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BANK INVESTMENT DENSITY AND ESG: A PATHWAY TO REDUCING INCOME INEQUALITY IN THE SOCIETY

Densidade de investimento bancário e ESG: um caminho para reduzir a desigualdade de renda na sociedade

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ABSTRACT

This study explores the influence of bank investment density measures by green and sustainable investment, fintech and digital banking, financial inclusion and social equity, smart cities, and infrastructure on the Gini coefficient and Theil index indicators of income inequality (SDG-10) in society. The study reveals that bank investment density towards sustainable investment activities significantly helps to reduce income inequality. Further, we find that moderating variable Environmental, Social, and Governance (ESG) compliance has restructured traditional banking practices to sustainable initiatives for long-term sustainability. Likewise, we reveal that mediating variable bank liquidity positively channelize the funds into sustainable investment initiatives. While mediating variable bank volatility restricts the bank's ability to allocate funds for sustainable investment projects. The managers should design rigorous risk management practices to effectively implement sustainable investment projects to combat income inequality in society.

Keywords: Income inequality, Bank investment density, ESG, Bank liquidity, Bank volatility
JEL Codes: D63, G21, Q56

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DENSIDADE DE INVESTIMENTO BANCÁRIO E ESG: UM CAMINHO PARA REDUZIR A DESIGUALDADE DE RENDA NA SOCIEDADE

Banking and ESG Investment Density: A Pathway to Reduce Income Inequality in Society

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RESUMO

Este estudo explora a influência das medidas de densidade de investimento bancário por investimento verde e sustentável, fintech e banco digital, inclusão financeira e equidade social, cidades inteligentes e infraestrutura no coeficiente de Gini e nos indicadores do índice de Theil de desigualdade de renda (ODS-10) na sociedade. O estudo revela que a densidade de investimento dos bancos para atividades de investimento sustentável ajuda significativamente a reduzir a desigualdade de renda. Além disso, descobrimos que a moderação da conformidade ambiental, social e de governança (ESG) variável reestruturou as práticas bancárias tradicionais para iniciativas sustentáveis para sustentabilidade de longo prazo. Da mesma forma, revelamos que a mediação da liquidez variável dos bancos canaliza positivamente os fundos para iniciativas de investimento sustentável. Ao mediar a volatilidade variável dos bancos, restringe a capacidade do banco de alocar fundos para projetos de investimento sustentável. Os gestores devem projetar práticas rigorosas de gerenciamento de risco para implementar efetivamente projetos de investimento sustentável para combater a desigualdade de renda na sociedade.

Palavras-chave: Desigualdade de renda, Densidade de investimento bancário, ESG, Liquidez bancária, Volatilidade bancária

INTRODUCTION

The restructuring of banking sectors after the 2008 financial sectors triggered major reforms in the banking sector globally. The European Union (EU) is the mainstream of interest, according to the EU Central Bank; the total investment of the EU banking sector is approximately €33 trillion around about 25% of the EU's GDP in 2019 (Almeida et al., 2023). The EU banking industry allocated 4 billion annually for IT and digital banking investment, while the capital adequacy ratio raised 9% to 15% from 2008 to 2015 under Basel III (Grossman & Woll, 2014). This has dramatically increased the bank investment density for growth and prosperity (Banks, 2018).

The density of investment involves allocating the funds across the numerous classes of assets, industries, and different segments of society to generate sustainable returns. However, adopting the Environmental, Social, and Governance (ESG) disclosures has modified conventional banking practices to sustainable banking for long-term sustainability (Mishra & Sant, 2024). Yan et al. (2019) argues that ESG practices absorb the density of investment sensitivity by directing funds toward initiatives and projects that are aligned with long-term sustainability goals. Therefore, sustainable investment practices further enhance the density of investment in green and sustainable initiatives.

According to Sadiq et al. (2022), the banking industry is the major source of funding for sustainable entrepreneurial activities and creating job opportunities for long-term sustainability. Kara et al. (2021) argues that investment density towards sustainable investment practices is significantly contributed to reducing the income inequality in the society an indicator of the Sustainable Development Goal (SDG 10). The density of investments in emerging areas is more beneficial to the deprived segments of society. Thompson et al. (2018) argued that aligning ESG compliance with firms' strategic objectives further enhances the density of investment towards the initiatives and projects that yield not only financial return but also positive social outcomes. Habib, Khan, Haddad, et al. (2024) finds that banks that adopt ESG compliance provide more affordable banking services, loans, and credits to lower-income segments of society that help to reduce the income gap in the community.

The density of investment to long-term sustainability may be affected by the important factors e.g. bank's liquidity and volatility. High liquidity warrants that allocated funds are sufficient to finance the business operations and reduce investment volatility (Roncoroni et al., 2021). However, lower liquidity of a bank reduces its ability to finance business operations as well as the investment density for long-term sustainability (Torre Olmo et al., 2021). To finance investment projects e.g. green infrastructure, green energy, social projects and environment business models, a large amount of funds is often required (Dudley, 2012). The firms have sufficient funds to improve the investment density by funding these projects for long-term sustainability. Barko et al. (2022) explains that it is liquidity that has a dynamic role to adopt ESG practices for long-term sustainability. Similarly, Habib, Khan and Tangl (2024) argue that liquidity enables firms to adopt ESG compliances more flexibly . They ensure that ESG practices become an integral part of corporate strategies to combat income inequality in society. Furthermore, Dicuonzo et al. (2022) explains that ESG compliance is aligned in modern banking practices that contributes to long-term sustainability as well as significantly reduces the income disparity in society.

This aim of this study is to examine the role of bank investment density in reducing income inequality in society as an indicator of SDGs (10). The study investigates how bank investment density across various dimensions accelerates entrepreneurial activities and contribute to long-term sustainability (Zhang & Dilanchiev, 2022). Additionally, we explore whether the adoption of ESG practices enhances the investment density to combat income inequality in society (Malik & Sharma, 2024). This study also highlights the dynamic role of bank liquidity and volatility in designing the optimal level of investment density for long-term sustainability (Bouteska et al., 2024). The objective of this study is to find how banks stabilize their liquidity and volatility to make effective investment, especially to enhance their ESG practices and reduce income inequality.

1 LITERATURE REVIEW AND HYPOTHESIS DEVELOPM

According to Freeman (1999), stakeholder theory emphasizes that a firm's investment strategy should focus on all stakeholders rather than just shareholders that is closely aligned with bank investment density. Modern banking practices align the stakeholders' approach with corporate investment strategy. They consider the broader impact of their investments on stakeholders including customers, employees, regulators, communities and the environment for long-term sustainability. Scholtens (2006) argues that emerging corporate investment strategy is

heavily designed around sustainability, social responsibility and financial stability. It can enhance the bank's reputation, growth potential and ensure value for all stakeholders. Similarly, Balp and Strampelli (2022) explains that stakeholders theory aligns the bank investment density with ESG compliance to address the interest of numerous stakeholders and support to equal distribution of wealth. The emerging areas of bank investment density are green and sustainable investment, fintech and digital banking, financial inclusion, social equity, smart cities and infrastructure.

1.1 Green and Sustainable Investment

Bank investment density to generate a positive rate of return has been broadened through the emerging areas of green and sustainable investment e.g. carbon emissions, renewal energy, energy efficiency, climate resilience and protection of biodiversity projects (Boyd et al., 2015). The banking industry has shown commitment in the past decade to become carbon neutral in its business operations and sustainable portfolio investment for long-term sustainability (Yip & Bocken, 2018). The alignment of corporate investment strategy with sustainable investment is in the core domain of the bank's sustainable advisory unit by identifying the threats and opportunities of green and sustainable investment for long-term sustainability (Chatzitheodorou et al., 2019).

Further, the government and financial bodies are introducing more stringent rules for the banking industry to allocate more funds for green and sustainable projects (Dikau & Volz, 2021). Banks are addressing these challenges by aligning investment risk assessments into their sustainable risk management process and designing their corporate strategy in line with global sustainable frameworks, like EU green taxonomy, climate financial disclosures, and principles for responsible banking (Harclerode et al., 2016). Green and sustainable investment practices promote positive social outcomes by creating sustainable employment opportunities in the market. Camilleri (2021) argued that the impact of sustainable investment is complex and multifaceted the potential to address the income inequality in society. Urban and Wójcik (2019) finds that modern banking practices are addressing income inequality by transitioning traditional investment to sustainable investment for long-term sustainability. Therefore, green and sustainable investment density is crucial in combating income inequality in society.

Hypothesis 1: The bank's green and sustainable investment density significantly reduces income inequality in society.

1.2 Fintech and Digital Banking

Fintech and digital banking encompass various applications to improve or automate financial services like online banking, peer-to-peer lending, AI-driven investment, opening online accounts, transferring funds, online bank loans, and investment products through digital channels (Popova, 2021). Fintech and digital banking offer more accessible and affordable services to all customers through lower fees and better interest rates. This enables the potential clients to participate in the financial systems and positively contribute to economic growth (Stulz, 2019). Grassi et al. (2022) argued that Fintech and digital banking practices analyze customer data, offer customized recommendations, proposed financial advice, and even optimized investment portfolios for long-term sustainability. It creates new ways for individuals and businesses to interact with money, fostering new ventures and job opportunities while enhancing financial inclusion and empowerment.

Demir et al. (2022) explain that fintech and digital banking are reducing barriers to entry in the financial landscape and narrowing the gap between the high and low-income groups, empowering society to manage their resources more effectively and design a sustainable investment for long-term sustainability. Ferilli et al. (2024) explains that fintech and digital banking have the potential to combat income disparity by democratizing access to financial resources, enhancing economic participation, and offering innovative solutions to deprived groups in society. Therefore, the bank investment density toward fintech and digital banking helps to reduce income inequality in society.

Hypothesis 2: The bank fintech and digital investment density significantly help to reduce income inequality in society.

1.3 Financial Inclusion and Social Equity

The sustainable banking practices also added financial inclusion and social equity into their portfolio for the provision of essential financial services to underserved segments of the population (Mishra & Sant, 2024). The microloan is granted to low-income communities for starting small businesses or accessing basic needs like education and healthcare. Almeida et al. (2023) argued that micro financing empowers small businesses in marginalized communities to start new businesses or expansion of existing businesses for sustainability. Yan et al. (2019) banks promote financial inclusion by offering numerous types of products such as micro-credit, accessible saving accounts, agro-financing and educational programs to low-income groups of society for long-term sustainability.

Bouteska et al. (2024) argued that the banking industry is a major contributor to affordable housing loans, and low-free accounts to deprive the segment of society of economic mobility. Additionally, the promotion investment density in underserved regions whether through physical branches, digital banking, or collaboration with the local community support access to financial services, which can enhance economic stability and reduce poverty (Dicuonzo et al., 2022). Torre Olmo et al. (2021) explain that banks' alignment of bank investment density with social equity principles expands the benefits of financial inclusion to marginal communities and stimulates economic growth. This holistic approach promotes a financial ecosystem that integrates with social and environmental sustainability goals which help to reduce the income inequality in the society (Zhang & Dilanchiev, 2022).

Hypothesis 3: The bank investment density towards financial inclusion and social equity significantly helps to reduce income inequality in society.

1.4 Smart Cities and Infrastructure

The bank's investment density expands its investments to smart cities and infrastructure that integrate advanced technologies, data analysis, and innovative infrastructure to promote urban living, increase efficiency, and reduce carbon emissions (Balp & Strampelli, 2022). Camilleri (2021) noted that the banking sector is a major source of financing for the development of smart cities and infrastructure in areas such as energy, transportation, telecommunication, and financial services. Yip and Bocken (2018) explains that banks offer various products like loans, green bonds, and project finance to municipalities and private sector organizations to invest in advanced technologies and infrastructure for the development of smart cities.

Further, Urban and Wójcik (2019) argued that banks have expanded their financing to large-scale smart city infrastructure projects like public transportation systems, smart grids, and wastewater management projects. Sustainable bank financing reduces the uncertainty surrounding the return on investment for large-scale projects and uplifts the deprived part of society (Yip & Bocken, 2018). Therefore, the banks provide substantial capital investment in the advancement of smart cities and infrastructure through various instruments like project financing, green bounds, and venture capital that significantly help to reduce income inequality in society.

Hypothesis 4: The bank investment density of smart cities and infrastructure significantly helps to reduce income inequality in society.

1.5 Bank Investment Density and ESG Sustainability

The banking industry is under increasing pressure to integrate its investment density with ESG principles (Popova, 2021). This has stimulated the banking firms to reallocate funds to reduce the investment density in fossil fuels and high-emission industries while enhancing density in green infrastructure, green technology, and other sustainable industries (Yip & Bocken, 2018). The stakeholders' theory appeals to banking firms to align the ESG criteria into their investment decisions to address regulatory requirements and stakeholders' interests. Harclerode et al. (2016) argues that ESG investment practices have reported exponential growth, especially after addressing climate change, social justice, and corporate sustainability. Demir et al. (2022) finds that ESG practices reshaped

the traditional investment strategy with sustainable projects that positively contributed to reducing the income disparity in society. The bank investment density in ESG compliance sectors not only enhances a positive return on investment (Ferilli et al., 2024) but also social justice, fair labor practices, and environmental sustainability which significantly help to reduce the income disparity in society (Grassi et al., 2022).

Hypothesis 5: The ESG practices enhance the influence of bank investment density to reduce income inequality in society.

1.6 Bank investment Density and Liquidity

A higher investment density indicates that a significant amount of capital is tied up in long-term investments, which may not be immediately liquidated to pay off the short-term obligations (Wang et al., 2018). While this may generate a higher return on investment due to the greater profitability of these assets. It reduces the firm's short-term liquidity and restrict its ability to quickly convert assets into cash (Liu et al., 2024). On the other hand, banks that maintain more liquidity to meet short-term liabilities may sacrifice potential sources of earnings from long-term investments (Amalia et al., 2024).

Mishra and Sant (2024) argues that financial institutions should prioritize investment density to meet liquidity challenges in times of financial crisis, as this may be in a position to liquidate long-term investments without incurring losses. Roncoroni et al. (2021) identifies that sustainable investment density is supported by the lower level of liquidity for long-term sustainability. Further, it explains that the trade-off between liquidity and investment density significantly influences income inequality in society. Sadiq et al. (2022) reports that liquidity directly or indirectly intervenes in the bank's sustainable investment density which significantly helps to reduce income inequality in society.

Hypothesis 6: The bank liquidity may influence the bank investment density in addressing income inequality in society.

1.7 Bank Investment Density and Investment Volatility

The bank investment density can be enhanced by allocating capital across different assets to seek higher returns while reducing investment volatility. Zabavnik and Verbič (2024) argued that investment density can provide higher returns; it also increases investment volatility, as the bank becomes more volatile to market fluctuations in these specific areas. Further, Vuong et al. (2024) reported that high investment density often results in higher volatility because their investments are more sensitive relative to general market fluctuation. To generate stable cash flows, banks reduce the volatility by trade off risk and return in their corporate investment strategy. Additionally, Yang et al. (2020) explains that diversification of investment portfolio can mitigate the idiosyncratic risk of a bank however, systematic risk depends on the financial capacity of each firm. Meng et al. (2024) argued that bank investment density toward sustainable investment projects improves their financial capacity to resist the systematic risk caused by market fluctuation. Song et al. (2023) explained that bank investment density in sustainable projects leads to lower systematic risk and a greater capacity to positively contribute to society. Urban and Wójcik (2019) find that firm’s investment in sustainable projects have lower risk and are more sustainable, helping to reduce the income inequality in society.

Hypothesis 7: The volatility of banks’ investment influences their investment density to address income inequality in society.

2. DATA AND METHODOLOGY

2.1 Sample Selection

In this study, data of the listed commercial banks of European Union (EU) countries over the period from 2014 to 2023 is used by employing the cluster sampling method. The sample is devised through stratified sampling based on factors like bank investment density, ESG rating, bank liquidity and volatility. The data is extracted from the Standardized World Income Inequality Database and Thomson Reuters. To extract data on each variable, we mark the country, period and specific variable name within the respective database. This process helps us to manage

the data in the same sequence within a specific period. Initially, we extracted data from 1270 listed banks across. After filtering out missing and incomplete observations of each variable, we get a final dataset of 985 listed commercial banks across 48 EU. Table 1 shows the sample selection and summary statistics.

Table 1 - Sample and summary statistics

Panel 1-Sample Selection	
Yearly observations of firms from 2014-2023	12700
Less missing data of banks investment density variables	735
Less firms do not match with ESG Compliance and ESG Score	770
Less firms do not have mediating variable liquidity and volatility data	488
Less firms have incomplete data on control variables and do not match	857
Final sample to analyze the bank density and income inequality	9850

2.2 Variable Measurement

This study aims to examine the influence of Bank Investment Density (BID) on the income inequality of listed banks in EU member countries over the period from 2014 to 2023. The world inequality database is used for the Gini coefficient and Theil index as proxies of income inequality in society (Mishra & Sant, 2024). The Gini coefficient represents income or wealth distribution to quantify income inequality in society. The Gini coefficient is commonly used by organizations like the World Bank, IMF and numerous regional alliances like the EU, ASEAN and national governments in the projection of inequality and its consequences on social stability, health and economic growth (Sadiq et al., 2022). The ranges of the Gini coefficient lie between 0 and 1, where 0 indicates perfect equality and 1 indicates perfect inequality in society. Similarly, the index is also used to assess income inequality in society. It decomposes the entire population between-group and within-group of society to access income inequality. This means the index is a representation of the population divided into subgroups by region, industry, etc. It examines the percentage of inequality that exists within each sub-group and between-sub-groups. The ranges of the index between 0 and 1, where 0 indicates perfect equality and 1 perfect inequality.

The independent variable Bank Investment Density (BID) reflects the allocation of bank capital towards the specific investment. The BID is measured by the bank's long-term investment toward the specific sectors/ total investment over the period from 2016 to 2023 (Yan et al., 2019). The moderating variable bank sustainability is the yearly ESG score secured by a bank over eight years. The mediating variable bank liquidity is short-term assets divided by total assets and beta is the volatility of the firm investment (Roncoroni et al., 2021). We also include the control variables like operating cash flows, firm size, and leverage are used in previous studies to test the investment density on income inequality. The data on bank variables and ESG are collected from the Bloomberg database to test the hypotheses. Table 2 shows the variable estimation, acronym, expected sign, and multicollinearity of each variable.

Table 2 - Variable estimation, acronym, and multicollinearity of each variable

Variable	Agronomy	Measurement	Multicollinearity		Expected sign
			Toler	VIF	
Income Inequality					
(i) Gini Coefficient	Gini Coefficient	World Inequality Index score			
(ii) Theil index	TI	World Inequality Index score	0.67	1.65	
Bank Investment Density	BID				

(i) Green and sustainable investment	GSI	Bank investment in green and sustainable investment/total investment	0.59	1.32	Neg (-)
(ii) Fintech and digital banking	FDB	Bank investment in Fintech and digital banking/ total investment	0.68	1.48	Neg (-)
(iii) Financial inclusion and social equity	FI&SE	Bank financial inclusion and social equity	0.43	1.23	Neg (-)
(iv) Smart cities and infrastructure	SC&IF	Bank investment in smart cities and infrastructure/ total investment	0.54	1.34	Neg (-)
Bank sustainability	ESG Score	Bank yearly ESG score	0.47	1.41	Neg (-)
Bank liquidity	BLIQ	Short-term assets/ total assets	0.54	1.39	Neg (-)
Bank volatility	BV	Systematic risk of firm investment	0.65	1.52	Neg (-)
Sales Growth	Growth	Percent growth in dales	0.73	1.64	Neg (-)
Firm size	FS	Log of total assets	0.63	1.53	Neg (-)
Cash flow	CF	Operation cash flows/fixed assets	0.59	1.54	Neg (-)
Leverage	LEV	Long-term debt/total assets	0.63	1.59	Neg (-)

2.3 Methodology

The existing studies employ regression analysis as the main tool to examine sustainable investment practices but these studies fail to address the correlations of errors and unbiased estimation due to the omission of errors in the regression analysis (Bouteska et al., 2024). We use the Breusch-Pagan test to check the heteroskedasticity and it finds positive in our econometric model. We check the endogeneity in analysis using the two-stage least squares regression and find that the endogeneity problem exists among the variables (Malik & Sharma, 2024). Further, Tolerance (Tolr) and Variance Inflation Factor (VIF) are below their respective range, indicating no multicollinearity problem in our model.

When analyzing residual error, we reveal that residual errors are correlated across years for a given firm and across time, so we mark the source of dependence in the dataset. If there is an effect of firm sign, clustering by firms can generate unbiased standard errors (Torre Olmo et al., 2021). When clustering by both year and firm, the standard errors are estimated based on two dimensions firm identifier and time identifier within a cluster correlation. Therefore, both dimensions are controlled by clustering the observation based on both the industry effect and the year effect. To analyze this study, we design the following model to examine the sustainable investment density toward income inequality in society (Zhang & Dilanchiev, 2022).

Model 1(without interaction)

$$\text{Gini Coefficient} = \mathrm{C} + \beta_1 \mathrm{BID}_{it} + \beta_2(\mathrm{ESG}_{it}) + \beta_3 \mathrm{Liq}_{,it} + \beta_4 \mathrm{BV}_{,it} + \beta_5 \mathrm{FS}_{,t} + + \beta_5 \mathrm{CF}_{it} + \beta_7 \mathrm{LEV}_{it} + \mu_{it}$$

Model 2(with interaction)

$$\text{Gini Coefficient} = \mathrm{C} + \beta_1(\mathrm{BID}_{it}) + \beta_2(\mathrm{ESG}_{it}) + \beta_3(\mathrm{ESG}_{it} \times \mathrm{BID}_{it}) + \beta_4(\mathrm{Liq}_{,it}) + \beta_5(\mathrm{BV}_{,it}) + \beta_6(\mathrm{FS}_{it}) + \beta_7(\mathrm{CF}_{it}) + \beta_8(\mathrm{LEV}_{it}) + \mu_{it}$$

Model 3 (with interaction)

$$\text{Gini Coefficient} = \mathrm{C} + \beta_1(\mathrm{BID}_{it}) + \beta_2(\mathrm{ESG}_{it}) + \beta_3(\mathrm{BID}_{it} \times LIQ) + \beta_4(\mathrm{Liq}_{,it}) + \beta_5(\mathrm{BV}_{,it}) + \beta_6(\mathrm{FS}_{it}) + \beta_7(\mathrm{CF}_{it}) + \beta_8(\mathrm{LEV}_{it}) + \mu_{it}$$

Model 4 (with interaction)

$$\text{Gini Coefficient} = \mathrm{C} + \beta_1(\mathrm{BID}_{it}) + \beta_2(\mathrm{ESG}_{it}) + \beta_3(\mathrm{BID}_{it} \times \mathrm{SR}_{it}) + \beta_4(\mathrm{Liq}_{,it}) + \beta_5(\mathrm{BV}_{,it}) + \beta_6(\mathrm{FS}_{it}) + \beta_7(\mathrm{CF}_{it}) + \beta_8(\mathrm{LEV}_{it}) + \mu_{it}$$

3 RESULTS AND DISCUSSION

3.1 Descriptive Statistics

Table 3 shows the descriptive statistics of variables use to test the hypotheses. As part of the data analytic preparation, all variables have been winsorized at the one and ninety-nine percentiles of the corresponding data set (Maalouf, 2024). The mean values of dependent variables Gini coefficient (0.27) and Theil index (0.15) indicate that income inequality is relatively low in EU member countries. The Gini coefficient and Theil index have medium values (Gini: 0.24 and Theil index: 0.13) and lower standard deviation (Gini: 0.13 and Theil: 0.06) indicating that only a small percentage of data deviates from their mean values (Balp & Strampelli, 2022).

Table 3 - Descriptive Statistics

Variable	Mean	Median	Std.	Min	Max	observations
Gini Coefficient	0.27	0.24	0.13	0.19	0.39	9850
TI	0.15	0.13	0.06	0.06	0.19	9850
GSI	0.10	0.08	0.04	0.03	0.20	9850
FDB	0.60	0.63	0.17	0.32	0.87	9850
FI&SE	0.68	0.73	0.09	0.38	0.92	9850
SC&IF	0.63	0.69	0.13	0.41	0.93	9850
ESG Score	0.64	0.62	0.14	0.44	0.92	9850
BLIQ	0.75	0.69	0.12	0.54	0.91	9850
BV	0.21	0.18	0.06	0.06	0.34	9850
Growth	0.04	0.04	0.02	0.02	0.11	9850
FS	0.54	0.59	0.13	0.24	0.76	9850
LEV	0.08	0.06	0.01	0.03	0.12	9850

Likewise, the mean and medium values of independent variables like GSI (mean: 0.10 and medium: 0.08), FDB (mean: 0.60 and medium: 0.63), FI&SE (mean: 0.68 and medium 0.73), and SC&IF (mean: 0.63 and medium: 0.69) indicate that large portion of data for this independent variable is normally distributed across the entire dataset (Balp & Strampelli, 2022). The lower standard deviation and small spread between maximum and minimum values indicate that large volumes of data cluster closely around their mean values (Yip & Bocken, 2018). Further, the higher mean and medium values of sustainability variable ESG score (mean: 0.64 and medium value: 0.62) suggest that the EU banking industry is largely financing the projects that are more beneficial to society (Camilleri, 2021). Moreover, the mean values of BLIQ and Vol, (0.75 and 0.21) along with their medium values (0.69 and 0.18) and relatively lower standard deviation (0.12 and 0.06) respectively show that the banking industry maintains a large amount of liquidity (Zabavnik & Verbič, 2024). This indicates that banking firms maintain large amounts of liquidity to reduce volatility and the costs associated with financial distress. Additionally, the descriptive statistics of control variables like Growth, FS, and LEV also show data of these variables is also distributed smoothly and can be used for future research analysis (Dikau & Volz, 2021).

3.2 Correlation Analysis

Table 4 presents the correlation analysis of variables under consideration to test the hypotheses. The independent variables GSI (0.32 and -0.39), FDB (-0.41 and -0.46), FI&SE (-0.37 and -0.53), and SC&IG(-0.42 and -0.46) are significantly negatively correlated with the dependent variables Gini coefficient and Theil index respectively. The findings indicate the increase of bank sustainable practices significantly helps to reduce the income inequality in the society (Yip & Bocken, 2018). Further, the sustainability variable ESG score is also negatively correlated (-0.33 and -0.38) with the Gini coefficient and Theil index respectively. It guides that the adoption of ESG practices plays a significant role to combat the income inequality in the society (Popova, 2021).

Table 4 - Correlation Analysis among the variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1-Gini Coefficient	1											
2-TI	0.44	1										
3-GSI	-0.32[a]	-0.39[a]	1									
4-FDB	-0.41[a]	-0.46[a]	0.26[b]	1								
5-FI&SE	-0.37[a]	-0.53[a]	0.19[c]	0.23[a]	1							
6-SC&IF	-0.42[a]	-0.46[a]	0.15[b]	0.15[a]	0.18[a]	1						
7-ESG Score	-0.33[a]	-0.38[a]	0.23[b]	0.16[a]	0.32[a]	0.20[a]	1					
8-BLIQ	0.45[a]	0.42[b]	0.17[a]	0.21[a]	0.21[a]	0.19[a]	0.18[a]	1				
9-BV	-0.26[a]	-0.23[a]	0.23[a]	0.22[b]	0.15[a]	0.24[a]	0.22[a]	0.22[a]	1			
10-Growth	-0.34[a]	-0.33[a]	0.31[b]	0.25[b]	0.17[a]	0.18[a]	0.13[b]	0.12[a]	0.25[a]	1		
11-FS	-0.39[a]	-0.38[b]	0.17[a]	0.19[a]	0.14[b]	0.17[a]	0.18[b]	0.17[a]	0.23[a]	0.21[a]	1	
12-LEV	-0.29[a]	-0.27[a]	0.22[a]	0.15[c]	0.22[a]	0.23[b]	0.16[a]	0.17[a]	0.26[b]	0.15[b]	0.17[a]	1

[***]significant at 1%, [**]significant at 5%, [*]significant at 10%

While the bank-specific variable bank liquidity BLIQ (0.45 and 0.42) is significantly positively correlated with the Gini coefficient and Theil index. It guides that maintaining more liquidity reduces the bank's ability to finance sustainable investment activities (Camilleri, 2021). However, other bank-specific variables like BV (-0.26 and -0.23), Growth (-0.34 and -0.33), FS (-0.39 and -0.38), and LEV (-0.29 and -0.27) are significantly negatively correlated with Gini coefficient and Theil index. The findings indicate promotion of banking activities negatively impacts income inequality in society (Liu et al., 2024). Further, independent variables are weakly significantly correlated with each other, which indicates no multicollinearity problem exists in our research mode.

3.3 Cluster Regression Analysis

Table 5 presents the results of cluster regression analysis to examine the impact of bank investment density on income inequality in society (Demir et al., 2022). The independent variable green and sustainable investment GSI (β= -0.073 and β= -0.065) significantly negatively explain the dependent variable Gini coefficient and Theil Index respectively as proposed in hypothesis 1. The significant negative effect shows that bank green and sustainable finance is an emerging area of investment that contributes to reducing income inequality in society (Yang et al., 2020). Ferilli et al. (2024) argues that the banking industry allocates a significant amount of funds for green and sustainable investment practices that simultaneously create economic opportunities for underprivileged communities. This dual aspect of green and sustainable investment help to bridge the income gap to ensure the benefits of sustainable investment are shared equitability across society (Grassi et al., 2022).

The independent variable fintech and digital banking (FDB) is (β= -0.054 and β= -0.076) significantly negatively explains the dependent variable Gini coefficient and Theil index respectively as proposed in hypothesis 2. The findings indicate that financial literacy makes financial services more accessible to the underprivileged part of a community which helps to reduce the income gap in the society (Demir et al., 2022). Yang et al. (2020) argued that digital banking reduces traditional banking barriers such as physical distance, expense banking services, and complex account requirements, while fintech facilitates a lower segment of society to access credit and promotes saving and investment opportunities (Zabavnik & Verbič, 2024). The FDB enables more people to participate in the formal and informal economy, thereby distributing income more evenly. The expansion of FDB is more likely to concentrate on the low-income group of society, which directly impacts the Gini coefficient and Theil index. Further, fintech and digital banking practices contribute to economic productivity through financial inclusion and support for micro-entrepreneurs and venture capital (Popova, 2021).

Table 5 - Regression analysis of bank investment density and income inequality

Variables	Gini			Theil index		
	Coefficient	T	VIF	Coefficient	T	VIF
GSI	-0.073***	2.39	1.68	-0.065***	2.45	1.86
FDB	-0.054***	2.25	1.73	-0.076***	2.38	1.87
FI&SE	-0.082***	2.67	1.75	-0.097***	2.59	1.78
SC&IF	-0.037***	2.72	1.84	-0.045***	2.42	1.91
ESG Score	0.076***	2.26	1.87	0.086***	2.32	1.87
BLIQ	-0.086**	2.75	1.92	-0.054***	2.75	1.89
BV	0.046**	2.54	1.68	0.034****	2.53	1.69
Growth	-0.054***	2.56	1.85	-0.053***	2.44	1.86
FS	0.072***	2.38	1.79	0.054***	2.34	1.82
LEV	-0.054**	2.59	1.89	-0.034***	2.75	1.76
Industry	0.042*	2.69	1.39	0.034*	2.78	1.32
Yearly	0.034*	2.51	1.43	0.027*	2.45	1.38
R-Square	0.37			0.33		

***significant at 1%, ** significant at 5%, * significant at 10%

Further, the Gini coefficient and Theil index are significantly negatively influenced by the financial inclusion and social equity FI&SE (β= -0.082 and β= -0.097) as proposed in hypothesis 3. The findings indicate that bank investment in FI&SE is an effective mechanism for reducing income inequality as captured by the Gini coefficient and Theil index. Equitable access to financial and social resources empowers marginalized communities, leading to a balance distribution of wealth (Ferilli et al., 2024). The FI&SE helps deprive groups of society to build financial stability, invest in education or small businesses, and mitigate risk. Financial inclusion and social equity enable individuals to get access to financial services that reduce the gap between rich and poor in a community (Grassi et al., 2022). Meng et al. (2024) finds that financial inclusion supports the deprived segment of society to access banking services, which play an essential role in economic participation.

Additionally, Smart Cities and Infrastructure SC&IF have significantly negative effect on Gini coefficient (-0.037) and Theil index (-0.045) respectively as proposed in hypothesis 4. The findings explain that bank investment in SC&IF leverages advanced technology and data to improve urban infrastructure and governance. It further helps to reduce the income inequality in society (Kara et al., 2021). The banking industry provides finance to sustainable projects like transit systems, renewable energy and smart grids that create job opportunities and also reduce the cost of living in urban areas (Mishra & Sant, 2024). The bank has specialized skills to evaluate factors like project feasibility, regulatory framework and revenue potential which help to accurately assess potential benefits of SC&IF. It also makes easier to secure funding for these projects (Sadiq et al., 2022). Barko et al. (2022) argued that funding the SC&IF faster entrepreneurial activities and create job opportunities that help to reduce the income gap in society.

Further, the sustainability variable ESG score significantly negatively explains the dependent variable Gini coefficient (-0.076) and Theil index (-0.086) respectively. The findings indicate the bank's adoption of ESG practices promotes sustainable projects that help to reduce the income gap in society. Bouteska et al. (2024) explains that the alignment of corporate strategy with ESG practices addresses the numerous stakeholders and societal issues that significantly help to reduce the income gap in society. Additionally, the bank fundamental variables like BLIQ (β= -0.86 and β= -0.54) significantly negatively affect the Gini coefficient and Theil index respectively. The findings guide that banks have sufficient funds can finance lower-income groups of the population at low cost of financing which helps to reduce the income inequality in the society (Yan et al., 2019).

While bank volatility BV (β =0.46 and β= 0.34) significantly negatively influenced the Gini coefficient and Theil index. The results explain that higher bank volatility increases the cost of financing and reduces the bank's ability to finance the lower-income group of society which may become the cause of income inequality in the society (Dicuonzo et al., 2022). Additionally, the control variables Growth (β = -0.54 and β = -0.53), FS (β = -0.72

and β = -0.54), and LEV (β = -0.54 and β = -0.34) significantly negatively explain the dependent variable Gini coefficient and Theil index respectively (Habib, Khan, & Tangl, 2024).

3.4 Moderation Analysis of BID and ESG

Table 6 presents the results of the moderation analysis of bank investment density and ESG compliance on income inequality indicators of SDG-10. The proxies of bank investment density (BID) like GSI (β= -0.063 and β= -0.56), FDB (β= -0.063 and β= -0.56), FI&SE (β= -0.072 and β= -0.083) and SC&IF (β= -0.046 and β= -0.056) are significantly negatively explain the Gini coefficient and Theil index respectively (Vuong et al., 2024). The ESG Score has also significantly negative impact on Gini coefficient (β= -0.068) and Theil index (β= -0.76) respectively. The findings indicate that bank adoption of ESG practices are significantly influenced the distribution of income in society (Demir et al., 2022). The finding indicates that a higher ESG score has more influence on the Gini coefficient and Theil index than a low ESG score (Liu et al., 2024). The interaction term of ESG and proxies of bank investment density GSI×ESG Score significantly negatively explains the Gini coefficient (β= -0.084) and Theil index (β= -0.069) respectively. The findings indicate that the ESG score is moderate in the relationship between GSI and income inequality and it enhances the effect of GSI on the Gini coefficient and Theil index measures of income inequality (Malik & Sharma, 2024). Torre Olmo et al. (2021) explain firms that integrate ESG compliance into their business policy are more effectively promoting green and sustainable investment which in turn supports to combat the income inequality in the community (Zhang & Dilanchiev, 2022).

Table 6 - Moderation analysis of BID and ESG

Variables	Gini			Theil index		
	Coefficient	T	VIF	Coefficient	T	VIF
GSI	-0.063***	2.37	1.71	-0.056***	2.47	1.89
FDB	-0.034***	2.27	1.78	-0.062***	2.38	1.85
FI&SE	-0.072***	2.79	1.78	-0.083***	2.65	1.83
SC&IF	-0.046***	2.75	1.87	-0.056***	2.49	1.89
ESG Score	0.068***	2.33	1.85	0.076***	2.36	1.93
GSI × ESG Score	-0.084***	2.39	1.79	-0.069***	2.54	1.84
FDB × ESG Score	-0.054***	2.37	1.73	-0.072***	2.45	1.87
FI&SE × ESG Score	-0.092***	2.85	1.69	-0.088***	2.69	1.84
SC&IF× ESG Score	-0.056***	2.76	1.88	-0.057***	2.79	1.93
BLIQ	-0.076**	2.73	1.89	-0.064***	2.54	1.75
BV	0.056**	2.57	1.69	0.043****	2.62	1.79
Growth	-0.063***	2.63	1.89	-0.058***	2.63	1.92
FS	0.074***	2.39	1.83	0.064***	2.45	1.72
LEV	-0.064**	2.69	1.93	-0.057***	2.73	1.75
Industry	0.052*	2.67	1.38	0.036*	2.73	1.35
Yearly	0.035*	2.59	1.45	0.028*	2.48	1.39
R-Square	0.35			0.32		

*** significant at 1%, ** significant at 5%, * significant at 10%

The Gini coefficient and Theil index are significantly negatively influenced by the interaction term of FDB × ESG Score (β = -0.054 and β= -0.072) respectively as proposed in hypothesis 5. The findings indicate that the magnitude of FDB × ESG Score on the Gini coefficient and Theil index is higher than the individual effect of FDB

(β= -0.034 and β= 0.62) on Gini coefficient and Theil index indicators of income inequality (Balp & Strampelli, 2022). It shows that the ESG score is moderate in the relationship between FDB and income inequality as proposed in Hypothesis 5. The results guide that bank investment in ESG compliance drives the growth of fintech and digital banking, making financial services more accessible to deprived groups of society (Yip & Bocken, 2018).

The interaction term of (FI&SE× ESG score) significantly negatively explains the dependent variable Gini coefficient (β = 0.092) and Theil index (β= 0.088) indicators of income inequality in the society. The results show that the combined effect of FI&SE× ESG score (β = 0.092 and β= 0.088) is higher than the individual effect of (β = 0.072 and β = 0.083) on income inequality in the society as proposed in hypothesis 5. The findings indicate that ESG scores act as moderators and accelerate the impact of financial inclusion and social equity on income inequality in society (Meng et al., 2024). Song et al. (2023) reveals that firms implementing ESG compliance are more effectively introducing various products and services to the general public that help to combat income inequality in society. Mishra and Sant (2024) explains that integration of ESG compliance with FI&SE represents an emerging area of bank investment density aimed at addressing the income inequality in society. Therefore, this framework is more effective combat economic disparities, channeling investments toward sustainable initiatives and financial products that promote equitable access and opportunities (Camilleri, 2021).

Finally, the interaction term of (SC&IF× ESG score) significantly negatively affects the dependent variable Gini coefficient (β = -0.056) and Theil index (-0.57) measures of income inequality in the society. The findings indicate that the interaction effect of SC&IF× ESG score (β = -0.056) and -0.57) more effectively addresses income inequality in society as compared to the individual effect of SC&IF (β =0.46 and β= -0.56) on income inequality in the society (Yan et al., 2019). The results guide that ESG compliance enhances the effect of SC&IF on income inequality as proposed in hypothesis 5. The bank investment density toward the SC&IF provides equitable access to resources, improves living standards, and creates sustainable economic opportunities for lower groups of the community (Mishra & Sant, 2024). The ESG compliance appeals to the banking firms to fund smart cities and infrastructure projects that are more sustainable and beneficial to society. Malik and Sharma (2024) explains that ESG drives smart cities initiative, and affordable housing facilities, and offers low-cost utilities like clean water and reliable electricity to lower groups of society. Therefore, the holistic approach of integration of SC&IF and ESG compliance not only improves the quality of life in marginalized communities but also provides a foundation for long-term societal equity and economic resilience (Bouteska et al., 2024).

3.5 Meditation Analysis of Bank Investment Density and Liquidity

Table 7 presents the results of the mediation analysis to purify the influence of bank investment density on income inequality in society. The mediating variable bank liquidity significantly negatively explains the dependent variable Gini coefficient (β= -0.066) and Theil index (β= -0.067) measures of income inequality in the society (Dudley, 2012). The results show that sufficient liquidity supports the bank investment density to adopt more sustainable investment projects that help to reduce income inequality in the society (Torre Olmo et al., 2021).

Table 7 - Meditation analysis of bank investment density and bank liquidity

Variables	Gini			Theil index		
	Coefficient	T	VIF	Coefficient	T	VIF
GSI	-0.074***	2.47	1.75	-0.067***	2.54	1.82
FDB	-0.065***	2.37	1.70	-0.072***	2.39	1.86
FI&SE	-0.076***	2.71	1.79	-0.084***	2.66	1.85
SC&IF	-0.062***	2.74	1.88	-0.058***	2.53	1.83
ESG Score	0.074***	2.39	1.84	0.067***	2.36	1.93
BLIQ	-0.066**	2.74	1.86	-0.067***	2.59	1.78
GSI × BLIQ	-0.086***	2.49	1.78	-0.073***	2.58	1.86
FDB × BLIQ	-0.064***	2.39	1.74	-0.076***	2.54	1.83
FI&SE × BLIQ	-0.096***	2.87	1.62	-0.086***	2.73	1.82
SC&IF× BLIQ	-0.067***	2.74	1.74	-0.067***	2.73	1.84

BV	0.043**	2.54	1.66	0.045****	2.65	1.81
Growth	-0.064***	2.64	1.84	-0.063***	2.64	1.84
FS	0.075***	2.47	1.84	0.065***	2.46	1.73
LEV	-0.065**	2.74	1.83	-0.056***	2.75	1.61
Industry	0.047*	2.68	1.39	0.043*	2.74	1.36
Yearly	0.036*	2.63	1.46	0.029*	2.49	1.43
R-Square	0.37			0.35		

*** significant at 1%, ** significant at 5%, * significant at 10%

The mediating effect of GSI × BLIQ is significantly negatively explained by the dependent variable Gini coefficient (0.086) and Theil index (0.073) respectively as proposed in hypothesis 6. The findings show that the magnitude of the mediating effect Gini coefficient (0.086) and Theil index (0.073) is higher than the individual effect of GSI on Gini coefficient (β= -0.074) and Theil index (β= -0.067) respectively. It guides that higher liquidity supports the banking firms to invest in green and sustainable investment projects for long-term sustainability (Dicuonzo et al., 2022).

Further, the mediating effect of (FDB × BLIQ) is significantly negatively explained by the dependent variable Gini coefficient (0.064) and Theil index (-0.076) respectively. The results show that the mediating effect of (FDB × BLIQ) on Gini coefficient (0.064) and Theil index (-0.076) is higher than the individual effect of FDB on Gini coefficient (-0.65) and Theil index (-0.072) respectively as proposed in hypothesis 6. The findings guide that higher liquidity firms invest more in FDB projects that are significantly help to reduce income inequality in the society (Yang et al., 2020). Likewise, the mediating effect of (FI&SE × BLIQ) on Gini coefficient (0.064) and Theil index (-0.076) is higher than the individual effect of FI&SE on Gini coefficient (-0.076) and Theil index (-0.084) as proposed in hypothesis 6.

The findings indicate that higher liquidity enhances investment more in FI&SE projects that significantly contribute in combatting income inequality in society (Malik & Sharma, 2024). Additionally, the mediating effect of SC&IF× BLIQ significantly negatively explains the dependent variable Gini coefficient (-0.067) and Theil index (-0.067) than the individual effect of Gini coefficient (-0.062) and Theil index (-0.058) respectively (Zhang & Dilanchiev, 2022). The results guide that the mediating effect of liquidity empowers the banking firms to investment more in smart cities and infrastructure projects that significantly help to reduce income inequality in the society (Balp & Strampelli, 2022).

3.6 Meditation analysis of Bank Investment Density and Bank Volatility

Table 8 presents the results of the mediation analysis of bank volatility to purify the influence of bank investment density on income inequality in society. The findings indicate that mediating effect of (GSI × BV) on the Gini coefficient (β= -0.057) and Theil index (β= -0.53) is lower than the individual effect of GSI on the Gini coefficient (β= -0.075) and Theil index (β= -0.066) respectively. The results show that higher bank volatility restricts the effect of green and sustainable investment on income inequality in society (Vuong et al., 2024). Likewise, the mediation effect of (FDB × BV) on Gini coefficient (β= -0.046) and Theil index (β= -0.053) is lower than the individual effect of FDB (β= -0.067) Gini coefficient and (β= -0.074) Theil index respectively (Zabavnik & Verbič, 2024). The results guide that bank volatility confines the bank investment in fintech and digital banking which reduces the role of FDB to combat the income inequality in the society (Wang et al., 2018).

Table: 8 Meditation analysis of bank investment density and bank volatility

Variables	Gini			Theil index		
	Coefficient	T	VIF	Coefficient	T	VIF
GSI	-0.075***	2.48	1.76	-0.066***	2.56	1.83
FDB	-0.067***	2.38	1.74	-0.074***	2.43	1.87
FI&SE	-0.073***	2.78	1.78	-0.079***	2.67	1.76
SC&IF	-0.078***	2.77	1.74	-0.064***	2.54	1.76
ESG Score	0.069***	2.42	1.85	0.063***	2.37	1.83
BLIQ	-0.067**	2.76	1.74	-0.064***	2.54	1.71
BV	0.045**	2.56	1.67	0.042****	2.54	1.79
GSI × BV	-0.057***	2.51	1.88	-0.053***	2.51	1.79
FDB × BV	-0.046***	2.43	1.75	-0.053***	2.53	1.69
FI&SE × BV	-0.044***	2.73	1.65	-0.047***	2.69	1.76
SC&IF× BV	-0.053***	2.73	1.69	-0.054***	2.72	1.76
Growth	-0.065***	2.66	1.83	-0.053***	2.68	1.81
FS	0.074***	2.48	1.85	0.062***	2.45	1.78
LEV	-0.065**	2.74	1.83	-0.056***	2.75	1.61
Industry	0.047*	2.68	1.39	0.043*	2.74	1.36
Yearly	0.037*	2.64	1.47	0.028*	2.53	1.45
R-Square	0.32			0.34		

*** significant at 1%, ** significant at 5%, * significant at 10%

Further, the interaction effect of (FI&SE × BV) on the Gini coefficient (β= -0.044) and Theil index (β= -0.047) is lower than the individual effect of FI&SE on the Gini coefficient (β= -0.073) and Theil index (β= -0.079) respectively. The findings indicate that higher bank volatility reduces the influence of FI&SE on income inequality (Grassi et al., 2022). Additionally, the mediation effect of SC&IF× BV on the Gini coefficient (β= -0.053) and Theil index (β= -0.054) is lower than the individual effect of SC&IF on the Gini coefficient (β= -0.078) and Theil index (β= -0.064) respectively (Mishra & Sant, 2024). The findings show that higher bank volatility reduces the investment in smart cities and infrastructure that play a significant role in combatting income inequality in society.

CONCLUSION

This study aims to explore the impact of bank investment density on income inequality in society (SDG-10). The bank investment density is emerging areas of investment like green and sustainable investment, fintech and digital banking, financial inclusion and social equity, smart cities, and infrastructure play a crucial role in combatting income inequality in the community. The study finds that bank investment density is significantly negatively explained by the dependent variable Gini coefficient and Theil index proxies of income inequality in society. The findings indicate that the banking industry is consistently investing in green and sustainable investment, fintech and digital banking, financial inclusion, and social equity, smart cities and infrastructure for long-term sustainability, and reducing income inequality in society. The findings guide that modern banking practices align the stakeholders' theory with corporate investment strategy by considering the numerous stakeholders including customers, employees, regulators, communities, and the environment for long-term sustainability.

Further, this study highlights the role of environmental, social, and governance (ESG) practices in promoting the bank investment density for long-term sustainability. The study reveals that ESG practices play a moderating role in enhancing the impact of bank investment density in reducing income inequality in society. The findings indicate that ESG disclosures replaced traditional banking practices with sustainable investment banking for long-term sustainability. The ESG practices faster the bank investment density for allocating funds to

sustainable entrepreneurial activities and creating job opportunities for long-term sustainability. The findings support that the adoption of ESG compliance is more effective in promoting bank investment density which in turn helps to combat the income inequality in the society. Therefore, the holistic approach of integration of bank investment density and ESG compliance not only improves the quality of life to marginalized communities but also provides a foundation for long-term societal equity and economic resilience.

The study also explored the mediating role of bank liquidity and volatility to purify the impact of bank investment density on income inequality in society. The study finds higher liquidity expands the bank investment density in sustainable investment projects that significantly help to reduce income inequality in society. The findings indicate that liquidity is indirectly channeling the funds for sustainable investment projects that play an important role in reducing income inequality in society. The study finds that mediating variable bank volatility reduces the bank investment density toward sustainable projects for long-term sustainability and income inequality. The findings guide that bank volatility is indirectly restricting the bank's ability to invest in sustainable investment projects for long-term sustainability and income equality in society.

Managerial Implications

The findings of this study provide actionable insights for financial institutions, governments, and policymakers that aim to optimize investment practices for long-term sustainably and social justice. The managers should align the ESG practices with corporate strategy to enhance sustainable investment projects for long-term sustainability. The financial institution should implement sustainable initiatives like microfinance, easy lending, and digital banking to facilitate access to financial services for the low-income group of society. This strategy helps to narrow the income gap in the community, promote sustainable development, and enhance economic cooperation. Further, the study reveals that bank liquidity positively channels the funds into sustainable investment initiatives. Hence, the managers ensure optimal liquidity levels to finance the emerging entrepreneurial opportunities for sustainable investment projects and society. Further, the findings indicate that managers should implement risk management practices that stabilize returns and reduce volatility for the effective implementation of sustainable investment projects to combat income inequality in society. Therefore, financial institutions and policymakers should closely work to develop a framework that supports sustainable investment practices aimed at creating long-term societal equity and economic resilience. Such collaboration can lead to sustainable investment and projects that promote responsible financial inclusion, allowing banks to take a more effective role in combating income inequality in society.

Limitations and future work

This study has also some limitations in analyzing the impact of bank investment density on income equality in society. The study primarily focuses on bank investment density, ESG, and income equality which may not capture all relevant investment practices or variations across the regions and financial institutions. The study emphasizes sustainable investment initiatives like green and sustainable investment, fintech and society equity may ignore other valuable investment activities within bank sectors that also play a significant role in reducing income inequality. Although we explore bank liquidity and volatility as mediating factors other variables like interest rate, global market condition, and market capitalization can also mediate in the relationship of bank investment and income inequality. Additionally, findings may not fully capture the different types of banking systems like listed and non-listed, or banks operate in different financial regulations and economic environments.

The findings of this study open avenues for future research in the area of bank investment density and its role in reducing income inequality in society. Future research can examine the comparative analysis of bank investment density within specific economic sectors such as technology, energy, and healthcare to identify which area of investment creates the most significant economic opportunities and benefits for low-income groups of society. Further, future studies could analyze how regional economic, regulatory, and political factors influence the bank investment density on income inequality in the communities. Additionally, the researchers can also examine how global economy shocks such as financial crises or pandemics influence the relationship of bank investment density on income inequality. This line of inquiry can help the financial sector to build resilience into their

investment strategies, particularly during financial instability to continue to support sustainable investment initiatives.

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