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Impact of green finance and environmental protection on green economic recovery in South Asian economies: mediating role of FinTech

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Abstract

Green finance and digital finance are cornerstones of sustainable growth. Given the significant investment and funding challenges that South Asia's new energy development faces, the potential role of digital finance in this situation is uncertain. Applying panel regression analysis and using a two-step generalized method of moments (GMM) to eliminate endogeneity, this study examines the connections between green finance, financial technology (FinTech), and high-quality economic development using data from three South Asian economies between 2000 and 2018. The study demonstrates that India, Bangladesh, and Pakistan use multiple green financing initiatives, resulting in a considerable decrease in commercial CO_2 across the review period, which extends environmental protection and confirms the green economic recovery. FinTech development also helps reduce CO_2 emissions, making a favorable contribution. Selected South Asian countries are on track to become world leaders in green finance strategy implementation, and authorities must speed up the development of green recovery and services and strengthen banking institutions' ability to provide green loans. FinTech and green finance, it turns out, have a significant impact on green economic development. The study also has policy implications for the associated stakeholders.

Keywords FinTech · Green finance · Environmental protection · Green economic recovery, economic resilience

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1 Introduction

In order to address climate complexities, there is a need to restrict the % of carbon emissions. Several nations as of now have made their top target to mitigate the emissions and prepare themselves for the consequences that are inevitable. Countries are trying to develop strategies and programs to show their support for low-carbon growth models in order to contribute not only in financial areas but also add on fruitful bearings in social well-being with the help of preservation and restoration of environment and natural resources. This overall effort ultimately helps them to achieve sustainable development goals which as of now is globally a top most priority (Chien et al. 2022b; Syed et al. 2021).

Since, economic growth is a combination of various financial factors and trading efficacy of business factors, thereby, the transformation of a rudimentary economic growth model and the realization of green development as a goal, green growth is a vital institutional guarantee. Organizations at all levels are being tested, as the traditional development model's high per-capita resource use and rising environmental strain from resource extraction, processing, and use raise additional macroeconomic costs (Ainou et al. 2022; Han et al. 2022). Green growth may detach economic development from pollution and connect the economic and the environmental aspect. Administrations have invested a lot of time and energy into this strategy, since it is a development plan that provides for the many factors or resources required for manufacturing and living processes, and enables financial progress (Bai et al. 2022; Liu et al. 2022a). It is argued that financial sector of developed economies has already been shifted to novel and innovative green financial approaches such as reduce, reuse and recycle. The reason being its effective and eco-friendly adaptation. Due to its easier adaptability, environmental biologists and researchers are working simultaneously on ventures through which they can develop green financial economy and infrastructure. The concept of green economy emerges with ecological crisis due to which environmental balance has been disturbed; hence, the world now need an honest effort in the form of green economy and businesses.

Green financing, among other themes, is one of the emerging themes of green economic development program. It is a kind of investment which caters social and environmental areas at private or state level. It is green financing, which motivates investors to investment eco-friendly resources at industrial level because energy resource is the main aspect of businesses especially related to manufacturing, transport, mining or tourism. Since non-renewable resources are cheap in comparison with renewable resources, thereby, their share in energy mix is greater (Chien 2022a; Ozili 2021). However, their excessive usage has an adverse effect on society, environment and natural resources quality. Alternatively, renewable resources demand more financial resources but their usage is not dangerous to environment and general public. Green financing, in this regard, allows firms to carry out their activities inline with green objectives by promoting renewable resources. It is said that during pandemic, green financing considered to be the most significant source as it protected the health of individuals, safeguard natural

environment and rescue economic growth from further fall (Zhao et al. 2022). This indicates that green financing is capable enough to mitigate GHG emissions through capital reallocation of energy intensive industries toward green economic recovery. Besides, green financing also doubled the existing funds and use them to refine the green industrial structure. Environment-related financial disclosures are one of the fine examples of financial regulation tools that are used by central banks to direct their capital flows. There is no doubt that many countries are exerting full flash efforts to make a shift toward high-quality economic model where ecological protection is primary focus (Chien et al. 2022c; Kshetri et al. 2019).

Other than green financing, digital financing unifies financial services with digital technologies. This is possible due to remarkable advancement in big data analysis, AI and Information technology. In finance, digitalization encourages the usage of digital technologies in banking and financial sector. Individuals as well as firms utilize digital services in the form of remittances, savings, online transactions, etc. through digital platforms such as ATMs, POS terminals and mobile apps. Fintech services are also a part of digital payments (Chien, 2022d). In last three years, IMF report claims that an unprecedent increase in digital remittance, lending and payment is observed in developing economies. Particularly, in emerging economies, digital payment services jumped from 1.2 to 1.5 dollar trillion in 2019 (Medina and Schneider, 2018; Zhang et al. 2022). In a similar manner, mobile payments have also escalated by 50%. Not only these services have witnessed sharp jump, but the % of users have also been increased. For example, users of mobile payment service particularly reached up to 4 billion in 2019 which represents the 64 parts of population. Hence, it shows that technological advancement in particular financial services bring financial inclusion which is a sustainable way to achieve low-carbon goal. As per technological spill over theory "financial inclusion results from reaching out to people through the internet and fintech technologies." Thereby, it is one of the prime objectives' of 2030 sustainable goals (Mani 2016). Because of this, South Asian economies are putting efforts to transform non-banking population into banking population through Fintech revolution and digital finance. Unfortunately, the lack of infrastructure and scarce resources expedites the whole process. As per statistics, in the area of digital payments, the share of Pakistan, India and Bangladesh is less than 1% (Chien et al. 2021; Risman et al. 2021).

Further to the discussion, digitization and service-related development particularly in South Asian economies depict that the said area witnessed growth by 6.89% in between 2018 and 2019. Although the progress of overall South Asian region witnessed the upward growth, however, the rebound has been uneven among countries and industries. After the breakout, the average annual of South Asian region reached up to 5.3% which is comparatively 4 points lower before breakout era. The economy of India, which is considered a biggest economy of South Asia, is predicted to expand further by 8.3% due to spending of state and creation of subsidies to increase production. Similarly, Commerce and expenditures will support Bangladesh to gain strength in its growth rate. Institutions and authorities throughout the globe are taking precautionary measures to minimize their energy consumption due to climate eclipse. In this regard, government

policy measures, that are to be helpful to achieve zero-carbon objective in adverse climate effect, might boost the country's competitiveness, efficiency and income growth (Mugoda et al. 2020).

Moreover, due to scarce resources and insufficient infrastructure, 50% of the population of emerging economies do not have access to financial services. Hence, these technological spill over effects motivates to investigate the effect of green finance and environmental protection on green economic recovery in the presence of Fintech in selected South Asian economies. The reason to chose South Asian countries can be justified in various ways (Dinh et al. 2022; Niebel 2018). As it is known that south Asia is comprised of eight economies and among these 8 economies, India, Bangladesh and Pakistan are three economies which are included in the fastest emerging economies of South Asia having a large population and potential market. Moreover, in terms of political instability, these countries' progress is much low in the context of financial inclusion. Besides, in over all south Asia, only 60% population is unable to have access to formal financial services. However, 2030 SD goals, pushed these economies to put maximum effort to increase financial inclusion. For instance, India whose GDP represents 80% GDP of said region, its growth particularly in digital finance is multifarious. Moreover, by 2025, it is expected that digital transactions will grow by 71.7 percent in India. In similar notion, a bullish view on the virtual economy of Pakistan by world bank articulates that the estimations might reach 36 million dollars, hence, boosting GDP by 7% (Ramli and Hamzah 2021; Zhao et al. 2021). Hence, the untapped financial market encourages us to explore outlined constructs in these three economies.

The following sections of this paper provide insight into the subject selection process from a new angle. Many studies examine how financial innovation affects green growth, but only a few examine how FinTech innovation affects green growth, which is discussed in this study. The mechanism and trajectory of the role of FinTech are outlined and tested, which is the first contribution of this research. FinTech innovation directly leads to the creation of environmentally friendly financial products and services, which stimulates the rise of green growth. Studying this enhances the theoretical and empirical understanding of the concept, which is the second contribution of the research. This research creates an indicator of green economic growth in the form of a three-level index based on several previous studies and the reality of Pakistan, India, and Bangladesh. It takes a panel data approach to decrease the dimensions and weight the index to compute the green growth index. To compensate for the shortcomings of previous research, this study conducts empirical testing at many levels. It examines the link between green growth and FinTech innovation and challenges the heterogeneity and effect mechanism. Exploring the regional differences in FinTech innovation and the tools that impact green growth is the fourth contribution of this research. The remainder of the paper is arranged as follows: Sect. 2 contains the literature review; Sect. 3 covers the methodology and data sources; the empirical results and discussion are presented in Sect. 4; and the conclusion and policy implications are discussed in the final section.

2 Literature review

An environmentally friendly expansion of the economy has been ongoing for some time (Shibli et al. 2021). As discussed by Acheampong et al. (2020), ecological funding can promote economic efficiency and minimize environmental deterioration. Green funding was conceived and implemented between 1997 and 2003. Green financial development is a crucial financial innovation that connects the banking industry with the circumstances surrounding climate change management (Duong et al. 2022; Mohsin et al. 2022). Green economic growth and ecological footprints tend to grow at different rates. Although Heinlein et al. (2021) find no direct relationship between GDP and environmental cost, there is a strong link between manufacturing upgrading and research and development activities. Incorporating green economic development can promote economic viability (He et al. 2019; Sudapet et al. 2021), which is crucial to the efficient running of projects. Therefore, it is crucial to know how far down the green development path the countries of South Asia are (Dhakouani et al. 2019; Huang et al. 2022). To summarize the green economic growth environments of South Asian countries: firstly, the green economic development of South Asian nations has expanded dramatically over the last decade, although it lags behind Europe, with the average GDP per capita in South Asian countries being 67.3 in 2016, up from 51.7 in 2008, and there is much room for improvement in ecologically friendly growth in South Asian countries. Secondly, green economic development levels in South Asian countries are more dispersed than in Europe. Between 2002 and 2006, the theory of green finance persisted, with environmental sustainability informing the theoretical underpinnings of finance, which were used to incorporate the financial sector into the overarching framework of the business world (Gumashta and Gumashta 2021; Kamarudin et al. 2021). El-Kassar and Singh (2019), as part of a study of green financial development, surveyed financial firms in developing nations and worldwide international market nations about their spending on the social, economic, and natural environment. According to Tolliver et al. (2020), who explore the environmental Kuznets curve (EKC) theory in Istanbul, there is a symbiotic relationship between financial growth and environmental sustainability.

3 Research into digital finance

Developments in digital finance have become crucial drivers of high-quality financial growth in the context of the ongoing scientific and technological revolution and industrial transformation (Ikram et al. 2019; Lan et al. 2022). Digital finance emerged from the successful merger of finance and technology to address the challenges that hampered the growth of conventional finance, encompassing

a broad spectrum of goods and services, and supporting infrastructures that allow individuals and organizations to pay, save, and access credit using the internet banking (Lin et al. 2022; Mohsin et al. 2021; Ojogiwa 2021). By modernizing financial goods and business processes, and reshaping business situations using science and technology, digital finance has become a crucial type of technology-driven financial innovation in the context of the digital economy. Much of what is written about digital finance concerns how the industry affects the economy and how regulators oversee it (Liu et al. 2022b; Nieuwenhuijsen 2021). Van Vuuren et al. (2017) suggest using digital technology to create more intelligent and humanized goods, which help customers and institutions. By using big data and other technology, businesses can better understand their customers' wants and requirements, and those unable to get funding can access flexible funding options while helping to consolidate the financial sector. In their analysis of the effects of digital finance on consumption, Calise et al. (2020) and Jermsittiparsert (2021) conclude that the growth of this sector contributes to higher standards of living and economic growth. The COVID-19 pandemic put unprecedented strain on the economy, governments, businesses, and people, and the resulting human, economic, and financial consequences rose quickly. Therefore, a novel digital financial model may accelerate economic recovery (Atahau et al. 2021; Moslehpour et al. 2022a). However, various subject roles provide digital finance with varying degrees of power, leading to nuanced consumer demand among communities that have mastered contemporary forms of communication. In general, digital finance can more readily influence groups with higher education, and financial limitations of financing or credit can significantly diminish the role that digital finance can play (Moslehpour et al. 2022b; Zhou et al. 2017). On the one hand, digital finance has achieved high-quality financial growth by increasing financial innovation and service levels. But, on the other, some researchers point to the negative effects of digital finance. The good and bad effects of digital finance are examined by Shemer et al. (2001) and Wirsbinna and Grega (2021), who find that digital finance significantly affects financial systems, particularly system risk. Therefore, limiting risk variables is a crucial assurance that digital finance can play a significant role.

Technical innovation, economic considerations, energy use, industrial upgrading, and other aspects impacting economic development are vital components of green economic growth. Avom et al. (2020) find yearly discrepancies in the adoption of green growth plans, which undermine them. For companies that rely heavily on natural resources, economic swings and extreme variations in resource costs are a significant concern (Lowitzsch et al. 2020; Moslehpour et al. 2022c), which may have an impact on green growth. Energy use damages green growth, and reducing energy consumption considerably enhances green development. From the vantage point of industrialization, Liu et al. (2019) use the spatial Durbin and intermediate effect models to examine the variables influencing China's green financial development.

4 Methodology

4.1 The theoretical framework

This study measures environmental protection through green finance for economic recovery (Campbell and Perron 1991) and the role of FinTech. Neoclassicists believe that green economic recovery through net GDP rate is not smooth or harmonious and is more likely to be achieved through a continuous process, meaning the use of FinTech is unrealistic, especially in terms of capital creation for environmental protection and green economic recovery. However, recent studies verify the theoretical underpinning of green financing for environmental protection, green economic recovery, and FinTech.

$$Y_i = A_i \mathrm{DT}_i^{\alpha} \mathrm{KL}_i^{\beta} \tag{1}$$

4.2 Study data

Modern economists believe that FinTech has an important role to play in achieving green economic recovery and environmental protection through green financing. Using the World Development Index (WDI) database, the study collects data from 2000 to 2018 (Table 1).

4.3 Model development

This research uses a panel regression model to investigate how developments in the financial sciences and cutting-edge technologies affect sustainable development in the sample of three South Asian Economies; India, Bangladesh, and Pakistan. The approach uses a green growth index and the innovation rate in FinTech as independent variables. The explanatory variable is FinTech, and its corollaries are technology input, capital, and labor input.

The study uses three distinct estimating procedures for panel regression: mixed regression, fixed effect, and random effect. The estimated method is evaluated first. The results of the *F* test for the panels show that the fixed effect model is better than the mixed regression model ($p < 0.05$). Secondly, the random effect is superior to the

Table 1 Variable specification and data sources

Variable	Description	Data source
GF	Green finance development index	WDI
GER	Green economic recovery	WDI
EP	Environmental protection	WDI
FT	FinTech adoption	WDI
GDP	Gross domestic product	WDI
CO_2	Carbon dioxide emission	WDI

mixed regression model, as shown by the panel regression Breusch–Pagan (BP) test results. Rejecting the null hypothesis, the Hausmann test concludes that the fixed effect model is more appropriate than the random effect model.

In conclusion, the research uses a fixed effect model to investigate how advances in financial technology affect environmentally friendly economic expansion. The formula is the standard regression model. The variable i in the model stands for one of the South Asian subnational administrative divisions, *and* t is the year. The hypothesis testing includes the use of the benchmark regression:

$$\gamma = \alpha + \beta 1 \chi 1 + \ldots + \beta nxn + \varepsilon \tag{2}$$

The econometric specification of the study model is:

$$yt = \beta_0 + \beta_1 \mathrm{EP}t_{i,t} + \beta_2 \mathrm{GER}_{i,t} + \beta_3 \mathrm{FT}_{i,t} + \beta_4 + i \sum_{i=1}^{18} \mathrm{Year} + i + \beta_5 j \sum_{j=1}^{8} \mathrm{country}j + \varepsilon t a_0 \tag{3}$$

$$yt = \beta_0 + \beta_1 \mathrm{EP}t_{i,t} + \beta_2 \mathrm{FT}_{i,t} + \sum X_{i,t} + \mu_{i,t} \tag{4}$$

where environmental protection (EP), and green economic recovery (GER) FinTech (FT), refer to the main variables of the study.

5 Results and discussion

EP has a twofold threshold impact on both energy-FT and climate, using the panel threshold model with ECR having less. The estimation coefficients of EP are notably positive before the initial threshold of 0.1661 for both energy-BTP and its surroundings. The estimated value of EP to GDP rises as the initial threshold is exceeded, indicating that the impact of EP on GDP grows in tandem with the enhancement of ECR. This indicates that ECR may boost the favorable impact of green finance (GF) on eco-friendly technology development. The regulatory function of ECR and GF may accomplish a win–win scenario between relatively brief energy saving and energy production.

5.1 Empirical results

Increasing tax revenue is possible via several taxing and charging strategies that may also further EFR or sustainability standards. FinTech and other instruments with a specific emphasis on environmental concerns may enhance regulations and other actions in the area of natural research. Compared to regulated methods, FinTech offers the potential to more swiftly and cheaply achieve environmental objectives. The research finds that green economic recovery is aided by environmental preservation efforts. Increasing the availability of green finance sets off this correlation. Now, more than ever, administrations are recommending resource-efficient and ecologically friendly goods and services, such as FinTech, in exchange for financial backing. This serves as a means of stimulating creative

Table 2 Summary statistics

Variable	Mean	SD	Mini	Max	Skew	Kurtosis
GF	6.115	4.788	−13.129	31.087	1.497	11.868
ECR	4.154	4.515	−15.397	24.099	0.704	9.754
EP	35.418	23.98	−26.393	112.645	1.025	4.652
FT	22.828	2.081	19.129	26.98	0.121	2.033
GDP	2.376	1.787	0.058	8.549	1.13	4.247
CO_2	27.432	12.559	12.154	68.023	1.488	4.809

Table 3 Panel unit root tests (IPS and CIPS)

Variable	IPS unit root test		CIPS unit root test	
	Level	First difference	Level	First difference
GF	−3.3318***	−5.6156***	−3.818***	−5.366***
ECR	−3.1899***	−5.5989***	−3.693	−5.318***
EP	−1.8338	−3.1561***	−1.635	−3.888*
FT	−1.6319	−3.1633***	−1.811	−3.139**
GDP	−1.9588*	−6.8366***	−3.186	−6.165***
CO_2	−1.8161	−3.3136***	−1.388	−3.933

activity, facilitating the introduction of novel statutory systems, and preserving environmentally benign building designs and production methods. Spending and purchasing choices may be swayed by the use of such benefits. It is possible that they put a dent in government funding or halt the steady expansion of markets. Governments also give fixed amounts for FinTech and green funding alternatives to maintain these necessities. Undervaluing causes inefficient use of resources, ecological pollution, and severe fiscal restrictions for administrations.

Carbon pollution is not the same as sulfur dioxide, soot, or industrial effluent, which have indirect indications computed based on power and energy usage. Therefore, the fuel and environmental BTP are computed without CO_2 as the regression coefficient, and the related regression results are shown in Table 2. According to the standard regression, the GF parameters are significant, providing more evidence for the model's validity (see Table 3). Green marketing and ECR have long been points of contention. There are two competing schools of thought on the issue: the conformance cost impact (Thomson and Bouzarovski 2018) and the intellectual recompense effect (Pang et al. 2015; Phuoc et al. 2022).

The intersection of ECR, GF, and environmentally friendly technological advancement has yet to receive much attention. Because of issues with externalities, public utilities, and adverse selection in the GF process, governments must step in to prevent short-term profits from driving investment in energy and contaminating businesses (Zhang and Zhou 2020). The link between GF and ECR in green technology innovation provides valuable conclusions and recommendations for solving challenges (Irshad 2017). We set the threshold model transition from

Model 3 to Model 5. For GF to affect GDP, ECR is thought to be the determining factor.

There cannot be a lot of variables that affect each other in the model, as this goes against the econometric theory. Multicollinearity is tested using the Klein criteria approach, step analysis, and other appropriate procedures. The variables are likely multicollinear with each other (Solangi et al. 2018). There is no evidence of cointegration between the independent variables, even if there is some connection between them. The variance inflation factor (VIF) fraction is less than 10, meaning there is no cointegration in the data, and the research is free from any collinearity.

As a result of business readjustment of innovation behavior in response to the economy (Wang et al. 2019b), it is acceptable and essential to identify the contribution of shock from the financial crisis and the consequences GF has for innovation. The 2015 Sustainable Development Goals (SDGs) provide a precise course correction for environmentally friendly innovation and growth. Advancements in electricity and the environment-BTP are becoming increasingly urgent as many countries and regions formulate specific objectives and strategies for the SDGs, such as pollution prevention programs, decarbonization, a circular economy, etc. (Liu et al. 2017). Also, since 2016, India, Bangladesh and Pakistan have prioritized top-down promotion and bottom-up exploration to hasten the conversion to green finance. For this reason, re-evaluating these countries chances of reaching the SDGs requires addressing the variability of the impact of FD in a significantly changed economic context. The potential cryptographic applications are vast, but the innovation is still in its infancy.

Table 3 shows the data's stationarity properties, to show where the unit root problem is using the IPS and CIPS unit root tests. There is no change in green finance (GF), fiscal stimulus (ECR), environmental protection (EP), or gross domestic product (GDP). More importantly, the data is normally distributed since all of the covariates are constant at first difference. Broad subsidies may be seen as doubly wasteful since they benefit the well-off more than the needy. Reducing or removing these subsidies might lead to lower government debt and fewer market failures. If subsidies are reduced, low-income households and other vulnerable groups may feel the effects more severely. In such cases, appropriate levels may be implemented to soften the blow.

Both economic and ecological resilience are considered, and the full specification results are shown in Table 4. These results lend credence to the hypothesis that there is a negative correlation between variables related to foreign green finance via FinTech and economic recovery (Zhou et al. 2008). Table 4 shows a negative correlation between the share of green finance (GF) provided by overseas FinTech firms and the share of total GF provided by foreign firms' FT. The expansion of external green funding through FinTech would reduce GDP by 8%, but this expansion comes at the expense of the environment. Economic growth of 8% is possible if the rate of foreign green finance via FinTech is lowered by 8%, and vice versa (0.085). The quantile regression model suggests a decrease in GDP growth of 5% (−0.0455) for every 5% increase in economic recovery (ER) (−0.0455). Investigating the potential negative relationship between foreign green financing via FinTech and environmental stability, we find that the current

Table 4 Pooled test with economic recovery and environmental protection through FinTech

	PLS			QR		
	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
GF	−0.0612	−0.0608	−0.0686	−0.0592***	−0.0544***	−0.0556***
	(−2.25)	(−2.09)	(−1.72)	(−5.18)	(−5.22)	(−4.28)
ECR	0.0750*	0.0734*	0.0958**	0.0983***	0.0841***	0.108***
	(−3.13)	(−2.92)	(−4.28)	(−3.95)	(−3.80)	(−4.28)
EP	5.043	5.547*	5.344	3.432***	4.628***	4.272**
	(−1.97)	(−2.74)	(−2.32)	(−3.38)	(−3.64)	(−3.27)
FT		0.0843*	−0.0856*		0.262	0.222
		(−0.24)	(−0.21)		(−1.83)	(−1.30)
GDP			0.0973			0.0539
			(−0.330)			(−0.33)
CO_2			0.0429			0.025
Constant	1.673*	−0.537	3.254	1.943**	−4.484	−4.051
	−2.91	(−0.06)	−0.3	−3.15	(−1.18)	(−0.93)
Observations	152	152	152	152	152	152

account balance has a negative correlation with the pace of economic growth. A rise of only 1% in the CAB is predicted to reduce GDP growth by 8%.

External liabilities stock, as a proportion of GNI and total green financing via FinTech, have a statistically significant and negative influence on GDP per capita, as shown in Table 4. If overseas green finance increases FinTech quantities, it means that the economic recovery is sluggish. Conversely, the stock market and overall fixed capital production are related positively to both GDP growth and unemployment (as a measure of economic recovery). With a 1% rise in international green funding through FinTech, Model 1 indicates GDP growth drops by 6% (−0.0612), whereas Model 3 shows GDP growth reduced by 7%. (0.0686). In the alternative scenario, a significant negative relationship of −0.0856 is established (9%). Model 3 shows a positive correlation of 0.0958 (9%) between FCF and GDP per capita, but the regression analysis appears to show a correlation of 0.108 (11%). A positive correlation is established between CAB and GDP per capita in the ordinary least squares (OLS) model. The same result is achieved in all OLS models (1, 2, and 3). Overall, the quantile regression model finds a positive correlation between GDP per capita and CAB. Contrarily, neither Model 1 nor Model 2 demonstrate any significant impact. Environmental degradation is becoming widely recognized as a potential threat to the sustainability of the economic agenda. There are ongoing conversations about the possible harm, legal consequences, and changeover risks involved. The damage to assets such as properties and businesses as a consequence of more severe storms, floods, and drought raises overall socioeconomic risk (Zhang et al. 2018).

5.2 Robustness analysis

To test whether the two equations are statistically significant, we use the quadratic term of the correlation of green finance via the FinTech index. Green finance via the FinTech index coefficient would be negatively affected if these considerations were not accounted for in other equations. It follows that a nonlinear relationship can be established between environmental steadiness and green financing indicators utilizing a FinTech load. Capital formation and trade liberalization are positively correlated with environmental stability. In most cases, a negative current account balance is associated with lower economic growth. India and Bangladesh's economies have recovered more quickly than those of the other countries while their production-to-importation ratios are higher. For this reason, all six of the countries studied have ratios that are too high (Alemzero et al. 2020) (see Table 5). Due to these factors, South Asian economies may collapse, with large countries such as India, Pakistan, and Bangladesh taking the brunt of the burden. Green finance via FinTech off-sets 30% of the budget, which in 2015 translates to 3% of GDP and 25% of exports. The GDP growth rate in the late 2000s was only around 4.5%, which is low, given historical averages.

Finally, we find no significant differences between the control and experimental groups. The difference in differences (DID) analysis allows us to evaluate the

Table 5 Robustness analysis

	FGLS			GMM		
	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
GF	−1.1835***	−1.1833***	−1.1881***	−1.1747***	−1.1741***	−1.1777***
	(−3.73)	(−3.74)	(−3.39)	(−4.57)	(−4.51)	(−3.77)
ECR	1.1431*	1.1454*	1.1454	1.1314	1.1397	1.1358
	(−1.89)	(−1.97)	(−1.85)	(−1.17)	(−1.11)	(−1.18)
EP	7.818***	5.133	4.797	7.198***	7.734***	7.538***
	(−3.38)	(−1.87)	(−1.73)	(−7.14)	(−4.58)	(−4.33)
FT		−1.311*	−1.371*		1.1731	1.1178
		(−1.98)	(−1.98)		(−1.371)	(−1.17)
GDP			1.11			1.11
			(−1.38)			(−1.37)
CO_2			−1.11137			1.1111
			(−1.11)			(−1.37)
Constant	4.131***	13.37	13.49	3.513***	1.597	3.87
	(−3.33)	(-1.47)	(−1.43)	(−4.87)	(−1.31)	(−1.49)
Observations	153	153	153	153	153	153
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Further controls	Yes	Yes	Yes	Yes	Yes	Yes
Wald chi^2	33.5	34.17	34.17	54.37	54.34	54.44
Autocorrelation	No	No	No	1.791	1.778	1.797
Sargan OIR				1.35	1.347	1.354

difference in default rates and loan spreads between the high-polluting businesses targeted by Clean Air Action and the close-to-the-bottom businesses which are less prone to regulation. If banks and financial institutions are aware of the dangers of global change, they should regard financing pollution similarly to financing other enterprises. When categorizing the multiple connections between green funding through FinTech and growth, countries are sorted based on their respective economic development stages. Total international green funding through FinTech harms GDP growth. As shown by our innovative empirical model, the effects of shocks to international green finance through FinTech are felt over a long period. Total green finance via FinTech affects GDP and GDP growth. Martínez et al. (2021) endogenous model of growth corroborates these findings showing an inverse U-shaped relationship between foreign green funding through FinTech and GDP growth.

5.3 Discussion

The private sector has, for some time, had a role to play in addressing environmental problems and fostering sustainable practices. Economic recovery is the process through which average incomes rise. Environmental issues are lessened, ecosystems preserved, and water and agricultural practices enhanced by the economic recovery. However, it requires environmentally conscious business practices, and environmental sustainability can only occur when economic recovery does not compromise ecological integrity. Industrialization has a positive effect on ecological pollution, according to much research undertaken within the framework of environmental ideology (Nguyen et al. 2021; Rehman et al. 2021). Green technology, also known as ecological innovation, may improve environmental quality while decreasing emissions if it is adopted at the same rate as industrialization. The impact of external green finance via FinTech is negative at lower levels (less than 30%), but beneficial at between 30 and 60%. In certain countries, green funding from FinTech contributes significantly to GDP, while in others it has a much smaller impact. However, when developing and intermediate nations are included, the result is the opposite (Phouc et al. 2022; Zhou et al. 2020). While there is a decent reaction to increasing international green funding through FinTech, there is no such relationship to increasing levels of channeling public funds via FinTech. However, even between the thresholds of 0 and 30%, this has a significant proportional influence on private international green finance through FinTech. Labor, wealth, and payment balances all contribute positively to economic expansion. The details from Model 3 show the effectiveness of a Bayesian approach (at the 25, 75, and 90% levels). In contrast, green finance via FinTech has a positive correlation with economic development in both developed and developing nations. The additional information provided by these data greatly strengthens our previous findings. According to conservative logic, if an administration wants to increase spending, it must do so by discouraging capital enterprise (Quynh et al. 2022; Wang et al. 2019a). According to this view, the government deficit is inadequate, since current residents must depend on future generations to bring in sufficient tax revenue to bring the deficit down. Institutional support and the quantity of international green funding through FinTech are crucial

to the achievement of fiscal policy (Sadiq et al. 2022a, 2022b; Seghier et al. 2020). According to neoclassical theory, business investment is more productive than public spending in the long run. The outcome is a drop in GDP since the high rates of output caused by government spending are not enough to make up for the losses due to private investor crowding (Ferreira et al. 2020; Sadiq et al. 2023a, 2023b). Our study suggests using the threshold previously used in the literature to determine how industrial production reacts to various forms of external green funding through FinTech. The results suggest that South Asian nations should work to reduce their reliance on foreign green funding via FinTech, but also tighten domestic investment rules (Qiao et al. 2020; Tan et al. 2021; Zhang et al. 2023).

6 Conclusion and policy implications

The fundamental objective of this research is to examine the impact of green finance via FinTech on climate safeguarding and economic revival in South Asian countries. Protracted annihilation raises ethical questions about providing uncompensated help to other nations. One major takeaway from the data is the need to comprehensively investigate the effects of increasing the number of new loans through FinTech for green finance, ideally within profit-maximizing structures. This research uses several methods to investigate the connection between international green funding through FinTech and industrial revival. Academic and imaginative frameworks are inherently static and, if models are to be used to predict the future, the methods include panel unit root tests, pooled OLS and QR tests, a robustness check using system GMM, and coefficient output regression tests. Growth in FinTech raises international green finance via FinTech stock, which reduces GDP by 31% according to the EXDS regression coefficient of 0.3065 (31%). This suggests that a 31% improvement in economic recovery might be achieved by increasing the error margin and so increasing the amount of green organizational finance available via FinTech stock. Experts are urged by the report's limited conclusions to prioritize the most important forms of capital to foster long-term economic viability. The implications for practice are connected to the gains that can be made via a green structural ecological stability approach, which is of significant relevance for businesses in emerging countries, in order to ensure their long-term viability. We observe that this study adds significantly to the body of knowledge by considering its theoretical underpinnings. The study concludes that governments falling back on green financing through FinTech would cause funds to be directed into the industrial sector in several stages, but this would have no effect on personal willingness to engage in constructive alternative investment.

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