

FinTech Adoption and the ESG–Firm Value Nexus: Empirical Evidence from GCC-Listed Firms

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Abstract

The growing emphasis on sustainable finance and digital transformation has fundamentally reshaped how firm value is created and assessed in emerging capital markets. In regions such as the Gulf Cooperation Council (GCC), where ownership concentration, information opacity, and evolving regulatory frameworks remain structural challenges, understanding the mechanisms through which sustainability initiatives translate into market value is of critical importance. This study addresses this need by examining whether Environmental, Social, and Governance (ESG) performance enhances firm value and whether financial technology (FinTech) adoption strengthens this relationship. Grounded in Stakeholder Theory and Information Asymmetry Theory, the study highlights FinTech as a practical mechanism that improves transparency, credibility, and investor interpretation of ESG activities. Using a balanced panel of 242 non-financial GCC-listed firms from 2017 to 2024, firm value is measured by Tobin's Q, ESG performance by Bloomberg ESG scores, and FinTech adoption by a firm-level textual analysis index. Employing the Least Squares Dummy Variable Corrected (LSDVC) estimator to address dynamic panel bias, the results show that ESG performance positively affects firm value and that this effect is significantly amplified by FinTech adoption. The findings demonstrate that sustainability initiatives generate valuation benefits only when supported by effective digital financial infrastructure. The study offers practical insights for managers, investors, and policymakers seeking to enhance firm valuation, attract long-term capital, and advance sustainable economic transformation in the GCC.

Keywords: FinTech, ESG, Firm Value, GCC

Introduction

The Gulf Cooperation Council (GCC) countries are undergoing a historic phase of economic transformation, driven by the urgent need to reduce reliance on hydrocarbon revenues and

establish diversified, resilient, and knowledge-based economies. National development strategies such as Saudi Arabia's Vision 2030, the UAE's Centennial 2071, Kuwait Vision 2035, Oman Vision 2040, Bahrain Economic Vision 2030, and Qatar National Vision 2030 collectively reflect a regional commitment to modernizing economic structures, strengthening private-sector participation, and building globally competitive corporate environments. These long-term national plans highlight the importance of innovation, sustainability, financial transparency, and efficient capital markets as core foundations for future growth.

Within this broader transformation, the concept of firm value has gained renewed significance. Firm value is more than a financial metric; it represents a comprehensive indicator of an organization's market performance, operational strength, investor confidence, and long-term viability. As GCC economies open further to international investment and deepen their capital-market reforms, the ability of firms to sustain and enhance their value has become a strategic priority (Elshareif et al., 2022). Policymakers increasingly view strong corporate performance as essential for attracting foreign capital, improving economic diversification, and elevating the global standing of GCC financial markets. Likewise, managers and investors recognize that firm value is shaped by a complex set of non-financial factors that interact within the evolving institutional environment of the region.

In recent years, particular attention has been given to how sustainability practices, governance quality, and technological advancements influence corporate valuation. The growing emphasis on Environmental, Social, and Governance (ESG) performance reflects the international shift toward responsible and transparent business practices.

Firm value represents a central concept in financial and strategic management, reflecting a firm's market-based valuation derived from its ability to generate future economic benefits. As a composite measure, it captures key aspects of profitability, operational efficiency, and long-term sustainability, and therefore serves as a guiding indicator for a broad spectrum of stakeholders, including corporate executives, investors, and policymakers. From the perspective of corporate management, the maximization of firm value constitutes a fundamental financial objective. It serves as a tangible measure of the success of managerial decisions, the effectiveness of capital deployment, and the competitiveness of the firm in dynamic market environments. A company with a strong valuation is generally perceived as financially stable, strategically viable, and well-positioned for growth. For investors, a firm's value functions as a core criterion in evaluating potential investments and allocating capital. Beyond firm- and investor-level considerations, firm value plays a broader macroeconomic role as an indicator of private sector vitality and economic development. But despite the evolution and the significant indicators, progress in diversification has been uneven and challenging. Recent analysis has concluded that the institutional diversification strategies implemented so far have yielded limited success, as GCC economies remain deeply influenced by the hydrocarbon sector. Moreover, the GCC's economic base is still narrow, and sustainable development goals tied to diversification have not been fully realized. The need to invigorate the private sector and attract outside capital is increasingly apparent as countries strive to meet their vision targets.

High ownership concentration remains a defining structural challenge in GCC capital markets and directly undermines diversification efforts, as shown in Figure 1. Unlike dispersed

ownership systems in advanced economies such as the United States (25%) or Australia (35%), GCC-listed firms often exhibit dominant block holdings of up to 75%, typically controlled by royal families, state entities, or founding family conglomerates. Although such concentrated structures can provide stability and privileged access to resources, they simultaneously create governance frictions, reduced transparency, weak board independence, and potential conflicts with minority shareholders that discourage foreign direct investment (Goldani Mahdi, 2023; Sweidan, 2025)

Empirical evidence further indicates that majority government ownership depresses firm performance, while moderate state holdings (15–50%) combined with family participation may reduce inefficiencies. Excessive family ownership is also associated with valuation discounts due to investor concerns about entrenchment and limited disclosure. Royal ownership can enhance performance through resource access yet still raises concerns for international investors seeking transparency and equal treatment.

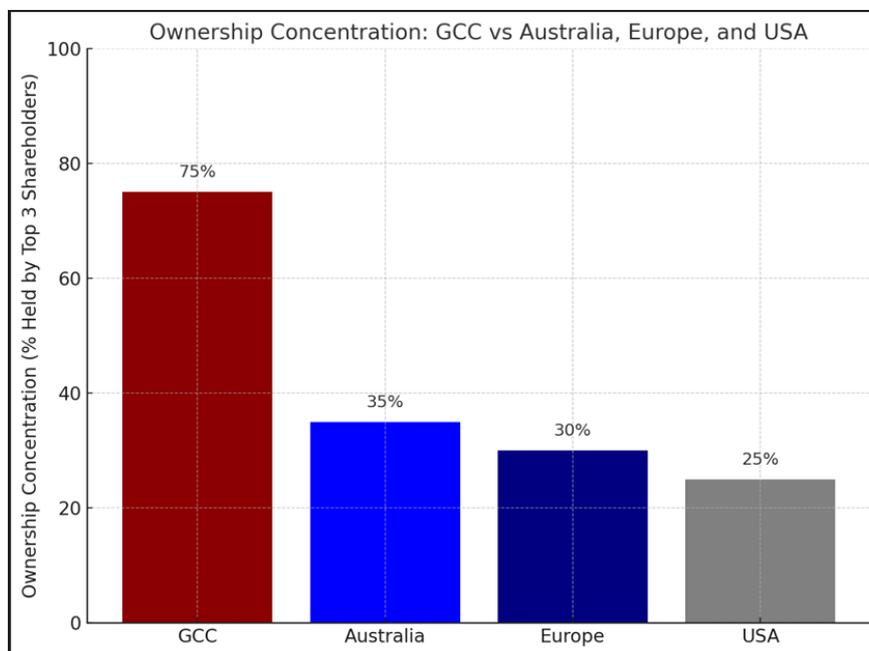


Figure Error! No text of specified style in document. Ownership concentration of the GCC firms vs. other countries and regions

Source: Financial Times (www.ft.com)

Overall, ownership concentration in the GCC serves a dual purpose: it not only ensures continuity and strategic stability but also diminishes investor confidence, lowers firm valuation, and limits foreign capital inflows. This dynamic stands in tension with the region's broader diversification agenda, which depends on attracting global investors and fostering more open, competitive capital markets, and to reach this goal we need to see how the governments can accelerate the process of collecting the foreign direct investments.

Adoption of financial technology in the GCC's financial markets is accelerating, and it offers potential solutions to the dilemma outlined above by improving information transparency and expanding capital market efficiency. Several FinTech applications are particularly relevant. The transformative impact of financial technology (FinTech) on corporate finance is

most visible in its dual capacity to reduce information asymmetry and to enable Environmental, Social, and Governance (ESG) integration, thereby enhancing firm transparency. FinTech tools not only close informational gaps between market actors but also serve as functional mechanisms for improving ESG performance.

The first channel is the transparency of blockchain and ESG. Blockchain technology offers a decentralized, immutable ledger that ensures all parties access the same verified data, effectively reducing the informational advantage held by any single stakeholder. The second channel is Artificial Intelligence (AI) and Real-Time ESG Analytics. AI technologies, particularly machine learning, enable the real-time processing of complex and unstructured data sets, improving the flow and quality of financial and non-financial information. AI is now used to analyze climate data, social metrics, and corporate disclosures to provide dynamic ESG scores and risk alerts. Through the above mechanisms, FinTech can help resolve the dilemma faced by GCC firms and policymakers. By enhancing ESG transparency, fintech reduces uncertainty and builds trust, making investors more willing to invest at lower required returns for companies with solid sustainability profiles.

FinTech tools contribute to the reduction of information asymmetry between firms and investors by providing more accessible and standardized ESG information. This reduction in information gaps leads to more efficient pricing of securities and can lower the risk premiums demanded by investors. provide empirical evidence that FinTech development enhances corporate ESG performance, particularly by alleviating financing constraints and improving information transparency.

It is important to note that fintech is not a panacea on its own. Realizing its full benefits will require supportive regulation (for instance, regulations to integrate blockchain records into official disclosure regimes or investor protection in crowdfunding). There are also challenges around cybersecurity and technology infrastructure that need careful management. Nonetheless, the trajectory is clear: FinTech is becoming an integral enabler of sustainable finance in the GCC; it strengthens the links between ESG performance and investor confidence by providing tools for truth and access.

This oversight is especially significant in the GCC, where institutional characteristics such as high ownership concentration, varying levels of disclosure quality, and differing stages of capital market maturity can intensify information asymmetries and distort valuation mechanisms. Understanding how FinTech adoption interacts with ESG practices and financing conditions is therefore crucial for capturing the realities of corporate behavior in the region. Empirical studies confirm a mixed relationship between ESG performance and firm value, with some showing positive effects while others present contradictory or context-specific findings. These inconsistencies highlight that ESG outcomes cannot be universally interpreted, as their impact on firm value often depends on variations in research methodology, measurement frameworks, industry characteristics, and institutional enforcement strength. What remains rare in the literature is a focused empirical analysis of how FinTech adoption moderates these relationships. A few pioneering studies show that FinTech can improve ESG transparency, which in turn influences firm value.

Tan et al. (2024) found that blockchain-based ESG reporting improved firm ESG scores but did not link this improvement directly to firm value, leaving open the question of whether technological enhancement translates to meaningful valuation gains. Moreover, in a cross-country comparison, it was found that AI-based FinTech tools facilitated ESG adoption, yet the link to valuation and capital cost outcomes remains underexplored. Collectively, these research gaps underscore the need for a contextual and statistically robust examination of how FinTech adoption shapes sustainability outcomes in emerging markets like the GCC, where digital transformation and ESG integration are progressing rapidly but asymmetrically. The ideal practical scenario is one in which FinTech is fully integrated into corporate reporting. In such an environment, firms can deliver transparent, standardized, and real-time ESG and disclosures that investors trust. This enhanced transparency would reduce perceived risk, and support higher firm valuation. Combined with more balanced ownership structures and clearer regulatory direction, such integration would also strengthen investor protections, accelerate FDI inflows, and contribute directly to the realization of national transformation visions such as Saudi Vision 2030 and UAE Vision 2050.

The consequences of failing to transition toward this model are substantial. Without improvements in transparency, governance, inclusivity, and FinTech-enabled data infrastructure, the region risks stagnation in capital formation and declining access to sustainable investment pools. Firms will continue facing valuation discounts and elevated funding costs, limiting their ability to grow, innovate, and compete globally. Meanwhile, governments may struggle to achieve diversification targets, and capital markets may fall short of becoming globally recognized investment destinations. Ultimately, persistent information asymmetry and entrenched ownership opacity threaten to undermine the GCC's potential to emerge as a leader in sustainable and technology-driven financial markets.

Drawing from the issues articulated in the problem statement, this study seeks to address key gaps related to sustainability performance, financing structure, and technological transformation within the GCC corporate landscape. Accordingly, this study is guided by the following research questions:

1. What is the impact of ESG performance on firm value among GCC-listed firms?

This question aims to explore whether sustainability practices, reflected through environmental, social, and governance indicators, translate into observable market value in emerging markets where transparency and regulatory enforcement vary significantly.

2. Does fintech adoption moderate the relationship between ESG performance and firm value among GCC-listed firms? The question investigates whether digital innovations, such as blockchain-based reporting, AI-driven analytics, and financial automation, strengthen or alter the ESG-value relationship by improving information flow and reducing credibility gaps.

By providing a roadmap for integrating sustainability practices with technological transformation, the study empowers managers to design long-term value-creation strategies that are aligned with global investor expectations and emerging market trends. It emphasizes that firms that proactively adopt FinTech and embed ESG into their operational models are better positioned to gain competitive advantages, attract long-term institutional investors, and adapt to evolving regulatory landscapes. Overall, the study offers actionable insights that strengthen managerial capacity to navigate the complex interface between sustainability and

technological innovation, making it highly relevant for organizations seeking to thrive in the GCC and comparable emerging markets.

The population of this study comprises all non-financial firms listed on the official stock exchanges of the six Gulf Cooperation Council countries, namely Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates, over the period from 2017 to 2024. From this population, the final sample consists of 242 publicly listed non-financial firms, generating a balanced panel of 1,936 firm-year observations after applying data availability and consistency criteria.

The unit of analysis in this study is the individual firm-year observation, which allows for a detailed examination of changes in ESG performance, FinTech adoption, and firm value within the same firm over time. This study ensures that all variables are uniformly measured, accurately interpreted, and aligned with established academic standards, thereby strengthening the validity, reliability, and comparability of the empirical findings.

In this study, firm value is operationally defined as a market-based concept that reflects investor perceptions of the firm's long-term value creation capacity. It serves as the dependent variable, capturing how variations in sustainability performance, financing conditions, and digital financial transformation influence the valuation of non-financial firms operating in GCC capital markets. This definition is consistent with contemporary finance literature that emphasizes market valuation as a comprehensive indicator of firm performance and future prospects.

In this study, ESG is operationally defined as the extent to which a firm integrates environmental stewardship, social responsibility, and sound governance principles into its strategic orientation, operational practices, and stakeholder engagement. ESG functions as a key independent variable, reflecting the firm's commitment to sustainable value creation and responsible corporate behavior within the GCC context. To enhance conceptual clarity, ESG is operationalized as a multidimensional construct, comprising three interrelated but distinct dimensions: Environmental (E), Social (S), and Governance (G). Each dimension is defined as follows.

In this study, FinTech adoption is operationally defined as the degree to which a firm incorporates digital financial technologies into its organizational practices and disclosure environment. Conceptually, FinTech reflects a firm's technological orientation and its capacity to reduce information asymmetry, improve disclosure quality, and support data-driven decision-making. FinTech is treated as a moderating variable, influencing how ESG performance and cost of capital translate into firm value within the GCC context. This definition is consistent with recent literature highlighting the role of digital finance in enhancing transparency and reshaping corporate valuation mechanisms.

Literature Review

The reviewed literature on the impact of ESG performance on firm value and the moderating role of fintech adoption among GCC-listed firms reveals a growing body of empirical evidence supporting the positive influence of ESG on firm valuation. However, the findings are nuanced by sectoral, regional, and methodological variations. Fintech adoption emerges as a significant moderator that can enhance ESG outcomes, yet the mechanisms and contextual

factors influencing this relationship remain underexplored. Methodological rigor varies across studies, with some employing advanced econometric techniques to address endogeneity, while others rely on cross-sectional or survey data, limiting causal inference. Theoretical frameworks are predominantly grounded in stakeholder and signaling theories, but integration with fintech innovation theories is less developed. Overall, the literature underscores the complexity of ESG-fintech-firm value dynamics, highlighting the need for more sector-specific, longitudinal, and regionally focused research.

Numerous studies provide robust empirical support for a positive relationship between ESG performance and firm value, using diverse proxies such as Tobin's Q, price to book, and financial performance metrics. Cross-country and cross-sector analyses, including those focused on the MENA and GCC regions, reinforce the generalizability of these findings. Advanced econometric methods like GMM and fixed-effects models enhance the reliability of results (Hágen & Ahmed, 2024; Duan et al., 2023). Despite positive findings, results are mixed in emerging markets, with some studies reporting insignificant or negative effects, reflecting heterogeneity across sectors and regions (Siddiqui et al., 2024; Sabila et al., 2025). The reliance on aggregate ESG scores often masks the differential impacts of individual ESG pillars, limiting nuanced understanding (Rasyad et al., 2024; Siddiqui et al., 2024). Some studies focus predominantly on nonfinancial firms, restricting applicability to financial sectors (Hágen & Ahmed, 2024).

The literature identifies fintech as a critical enabler that amplifies the positive effects of ESG on firm value by improving transparency, reducing information asymmetry, and facilitating access to green finance (Acheampong et al., 2025; Ding et al., 2024; Du et al., 2022). Empirical analyses demonstrate fintech's mediating and moderating roles in enhancing ESG performance, particularly in banking and financial institutions within the GCC and comparable emerging markets (Srairi, 2024; Mahdi et al., 2023; Faizulayev, 2025). The development of fintech ecosystems correlates with higher sustainability indicators (Larionov, 2024). Measurement of fintech adoption varies widely, with some studies lacking standardized indices or relying on keyword-based proxies, which may affect comparability and validity (Dicuonzo et al., 2024). The moderating effects of fintech are sometimes context-dependent and not uniformly significant across all settings, as seen in mixed results regarding leadership and regulatory support (Mushtaq et al., 2025). Limited longitudinal data restricts understanding of fintech's evolving impact over time (Najaf et al., 2024).

The application of stakeholder theory and signaling theory provides a solid foundation for explaining ESG's influence on firm value and the signaling role of financial strategies in sustainability (Hágen & Ahmed, 2024) (Li et al., 2024). Emerging integration of dynamic capabilities and knowledge capital models enriches understanding of fintech's role in ESG enhancement (Sun & Guo, 2025; Mushtaq et al., 2025). The literature also explores legitimacy and agency theories to contextualize ownership structure effects (Truong, 2024; Lerskullawat & Ungphakorn, 2024). There is a relative paucity of theoretical models explicitly linking fintech innovation with ESG performance and firm valuation, resulting in fragmented conceptualizations (Larionov, 2024; Soomro et al., 2025). Theoretical discussions often remain descriptive without fully integrating fintech's technological and financial dimensions into ESG frameworks (Ding et al., 2024). This gap limits the development of comprehensive models that capture the complex interactions in GCC contexts.

Several studies highlight sector-specific differences in ESG impacts, with financial institutions, manufacturing, and energy-intensive industries showing varied relationships between ESG and firm value (Hágen & Ahmed, 2024; Duan et al., 2023). Regional analyses within GCC and MENA emphasize the influence of institutional and market environments on ESG-fintech dynamics (Rashwan et al., 2025) (Elidrisy, 2024). Islamic banks exhibit distinct ESG-fintech interactions due to Shariah-compliant structures (Srairi, 2024) (Faizulayev, 2025). Many studies aggregate data across sectors or countries, potentially obscuring critical heterogeneity and limiting targeted policy implications (Li et al., 2024) (Bashir et al., 2023). The GCC-specific literature is relatively sparse, with few studies directly addressing the unique regulatory, cultural, and economic characteristics of the region (Hágen & Ahmed, 2024) (Mahdi et al., 2023). This limits the precision of conclusions for GCC-listed firms.

The use of panel data, fixed and random effects models, GMM estimators, and instrumental variable techniques enhances the robustness of causal inferences in several studies (Hágen & Ahmed, 2024) (Acheampong et al., 2025) (Fu & Li, 2023). Mixed-method approaches, including survey-based PLS-SEM, complement quantitative analyses by capturing managerial perspectives (AlQudah et al., 2024) (Mushtaq et al., 2025). Robustness checks and heterogeneity analyses strengthen confidence in findings (Yin et al., 2024) (Ren et al., 2023). Methodological limitations include potential endogeneity issues not fully addressed in some cross-sectional or survey studies (Eriandani & Winarno, 2023) (Dihardjo & Hersugondo, 2023). Sample sizes and periods vary widely, with some studies limited to short time frames or small samples, reducing generalizability (Rasyad et al., 2024) (Lamey et al., 2024). Measurement inconsistencies in ESG and fintech variables, as well as reliance on secondary data sources, may introduce bias (Dicuonzo et al., 2024) (Rabbani & Hassan, 2025).

Studies demonstrate that digital transformation and green innovation mediate or moderate the ESG-firm value relationship, highlighting the synergistic effects of technology adoption on sustainability outcomes (Wang & Xia, 2024)(Jung & Kim, 2022). Fintech-driven innovation fosters improved ESG disclosure quality and financial performance (Alshareef, 2025) (Tripopsakul, 2025). The causal pathways linking digital transformation, fintech, and ESG remain underexplored, with limited longitudinal evidence on sustained impacts (Yin et al., 2024) (Leeraphong et al., 2025). Some findings suggest nonlinear or context-dependent effects, complicating straightforward policy recommendations (Yin et al., 2024). The interaction between innovation investments and ESG may sometimes impose short-term financial burdens (Sabila et al., 2025).

Methodology

The relationship between ESG and firm value is best explained through the lens of stakeholder theory, which asserts that a firm's long-term value is enhanced when it considers the interests of all its stakeholders, not only shareholders but also employees, regulators, customers, and the broader community. According to (Freeman, 2007), firms that proactively address stakeholder expectations through responsible environmental practices, sound governance structures, and positive social engagement tend to build reputational capital and trust. This, in turn, attracts long-term investors, enhances operational stability, and reduces regulatory and reputational risks, all of which contribute to a higher firm valuation. the introduction of FinTech as a moderating variable necessitates the application of Information Asymmetry

Theory. First conceptualized by , this theory highlights the problems that arise when one party in a financial transaction possesses more or better information than the other. In corporate finance, such asymmetries can lead to increased perceived risk, higher financing costs, and lower firm valuations. FinTech technologies, such as blockchain for immutable ESG disclosures, , and digital investor engagement tools, can reduce these asymmetries by providing timely, transparent, and credible non-financial information.

Specifically, FinTech moderates the ESG–firm value relationship by enhancing the credibility and accessibility of ESG data. Traditional ESG reporting mechanisms, often annual and static, are being replaced or supplemented by dynamic, tech-enabled disclosures that allow investors to access near real-time updates on corporate sustainability practices . This increased transparency strengthens investor confidence, reduces skepticism, and facilitates the integration of ESG performance into investment valuation models. As such, FinTech serves as a technological amplifier that enhances the value relevance of ESG activities, especially in regions like the Gulf, where ESG reporting practices are still maturing and subject to skepticism. This framework in Figure 2 below captures the interplay of sustainability (ESG) and Fintech in shaping firm value.

Theoretical Framework

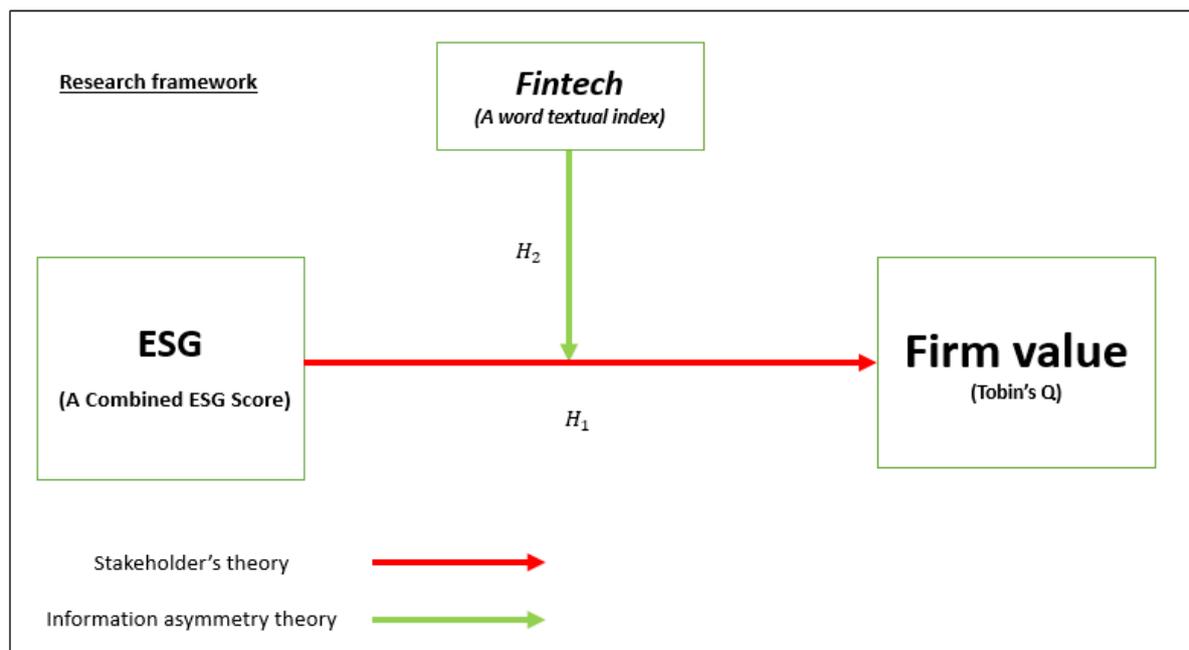


Figure 2

Source: Developed by the author (2025)

This study adopts a quantitative approach that integrates both descriptive and explanatory research elements. The descriptive component establishes the empirical characteristics of the dataset by summarizing the behavior of key variables such as ESG scores, FinTech adoption indicators, and firm value through measures of central tendency, dispersion, and graphical exploration. These descriptive diagnostics not only provide foundational insights into the data but also act as preliminary checks for data quality, variation across firms, and potential distributional irregularities.

To ensure the reliability and robustness of the empirical analysis, firms were included in the final dataset only if they were established prior to 2017 and had complete, consistent, and high-quality annual data from 2017 to 2024. This period provides sufficient temporal depth to capture medium-term financial behavior and meaningful variation in ESG scores, capital structure indicators, FinTech adoption measures, and market valuation metrics. Firms that did not meet these criteria, such as those with missing financial disclosures, irregular ESG reporting practices, or late stock market entry, were excluded from the analysis. Additionally, a number of observations were removed due to the presence of extreme outliers that could distort parameter estimates or compromise the validity of econometric tests. Although the population of non-financial GCC-listed firms comprises 549 companies, the rigorous screening criteria described above resulted in a final analytical sample of 242 firms.

The research results are known to be as good as the data quality. Therefore, data for the study regarding the firm value and the Fintech will be obtained from the websites that contain annual financial reports and management and discussion reports of the nonfinancial companies listed in the financial markets. These websites provide information about the listed companies, market performance, and other relevant financial data. These websites are shown in Table 1 below.

Table 1
Website links for the stock exchange

Stock Exchange	Website Link
Abu Dhabi Securities Exchange (ADX)	https://www.adx.ae
Dubai Financial Market (DFM)	https://www.dfm.ae
NASDAQ Dubai	https://www.nasdaqdubai.com
Saudi Stock Exchange (Tadawul)	https://www.saudiexchange.sa
Qatar Stock Exchange (QSE)	https://www.qe.com.qa
Bourse Kuwait	https://www.boursakuwait.com.kw
Bahrain Bourse	https://www.bahrainbourse.com
Muscat Securities Market (MSM)	https://www.msm.gov.om

Whereas the data for the (ESG) combined score can be obtained from many sources, we used the Bloomberg website.

FinTech adoption is often measured through the extent of digital transformation in financial services. Hong et al. (2023) developed a firm-level indicator of FinTech adoption using textual analysis techniques. The approach relies on the idea that companies typically reveal important details about their operations, including the use of FinTech in their management and discussion reports (M&D Reports). Therefore, by examining how often FinTech-related terms appear in these reports, one can reasonably assess how much a firm has integrated FinTech into its business practices.

Tobin's Q is particularly valuable as it provides a forward-looking signal of investor expectations and confidence in a firm's future growth potential. In this study, we will use the latest. The metric is calculated as follows:

$$Tobin's\ Q = \frac{MV\ of\ equity + BV\ of\ debt}{BV\ of\ total\ assets}$$

From an operational standpoint, ESG performance is typically measured through composite ESG ratings or scores issued by international data providers such as Bloomberg. These ratings are derived from firms' publicly disclosed information, sustainability and governance reports, regulatory filings, and external assessments, and are standardized across sectors to allow for meaningful cross-firm comparisons. As a result, ESG performance is not calculated using a single mathematical formula but is instead captured through externally validated scoring systems.

FinTech adoption is often measured through the extent of digital transformation in financial services. The method developed by Hong et al. (2023), in which a firm-level indicator of FinTech adoption was measured using textual analysis techniques. The approach relies on the idea that companies typically reveal important details about their operations, including the use of FinTech in their financial reports. Therefore, by examining how often FinTech-related terms appear in these reports, one can reasonably assess the extent to which a firm has integrated FinTech into its business practices. This method captures the degree to which companies incorporate or report FinTech-related terms in their annual reports, signaling their level of technological engagement and transparency. These words are listed above in the previous section. We will choose these words to serve as an indicator for the fintech usage and adoption, investment in fintech, or the usage rate of fintech services among consumers. A comprehensive list of FinTech-related keywords can be used for textual analysis of firm-level reports, particularly for measuring FinTech adoption. Here are all the 144 words that are in the fintech keywords list:

{fintech, financial technology, digital finance, digital transformation, digitization, digitalization, innovation, techdriven, automation, efinance, efinance, smartfinance, techfinance, mobilebanking, onlinebanking, internetbanking, ebanking, digitalbanking, paymentgateway, mobilepayment, epayment, contactless, wallet, digitalwallet, ewallet, qrpayment, remittance, micropayment, paytech, digitalcard, applepay, googlepay, samsungpay, ai, artificialintelligence, machinelearning, deeplearning, neuralnetwork, predictiveanalytics, bigdata, datascience, analytics, intelligentautomation, chatbot, virtualassistant, naturallanguageprocessing, sentimentanalysis, algorithmictrading, roboadvisor, blockchain, distributedledger, ledger technology, smartcontract, tokenization, cryptocurrency, cryptoasset, digitalasset, bitcoin, ethereum, stablecoin, defi, nft, mining, token, web3, metaverse, cryptoexchange, cryptopayment, digitalcurrency, cbdc, regtech, complianceautomation, regulatorytechnology, aml, antimoneylaundering, kyc, knowyourcustomer, frauddetection, cyberrisk, cybersecurity, dataprotection, digitalidentity, identityverification, esignature, riskanalytics, sanctionmonitoring, cloud, cloudcomputing, saas, paas, iaas, virtualization, infrastructure, datacenter, cloudbanking, apis, openapi, openbanking, digitalplatform, apiplatform, finservplatform, ecosystemintegration, crowdfunding, peertopeer, p2p, p2plending, digitallending, onlinecredit, microfinance, microloan, altfinance, neobank, challengerbank, digitalinsurer, insurtech, digitalinsurance, telematics, usagebasedinsurance, onlineloan, iot, internetofthings, biometrics, facialrecognition, voicebanking, quantumcomputing, augmentedreality, virtualreality, metaversefinance, blockchainai, fintechplatform, stcpay,

dubaipay, tammpay, mada, benefitpay, noqodi, fabmobile, emipay, qatarpay, omanpay, urpay, baraka, rainexchange, ahlibankdigital }

These fintech words were compiled from peer-reviewed sources and a general FinTech taxonomy used in empirical research. A Python code is developed so that we can input the report of each company for each year, whether it's in Word or PDF format, and run the results to get the fintech index as an output in Excel. The formula used and the code are provided below.

$$FinTIndex_{it} = \sum_{k=0}^n \left(\frac{Frequency(keyword_j)}{Total\ words} \right) \times 100$$

Where:

- $FinTIndex_{it}$ = FinTech adoption score for firm i in year t
- $keyword_j$ = the j -th FinTech-related term from the predefined keyword list
- $Frequency(keyword_{j,it})$ = frequency count of the j th FinTech related term within firm's i annual report disclosures in each year t
- n = Total number of firms

Control variables are important in our study because they help us to measure the true effect of our key independent variable, ESG fintech, on the firm value, without bias from other influencing factors, and also, they will reduce omitted variable bias since excluding important variables that affect both the independent and dependent variables can lead to biased and inconsistent estimates. By using control variables, it will mitigate this bias. Moreover, it will improve model fit and precision and the R-squared, ensuring that any observed effects are not spurious or due to unobserved heterogeneity. The control variables are described below in Table 2.

Table 2
Control variables

Firm Size (Log of Total Assets)	Larger firms tend to have greater access to capital markets, better credit ratings, and more resources to invest in ESG initiatives. They also experience a lower cost of debt due to reduced information asymmetry and higher transparency.	
Leverage (Total Debt / Total Assets)	Highly leveraged firms face greater financial risk, which raises their cost of debt. Such firms may also prioritize short-term financial performance over long-term sustainability, negatively impacting ESG outcomes.	
Ownership Concentration (% of shares held by top 3 or 5 shareholders)	High ownership concentration is typical in Gulf firms due to state, family, or institutional ownership. This structure can weaken monitoring mechanisms and reduce transparency, which affects ESG disclosures, capital costs, and investor perception of firm value. It may also reduce incentives for FinTech adoption.	

Liquidity (Current ratio=Current Assets/Current Liabilities)	Liquidity plays a crucial role in influencing both the cost of capital and firm value. Firms with higher liquidity are generally perceived as less risky by investors and creditors, which can result in a lower required rate of return and, consequently, a reduced cost of capital (Brealey, Myers, & Allen, 2020). Additionally, high liquidity provides firms with greater operational flexibility and the ability to seize investment opportunities without resorting to costly external financing, thereby enhancing firm value.	
Return on Assets (ROA = NI/TA)	ROA measures managerial efficiency in utilizing assets to generate profits, reflecting internal performance quality. Firms with higher ROA are typically more profitable and financially stable, which can enhance investor confidence and firm value. In the ESG–firm value nexus, higher profitability enables firms to invest more in sustainable initiatives and absorb associated costs without deteriorating financial performance.	
Board Size (Number of Directors)	Board size represents the governance structure and diversity of expertise in decision-making. Larger boards may provide broader perspectives and enhance monitoring, improving ESG implementation and firm performance. However, excessively large boards could hinder coordination and reduce effectiveness, increasing agency costs. Thus, optimal board size is expected to positively influence firm value and ESG performance in the Gulf context.	

Source: Developed by the author (2025)

Analysis and Discussions

This chapter presents the empirical analysis and econometric findings of the study. Before proceeding to the econometric estimations, this section presents a comprehensive descriptive analysis of the dataset to characterize the fundamental properties of the sampled GCC firms and the variables included in the empirical models.

Table 3 presents the descriptive statistics for all variables employed in the empirical analysis, including measures of central tendency, dispersion, and distributional shape. Descriptive statistics provide an essential preliminary assessment of data quality, enabling detection of heterogeneity, outliers, and non-linearities that may influence model behaviour and subsequent econometric specifications (Wooldridge, 2016). The table reports the mean, standard deviation, minimum, maximum, first percentile, ninety-ninth percentile, skewness, and kurtosis values for each variable, thereby offering a comprehensive view of the dataset's structure across the 1,936 firm-year observations.

Table 3

Descriptive statistics of the study variables (2017–2024)

Variables	Obs	Mean	Std.Dev.	Min	Max	p1	p99	Skew.	Kurt.
Tobin q	1936	1.013	.207	.615	1.623	.62	1.574	.415	3.007
ESG	1936	20.296	11.238	1.11	46.197	1.425	42.665	.062	1.904
FinTINDEX	1936	34.196	20.302	1	95	2	86	.582	2.637
leverage	1936	.47	.271	.004	3.15	.019	.981	.571	6.772
CurrentRatio	1936	2.162	3.364	.011	19.575	.046	18.011	3.25	13.844
firmsize	1936	9.511	1.057	5.15	13.888	7.06	12.582	.517	3.863
OwnConc	1936	.085	.207	0	6.15	0	.831	14.234	384.927
ROA	1936	.259	.259	-	7.15	-.067	.673	9.85	260.692
				.073					
boardsize	1936	9.923	3.004	4	26	5	20	1.173	5.412

The descriptive statistics reveal substantial heterogeneity across firms in ESG engagement, technological adoption, capital structure, and performance. These patterns underscore the necessity of applying robust dynamic panel estimators, such as the LSDVC model, to effectively account for firm-specific heterogeneity and non-normal variable distributions.

Correlation analysis represents a crucial preliminary step in the empirical investigation, particularly within the context of panel-data modelling. Table 4 reports the Pearson correlation coefficients for all variables used in this study. From an econometric standpoint, the correlation matrix functions both as an exploratory descriptive tool and as an econometric diagnostic device that informs model specification and guides interpretation of subsequent estimation results.

Table 4

Correlation matrix of the study variable

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Tobin_q	1.000								
(2) ESG	0.876	1.000							
(3) FinTINDEX	0.712	0.799	1.000						
(4) Leverage	0.119	0.123	0.208	1.000					
(5) CurrentRatio	0.089	0.091	0.109	0.071	1.000				
(6) Firmsize	0.128	0.177	0.163	-0.049	-0.043	1.000			
(7) OwnConc	0.046	0.025	0.067	0.209	0.022	-0.136	1.000		
(8) ROA	0.098	0.111	0.192	0.220	0.057	-0.134	0.393	1.000	
(9) Boardsize	0.067	0.118	0.134	0.022	-0.021	0.248	-0.016	-0.006	1.000

The correlation matrix in Table 4 reveals several strong and theoretically coherent relationships among the main variables. None of the pairwise correlations among the explanatory variables exceed the commonly referenced multicollinearity threshold of 0.80, indicating that multicollinearity is unlikely to bias coefficient estimates in the dynamic panel regression models. This observation strengthens confidence in the empirical identification strategy and supports the validity of incorporating ESG and FinTech simultaneously within the LSDVC framework.

This study employs the Least Squares Dummy Variable Corrected (LSDVC) estimator as the primary estimation technique for testing the two hypotheses. The choice of LSDVC is theoretically and econometrically grounded, particularly given the structure of the dataset and the dynamic nature of firm-value behaviour. Firm value exhibits strong persistence over time, as past performance influences current valuation through investor expectations, capital-market signalling, and cumulative firm-specific characteristics. Incorporating the lagged dependent variable (*Tobin's* $q_{i,t-1}$) is therefore essential to capture this dynamic adjustment process. However, including lagged dependent variables in a fixed-effects model introduces the well-known Nickell bias, which becomes more severe when the time dimension ($T = 8$ years) is relatively small compared to the cross-sectional dimension ($N = 242$ firms). Traditional fixed-effects estimators (within estimators) are thus biased and inconsistent under these conditions (Bruno et al., 2005).

The LSDVC estimator is particularly appropriate for this study because the panel is large in N but small in T , which is the exact setting for which LSDVC was developed. With 242 firms over eight years (unbalanced), the estimator ensures efficiency gains relative to GMM approaches, which typically require larger time spans to stabilize the instrument matrix and avoid overfitting. LSDVC avoids the common pitfalls of GMM, such as instrument proliferation, weakened Hansen tests, and finite-sample distortions, making it the superior choice for corporate-finance panels of this structure.

This section sequentially reports and interprets the regression results for the hypotheses.

- H_1 : *There is a positive direct relationship between ESG performance and firm value among GCC-listed firms.*
- H_2 : *There is a significant moderating role of FinTech in the relationship between ESG performance and firm value among GCC-listed firms.*

Model notation (common to all four hypotheses)

- $Tobin_{q_{it}}$: Tobin's Q (firm value) for the firm i in year t (DV)
- ESG_{it} : ESG score for the firm i in year t (IV)
- $FinT_{it}$: FinTech index for the firm i in year t (moderator)
- $CONTROLS_{it}$: Control variables, which are
 - Leverage (Total Debt / Total Assets)
 - Liquidity: measured by the Current ratio
 - Firm Size: measured by Log of Total Assets
 - Ownership Concentration: measured by (% of shares held by top 3 or 5 shareholders).
 - Return on Assets: measured by ROA (ROA = NI/TA).

- Board size: measured by the number of board committees.
- μ_i : firm fixed effect; τ_t : year fixed effect; ε_{it} : idiosyncratic error
- $Tobin_q_{i,t-1}$: captures persistence (dynamic panel; LSDVC corrects Nickell bias).

The models for each hypothesis are

Model (1)

$$Tobin_q_{it} = \beta_0 + \beta_1 Tobin_q_{i,t-1} + \beta_2 ESG_{it} + \beta_i CONTROLS_{it} + \mu_{it} + \tau_t + \varepsilon_{it}$$

Model (2)

$$Tobin_q_{it} = \beta_0 + \beta_1 Tobin_q_{i,t-1} + \beta_2 ESG_{it} + \beta_3 Fint_{it} + \beta_4 (ESG_{it} * Fint_{it}) + \beta_i CONTROLS_{it} + \mu_{it} + \tau_t + \varepsilon_{it}$$

The first model investigates the direct effect of environmental, social, and governance (ESG) performance on firm value, interpreted through the lens of Stakeholder Theory.

The LSDVC results presented in Table 5 show that ESG performance exerts a strong and positive effect on firm value, with a highly significant coefficient ($\beta = 0.924$, $p < 0.01$). This result provides clear empirical support for Hypothesis 1, which proposed that ESG performance enhances firm value among GCC-listed firms.

Table 5

LSDVC results for model 1

Note: Blundell and Bond estimator is implemented through the user-written Stata command `-xtabond2-` by David Roodman, Center for Global Development, Washington, DC droodman@cgdev.org
note: Bias correction up to order $O(1/NT)$

LSDVC dynamic regression
(bootstrapped SE)

Tobin_q	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
Tobin_q L1.	-.0478964	.0197002	-2.43	0.015	-.086508	-.0092848
ESG	.9242245	.0144174	64.10	0.000	.8959669	.952482
FinTINDEX	.0675736	.0137828	4.90	0.000	.0405597	.0945875
Leverage	.0233076	.0127466	1.83	0.067	-.0016754	.0482906
CurrentRatio	.0012697	.0006625	1.92	0.055	-.0000288	.0025681
FirmSize	-.0065288	.0021525	-3.03	0.002	-.0107475	-.00231
OwnConc	.0146828	.0158357	0.93	0.354	-.0163546	.0457202
ROA	-.0062765	.0017585	-3.57	0.000	-.0097232	-.0028299
Boardsize	-.0077196	.0023868	-3.23	0.001	-.0123977	-.0030416

The positive association aligns closely with the conceptual and theoretical foundations established in the literature, where ESG is understood as a multidimensional framework that strengthens stakeholder relationships, enhances transparency, reduces risk, and signals long-term strategic orientation. As emphasized by (Chang & Lee, 2022; Mishra et al., 2024; Yildiz et al., 2024), firms that perform well in environmental, social, and governance dimensions typically exhibit stronger internal controls, reduced exposure to non-financial risks, and more effective engagement with their broader stakeholder environment. These attributes allow

markets to view ESG performance as an indicator of managerial quality and organizational resilience, which naturally translates into higher firm valuation.

Stakeholder Theory offers a particularly clear explanation for the observed significance of the ESG variable. According to this perspective, firms that address the expectations of diverse stakeholders—investors, employees, customers, regulators, and local communities—develop legitimacy, credibility, and trust, which together contribute to improved market performance. The literature consistently underscores this dynamic. (Espinosa-Méndez et al., 2023; Kong et al., 2023; Lerskullawat & Ungphakorn, 2024) argue that ESG activities enhance reputation and reduce information asymmetry, enabling firms to secure more stable cash flows and lower their perceived risk. Research in developed markets confirms that ESG performance enhances firm value by strengthening risk management, supporting innovation, and improving long-term operational efficiency (Ge et al., 2022). Studies examining institutional ownership, governance quality, and market sentiment—such as (Yurtoğlu & Gülşen, 2025) suggest that investors reward firms that credibly commit to sustainability through improved market valuation metrics, including Tobin's Q. The significant coefficient reported in Model 1 sits firmly within this empirical pattern. The model's findings also match empirical evidence from the Gulf region, where several studies highlight a positive association between ESG and firm value. (A. Almaqtari et al., 2022; Ahmad et al., 2023) (Aras & Hacıoglu Kazak, 2022) (Mishra et al., 2024). Although part of the literature reports contradictory or mixed findings—including negative effects on Tobin's Q (Rasyad et al., 2024), diminishing returns beyond certain ESG investment thresholds (Teng et al., 2022), and short-term constraints affecting ESG's financial impact (Kayani et al., 2023).

The second model introduces the interaction term (ESG × FinTech) (denoted by *inter1*) to test whether FinTech adoption strengthens the relationship between ESG performance and firm value.

It extends the baseline specification by incorporating the interaction term between ESG performance and FinTech adoption to test whether digital financial capabilities enhance the valuation effects of ESG practices. The LSDVC results in Table 6 indicate that the interaction term between ESG and FinTech (ESG × FinTech), denoted by (*inter 1*), is positive and statistically significant ($\beta = 0.217$, $p = 0.003$), demonstrating that FinTech adoption strengthens the impact of ESG on firm value. This finding provides clear empirical support for Hypothesis 2, which proposed that FinTech acts as a positive moderator in the ESG–firm value relationship among GCC-listed firms. The use of the LSDVC estimator is again crucial, given the dynamic nature of firm valuation and the strong persistence captured by the lagged dependent variable. By correcting for dynamic panel bias, the estimator ensures that the moderating effect detected is not driven by unobserved heterogeneity or past performance but reflects a genuine structural interplay between ESG and FinTech capabilities.

Table 6

LSDVC results for model 2

Note: Blundell and Bond estimator is implemented through the user-written Stata command `-xtabond2-` by David Roodman, Center for Global Development, Washington, DC droodman@cgdev.org
 note: Bias correction up to order $O(1/NT)$

LSDVC dynamic regression
 (bootstrapped SE)

Tobin_q	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
Tobin_q						
L1.	-.0493266	.0187678	-2.63	0.009	-.0861108	-.0125423
ESG	.009959	.3053531	0.03	0.974	-.588522	.60844
FinTINDEX	-.0266955	.0380565	-0.70	0.483	-.1012849	.0478938
Leverage	.0243079	.012552	1.94	0.053	-.0002935	.0489093
CurrentRatio	.0012585	.0006601	1.91	0.057	-.0000353	.0025522
FirmSize	-.0094308	.0024025	-3.93	0.000	-.0141395	-.004722
OwnConc	.0115421	.0155304	0.74	0.457	-.0188969	.0419811
ROA	-.0052661	.0019753	-2.67	0.008	-.0091375	-.0013946
Boardsize	-.0076582	.0023849	-3.21	0.001	-.0123325	-.0029839
inter1	.2168061	.0730664	2.97	0.003	.0735986	.3600136

The results show that ESG performance does not automatically lead to higher firm value unless it is supported by adequate digital capabilities. When FinTech is introduced into the model, the direct effect of ESG on firm value becomes statistically insignificant, indicating that sustainability initiatives alone are insufficient to generate valuation premiums in the GCC context. Instead, ESG creates financial value only when firms possess the technological infrastructure needed to operationalize, verify, and communicate these initiatives effectively. The significant interaction between ESG and FinTech confirms that digital financial capability is the key mechanism through which ESG investments are transformed into market-recognized value. FinTech acts as a strategic enabler by enhancing the transparency, credibility, and visibility of ESG performance, allowing investors to better assess its authenticity and impact. As a result, ESG performance is most effective when paired with FinTech adoption, which strengthens and amplifies its valuation effect.

Overall, the findings validate the moderating role of FinTech and confirm that the ESG–firm value relationship in GCC-listed firms is fundamentally conditioned by digital transformation. Firms equipped with FinTech capabilities are better positioned to convert sustainability commitments into superior market valuation, reinforcing the view that ESG value realization increasingly depends on complementary technological innovation.

Conclusion

This study underscores the growing importance of integrating sustainability practices with digital financial capabilities as a foundation for firm value creation in emerging markets. In the context of the Gulf Cooperation Council, where capital markets are shaped by ownership concentration, information asymmetry, and ongoing structural transformation, ESG performance alone is insufficient to generate sustained valuation gains. The findings clearly demonstrate that FinTech adoption plays a decisive role in converting ESG commitments into market-recognized value by enhancing transparency, credibility, and investor confidence.

From a practical standpoint, the study highlights the effectiveness of FinTech as more than an operational efficiency tool. FinTech emerges as a strategic enabler that allows firms to communicate sustainability efforts more clearly, reduce uncertainty surrounding non-financial information, and strengthen the pricing of ESG performance in capital markets. For corporate managers, the results emphasize the need to align ESG strategies with digital reporting, analytics, and disclosure infrastructures to ensure that sustainability investments are effectively valued by investors. Firms that neglect this integration risk continued valuation discounts despite ESG engagement.

The study is particularly beneficial for investors and policymakers. Investors gain clearer insight into how ESG information should be interpreted in environments where disclosure quality varies, while policymakers are provided with empirical evidence supporting the joint promotion of FinTech innovation and ESG reporting standards. These findings are directly relevant to national development agendas such as Saudi Vision 2030 and UAE Vision 2050, which aim to attract foreign investment, deepen capital markets, and promote sustainable private-sector growth.

Theoretically, the study advances existing literature by demonstrating how Stakeholder Theory and Information Asymmetry Theory operate jointly in emerging markets. ESG creates potential value through stakeholder alignment, while FinTech determines whether that value is effectively realized by reducing informational frictions. Methodologically, the use of the LSDVC estimator strengthens confidence that these relationships reflect genuine economic mechanisms rather than statistical artifacts.

Overall, the study delivers a clear and actionable message: sustainable firm value in the GCC is achieved not through ESG adoption alone, but through the effective integration of sustainability and digital financial innovation. By highlighting how and for whom this integration matters, the study contributes meaningful insights for firms, investors, regulators, and scholars seeking to understand and enhance value creation in rapidly transforming emerging markets.

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