

LEVERAGING FINANCIAL TECHNOLOGY TO BOOST GREEN CREDIT IN VIETNAMESE COMMERCIAL BANKS

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Abstract: *This study examines the impact of Fintech on the development of 28 Vietnamese commercial banks' green credit from 2014 to 2023. According to panel data regression models, the research examines the impacts of Fintech on green credit lending. The findings indicate that Fintech positively affects green credit growth, particularly improved risk management and operating capabilities. Bank size and loan-to-deposit ratio have a strong positive impact on green credit, while financial leverage, asset turnover, and income-to-cost ratio have little impact on green credit. The research has policy implications for the policymakers and financial institutions, concerning the need for facilitative policies in encouraging Fintech and green credit growth.*

• Keywords: *fintech, green credit, commercial bank, sustainable development.*

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1. Introduction

In the global context, climate change and environmental degradation are becoming urgent issues, requiring countries and industries to promote green initiatives to achieve sustainable development goals (Hasan et al., 2022). The financial sector, especially banks, play a central role in supporting green projects through the granting of green credit. Green credit has become a focus of sustainable finance, making an important contribution to the sustainable development goals (SDGs) set by the United Nations, especially in reducing carbon emissions and promoting renewable energy (Hasan et al., 2022).

However, Vietnam's green credit indicators are still modest compared to countries in the region, such as China and Singapore. Moreover, FinTech in Vietnam, despite growing rapidly, with a series of startups and advanced technology platforms, still faces many limitations in integrating into the green credit sector due to lack of legal framework and effective support mechanisms (Nguyen, 2022). And green credit is still quite new in Vietnam. That makes banks quickly seek innovative solutions to promote green credit to meet the needs of sustainable development. Therefore, commercial banks are also strongly transforming and promoting green credit activities. In addition, research on the application of FinTech in promoting green credit in Vietnam is still very limited, leading to a shortage of scientific basis to guide policy and implementation practices.

Although there have been many studies on green

credit and FinTech, these studies mainly focus on developed countries or large markets such as China, the US and Europe (Fuster et al., 2019). The studies pay little attention to the differences in the level of FinTech development and financial systems in developing countries like Vietnam. Furthermore, current studies still lack a focus on transmission mechanisms such as resource allocation or green credit risk in the relationship between FinTech and green credit, so that it can be applied in the context of FinTech and green credit. specific situation of Vietnam. This is research gap. The research will test the influencing factors of Fintech on Green credit at Vietnamese commercial banks and proposing policy and management implications to improve and enhance green credit policies. The article is structured including introduction, literature review, methodology and results.

2. Literature review

FinTech has emerged as a rapidly growing concept frequently discussed in academic practice and economic literature. The development of emerging FinTech technologies such as big data, cloud computing, blockchain and artificial intelligence (AI) is happening rapidly, changing the way individuals learn, live and work. In recent years, the relationship between fintech innovation and green credit has been of great concern to scholars. Fintech, by virtue of its ability to employ advanced technology in banking business, is playing a key role in promoting green credit, helping financial institutions to direct funds into environmental protection and sustainable development activities.

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Green credit are loans provided enable businesses to implement projects, policies, and strategies aimed at reducing emissions and protecting the environment through policies from the point of view of the government (Zhao et al., 2022).

This study by Hasan et al. (2022) shows that fintech has a positive impact on the ability of banks in China to green credit supply, primarily through two avenues: reducing information asymmetry and increasing green credit efficiency. Fintech helps banks to efficiently collect and process information quickly, thereby decreasing risk and enhancing capacity for green firm service. Zhou et al. (2022) also show that fintech not only improves the relief of information asymmetry but also improves green credit allocation efficiency by improving environmental disclosures and media coverage.

In addition to promoting green credit, fintech also assists in increasing bank profitability. Mirza et al. (2023) proved that fintech expansion not only increases green lending operations but also improves risk-adjusted returns for banks, particularly in the Eurozone. Banks that employ fintech can reduce transaction costs and improve risk management, thereby improving their ability to provide credit to green projects while maintaining stable profits. Muganyi et al. (2021) found that Chinese fintech banks are more inclined to provide credit to green companies within the traditional energy sector and regions where there is abundant energy supply. This reflects the strategic realignment of the banks along environmental objectives and government policy support. On the other hand, Tarawneh et al. (2024) research showed that while fintech helps banks in increasing profits, it also creates competition from peer-to-peer lending and digital payment platforms that may affect the credit allocation of traditional banks, including green credit.

The application of Fintech in Vietnam has created a period of rapid technology advancement, creating convenience and speed for users across various sectors. Nhung et al. (2023) investigated how the rise of fintech in Vietnam affects the market power and financial performance of commercial banks. Similarly, Pham et al. (2024) analyzed the effect of fintech on bank performance in Vietnam and concluded that fintech significantly influences profits and net interest margins. In the context of green finance, Van Hoa et al. (2022) conducted a study examining the relationship between fintech and green finance in Vietnamese banks. The study showed that fintech positively impacts green finance, with factors like bank size, leverage, and non-interest income ratio influencing the extent of this relationship.

3. Methodology

The model used in this study aims to analyze the relationship between FinTech activities and green credit (GC) in commercial banks as follow:

$$GC_{it} = \alpha_0 + \alpha_1 FT_{it} + \alpha_2 CAR_{it} + \alpha_3 NPM_{it} + \alpha_4 EM_{it} + \alpha_5 TAT_{it} + \alpha_6 SIZE_{it} + \alpha_7 LDR_{it} + \alpha_8 CIR_{it} + \varepsilon_{it}$$

Table 1. Variable description

Variable	Variables name	Calculation	Expectations of coefficient's sign	Source
Dependent variables				
GC	Green credit	Collected from the financial statements of commercial banks.		Liu & You (2023)
Independent variables				
FT	Fintech	Refer to the explanation of the keyword table related Fintech.	+	Pham et al. (2024)
CAR	Capital Adequacy ratio	$\frac{\text{Total Capital}}{\text{Total risk - weighted assets}}$	+	Pham et al. (2024)
NPM	Net Profit Margin	$\frac{\text{Net Profit}}{\text{Total Revenue}}$	+	Pham et al. (2024)
Control variables				
SIZE	Asset Size	The natural logarithm of total bank assets.	+	Yin et al. (2021)
EM	Leverage Ratio	$\frac{\text{Total assets}}{\text{Total equity}}$	+	Yin et al. (2021)
TAT	Total Asset Turnover	$\frac{\text{Net revenue}}{\text{Average Total assets}}$	+	Yin et al. (2021)
LDR	Loan to Deposit	$\frac{\text{Total Loans}}{\text{Total Deposits}}$	+	Yin et al. (2021)
CIR	Cost to income ratio	$\frac{\text{Operating Costs}}{\text{Operating income}}$	-	Yin et al. (2021)

Description of the variables presented in table 1. The research sample consists of 28 banks from 2014 to 2023, totaling 280 observations. Data are analyzed and processed through regression estimation methods using three different methods: Pooled OLS regression method, Fixed effects model (Fixed Effective Model-FEM) and random effects model (Random Effective Model - REM). Then use the F- Test and Hausman to choose the most optimal model: F- Test to choose between OLS and FEM, Hausman to choose between FEM and REM, in which the REM model is suitable for the sample. study. Next, use Wooldridge tests to test for autocorrelation with the data and Wald to test for changes in variances. Finally, apply the feasible generalized least squares (FGLS) method to overcome changes in the model.

4. Results

Table 2. Descriptive statistics

Variable	Number of observations	Mean	Standard deviation	Minimum value	Maximum value
GC	280	0.06	0.03	0.01	0.17
FT	280	40.3	49.82	0	0.35
CAR	280	0.12	0.03	0.08	0.25
NPM	280	0.12	0.09	0.01	0.52
SIZE	280	14.25	0.51	13.2	15.36
EM	280	0.13	0.05	0.05	0.25
TAT	280	0.08	0.02	0.05	0.16
LDR	280	0.09	0.01	0.04	0.02
CIR	280	-0.51	0.16	-1.78	-0.23

The data applied in this paper includes various variables for measuring commercial banks' performance and characteristics in Vietnam (Table 2).

Table 3. Correlation coefficient matrix

	GC	FT	CAR	NPM	SIZE	EM	TAT	LDR	CIR
GC	1.0000								
FT		1.0000							
CAR		-0.0943	1.0000						
NPM			-0.0544	1.0000					
SIZE					1.0000				
IN	0.0676					1.0000			
TAT			0.0067				1.0000		
LDR			-0.0560					1.0000	
CIR					-0.1044			0.482	1.0000

The correlation test in table 3 reveals underlying relations between commercial bank variables. All correlation coefficients meet the recommended threshold of Cohen (1988)

Table 4. Multicollinearity test

Variables	VIF	1/VIF
SIZE	2.49	0.402051
EM	2.48	0.403761
CIR	2.02	0.495577
CAR	1.79	0.557836
LDR	1.64	0.608576
NPM	1.48	0.674781
TAT	1.48	0.677368
FT	1.29	0.773685
Mean VIF	1.83	

The table 4 shows that the independent variables' variance coefficients (VIFs) range from 1.29 to 2.49, with an average of 1.83. This indicates that the variables are moderately correlated and not significantly so. Virtually none of the independent variables' VIF coefficients are greater than 3. It is evident that this model does not have a multicollinearity issue.

Table 5. Regression results

Variable name	Pooled OLS	FEM	REM	FGLS
FT	0.004*** (0.000)	0.004*** (0.000)	0.004*** (0.000)	0.0004*** (0.000)
CAR	-0.169** (0.009)	-0.105 (0.135)	-0.128 (0.052)	-0.098** (0.012)
NPM	0.028 (0.132)	0.017 (0.506)	0.022 (0.324)	0.042** (0.001)
SIZE	0.016*** (0.000)	0.022** (0.048)	0.019** (0.003)	0.014*** (0.000)
EM	-0.002 (0.967)	-0.091 (0.145)	-0.054 (0.343)	0.065 (0.054)
TAT	-0.014 (0.899)	0.089 (0.556)	0.047 (0.718)	0.086 (0.286)
LDR	3.041* (0.010)	1.903 (0.221)	2.439 (0.065)	2.232** (0.007)
CIR		-0.275 (0.078)	0.001 (0.917)	-0.007 (0.300)
Number of observations	280	280	280	280
Coefficient of determination R ²	0.532	0.513	0.525	N/A
F statistics	38.56	25.75	244.78	N/A
P-value	0.0000	0.0000	0.0000	N/A

Note: GC is green credit, FT is fintech, CAR is capital adequacy ratio, NPM is net profit margin, SIZE is bank size, EM is leverage ratio, TAT is total asset turnover, LDR is loan to deposit, CIR cost to income ratio; *, **, *** represent statistical significance level 10%, 5% and 1%, respectively.

The results from the Pooled OLS model are that fintech, capital adequacy ratio, asset size, loan ratio, and cost-to-income ratio are significant at a statistical level, with fintech, asset size, and loan ratio having

positive coefficients and capital adequacy and cost-to-income ratio having negative coefficients (Table 5). The other variables were insignificant. Under both the FEM and REM specifications, bank size and fintech were also positive to green credit, but others were not yet significant. In implementing the F-test and Hausman test, the FEM was found superior to Pooled OLS and REM superior to FEM when investigating the effects of fintech on green credit.

Despite these findings, both FEM and REM models suffered from heteroskedasticity and autocorrelation issues that could undermine the validity of the model. The Breusch and Pagan test indicated heteroskedasticity in the REM model, and the Wooldridge test validated autocorrelation. The Durbin-Wu-Hausman test also did not find an endogeneity issue in the model. Due to these issues, the study then went on to use the FGLS (Feasible Generalized Least Squares) estimation technique to address these issues and further refine the model.

The study confirms that Fintech (FT) has a significant and positive impact on Green Credit (GC), with the parameter's value being 0.0004 at the 1% significance level. The finding corroborates previous research, which has shown that fintech technologies like big data, AI, and blockchain enable banks to make more informed decisions, reduce risks, and process green credit loans in advance. Also, the Capital Adequacy Ratio (CAR) is negatively associated with green credit, with a coefficient of -0.098. It means that higher CAR can lower green credit issuance, and policies should be introduced to stimulate green credit growth without sacrificing financial safety. Furthermore, the study suggests that bank profitability (NPM), asset size (SIZE), and loan-to-deposit ratio (LDR) have a positive effect on green credit, reflecting that richer, more financially stable banks are better placed to invest in green activities.

On the other hand, EM and TAT are positively related with GC, though not statistically significant in the study. These variables illustrate that banks that have more leverage and asset turnover will be prone to grow green credit since they have more capital and efficiency to invest in such long-term activities. Moreover, even though Cost-to-Income Ratio (CIR) had no prominent part to play in GC in this study, it reflects that the banks with low operating costs are capable of earning more revenue to invest in green credit projects. In general, the results point to the complex interplay between financial stability, operational efficiency, and fintech adoption in playing a role in green credit growth in the banking sector.

5. Discussion

The results indicate that fintech significantly promotes the development of green credit in Vietnam, with positive coefficients that align with previous research. This result

is consistent with previous research, such as that by Liu & You (2023). Fintech technologies, such as big data, artificial intelligence, and blockchain, improve the efficiency and accessibility of green credit by optimizing decision-making and risk management.

In addition, the study found that CAR negatively affects green credit, which is contrary to previous research suggesting a positive impact. This negative relationship reflects the high initial investment costs associated with fintech and the evolving stage of risk management in Vietnam's banking sector. The results suggest that, in the short term, fintech may increase management costs and strain bank resources, hindering green credit growth. On the other hand, factors such as bank size (SIZE) and loan-to-deposit ratio (LDR) positively impact green credit, as larger banks with more resources are better positioned to allocate funds to green credit projects, which often require long payback periods. This results is similar to the research by Yin et al. (2021)

The study also finds that variables like financial leverage (EM), total asset turnover (TAT), and cost-to-income ratio (CIR) do not have a significant impact on green credit. These findings suggest that these factors are not key drivers in promoting green credit in Vietnam. This result is consistent with the research by Duong & Trang (2019). The research provides valuable insights for policymakers and financial institutions, emphasizing the need for a supportive policy framework to foster the growth of fintech and green credit. It also highlights the importance of addressing data limitations and current regulatory challenges to further develop green finance and ESG initiatives in the country.

6. Management Implications

The research has shown that Fintech has a positive impact on green credit, banks can take action to develop resources in building a Fintech ecosystem to support green credit. Banks need to cooperate with companies that specialize in providing financial technology services and have expertise in the field of digital transformation to develop digital platforms to upgrade products and customer care services. Thereby, green credit activities can be improved. The application of blockchain technology and artificial intelligence (AI) can help increase transparency in monitoring and managing projects, while minimizing costs and processing time for lending activities. green area.

Banks need to invest in developing advanced data analysis tools, applying AI and big data to comprehensively forecast and assess risks. Developing effective risk management strategies is an important policy implication in the context of FinTech increasing pressure on risk management costs for banks when deploying green credit. The characteristics of green credit are often associated with long-term, complex

projects with potential environmental, market and financial risks, requiring specialized management tools. Building specialized risk management systems, integrating blockchain technology to increase transparency and reduce fraud is a key factor in optimizing operational efficiency.

High-quality human resources in Vietnam in the Fintech field are still modest and knowledge about green credit is not yet widely disseminated. Thus, commercial banks can increase professional knowledge and training on green credit for employees. Banks need to invest in training employees on green credit regulations and standards and how to apply Fintech technology to optimize the lending process.

Thus, the application of Fintech in green credit will help Vietnamese commercial banks not only improve financial indicators but also contribute to the country's sustainable development goals. This is a digital revolution in all fields in general and in the banking sector in particular for the goal of sustainable growth in the future.

7. Research limitation

The research successfully examines the impact of Fintech on green credit in Vietnamese commercial banks and offers policy recommendations to support its development. However, the study has several limitations. First, the selected data does not fully represent all the Fintech factors that could affect green credit, as some relevant variables were not included. Second, the research was limited to data from only 28 commercial banks due to barriers in accessing complete information, which means it does not cover the entire banking system in Vietnam. Lastly, the variables related to Green Credit (GC) and Fintech (FT) are relatively new in Vietnam, and the data was mainly collected from primary sources, which may have led to some gaps or omissions in the information.

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