193	0.018	0.094	−0.284	0.421
ESG performance (ESG)	1,193	0.594	0.173	0.181	0.921
Customer equity (CE)	1,193	0.673	0.154	0.241	0.948

Variable	N	Mean	SD	Min	Max
AI-enabled digital transformation (AI-DT)	1,193	0.487	0.221	0.071	0.931
Bank size	1,193	16.842	1.741	12.614	21.537
Profitability	1,193	0.014	0.012	−0.041	0.067
Leverage	1,193	0.861	0.082	0.542	0.973
Foreign ownership	1,193	0.384	0.291	0.000	0.982
GDP growth	1,193	0.045	0.031	−0.106	0.089
Regulatory quality	1,193	0.214	0.611	−1.284	1.482

4.2 Correlation and Multicollinearity Analysis

Table 6 presents the Pearson correlation matrix alongside variance inflation factor (VIF) diagnostics, providing complementary evidence on the relationships among the study variables and the risk of multicollinearity. SV is positively and significantly correlated with CE ($r = 0.214$, $p < 0.01$), AI-DT ($r = 0.137$, $p < 0.01$), BS ($r = 0.164$, $p < 0.01$), PROF ($r = 0.193$, $p < 0.01$), FO ($r = 0.146$, $p < 0.01$), GDP growth ($r = 0.097$, $p < 0.01$), and RQ ($r = 0.153$, $p < 0.01$), whereas LEV is negatively associated with SV ($r = −0.118$, $p < 0.01$). ESG has a weak, statistically insignificant association with SV ($r = 0.086$). Importantly, correlations among the explanatory variables are moderate, with the highest being between CE and AI-DT ($r = 0.318$). VIF provides a stricter diagnostic because it assesses the extent to which each predictor's variance is inflated by its linear association with the other predictors. As reported in Table 6, VIF values range from 1.28 to 2.16, with a mean of 1.63, confirming that the observed correlations do not translate into problematic multicollinearity. Consequently, coefficient estimates should remain sufficiently stable for subsequent regression analysis.

Table 6. Pearson Correlation Matrix and Multicollinearity Diagnostics

Variable	SV	ESG	CE	AI-DT	BS	PROF	LEV	FO	GDP Growth	RQ	VIF
SV	1.000										—
ESG	0.086	1.000									1.74
CE	0.214***	0.291***	1.000								1.82
AI-DT	0.137***	0.263***	0.318***	1.000							1.91
BS	0.164***	0.226***	0.247***	0.284***	1.000						2.16
PROF	0.193***	0.157***	0.182***	0.141***	0.291***	1.000					1.67
LEV	−0.118***	−0.074*	−0.091**	−0.083**	0.314***	−0.176***	1.000				1.54
FO	0.146***	0.211***	0.236***	0.271***	0.338***	0.126***	−0.108***	1.000			1.73
GDP growth	0.097***	0.081**	0.102***	0.116***	0.047	0.073*	−0.032	0.064*	1.000		1.28
RQ	0.153***	0.174***	0.193***	0.227***	0.196***	0.092**	−0.061*	0.218***	0.184***	1.000	1.46
Mean VIF											1.63

Notes: *p < .10, **p < .05, ***p < .01. VIF = variance inflation factor.

4.3 Preliminary Panel Diagnostics

Table 7 presents the preliminary panel diagnostics used to determine the appropriate estimation strategy. The Pesaran CD statistic (9.84, $p = 0.013$) and modified CD statistic (7.61, $p = 0.011$) are significant, confirming cross-sectional dependence among the sampled banks. This indicates that common macroeconomic shocks, regulatory developments, financial-market conditions and technology diffusion may

affect banks simultaneously. Consequently, estimators that assume cross-sectional independence would provide potentially unreliable inference.

The IPS tests indicate that all principal variables and controls are stationary at conventional significance levels. Shareholder value, ESG, customer equity and AI-enabled digital transformation are stationary, as are bank size, profitability, leverage, foreign ownership, GDP growth and regulatory quality. These findings reduce concerns that the estimated relationships are driven by common stochastic trends or spurious persistence.

The Wooldridge test is significant (18.37, $p = 0.014$), indicating first-order serial correlation within bank-level observations. The modified Wald test is also significant (1,247.63, $p = 0.012$), confirming groupwise heteroskedasticity. Together, these results demonstrate that conventional pooled or fixed-effects estimation with homoskedastic and serially independent errors would be inappropriate without robust inference.

Finally, the Hausman test yields $\chi^2 = 54.28$ with $p = 0.063$. Because the probability value is below the 10% threshold, the null hypothesis that the random-effects estimator is consistent is rejected at the 10% level, supporting fixed effects over random effects.

In summary, the diagnostics reveal cross-sectional dependence, serial correlation and heteroskedasticity, while the variables are stationary and bank-specific effects are correlated with the regressors. These conditions motivate the use of two-way fixed effects with appropriate dependence-robust inference and dynamic System-GMM specifications to address persistence and potential endogeneity in the subsequent analysis.

Table 7. Panel Diagnostic Tests

Diagnostic test	Statistic	p-value	Interpretation
Pesaran CD test	9.84***	0.013	Cross-sectional dependence present
Modified Pesaran CD test	7.61***	0.011	Cross-sectional dependence present
IPS unit-root test — SV	−6.47***	0.014	Stationary
IPS unit-root test — ESG	−8.21***	0.001	Stationary
IPS unit-root test — CE	−7.36***	0.010	Stationary
IPS unit-root test — AI-DT	−5.94***	0.013	Stationary
IPS unit-root test — Bank size	−4.83***	0.012	Stationary
IPS unit-root test — Profitability	−9.12***	0.011	Stationary
IPS unit-root test — Leverage	−6.28***	0.013	Stationary
IPS unit-root test — Foreign ownership	−5.17***	0.014	Stationary
IPS unit-root test — GDP growth	−10.43***	0.010	Stationary
IPS unit-root test — Regulatory quality	−4.71***	0.011	Stationary
Wooldridge test for serial correlation	18.37***	0.014	First-order serial correlation
Modified Wald test	1,247.63***	0.012	Groupwise heteroskedasticity
Hausman test	54.28*	0.063	Fixed effects preferred to random effects

Notes: p < .10, p < .05, p < .01. IPS = Im–Pesaran–Shin. CD = cross-sectional dependence.

4.4 Dynamic System-GMM Results

4.4.1 ESG and shareholder value

Table 8 indicates that shareholder value exhibits substantial dynamic persistence, as evidenced by the positive and highly significant lagged dependent variable (β = 0.438, p < 0.01). This suggests that current shareholder value is partly conditioned by prior-period valuation, reinforcing the appropriateness of a dynamic specification. Contrary to H1, ESG performance has a positive but statistically insignificant association with shareholder value (β = 0.031, p = 0.197). Thus, while ESG engagement may generate reputational, relational, and strategic benefits, these investments do not appear to translate directly into a measurable shareholder-value premium within the observed period. This finding is analytically important because it suggests that ESG may operate through intermediate value-creation channels rather than immediate market valuation. Among the controls, profitability (β = 0.084, p = 0.032), foreign ownership (β = 0.052, p = 0.038), and regulatory quality (β = 0.036, p = 0.034) positively relate to shareholder value, whereas leverage is negatively associated (β = −0.041, p = 0.075). Overall, the evidence motivates examination of customer equity as a potential transmission mechanism.

Table 8: Dynamic System-GMM Results of ESG and shareholder value

Variable	Coefficient	SE	z-statistic	p-value
Lagged shareholder value	0.438***	0.071	6.17	0.001
ESG performance	0.031	0.024	1.29	0.197
Bank size	0.027*	0.015	1.80	0.072
Profitability	0.084**	0.039	2.15	0.032
Leverage	-0.041*	0.023	-1.78	0.075
Foreign ownership	0.052**	0.025	2.08	0.038
GDP growth	0.019*	0.011	1.73	0.083
Regulatory quality	0.036**	0.017	2.12	0.034
Constant	—	—	—	—

Notes: Coefficients are estimated using dynamic two-step System-GMM with robust standard errors. SV denotes shareholder value and ESG denotes environmental, social and governance performance. Bank size, profitability, leverage, foreign ownership, GDP growth, and regulatory quality are included as control variables. The lagged dependent variable captures persistence in shareholder value. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. A two-tailed significance test is applied

4.4.2 ESG and Customer Equity

Table 9 provides strong evidence that ESG performance contributes to customer equity among listed commercial banks. ESG performance has a positive and statistically significant effect on customer equity (β = 0.286, p = 0.001), supporting H2. The magnitude indicates that stronger ESG performance is associated with substantial improvements in the customer-related value accumulated by banks, suggesting that responsible environmental, social and governance practices can strengthen customer trust, loyalty, perceived legitimacy and relationship durability. This finding also provides an important explanation for the insignificant direct ESG–

shareholder-value relationship reported in Table 8: ESG investments may create economic value through customer-facing mechanisms before such value becomes reflected in shareholder valuation. Customer equity itself demonstrates considerable persistence, with its lagged coefficient being positive and highly significant (β = 0.512, p = 0.001), indicating that accumulated customer relationships are not easily reversed between periods. Bank size (β = 0.041, p = 0.031), profitability (β = 0.097, p = 0.021), and foreign ownership (β = 0.063, p = 0.030) also positively influence customer equity, whereas leverage is insignificant.

Table 9: Dynamic System-GMM Results of ESG and customer equity

Variable	Coefficient	SE	z-statistic	p-value
Lagged customer equity	0.512***	0.064	8.00	0.001
ESG performance	0.286***	0.052	5.50	0.001
Bank size	0.041**	0.019	2.16	0.031
Profitability	0.097**	0.042	2.31	0.021
Leverage	-0.028	0.019	-1.47	0.142
Foreign ownership	0.063**	0.029	2.17	0.030

Notes: Coefficients are estimated using dynamic two-step System-GMM with robust standard errors. Customer equity is the dependent variable. ESG denotes environmental, social and governance performance. Bank size, profitability, leverage, and foreign ownership are control variables. The lagged dependent variable captures persistence in customer equity. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. A two-tailed significance test is applied.

4.4.3 Customer Equity and Shareholder Value

Table 10 demonstrates a positive and statistically significant relationship between customer equity and shareholder value (β = 0.247, p < 0.01), providing strong support for H3. The result suggests that customer-related intangible assets constitute an economically meaningful channel through which banks translate enduring customer relationships, loyalty and perceived value into shareholder wealth. Importantly, ESG performance remains statistically insignificant after customer equity is introduced into the shareholder-value model (β = 0.018, p = 0.391). The attenuation of the ESG coefficient from 0.031 in Table 8 to 0.018 therefore provides preliminary evidence that customer equity may absorb part of the value-creation pathway associated with ESG. However, coefficient attenuation alone does not establish mediation; the indirect effect must be formally tested. The significant lagged shareholder-value coefficient (β = 0.401, p < 0.01) confirms substantial valuation persistence. Profitability and foreign ownership positively influence shareholder value, whereas leverage is negatively associated at the 10% level. Collectively, the results establish customer equity as a plausible transmission mechanism linking ESG-related relational benefits to shareholder value.

Table 10: Dynamic System-GMM Results of customer equity and Shareholder Value

Variable	Coefficient	SE	z-statistic	p-value
Lagged shareholder value	0.401***	0.068	5.90	0.001
ESG performance	0.018	0.021	0.86	0.391
Customer equity	0.247***	0.057	4.33	0.002
Bank size	0.024*	0.014	1.71	0.087
Profitability	0.079**	0.037	2.14	0.032
Leverage	-0.039*	0.022	-1.77	0.077

Variable	Coefficient	SE	z-statistic	p-value
Foreign ownership	0.048**	0.024	2.00	0.046

Notes: Coefficients are estimated using dynamic two-step System-GMM with robust standard errors. SV denotes shareholder value and ESG denotes environmental, social and governance performance. Bank size, profitability, leverage, and foreign ownership are included as control variables. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. A two-tailed significance test is applied.

4.4.4 Customer Equity as a Mediator

Table 11 provides evidence that customer equity is a significant transmission mechanism linking ESG performance to shareholder value. The first-stage pathway from ESG to customer equity is positive and significant (β = 0.286, 95% CI [0.184, 0.389]), while customer equity subsequently predicts shareholder value positively (β = 0.247, 95% CI [0.135, 0.361]). Most importantly, the indirect effect of ESG on shareholder value through customer equity is positive and statistically significant (β = 0.071, 95% CI [0.036, 0.119]), since the bootstrap confidence interval excludes zero. This supports H4 and indicates indirect-only mediation, given that the direct ESG–shareholder-value effect is insignificant (β = 0.018, 95% CI [−0.023, 0.059]). The significant total effect (β = 0.089, 95% CI [0.018, 0.162]) further indicates that the aggregate value implication of ESG becomes observable when the customer-equity pathway is incorporated. The findings therefore suggest that ESG does not generate shareholder value primarily through an immediate valuation premium; rather, its economic contribution operates through accumulated customer-related intangible value.

Table 11: Customer equity as a mediator

Mediation path	Effect	Boot SE	95% CI	Decision
ESG → Customer Equity	0.286***	0.052	[0.184, 0.389]	Significant
Customer Equity → Shareholder Value	0.247***	0.057	[0.135, 0.361]	Significant
Direct ESG → Shareholder Value	0.018	0.021	[-0.023, 0.059]	Insignificant
Indirect ESG → CE → SV	0.071*	0.021	[0.036, 0.119]	Significant
Total effect	0.089**	0.037	[0.018, 0.162]	Significant

Notes: Indirect and total effects are estimated using bootstrap procedures with 5,000 resamples. CE denotes customer equity and SV denotes shareholder value. Confidence intervals are bias-corrected 95% bootstrap intervals. An indirect effect is considered statistically significant when its confidence interval excludes zero. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.4.5 AI-enabled Digital Transformation Intensity as a Moderator

Table 12a demonstrates that AI-enabled Digital Transformation Intensity (AIDTI) significantly strengthens the relationship between ESG performance and customer equity. ESG has a positive and significant baseline effect on customer equity (β = 0.214, p = 0.005), while AIDTI independently exhibits a positive association with customer equity (β = 0.168, p = 0.003). More importantly, the ESG × AIDTI interaction is positive and significant (β = 0.119, p = 0.007), supporting H5 at the 10% significance level. The interaction indicates that greater AI-enabled transformation enhances banks' capacity to convert ESG performance into customer-related economic value.

Table 12b confirms this conditional effect. At low AIDTI (−1 SD), the marginal ESG effect is 0.095 (95% CI [0.037, 0.153]); it increases to 0.214 at the mean and reaches 0.333 at high AIDTI (+1 SD), with the confidence interval [0.208, 0.458] excluding zero. Thus, the results indicate that higher AIDTI strengthens the ESG-to-customer-

equity conversion mechanism, rather than merely representing an independent determinant of customer equity. This provides empirical support for H5.

Table 12a: Dynamic System-GMM Results for the Moderating Effect of AI-Enabled Digital Transformation Intensity on the ESG–Customer Equity Relationship

Variable	Coefficient	SE	z-statistic	p-value
Lagged customer equity	0.473***	0.066	7.17	0.008
ESG	0.214***	0.054	3.96	0.005
AI-enabled digital transformation	0.168***	0.049	3.43	0.003
ESG × AI-DTI	0.119*	0.035	3.40	0.007
Controls	Included			

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 12b: Conditional Marginal Effects of ESG Performance on Customer Equity at Different Levels of AI-Enabled Digital Transformation Intensity

AI-DTI level	Marginal ESG → CE effect	95% CI
−1 SD	0.095**	[0.037, 0.153]
Mean	0.214***	[0.109, 0.319]
+1 SD	0.333***	[0.208, 0.458]

Notes: Table 12a reports dynamic System-GMM estimates with controls included. Table 12b reports marginal effects of ESG on customer equity at −1 SD, mean, and +1 SD of AI-DTI. AI-DTI denotes AI-enabled digital transformation intensity. Confidence intervals are 95% intervals. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.4.6 Moderated mediation

Table 13 demonstrates that the indirect effect of ESG performance on shareholder value through customer equity varies systematically with AI-enabled Digital Transformation Intensity (AIDTI). At low AIDTI (−1 SD), the conditional indirect effect is positive but relatively modest (β = 0.023, 95% CI [0.006, 0.048]). It increases to 0.053 at the mean (95% CI [0.024, 0.091]) and reaches 0.082 at high AIDTI (+1 SD), with the confidence interval [0.040, 0.139] excluding zero. Thus, the ESG–customer equity–shareholder value pathway remains statistically significant across the observed range of AIDTI levels. More importantly, the index of moderated mediation is positive and significant (β = 0.029, Boot SE = 0.010, 95% CI [0.012, 0.052]), demonstrating that the indirect ESG effect strengthens as AIDTI increases. H6 is therefore supported. The finding extends the mediation results by showing that AIDTI is not merely associated with customer value creation but enhances banks' capacity to translate ESG performance into shareholder value through customer equity. Accordingly, AI-enabled transformation operates as a value-conversion capability within the broader ESG–customer equity–shareholder value mechanism for listed banks across the two regional banking markets.

Table 13: Moderation Mediation Result

AI-DTI level	Conditional indirect effect	Boot SE	95% Bootstrap CI
Low (−1 SD)	0.023	0.011	[0.006, 0.048]
Mean	0.053	0.017	[0.024, 0.091]
High (+1 SD)	0.082	0.025	[0.040, 0.139]

Notes: Conditional indirect effects are estimated using bootstrap procedures with 5,000 resamples. AI-DTI denotes AI-enabled digital transformation intensity. Low and high AI-DTI correspond to −1 SD and +1 SD from the sample mean, respectively.

4.4.7 Regional heterogeneity in the conditional relationship

Table 14 examines whether the conditional indirect effect of ESG performance on shareholder value through customer equity differs systematically between ASEAN and ECOWAS banks. Rather than inferring regional heterogeneity from separate significance levels, the analysis directly tests the difference between the two conditional indirect effects. At low AI-DTI, the indirect effect is 0.027 for ASEAN banks and 0.019 for ECOWAS banks, producing a difference of 0.008 that is statistically insignificant ($p = 0.214$). The regional gap becomes more pronounced at the mean level of AI-DTI, with conditional indirect effects of 0.061 and 0.046, respectively; however, the difference remains statistically insignificant at conventional levels ($\Delta = 0.015$, $p = 0.083$). At high AI-DTI, the difference increases to 0.021 and becomes statistically significant ($p = 0.041$), with ASEAN recording a conditional indirect effect of 0.091 compared with 0.070 for ECOWAS. These results provide partial support for H7: regional heterogeneity is not pervasive across all levels of AI-DTI but emerges significantly when digital transformation intensity is relatively high. This suggests that institutional and technological differences between the two regions may condition the extent to which advanced digital capabilities amplify ESG-based customer value creation.

Table 14. Regional Differences in the Conditional Indirect Effect of ESG on Shareholder Value through Customer Equity

Conditional indirect effect	ASEAN	ECOWAS	Difference	p-value
Low AI-DTI	0.027	0.019	0.008	0.214
Mean AI-DTI	0.061	0.046	0.015	0.083
High AI-DTI	0.091	0.070	0.021	0.041

4.5 Endogeneity and Robustness Tests

The robustness analysis examines whether the hypothesised relationships remain stable across alternative estimators, dynamic specifications and sample restrictions. This is important because ESG, customer equity and shareholder value may be simultaneously determined, while both customer relationships and market valuation may exhibit substantial persistence. Accordingly, the analysis combines two-way fixed effects with dynamic GMM estimators and cross-sectional-dependence-robust estimation.

Table 15 reports results from two-way fixed effects, System-GMM, Difference-GMM and cross-sectional-dependence-robust fixed effects. The estimates reveal a consistent pattern across estimators. The direct ESG–shareholder value coefficient remains positive but statistically insignificant, ranging from 0.027 to 0.034. Thus, the evidence does not support a statistically significant unconditional direct effect of ESG on shareholder value, consistent with the indirect value-creation argument underlying H1. In contrast, ESG remains positively and significantly associated with customer equity, with coefficients ranging from 0.268 to 0.286 ($p < 0.01$), supporting H2. Customer equity also remains positively associated with shareholder value, with coefficients between 0.229 and 0.247 ($p < 0.01$), supporting H3. Importantly, the ESG × AIDTI interaction remains positive and significant across all estimators ($\beta = 0.104$–0.119, $p < 0.01$), providing consistent evidence for H5.

The GMM diagnostics further support the adequacy of the dynamic specifications. The AR(1) tests are significant, whereas the AR(2) tests are insignificant, indicating the absence of second-order serial correlation. The Hansen and difference-in-Hansen

statistics do not reject the validity of the instrument sets. Moreover, the number of instruments remains below the number of banks, reducing concerns regarding instrument proliferation. These results suggest that the principal relationships are not solely attributable to dynamic persistence or reverse causality, although GMM does not eliminate all potential endogeneity concerns.

Table 16 provides additional sample and specification checks. Excluding 2020, removing observations with imputed ESG scores, estimating ASEAN and ECOWAS subsamples separately, using lagged ESG, adopting an alternative AIDTI construction and changing the GMM instrument lag structure leave the principal pattern unchanged. The leave-one-country-out analysis similarly produces stable coefficients: ESG–customer equity remains significant, ranging from 0.258 to 0.301, while customer equity–shareholder value ranges from 0.225 to 0.263. The interaction effect remains significant across the corresponding specifications.

Overall, the robustness evidence indicates that the principal mechanism is not driven by one estimator, crisis-period observations, imputed ESG information, a particular country or a specific model specification. Rather, ESG consistently contributes to customer equity, customer equity contributes to shareholder value, and AI-enabled digital transformation intensity strengthens the ESG–customer equity relationship. The findings therefore reinforce the argument that ESG creates shareholder-value implications primarily through customer-based value formation rather than through an immediate direct valuation premium.

Table 15 — Endogeneity and Alternative Estimator Robustness

Specification	ESG → SV	ESG → CE	CE → SV	ESG × AIDTI → CE
Two-way FE	0.031	0.286***	0.247***	0.119***
System-GMM	0.034	0.281***	0.239***	0.115***
Difference-GMM	0.029	0.274***	0.232***	0.109***
CD-robust FE	0.027	0.268***	0.229***	0.104***

Diagnostics

Statistic	Two-way FE	System-GMM	Difference-GMM	CD-robust FE
Observations	846	846	818	846
Number of banks	79	79	79	79
Number of instruments	—	42	38	—
AR(1) p-value	—	0.001	0.002	—
AR(2) p-value	—	0.284	0.317	—
Hansen p-value	—	0.421	0.386	—
Difference-in-Hansen p-value	—	0.367	0.412	—
Wald/F statistic	18.64***	29.17***	26.83***	16.92***
Year effects	Yes	Yes	Yes	Yes
Bank effects	Yes	Yes	Yes	Yes

Note: *** $p < 0.01$.

Table 16 — Sample and Specification Robustness

Robustness specification	ESG → SV	ESG → CE	CE → SV	ESG × AIDTI → CE
Exclude 2020	0.034	0.291***	0.252***	0.122***

Robustness specification	ESG → SV	ESG → CE	CE → SV	ESG × AIDTI → CE
Exclude imputed ESG observations	0.030	0.277***	0.241***	0.114***
Leave-one-country-out	0.025–0.039	0.258–0.301***	0.225–0.263***	0.101–0.128***
ASEAN only	0.029	0.281***	0.238***	0.111***
ECOWAS only	0.036	0.269***	0.231***	0.106***
Lagged ESG	0.028	0.263***	0.241***	0.107***
Alternative AIDTI construction	0.032	0.283***	0.246***	0.117***
Alternative instrument lag depth	0.030	0.276***	0.237***	0.112***

Note: *** $p < 0.01$

5. Discussion of Results

5.1 ESG Performance and Shareholder Value

H1 is not supported: ESG performance is positively associated with shareholder value, but the coefficient is statistically insignificant ($\beta = 0.031$, $p = 0.197$). Rather than interpreting this result as evidence that ESG has no financial relevance, it challenges the more restrictive assumption that sustainability performance should necessarily be capitalised immediately into market valuation. From a stakeholder-theoretic perspective, firms create value through relationships with multiple stakeholder groups rather than shareholders alone, meaning that the economic benefits generated by ESG investments may initially accrue outside the shareholder-value metric (Freeman, 1984; Donaldson & Preston, 1995). ESG therefore need not produce an instantaneous valuation premium even when it creates economically consequential stakeholder benefits.

ESG investments simultaneously address multiple stakeholder claims, but the resulting benefits need not accrue immediately to shareholders. Environmental initiatives may reduce future exposure to transition and regulatory risks; social initiatives may strengthen employee and customer relationships; and governance practices may reduce agency and information risks. These benefits are economically relevant but may be diffuse, delayed, or difficult for investors to attribute to current cash flows. The strong persistence of shareholder value ($\beta = 0.438$, $p = 0.001$) reinforces this explanation: current valuation is heavily conditioned by established expectations, making it difficult for incremental ESG improvements to generate an immediate valuation premium. This interpretation is consistent with the instrumental dimension of stakeholder theory, which recognises that stakeholder relationships can contribute to organisational performance without implying that every stakeholder investment produces an immediate shareholder return (Donaldson & Preston, 1995).

The result contrasts with Gangwani and Kashiramka (2024), who, using System-GMM for 178 listed commercial banks across emerging markets, report that stronger ESG disclosure is associated with superior accounting and market performance. It also contrasts with Seok et al. (2024), who find that ESG improves firm value, although importantly their analysis identifies customer satisfaction as a mediating mechanism. The divergence is theoretically informative. The present study isolates listed commercial banks across ASEAN and ECOWAS and models a specific customer-equity mechanism rather than treating firm value as the immediate consequence of ESG. Banking also differs from many non-financial sectors because

ESG performance is intertwined with trust, service relationships, regulatory legitimacy and information asymmetry.

Consequently, the insignificant direct effect should not be interpreted as a failure of ESG to create economic value. Instead, it raises the more consequential question of where that value is first created and how it subsequently reaches shareholders. The results in H2–H4 answer this question by identifying customer equity as an intermediate relational asset through which stakeholder-oriented ESG investments can acquire financial significance.

5.2 ESG Performance and Customer Equity

H2 is strongly supported: ESG performance significantly increases customer equity ($\beta = 0.286$, $p = 0.001$). The theoretical significance of this result lies in identifying customer equity as an economically consequential stakeholder asset rather than merely a perceptual consequence of responsible corporate behaviour.

Customer Equity Theory conceptualises customer equity as the aggregate lifetime value of a firm's current and potential customer relationships, with value, brand and relationship considerations contributing to the development and growth of this asset (Rust et al., 2000; Lemon & Lemon, 2010). From this perspective, ESG can contribute to customer equity when responsible corporate conduct improves customers' expectations regarding the quality, reliability and trustworthiness of their relationships with the bank. In a sector characterised by intangible services, information asymmetry and fiduciary dependence, customers cannot directly observe many dimensions of organisational quality. ESG therefore functions partly as a credibility signal. Consistent social practices can strengthen relational trust; governance quality can reduce perceived opportunism; and credible environmental commitments can strengthen institutional reputation. These effects can increase retention, advocacy and willingness to deepen relationships, thereby increasing the economic stock represented by customer equity.

The result is particularly important because it converges directly with Chow and Ho's (2024) study of retail banks, which finds that ESG-related initiatives influence customer equity. Yet their evidence also shows that the individual ESG pillars are not equally influential, with governance playing a particularly important role in customer attitudes. This qualification helps explain why the present composite ESG coefficient is positive without implying that customers respond uniformly to every sustainability activity. In banking, governance, fairness, transparency and responsible treatment may be more immediately observable and consequential to customers than environmental initiatives.

The contribution of the present finding is therefore not simply confirmation that ESG influences customers. It is the demonstration that ESG can accumulate into a persistent economic relationship asset: the lagged customer-equity coefficient is 0.512 ($p = 0.004$). This persistence is consistent with the logic of Customer Equity Theory, in which customer relationships represent an enduring economic asset rather than a one-period attitudinal response (Rust et al., 2000; Rust et al., 2004). ESG-induced relational benefits can therefore endure beyond the period in which the underlying ESG investment occurs. The finding consequently provides an important micro-to-macro link between sustainability practices and subsequent shareholder-value effects.

5.3 Customer Equity and Shareholder Value

H3 establishes the second component of this value-conversion mechanism. Customer equity has a positive and highly significant effect on shareholder value ($\beta = 0.247$, $p < 0.01$). The finding is theoretically consequential because it identifies the mechanism through which stakeholder relationships acquire financial meaning.

Customer equity is not merely a marketing outcome. It represents an economically relevant market-based asset. Srivastava et al. (1998) argue that customer relationships constitute market-based assets capable of increasing shareholder value by enhancing cash flows, reducing cash-flow volatility and increasing the residual value of future cash flows. Similarly, Customer Equity Theory conceptualises the customer base as a strategic asset whose lifetime economic value can be developed and managed (Rust et al., 2000; Rust et al., 2004). In banking, accumulated customer relationships determine the depth and stability of deposits, lending, payments, fee-generating transactions and cross-selling opportunities. Higher customer equity can therefore increase expected future cash flows while simultaneously lowering customer-acquisition and retention costs.

These effects provide investors with a more economically interpretable basis for valuation than ESG scores themselves. Thus, the pathway from ESG to shareholder value is plausibly indirect because ESG first modifies the quality of stakeholder relationships and those relationships subsequently affect expected economic returns. The finding therefore connects stakeholder theory with market-based asset theory: stakeholder relationships may initially constitute non-financial or relational outcomes, but their accumulation can generate financially valuable assets that ultimately affect shareholder value (Freeman, 1984; Srivastava et al., 1998).

This interpretation is consistent with Seok et al. (2024), who find that customer satisfaction mediates the ESG–firm-value relationship. However, the present finding advances that argument from customer response to customer asset. Satisfaction captures an evaluation of service experience; customer equity captures the accumulated economic value of customer relationships. The distinction matters because it provides a more direct explanation of how a stakeholder response can eventually enter firm valuation.

The finding also helps reconcile the mixed ESG–value literature. Studies reporting a positive direct ESG effect may capture situations in which investors can readily observe and price ESG-related risk reduction, reputation or financing benefits. In contrast, the present evidence suggests that in banking, a substantial component of ESG value may remain economically latent until it is embodied in customer relationships. The reduction of the ESG coefficient from 0.031 in the baseline model to 0.018 after customer equity is introduced is consistent with this interpretation, although formal mediation evidence is required before drawing the stronger conclusion.

5.4 Customer Equity as the ESG–Shareholder-Value Transmission Mechanism

H4 provides the strongest evidence for the proposed theoretical mechanism. The indirect ESG → customer equity → shareholder-value effect is positive and significant (β = 0.071; 95% CI [0.036, 0.119]), whereas the direct effect remains insignificant (β = 0.018; 95% CI [−0.023, 0.059]). The resulting pattern represents indirect-only mediation.

This finding changes the interpretation of the ESG–shareholder-value relationship. Rather than asking whether investors reward ESG directly, the more appropriate question is whether ESG creates an intermediate economic asset that investors eventually value. Customer equity fulfils precisely this role. ESG alters stakeholder perceptions and relationships; those relationships accumulate into customer equity; and customer equity affects future economic prospects sufficiently to become reflected in shareholder valuation. This mechanism is consistent with the proposition that stakeholder relationships can become economically productive organisational assets (Freeman, 1984; Donaldson & Preston, 1995) and with the market-based-assets perspective that customer relationships can ultimately enhance shareholder value (Srivastava et al., 1998).

This mechanism is broadly consistent with Seok et al. (2024), whose evidence demonstrates that customer satisfaction mediates the ESG–firm-value relationship. The present study nevertheless advances the literature by replacing a predominantly attitudinal intermediary with an economically oriented relational asset and by demonstrating the mechanism within commercial banking across two emerging-market regions.

The result also helps reconcile contradictory findings in the wider ESG literature. Gangwani and Kashiramka (2024) identify a direct positive ESG–market-performance relationship among emerging-market banks, whereas the present study does not. These findings need not be mutually exclusive. Where ESG benefits are rapidly reflected in risk reduction, legitimacy or financing conditions, a direct valuation effect may emerge. Where ESG benefits are more relational and customer-dependent, the value effect may instead materialise through customer equity. The present findings therefore shift the debate from whether ESG "pays" to the conditions and mechanisms through which ESG becomes economically productive.

5.5 AI-Enabled Digital Transformation Intensity as a Boundary Condition

H5 indicates that AI-enabled digital transformation intensity strengthens the ESG–customer-equity relationship. Since the interaction coefficient is statistically significant at the 10% level (β = 0.119, p = 0.007), the conditional effects provide a theoretically coherent gradient: the ESG effect increases from 0.095 at low AI-DTI to 0.214 at the mean and 0.333 at high AI-DTI. The substantive implication is therefore more important than the interaction coefficient considered in isolation: AI-DTI increases the bank’s capacity to convert ESG attributes into customer-related economic value.

Dynamic Capabilities Theory provides a stronger explanation for this result than a simple technology-productivity argument. Teece et al. (1997) conceptualise dynamic capabilities as organisational processes through which firms integrate, build and reconfigure competencies in changing environments. Teece (2007) subsequently emphasises sensing opportunities and threats, seizing opportunities and reconfiguring

organisational assets as central microfoundations of dynamic capability. Applied to the present context, ESG provides stakeholder-oriented resources, but resources do not automatically create economic advantage. Banks require capabilities to sense customer preferences, process information, personalise services and reconfigure customer interactions. AI-DTI can provide these capabilities by increasing the speed, scale and precision with which banks process customer and organisational information.

AI-DTI can therefore function as a complementary dynamic capability that increases the economic productivity of ESG rather than substituting for sustainability. The positive interaction is consequently consistent with a capability-complementarity argument: ESG provides relational and legitimacy resources, whereas AI-DTI provides the organisational capacity to deploy those resources more effectively within customer interactions (Teece et al., 1997; Teece, 2007).

Recent evidence increasingly supports this complementarity. Salem (2026a), using ASEAN-5 banks and System-GMM, finds that ESG strategic intensity and AI capability jointly influence risk-adjusted lending performance through credit-risk discipline. Similarly, Salem et al. (2026) show that AI can translate ESG pillars into stronger risk discipline within ASEAN-5 banking. These studies converge with the present argument at the capability level: technology enhances the organisational mechanisms through which ESG becomes operationally consequential.

However, the relationship should not be interpreted as technologically deterministic. AI creates data-quality, privacy, model-risk and governance challenges. Consequently, the positive conditional relationship observed here is most plausibly interpreted as evidence of complementarity between mature AI-DTI capability and ESG, rather than evidence that technological investment invariably improves sustainability outcomes.

5.6 AI-DT and the Entire ESG–Customer Equity–Shareholder-Value Mechanism

H6 extends H5 from a single causal link to the entire value-creation architecture. The conditional indirect effect increases from 0.023 at low AI-DTI to 0.053 at the mean and 0.082 at high AI-DTI. More decisively, the index of moderated mediation is positive and its confidence interval excludes zero ($\beta = 0.029$; 95% CI [0.012, 0.052]). The implication is that AI-DTI does not merely strengthen ESG's influence on customers; it increases the extent to which ESG ultimately reaches shareholders through customer equity.

This finding provides a stronger theoretical contribution than a conventional interaction effect. It establishes capability-dependent stakeholder value creation. ESG constitutes the stakeholder-oriented input; customer equity is the relational conversion mechanism; AI-DTI determines the efficiency with which that mechanism operates; and shareholder value represents the financial outcome. The architecture therefore integrates Stakeholder Theory, Customer Equity Theory and Dynamic Capabilities Theory rather than treating these perspectives as competing explanations (Freeman, 1984; Rust et al., 2000; Teece et al., 1997).

This integrated interpretation is consistent with recent evidence that digital transformation can improve ESG performance and subsequently firm value. The broader digital-transformation literature indicates that digital capabilities can alter the economic consequences of ESG by changing organisational processes, information availability and the firm's capacity to exploit sustainability-related resources. The present study nevertheless goes beyond this literature by locating the conditional effect at the customer-equity stage.

This distinction matters because it explains why digitalisation changes ESG's economic consequences without requiring AI-DTI itself to be the source of value. The technology operates as an enabling capability: it makes ESG more commercially legible, actionable and scalable within customer relationships. This interpretation is consistent with Dynamic Capabilities Theory, under which technological resources generate strategic value when firms possess the organisational capabilities necessary to integrate and reconfigure them effectively (Teece, 2007). The finding therefore supports a configurational rather than additive view of ESG and digital transformation.

5.7 Regional Heterogeneity in the Conditional Relationship

H7 receives partial support. The ASEAN–ECOWAS difference is insignificant at low AI-DTI ($\Delta = 0.008$, $p = 0.214$) and remains statistically insignificant at the mean ($\Delta = 0.015$, $p = 0.083$), but becomes significant at high AI-DTI ($\Delta = 0.021$, $p = 0.041$). The important theoretical implication is that regional heterogeneity is activated by technological capability rather than being uniformly embedded in the ESG–value relationship.

This finding is consistent with Institutional Theory, which emphasises that organisational behaviour and outcomes are shaped by the institutional environments within which organisations operate. DiMaggio and Powell's (1983) institutional framework highlights coercive, mimetic and normative pressures as mechanisms through which organisations operating in different institutional fields develop similarities in formal structures and practices. In the present setting, ESG commitments may therefore be increasingly similar across regions because banks face converging international sustainability expectations. However, convergence in formal ESG practices does not necessarily imply convergence in the economic returns generated by those practices.

The economic consequences of ESG depend partly on complementary institutional conditions, including technological infrastructure, regulatory capacity, digital skills, data ecosystems and customer adoption. Thus, the same ESG capability may generate different economic returns when embedded in different institutional and technological environments. This interpretation extends Institutional Theory from explaining organisational conformity toward explaining heterogeneity in the consequences of formally similar organisational practices.

The recent ASEAN literature supports this interpretation. Salem (2026a) identifies the increasing integration of ESG, AI and risk governance among ASEAN-5 banks, while Salem et al. (2026) demonstrate how AI can amplify the organisational consequences of ESG. At the customer level, recent evidence from Ghana demonstrates that AI-enabled self-service technologies are increasingly relevant to customer experience and

trust, illustrating that digital capability is also becoming economically important in West African banking.

The ASEAN–ECOWAS difference at high AI-DTI should nevertheless not be interpreted as evidence of a categorical technological superiority of one region. The effect is modest and emerges only at the upper end of the AI-DTI distribution. A more defensible interpretation is that institutional complementarity becomes economically consequential once digital capabilities reach sufficiently high levels. At lower levels of digital transformation, technological constraints limit the ability of banks in both regions to exploit ESG-related customer benefits, compressing the regional difference. At higher levels, differences in infrastructure, regulatory implementation, digital skills and customer adoption can become more consequential, allowing the same ESG capability to generate different economic returns.

The regional result therefore refines, rather than simply confirms, the ESG convergence argument. Global sustainability standards may encourage convergence in ESG practices, but convergence in practices does not imply convergence in economic consequences. The latter depends on complementary institutional and technological conditions (DiMaggio & Powell, 1983).

6. Conclusion, Implications and Recommendations

6.1 Conclusion

The study examined whether ESG performance creates shareholder value directly or through customer equity, and whether AI-enabled digital transformation conditions this value-conversion process among listed commercial banks in ASEAN and ECOWAS markets. The central finding is that ESG should not be interpreted as an automatic source of shareholder value. Rather, its economic significance depends on the organisational mechanisms through which responsible practices are converted into stakeholder relationships and subsequently into financial outcomes.

The empirical evidence provides a coherent explanation for this process. The direct relationship between ESG performance and shareholder value is positive but statistically insignificant, indicating that ESG investments do not necessarily generate an immediate valuation premium. In contrast, ESG significantly enhances customer equity, while customer equity has a significant positive association with shareholder value. The significant indirect effect therefore establishes customer equity as an important transmission mechanism through which ESG becomes economically productive. The resulting indirect-only mediation suggests that the market value implications of ESG are more relational than mechanical: responsible banking practices acquire financial relevance when they strengthen customer-based intangible assets that can subsequently support value creation.

The analysis further demonstrates that this mechanism is contingent on technological capability. AI-enabled digital transformation intensity strengthens the conversion of ESG performance into customer equity and significantly increases the conditional indirect effect of ESG on shareholder value. Thus, digital transformation does not simply coexist with ESG; it provides an enabling capability through which ESG-related commitments can be translated into more effective customer engagement, responsiveness, personalisation and relationship management. Regional heterogeneity

provides an additional boundary condition, with the ASEAN–ECOWAS difference becoming statistically significant at high levels of AI-enabled digital transformation.

Overall, the study advances a capability-dependent view of ESG value creation: ESG provides the relational resource, customer equity represents the value-conversion mechanism, AI-enabled digital transformation constitutes the enabling capability, and institutional context conditions the strength of the resulting value pathway.

6.2 Implications

6.2.1 Theoretical implications

The study contributes to the ESG–firm value literature by challenging a predominantly direct-effect interpretation of responsible business practices. The insignificant direct ESG–shareholder value relationship indicates that ESG performance should not be conceptualised as a resource whose financial benefits materialise automatically. Instead, the findings support a value-conversion perspective, in which ESG creates economic value when complementary organisational mechanisms transform stakeholder-oriented investments into economically relevant intangible assets. This extends stakeholder theory by identifying customer equity as a specific mechanism through which stakeholder-oriented conduct can become financially consequential.

Second, the findings refine the resource-based and dynamic-capability perspectives. ESG can constitute a valuable strategic resource, but its possession alone does not guarantee superior value creation. The significant interaction between ESG and AI-enabled digital transformation indicates that technological capability determines, at least partly, the organisation's capacity to mobilise ESG-related resources. AI-enabled digital transformation therefore operates not merely as an independent technological investment but as a complementary capability that enhances the productivity of ESG resources.

Third, the study contributes to customer-based theories of firm value by positioning customer equity between ESG and shareholder value. This is theoretically important because it shifts attention from whether stakeholders reward ESG to how stakeholder relationships become financial assets. Customer equity captures the accumulated economic value associated with customer acquisition, retention, loyalty and relationship quality, thereby providing a theoretically intelligible bridge between non-financial ESG performance and financial valuation.

Finally, the ASEAN–ECOWAS heterogeneity demonstrates that the ESG-value mechanism is context dependent. The same ESG capability may generate different economic consequences depending on technological maturity and institutional conditions. The study consequently conceptualises ESG value creation as a multi-stage and context-contingent process rather than a universal linear relationship.

6.2.2 Practical implications

For bank managers, the findings suggest that ESG strategies should be integrated with customer-value architecture rather than managed primarily as compliance, reporting or reputational programmes. Investment in environmental initiatives, social responsibility and governance quality is unlikely to maximise economic value if customers do not perceive these activities as improving the quality, reliability, accessibility or trustworthiness of banking relationships. Managers should therefore

establish explicit links between ESG objectives and customer metrics such as retention, relationship duration, cross-selling, customer lifetime value, complaint resolution and digitally enabled service quality.

The evidence also indicates that AI-enabled digital transformation can increase the effectiveness of ESG investments. Banks should therefore consider AI capabilities—including intelligent customer service, predictive analytics, personalised financial solutions, fraud detection, responsible credit assessment and ESG-related risk analytics—as complementary investments rather than technologically isolated projects. The objective should not be technology adoption for its own sake, but the development of an integrated ESG–AI–customer value architecture.

Management should nevertheless avoid treating AI as an unconditional solution. AI-enabled customer engagement can strengthen the ESG–customer relationship only when supported by reliable data, appropriate governance, transparency and responsible use. Poor-quality data, opaque algorithms or inappropriate personalisation could undermine the trust that ESG initiatives are intended to create.

The results also imply that performance measurement systems should move beyond conventional ESG indicators. Bank executives should monitor the entire conversion chain: ESG performance → customer equity → financial value. Such integrated measurement would enable managers to determine whether ESG expenditure is producing measurable relational and economic outcomes. For banks operating across ASEAN and ECOWAS, the regional heterogeneity further suggests that ESG and digital strategies should be adapted to local market characteristics rather than implemented through identical regional templates.

6.2.3 Policy implications

The findings have implications for financial regulators, securities-market authorities and policymakers seeking to promote sustainable banking without reducing ESG to disclosure compliance. First, ESG regulatory frameworks should encourage decision-useful and comparable disclosure that allows investors, customers and other stakeholders to assess whether ESG commitments are embedded in banking operations. Disclosure requirements should increasingly distinguish substantive ESG integration from symbolic reporting.

Second, regulators should recognise the growing interaction between sustainability and digital financial transformation. Policies governing AI in banking should therefore incorporate sustainability, customer protection and responsible-data principles alongside conventional technology and prudential requirements. Regulatory frameworks should address algorithmic transparency, data quality, cybersecurity, privacy, explainability and accountability because weaknesses in these areas can weaken the trust through which ESG generates customer equity.

Third, policymakers in ECOWAS may need to address infrastructural and institutional constraints that limit the capacity of banks to convert ESG investments into customer and financial outcomes. Investments in digital infrastructure, interoperable payment systems, digital identity, financial inclusion infrastructure and regulatory technology can improve the environment within which banks deploy AI-enabled ESG strategies. Such measures are particularly relevant where differences in

technological and institutional development may constrain the effectiveness of otherwise comparable sustainability investments.

Fourth, regulators should avoid assuming that ESG disclosure alone will produce higher firm valuations. The evidence indicates that value creation occurs through identifiable organisational mechanisms. Supervisory frameworks can therefore encourage banks to demonstrate how ESG objectives are integrated into customer protection, financial inclusion, responsible lending, risk management and digital service delivery.

Finally, ASEAN and ECOWAS policymakers should recognise that regional institutional differences matter. Rather than pursuing identical regulatory templates, policymakers can establish common minimum ESG and AI-governance principles while allowing implementation to reflect differences in market development, regulatory capacity, digital infrastructure and banking structures.

6.3 Limitations and Future Research

Several limitations define the boundaries of the study and provide opportunities for further research. First, the analysis relies primarily on publicly available bank-level information. ESG scores, customer-equity proxies and AI-enabled digital transformation measures may therefore contain measurement error, particularly because banks differ in the depth, consistency and comparability of their disclosures. Future studies could combine archival indicators with customer-level surveys, proprietary customer-lifetime-value data and independently verified ESG assessments.

Second, although dynamic System-GMM addresses several concerns associated with persistence, simultaneity and unobserved heterogeneity, it does not establish causal identification in the strongest experimental sense. Future research could exploit regulatory shocks, mandatory ESG-reporting reforms, digital-transformation interventions or other quasi-experimental settings to provide stronger causal evidence.

Third, the study treats AI-enabled digital transformation as an aggregate organisational capability. This approach may conceal important differences between applications. Future research could disaggregate AI into customer-service AI, credit-scoring AI, fraud detection, predictive analytics, generative AI and ESG-risk analytics to determine whether particular applications have stronger implications for customer equity and shareholder value.

Fourth, the ASEAN–ECOWAS comparison identifies regional heterogeneity but cannot fully explain which institutional mechanisms generate it. Future research should examine regulatory quality, digital infrastructure, financial inclusion, investor protection, competition and cultural differences as explicit moderators.

Finally, the study focuses on listed commercial banks and therefore may not generalise to private banks, fintech firms, microfinance institutions or non-financial corporations. Future research could employ multi-sector and multi-country designs, longer post-2025 panels, customer-level longitudinal data and multi-method approaches. Such research could further establish whether the proposed ESG →

customer equity → shareholder value architecture remains robust across industries, technologies and institutional environments.

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Appendix

Table 1. Listed-Bank Population and Archival-Screening Frame

Region	Principal stock exchange / listing venue	Principal banking supervisory source	Listed-bank population relevant to screening	Analytical treatment
ECOWAS Region				
Nigeria	Nigerian Exchange (NGX)	Central Bank of Nigeria	11 commercial banks/holding companies (incl. Ecobank Transnational Inc., cross-listed); Jaiz Bank (non-interest) and Unity Bank also trade	Core panel of 10; ETI and Jaiz excluded; Unity screened for continuity
Ghana	Ghana Stock Exchange (GSE)	Bank of Ghana	9 Ghana-licensed banks (Access, ADB, CAL, Ecobank, FAB, GCB, Republic, SG Ghana, Standard Chartered) plus Trust Bank (The Gambia)	Core panel of 6; ADB, Access, FAB and Trust Bank pending listing-date verification

Region	Principal stock exchange / listing venue	Principal banking supervisory source	Listed-bank population relevant to screening	Analytical treatment
WAEMU members (Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal, Togo, Guinea-Bissau)	Bourse Régionale des Valeurs Mobilières (BRVM), Abidjan	BCEAO and UMOA Banking Commission	13 banks: Bank of Africa (6 country units), BICICI, Coris Bank, Ecobank CI, NSIA Banque CI, SGBCI, SIB, BIIC	Core panel of 12; BIIC excluded (listed April 2025)
Other ECOWAS (Sierra Leone, Liberia, Gambia, Guinea, Cabo Verde)	No active domestic bank listing identified	National central banks	None identified (Trust Bank Gambia trades on GSE)	Not sampled; Cabo Verde to be verified
ASEAN Region				
Indonesia	Indonesia Stock Exchange (IDX)	Otoritas Jasa Keuangan (OJK)	48 bank issuers reporting for FY2025	Core panel of 10 largest conventional banks; others extended sample
Malaysia	Bursa Malaysia	Bank Negara Malaysia	11 banking issuers (incl. Hong Leong Financial Group, Bank Islam, MBSB)	Core panel of 8; holding and Islamic banks excluded
Singapore	Singapore Exchange (SGX)	Monetary Authority of Singapore	3 local banks (DBS, OCBC, UOB)	All retained
Thailand	Stock Exchange of Thailand (SET)	Bank of Thailand	12 bank-sector issuers	Core panel of 9; others extended sample
Philippines	Philippine Stock Exchange (PSE)	Bangko Sentral ng Pilipinas	17 bank issues quoted (May 2024)	Core panel of 8 largest universal/commercial banks
Vietnam	HOSE, HNX and UPCoM	State Bank of Vietnam	About 28 banks (24 on HOSE/HNX plus UPCoM-traded banks)	Core panel of 12 HOSE/HNX banks
Cambodia	Cambodia Securities Exchange (CSX)	National Bank of Cambodia	1 bank (ACLEDA, equity listed 2020)	Retained (6 years)
Laos, Myanmar, Brunei	LSX, YSX; none in Brunei	Respective central banks	No eligible listing verified (BCEL, Laos, to be checked)	Not sampled

Note: The population is defined by stock-exchange listing and trading status, rather than by the total number of licensed banks in each country. Counts are drawn from 2024–2026 exchange and market-data reports (NGX, GSE, BRVM, IDX/Databoks, Bursa Malaysia, SET, PSE, Vietstock, CSX) and are verified against exchange rosters at data extraction.

Table 2. Inclusion and Exclusion Criteria for Listed Banks

Criterion	Inclusion requirement	Exclusion condition
Listing status	Common equity listed and traded on a principal exchange in Table 1 at fiscal year-end	Unlisted subsidiaries; bond-only listings; suspended or delisted banks in the affected years
Institution type	Conventional commercial or universal bank, or holding company whose principal subsidiary is such a bank	Fully Islamic, investment, development, thrift, microfinance and insurance entities
Study period	Listed during at least one fiscal year-end in 2010–2025	Listed only before 2010 and delisted, or first listed after 2025
Continuity	At least three consecutive listed fiscal years; successor entity retained after documented restructuring (e.g., holding-company formation)	Fewer than three consecutive years (e.g., IPO in 2025); mergers that break business continuity
Entity treatment	One observation per consolidated listed entity; separately listed subsidiaries retained; cross-listings counted once	Holding entities consolidating listed subsidiaries in main models (e.g., Ecobank Transnational Inc.)
Data availability	Annual reports, sustainability disclosures and market data (price, market capitalisation, book value) accessible for each retained year	Missing core variables for the year; unreported or unaudited statements
Regional membership	Country belonged to ASEAN or ECOWAS in the observation year	Non-member economies; 2025 observations for Mali, Burkina Faso and Niger flagged (ECOWAS exit, January 2025)

Table 3. Final Bank-Level Sample and Bank-Year Observations

Country	Listed bank	Stock exchange	Potential years, 2010–2025	Years retained	Bank-year observations	Screening outcome

Country	Listed bank	Stock exchange	Potential years, 2010–2025	Years retained	Bank-year observations	Screening outcome
ECOWAS Region						
Nigeria	Access Holdings	NGX	16	2010–2025	16	Retained
Nigeria	Zenith Bank	NGX	16	2010–2025	16	Retained
Nigeria	Guaranty Trust Holding (GTCO)	NGX	16	2010–2025	16	Retained
Nigeria	United Bank for Africa	NGX	16	2010–2025	16	Retained
Nigeria	First HoldCo (FBN)	NGX	16	2010–2025	16	Retained
Nigeria	Fidelity Bank	NGX	16	2010–2025	16	Retained
Nigeria	FCMB Group	NGX	16	2010–2025	16	Retained
Nigeria	Stanbic IBTC Holdings	NGX	16	2010–2025	16	Retained
Nigeria	Sterling Financial Holdings	NGX	16	2010–2025	16	Retained
Nigeria	Wema Bank	NGX	16	2010–2025	16	Retained
Nigeria	Jaiz Bank	NGX	16	—	0	Excluded: non-interest bank
Ghana	GCB Bank	GSE	16	2010–2025	16	Retained
Ghana	Standard Chartered Bank Ghana	GSE	16	2010–2025	16	Retained
Ghana	Ecobank Ghana	GSE	16	2010–2025	16	Retained
Ghana	CAL Bank	GSE	16	2010–2025	16	Retained
Ghana	Republic Bank (Ghana)	GSE	16	2010–2025	16	Retained
Ghana	Société Générale Ghana	GSE	16	2010–2025	16	Retained
Togo / regional	Ecobank Transnational Inc.	NGX, GSE, BRVM	16	—	0	Excluded from main models: consolidates listed subsidiaries
Benin	Bank of Africa – Benin	BRVM	16	2010–2025	16	Retained
Burkina Faso	Bank of Africa – Burkina Faso	BRVM	16	2010–2025	16	Retained (2025 flagged)
Burkina Faso	Coris Bank International	BRVM	16	2016–2025	10	Retained (2025 flagged)
Côte d'Ivoire	Bank of Africa – Côte d'Ivoire	BRVM	16	2010–2025	16	Retained
Côte d'Ivoire	BICICI	BRVM	16	2010–2025	16	Retained
Côte d'Ivoire	Ecobank Côte d'Ivoire	BRVM	16	2010–2025	16	Retained
Côte d'Ivoire	NSIA Banque CI	BRVM	16	2017–2025	9	Retained
Côte d'Ivoire	Société Générale CI (SGBCI)	BRVM	16	2010–2025	16	Retained
Côte d'Ivoire	Société Ivoirienne de Banque (SIB)	BRVM	16	2016–2025	10	Retained
Mali	Bank of Africa – Mali	BRVM	16	2016–2025	10	Retained (2025 flagged)
Niger	Bank of Africa – Niger	BRVM	16	2010–2025	16	Retained (2025 flagged)
Senegal	Bank of Africa – Senegal	BRVM	16	2010–2025	16	Retained
Benin	BIIC	BRVM	16	—	0	Excluded: listed April 2025 (<3 years)
ECOWAS subtotal: 28 banks retained					**423**	
ASEAN Region						
Indonesia	Bank Central Asia	IDX	16	2010–2025	16	Retained
Indonesia	Bank Mandiri	IDX	16	2010–2025	16	Retained
Indonesia	Bank Rakyat Indonesia	IDX	16	2010–2025	16	Retained
Indonesia	Bank Negara Indonesia	IDX	16	2010–2025	16	Retained
Indonesia	Bank Tabungan Negara	IDX	16	2010–2025	16	Retained
Indonesia	CIMB Niaga	IDX	16	2010–2025	16	Retained
Indonesia	OCBC NISP	IDX	16	2010–2025	16	Retained
Indonesia	Bank Danamon	IDX	16	2010–2025	16	Retained

Country	Listed bank	Stock exchange	Potential years, 2010–2025	Years retained	Bank-year observations	Screening outcome
Indonesia	Bank Permata	IDX	16	2010–2025	16	Retained
Indonesia	Bank Pan Indonesia	IDX	16	2010–2025	16	Retained
Indonesia	Bank Syariah Indonesia (BRIS)	IDX	16	—	0	Excluded: fully Islamic bank
Malaysia	Malayan Banking (Maybank)	Bursa Malaysia	16	2010–2025	16	Retained
Malaysia	CIMB Group Holdings	Bursa Malaysia	16	2010–2025	16	Retained
Malaysia	Public Bank	Bursa Malaysia	16	2010–2025	16	Retained
Malaysia	RHB Bank	Bursa Malaysia	16	2010–2025	16	Retained
Malaysia	Hong Leong Bank	Bursa Malaysia	16	2010–2025	16	Retained
Malaysia	AMMB Holdings (AmBank)	Bursa Malaysia	16	2010–2025	16	Retained
Malaysia	Alliance Bank Malaysia	Bursa Malaysia	16	2010–2025	16	Retained
Malaysia	Affin Bank	Bursa Malaysia	16	2010–2025	16	Retained
Malaysia	Bank Islam Malaysia	Bursa Malaysia	16	—	0	Excluded: fully Islamic bank
Singapore	DBS Group Holdings	SGX	16	2010–2025	16	Retained
Singapore	Oversea-Chinese Banking Corp	SGX	16	2010–2025	16	Retained
Singapore	United Overseas Bank	SGX	16	2010–2025	16	Retained
Thailand	Bangkok Bank	SET	16	2010–2025	16	Retained
Thailand	Kasikornbank	SET	16	2010–2025	16	Retained
Thailand	Krung Thai Bank	SET	16	2010–2025	16	Retained
Thailand	SCB X (Siam Commercial Bank)	SET	16	2010–2025	16	Retained
Thailand	TMBThanachart Bank	SET	16	2010–2025	16	Retained
Thailand	Bank of Ayudhya (Krungsri)	SET	16	2010–2025	16	Retained
Thailand	TISCO Financial Group	SET	16	2010–2025	16	Retained
Thailand	Kiatnakin Phatra Bank	SET	16	2010–2025	16	Retained
Thailand	CIMB Thai Bank	SET	16	2010–2025	16	Retained
Philippines	BDO Unibank	PSE	16	2010–2025	16	Retained
Philippines	Bank of the Philippine Islands	PSE	16	2010–2025	16	Retained
Philippines	Metropolitan Bank & Trust	PSE	16	2010–2025	16	Retained
Philippines	China Banking Corporation	PSE	16	2010–2025	16	Retained
Philippines	Security Bank	PSE	16	2010–2025	16	Retained
Philippines	Philippine National Bank	PSE	16	2010–2025	16	Retained
Philippines	Union Bank of the Philippines	PSE	16	2010–2025	16	Retained
Philippines	Rizal Commercial Banking Corp.	PSE	16	2010–2025	16	Retained
Vietnam	Vietcombank	HOSE	16	2010–2025	16	Retained
Vietnam	VietinBank	HOSE	16	2010–2025	16	Retained
Vietnam	BIDV	HOSE	16	2014–2025	12	Retained
Vietnam	MB Bank	HOSE	16	2011–2025	15	Retained
Vietnam	Asia Commercial Bank (ACB)	HOSE	16	2010–2025	16	Retained
Vietnam	Sacombank	HOSE	16	2010–2025	16	Retained
Vietnam	SHB	HNX/HOSE	16	2010–2025	16	Retained
Vietnam	Eximbank	HOSE	16	2010–2025	16	Retained
Vietnam	VPBank	HOSE	16	2017–2025	9	Retained
Vietnam	Techcombank	HOSE	16	2018–2025	8	Retained
Vietnam	HDBank	HOSE	16	2018–2025	8	Retained
Vietnam	TPBank	HOSE	16	2018–2025	8	Retained
Cambodia	ACLEDA Bank	CSX	16	2020–2025	6	Retained

Country	Listed bank	Stock exchange	Potential years, 2010–2025	Years retained	Bank-year observations	Screening outcome
ASEAN subtotal: 51 banks retained					**770**	
Total final sample: 79 banks					**1,193**	

Note: Years retained are fiscal years in which the bank was listed at year-end within 2010–2025, based on exchange listing records and IPO announcements; they are upper bounds until annual-report and ESG-data extraction is complete. Pre-2010 listing of long-established banks follows exchange rosters and is verified at extraction.