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The Role of ESG in Shaping the Impact of Financial Development on Banks' Performance

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ABSTRACT

This study investigates how financial development, divided into financial markets and financial institutions, affects banks' performance across 93 financially developed countries during the period between 2008 and 2023. The analysis highlights the role of environmental, social and governance readiness as core determinants that reshape financial progress and banking outcomes. On the basis of financial intermediation theory and the broader idea of stakeholder engagement, this study finds that entrepreneurship strengthens bank performance, internet usage negatively affects it, and mobile usage shows a negative effect in the case of financial institutions but a positive impact when financial markets are considered.

JEL Classification: G2, G3, M14

1 | Introduction

Financial markets and institutions are essential elements that shape the direction and performance of the banking sector (Ul-Durar et al. 2025). Financial markets serve as important platforms where banks can mobilize capital, manage risk exposure and diversify their asset portfolios. These functions are closely linked with the ability of banks to access long-term finance, participate in innovation and ensure liquidity in times of uncertainty. Within this structure, banks are not only intermediaries but also key participants in financial development, contributing to economic efficiency through the optimal use of resources (Nasim et al. 2025). A dynamic and inclusive financial expansion paves the way for banks to grow and become sustainable. It happens due to decreased operational costs, increased investment opportunities for investors and improved funding instrument access. A profitable or sound bank would mean that it has been able to maximize the productivity of funds beyond the costs required to manage them. Thus, a well-performing banking sector ensures that idle capital is used in productive sources, such that it is also generating surplus to the institution, which is mobilizing this capital (Youssef 2024).

Simultaneously, financial organizations, such as central and commercial banks, investment companies and regulatory bodies, source the infrastructure that orders financial systems (Zhao et al. 2025). They have a critical role in maintaining the strength and credibility of banking operations. Svirydzenka (2016) divides the financial system into two components first is the financial institutions that include banks, insurance, pension funds and private credit providers while the financial markets include stock and bond markets. Institutions increase transparency, minimize information asymmetry, and enforce national and international financial standards. From the point of view of the theory of financial intermediation, banks perform better in settings where regulatory environments are reliable, supervision is adequate and information flow is in good order (Gidage et al. 2025). The relationship between financial markets and institutions creates a framework that affects how banks

compete, operate and react to changes in economic conditions. While considering the findings of Berndsen et al. (2018) and Park and Kim (2020), this study supports that the link between bank performance (BPR) and financial institution performance is U-shaped, which implies that an initial financial expansion decreases banks' performance while an extended financial expansion brings an improvement in it.

In addition to financial development and banks' financial performance, economic, social and governance (ESG) readiness has emerged as an influential driver in determining how banks attain long-term sustainability (Huang et al. 2024). ESG readiness enhances operational efficiency, upholds ethicality and reinforces the relationship between investors, regulators and customers (Andrieș and Sprincean 2023). These are the vital stakeholders in banking activities. From this perspective, the stakeholder theory holds this reasoning by pointing out that companies perform better when they satisfy the expectations of all stakeholders. As a driver, ESG promotes sound lending, ethical investment and risk management approaches that contribute to enhanced financial performance and institutional stability (Palmieri et al. 2024).

Furthermore, the status of ESG readiness has an important moderating effect on the model between financial development and BPR (Gangwani and Kashiramka 2024). This study illustrates that ESG serves to minimize the harmful impacts that can arise as financial systems get overelaborated or poorly regulated (Del Sarto 2025). Banks can initiate blended financing that integrates the environmental goals as preferential treatment. An increased share of such financing by banks would mean that the borrowing businesses are transitioning towards green growth, which, through many channels, ensures that they are able to pay back their loans. Climate disclosure reports claim that a $1 spent on climate mitigation leads to approximately $21 yield in business returns (CDP 2025), which would reduce the risks for banks. ESG adds a layer of social responsibility to financial activities that enhances risk governance and minimizes vulnerability to shocks. ESG promotes sustainable growth and confirms that financial advancement does not result in environmental degradation or exclusion from society (Lee 2024; Galletta et al. 2023). The fusion of ESG activities with financial expansion increases resilience, promotes long-term value creation and confirms the achievements of sustainability objectives. The financial market can facilitate the extension of climate positive financing and maintaining this at a preferential rate across all the lending institutions. Regulatory support from the financial system would help banks to engage in ESG activities leading to their increased stability. Central banks can integrate sustainable development goals with financial sector investments, which can help them go beyond growth to support the economy.

Primarily, this study tests the quadratic impact of financial markets and institutions on the performance of banks in two separate models. Second, ESG is incorporated as a determinant of a BPR and the moderator of financial markets and institutions to endorse its role for sustainable practices in a BPR. Third, to test the role of controlling factors, this study has incorporated mobile and internet usage and entrepreneurial activities to test their determining role. Fourth, it is also included in the objectives to propose a suitable policy implication based on the estimated results.

This study used the panel quantile regression method and confirmed that the financial market and institutional environment had a nonlinear effect on the performance of banks. The results also pointed out the moderating role of ESG in banking performance.

Section 1 provided some introductory remarks. Section 2 reviews the literature to analyze the work done so far and identify a literature gap. Section 3 details the data collection, some econometric techniques and the theoretical relationship between the proposed functional form. Section 4 is about interpreting the estimated results. Section 5 covers the concluding remarks and some policy implications.

2 | Literature Review

The literature regarding the determinants of BPR is vast and continues to evolve with emerging financial trends. This study, however, focuses on the recent literature that directly connects financial development with BPR. The performance of financial markets is central to the profitability, resilience and efficiency of banks. Financial markets allow banks to access capital, manage liquidity and diversify investments, which are essential to support their core functions. Hence, the contribution of financial market performance (FMP) to bank outcomes cannot be overlooked. Ahamed et al. (2021), El Khoury et al. (2023) and Asutay and Ubaidillah (2024) have confirmed that efficient financial markets have a statistically significant and positive effect on BPR by improving returns and reducing operational risk. Similarly, Zhao et al. (2022) used FinTech as an instrument for financial market innovation and found its favourable impact on banks' performance.

However, there are also contradictory shreds of evidence validated by many studies. In this respect, Ozili and Ndah (2024) and Siddique et al. (2022) pointed to a negative relationship between FMP and BPR, implying that excessive market competition and the existence of volatility in market conditions lowers profitability. These contradictions emphasize the need to account for the stage of financial development and the existence of regulatory protection. In addition, Tashkandi (2023) emphasized the significance of Islamic financial markets in improving BPR. In contrast, Ben Abdallah and Bahloul (2023) reported contrasting findings by validating adverse effects, indicating that the institutional environment and compliance arrangements are important. Outside of markets, financial institutions also shape how banks perform. Gutiérrez-Ponce and Wibowo (2023) emphasized that stable and sustainable financial institutions improve banks' profitability through fostering good governance, strong regulation and risk management principles. Nasreen et al. (2020), Haddad and Hornuf (2021) and Z. Chen et al. (2022) also confirmed the constructive role of financial institutions in leading banks during times of market volatility. However, not all results are consistent. Ozili and Ndah (2024) contended that strictly or overregulated financial institutions can be limited to innovation and adaptability, hence affecting BPR. Conversely, the findings of Asutay and Ubaidillah (2024) are entirely different. Their findings suggest that the relationship may be conditional upon other contextual or structural factors of financial institutions, but they found no significant effect.

Building on the debate, recent studies have acknowledged that the financial system and banking performance relationship could be nonlinear, showing both positive and negative effect

phases. Law and Singh (2014), Arcand et al. (2015) and Samargandi et al. (2015) advocate that early development of financial systems could reduce financial costs and expand the credit market, which helps banks to become profitable. However, this positive effect is not permanent as, beyond a certain threshold, excessing financial deepening could lead to the erosion of banking margins. This effect is discussed in the lens of the too much finance hypothesis, which is the conceptual bridge this study has used to develop the quadratic model.

In every economy, the role of an entrepreneur cannot be neglected. Studies like Cowling et al. (2020), Nugroho and Nugraha (2020), Alrazehi et al. (2021), Dutta and Meierrieks (2021) and Mohsin et al. (2023) have all confirmed that entrepreneurs are the drivers of innovation and economic development, driving demand for financial services and ensuring the long-term viability of banks through diversified and robust banking operations. Oppositely, Esubalew and Raghurama (2020) disagree with them. The Schumpeter (1983) classical view positions entrepreneurs as drivers of financial intermediation, which stimulates demand for credit, leading to banking profitability (Schumpeter 1983). Empirical evidence shows that entrepreneurship fosters the small and medium enterprises, which increase the bank's loan portfolios by increasing lending opportunities and diversified risk (Fotopoulos 2023). Entrepreneurship also increases the financial deepening and market penetration for banks, which can, in turn, enhance their profitability.

The expansion in digitalization is crucial for sustainable development (Forcadell et al. 2020), although expansion in mobile phone usage can increase competition and operational expenses for a bank. However, its usage enhances banking performance by facilitating effective digital transactions, increasing financial inclusion and enhancing customer service, as discussed in various studies, such as Alrabei et al. (2022), Hassan (2024), Agyemang and Agyare (2024) and Siasulingana and Haabazoka (2024). Contrary to these studies, Adhitya and Sembel (2020) have confirmed the adverse effect of mobile phone usage on BPR. Kıymalıoğlu et al. (2024) have confirmed the indirect effect of mobile phone usage on enhancing BPR. Likewise, internet usage improves BPR by simplifying operations, broadening online activities and enhancing customers' accessibility, but also exacerbating cybersecurity threats and complexities in operations. Literature is also present in this facet of internet usage. Research such as Owusu-Agyei et al. (2020), Dong et al. (2020), Mir et al. (2023), Ighomereho et al. (2023) and D'Andrea and Limodio (2024) have proven the same. The study by Alarifi and Husain (2023) has some interesting but reality-based findings that have argued in favour of Covid-19 and declared it responsible for sustainable banks' performance.

Sustainable behaviour, increasing risk mitigation and enhancing long-term resilience are the most important elements for banks, and achieving them without ESG factors is impossible. Banks can use ESG integration to keep their operations aligned with regulatory environments, bring in responsible investors and generate customers' trust (Menicucci 2025). Hoang et al. (2025) showed that firms can use green loans as a signalling mechanism to increase firm performance. Banks improve stakeholder communication and enhance their reputational position by pursuing ESG-driven strategies. This convergence with ESG factors also facilitates banks to adhere to global standards of sustainability and ensures ethical lending and responsible investment strategies. Aside from compliance, ESG programs also reduce the scope of operational risks on environmental liabilities, social unrest and poor governance, hence ensuring steady performance amid a changing financial landscape (KPMG 2021; Nian and Said 2025). Here, ESG has emerged as a strategic cornerstone in contemporary banking operations. Empirical studies in recent times have supported these theoretical connections. Andrieș and Sprincean (2023), Liu et al. (2023), Galletta et al. (2023), Miranda et al. (2023) and Palmieri et al. (2024) concluded that ESG performance notably contributes to the financial performance of a bank through enhanced internal efficiency, cost savings linked to risk and long-term value creation. It could be said that studies highlighted the importance of ESG for banks wanting to achieve financial stability and expansion in terms of transparency, lowering uncertainty and promoting long-term investment choices.

El Khoury et al. (2023) provided a perspective by validating both the positive and negative effects of ESG on BPR. They emphasized that while ESG can add value, its implementation cost and possible conflicts between environmental goals and profit objectives may sometimes reduce short-term financial gains. Similarly, Menicucci and Paolucci (2023) confirmed only the negative impacts of ESG, arguing that high compliance and reporting costs can become a burden for some banking institutions, especially in the early phases of ESG adoption. On the other hand, Gutiérrez-Ponce and Wibowo (2023) highlighted that the three pillars of ESG affect banks differently. Their findings suggested that each ESG dimension contributes uniquely to bank outcomes depending on regional, institutional and structural factors. Hin and Liu (2023) specifically emphasized governance as the most influential ESG factor, linking it to stronger oversight, reduced fraud risk and enhanced managerial accountability. Thus, ESG's impact on BPR is not only significant but also multidimensional, requiring careful consideration of individual components.

The reviewed studies have clarified the existing research gap. While many have examined the role of financial markets or institutions in shaping BPR, limited research considers both within a unified empirical framework. This study fills that gap by incorporating financial markets and institutions simultaneously, applying a quadratic specification to capture nonlinear effects. This approach allows the detection of complex relationships, such as U-shaped or inverted U-shaped patterns, which are often missed in linear estimations. It reflects the idea that financial development can be both beneficial and harmful depending on its intensity and the surrounding institutional environment. A second major contribution of this study is the introduction of ESG readiness in two distinct roles. First, ESG is treated as a direct determinant of BPR where it improves efficiency, builds resilience and supports ethical strategies. Second, ESG acts as a moderator, altering the impact of financial development on banks by reducing exposure to risks and promoting sustainability. This dual role of ESG responds to a noticeable gap in the existing literature that often overlooks ESG's potential to guide responsible finance. Additionally, rather than focusing broadly on FinTech, the study uses internet access, mobile usage and entrepreneurship as practical control variables. These reflect current digital and behavioural trends. Lastly, by using global data from 93 countries, the study

offers relevant findings for policymakers and institutions aiming to build a more sustainable financial system.

3 | Methods and Data

3.1 | Theoretical Model

Regarding the impact of financial development on banks' performance, this study has taken a quadratic approach and proposes a U-shaped relationship between financial markets, financial institutions and BPR. It implies that, early on, the evolution of financial markets and institutions decreases BPR through unfair competition, the market becomes saturated, compliance becomes increasingly onerous and marginal returns diminish (Ozili and Ndah 2024; Siddique et al. 2022). At this stage, banks can have higher operational risks and low profitability because of structural inefficiencies or poor governance of excessively developed financial systems. While financial systems expand and advance, they provide a good platform for banking activities. It also paves the way for better availability of capital, fostering innovation and enhancing institutional arrangements. Through these advancements, banks are able to offer more services, better manage risk and enhance overall efficiency and profitability (Ahamed et al. 2021; El Khoury et al. 2023). This relationship encompasses institutional theory, whereby financial systems can help in mitigating uncertainty, transaction costs and trust.

The incorporation of ESG can moderate banks' performance towards sustainability. However, this study incorporates it as an integral part of the model through a twofold role, first, as an immediate determinant. It is assumed that ESG enhances BPR by promoting sustainability, long-term risk management and socially responsible investment choices (Andrieș and Sprincean 2023; Liu et al. 2023). Second, it also enables banks to meet regulatory expectations and establish more robust relationships with customers and investors. While considering its moderating role, it potentially reduces the negative impacts of financial system instability and saturation by inculcating transparency, governance and environmental accountability standards. This study also considers the ESG role, as banks become robust to shocks when they adopt ESG standards (Galletta et al. 2023; Hin and Liu 2023).

Hereby, high ESG readiness at the economic level can strengthen banks. The economies that are prepared will have stable macrofinancial conditions, lower systemic risks and improved stakeholder confidence. This overall resilience minimizes the exposure of climate-induced risks to banks. Higher readiness also increases demand for financing in green investments and sustainable infrastructure. Hence, readiness to climate change not only reduces risks but also opens up profitable ventures (Battiston et al. 2017; Campiglio et al. 2018; Zhang et al. 2022).

3.2 | Econometric Approach

$$BPR_{it} = \beta_0 + \beta_1 FMP_{it} + \beta_2 FMP_{it}^2 + \beta_3 ENT_{it} + \beta_4 MOB_{wit} + \beta_5 INT_{it} + \beta_6 ESG_{it} + \beta_7\left(FMP_{it} * ESG_{it}\right) + \beta_7\left(FMP^2{}_{it} * ESG_{it}\right) + \varepsilon_t, \quad (1)$$

$$BPR_{it} = \beta_0 + \beta_1 FIP_{it} + \beta_2 FIP_{it}^2 + \beta_3 ENT_{it} + \beta_4 MOB_{wit} + \beta_5 INT_{it} + \beta_6 ESG_{it} + \beta_7 (FIP_{it} * ESG_{it}) + \beta_7 (FIP^2{}_{it} * ESG_{it}) + \varepsilon_t. \quad (2)$$

3.3 | Variables and Sample

Table 1 shows the entire list of variables employed in the analysis, as well as their descriptions and sources. This study takes panel data covering 93 financially advanced nations from 2008 to 2023. The list of countries is provided in Table A1. The dependent variable represents the national performance of banks. It indicates whether the banks are running efficiently regarding profitability, stability and long-term financial health; its symbol is BPR. The objective of taking this instrument is to test banks' performance in how banking systems react to

TABLE 1 | Variables and data sources.

Variable (symbol)	Short definition	Source
Bank's performance (BPR)	Annual average of an opinion survey of how healthy your bank is by World Economic Forum	World Economic Forum (Schwab 2018)
Financial market performance (FMP)	Index assessing depth, access and efficiency of financial markets	International Monetary Fund (IMF) (Svirydzenka 2016)
Financial institution performance (FIP)	Index assessing depth, access and efficiency of financial institutions	IMF (Svirydzenka 2016)
Entrepreneurship (ENT)	New business registered density	World Development Indicators (WDI 2021)
Mobile users (MOB)	Percentage of the population using a mobile phone	World Development Indicators (WDI 2021)
Internet users (INT)	Percentage of the population who has subscribed to the internet	World Development Indicators (WDI 2021)
Economic, social and governance factors (ESG)	Business economic, social and governance readiness to invest for climate change risks.	Norte Damme Gain (C. Chen et al. 2015)

Note: This table provides the names of variables used in the study with their definitions and data sources

financial and institutional changes over time. Schwab (2018) provides the indicator for the financial health of the banks across countries. In the case of financial development, FMP and Financial Institutional Performance (FIP) are the two most important independent variables for financial development. These variables are sourced from the International Monetary Fund (Svirydzenka 2016) and are accepted worldwide in research for the measures of depth, efficiency and availability of financial systems. Therefore, collectively this set of variables as a functional form assist in assessing the financial development role in determining banks' performance. Hence the context of the banks' financial health is relevant and is determined by external environmental and institutional factors like financial market and financial institution development (Ozili and Ndah 2024). The linkage between them is developed under the lens of external enabler theory (Davidsson et al. 2020).

The ESG indicator is also included in the model as both a determinant and a moderator. This variable is collected from the Notre Dame Global Adaptation Initiative and captures ESG readiness. C. Chen et al. (2015) provide the details of how each of the components is constructed. It reflects the ability of each country to manage ESG-related risks and adopt sustainable practices in their financial and banking sectors. Arshed et al. (2025) have used this ESG indicator at the macroeconomic level. ESG is an essential component in the study as it links sustainability with financial development and BPR. In addition to the main variables, three control variables are used to ensure robust analysis. ENT represents entrepreneurship, reflecting the innovative and productive activities in the economy. It helps explain how business creation influences banking performance. MOB and INT represent mobile phone usage and internet usage, both acting as proxies for digital transformation in the financial sector. These digitization indicators show how technological progress and digital access affect bank efficiency and customer engagement across countries.

3.4 | Estimation Method

This study has deployed the panel data set since the data varies across countries and over time. The advantage of this method is that it can aggregate the data to find common patterns to generalize the theory. Further, most studies used simple linear regression-based panel data models like Fixed and Random Effects, which have the ability to absorb unobserved heterogeneity. However, since it is expected that several pre-tests confirmed that the data are not normally distributed and have the presence of outliers, the standard least square method could be used for inference. This study uses the Panel Quantile Regression (Koenker 2005), which can estimate the marginal effect using medians, making them robust to outliers. Further, it can also estimate the marginal effects on the thicker data tails. Empirically, several studies (Sohail and Arshed 2022, 2023, 2024) have used this model in the context of banking. This study has also used the quadratic moderating effect of entrepreneurship on financial inclusion. The study by Haans et al. (2015) provided the framework for understanding the non-linear effects and visualized them using Dawson (2013). This model can provide estimates at different quantiles of the dependent variable, if there are subgroups in the data; this makes it a robust analysis. This study adds the M-Estimator by Huber (1973) as a model that can estimate nonnormal variables. This model minimizes robust loss using iteratively re-weighted least squares (IRLS). This model reduces the weights on the large residuals, and it is an Ordinary Least Squares (OLS)-like approach (Huber 1981).

4 | Results and Discussion

Table 2 provides the descriptive statistics of the data included in the study. Here, we can see that the mean and median are unequal, while the skewness is not nearing 0, and kurtosis is not nearing 3. All of them are concluded in the Jarque–Bera test showing that the variables are not normally distributed. The standard deviation shows how much the values in a data set vary or spread out from the average (mean). A slight standard deviation means the values are close to the mean, while a significant standard deviation indicates they are more spread out. It helps understand the consistency or variability in data. Table 3 provides the correlation matrix for the variables used in the study. It shows the correlations between independent variables; this section aims to assess if there is any hint of multicollinearity. Gujarati (2009) mentions that if the pairwise correlation is below 0.9, it would lead to Variance Inflation Factor less than the threshold of 10, confirming the absence of collinearity.

Figure 1 provides a detailed visual assessment of the normality of the dependent variable, BPR. Several graphical techniques, such as the histogram, kernel density plot and standard probability plot, are used for this purpose. These visualizations show that the distribution of BPR is left-skewed, indicating that most

TABLE 2 | Descriptive statistics.

Statistic	BPR	ESG	ENT	MOB	INT	FMP	FIP
Mean	5.181	0.477	3.881	116.058	55.938	0.333	0.513
Median	5.381	0.452	2.128	118.074	61	0.294	0.479
Std. Dev.	0.943	0.150	4.473	29.875	28.939	0.276	0.215
Skewness	−0.665	0.493	1.810	−0.382	−0.342	0.402	0.198
Kurtosis	3.233	2.279	6.592	3.899	1.862	1.905	2.171
Jarque–Bera	84.343***	69.153***	1204.139***	64.535***	81.656***	85.473***	39.049***

Note: This table provides the descriptives of the data in terms of mean, median, std. dev., skewness, kurtosis and Jarque–Bera test, which are helpful in understanding the data.
Abbreviations: BPR, bank performance; ENT, entrepreneurship; ESG, economic, social and governance factor; FIP, financial institution performance; FMP, financial market performance; INT, Internet users; MOB, mobile users.
***Significant at 1%.

values are concentrated towards the higher end, with a long tail on the left. This skewness reflects the presence of nonnormality in the data and suggests that BPR across the sampled countries is not evenly distributed. In particular, a high proportion of observations are clustered at the right tail, which highlights that a few countries have exceptionally strong BPR while others have relatively lower levels. This skewed distribution pattern confirms that using simple OLS regression may not be appropriate for reliable inference. Since OLS is based on the assumption of normally distributed residuals and constant variance, violating these assumptions could result in biased or inefficient estimates. Further, the concentration of values at one tail and the spread of extreme values increase the likelihood of heteroskedasticity in the residuals, where the error terms do not maintain constant variance across observations (Arshed 2020).

TABLE 3 | Correlation matrix.

	BPR	ESG	ENT	MOB	INT	FMP	FIP
BPR	1						
ESG	0.322	1					
ENT	0.255	0.543	1				
MOB	0.172	0.344	0.235	1			
INT	0.222	0.774	0.459	0.557	1		
FMP	0.367	0.703	0.314	0.264	0.582	1	
FIP	0.340	0.774	0.525	0.366	0.706	0.745	1

Note: This table provides the correlation between variables that can help assess the link between independent and dependent variables and the presence of multicollinearity.
Abbreviations: BPR, bank performance; ENT, entrepreneurship; ESG, economic, social and governance factor; FIP, financial institution performance; FMP, financial market performance; INT, Internet users; MOB, mobile users.

Figures 2 and 3 provide further support for this concern. These figures provide the Tukey fence plot (Tukey 1977). These figures visually detect the presence of outliers by comparing fitted values against residuals and using leverage plots. Both figures indicate a high frequency of extreme observations that do not align well with the normal distribution assumption. These outliers may distort the results under standard regression techniques, causing misleading interpretations. Hence, this study moves towards more robust econometric techniques that can handle nonnormal distributions and account for the presence of outliers. This approach ensures that the results are

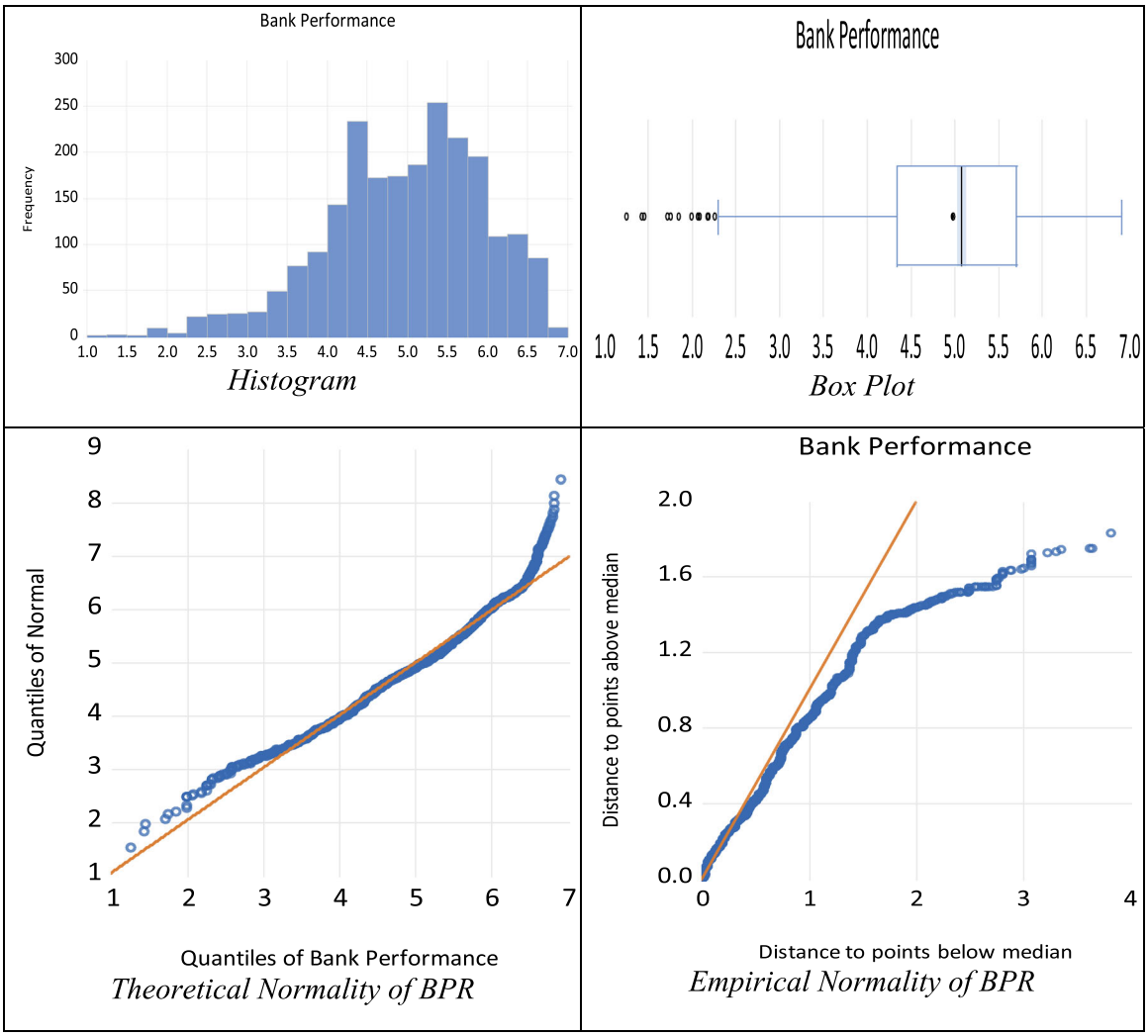

FIGURE 1 | Normality assessment. This figure includes four subplots: top left is the histogram of the dependent variable, top right is the box plot of the dependent variable, bottom left is the theoretical normality plot and bottom right is the empirical normality plot. All of them are designed to assess if the data are normally distributed or not. BPR, bank performance. [Color figure can be viewed at wileyonlinelibrary.com]

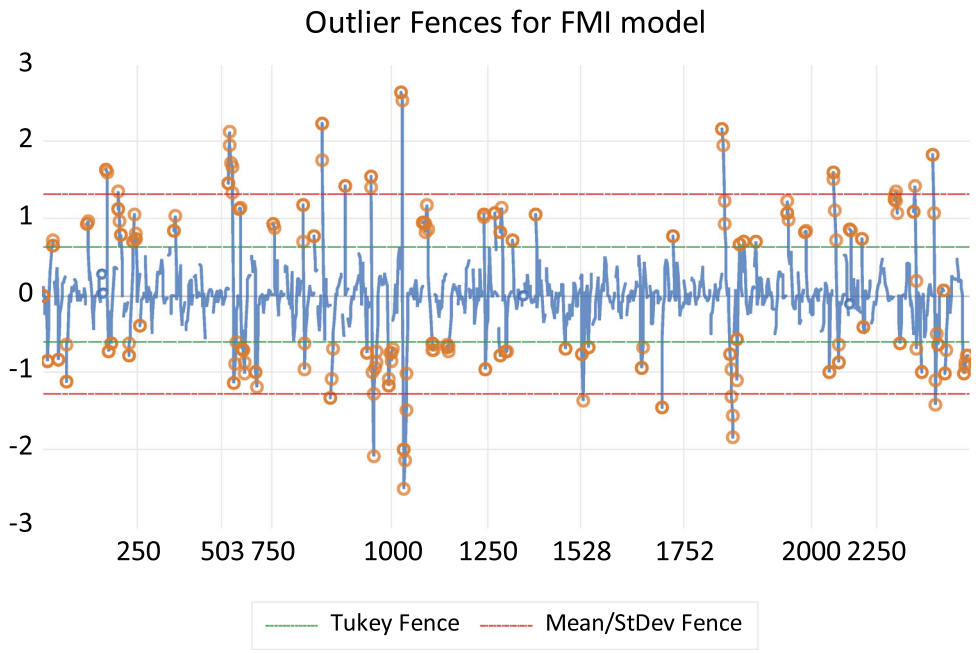

FIGURE 2 | Post estimates presences of outliers in the FMP model. FMI, financial market index; FMP, financial market performance. [Color figure can be viewed at wileyonlinelibrary.com]

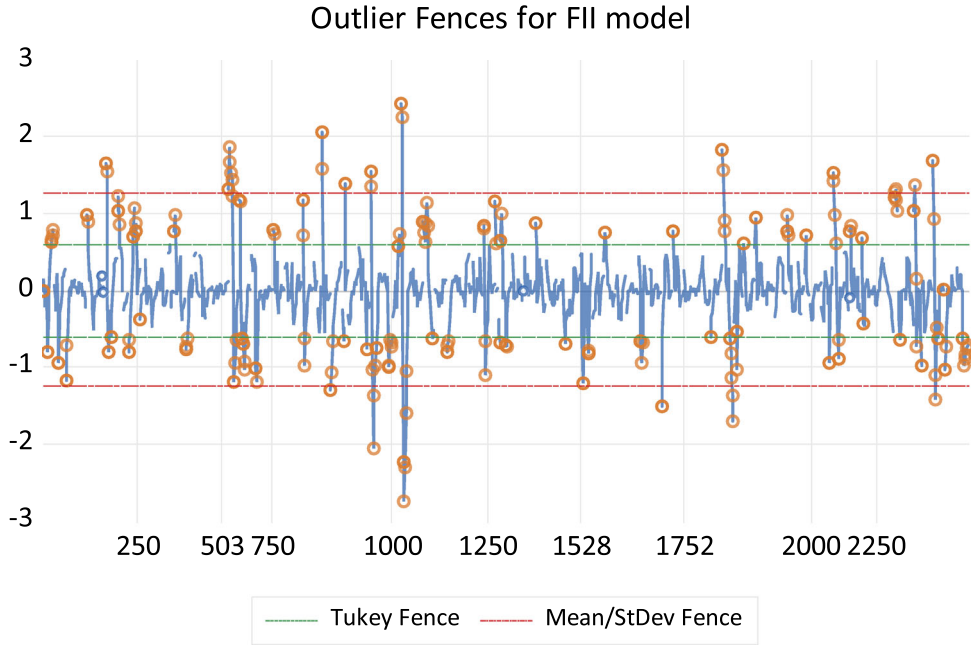

FIGURE 3 | Post estimates outliers in the FIP model. FII, financial institution index; FIP, financial institution performance. [Color figure can be viewed at wileyonlinelibrary.com]

statistically reliable and better reflect the actual behaviour of BPR across countries.

Table 4 presents the regression estimates using quantile regression at the median. There are two models: one using FMP as financial inclusion and the other using FIP as financial inclusion. The FMP model can explain 61% of the banking performance changes, while the FIP model can explain 62% of the changes in banking performance. Both the overall and redundant effects tests are significant, confirming that the models are fit, and the fixed effect-based unobserved heterogeneity is significant.

While discussing the control variables, a 1% increase in entrepreneurship increases bank soundness by 0.03% at the median. The results show that an increase in entrepreneurship leads to an increase in portfolio diversity, reducing the likelihood of losses. These results support the argument raised by Boot (2017) and Ghosh (2021). Further, for the case of access to the internet, its 1% increase leads to a decrease in bank soundness by 0.01% at the median. Studies show that an increase in internet access leads to an increase in online banking and reduces the cost of access to banking services. At the same time, it also increases financial management through

TABLE 4 | Panel quantile regression estimates.

Variables	Coef. (Prob.)	Coef. (Prob.)
ESG	2.03 (0.24)	−4.24 (0.11)
ENT	0.03 (0.00)***	0.03 (0.00)***
MOB	−0.001 (0.25)	−0.002 (0.11)
INT	−0.01 (0.00)***	−0.01 (0.00)***
FMP	1.24 (0.62)	
FMP^2	0.05 (0.38)	
FMP * ESG	−4.81 (0.38)	
FMP^2 * ESG	2.75 (0.55)	
FIP		−16.84 (0.00)***
FIP^2		20.75 (0.00)***
FIP * ESG		28.89 (0.00)***
FIP^2 * ESG		−33.66 (0.00)***
Country effects	Yes	Yes
R^2	0.61	0.62
Wald (Prob.)	391.02 (0.00)***	454.27 (0.00)***
Redundant effects test (Prob.)	102.71 (0.00)***	121.99 (0.00)***

Note: This table provides the estimates of the model using panel quantile regression for FIP and FMP models.
Abbreviations: Coef., coefficient; ENT, entrepreneurship; ESG, economic, social and governance factor; FIP, financial institution performance; FMP, financial market performance; INT, Internet users; MOB, mobile users; Prob., probability.
***Significant at 1%.

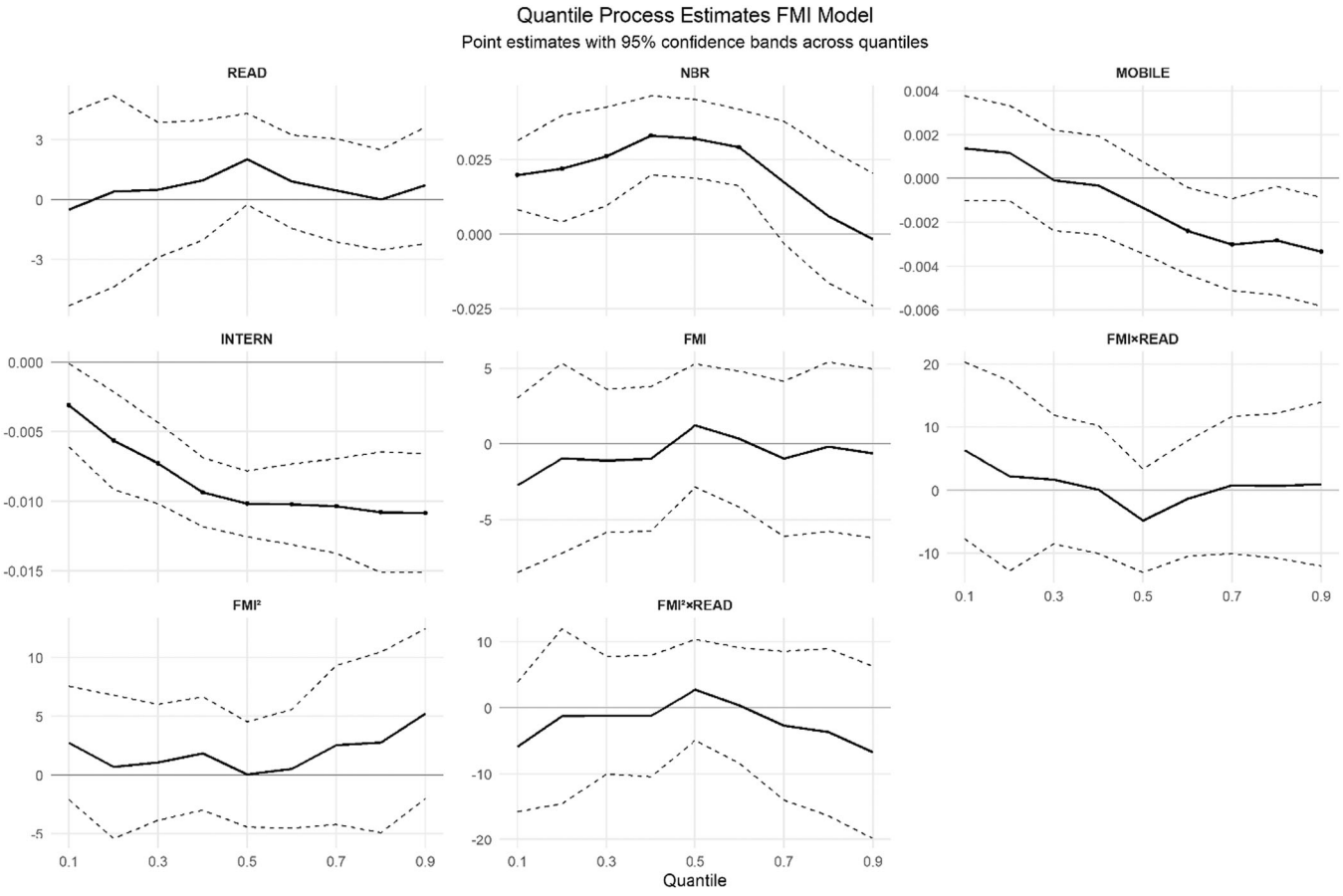

FIGURE 4 | Quantilewise effects of independent variables on BPR in the FMP model. This figure provides eight subplots. These plots represent all of the independent variables used in the model. In the graphs, the *y*-axis is the value of the coefficient and the upper and lower limit, while the *x*-axis is the quantile position of the dependent variable. BPR, bank performance; FMP, financial market performance.

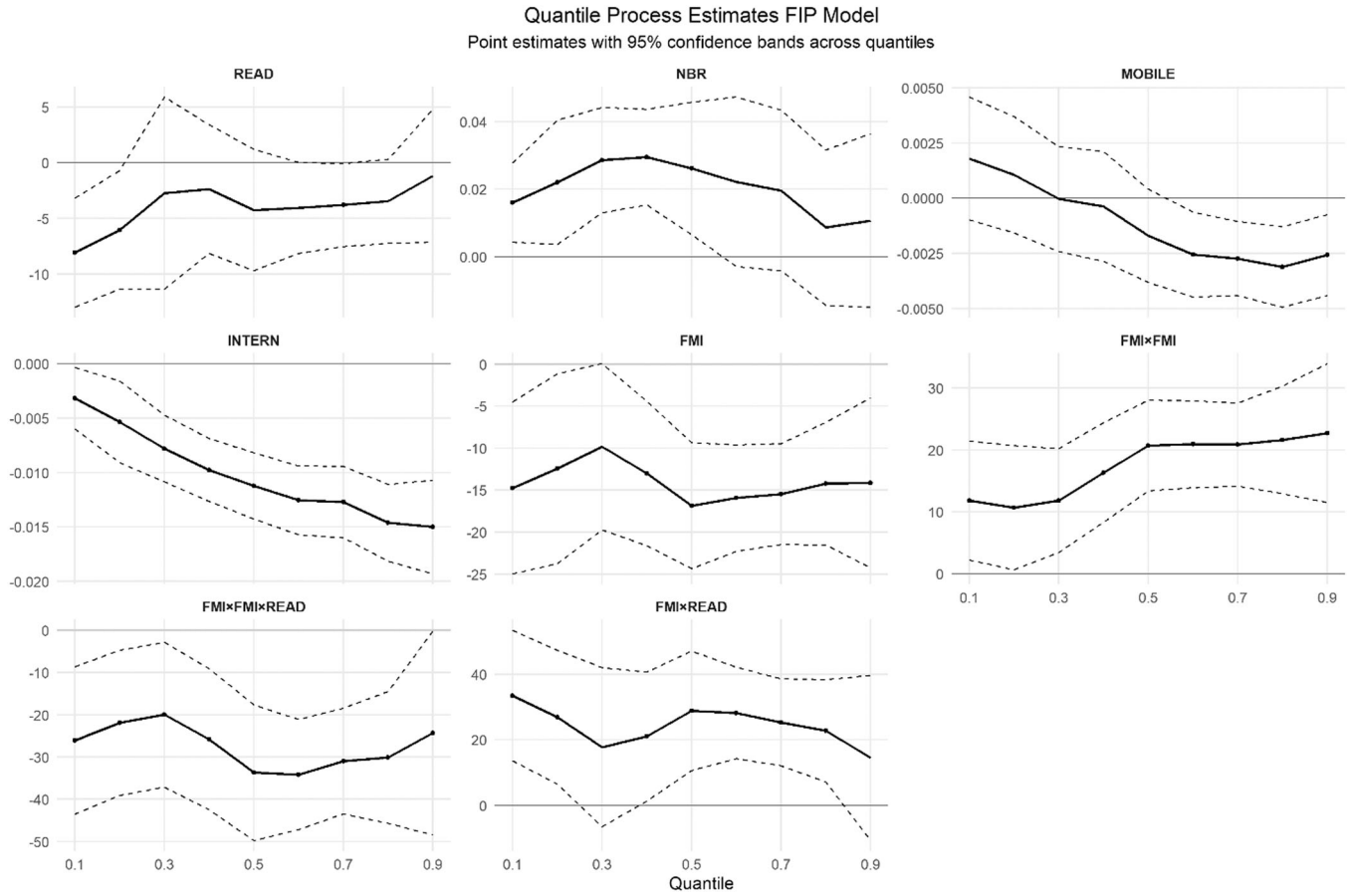

FIGURE 5 | Quantilewise effects of independent variables on BPR in the FMP model. This figure provides eight subplots. These plots represent all of the independent variables used in the model. In the graphs, the *y*-axis is the value of the coefficient and the upper and lower limit, while the *x*-axis is the quantile position of the dependent variable. BPR, bank performance; FIP, financial institution performance; FMP, financial market performance.

peer-to-peer platforms. This increases the competition, often unregulated among the banks (Y. Chen et al. 2018). Internet access also increases the cost of cybersecurity (Sha'ban et al. 2023). Lastly, increased entrepreneurship may also increase demand for equity finance, which is more risky for commercial banks to manage (Arshed and Kalim 2021). At higher percentiles of bank soundness, access to mobile phones also has a negative effect, as depicted in Figures 4 and 5.

ESG is generally insignificant, but Figures 4 and 5 show that banks with higher soundness tend to experience higher gains from ESG spending. This outcome is due to the requirement that banks be highly stable to fund ESG. The shortage of ESG has also been shown to have a high marginal impact (though insignificant) in Table 4. Table 5 adds to it by assessing the quantile symmetry. For both models, it is significant showing that quantiles are asymmetric, which points towards the need for quantile regression models.

While comparing the indicator of financial markets and financial institution-based performance, it can be noted that financial institutions are more potent in providing support for sound banks. The results of FIP show that a 1% increase in FIP leads to an initial decrease in soundness, as discussed by Y. Chen et al. (2018), but a persistent increase in FIP leads to an improvement in soundness. Conclusively, it has a U-shaped effect. The intuition behind this nonlinear pattern is that, initially, financial inclusion leads to an increase in new market entrants-based competition. However, this competition stabilizes when financial inclusion adds new demand for banking services. These results comply with the institutional theory where the financial system creates a regulatory environment that can facilitate the working of the banks. Further, the moderating role of ESG can be seen in the FIP model (Figure 6); here, the cross product of FIP and ESG is positive while the cross product of FIP squared and ESG is negative. This concludes that entrepreneurship flattens the U-shaped FIP and BPR relationship and, since ESG has a positive direct effect, the FIP and BPR relationship also becomes stable positive. This concludes that the transitioning time from a negative to positive effect of financial inclusion is reduced with ESG and is promoted at national level. From Figure 6 it can be seen that ESG helps with bank stability and improves FIP's marginal effect. The moderating role of ESG can be seen in the FMP model (Figure 7). The U-shaped impact on

TABLE 5 | Symmetric quantiles test.

Model	Chi-square statistic	Probability
FMP model	351.464	0.00***
FIP model	300.593	0.00***

Note: This table provides the test to confirm the asymmetry between quantiles in both FMP and FIP models.
Abbreviations: FIP, financial institution performance; FMP, financial market performance.
***Significant at 1%.

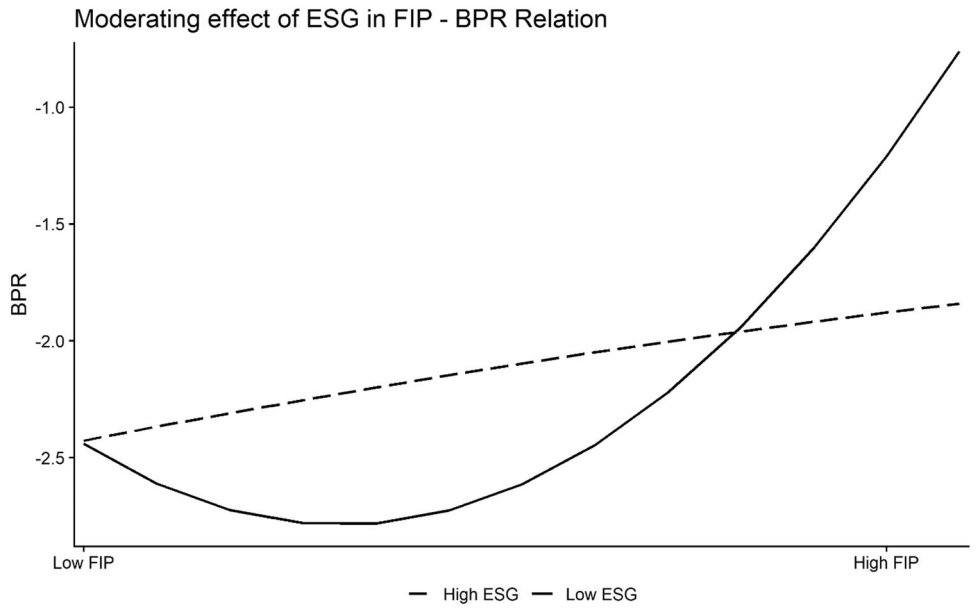

FIGURE 6 | Moderating role of ESG in the FIP model. This figure plots the quantile moderating effect. Here, BPR is on the *y*-axis and FIP is on the *x*-axis, while the shifting of the line represents the changes in ESG values. The solid line shows low ESG, while the dotted line shows the high ESG value. BPR, bank performance; ESG, economic, social and governance factor; FIP, financial institution performance.

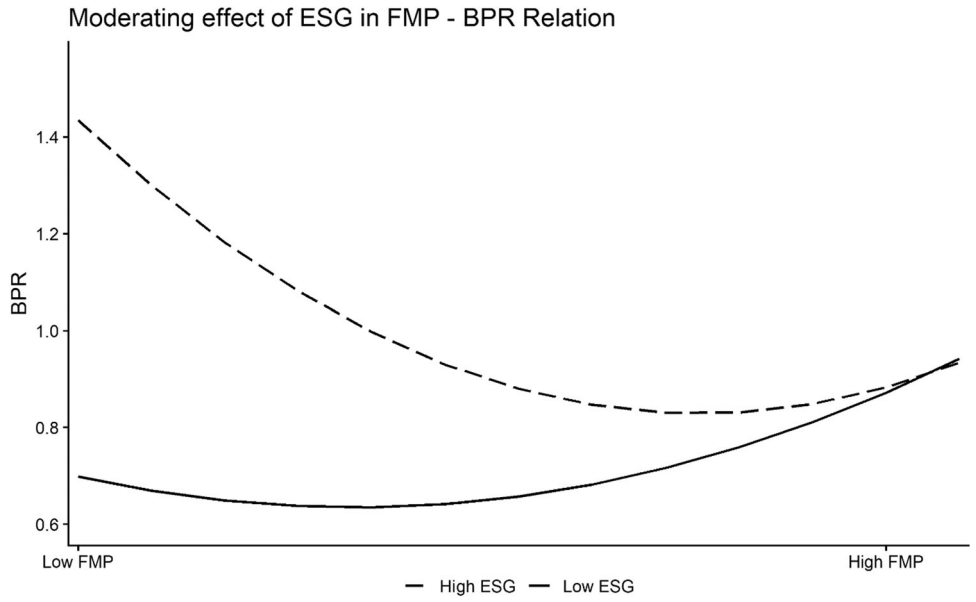

FIGURE 7 | Moderating role of ESG in the FIP model. This figure plots the quantile moderating effect. Here, BPR is on the *y*-axis and FMP is on *x*-axis, while the shifting of the line represents the changes in ESG values. The solid line shows low ESG, while the dotted line shows the high ESG value. BPR, bank performance; ESG, economic, social and governance factor; FIP, financial institution performance; FMP, financial market performance.

the performance of banks is validated. However, the moderating role of ESG has noticeably transformed FMP and shifted this U-shaped relationship upward until the turning point arrives. This ensures the sustainable practices of ESG.

Table 6 estimates the model using M-Estimation, which is also a competitive model that can be used when the data are not normally distributed. By comparing the slope coefficients, the results are similar for both models. This ensures that the estimation results are reliable and provide similar results across models.

5 | Conclusions and Policy

Bank stability is of prime importance when considering the effectiveness of monetary policy and national targets. Any changes in the national policy can alter the way banks operate. Considering the objectives of this study, the U-shaped impact of financial markets and institutions on BPR is validated, especially in the FIP model. To propose suitable policy implications, this study has incorporated ESG through economic, social and governance readiness. It is confirmed that incorporating ESG

TABLE 6 | Robust estimates using M-estimation.

Variables	Coef. (Prob.)	Coef. (Prob.)
ESG	0.87 (0.22)	−4.80 (0.00)***
ENT	0.02 (0.00)***	0.016 (0.02)**
MOB	−0.002 (0.01)**	−0.002 (0.02)**
INT	−0.01 (0.00)***	−0.01 (0.00)***
FMP	−1.14 (0.49)	
FMP^2	1.37 (0.50)	
FMP * ESG	0.14 (0.96)	
FMP^2 * ESG	0.14 (0.97)	
FIP		−14.45 (0.00)***
FIP^2		17.66 (0.00)***
FIP * ESG		29.25 (0.00)***
FIP^2 * ESG		−32.98 (0.00)***
Country effects	Yes	Yes
Observations	1111	1111
Rn squared statistics	313,552.8 (0.00)***	297,635.9 (0.00)***
R^2	0.65	0.67

Note: This table provides the estimates of the model using panel *M*-regression for FIP and FMP models.
Abbreviations: Coef., coefficient; ENT, entrepreneurship; ESG, economic, social and governance factor; FIP, financial institution performance; FMP, financial market performance; INT, Internet users; MOB, mobile users; Prob., probability.
***Significant at 1%.
**Significant at 5%.

improves banks' performance and moderates the financial institutions for sustainability in BPR. To bring comprehensiveness to the model, three control variables are included. Entrepreneurship is validated as a positive determinant, while internet usage negatively impacts BPR in both models. In the financial institutions model, mobile phone usage negatively determines the BPR, while it positively affects the financial market's model.

On the basis of the findings of this study, several strong and practical policy directions emerge that are valuable for diverse stakeholders involved in financial regulation, sustainability, innovation and banking performance. These implications are grounded in both empirical results and theoretical logic, aiming to create a stable and forward-looking financial system. First of all, governments, central banks and financial regulatory authorities must take the lead in embedding ESG readiness as a standard practice within the banking sector. The results indicate that ESG not only directly supports BPR but also softens the negative effects of financial deepening, especially in cases where financial systems become overextended or inefficient. From a stakeholder theory perspective, the presence of ESG encourages transparency, accountability and risk management, which leads to more sustainable financial systems. Therefore, regulatory frameworks must include clear ESG compliance benchmarks. Governments should also launch national ESG scoring systems that monitor and rank banks based on their ESG contributions. Central banks can play a supporting role by offering preferential refinancing rates or liquidity windows to banks that show consistent ESG adherence, as this strengthens the connection between financial soundness and sustainability. Central banks can integrate economic targets with environmental targets by motivating environmental blended credit expansion. The monetary policy can promote preferential rates for green financing, which can reap higher growth for firms, reducing the banking sector risks.

Second, entrepreneurship is a powerful and positive force in improving BPR, suggesting the need for more targeted efforts to build an entrepreneurial ecosystem. Ministries of finance, small business development agencies and economic policy institutions should create enabling environments by offering new ventures, tax rebates, subsidized interest rates and innovation grants. Entrepreneurship increases the demand for banking services such as loans, deposits and payment systems, which directly improve banks' business models. In this regard, policymakers must ensure that small- and medium-sized enterprises have access to affordable financial resources and that banks are encouraged to lend without excessive collateral requirements. National curricula must also consider entrepreneurial dynamics to foundation an innovation-driven financial culture from an early age.

Third, the estimated results of this study confirm the adverse impacts of internet use on banks' performance. Therefore, the findings could be said to designate possible harms of unwanted digital growth. Banks' information technology divisions, national cybersecurity institutions and financial regulators need to collaborate to create secure digital banking systems. There is an apparent necessity to raise investment in cybersecurity infrastructure to prevent attacks that unfold through extensive internet banking. Banks should be encouraged to implement multilayered authentication systems and make customers aware through country-wide digital literacy campaigns. Additionally, banks should also evaluate their operational efficiency and customer trust, which can be performed through periodic risk assessments to monitor internet banking operations.

Fourth, mobile phone usage has shown mixed effects, which calls for robust policy responses. While mobile technology enhances financial market access and activity, it weakens BPR in institutional setups. This points to a gap in strategy between technological innovation and institutional preparedness. FinTech regulators, telecommunications ministries and mobile service providers must coordinate efforts to design policies that do not simply expand mobile finance but also strengthen its integration with the traditional banking system. Banks should be encouraged to adopt mobile platforms that offer a seamless user experience without undermining their core institutional values and risk management frameworks. A national task force on mobile financial integration could be established to ensure that innovation is inclusive and sustainable.

Lastly, these findings open the door for academia, think tanks and policy researchers to contribute further by studying how ESG, entrepreneurship and digital tools shape the finance performance relationship in developing economies. This cross-learning can support the design of flexible policy models that adapt to diverse financial environments. This study validates the U-shaped impact of financial markets and institutions on BPR, highlighting the role of ESG readiness in improving performance and moderating the relationship for sustainability. While entrepreneurship, internet usage and mobile phone

usage add depth to the model, limitations remain. The study is constrained by the availability of data on ESG and its dual role and the specific focus on mobile and internet usage, which may not capture the full range of digital factors influencing BPR. Future research should explore broader digital transformation variables, such as FinTech integration, and examine the long-term effects of ESG practices across diverse banking environments to provide more comprehensive insights. Methodologically, future studies can explore dynamic panel data models to explore the empirical patterns and their implications on the data, which will help in developing long-run policy.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data will be made available on request.

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Appendix A

TABLE A1 | Sample countries.

Algeria	France	Lithuania	Romania
Argentina	Gabon	Luxembourg	Russian Federation
Australia	Georgia	Malawi	Rwanda
Austria	Germany	Malaysia	Saudi Arabia
Bangladesh	Ghana	Mali	Senegal
Barbados	Greece	Malta	Seychelles
Belgium	Guatemala	Mauritius	Sierra Leone
Benin	Guinea	Mexico	Singapore
Bhutan	Honduras	Mongolia	South Africa
Bosnia and Herzegovina	Hungary	Morocco	Spain
Botswana	Iceland	Namibia	Sri Lanka
Brazil	India	Nepal	Sweden
Brunei Darussalam	Indonesia	New Zealand	Switzerland
Bulgaria	Ireland	Nigeria	Thailand
Cambodia	Israel	Norway	Trinidad and Tobago
Canada	Italy	Oman	Tunisia
Chad	Jamaica	Pakistan	Uganda
Chile	Japan	Panama	Ukraine
Colombia	Jordan	Paraguay	United Arab Emirates
Costa Rica	Kenya	Peru	United Kingdom
Cyprus	Kuwait	Philippines	Uruguay
Denmark	Latvia	Portugal	Zambia
El Salvador			

Note: This table provides the countries in the sample.