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Economic Research-Ekonomska Istraživanja

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/rero20

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To cite this article: Vu Trong Lam, Thi Thu Hien Phan, Nguyen Hong Mai, Pham Quang Huy & Thanh Quang Ngo (2023) Dynamic association of green financial innovation, eco-financing, carbon tax, economic openness, and sustainable energy transition in Vietnam: fresh evidence using DARDL approach, Economic Research-Ekonomska Istraživanja, 36:3, 2199416, DOI: 10.1080/1331677X.2023.2199416

To link to this article: https://doi.org/10.1080/1331677X.2023.2199416

Published online: 21 Aug 2023.

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA
2023, VOL. 36, NO. 3, 2199416
https://doi.org/10.1080/1331677X.2023.2199416

Dynamic association of green financial innovation, eco-financing, carbon tax, economic openness, and sustainable energy transition in Vietnam: fresh evidence using DARDL approach

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ABSTRACT

Sustainable energy (SE) transition and environmental quality have become a predominant part of integral policy worldwide. Besides, economic development policies at global level are being reformulated to make sure that energy supplies are reliable and have the tendency to protect environment. Although, economies are participating in activities which can help to fulfill overarching goals but developing economies specifically face challenges due to high dependency on coal consumption. The article, thereby, intends to explore the role of green financial innovation, eco-financing, carbon taxes, and economic openness on the SE transition in Vietnam. The study also checks the role of inflation and industrialization on the SE transition as control variables. The article also used Dynamic Auto-regressive Distributed Lags (DARDL) to test the connection among the variables. The outcome indicated that green financial innovation, eco-financing, carbon taxes, economic openness, inflation, and industrialization have a positive and significant linkage with the SE transition in Vietnam. These outcomes provide guidelines to policymakers in establishing new policies regarding SE transition.

ARTICLE HISTORY
Received 7 December 2022
Accepted 30 March 2023

KEYWORDS
Green financial innovation; eco-financing; carbon taxes; economic openness; inflation; industrialization; sustainable energy transition

JEL CODES
Q01; Q56; H23; O16; O13; P18

1. Introduction

Numerous problems, including population increase, sustainability, economic progress, and the loss of natural resources as a result of globalization, plague the modern world. Environmental deterioration is the most important. One of the reasons is that

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it has an impact on many things, including health problems, the loss of natural resources, and global warming (Bai et al., 2022; Tan et al., 2022). The best tool for controlling the negative effects of environmental deterioration is energy transition. The two main problems the world is facing are keeping global warming to 1.5 °C and fostering socioeconomic development. These two problems shouldn't be seen as competing and should be tackled jointly. Particularly today, when everyone is looking forward to the Covid pandemic recovery efforts, Switching to clean and renewable energy sources is the best answer. In the energy transition, assumptions are made regarding energy independence, cost, reliability, and efficiency. It also encompasses aspirations for social inclusivity, economic expansion, and environmental sustainability, particularly in developing countries. These countries will be crucial since the bulk of the world's potential for renewable energy currently lies in developing countries (Ainou et al., 2023; Murshed, 2021; Østergaard et al., 2021). Electricity and RE expansions and technological enhancement are the essential factors of energy transition. It shows that energy transition will never be outdated when environmental, social and governance issues are prioritized by investors (Chien, 2022a; Murshed, 2021). This transformation is occurring as more businesses and investors want greater assurance and clarity when assessing long-term climate threats and possibilities. Technological advancements and a social desire for sustainability make the switch from non RE sources to RE sources possible. Through various de-carbonization techniques, the energy transition, which is fueled by structural, long-term modifications to energy supply, demand, and pricing, also aims to reduce greenhouse gas emissions related to energy use (Chien et al., 2022c; Davidson, 2019).

With an approximate population of 100 million, Vietnam is a vibrant rising economy. Prior to Covid-19, the country used to have 6%–7% annual GDP growth, which led to a sharp increase in energy demand and greenhouse gas emissions. Moreover, Vietnam is counted among those economies that envisions a considerable amount of coal fired electricity generation in order to inject growth in its economy on the basis of energy intensive production (Chien et al., 2022a; Tang et al., 2016). At global level, Vietnam is ranked 5th when it comes to planned additional coal capacity. Moreover, with the estimated installed magnitude of approximately 49 giga watt by the year 2030, it is projected that coal capacity will be fourfold when compares with 2015 level. It is also argued that if all the plants would run till their expected lifetime, GHG emissions will become a challenge for Vietnam and might cause resistance for country to meet the goal of energy reduction targets that was committed by country under Paris Agreement. Besides beneficial for energy production, coal appears to be favorable for economic activities due its significant spill over on infrastructure and other institutions. However, the existing coal-based plants are already jeopardizing country's environment and public health (Chien, 2022b; Thitinan & Chankoson Thanaporn, 2022). In addition, country's coal fired generation has also started relying on imports since 2015. Thereby, If this will not be addressed timely, increased energy consumption will cause serious power shortages given the projections for consistently strong economic development until the year 2030 (Chien et al., 2022b; Kurniawan et al., 2022). While prioritizing ongoing growth, job creation, energy security, and a better national balance of payments, the Vietnamese government may take advantage

of the chance to address climate change on a global scale. Power companies have a great potential to maintain grid stability and cost concerns by carefully and methodically using emerging technology. When compared to the business-as-usual scenario stated in Vietnam' (Minh Thong et al., 2021; Sriyakul et al., 2022), the ideal scenario provided below reduces carbon emissions by 59% by 2030. This is accomplished by gradually investing in more power generation sources, such as offshore wind, solar, and liquefied natural gas (LNG) generation, and limiting the addition of coal capacity to the assets already under consideration, supported by new energy efficiency programs and battery energy storage, and by maximizing existing hydropower (Duong & Hai Thi Thanh, 2022; Nguyen et al., 2021a). Investors and financiers in green energy will concentrate on Vietnam. This is mainly because there are so many different green energy alternatives, including purchasing solar energy. For Vietnam, a renewables-driven approach might open up a number of doors. This entails a 10% reduction in overall energy expenditures, a 1.1 giga-tonnes reduction in greenhouse gas emissions, and a 0.6 mega-ton reduction in particle emissions. Energy imports would also be reduced by 60% by 2030 (Nguyen et al., 2022; Yousaf et al., 2021). Investment in Vietnam for energy transition is given in Figure 1.

By assessing gap in existing body of knowledge, the study addresses various issues such as 1) the globe is seeing rapid technological change as a result of globalization. Energy availability is intimately related to complete technological progress. The contemporary era's growing requirements have likewise increased energy consumption. The globe now prefers renewable energy because rising demand causes traditional energy production to rise, which has an adverse impact on the environment, although it is researched but due to scarcity it demands further exploration. 2) Cantarero (2020) investigated whether the is any nexus between energy transition i.e., renewable energy, energy democracy, and sustainable development, however, the present investigation will also work on energy transition along with eco-innovation, carbon taxes, inflation, industrialization, green financing innovation in Vietnam with advanced data, 3) the model consists of sustainable energy transition, sustainable energy technologies, government governance, environmental taxes, industrialization, inflation

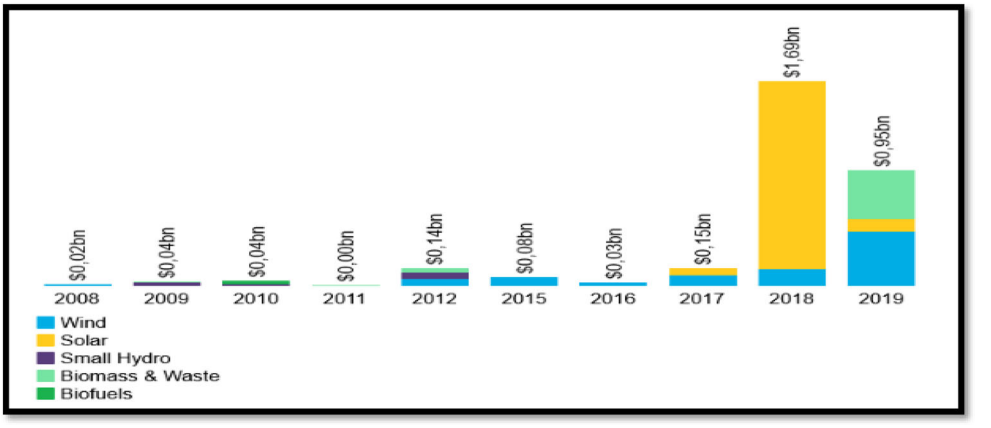

Figure 1. Energy transition investment in Vietnam. Source: Global Climate scope.

and population growth particularly in E7 countries is not tested before in recent time, 4) Saheb et al. (2018) investigated the energy transition and sustainable development goals, however the present study assesses energy transition with carbon taxes, eco-financing, green financing innovation with fresh sample set, 5) Wang and Wang (2020) checked whether there any association between energy transition and economic development, whereas the present study evaluates energy transition from green financing and innovation perspective in Vietnam with fresh data set, 6) Bazilian et al. (2020) explored energy transition and geopolitics, while the current study look into energy transition from green investment and innovation perspective, 7) Huang et al. (2018) worked on the energy transition and governance only while the study scrutinizes energy transition with carbon taxes, inflation recent times with fresh data sample. Hence, several contributions are being made by study. Firstly, the study specifically highlights the significance of energy transition by providing evidence from Vietnam. Secondly, with the provided evidence, professional can have a chance to revise their policies with the view to ensure energy transition. Thirdly, with the evidence, it also provides support to future scholars to explore new setbacks of renewable energy and sustainable energy transition.

2. Literature review

Conventional modes of energy resources disturbed the environmental patterns of globe, hence, it evoked communities to prioritize their goals through the alternative measures (Bointner et al., 2016; Kamarudin et al., 2021). The over-exploitation of these scarce resources caused by the monotonic dependence on non-renewable energy combustion has seriously jeopardized the phenomenon of global energy security. In order to support the energy transition, the world is expressing much interest in green energy financing. Lan et al. (2022) and Ramzan et al. (2023) both investigated that either green innovation supports energy transition or not in a sample of UK. From the analysis, it was exposed that green innovation significantly supports the energy transition process. Similarly, Yu et al. (2022) also investigated the green innovation plays any role in achieving the energy transition. The investigation was carried out in E7 countries. The gathered sample data revealed a significant connection of green innovation with energy transition. Further, policymakers in the E7 nations should abandon fossil fuels since anticipated increases in power production won't be enough to significantly cut emissions. It is quite essential to bring major changes in order to comply with environmental rules, promote technical innovation, embrace green and sustainable technology, and usage of clean energy sources. Moreover, Liu et al. (2022b) and Zhang et al. (2022) investigated the association between green finance, energy and the environment. The investigation was carried out in 49 countries. The data from 12 years from 2012 to 2019 was collected as a sample. The gathered sample was analyzed through SE models. From results, it was obvious that innovation can dramatically increase the RE usage and lower CO2 emissions and lessen the effects of climate change. Moreover, climate change can successfully be reduced using green funding. Sustainable development is primarily driven by the need to hasten the growth of green financing. An increase in green funding will have a more favorable

effect on the use of renewable energy. Innovation has a more detrimental effect on CO_2 emissions and a lesser effect on climate change when green financing is developing rapidly (Liu et al., 2022a).

Countries are working hard to create a sustainable environment in the next decades, especially by 2050, in an effort to avert further ecological degradation (Koval et al., 2022; Liu et al., 2022b). This challenging objective sparked international cooperation and led to the most recent climate summit, COP26, which offers a roadmap for attaining environmental sustainability. In this context, Dinh et al. (2022) conducted an investigation to check whether eco-financing will be helpful in the energy transition. The investigation was carried out in SEAN countries. The data from 20 years from 2000 to 2020 was collected as a sample. The gathered sample was analyzed with the help of the ARDL approach. The results of the investigation revealed that eco-finance adversely affects CO2 emissions but benefits the energy transition, which can help ASEAN countries uphold COP26 resolutions. Based on the findings, officials in the selected economies are urged to push the financial sector to adopt eco-financing practices in order to achieve sustainability in a longer run. In order to achieve green growth, innovation is crucial (Lin et al., 2022; Park & Jeong, 2013). While it is generally agreed that significant environmental concerns would be extremely challenging and expensive to handle without innovation, innovation itself is typically hindered by limited access to eco-financing and is intrinsically hazardous, necessitating a long-term vision. Although the urgency and necessity of advancing green innovation are well acknowledged, both the quality and amount of finance in this sector are woefully inadequate, with funding disparities widening in many nations (Khan et al., 2022; Moslehpour et al., 2022c). Similarly, Mahadwartha (2016) conducted an investigation to evaluate whether eco-financing supports the planet through the betterment of the environment. The investigation was carried out in In Indonesia (Bali). The results of the investigation revealed that eco-financing significantly influences the world in terms of the betterment of the environment.

There are numerous factors which support the energy transition in any country. One of the prominent factors is economic openness. The countries that follow the economic openness concept usually support the energy transition in a better way (Zhao et al., 2021, 2022). Murshed (2018a), scrutinized whether economic openness through trade openness affects the energy transition. The investigation was carried out in South Asian Economies. Investigation revealed that an increase in trade openness encourages the RE usage, enhances the efficiency of primary energy usage, and provides access to clean cooking fuel technology. The data also pointed to the outcomes that trade openness measures were ineffectual in reducing the relative use of non-RE, which marginalized the chances for the total energy transition in these economies. Additionally, Afonso et al. (2021) investigated whether economic openness through trade openness along with energy efficiency has any effect on the energy transition. The investigation was carried out in countries of organization for economic cooperation. The investigation used the data of 1971 to 2016 as sample. The results of the investigation revealed that energy security and energy consumption's carbon intensity are impeding the transition to a low-carbon economy. The energy transition is being constrained by the carbon intensity of energy use while being

driven by energy efficiency and trade openness. By using fewer fossil fuels, energy efficiency measures are required to hasten the energy transition. Moreover, Murshed (2018b), investigated whether economic openness through trade openness facilitates the energy transition. The investigation was carried out in 38 countries including Asia, Sahar Africa, Latin America and South Africa. The investigation used data from 15 years like from 2000 to 2014 as a sample. The results of the investigation revealed that trade openness generally does not benefit the economy's usage of renewable energy, but it does improve energy use efficiency. Additionally, the FDI influx is helpful in achieving most of the energy sustainability goals outlined under the UN 2030 Sustainable Development Agenda. Additionally, remittances have a contradictory impact on the overall shift to renewable energy. Further, while the influx of remittances raises the usage of renewable energy, it concurrently lowers its proportion of overall energy consumption. Similarly, Murshed (2020) also worked on the relationship between energy transition and economic openness through trade openness. The investigation was carried out in Asian countries. The results of the investigation proposed that trade in ICT directly raises renewable energy consumption, raises renewable energy shares, lowers energy usage intensity, and lowers emissions. Additionally, ICT commerce indirectly reduces carbon emissions by increasing RE usage and strengthening energy efficiency (Moslehpour et al., 2022b; Van Hoa et al., 2022).

Governments all around the globe collect their revenue from different resources to cover their expenses. The imposition of taxes is the most frequent way that nations generate money. Taxes exist in a variety of ways, including income tax, sales tax, and environmental tax. Environmental taxes are described as levied on natural resources like water and electricity. The tax imposed on EC and EP is the most typical type of environmental tax. The government retains these taxes as the main factor when developing any project or policy involving natural resources. The rationale is that any insignificant change in these taxes will directly affect the project's success or failure. Similar is the energy transition. Environmental taxes affect the country's energy transition (Moslehpour et al., 2022a; Nguyen et al., 2021b). In this context, Freire-González and Puig-Ventosa (2019) investigated whether environmental taxes i.e., carbon taxes have any association with the energy transition. The investigation was carried out in Spain. Findings exposed that the energy transition process of the country is strongly affected by any sort of fluctuation in the environment i.e., carbon taxes. Therefore, there is a direct association between environmental i.e., carbon taxes and the energy transition. Additionally, Breetz et al. (2018) also investigated the energy transition from a political perspective. Governments over the globe ensure their natural resources' best usage with the view to safeguarding them but also to safeguarding the environment. The results of the investigation proposed that the imposition of taxes in the government's policies and political decisions of the governments affects the environmental taxes which further affect the energy transition process of the country. Similarly, Bashir et al. (2021) also investigated carbon taxes and energy relation in OECD countries. The results of the investigation proposed that the efforts for a sustainable environment can be succeeded by reducing energy usage as well as from energy transition. Additionally, Bashir et al. (2022) investigated whether environmental i.e., carbon taxes affect the energy transition. The investigation was

carried out by OECD. The data from 29 OECD countries was collected as a sample. The data belongs to tenure from 1196 to 2018. Investigation showed that environmental rules in OECD economies restrict the RE usage. It means efforts should be made on environmental plans and turn into practice to promote harmony (Sadiq et al., 2022b).

The shift from traditional energy resources helped the planet in numerous ways, including the development of low-carbon habitats that can restrict global warming effect. The use of renewable energy, in the opinion of policymakers, increases economic and social reasons by supporting job creation and improving economic growth in addition to contributing to a future low-carbon environment (Phuoc et al., 2022; Quynh et al., 2022). Deka and Dube (2021) investigated whether the exchange rate and renewable energy have nexus with inflation. The investigation was carried out in Mexico. The gathered data was analyzed by employing the ARDL approach. The results of the investigation proposed that in long run there is a bidirectional relationship between inflation and exchange rate. Moreover, the usage of renewable energy particularly in Mexico affects inflation; while inflation has no effect on renewable energy. The investigation also recommended that renewable energy should be preferred particularly in Mexico. Furthermore, it will also lead to betterment in environmental degradation in terms of reduction in carbon emission. Similarly, Talha et al. (2021) also investigated energy and inflation within a single framework and scrutinized the effect in Malaysian context. Analysis revealed that the factors like oil prices, energy consumption along with economic growth positively affect the inflation rate. The findings will also be helpful for the government in order to mitigate inflation with essential deals with oil prices.

The planet is growing quickly with the passage of time. Numerous factors, including population increase and globalization, have contributed to this world's expansion. The world's demands for food, shelter, utility appliances, and clothes increase as a result of this expansion. The supply and demand for requirements become unbalanced as a result (Rahman et al., 2020; Sadiq et al., 2022d). In addition, the quick development of technology led to an increase in demand for goods created in the modern period. In order to fulfil the need, the nations also develop their production capacity in order to meet the rising demands and to boost their income. Industrialization grew, requiring more energy. This result in an increase in energy production from traditional sources which in turn results in environmental degradation (Hanlin et al., 2021; Sadiq et al., 2022a, 2022c). The world is switching to renewable energy vide energy transition with the view to balance environmental degradation. In this context, Hanlin et al. (2021) examined the link between industrialization and environmental contamination. Africa was the location of the study. The findings of a careful analysis of the data showed that the expansion of industrialization led to environmental deterioration. Therefore, it is advised that Africa convert to renewable energy. The availability of an inexpensive, trustworthy energy source determines a nation's ability to grow and develop sustainably. Energy demand rises as a result of increasing energy use brought on by economic expansion. While boosting the global economy, on the one hand, the rising industrialization of the world is also having an impact on the environment. More energy is needed because of

industrialization, and this additional energy is produced through conventional resources, which harms the environment. Thus, Fernandes (2020) examined the link between industrialization, economic expansion, and energy usage. The study was carried out throughout six Asian countries. With the aid of ARDL and other models, the data set of energy consumption in the chosen countries from 1971 to 2018 was gathered and tested. The findings showed that industrialization increases energy use and carbon emissions. The environment is further impacted by this. The energy transition to renewable energy was strongly recommended for the selected countries.

3. Research methods

The article investigates the role of green financial innovation, eco-financing, carbon taxes, economic openness, inflation, and industrialization on the SE transition in Vietnam. The study used the OECD database and (WDI) database and chose 1991 to 2020 study time period. The researchers have established the study equation given below:

$$SET_t = \alpha_0 + \beta_1 GFI_t + \beta_2 ECF_t + \beta_3 CRT_{it} + \beta_4 ECO_t + \beta_5 INF_t + \beta_6 IND_t + e_t \quad (1)$$

where

SET = Sustainable Energy Transition

t = Time Period

GFI = Green Financial Innovation

ECF = Eco-financing

CRT = Carbon Taxes

ECO = Economic Openness

INF = Inflation

IND = Industrialization

From Table 1, it can be seen that the study has taken the SE transition as the dependent construct. The study also used four predictors such as green financial innovation, eco-financing, carbon taxes and economic openness. Besides, industrialization and inflation was also considered a part of study as a control variable.

The study checks all the variables' details via descriptive statistics. Correlation matrix was also employed in the study in order to check the strong and weak relation among variables. Along with it, investigation was also made regarding constructs

Table 1. Variables with measurements.

S#	Variables	Measurement	Sources
01	Sustainable Energy Transition	RE output (% of total output)	WDI
02	Green Financial Innovation	Eco-innovation index	OECD
03	Eco-financing	Green investment (% of GDP)	Bloomberg
04	Carbon Taxes	The ratio of environmental taxes to total taxes	WDI
05	Economic Openness	(Imports + exports) / GDP	WDI
06	Inflation	Inflation, consumer prices (annual %)	WDI
07	Industrialization	Industry value added (% of GDP)	WDI

Source: Author's estimation.

stationarity in order to apply appropriate model with the help of unit roots tests such as the augmented Dickey-Fuller (ADF) test and Phillips–Perron (PP) test (see Eq. (1))

$$d(Y_t) = \alpha_0 + \beta t + YY_{t-1} + d(Y_t(-1)) + \varepsilon_t \tag{2}$$

Moreover, the researchers have also investigated the co-integration in the model, which is also necessary to apply the appropriate model with the help of Westerlund and Edgerton (2008) approach. Thus, the equations of the approach are mentioned below:

$$LM_{\varphi}(i) = T\hat{\varphi}_i \ (\hat{r}_i/\hat{\sigma}_i) \tag{3}$$

$$LM_{\tau}(i) = \hat{\varphi}_i/SE(\hat{\varphi}_i) \tag{4}$$

In Eqs. (3) and (4), the estimate beside standard error is represented by $\hat{\boldsymbol{\varphi}}_{\boldsymbol{i}}$, while long-run measured variance is represented by $\hat{r}^2 i$. In addition, in Eqs. (3) and (4), the scalar polynomial with L lag length is represented by $\boldsymbol{\varphi i}\ (\boldsymbol{L}) = \mathbf{1} - \boldsymbol{\Sigma}\ \boldsymbol{\varphi}_{\boldsymbol{ij}}\mathbf{L}^{\boldsymbol{j}}$, and the factor loading parameters vector is represented by ρ_i.

In addition, the article checks the connection among the variable with the help of the ARDL approach. The basic condition to apply the ARDL approach is that some variables must be stationary at I(0), and other variables must be stationary at I(1) (Zaidi & Saidi, 2018). The basic function of the ARDL approach is that it covers the effects of heteroscedasticity and autocorrelation (Nazir et al., 2018). The ARDL approach equation is mentioned below:

$$\begin{aligned}\Delta SET_t = {} & \alpha_0 + \sum \delta_1 \Delta SET_{t-1} + \sum \delta_2 \Delta GFI_{t-1} + \sum \delta_3 \Delta ECF_{t-1} \\ & + \sum \delta_4 \Delta CRT_{t-1} + \sum \delta_5 \Delta CEO_{t-1} + \sum \delta_6 \Delta INF_{t-1} + \sum \delta_7 \Delta IND_{t-1} \\ & + \varphi_1 SET_{t-1} + \varphi_2 GFI_{t-1} + \varphi_3 ECF_{t-1} + \varphi_4 CRT_{t-1} \\ & + \varphi_5 CEO_{t-1} + \varphi_6 INF_{t-1} + \varphi_7 IND_{t-1} + \varepsilon_t\end{aligned} \tag{5}$$

Finally, the current paper also investigates the nexus between the constructs with the help of the DARDL model. Jordan and Philips (2018) have established this approach. This approach covers all the issues and shortcoming that exists in the ARDL approach. In addition, the study employed 5000 simulations for parameters vector by applying the multivariate normal distributions for the dynamic ARDL simulations model. The equation for the DARDL approach is mentioned below:

$$\begin{aligned}\Delta SET_t = {} & \alpha_0 + \sum \delta_1 \Delta SET_{t-1} + \sum \delta_2 \Delta GFI_t + \sum \delta_3 \Delta GFI_{t-1} + \sum \delta_4 \Delta ECF_t \\ & + \sum \delta_5 \Delta ECF_{t-1} + \sum \delta_6 \Delta CRT + \sum \delta_7 \Delta CRT_{t-1} + \sum \delta_8 \Delta CEO_t \\ & + \sum \delta_9 \Delta CEO_{t-1} + \sum \delta_{10} \Delta INF_t + \sum \delta_{11} \Delta INF_{t-1} + \sum \delta_{12} \Delta IND_t \\ & + \sum \delta_{13} \Delta IND_{t-1} + \varepsilon_t\end{aligned} \tag{6}$$

4. Findings results

The study checks all the variables' details with the help of descriptive statistics. The output indicated that the study used 30 observations. In addition, the output also exposed that the SET mean value was 46.035 percent, the GFI average value was 81.542, the ECF mean value was 5.620 percent, and the CRT average value was 34.971 percent. Moreover, the output also exposed that the ECO average value was 23.447, while INF mean value was 5.991 percent and IND average value was 23.652 percent. These outputs are given in Table 2.

The outcome of Table 3 indicated that green financial innovation, eco-financing, carbon taxes, economic openness, inflation, and industrialization have a positive and significant linkage with the SE transition in Vietnam.

Additionally, the article also investigates the stationarity of the constructs to apply the appropriate model with the help of unit roots tests such as the ADF test and PP test. The output indicated that the SET, GFI, ECF, INF, and IND are stationary at a level, while CRT and CEO are stationary at the first difference. These outcomes revealed that the ARDL model is appropriate. These outputs are given in Table 4.

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
SET	30	46.035	17.358	19.945	75.220
GFI	30	81.542	52.339	5.547	168.784
ECF	30	5.620	2.222	3.390	11.939
CRT	30	34.971	0.640	33.902	36.024
ECO	30	23.447	0.848	22.092	24.843
INF	30	5.991	4.879	−1.710	23.115
IND	30	23.652	0.300	23.091	24.142

Source: Author's estimation.

Table 3. Correlations.

Variables	SET	GFI	ECF	CRT	ECO	INF	IND
SET	1.000						
GFI	0.826	1.000					
ECF	0.381	−0.299	1.000				
CRT	0.912	0.976	−0.341	1.000			
ECO	0.913	0.976	−0.336	1.000	1.000		
INF	0.125	−0.010	0.265	0.031	0.031	1.000	
IND	0.901	0.963	−0.306	0.993	0.993	0.031	1.000

Source: Author's estimation.

Table 4. Unit root test.

ADF PP				
Series	Level	First difference	Level	First difference
SET	−3.657***	–	−3.622***	–
GFI	−3.807***	–	−3.784***	–
ECF	−2.854***	–	−4.029***	–
CRT	–	−5.902***	–	−4.442***
CEO	–	−5.552***	–	−5.301***
INF	−3.782***	–	−4.332***	–
IND	−3.938***	–	−4.144***	–

***1%.

Source: Author's estimation.

Table 5. Co-integration test.

	No Shift		Mean Shift		Regime Shift	
Model	Test Stat	p-value	Test Stat	p-value	Test Stat	p-value
LMτ	−5.003	.00	−5.094	.00	−5.392	.00
LMφ	−3.302	.00	−5.488	.00	−5.584	.00

Source: Author's estimation.

Table 6. Dynamic ARDL model.

Variable	Coefficient	t-Statistic	Prob.
ECT	−3.629***	−5.562	0.000
GFI_{t-1}	4.774***	3.902	0.000
GFI	1.902**	2.227	0.022
ECF_{t-1}	3.055*	1.927	0.032
ECF	4.003***	4.909	0.000
CRT_{t-1}	3.292***	3.902	0.000
CRT	4.320***	3.763	0.001
CEO_{t-1}	3.987**	2.976	0.018
CEO	2.291**	4.323	0.000
INF_{t-1}	1.322**	5.432	0.000
INF	2.711**	4.463	0.000
IND_{t-1}	3.778***	3.728	0.002
IND	3.672**	4.372	0.000
Cons	3.673**	4.332	0.000

***1%, **5% and *10%.
R square = 62.293; Stimulation = 5000.
Source: Author's estimation.

Moreover, the researchers have also investigated the co-integration in the model, which is also necessary to apply the appropriate model via Westerlund and Edgerton (2008) approach. The output of Table 5 indicates that the p-values and t-statistics are fulfilling the criteria by meeting the benchmark values. This means co-integration exists and ARDL model can be applied.

The article also used the DARDL to test the connection among the variables. The outcome of Table 6 indicated that green financial innovation, eco-financing, carbon taxes, economic openness, inflation, and industrialization are linked with SE transition in a positively manner as p-values are less than 5%.

5. Discussions

Green financial innovation has a positive association with SET as per study findings. Consistent with prior findings, the study is in line with Su et al. (2021), which highlights that when the firms are concerned about the public well-being and, therefore, show worries about the environmental influences of their economic processes and their outcomes. These firms are motivated to commit financial transactions for green innovation in their work. The financial efforts for reducing the environmental impacts of the business most often result in a transition to sustainable energy. Similarly, Awan et al. (2019) claimed that responsible and socially committed firms never hesitate to put financial resources into eco-friendly innovation practices like changes in technologies or processes. This green financial innovation raises the need for sustainable energy and facilitates energy transition. Song et al. (2019) also highlights that if firms adopt green financial innovation, they tend to utilize renewable

energy for performing different processes. Hence, there is a highly sustainable energy transition.

Eco-finance has a positive association with SET. Mona et al. (2020) also produced similar results and posited that banks or other financial institutions provide finance in the form of investment or short & long-term loans with the condition that these investments or loans should be used to provide capital for eco-friendly practices. When technologies or processes are changed and formed into ones that require renewable energy, the sustainable energy transition comes into existence. Similarly, He et al. (2019) stated that when business organizations interact with the representatives of financial institutions in order to have the funds for ecologically friendly operations, they have the ability to turn to renewable energy. So, there is the transition to sustainable energy. Nawaz et al. (2021) also claimed that the increasing issuance of eco-finance starts technological innovation adoption where renewable energy is used.

Carbon taxes also connect with SET positively, hence, supported by prior evidence. For example, Bashir et al. (2022) proclaimed that the economy where carbon taxes are imposed regulates the economic practices as they cannot damage the environment with toxic CO2 emissions. These taxes force the economic entities to use sustainable like wind power, biomass, solar power, hydroelectricity, etc. Similarly, Lu et al. (2020) emphasized that carbon taxes are useful to promote sustainable energy transition. Karmaker et al. (2021) also claimed that many of the economic practices for the utilization of fossil fuels or nuclear reactions to gain energy cause CO2 emissions. The legal authorities concerned with environmental quality levies carbon taxes in order to control these practices and their environmental repercussions. Consequently, firms make efforts to avoid carbon activities by employing SET. Thereby, the authorities encourage sustainable energy transition.

The results showed that economic openness has a positive association with sustainable energy transition. These results are also in line with Murshed (2020), which highlights that economic openness allows the acquisition of technologies, tools, and instruments. This helps to enhance sustainable energy output and use it in place of fossil fuels to keep business practices. These results are supported by Zeren and Akkuş (2020), which proclaims that economic openness is a considerable source of revenue for the government. The better financial position is the result of the acquisition of foreign exchange, and government can spend on subsidies for carbon-free energy. Hence, there is a transition to sustainable energy. Similarly, Qamruzzaman and Jianguo (2020) stated that trade openness is a source of meeting between people of two regions and creates environmental awareness. The people have higher environmental awareness and transit from nonrenewable energy to sustainable energy.

According to findings, inflation has a positive association with sustainable energy transition, hence, show consistency with several studies. Sadiq et al. (2022a) such as revealed that the occurrence of inflation moves the prices of different goods and services upward. As the prices increase in the market, firms have the ability to raise more profits. With the assurance of higher future profits, the firms can make initiatives for eco-innovation and move towards sustainable energy to run the business. Podbregar et al. (2020) also debated about inflation and sustainable energy transition. This study posits that the increasing inflation improves businesses' ability to transition to utilize

sustainable energy. Hidayatno et al. (2019) also claims that inflation proves to be a booster of economic development and, thereby, it encourages sustainable energy transition.

According to results industrialization promotes sustainable energy transition. Various studies support the results. For example, Alves et al. (2021) claim that the increasing industrial activities, which mostly include the use of machines and plants, increase the economic requirement for energy. The availability of natural fossil fuels is going to be reduced for energy purposes as fossil fuels are limited and unable to meet the increasing demands. In this situation, the use of alternative sources of energy increases. This leads to a sustainable energy transition. Svobodova et al. (2021) also stated that when the fossil fuels supply is getting lower and becoming expensive, alternative sustainable energy sources are required. So, people pay attention to renewable energy consumption instead of fossil fuels. Similarly, Usman et al. (2022), which proclaims that industrialization boosts technological advancements, human capital improvement, and economic innovation. Hence, sustainable energy is possible.

6. Implications

The major focus of the study is on the role of green financial innovation, eco-finance, carbon taxes, economic openness, inflation, and industrialization in the sustainable energy transition. Unlike the prior literature, the authors give more detail and throw a look at the role of green financial innovation, eco-finance, carbon taxes, economic openness, inflation, and industrialization in sustainable energy transition simultaneously. The study employs an extended period and checks the impacts of green financial innovation, eco-finance, carbon taxes, economic openness, inflation, and industrialization on sustainable energy transition for Vietnam.

The study also has many empirical implications in Vietnam country, an emerging economy. This study provides ways how to progress on sustainable energy transition in the country. This study makes it clear to policymakers that green financial innovation must be encouraged in organizations in order to enhance sustainable energy transition in a place of fossil fuel consumption. The study guides that the attention of financial institutions must be turned towards the issuance of eco-finance widely in the country to ensure sustainable energy transition. It is suggested that government must use carbon taxes implementation as a tool to promote SET. The study also guides that the economy must grow through trade openness and, thereby, eases the sustainable energy transition. The article provides guidelines to policymakers in establishing new policies regarding SE transition using green financial innovation, eco-financing, carbon taxes, and economic openness. Moreover, economic and financial policymakers, along with organizations, must benefit from inflation and encourage SET.

7. Conclusion

The study aimed to examine the impacts of green financial innovation, eco-finance, carbon taxes, economic openness, inflation, and industrialization on sustainable

energy transition. The statistics of Vietnam's economy show a positive link between green financial innovation, eco-finance, carbon taxes, economic openness, inflation, industrialization, and sustainable energy transition. The study implies that if businesses implement green financial innovation, they are more likely to use renewable energy for a variety of activities. As a result, there is a high shift to sustainable energy. The results showed that the increasing issuance of eco-finance starts with technological advancements and the adoption of energy-efficient technologies (including processes). It results in a sustainable energy transition. The results also indicated that carbon taxes are useful for promoting sustainable energy transition by discouraging carbon-emitting practices. Likewise, the growth in economic openness helps acquire resources and promote capital formation, which all ultimately promote sustainable energy technologies. The results revealed that economic growth and financial development are demonstrated to be boosted by inflation, which promotes the transition to SE sources. The paper also evaluated that technological progress, the development of human capital, and economic innovation are all boosted by industrialization. As a result, there is a sustainable energy transition.

8. Limitations

Still, several limitations are found in the current research. These limitations are likely to be removed in further works. A limited number of factors, including green financial innovation, eco-finance, carbon taxes, economic openness, inflation, and industrialization, are analyzed to evaluate sustainable energy transition. The authors leave many other significant factors which have a greater influence on sustainable energy transition. In the future, further literature on sustainable energy transition must be comprehensive with more factors analysis. Vietnam is a lower-middle-income developing economy which can provide an insufficient context for the analysis of the nexus between green financial innovation, eco-finance, carbon taxes, economic openness, inflation, industrialization, and sustainable energy transition. So, the academics must employ data from developing, and developed countries mix to check the relationship between green financial innovation, eco-finance, carbon taxes, economic openness, inflation, industrialization, and sustainable energy transition.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This research is partly funded by the University of Economics Ho Chi Minh City (UEH), Vietnam.

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References

Afonso, T. L., Marques, A. C., & Fuinhas, J. A. (2021). Does energy efficiency and trade openness matter for energy transition? Empirical evidence for countries in the Organization for Economic Co-operation and Development. *Environment, Development and Sustainability*, *23*(9), 13569–13589. https://doi.org/10.1007/s10668-021-01228-z

Ainou, F. Z., Ali, M., & Sadiq, M. (2023). Green energy security assessment in Morocco: Green finance as a step toward sustainable energy transition. *Environmental Science and Pollution Research*, *30*(22), 61411–61429. https://doi.org/10.1007/s11356-022-19153-7

Alves, L., Pereira, V., Lagarteira, T., & Mendes, A. (2021). Catalytic methane decomposition to boost the energy transition: Scientific and technological advancements. *Renewable and Sustainable Energy Reviews*, *137*, 110465. https://doi.org/10.1016/j.rser.2020.110465

Awan, U., Sroufe, R., & Kraslawski, A. (2019). Creativity enables sustainable development: Supplier engagement as a boundary condition for the positive effect on green innovation. *Journal of Cleaner Production*, *226*, 172–185. https://doi.org/10.1016/j.jclepro.2019.03.308

Bai, X., Wang, K. T., Tran, T. K., Sadiq, M., Trung, L. M., & Khudoykulov, K. (2022). Measuring China's green economic recovery and energy environment sustainability: Econometric analysis of sustainable development goals. *Economic Analysis and Policy*, *75*, 768–779. https://doi.org/10.1016/j.eap.2022.07.005

Bashir, M. F., Benjiang, M., Shahbaz, M., Shahzad, U., & Vo, X. V. (2021). Unveiling the heterogeneous impacts of environmental taxes on energy consumption and energy intensity: Empirical evidence from OECD countries. *Energy*, *226*, 120366. https://doi.org/10.1016/j.energy.2021.120366

Bashir, M. F., Ma, B., Bashir, M. A., Radulescu, M., & Shahzad, U. (2022). Investigating the role of environmental taxes and regulations for renewable energy consumption: Evidence from developed economies. *Economic Research-Ekonomska Istraživanja*, *35*(1), 1262–1284. https://doi.org/10.1080/1331677X.2021.1962383

Bazilian, M., Bradshaw, M., Gabriel, J., Goldthau, A., & Westphal, K. (2020). Four scenarios of the energy transition: Drivers, consequences, and implications for geopolitics. *Wiley Interdisciplinary Reviews: Climate Change*, *11*(2), 625–639.

Bointner, R., Pezzutto, S., Grilli, G., & Sparber, W. (2016). Financing innovations for the renewable energy transition in Europe. *Energies*, *9*(12), 990. https://doi.org/10.3390/en9120990

Breetz, H., Mildenberger, M., & Stokes, L. (2018). The political logics of clean energy transitions. *Business and Politics*, *20*(4), 492–522. https://doi.org/10.1017/bap.2018.14

Cantarero, M. M. V. (2020). Of renewable energy, energy democracy, and sustainable development: A roadmap to accelerate the energy transition in developing countries. *Energy Research & Social Science*. https://doi.org/10.1016/j.erss.2020.101716

Chien, F. (2022a). How renewable energy and non-renewable energy affect environmental excellence in N-11 economies? *Renewable Energy*, *196*, 526–534. https://doi.org/10.1016/j.renene.2022.07.013

Chien, F. (2022b). The mediating role of energy efficiency on the relationship between sharing economy benefits and sustainable development goals (case of China). *Journal of Innovation & Knowledge*, *7*(4), 100270. https://doi.org/10.1016/j.jik.2022.100270

Chien, F., Chau, K. Y., Sadiq, M., & Hsu, C. C. (2022a). The impact of economic and non-economic determinants on the natural resources commodity prices volatility in China. *Resources Policy*, *78*, 102863. https://doi.org/10.1016/j.resourpol.2022.102863

Chien, F., Hsu, C. C., Sibghatullah, A., Hieu, V. M., Phan, T. T. H., & Hoang Tien, N. (2022b). The role of technological innovation and cleaner energy towards the environment in ASEAN countries: Proposing a policy for sustainable development goals. *Economic Research-Ekonomska Istraživanja*, *35*(1), 4677–4692. https://doi.org/10.1080/1331677X.2021.2016463

Chien, F., Zhang, Y., Sharif, A., Sadiq, M., & Hieu, M. V. (2022c). Does air pollution affect the tourism industry in the USA? Evidence from the quantile autoregressive distributed lagged approach. *Tourism Economics*, 135481662210970. https://doi.org/10.1177/13548166221097021

Davidson, D. J. (2019). Exnovating for a renewable energy transition. *Nature Energy*, *4*(4), 254–256. https://doi.org/10.1038/s41560-019-0369-3

Deka, A., & Dube, S. (2021). Analyzing the causal relationship between exchange rate, renewable energy and inflation of Mexico (1990–2019) with ARDL bounds test approach. *Renewable Energy Focus*, *37*, 78–83. https://doi.org/10.1016/j.ref.2021.04.001

Dinh, H. P., Tran, K. N., Van Cao, T., Vo, L. T., & Ngo, T. Q. (2022). Role of Eco-financing in COP26 Goals: Empirical Evidence from ASEAN Countries. *Cuadernos de Economía*, *45*(128), 24–33.

Duong, K. D., & Hai Thi Thanh, T. (2022). Association between post-covid socio-economic development and energy-growth-environment nexus from developing economy. *International Journal of Economics and Finance Studies*, *14*(2), 247–270.

Fernandes, N. (2020). *Economic effects of coronavirus outbreak (COVID-19) on the world economy*.

Freire-González, J., & Puig-Ventosa, I. (2019). Reformulating taxes for an energy transition. *Energy Economics*, *78*, 312–323. https://doi.org/10.1016/j.eneco.2018.11.027

Hanlin, R., Andersen, M. H., Lema, R., & Nzila, C. (2021). Renewable electrification and sustainable industrialisation. In *Building innovation capabilities for sustainable industrialisation* (pp. 1–18). Routledge.

He, L., Liu, R., Zhong, Z., Wang, D., & Xia, Y. (2019). Can green financial development promote renewable energy investment efficiency? A consideration of bank credit. *Renewable Energy*, *143*, 974–984. https://doi.org/10.1016/j.renene.2019.05.059

Hidayatno, A., Destyanto, A. R., & Hulu, C. A. (2019). Industry 4.0 technology implementation impact to industrial sustainable energy in Indonesia: A model conceptualization. *Energy Procedia*, *156*, 227–233. https://doi.org/10.1016/j.egypro.2018.11.133

Huang, P., Broto, V. C., Liu, Y., & Ma, H. (2018). The governance of urban energy transitions: A comparative study of solar water heating systems in two Chinese cities. *Journal of Cleaner Production*, *180*, 222–231. https://doi.org/10.1016/j.jclepro.2018.01.053

Jordan, S., & Philips, A. Q. (2018). Cointegration testing and dynamic simulations of autoregressive distributed lag models. *The Stata Journal: Promoting Communications on Statistics and Stata*, *18*(4), 902–923. https://doi.org/10.1177/1536867X1801800409

Kamarudin, F., Anwar, N. A. M., Chien, F., & Sadiq, M. (2021). Efficiency of microfinance institutions and economic freedom nexus: Empirical evidence from four selected ASIAN countries. *Transformations in Business & Economics*, *20*(2b), 845–868.

Karmaker, S. C., Hosan, S., Chapman, A. J., & Saha, B. B. (2021). The role of environmental taxes on technological innovation. *Energy*, *232*, 121052. https://doi.org/10.1016/j.energy.2021.121052

Khan, M. A., Riaz, H., Ahmed, M., & Saeed, A. (2022). Does green finance really deliver what is expected? An empirical perspective. *Borsa Istanbul Review*, *22*(3), 586–593. https://doi.org/10.1016/j.bir.2021.07.006

Koval, V., Laktionova, O., Atstāja, D., Grasis, J., Lomachynska, I., & Shchur, R. (2022). Green financial instruments of cleaner production technologies. *Sustainability*, *14*(17), 10536. https://doi.org/10.3390/su141710536

Kurniawan, K., Supriatna, J., Sapoheluwakan, J., Soesilo, T. E. B., Mariati, S., & Gunarso, G. (2022). The analysis of forest and land fire and carbon and greenhouse gas emissions on the climate change in Indonesia. *AgBioForum*, *24*(2), 1–11.

Lan, J., Khan, S. U., Sadiq, M., Chien, F., & Baloch, Z. A. (2022). Evaluating energy poverty and its effects using multi-dimensional based DEA-like mathematical composite indicator approach: Findings from Asia. *Energy Policy*, *165*, 112933. https://doi.org/10.1016/j.enpol.2022.112933

Lin, C. Y., Chau, K. Y., Tran, T. K., Sadiq, M., Van, L., & Phan, T. T. H. (2022). Development of renewable energy resources by green finance, volatility and risk: Empirical evidence from China. *Renewable Energy*, *201*, 821–831. https://doi.org/10.1016/j.renene.2022.10.086

Liu, Z., Yin, T., Surya Putra, A. R., & Sadiq, M. (2022a). Public spending as a new determinate of sustainable development goal and green economic recovery: Policy perspective analysis in the

Post-Covid ERA. *Climate Change Economics*, *13*(03), 2240007. https://doi.org/10.1142/S2010007822400073

Liu, Z., Lan, J., Chien, F., Sadiq, M., & Nawaz, M. A. (2022b). Role of tourism development in environmental degradation: A step towards emission reduction. *Journal of Environmental Management*, *303*, 114078. https://doi.org/10.1016/j.jenvman.2021.114078

Lu, J., Ren, L., Yao, S., Rong, D., Skare, M., & Streimikis, J. (2020). Renewable energy barriers and coping strategies: Evidence from the Baltic States. *Sustainable Development*, *28*(1), 352–367. https://doi.org/10.1002/sd.2030

Mahadwartha, P. A. (2016). Eco friendly financing to save our planets. *Social Science & Business Research Network Symposium*, *1*, 1–14.

Minh Thong, L., Van Hiep, T., Thi Thu Thuy, B., & Huu Tung, D. (2021). The competition possibility between renewable energy and fossil energy in Vietnam in the future. *The Journal of World Energy Law & Business*, *14*(3), 215–228. https://doi.org/10.1093/jwelb/jwab021

Mona, S., Kumar, S. S., Kumar, V., Parveen, K., Saini, N., Deepak, B., & Pugazhendhi, A. (2020). Green technology for sustainable biohydrogen production (waste to energy): A review. *Science of the Total Environment*, *728*, 138481. https://doi.org/10.1016/j.scitotenv.2020.138481

Moslehpour, M., Chau, K. Y., Du, L., Qiu, R., Lin, C. Y., & Batbayar, B. (2022a). Predictors of green purchase intention toward eco-innovation and green products: Evidence from Taiwan. *Economic Research-Ekonomska Istraživanja*, 1–22. https://doi.org/10.1080/1331677X.2022.2121934

Moslehpour, M., Chau, K. Y., Tu, Y. T., Nguyen, K. L., Barry, M., & Reddy, K. D. (2022b). Impact of corporate sustainable practices, government initiative, technology usage, and organizational culture on automobile industry sustainable performance. *Environmental Science and Pollution Research International*, *29*(55), 83907–83920. https://doi.org/10.1007/s11356-022-21591-2

Moslehpour, M., Shalehah, A., Wong, W. K., Ismail, T., Altantsetseg, P., & Tsevegjav, M. (2022c). Economic and tourism growth impact on the renewable energy production in Vietnam. *Environmental Science and Pollution Research International*, *29*(53), 81006–81020. https://doi.org/10.1007/s11356-022-21334-3

Murshed, M. (2018a). Does improvement in trade openness facilitate renewable energy transition? Evidence from selected South Asian economies. *South Asia Economic Journal*, *19*(2), 151–170. https://doi.org/10.1177/1391561418794691

Murshed, M. (2018b). Questioning the effectiveness of trade openness in facilitating renewable energy transition: A panel data analysis. *Journal of Accounting, Finance and Economics*, *8*(1), 58–75.

Murshed, M. (2020). An empirical analysis of the non-linear impacts of ICT-trade openness on renewable energy transition, energy efficiency, clean cooking fuel access and environmental sustainability in South Asia. *Environmental Science and Pollution Research International*, *27*(29), 36254–36281. https://doi.org/10.1007/s11356-020-09497-3

Murshed, M. (2021). Can regional trade integration facilitate renewable energy transition to ensure energy sustainability in South Asia? *Energy Reports*, *7*, 808–821. https://doi.org/10.1016/j.egyr.2021.01.038

Nawaz, M. A., Seshadri, U., Kumar, P., Aqdas, R., Patwary, A. K., & Riaz, M. (2021). Nexus between green finance and climate change mitigation in N-11 and BRICS countries: Empirical estimation through difference in differences (DID) approach. *Environmental Science and Pollution Research International*, *28*(6), 6504–6519. https://doi.org/10.1007/s11356-020-10920-y

Nazir, M. I., Nazir, M. R., Hashmi, S. H., & Ali, Z. (2018). Environmental Kuznets Curve hypothesis for Pakistan: Empirical evidence form ARDL bound testing and causality approach. *International Journal of Green Energy*, *15*(14-15), 947–957. https://doi.org/10.1080/15435075.2018.1529590

Nguyen, H. V., Vu, T. D., Greenland, S., Nguyen, T. M. N., & Vu, V. H. (2022). Promoting sustainable renewable energy consumption: Government policy drives record rooftop solar

adoption in Vietnam. In *Environmental sustainability in emerging markets* (Vol. 6, pp. 23–45). Springer.

Nguyen, X. P., Le, N. D., Pham, V. V., Huynh, T. T., Dong, V. H., & Hoang, A. T. (2021a). Mission, challenges, and prospects of renewable energy development in Vietnam. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, 1–13. https://doi.org/10.1080/15567036.2021.1965264

Nguyen, C. H., Ngo, Q. T., Pham, M. D., Nguyen, A. T., & Huynh, N. C. (2021b). Economic linkages, technology transfers, and firm heterogeneity: The case of manufacturing firms in the Southern Key Economic Zone of Vietnam. *Cuadernos de Economía*, *44*(124), 1–25.

Østergaard, P. A., Duic, N., Noorollahi, Y., & Kalogirou, S. A. (2021). *Recent advances in renewable energy technology for the energy transition* (Vol. 179, pp. 877–884). Elsevier. https://doi.org/10.1016/j.renene.2021.07.111

Park, J., & Jeong, C. (2013). Financing the commercialisation of green innovation. *STI Policy Review*, *4*(1), 94–118.

Phuoc, V. H., Thuan, N. D., Vu, N. P. H., & Tuyen, L. T. (2022). The impact of corporate social and environmental responsibilities and management characteristics on SMES' performance in Vietnam. *International Journal of Economics and Finance Studies*, *14*(2), 36–52.

Podbregar, I., Šimić, G., Radovanović, M., Filipović, S., Maletič, D., & Šprajc, P. (2020). The international energy security risk index in sustainable energy and economy transition decision making—A reliability analysis. *Energies*, *13*(14), 3691–3699. https://doi.org/10.3390/en13143691

Qamruzzaman, M., & Jianguo, W. (2020). The asymmetric relationship between financial development, trade openness, foreign capital flows, and renewable energy consumption: Fresh evidence from panel NARDL investigation. *Renewable Energy*, *159*, 827–842. https://doi.org/10.1016/j.renene.2020.06.069

Quynh, M. P., Van, M. H., Le-Dinh, T., & Nguyen, T. T. H. (2022). The role of climate finance in achieving Cop26 goals: Evidence from N-11 countries. *Cuadernos de Economía*, *45*(128), 1–12.

Rahman, H. U., Ghazali, A., Bhatti, G. A., & Khan, S. U. (2020). Role of economic growth, financial development, trade, energy and FDI in environmental Kuznets curve for Lithuania: Evidence from ARDL bounds testing approach. *Engineering Economics*, *31*(1), 39–49. https://doi.org/10.5755/j01.ee.31.1.22087

Ramzan, M., Razi, U., Quddoos, M. U., & Adebayo, T. S. (2023). Do green innovation and financial globalization contribute to the ecological sustainability and energy transition in the United Kingdom? Policy insights from a bootstrap rolling window approach. *Sustainable Development*, *31*(1), 393–414. https://doi.org/10.1002/sd.2399

Sadiq, M., Amayri, M. A., Paramaiah, C., Mai, N. H., Ngo, T. Q., & Phan, T. T. H. (2022a). How green finance and financial development promote green economic growth: Deployment of clean energy sources in South Asia. *Environmental Science and Pollution Research*, *29*(43), 65521–65534. https://doi.org/10.1007/s11356-022-19947-9

Sadiq, M., Lin, C. Y., Wang, K. T., Trung, L. M., Duong, K. D., & Ngo, T. Q. (2022b). Commodity dynamism in the COVID-19 crisis: Are gold, oil, and stock commodity prices, symmetrical? *Resources Policy*, *79*, 103033. https://doi.org/10.1016/j.resourpol.2022.103033

Sadiq, M., Ngo, T. Q., Pantamee, A. A., Khudoykulov, K., Ngan, T. T., & Tan, L. L. (2022c). The role of environmental social and governance in achieving sustainable development goals: Evidence from ASEAN countries. *Economic Research-Ekonomska Istraživanja*, *36*(1), 170–190. https://doi.org/10.1080/1331677X.2022.2072357

Sadiq, M., Ou, J. P., Duong, K. D., Van, L., Ngo, T. Q., & Bui, T. X. (2022d). The influence of economic factors on the sustainable energy consumption: Evidence from China. *Economic Research-Ekonomska Istraživanja*, *36*(1), 1751–1773. https://doi.org/10.1080/1331677X.2022.2093244

Saheb, Y., Ossenbrink, H., Szabo, S., Bódis, K., & Panev, S. (2018). Energy transition of Europe's building stock. Implications for EU 2030. Sustainable development goals. *Annales des Mines-Responsabilite et environnement*, *90*(2), 62–67. https://doi.org/10.3917/re1.090.0062

Song, M., Fisher, R., & Kwoh, Y. (2019). Technological challenges of green innovation and sustainable resource management with large scale data. *Technological Forecasting and Social Change*, *144*, 361–368. https://doi.org/10.1016/j.techfore.2018.07.055

Sriyakul, T., Chienwattanasook, K., & Chankoson, T. (2022). Does industrialization and renewable energy consumption determine economic growth? Empirical evidence from asean countries. *International Journal of Economics and Finance Studies*, *14*(03), 264–279.

Su, C.-W., Umar, M., & Khan, Z. (2021). Does fiscal decentralization and eco-innovation promote renewable energy consumption? Analyzing the role of political risk. *Science of the Total Environment*, *751*, 142220. https://doi.org/10.1016/j.scitotenv.2020.142220

Svobodova, K., Owen, J., & Harris, J. (2021). The global energy transition and place attachment in coal mining communities: Implications for heavily industrialized landscapes. *Energy Research & Social Science*, *71*, 101831. https://doi.org/10.1016/j.rser.2020.110465

Talha, M., Sohail, M., Tariq, R., & Ahmad, M. T. (2021). Impact of oil prices, energy consumption and economic growth on the inflation rate in Malaysia. *Cuadernos de Economía*, *44*(124), 26–32.

Tan, L. P., Sadiq, M., Aldeehani, T. M., Ehsanullah, S., Mutira, P., & Vu, H. M. (2022). How COVID-19 induced panic on stock price and green finance markets: Global economic recovery nexus from volatility dynamics. *Environmental Science and Pollution Research*, *29*(18), 26322–26335. https://doi.org/10.1007/s11356-021-17774-y

Tang, A. K., Lai, K. H., & Cheng, T. C. E. (2016). A multi-research-method approach to studying environmental sustainability in retail operations. *International Journal of Production Economics*, *171*, 394–404.

Thitinan, K. S., & Chankoson Thanaporn, S. (2022). Examining the impacts of democracy on the economic growth of Asian countries aimed COVID-19: A panel data analysis. *International Journal of Economics and Finance Studies*, *14*(03), 153–167.

Usman, M., Jahanger, A., Makhdum, M. S. A., Radulescu, M., Balsalobre-Lorente, D., & Jianu, E. (2022). An empirical investigation of ecological footprint using nuclear energy, industrialization, fossil fuels and foreign direct investment. *Energies*, *15*(17), 6442–6465. https://doi.org/10.3390/en15176442

Van Hoa, N., Van Hien, P., Tiep, N. C., Huong, N. T. X., Mai, T. T. H., & Phuong, P. T. L. (2022). The role of financial inclusion, green investment and green credit on sustainable economic development: Evidence from Vietnam. *Cuadernos de Economía*, *45*(127), 1–10.

Wang, Q., & Wang, S. (2020). Is energy transition promoting the decoupling economic growth from emission growth? Evidence from the 186 countries. *Journal of Cleaner Production*, *260*, 120768. https://doi.org/10.1016/j.jclepro.2020.120768

Westerlund, J., & Edgerton, D. L. (2008). A simple test for cointegration in dependent panels with structural breaks. *Oxford Bulletin of Economics and Statistics*, *70*(5), 665–704. https://doi.org/10.1111/j.1468-0084.2008.00513.x

Yousaf, Z., Radulescu, M., Nassani, A., Aldakhil, A. M., & Jianu, E. (2021). Environmental management system towards environmental performance of hotel industry: Does corporate social responsibility authenticity really matter? *Engineering Economics*, *32*(5), 484–498. https://doi.org/10.5755/j01.ee.32.5.28619

Yu, Y., Radulescu, M., Ifelunini, A. I., Ogwu, S. O., Onwe, J. C., & Jahanger, A. (2022). Achieving carbon neutrality pledge through clean energy transition: Linking the role of green innovation and environmental policy in E7 countries. *Energies*, *15*(17), 6456. https://doi.org/10.3390/en15176456

Zaidi, S., & Saidi, K. (2018). Environmental pollution, health expenditure and economic growth in the Sub-Saharan Africa countries: Panel ARDL approach. *Sustainable Cities and Society*, *41*, 833–840. https://doi.org/10.1016/j.scs.2018.04.034

Zeren, F., & Akkuş, H. T. (2020). The relationship between renewable energy consumption and trade openness: New evidence from emerging economies. *Renewable Energy*, *147*, 322–329. https://doi.org/10.1016/j.renene.2019.09.006

Zhang, K. Q., Chen, H. H., Tang, L. Z., & Qiao, S. (2022). Green finance, innovation and the energy-environment-climate nexus. *Frontiers in Environmental Science*, *10*. https://doi.org/10.3389/fenvs.2022.879681

Zhao, L., Zhang, Y., Sadiq, M., Hieu, V. M., & Ngo, T. Q. (2021). Testing green fiscal policies for green investment, innovation and green productivity amid the COVID-19 era. *Economic Change and Restructuring*. https://doi.org/10.1007/s10644-021-09367-z

Zhao, L., Chau, K. Y., Tran, T. K., Sadiq, M., Xuyen, N. T. M., & Phan, T. T. H. (2022). Enhancing green economic recovery through green bonds financing and energy efficiency investments. *Economic Analysis and Policy*, *76*, 488–501. https://doi.org/10.1016/j.eap.2022.08.019