



Banking for Climate Risk Mitigation: An Investigation of the Role of Green Digital Finance

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Abstract

The businesses facing contains accessing finance when adopting sustainable practices in business operations. Digital finance is a tool to reduce financial constraints imposed by traditional financial systems. This study investigates the role of green digital finance in reducing climate risk using balanced panel data from South Asian economies. The study utilized a pooled mean group estimation approach to measure the impact of digital finance on climate risk in the presence of green innovation. The findings revealed that green digital finance mitigates climate risk and green innovation plays a significant role in enhancing the relationship. This study provides robust recommendations and policy implications.

Keywords: Digital finance, Climate risk, Green Innovation, Asian Economies

1. Introduction

It is imperative to implement clean, eco-friendly technologies in order to achieve long-term sustainable economic growth without compromising environmental protection. This demands better understanding, technological improvements, and agility in transitioning to clean energy for sustainable development as explained by (Liang, Zhao, Wang, & Li, 2018). He and Guo (2021) investigate how scholars and practitioners are actively proposing methods and policies for sustainable energy solutions in emerging economies, where the benefits of efficiency is still being examined. Opportunities to address these concerns are presented by the rapidly growing alternative energy sector. Because of the sector's strategic importance and inherent obstacles, researchers such as (Kamyk, Kot-Niewiadomska, & Galos, 2021) have explored the driving forces, like sustainable finance, technological innovation in financial sector.

Numerous studies have demonstrated that the role of financial capitals has been a main emphasis in this setting (Rasoulinezhad & Taghizadeh-Hesary, 2022; Taghizadeh-Hesary & Yoshino, 2019). Investments in alternative energy are risky due to their high initial costs and lengthy payback periods, which emphasizes the necessity of strong financial support. Numerous advantages come with this kind of funding system, including easier transactions, lower risk, more allocative efficiency, and more investment options (Yoshino et al., 2021; Zhuang, Mi, Zhi, & Zhang, 2022). Hence the need for sustainable finance have been highlighted due to the limitations of the traditional financial system. Due to the climate distress for banks and society at large, green finance is becoming a significant tool in banking industry. According to (Ziolo, Filipiak, Bąk, & Cheba, 2019) and (Dikau, Robins, & Volz, 2020) there is a dire need of transition from conventional banking to eco-friendly products. (Kim, 2017) claimed that global banking committed to supporting green financial solutions during the Paris "One Planet Summit" in December 2017. Moreover, (Urban & Wójcik, 2019) as well as (D. Zhang, Zhang, & Managi, 2019) support the World Bank's announcement that it will no longer provide funding to organizations that disregard environmental protection (2019).

Wang et al. (2021) explained that emerging technologies like online banking, blockchains, digital finance, and AI have enabled the financial sector to benefit from reduced costs, improved service quality, decreased information inequality, enhanced transparency, and greater diversity and stability. Sustainable finance is transforming financial services, offering clients alternatives to traditional lending methods at lower costs and pressuring conventional financial institutions to upgrade their offerings. Sustainable finance may resolve funding issues by offering digital finance that can help businesses to adopt sustainability practices. Taghizadeh-Hesary & Hyun (2022) explained the importance of digital financing that could significantly benefit climate mitigation practices. This study investigates the role of digital finance as a proxy of sustainable finance for climate risk mitigation.

According to Han & Wang (2023), digital finance has the potential to supplant conventional finance and effectively address financial obstacles, hence promoting investment in sustainable resources. The advent of financial technology (fintech) has led to enhanced credit accessibility for businesses (Tang, Chen, Zhang & Zhang, 2023). A comprehensive analysis is conducted in this study to investigate the effects of digital financing on sustainability parameters.

The study examines the correlation between digital finance and the reduction of climate risk by utilizing balanced panel data from emerging economies in South Asia. Digital finance offers an opportunity in South Asian emerging economies, where traditional financial institutions have limits in terms of their reach and efficiency. The study conducted by Sharma, Gupta, and Gupta (2024) presents innovative strategies for effectively addressing the financial risks associated with climate change, while also enhancing the availability of financial services. The significance of this matter lies in the fact that these economies often exhibit a higher vulnerability to the impacts of climate change due to socioeconomic and geographic factors (Sharma et al., 2024). Furthermore, South Asian

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nations are highly susceptible to the consequences of climate change. According to Zhang, Khan, See, and Ying (2023), the presence of this vulnerability highlights the necessity of implementing efficient financial solutions in order to address and reduce climate risks. Moreover, the swift expansion of digital finance in these areas, propelled by technological progress and rising internet accessibility, offers a distinctive chance to examine its influence on sustainability (Parihareta, 2022).

This study contributes to the existing body of literature by highlighting the unique benefits of digital finance and proposing a novel approach to mitigating climate risk. This study examines the correlation between digital finance and the growth of sustainable enterprises by investigating the optimal trajectory between digital finance and environmental governance.

2. Review of Literature

The term "green finance" refers to financial investments that support policies, environmental goods, and projects and activities that promote the growth of a more sustainable economy. It has gained prominence in discussions of international economics. Central banks are in a unique position to influence commercial banks' adoption of green finance policies because they are important regulators of the financial system. This study looks at the tactics used by central banks to support green finance and how these tactics affect the operations of commercial banks.

2.1 The Role of Central Banks in Green Finance

According to their mandates, most of the central banks' principal responsibility is to ensure low and stable inflation, which is the core objective of monetary policy. The theoretical and empirical understanding that low and stable inflation is a prerequisite for growth or development. This focus is sometimes nested inside an inflation-targeting framework. For central banks, which have historically preserved financial stability has always been of equal importance to them as ensuring low and stable inflation. However, climate change and other environmental threats impact central banks' ability to pursue their primary aims of monetary policy act as a driving force to consider environmental factors. Dikau & Volz (2021) contended that central banks are more inclined toward environmental risks to maintain financial stability. The promotion of best practices in green finance has been greatly aided by central banks and the Network for Greening the Financial System (NGFS, 2020). Regulatory frameworks requiring commercial banks to consider environmental risk when making lending and investment decisions are created by central banks (Campiglio et al., 2018).

Commercial banks can be encouraged to fund environmentally friendly initiatives supported by central banks through a variety of incentive programs. Lower reserve requirements and advantageous interest rates for green loans can be beneficial (Ozili, 2022). Targeted longer-term refinancing operations by the European Central Bank are one way to encourage banks to lend to environmentally friendly projects (Schnabel et al., 2020). Notwithstanding these initiatives, measuring environmental risks remains difficult, and there are no agreed-upon definitions and measurements for green financing (Monnin, 2018). There are also many worries about central banks going beyond their established missions and the possibility of greenwashing in the financial industry (Tooze, 2019).

Central banks play a crucial role in steering the financial sector towards sustainable practices. Through policy formulation, regulatory measures, and incentives, they can significantly influence commercial banks' adoption of green finance. However, the effectiveness of these measures is contingent upon overcoming challenges related to risk assessment, standardization, and maintaining the balance between regulatory objectives and environmental goals. These challenges also impact the commercial bank to motivate towards sustainable finance.

Commercial banks face several obstacles when implementing sustainable financing strategies. These difficulties are caused by a multitude of elements, from more general market and regulatory dynamics to internal operational problems. It is imperative that banks and policymakers comprehend these elements to successfully overcome these complications and advance a more sustainable financial system.

2.2 Digital Finance and its Role for Climate Change Mitigation

It is difficult to invest in new initiatives particularly sustainable development projects due to high initial costs, long payback periods and unforeseen risks in developing economies (Zhou, Wilson, & Caldecott, 2021). For instance, the renewable energy companies frequently face difficulties obtaining funding from financial institutions. According to Li et al. (2019), China's renewable energy enterprises deal with particular financial difficulties. The inadequate infrastructure for funding renewable energy projects needs to be supported by a market-oriented investment and finance platform. Government financial and regulatory incentives are essential for the development of sustainable business processes (Zhang et al., 2017). Furthermore, it could exacerbate the problem of financial exclusion by reshaping it to continually benefit the wealthy and powerful (Forero et al., 2018).

The financial sector's digitization offered services by online/digital enterprises (Fintech) and also by traditional financial institutions that are expanding digitally. The importance of digital finance is multifaceted. Firstly, it enhances the financial sector, creates new business models, and provides startups with access to financial services. Peer-to-peer lending, for example, has become increasingly popular as a means for startups to raise funds directly from individuals rather than through traditional financial intermediaries (Morse, 2015). Secondly, digital finance simplifies financial transactions, removing geographical and temporal barriers and enabling startups to access

reliable services without extensive paperwork. Thirdly, it levels the informational playing field and improves risk management. With the rise of big data, businesses can better evaluate creditworthiness and make informed decisions (Lee & Shin, 2018). Lastly, digital banking challenges traditional banks to enhance and innovate their services. Hence this study hypothesized that: *H1: Digital financing growth reduces climate change risk.*

Green technology is promoted by digital finance through several different means. It can spur innovation through raising household incomes, facilitating the construction of physical infrastructure, and expanding access to higher education. Ding, Wang, Wang, & Mohsin (2023) underscore that a crucial factor in enhancing scientific and technical innovation is the allocation of resources towards human capital. Digital finance at the university level has enabled deeper academic research and a wider pool of qualified persons, which are both responsible for the spread of innovation. Additionally, by lowering income inequality and generating job possibilities, digital finance promotes overall economic growth, which stabilizes government funding (Lee & Shin, 2018). This consistent government investment is essential for fostering innovation in the region and advancing a variety of fields, including economics, science, culture, medicine, and transportation.

Additionally, digital money may increase discretionary expenditure by consumers. In order to do this, it raises people earning and increases their purchasing power, allowing them to spend more on products that raise their standard of living and increase productivity at work. This shift in customer demand may encourage to embark on novel projects, fostering local innovation and improving the climate for innovation in the relevant fields. These observations lead to the following theory being put forth:

Hypothesis 2: Digital finance necessitates augmenting the degree of regional innovation.

Accordingly, digital finance has an impact on more than just financial transactions; it also has an impact on broader socio-economic aspects and promotes innovation and sustainability in the future. The transition to digital finance, represents a paradigm shift. It offers a more inclusive, efficient, and sustainable approach to financial management and investment, crucial for addressing the unique challenges faced by developing economies.

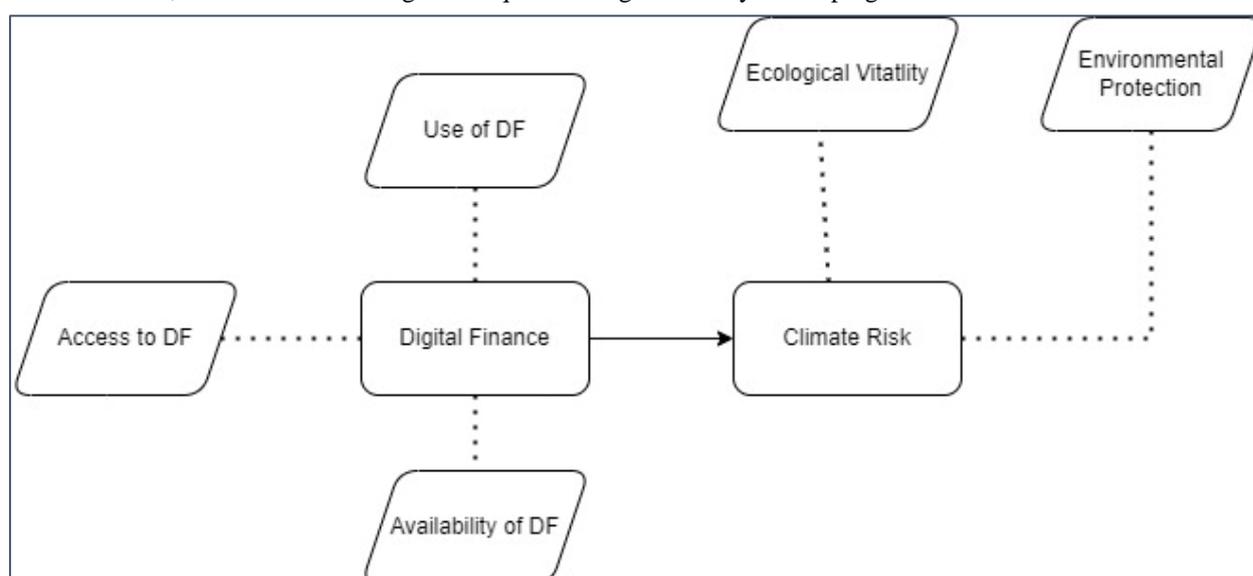


Figure 1: Conceptual Model of the Study

3. Research Design

This paper explores the interplay between green finance, and climate risk mitigation. It utilizes time series data from 2012 to 2021, encompassing south Asian emerging economies. To measure the climate risk, the Environmental Performance Index has been utilized which evaluates ecological vitality and protection, and a critical measure in this assessment (Ding et al., 2023). In tracking green finance (DF), the study adopts the World Bank data by developing DF index that comprised of three dimensions i) access to DF ii) availability of DF, and iii) use of digital finance. It is important to highlight that all these parameters are recorded in logarithmic form to ensure a more nuanced and accurate analysis of the data. The amount of grant applications for local technologies like air environmental protection, contamination emission reduction, sewage treatment, bioremediation, and environmental control technologies has been used as an indicator of green innovation. These numbers can be found in the organization for economic cooperation statistics database.

4. Results and Findings

In this study, a panel unit root test that accounts for cross-sectional dependence has been utilized in the first step. To determine the stationarity of all variables, the augmented Dickey-Fuller (ADF) test was used (Zhou et al., 2021). The results of this test are crucial for understanding the nature of the data being analyzed. Table 1 presents the findings of the ADF panel unit root test. It is found that all three variables named as DF, GI and CR exhibit a

unit root. This presence of a unit root indicates that the series are not stationary. However, at first difference the series becomes stationary. Consequently, these series are integrated, meaning that they are non-stationary in their level form but become stationary when differenced.

Testing for co-integration is the next step after determining that the series are integrated. In time series analysis, co-integration testing is essential, particularly when working with panel data, since it aids in determining the long-term equilibrium relationship between variables. When variables are co-integrated, it means that even though they are non-stationary in isolation, they move together across time and exhibit a similar stochastic trend. This stage is necessary for both additional analysis and deriving significant conclusions from the study's findings.

Table 1: Unit Root Test

CR	DF	GI	Δ CR	Δ DF	Δ GI
-1.89***	-2.45***	-1.98	-2.72***	-3.28**	-3.10**

*Denotes significance level at 10%, **Denotes significance level at 5% and *** Denotes significance level at 1%. We then use panel co-integration to investigate the long-term relationships among CR, DF, and GI. This approach solves the diversity problem.

Table 2: Estimation Panel Co- Integration

Model	G_{τ}	G_{α}	P_{τ}	P_{α}
<i>CR vs DF</i>	-13.04*** (-9.73)	-11.40*** (-9.75)	-19.30*** (-10.43)	-11.30*** (-11.80)
<i>CR vs GI</i>	-11.723*** (-7.27)	-12.374*** (-4.82)	-26.94*** (-13.64)	-10.83*** (-17.23)
<i>CR vs GI & DF</i>	-15.273*** (-12.09)	-10.09*** (-6.39)	-22.78*** (-12.53)	-13.22*** (-5.28)

*Denotes significance level at 10%, **Denotes significance level at 5% and *** Denotes significance level at 1%. Based on the residuals Table 2 explains the panel co-integration results. It is noted there is a long-run co-integration among variables. Moreover, the results of the pooled mean group for panel data have been presented in Table 3. There is a significant association between digital finance (DF) and climate risk (CR) in the long run. Furthermore, the moderating role of green innovation has also been noted as significant.

Table 2: Pooled Mean Group Estimation

Dependent Variable=CR			
Long-run		Short-run	
DF	-0.063*** (-1.37)	Δ DF	-0.826*** (-6.92)
GI	-0.032*** (-3.59)	Δ GI	-0.5263*** (-3.19)
Constant	0.8363*** (6.128)		

In order to balance digital finance and climate risk, this study explores the role of innovation that has not been previously examined in research. Results reveal that the impact of digital finance is significant to decrease climate risk in emerging economies. Additionally, because digital finance offers new funding options, companies with higher financial constraints or limited accessibility to finance can obtain benefit. Digital finance lessens the negative effects of financial limitations, enabling more smooth firm growth towards green practices. The findings of Dikau & Volz (2018), who observed that the majority of firms impacted by the digital credit scheme have restricted access to financing. This is also in line with Cheung, Baumber, & Brown (2022) that pollution is decreased by green innovation at the corporate level. However, the cost of additional financial resources and increased financial limitations as a result of green innovation can jeopardize financial success. Hence, the efficacy of digital finance can remove obstacles of limited financial resources by the growth of digital platforms, the adoption of sophisticated digital technology, and the demand for digital knowledge.

5. Conclusion and Recommendations

The global climate crisis has emerged with the ongoing use of natural and environmental resources and their degradation. The world has understood how urgent it is to become carbon neutral. The establishment of a low-carbon economy will be a central theme in economic and environmental discourse in the ensuing decades. Concurrently, there is considerable interest in a unique kind of finance, characterized by digitization and inclusive principles, which appears crucial in encouraging a low-carbon economy. The impact of green digital finance on sustainability is evaluated in this research using panel data from south Asian emerging economies between 2012 and 2021.

The key findings demonstrate that promotion of green technology innovation through digital financing can significantly reduce carbon intensity. Digital finance addresses the financing challenges of firms and reducing

financial risks. The role of green digital finance in CO² reduction is pronounced in developing countries with developed traditional finance systems, explains the paradigm shift in financial system of these countries. The article makes several policy recommendations considering these findings. It is recommended that governments prioritize the advancement of green finance through digital means, encourage cooperation between financial institutions and local authorities, create digital banking services that prioritize digital financing. To assist entrepreneurs in obtaining finance for green development, they should also enhance resource allocation to regional financial contexts. To improve digital financial landscape, traditional banks should also embrace digital finance to raise their impact on the environment and society.

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