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Full Length Article

Environmental consequences of financial development in emerging and growth-leading economies: A multidimensional assessment

Muhammad Atif Khan [a,b,*], Muhammad Asif Khan [b,c], Masood Ahmed [d], Karamat Khan [e]

[a] School of Finance, Zhongnan University of Economics and Law, Wuhan, PR China
[b] Department of Commerce, Faculty of Management Sciences, University of Kotli, City Kotli, Azad Jammu and Kashmir 11100, Pakistan
[c] Department of Business Management,College of Business and Economics, University of Johannesburg,South Africa
[d] Department of Public Administration, Faculty of Management Sciences, University of Kotli, City Kotli, Azad Jammu and Kashmir 11100, Pakistan
[e] School of Economics, Henan University, Kaifeng, PR China

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Abstract

The remarkable economic growth momentum in emerging and growth-leading economies (EAGLEs) raises concern about a sustainable global environment. Prior literature indicates the significant role of financial development (FD) in striking a win-win balance between economic growth and environmental sustainability. Unlike previous studies, this study takes a multidimensional approach to FD by investigating its holistic and multifaceted effects on environmental quality in the unique context of EAGLEs, which is absent from the extant literature to date. The results, based on panel data on 15 EAGLEs in 1984–2018, demonstrate that overall FD significantly reduces environmental quality in the EAGLEs. Additionally, the multidimensional analysis shows that across all the dimensions of FD—depth, access, and efficiency—development reduces environmental quality in EAGLEs. Our findings are robust to alternative measures of FD and ecological quality and alternative estimators. We offer stakeholders practical policy implications to mitigate the adverse environmental consequences of FD and achieve a win-win balance between development and ecological quality using FD as a tool.

JEL classification: G1; G2; Q5; Q56; R11

Keywords: CO_2 emissions; Ecological footprint; Emerging and growth-leading economies; Environmental quality; Financial development

1. Introduction

Economic growth is a critical part of the economic development process (Perera & Lee, 2013); however, it also has significant implications for environmental quality (Arouri, Ben Youssef, M'Henni, & Rault, 2012; Kasman & Duman, 2015). The literature shows that economic growth is associated with higher emissions of carbon dioxide (CO_2) (Arouri et al., 2012; Muhammad, 2019), jeopardizing environmental sustainability.[1] Thus, countries worldwide are striving to achieve a win-win solution between economic growth and ecological sustainability and protection, which is indeed a challenging task.

At present, world economic dynamics are changing rapidly, and the role of emerging and growth-leading economies

* Corresponding author. School of Finance, Zhongnan University of Economics and Law, Wuhan, PR China.
E-mail addresses: atif.khan@uokajk.edu.pk (M.A. Khan), khanasif82@uokajk.edu.pk (M.A. Khan), masood.ahmed@uokajk.edu.pk (M. Ahmed), karamatkhan81@gmail.com (K. Khan).
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[1] In the literature, two perspectives are presented about the relationship between economic growth and environmental quality: (1) an inverted U-shaped relationship, by Grossman and Krueger (1995), called the environmental Kuznets curve (EKC) hypothesis (Kasman & Duman, 2015); and (2) a monotonic relationship, that is, a rise in economic growth is associated with environmental degradation (e.g., Arouri et al., 2012).

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(hereafter EAGLEs) in the global economy has increased. The EAGLEs are a group of emerging countries classified by the Banco Bilbao Vizcaya Argentina (BBVA) Research that are expected to lead the global economic growth in the decades to come and become a hub for international investors because of increased investment opportunities.[2] According to BBVA Global Economic Outlook in 2016, over the subsequent decade emerging markets were expected to account for 79 percent of global economic growth, with EAGLEs contributing up to 64 percent. Khan, Kong, Xiang, and Zhang (2019) state that, because of their rapidly growing financial sector, EAGLEs are in a phase of rapid development, with lucrative investment opportunities.

Fig. 1 illustrates the growth in real gross domestic product (GDP) of emerging and developing markets compared with that in the developed economies and world averages. Since 2000, emerging markets have consistently outperformed both the world average and the advanced markets. Annual GDP growth in developed and emerging markets was the highest (4.1%) relative to the developed markets (2.4%) and world mean (3.7%), respectively (IMF, 2018), from 2000 until 2018.

The remarkable growth in EAGLEs has raised serious concerns about global environmental sustainability, creating an urgent call to explore the tools for reducing greenhouse gas emissions and mitigating environmental disasters in EAGLEs while maintaining economic growth. In this context, the role of the financial sector has received considerable attention from scholars and policy makers. A substantial body of literature suggests that FD could achieve two goals: promoting economic growth while mitigating environmental degradation (Ozturk & Acaravci, 2013).

However, to the best of our knowledge, no cross-country study has investigated the linkage between FD and environmental quality in the EAGLEs. Khan, Khan, Abdulahi, Liaqat, and Shah (2019) recently studied this group in the context of the relationship between institutions and FD.

Given the divergent evidence regarding FD's role in environmental quality, it is imperative to empirically examine the nexus between FD and environmental quality in EAGLEs.[3] It would be instructive for policy makers as it addresses the potential environmental disasters associated with rapid economic growth using FD as a tool. Moreover, FD is a complex and multidimensional process (Islam, Khan, Popp, Sroka, & Oláh, 2020; Khan, Khan, et al., 2019; Liu, Islam, Khan, Hossain, & Pervaiz, 2020; Svirydzenka, 2016), defined by the International Monetary Fund (IMF, 2016) as improvement in financial markets and institutions, depth, access, and efficiency. Hence, the financial sector is composed of two essential pillars, financial institutions and financial markets; and improvements in financial depth, access, and efficiency of both financial institutions and markets represent FD.

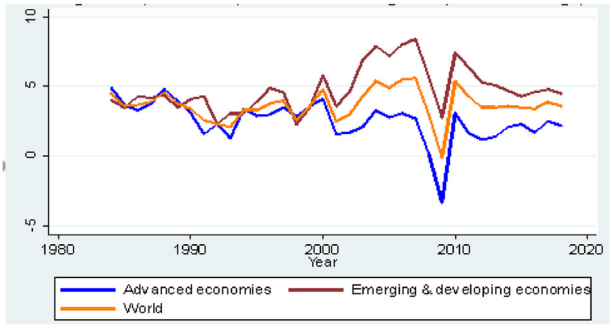

Fig. 1. Comparative snapshot of Real GDP (annual % change). Source: World Economic Outlook (IMF, 2016).

However, the literature indicates that the existing studies on the FD-environment nexus have conceptualized FD narrowly and used various measures to proxy multidimensional FD that essentially represent only one dimension of FD: financial sector depth. Recently, Acheampong, Amponsah, and Boateng (2020) have also revealed this serious limitation in the existing literature on the FD-environment link, offering some further details.

The existing studies using a unidimensional measure of FD give valuable insights into the environmental quality-FD nexus. However, they overlook the holistic impact of FD as well as the respective effects of various dimensions of FD—financial depth, financial access, financial efficiency—-which is most likely to be heterogeneous because of the unique nature of these aspects of FD (Svirydzenka, 2016). The FD indices by Svirydzenka (2016) show dissimilar performance of financial sectors around the world in terms of depth, access, and efficiency. Countries rank differently on these aspects, therefore, it is plausible that each of the dimensions of FD has different implications for environmental quality in EAGLEs.

Moreover, the literature shows that the relationship between FD and environmental quality is sensitive to proxies for FD (e.g, Acheampong, 2019). In view of the foregoing, we investigate the holistic impacts of FD as well as the respective effects of three dimensions of FD in a common framework to offer a fuller picture of the nexus between FD and environmental quality, which will lead to valuable policy implications.

This study makes the following contributions to the existing literature. First, this is the first study that investigates the impact of FD on environmental quality in EAGLEs, which is important because of their rapid economic growth and associated threat to global environmental sustainability. Our study suggests valuable implications to policy makers in EAGLEs as they try to make growth environmentally sustainable—that is, promoting economic growth while mitigating environmental degradation.

Secondly, unlike prior studies, this study paints a fuller picture of the FD-environmental quality nexus using a multidimensional approach to FD and investigates FD's holistic impacts on environmental quality in EAGLEs. To operationalize

[2] The BBVA is a multinational Spanish banking group; further details regarding this group are available at https://www.bbva.com.

[3] For the relevant literature, see Section 2.

the multidimensional FD, we use the most comprehensive FD index, from the IMF (Svirydzenka, 2016).[4]

Furthermore, considering the multidimensional nature of FD, this study examines the three dimensions of FD (depth, access, and efficiency) and the respective impact of each of them on environmental quality individually in a common framework of EAGLEs. In doing so, this study reveals the relative importance of each of these aspects for environmental quality, which is instructive for effective policy formulation.

In particular, this study addresses the following research questions:

Q1: What is the overall impact of FD on environmental quality in EAGLEs?

Q2: What is the respective impact of various FD aspects—financial depth, financial access, and financial efficiency—on environmental quality in EAGLEs?

The rest of the study is structured as follows. A brief literature review is in Section 2. Section 3 presents the baseline model, data, and methods. Section 4 discusses the empirical results and offers a discussion. Section 5 presents the conclusion and policy implications.

2. Brief review of related literature

2.1. Financial development and environmental quality

This section contains a review of the theoretical and empirical literature on the nexus between FD and environmental quality to support this study's hypothesis.

The literature shows that FD is significantly associated with both economic growth (Perera & Lee, 2013) and environmental quality (Ozturk & Acaravci, 2013). Since, FD is important to economic growth, and it has a significant effect on environmental quality. A substantial body of literature suggests that FD could achieve both goals: promoting economic growth and mitigating ecological degradation (Ozturk & Acaravci, 2013).

Considering the significant relevance of FD to economic growth and environmental quality, scholars have conducted many studies using different econometric strategies and samples. However, the literature has yet not reached a consensus on the impact of FD on environmental quality. From a theoretical perspective, contradictory viewpoints exist in the literature regarding FD's effects on environmental quality. Development of the financial sector could have both positive and negative impacts on environmental quality.

On the one hand, the literature holds that FD harms environmental quality through various economic mechanisms, such as an increase in economic growth that raises energy use and CO_2 emissions (referred to as the wealth effect) thereby worsening environmental quality. Saud, Chen, Haseeb, and Sumayya (2020) investigate the impact of FD on ecological quality and confirm that FD has a significantly negative impact on environmental quality. Jiang and Ma (2019) document that a well-developed financial system is an essential source of financing for new business and expanding existing businesses that increases energy consumption, thereby raising greenhouse gas emissions and negatively influencing environmental quality.

Similarly, the financial sector also provides better financial services, for example, access to cheap finance to individuals that enables them to purchase products such as automobiles and other mechanical appliances that could increase demand for energy and carbon emissions. Along these lines, Mukhtarov, Mikayilov, Mammadov, and Mammadov (2018) show that FD increases energy use and reduces environmental quality. FD is associated with higher energy use and economic growth by giving households and businesses affordable and easy access to finance, which could lead to higher carbon emissions and deterioration in environmental quality (Sadorsky, 2010). In the same vein, FD attract foreign direct investment (FDI), which promotes energy-intensive growth, leading to environmental degradation (Dhrifi, Jaziri, & Alnahdi, 2020).

Gök (2020) investigates the impact of FD on environmental quality through a metaregression analysis conducted with 72 primary studies. The results show that FD is positively associated with CO_2 emissions and thereby causes ecological degradation. This theoretical perspective has substantial empirical support; for example, many empirical studies investigate the nexuses between FD and environmental quality in various contexts and show the negative impact of FD on environmental quality (e.g., Adams & Klobodu, 2018; Boutabba, 2014; Omri, Daly, Rault, & Chaibi, 2015; Shahbaz, Shahzad, Ahmad, & Alam, 2016; Tamazian, Chousa, & Vadlamannati, 2009). However, this perspective is contentious.

At the same time, FD facilitates investment in environmentally friendly technological innovations that improve energy efficiency (referred to as the technical effect), reduce greenhouse gas emissions, and promote environmental quality (Tamazian et al., 2009; Zhang, 2011). It is also believed that FD significantly contributes to the development of renewable energy (Ji & Zhang, 2019).

In this context, Adams and Klobodu (2018) argue that FD reduces environmental degradation by creating greater access to environmentally friendly production technology. Financial inclusion, which is an important dimension of FD, positively derives environmental quality by providing firms, specifically small businesses, with affordable finance that they can invest in renewable energy that is cost effective as well as environmentally friendly (Innovation for Poverty Action [IPA], 2017). Moreover, FD helps mitigate environmental degradation by improving energy efficiency and minimizing energy consumption (Islam, Shahbaz, Ahmed, & Alam, 2013).

Several studies have reported the positive impact of FD on environmental quality (e.g., Godil, Sharif, Agha, & Jermsittiparsert, 2020; Ulucak, İlkay, Özcan, & Gedikli, 2020; Vo & Zaman, 2020; Zaidi, Zafar, Shahbaz, & Hou, 2019). The preceding discussion establishes that the theoretical and empirical literature on the effects of FD on environmental quality has not yet reached a consensus. This shows that

[4] Further details regarding the composition of this index are in Svirydzenka (2016).

the relationship between FD and environmental quality is very complex and still open to debate.

Jiang and Ma (2019) argue that, because the theoretical literature shows that FD has both positive and negative impacts on environmental quality, the aggregate effect is decided by the relative magnitude of these positive and negative effects. In this context, building a green financial system could be a way forward and is currently a hot topic among scholars and policy makers around the world. The objective of green finance is to provide financial services such as financing and investment for environmentally sustainable projects (Ren, Shao, & Zhong, 2020). We believe that introducing green reforms through financial regulations would steer more resources to environmentally friendly technological innovations that would help to avoid the negative impact of FD on environmental quality and help to reduce environmental degradation.

D'Orazio and Popoyan (2019) argue that because of the climate-related financial risks, governments could play a vital role in filling the green financing gap and support a greener economy by introducing green macroprudential financial regulations. In this context, Ren et al. (2020) examine the impact of green finance on carbon intensity in China and show that improvements in the green finance development index are significantly associated with a reduction in carbon intensity. Therefore, developing a green financial system might be an important way for EAGLEs and the rest of the world to maintain growth while reducing environmental degradation.

The reviewed literature leads us to propose the following hypothesis:

Hypothesis 1. FD significantly degrades environmental quality in the EAGLEs.

2.2. Financial Development's dimensions and environmental quality

This study conceptualizes FD as a multifaceted phenomenon that comprises the development of financial institutions and financial markets in terms of financial depth, access, and efficiency. This section provides a review of literature on each aspect of FD's respective effects on environmental quality.

Theoretically, the development of both financial markets and institutional depth, access, and efficiency can affect environmental quality positively or negatively. On the one hand, these aspects of FD raise environmental quality by reducing CO_2 emissions through financing renewable energy projects and environmentally friendly technological innovations (Tamazian et al., 2009). On the other hand, these aspects or indicators of FD boost economic growth, which in turn accelerate energy consumption and CO_2 emissions and reduce environmental quality (Sadorsky, 2011). Hence the net effect is determined by the relative magnitude of bot.

Hao, Zhang, Liao, Wei, and Wang (2016) examine the impact of FD indicators—financial depth and financial efficiency—on China's environmental quality. They document a differential impact of these indicators, that is, a positive effect of financial depth but a negative impact of financial efficiency on environmental quality.

Le, Le, and Taghizadeh-Hesary (2020) examine the effect of financial inclusion/access on CO_2 emissions in the Asian region and reported a significant positive impact of financial inclusion on CO_2 emissions. However, Renzhi and Baek (2020) found an inverted U-shaped relationship between financial inclusion and environmental quality. In the member countries of the Organization for Economic Cooperation and Development (OECD), financial deepening worsens environmental quality by raising CO_2 emissions (Paramati, Mo, & Huang, 2020).

Acheampong et al. (2020) finds a negative effect of financial market depth and efficiency on CO_2 emissions in the emerging financial markets but a positive effect on CO_2 emissions in frontier financial markets. Similarly, Samour, Isiksal, and Resatoglu (2019) investigate the effects of banking sector development on CO_2 emissions in Turkey. They document that banking sector development boosts emissions in Turkey and worsens environmental quality.

Drawing on the literature, we posit the following hypothesis for empirical testing:

Hypothesis 2. Financial depth, financial access, and financial efficiency have a significantly negative impact on environmental quality in EAGLEs.

3. Data and methodology

3.1. Data and variables

This study extracted annual data regarding dependent, explanatory, and control variables from several sources for the sample period, which comprised 35 years, 1984–2018. Because our goal is to investigate the overall impact of FD as well as the respective impact of financial depth (F_D), financial access (FA), and financial efficiency (FE) on environmental quality, therefore, our study uses four explanatory variables: FD, F_D, FA, and FE. In the literature, various proxies are used to measure these variables. However, none of the proxies is considered comprehensive, so they are subject to criticism by various scholars. Scholars argue that these measures cannot fully capture the multidimensional and complex FD phenomenon (Antonio, Montfort, & Ashwin, 2014; Khan, Kong, et al., 2019; Le, Kim, & Lee, 2016; Pradhan, Tripathy, Pandey, & Bele, 2014; Svirydzenka, 2016).

However, the IMF developed a comprehensive index that greatly mitigates the limitations associated with the previous measures. This index is constructed by integrating a variety of FD indicators to encompass its multiple dimensions—that is, financial depth, financial access, and financial efficiency—from both pillars of the financial sector, financial markets and financial institutions (Khan, Gu, Khan, & Oláh, 2020; Khan, Khan, et al., 2019; Svirydzenka, 2016).[5]

[5] See list of indicators used in the FD index in Table S1 (available online).

Specifically, the IMF's FD index is composed of two subindices: a financial institutions' index (FI) and a financial markets' index (FM). Each of these subindices is composed of three subindices: the FI index comprises financial institutions' depth, access, and efficiency indices; and the FM index is composed of financial markets' depth, access, and efficiency indices. All these indices are between 0 and 1.

Following the recent literature (Khan, Khan, et al., 2019; Liu et al., 2020; Svirydzenka, 2016), we employ the FD index to measure FD. F_D, FA, and FE are measured with an index that we built (F_D index) by averaging the FI and FM depth indices; FA is measured with the FA index, which is an average of the FI and FM access indices; and FE is proxied with the FE index, that is, by taking an average of the IMF's FI and FM efficiency indices. The data for these FD variables come from the IMF website.

The dependent variable is environmental quality, which is proxied by CO_2 emissions (in metric tons per capita). This measure is widely used in the existing literature. The data for CO_2 emissions comes from the World Bank's World Development Indicators. Further, we use the ecological footprint (EF) as an alternative measure for a robustness check, with data taken from the Global Footprint Network (2019). EF is also used as a measure of environmental quality in recent literature, for example, Saud et al. (2020), Shahzad, Fareed, Shahzad, and Shahzad (2021), and Udemba (2020).

The existing literature also suggests various important variables, such as economic growth (EG) (Arouri et al., 2012; Grossman & Krueger, 1995; Muhammad, 2019), energy utilization (EU) (Munir, Lean, & Smyth, 2020; Saidi & Omri, 2020), urbanization (URB_Pop) (Mahmood, Alkhateeb, & Furqan, 2020; Shahzad et al., 2021; Zheng, Wang, Mak, Hsu, & Tsang, 2021), trade openness (TO), and foreign direct investment (FDI) (Tiba & Belaid, 2020), which significantly explain environmental quality.

Hence, we use EG, EU, URB_Pop, TO, and FDI as control variables for environmental quality to overcome omitted variable bias in the model. We measure EG with GDP growth (annual %), EU is calculated in terms of the kilogram of oil equivalent per capita, URB_Pop is measured by the growth in urban population (annual %), TO with trade (% of GDP), and FDI with net inflows of foreign direct investment (% of GDP). The data for these variables are extracted from World Development Indicators (World Bank, 2019). The descriptive statistics of the variables, the measures, and data sources are presented in Table S2 (available online).

Our sample comprises EAGLEs, a classification of emerging countries introduced by BBVA.[6] These economies are expected to lead global economic growth in the next decade and to provide huge investment opportunities for investors. Unlike other economic blocs, the EAGLEs group is dynamic, and the membership in this group changes based on the forecasted performance of countries relative to the developed economies. Currently, fifteen economies are EAGLEs: Bangladesh, Brazil, China, Egypt, India, Indonesia, Iran, Malaysia, Mexico, Nigeria, Pakistan, Philippines, Russia, Turkey, and Vietnam. Further details about the EAGLEs classification are on BBVA website. For the empirical analysis, this study uses panel data for a 35-year period, 1984–2018, based on the availability of data.

3.2. Empirical model and method

This study investigates the impact of overall FD and the respective impact of the various dimensions of FD on environmental quality among the 15 EAGLEs using EG, EU, URB_Pop, TO, and FDI as control variables. To this end, the baseline fixed-effect regression model is specified as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 K_{it} + \delta_t + \mu_i + \varepsilon_{it} \quad (1)$$

where i and t represent the individual country and year respectively, and Y_{it} is the dependent variable, environmental quality represented by CO_2 emissions. X represents each of the explanatory variables: FD, F_D, FA, and FE (e.g., change over time is plugged into the equation separately in the estimation), and K represents the vector of controls including EG, EU, URB_Pop, TO, and FDI, β_0 is the intercept, and $\beta_1 - \beta_2$are the sequential coefficients of explanatory variables and controls, δ_t and μ_i are country and year dummies, respectively, which shows the use of a two-way fixed effect, and lastly, ε is a random error term.

We estimate Equation (1) using a fixed-effect regression estimator in the baseline analysis. Then, we test the assumptions regarding error, such as heteroskedasticity, serial correlation, and cross-sectional dependence. To do so, we performed a modified Wald test, a Wooldridge test, and a Pesaran test to check for the presence of heteroskedasticity, autocorrelation, and cross-sectional independence, respectively. The results (Table S3, available online) confirms the presence of heteroskedasticity, serial correlation, and cross-sectional dependence in the model.

Therefore, we estimate the models using robust standard errors as proposed by Driscoll and Kraay (1998) (DK) in the panel regression. DK corrects for the heteroskedasticity, autocorrelation, and cross-sectional dependence and yields robust estimates (Driscoll & Kraay, 1998; Hoechle, 2007; Khan, Islam, & Akbar, 2020). This method is widely used in cross-country panel studies with the aforementioned characteristics (e.g., Le et al., 2020; Marques & Pires, 2019; Wang, Zhou, Chen, & Rong, 2019). Furthermore, we also perform robustness checks by estimating the models using a feasible generalized least squares (FGLS) estimator that also corrects the diagnostic issues mentioned (Le & Nguyen, 2019; Nguyen, Le, & Su, 2020).

4. Results and discussion

4.1. Baseline results

The baseline results obtained using a fixed-effect regression are reported in Table 1. The results regarding the impact of

[6] Details are available at https://www.bbva.com.

Table 1
Baseline Results: Fixed effects regression.

Variables	(1)	(2)	(3)	(4)
	CO_2	CO_2	CO_2	CO_2
FD	0.656***			
	(4.68)			
F_D		0.701***		
		(4.72)		
FA			0.318**	
			(2.18)	
FE				0.257***
				(3.52)
EG	−0.003	−0.003	−0.003	−0.003
	(1.14)	(−1.16)	(-1.21)	(−1.06)
EU	0.000***	0.000***	0.000***	0.000***
	(8.80)	(7.97)	(9.29)	(10.94)
URB_Pop	−0.094***	−0.097***	−0.102***	−0.101***
	(−6.56)	(−6.83)	(−6.99)	(−7.02)
TO	0.008***	0.007***	0.008***	0.008***
	(14.23)	(13.67)	(15.61)	(15.24)
FDI	−0.001	0.004	0.008	0.002
	(−0.11)	(0.66)	(1.15)	(0.31)
Constant	−0.242***	−0.143*	−0.168**	−0.239***
	(−3.10)	(−1.92)	(−2.16)	(−2.95)
R-squared	0.729	0.730	0.719	0.724
Fixed effects	Yes	Yes	Yes	Yes
No. of countries	15	15	15	15
Adj. R-squared	0.717	0.717	0.706	0.711
F-statistics	196.8***	197.0***	186.8***	191.3***

Note: *T*-statistics are in parentheses. *, **, and *** indicate the level of significance at 10%, 5% and 1%, respectively.

overall FD are shown in the first column, and the effect of its variants—financial depth (F_D), financial access (FA), and financial efficiency (FE)—are reported in columns 2–4.

We find a positively significant coefficient of FD in column 1, which indicates that overall FD has an adverse effect on environmental quality in EAGLEs. In other words, FD is not green in EAGLEs and worsens environmental quality. Similarly, the decomposition analysis shows that all the dimensions of FD—F_D, FA, and FE—also have a significant and positive coefficient (the magnitude varies), which denotes worsening financial environmental consequences in the EAGLEs. Interestingly, although the effect is qualitatively similar, the magnitude of the effect of F_D, FA, and FE on environmental quality is not homogeneous and is consistent with our prediction.

The results are consistent with the stream of theoretical and empirical literature on the adverse effect of FD on environmental quality (e.g., Godil et al., 2020; Ulucak et al., 2020; Vo & Zaman, 2020; Zaidi et al., 2019). Moreover, the adjusted R-squared is fairly high and shows that it has significant explanatory power in our model.

In sum, the results suggest that FD worsens environmental quality in EAGLEs, and an urgent policy intervention by the EAGLE governments is required to align the FD goal with environmental sustainability.

4.2. Regressions with Driscoll and Kraay's standard error: main results

For comparison and comprehensiveness, we estimate the DK standard errors for coefficients with fixed-effect, random-effect, and pooled regressions. The results in Table 2 are consistent with the baseline results (significance level varies). Thus, the empirical results support the hypothesis, which implies that financial consequences are not environmentally conducive in the EAGLEs.

Specifically, we find a positive coefficient of FD (across all specifications), which is significant at the 1 percent level and shows that the overall effect of FD on environmental quality in EAGLEs is negative. This implies that the rise in FD due to the greater investment opportunity in EAGLEs worsens environmental quality. Similarly, the decomposition analysis shows that the dimensions of FD (F_D, FA, and FE) also has a significant and positive coefficient (the magnitude and level of significance vary) and indicates that F_D, FA, and FE reduce environmental quality in the EAGLEs. These results also support our prediction and baseline results.

This scenario shows that FD in EAGLEs mitigates the financial constraints of businesses and individuals and provides them with easy access to finance, which enables households and businesses to acquire more energy-intensive products that raise demand for and the level of energy consumption (specifically for fossil fuels) thereby harming environmental quality.

Our results are consistent with the stream of theoretical and empirical literature that shows an adverse effect of FD on environmental quality. For example, Godil et al. (2020), Ulucak et al. (2020), Vo and Zaman (2020), and Zaidi et al. (2019) reported adverse effects of FD on environmental quality in various contexts due to the rise in energy consumption. In this vein, Saud et al. (2020) argue that FD is associated with an increase in economic growth, which potentially leads to a rise in energy use and CO_2 emissions (the wealth effect) and thereby lowers environmental quality— which is relevant to our study. Le et al. (2020) investigate the effects of financial inclusion in Asian countries and report that financial inclusion has adverse effects on CO_2 emissions due to the rise in energy consumption.

In sum, the results suggest that FD in EAGLEs is not green and lowers environmental quality. This calls for an urgent policy intervention by governments to reverse this relationship and align FD goals with environmental quality. To accomplish this, the introduction of green financial regulations and associated implementation mechanisms could steer the financial resources in the right direction and mitigate the environmental catastrophes that accompany higher economic growth and FD in the EAGLEs.

FD is critical for maintaining the remarkable economic growth and prosperity in EAGLEs and therefore cannot be compromised or sacrificed. Considering the importance of FD, and based on the literature, the obvious solution is financial

Table 2
Main Results: Regressions with Driscoll and Kraay (DK) standard errors.

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Fixed effects regression				Random effects regression				Pooled OLS/Regression			
	CO_2	CO_2	CO_2	CO_2	CO_2	CO_2	CO_2	CO_2	CO_2	CO_2	CO_2	CO_2
FD	0.656***				0.652***				2.279***			
	(4.41)				(4.09)				(10.22)			
F_D		0.701***				0.679***				1.085***		
		(5.90)				(5.88)				(5.23)		
FA			0.318*				0.315*				0.604*	
			(1.82)				(1.71)				(1.70)	
FE				0.257*				0.260*				0.983***
				(1.79)				(1.80)				(4.34)
Baseline controls & constant	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fixed effects	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
No of countries	15	15	15	15	15	15	15	15	15	15	15	15
Adj. R-squared	.	.	.	.	.	.	.	.	.	.	.	.

Note: *t*-statistics are in parenthesis and *, **, and *** indicate level of significance at 10%, 5%, and 1% respectively.

reforms that could help in redirecting financial resources to building environmentally friendly technological innovation projects and alternative energy infrastructure and thereby achieve sustainable growth. In other words, promoting green finance or building a green financial system in EAGLEs could make their growth sustainable.

A substantial body of literature suggests that FD could attain the twin goals of promoting economic growth and mitigating environmental degradation (Ozturk & Acaravci, 2013). The coefficients of the controls and constant are not reported for brevity and are available from the authors on request.

4.3. Robustness checks

To confirm the robustness of our primary findings and their reliability for economic implications, we conduct two tests in this section: we introduce an alternative proxy for environmental quality (EF) and an alternative estimator (FGLS).

4.3.1. Alternative measure of environmental quality (EF)

The results (Table S4, available online) demonstrate that FD and its dimensions (F_D, FA, and FE) negatively explain environmental quality, measured with an alternative proxy, that is, EF in EAGLEs. The magnitude of the coefficient varies, however, the direction of the effect is similar to that in the earlier results. These results support the reliability of our findings.

4.3.2. Alternative estimator (FGLS)

Here we test the robustness of our findings by estimating the model with FGLS, which is robust to diagnostic issues such as heteroskedasticity and serial correlation in cross-country panel studies. The results (Table S5, available online) show the negative impact of overall FD as well as its dimensions (F_D, FA, and FE) on environmental quality in EAGLEs. Therefore, the results of FGLS also lead us to the same conclusion as our earlier results—that is, FD in EAGLEs reduces environmental quality and requires urgent policy intervention to steer FD in EAGLEs in the right direction.

5. Conclusion and policy implications

5.1. Conclusion

This study empirically investigates the impact of FD on environmental quality in EAGLEs during 1984–2018. EAGLEs are expected to lead global economic growth over the next decade. Because economic growth is accompanied by environmental threats, EAGLEs face a challenge in trying to strike a balance between economic growth and environmental quality—that is, maintaining growth while reducing environmental degradation. In this context, the role of FD is crucial because of its critical relevance to both economic growth and environmental quality. A substantial body of literature suggests that FD can attain both goals, that is, promoting economic growth and mitigating environmental degradation (Ozturk & Acaravci, 2013). Further, prior literature holds divergent perspectives about FD's role in environmental quality, which shows that this debate is still open. Additionally, prior literature considers FD a one-dimensional phenomenon, even though it is a multidimensional (Svirydzenka, 2016), and each dimension is unique and has different causes and consequences for various economic outcomes.

Motivated by these considerations, we use a comprehensive and multidimensional approach to FD and examine the holistic effects of FD and individual effects of various FD dimensions—F_D, FA, and FE—on environmental quality in EAGLEs.

Our empirical results show that FD adversely affects environmental quality in EAGLEs during the sample period. This implies that the negative effects of FD on environmental quality outweigh its positive effects in EAGLEs. Furthermore, the disaggregated analysis shows that the progress in the dimensions of FD—F_D, FA, and FE—also significantly harms environmental quality in EAGLEs. However, the effect of various FD indicators on environmental quality is quantitively heterogeneous, elucidating the relative role of each aspect of FD in ecological quality.

Based on these findings, we conclude that FD significantly hurts environmental quality in EAGLEs, and FD currently is not consistent with sustainable development goals in EAGLEs. Because this study focuses on EAGLEs, it may have limited generalizability. In the future, researchers should examine the effects of FD from a global perspective to reach a more generalizable conclusion. Moreover, future research should examine the effects of various economic conditions—for example, development levels, the institutional environment, and human capital—on the environmental consequences of FD, which could offer insights into environmental sustainability.

5.2. Policy implications

Our results have some policy implications for stakeholders in EAGLEs. Because FD in EAGLEs adversely affects environmental quality, policy makers should take steps to break this cycle and align FD goals with environmental sustainability/quality. More specifically, we recommend the following actions.

Governments and policy makers in EAGLEs should steer more financial resources to environmentally friendly projects through policy interventions and reforms. The government can do so by introducing green finance regulations and associated implementation mechanisms that incentivize financing and investment to environmentally sustainable projects (renewable energy, green innovation, green production) (Ren et al., 2020) and discourage investment in highly energy-intensive and environmentally unfriendly projects. We believe that green financial reforms can counterbalance the adverse effects of FD in EAGLEs and are an obvious way to strike a balance between economic growth and environmental sustainability—reducing environmental degradation while maintaining economic growth in EAGLEs.

Governments can also use fiscal policy to maintain environmental quality by providing subsidies to industries for the adoption of green technologies. Furthermore, the importation and adoption of energy-efficient technologies from advanced countries with the help of the financial sector can be an effective step in promoting economic growth without worsening environmental quality.

As FD is a multidimensional phenomenon, policy makers must consider all facets of FD when developing policies to achieve sustainable long-term growth. In particular, they must increase access to green finance to assist small and medium-size businesses in taking steps to mitigate CO_2.

In addition to these financial policies, the policy makers in EAGLEs should implement economic and energy policy reforms to blunt the rise in carbon emissions in EAGLEs for the sake of environmental sustainability. Policy instruments such as emissions trading or caps and taxes on carbon emissions are some practical steps that could be taken in this direction. Sustainable growth in EAGLEs would be facilitated by the having strong ecological regulations for industries and building a solid institutional structure that monitors environmental performance by industry. Governments should make significant investments in research and development to support their countries' transition to environmentally friendly technologies. In a nutshell, governments should develop a comprehensive policy by integrating regulatory and economic measures to mitigate the negative impact of FD on environmental quality in EAGLEs.

Declaration of competing interest

There is no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bir.2021.10.003

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