

Evaluating the Environmental Footprint of Digital Banking: A Step Towards Sustainability

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Abstract

In the modern-day digital era, banking operations play a vital role in inducing environmental impact, particularly concerning carbon emissions. This study discovers the intricate link between the use of digital financial services and the carbon emissions of India's top ten scheduled commercial banks. It utilizes panel data spanning the years 2019 to 2024, focusing on both the level of digital banking adoption and the reported carbon emissions from these institutions. The analysis employs various econometric techniques, including Pooled OLS to assess constant effects; the Breusch-Pagan test to determine the presence of fixed or random effects; Hausman and Wald tests to select fixed effects; and the LSDV (Least Squares Dummy Variable) regression method to analyze fixed effects with cross-sectional dependencies. Findings show a negative association between digital banking and carbon emissions, signifying that the augmented use of digital channels contributes to environmental sustainability by less reliance on physical resources. Though, this transition also leads to new challenges like cyber-security threats, financial fraud, and electronic waste. The results suggest enhancing digital banking infrastructure and implementing financial literacy programs to tackle these emerging risks. The research adds to the rising discourse on green finance by presenting empirical evidence of how technological adoption in banking can contribute to achieving broader climate objectives.

Keywords: Green-House Gases, Mobile Banking, Carbon Emission, RTGS and NEFT.

JEL Classification: G2 and Q56

1. Introduction

The ongoing rise in the intensity and frequency of severe weather incidents has heightened apprehension about the escalating risks of climate change. Expert researchers and environmentalists have cautioned about the consequences of climate change. The enormity of the impact of climate change on Earth is gaining more worldwide attention each day. The principal cause of climate change is the large amount of greenhouse gases in the atmosphere. Reducing greenhouse gas production is essential to keep the harmful effects of climate change at a minimum (Rahman et al., 2023).

The growing levels of carbon emissions have pushed policymakers to shift from a fossil fuel-based economy to one based on renewable energy. This evolution requires a focus on sustainable development instead of traditional development.. The United Nations has made a significant move in this direction by creating the Sustainable Development Goals. Sustainable Development Goal 13 deals with the concern of climate change overall. While goal number 13.1 advises for increased resilience of economies to climate change (Farzana et al., 2024). The Brundtland Commission of the United Nations describes sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." The notion of sustainable development is becoming normalized in society. It helps us change our behavior towards the environment and protect it for upcoming generation (Bekuma et al., 2023). Sustainable development emphasizes including cultural, social, ecological and ethical factors in economic development to achieve long-term sustainability (Mir & Bhat, 2022).

The "financial-climatic-economical" relationship has emerged as a major component of sustainable development, with the possibility of a common paradigm reflecting a growing threat to financial systems and economies from climate change (Kaur & Rani, 2024). At the Paris climate conference in 2015, finance was a central issue (Farzana et al., 2024). G20 countries have pledged to support green finance and the aim of a neutral economy (De Haas & Popov, 2019). Banks perform an important function as a link between the economy and society. They can help encourage their customers to invest in green finance. Additionally, banks can support sustainable development by integrating environmental factors into their economic growth (Rahman et al., 2023).

Overall, the banking sector generally operates in an environmentally friendly way, but large-scale infrastructure development can raise the carbon footprints of the banking industry (Bhardwaj & Malhotra, 2013). Using a Corporate Social Responsibility (CSR) campaign, banks can promote morally and socially responsible banking among stakeholders, as described by the United Nations in 2007: "the process by which banks consider the impact of their various operational activities, products, and services in meeting the needs of current and future generations." In light of the climate crisis, banks are concentrating on the optimal use of resources to minimize the carbon footprints of financial services. The use of environment friendly techniques by banks for long-term sustainable growth led to the concept of green banking (Zhelyazkova & Kitanov, 2015). Banks have created a few new products and methods, such as green cards, green mortgages and, green bonds for environmentally friendly finance (Gupta, 2015).

The financial sector has also been changing its policies to support environmental protection and expand green investment (Saxena et al., 2021). Countries with developing economies are working to also reduce carbon emissions. India reaffirmed yet again its commitment to achieving net-zero emissions at the Glasgow climate conference in 2021. With a change of government, the RBI put a plan together to help the environmental sustainability of the financial system in the country. In 2012, the Securities and Exchange Board of India required listed

corporations to prepare a Business Responsibility Report (BRR), and the BRR guidelines were updated in 2015. In 2019, SEBI mandated the first publication for the Business Responsibility and Sustainability Report (BRSR) by the top 1000 listed companies on the National Stock Exchange. This report covers diverse parameters and indicators related to the environmental impact of financial services. Banks are making commitments to achieve carbon neutrality by the given timeframes. For example, SBI and Yes Banks' target is to become carbon-neutral by 2030, while HDFC's target was 2032. Such a commitment requires banks to invest in environmental sustainability, transition to different banking products and practices. These commitments can build brand reputation, create investment opportunities, and improve risk management practices (Kaur & Rani, 2024).

A robust financial system is necessary to advance economic growth and respond to the climate crisis (Verma, 2023). This research intends to investigate how digital banking royal services impact the carbon footprint of banks, including whether digital technology can enable banks to reduce their carbon emissions as well as identifying and examining the role of the traditional finance sector in sustainable development further, as well as recognising the role of mobile banking services in achieving sustainable development goals. Implementing digital banking knowledge among financial sector actors could enable developing countries to reach environmentally sustainable development. Ongoing evidence is needed of how digital technology can facilitate a green transitional shift to meet sustainable development goals.

The current analysis reveals that various sustainable and environmentally friendly financial services and products, such as green loans, green buildings, green mortgages, and paperless banking, are crucial for sustainable growth amid the climate crisis (Versal et al, 2022).

2. Literature Review

Information and communication technology has transformed the entire industry. The manufacturing sector has moved from manual to automated processes, while the financial system has shifted from offline to online processes. Digital disruption is affecting the banking sector worldwide (Jiyanova et al., 2023). The progress and expansion of the internet present significant challenges to the banks' Information Technology strategies for providing mobile banking services (Kumar et al., 2023). Banks are seizing this challenge as an opportunity by delivering traditional banking products and services through one digital platform, through applications and powered by technology (Xie & Wang, 2023). While banks have used technology for many decades, digital banking has fully developed in the marketplace for the past two decades due to a number of technological breakthroughs (Panova, 2021).

Digital innovations are challenging the delivery of banking products and financial services. New business models and applications are being developed (Mhlanga, 2023). The pandemic was the impetus for changes to customer financial behavior as COVID-19 decreased barriers and concerns to use of digital banking; COVID-19 acted as an accelerative medium to increase the adoption of digital banking. Digital payments emerged from numerous fintech applications (Tay et al., 2022). The number of digital banking users has significantly increased on a global scale. The digital financial payment ecosystem has also expanded with improved access to the internet (Amiri et al., 2023). Technology evolves along with shifting consumer behavior: what was once accepted in a pre-COVID-19 world are now quickly becoming obsolete due to consumer habits and expectations stretching adoptions of technology. Banks must move quickly to recognize the opportunities being revealed and act on their strengths (Utami & Septivani, 2023).

Banks are pushing to rapidly digitalize their operations by building data platforms and implementing smart risk control systems (Tsindeliani et al., 2021). Analyzing big data enables banks to detect misuse of loan amounts and evaluate the risk of funds turning into non-

performing assets. Machine learning has the potential to be used to propose specific solutions for a range of risk categories (Kriebel & Debener, 2019). Artificial intelligence, cloud technology, and blockchain, for instance, can make banking services more efficient (Azmi et al., 2020).

Xie's study established that firms with a higher proportion of digital finance than traditional finance in their operations exhibit greater resilience to financial shocks and they have lower likelihoods of incurring losses and recover better (Xie & Wang, 2023). However, the digital financial system could potentially increase the level of e-waste, thereby threatening environmental sustainability. These findings provide new insights into environmental impacts of digital banking services pollution (Moufakkir & Qmichchou, 2019). The good governance enables effective climate strategies and, thereby reduce carbon emissions (Bahl et al., 2023). It is the responsibility of government to inform the public about the adverse effects of climate change in order to help them reduce emissions of carbon dioxide (Pawłowska et al., 2022). Research and technological reform in green energy innovation could help in the transition towards a carbon net-zero economy (Kumar et al., 2023). The increasing green finance and investments in green initiatives that produce significant benefits for sustainable development will drive economies towards sustainable development (Ryszawska, 2018).

The advancement of innovative and new banking products associated with sustainable development goals is critical to induce environment-friendly growth (Kumar Jha, 2022). Fintech's digital financial transactions will have lower carbon footprints than traditional bank's transactions. Thus, fintech has excellent environmental sustainability (Kotarba, 2017).

3. Objectives

1. To examine the change in the volume of mobile banking provided digitally by selected commercial banks.
2. To establish the relationship between banking services offered digitally and the carbon emissions of banks.
3. To advise financial institutions and public organizations on how to reduce the carbon emissions of banks.

4. Hypothesis

The aims of the study align with the three hypotheses noted below to identify the potential relationship between carbon emissions and digital banking services.

H_{n1}: The volume of mobile banking does not have a significant effect on the carbon emissions of banks.

H_{a1}: The volume of mobile banking does have a significant effect on the carbon emissions of banks.

H_{n2}: The volume of NEFT does not have a significant effect on the carbon emissions of banks.

H_{a2}: The volume of NEFT does have a significant effect on the carbon emissions of banks.

H_{n3}: Carbon emissions of banks do not depend on the volume of RTGS.

H_{a3}: Carbon emissions of banks does depend on the volume of RTGS.

5. Methodology

The prime motive of this research is to figure out the link between the practice of digital banking services and the carbon emissions by banks in India. The research includes the construction of a panel data set related to the use of digital banking services and carbon emissions by ten selected banks from 2019 to 2024. Research uses annual reports and business responsibility and sustainability reports of the top ten banks listed on the National Stock Exchange of India. Overall, 38 observations from ten banks over six years, from 2019 to 2024, have been included in the panel data. The extensive panel data analysis including the Pooled OLS test for common constant effect; the Breusch-Pagan test for presence of fixed or random effect; the Hausman and Wald test for selection of fixed or random effect; and the Least Square Dummy Variable (LSDV) regression model to study fixed effect with cross-sectional dependencies is implied to examine the effect of implication of digital banking services towards carbon emissions. The hypothesis testing is carried out by using panel data regression along with EViews. The generalized regression equation for measuring empirical relationships is as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + F_i + \varepsilon$$

Where Y is the dependent variable of carbon emission, β_0 is the intercept, β_1 , β_2 , and β_3 are the coefficients of independent variables of mobile banking (X_1), NEFT (X_2), and RTGS (X_3), F_i is the dummy variable for cross-section effect, and ε is the error term. The coefficients describe the relationship between carbon emissions and the independent variables. The error term helps to measure the deviation in carbon emission which cannot be explained by the independent variables.

6. Variable Explanation

Carbon emission is a dependent variable, and it is represented by the sum of scope 1 and 2 greenhouse gas emissions by banks annually. The data relating to scope 1 and 2 emissions must be disclosed by the top 1000 entities listed on the stock exchange by market capitalization in the annual Business Responsibility and Sustainability Report (BRSR) as the statutory requirement of the Securities and Exchange Board of India (SEBI).

Digital banking services are represented by three explanatory variables, i.e., the annual volume of mobile banking transactions, National Electronic Fund Transfer (NEFT), and Real Time Gross Settlement (RTGS) of banks. Mobile banking, NEFT, and RTGS are the three main modes of digital banking transactions (Deb & Sinha, 2022).

Mobile banking is based on a mobile application which uses the Unified Payment Interface (UPI) innovated by the National Payment Corporation of India (NPCI). The magnitude of mobile banking has increased exponentially in the last decade. The UPI has completely transformed the payment system of India. A substantial percentage of the traditional payment has been shifted towards the mobile banking system. Mobile banking has eliminated the need to visit a branch for payment.

The second explanatory variable is the annual volume of NEFT. It is another payment gateway used by customers for electronic payment via internet banking or visiting the branch. NEFT can be used for any amount of payment from Rs 1 to Rs 2 lakhs.

The third explanatory variable is the annual volume of RTGS. It is an electronic payment transfer system used for bulk payments increasing two lakhs and up to 10 lakhs. The settlement is carried out in real time.

7. Data Analysis

7.1 CAGR of GHG

The Indian government has submitted its future strategy to attain net-zero carbon emissions by 2070 according to the Paris Agreement. India's low-carbon emission strategy is built on common but differentiated responsibilities and capacities. Green gas Emissions are an important factor in achieving net-zero carbon emissions. Scope 1 emissions are immediate emissions from sources owned and controlled by the organization being studied, and scope 2 is indirect emissions from the purchase of electricity, steam, heat, or cooling by an organization for its buildings. The Compound Annual Growth Rate (CAGR) analysis has more benefits than a simple annual growth rate. The compound annual growth rate is long-term, consistent, and suitable for comparison and includes compounding effects.

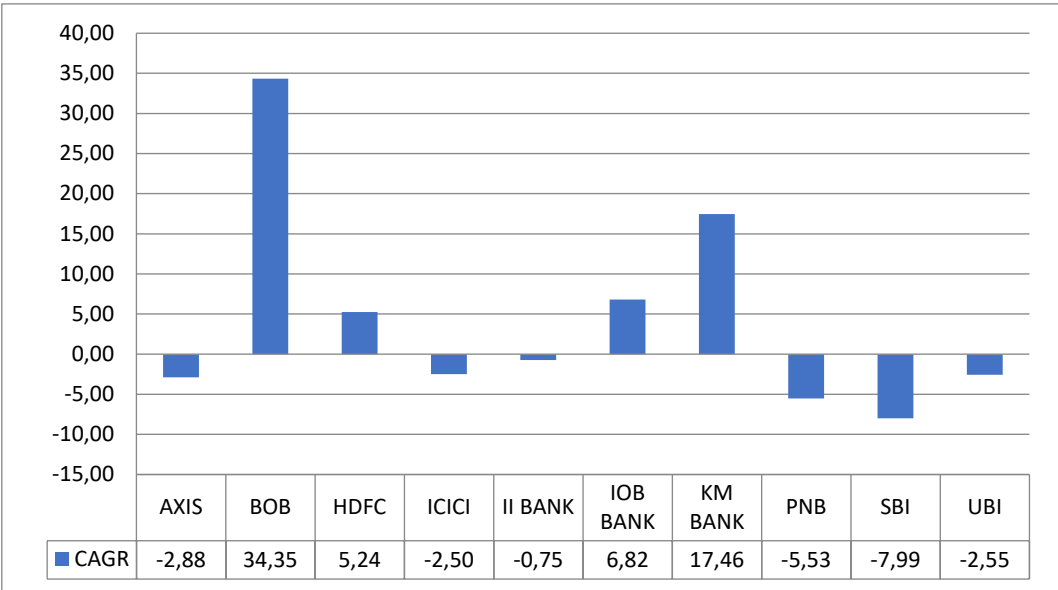


Fig. 1 CAGR of GHG Emissions (Source: compiled by Author)

Figure No. 1 shows the compound annual growth rate of the sum of scope 1 and scope 2 GHG emissions by banks over five years from 2019 to 2024. Out of ten banks, four have positive CAGR and six have negative CAGR. The reason for banks with positive CAGR may be their initial phase of growth or lagging in the adoption of sustainable techniques and methods of operation. Among the four banks with positive CAGR, two are government-owned banks whereas the rest two are private banks. There exists no difference between the public sector and private sector banks regarding the positive CAGR of carbon emissions.

7.2 CAGR of Volume of Mobile Banking

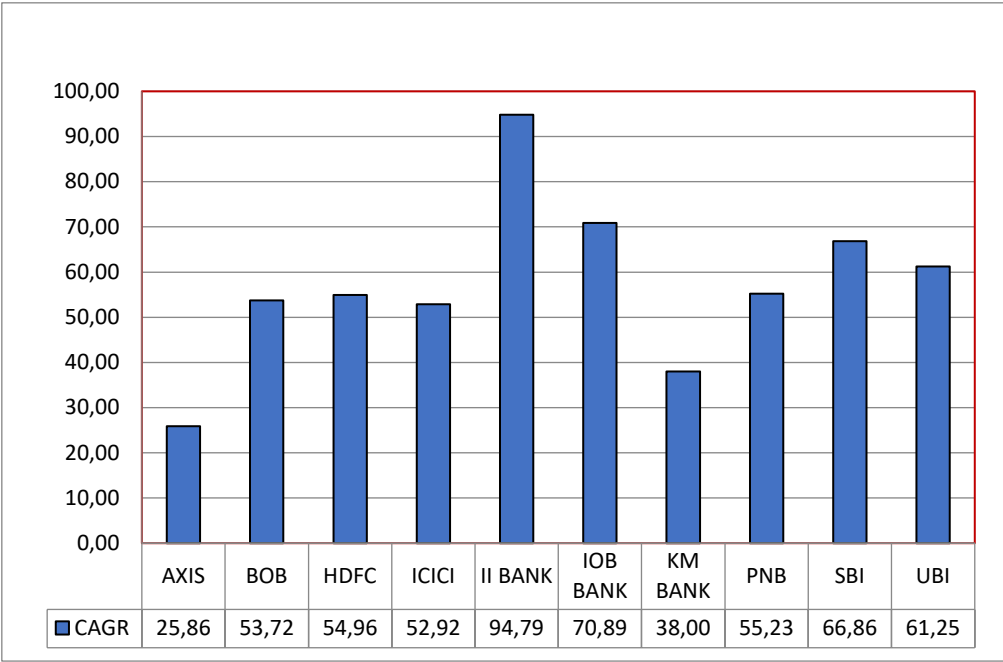


Fig. 2 CAGR of Mobile Banking Volume (Source: compiled by Author)

The data on the volume of mobile banking shows positive CAGR for all banks in the last six years, irrespective of public sector or private sector banks. This signifies all banks having adopted digital methods of banking in recent years.

7.3 CAGR of Volume of NEFT

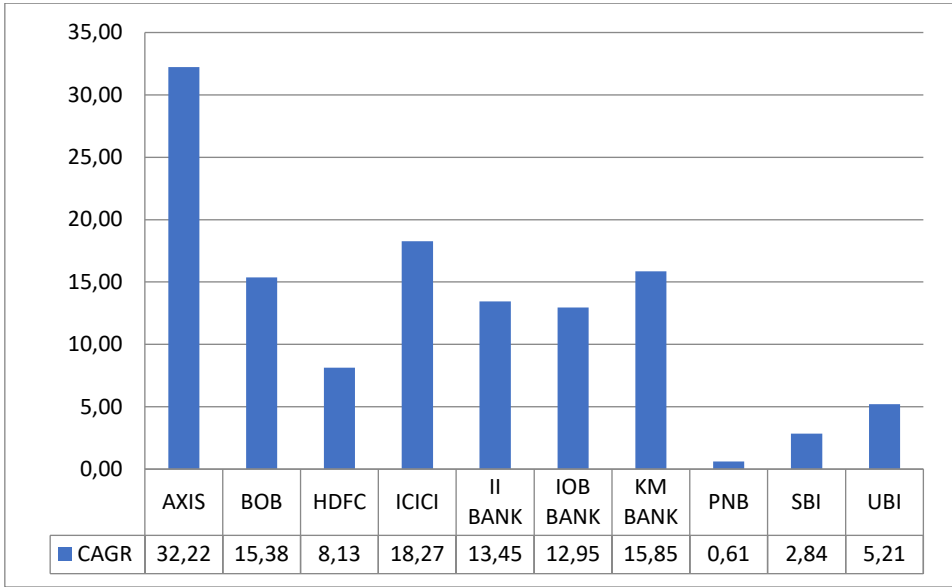


Fig. 3 CAGR of NEFT Volume (Source: compiled by Author)

Figure No. 3 shows data on the volume of NEFT transactions. It indicates a positive CAGR for all banks. But the CAGR of PNB, SBI, and UBI are very low and symbolizes stagnancy during the last six years in comparison to other banks.

7.4 CAGR of Volume of RTGS

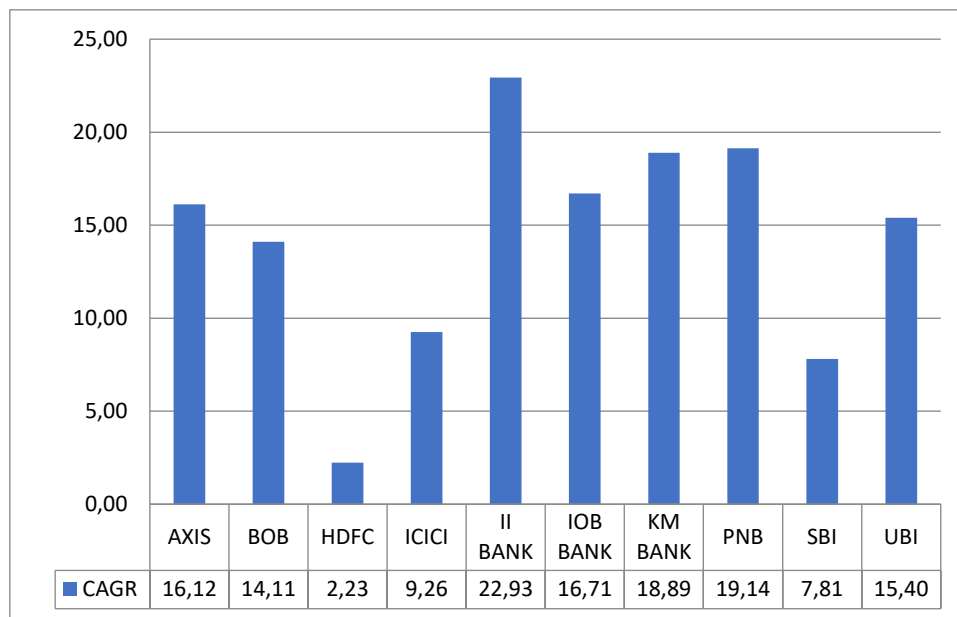


Fig. 4 CAGR of NEFT Volume (Source: compiled by Author)

Figure No. 4 shows the data for banks for the volume of RTGS transactions. The CAGR for all banks is again in the positive range. However, the CAGR of HDFC, ICICI, and SBI are very low, as these banks are established and in the stage of maturity in terms of growth. The low CAGR indicates saturation in the volume of RTGS transactions.

7.5 Descriptive Statistics

Table 1. Descriptive statistics

	GHG Emissions (Scope 1+2) million tCO ₂ e	Mobile-NM	NEFT-NM	RTGS-NM
Mean	0.34	0.40	0.33	0.21
Standard Error	0.06	0.05	0.05	0.03
Median	0.19	0.35	0.32	0.14
Mode	0.15	0.08	0.07	0.14
Standard Deviation	0.34	0.31	0.29	0.21
Sample Variance	0.12	0.09	0.08	0.05
Kurtosis	0.98	-1.53	-0.31	4.83
Skewness	1.45	0.23	0.80	2.03
Range	1.126	1	1	1
Minimum	0.044	0	0	0
Maximum	1.17	1	1	1
Sum	13.095	15.03	12.36	7.87
Count	38	38	38	38

(Source: compiled by Author)

Table No. 1 shows descriptive statistics of GHG Emissions (Scope 1+2) million tCO₂e, the volume of mobile banking transactions, the volume of NEFT transactions, and the volume of RTGS transactions utilized in the study. Descriptive statistics describe median, mean, variance, standard deviation, and other measures of central tendency, which indicate the fitness of the sample taken from the population for study. The variance ranges from 0.05 to 0.12 for four variables, which indicates a varied distribution of the sample (Kaur et al., 2018).

8. Results

8.1 Pooled OLS Regression

Table 2. Pooled OLS regression

Dependent Variable: GHG_Emissions_Scope_1&2_Million_TCO ₂				
Method: Panel Least Squares				
Date: 09/26/24 Time: 10:04				
Sample: 2019-2024				
Periods included: 6				
Cross-sections included: 10				
Total panel (unbalanced) observations: 38				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.090019	0.076574	1.175589	0.2479
MOBILE NM	0.201167	0.293957	0.684341	0.4984
NEFT NM	1.196600	0.471746	2.536537	0.0160
RTGS NM	-0.800471	0.458342	-1.746450	0.0898
R-squared	0.367475	Mean dependent var	0.344605	
Adjusted R-squared	0.311664	S.D. dependent var	0.342900	
S.E. of regression	0.284491	Akaike info criterion	0.423069	
Sum squared resid	2.751791	Schwarz criterion	0.595447	
Log likelihood	4.038316	Hannan-Quinn criter.	0.484400	
F-statistic	6.584260	Durbin-Watson stat	0.214191	
Prob(F-statistic)	0.001252			

(Source: compiled by Author)

Out of three explanatory variables, only the p-value of the NEFT variable is less than 0.05. Hence, in the Pooled OLS regression results, the volume of NEFT transactions has a momentous impact on carbon emissions from banks. The R-squared value is 36 per cent, which is moderately significant. But the value of Durbin-Watson statistics is less than R-squared value, which weakens the model of analysis. Since the sample population of panel data is heterogeneous, the pooled OLS method of the common constant might not be appropriate for panel analysis. If all cross-sections of a heterogeneous sample population are pulled together, then entity-specific characteristics are subsumed in error terms. This problem is called endogeneity, where the error term gets correlated with one of the regressor items. There may be fixed/random effects in the regression model. To verify the existence of fixed/random effects in regression, the Breusch-Pagan test is carried out.

8.2 Breusch Pagan Test

Table 3. Breusch-Pagan test

Lagrange Multiplier Tests			
Null hypotheses: No effects			
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others)			
Test Hypothesis			
	Cross-section	Time	Both
Breusch-Pagan	43.97447 (0.0000)	0.200617 (0.6542)	44.17509 (0.0000)
Honda	6.631325 (0.0000)	-0.447903 (0.6729)	4.372339 (0.0000)
King-Wu	6.631325 (0.0000)	-0.447903 (0.6729)	3.473212 (0.0003)
Standardized Honda	8.926867 (0.0000)	-0.109984 (0.5438)	2.758417 (0.0029)
Standardized King-Wu	8.926867 (0.0000)	-0.109984 (0.5438)	1.706585 (0.0439)
Gourieroux, et al.	-	-	43.97447 (0.0000)

(Source: compiled by Author)

The hypothesis statement of the Breusch-Pagan test is as follows:

The Null hypothesis: There are no fixed effects or random effects in regression.

The Alternative hypothesis: The fixed effects or random effects are present in the regression.

The Breusch-Pagan test (Table No. 3) is carried out through the Lagrange Multiplier test. The p-value test for the cross-section effect in the Breusch-Pagan test is less than 0.05. Hence, the null hypothesis is dropped, and the fixed or random effect (with cross-sectional effect) is present in the regression. To choose between fixed and random effects, the Hausman test is carried out.

8.3 Hausman Test

Table 4. Hausman test

Test Summary	Chi-Sq Statistics	Chi-Sq d. f.	Prob.	
Cross-section random	31.514040	3	0.0000	
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
MOBILE NM	-0.439062	0.372937	0.003239	0.2453
NEFT NM	0.354607	0.437156	0.004872	0.2370
RTGS NM	0.350109	0.177243	0.020535	0.2277
Cross-section random effects test equation: Dependent Variable: GHG Emissions Scope 1&2 Million TCO ₂				

(Source: compiled by Author)

The outcome of the Breusch-Pagan test indicates the presence of a fixed effect or random effect in the model. The Hausman test determines which model is more suitable for the study, the fixed effect model or the random effect model. The null hypothesis and the alternative hypothesis of the Hausman test are:

Null hypothesis: Random effect model is better than fixed effect model.

Alternative hypothesis: Fixed effect model is better than random effect model.

Results for the Hausman test statistics are located in Table No. 4. The p-value was less than 0.005, (the level of significance) so the null hypothesis was rejected and the alternative hypothesis of the Hausman test was accepted. The fixed effect model with a cross-sectional effect is appropriate for a panel data study is appropriate. The Breusch Pagan test already established a sectional effect in the model.

8.4 Wald Test

Table 5. Wald test

Wald Test:Equation: Untitled			
Test Statistics	Value	df	Probability
F- Statistics	247.5792	(4, 25)	0.0000
Chi-square	990.3169	4	0.0000
Null Hypothesis: C (1) = C (2) = C (3) = C (4) = 0			
Null Hypothesis Summary			
Normalised Restriction (= 0)	Value	Std. Err.	
C (1)	0.181404	0.069729	
C (2)	-0.439062	0.104098	
C (3)	0.354607	0.179395	
C (4)	0.350109	0.245687	
Restrictions are linear in coefficients.			

(Source: compiled by Author)

The outcome of the Wald test (Table No. 5) shows a p-value less than 0.05, which again confirms the presence of the cross-section effect in the regression. The fixed-effect model with a cross-sectional effect permits diverse constants for every group of cross-sections by adding a dummy variable to each group. This technique is also called Least Squares Dummy Variable (LSDV) estimator. Hence, Least Squares Dummy Variable (LSDV) method for fixed effects is a best-fit model for regression analysis in the present data set.

8.5 Least Square Dummy Variable (LSDV) Test

Table 6. Least Square Dummy Variable (LSDV)

Dependent Variable: GHG_Emissions_Scope_1&2_Million_TCO ₂				
Method: Panel Least Squares				
Date: 09/25/24 Time: 14:56				
Sample: 2019-2024				
Periods included: 6				
Cross-sections included: 10				
Total panel (unbalanced) observations: 38				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.181404	0.069729	2.601565	0.0154
MOBILE NM	-0.439062	0.104098	-4.217759	0.0003
NEFT NM	0.354607	0.179395	1.669785	0.0592
RTGS NM	0.350109	0.245687	1.425018	0.1665
Effects Specification				
Cross-section fixed (dummy variable)				
R-squared	0.973323	Mean dependent var	0.344605	
Adjusted R-squared	0.960519	S.D. dependent var	0.342900	
S.E. of regression	0.068134	Akaike info criterion	-2.269179	
Sum squared resid	0.116056	Schwarz criterion	-1.708952	
Log likelihood	56.11441	Hannan-Quinn criter.	-2.069855	
F-statistic	76.01250	Durbin-Watson stat	1.764628	
Prob(F-statistic)	0.000000			

(Source: compiled by Author)

The outcomes of the Least Squares Dummy Variable model estimation are displayed in Table No. 6. The p-value for the volume of mobile banking transactions and carbon emissions is 0.0003, less than the 0.05 value of significance. This implies a strong correlation amongst the volume of mobile banking transactions and carbon emissions by banks. The value of the coefficient for mobile banking is -0.439062, where a negative sign indicates a negative correlation between the volume of mobile banking transactions and carbon emissions by the bank. The one-unit rise in the volume of mobile money results in a decrease of 0.43 units of carbon emission by banks. Hence, the first null hypothesis is dropped. The alternate hypothesis, "There is a long-term interconnection between the volume of mobile banking and the carbon emissions of banks", is accepted. Mobile banking helps to lessen carbon emissions by using eco-friendly digital banking services relatively than branch banking. It eliminates the utilization of paper for banking transactions. Mobile banking has revolutionized the whole banking procedure. It allows customers to check account details, pay bills, perform money transfers, etc. Mobile banking performs almost all the functions of a brick-and-mortar bank branch. Originally, digitalization was introduced in the banking system for the convenience of both customers and banks. But it also plays a momentous role in protecting the environment. It helps to reduce the cutting of trees and deforestation by avoiding the use of paper for banking transactions, hence accomplishing sustainable development goals for climate action.

The p-value for the second explanatory variable of the volume of NEFT transactions and carbon emissions is 0.059, which is greater than the value of significance. The second null hypothesis, "There is no significant correlation between the volume of NEFT and the carbon emissions of banks", is accepted. As most NEFT transactions are performed by visiting a bank branch and filling out a form with a cheque or cash, they are not related to any decrease in the use of paper. Hence, the magnitude of NEFT transactions does not lead to a decrease in carbon emissions by banks.

The p-value for the third explanatory variable of the volume of RTGS transactions is 0.1665, and the carbon emission is larger than the value of significance. The third null hypothesis, "There is no substantial link between the volume of RTGS and the carbon emissions of banks", is accepted. The nature of RTGS transactions is bulk and used by firms, companies, organizations, etc., not by individuals. RTGS transactions involve the use of paper. Hence, any rise in the volume of RTGS transactions does not lead towards saving paper or a decrease in carbon emissions by banks.

9. Conclusion

The findings of research reveal a robust and negative correlation between the volume of mobile banking transactions and the carbon emissions produced by banks. The regression results are statistically significant. Digital banking reduces paper transactions and carbon footprints by 15 % by providing innovative technology solutions for financial services (Kotarba, 2017). 17.

It eliminates the necessity of making a trip to a physical Bank branch for transactions like money transfers and for loan applications, utility payments, investments, etc. In the future, mobile banking is an enabler for sustainable and green economic development. In combination with digital payment services, banks provide their services with efficiency and effectiveness. Moreover, the industry did not experience these changes simultaneously. It has seen abrupt changes in information and communication technology. The government wants a strong, vibrant and resilient banking sector in India, with emphasis on improving efficiency/productivity. Although they are known as the Sustainable Development goals, the premise is to promote environmentally sustainable economic development (Rahman et al., 2023). Fintech firms are bringing in new dimensions and propositions to banking services through green technology options (Versal et al., 2022). Mobile banking services are a necessary means to address financial inclusion and ensure sustainable economic growth. They provide a way for consumers to access financial services with one tap on a mobile screen while protecting the environment (Kaur & Rani, 2024). The volume of carbon emission by banks does not have a significant relationship with the second and third explanatory variables: the volume of NEFT and RTGS, respectively.

10. Recommendations

Acknowledging the role of mobile phones in using digital banking services, the administration should enhance efforts to promote the adoption of Fin-tech applications for financial services. Financial transactions such as money transfer, utility payment, credit application, investment, etc., are instantaneously accessible through fintech applications. But common people hesitate to use digital banking services due to a lack of financial literacy, risk of fraud, and cyber security concerns (Behl & Pal, 2016). However, a financial literacy campaign run by the government with the help of financial institutions can reduce the hesitation of customers for digital banking services. The government should ensure that common people have affordable access to smartphones (Murria et al., 2018). The collaboration of small finance Banks, payment banks, microfinance institutions and NBFCs with traditional banks can ensure the availability of financial services at a reasonable cost to customers. Scheduled commercial banks can

coordinate with fintech to promote digital innovation in financial services. The digital banking services would go a long way in lowering the carbon footprint of banks.

11. Acknowledgement

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