frontiers | Frontiers in Environmental Science

ORIGINAL RESEARCH
published: 04 July 2022
doi: 10.3389/fenvs.2022.914419

RETRACTED: Assessing the Nexus Between Green Economic Recovery, Green Finance, and CO_2 Emission: Role of Supply Chain Performance and Economic Growth

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Specialty section:
This article was submitted to Environmental Economics and Management, a section of the journal Frontiers in Environmental Science

Received: 06 April 2022
Accepted: 27 May 2022
Published: 04 July 2022

Citation:
Zhong W, Zong L, Yin W, Ali SA, Mouneer S and Haider J (2022) Assessing the Nexus Between Green Economic Recovery, Green Finance, and CO_2 Emission: Role of Supply Chain Performance and Economic Growth. Front. Environ. Sci. 10:914419. doi: 10.3389/fenvs.2022.914419

Environmentalists are more concerned with the environment in this age of industrialization, and they are continually interested in researching factors that can facilitate the transition towards sustainability. This study applies an econometric technique called the panel Generalized Method of Moments generalized moments to analyze green finance and renewable energy's impact on CO_2 emissions from 2010 to 2019. According to the findings, green finance has a significant negative and positive impact on carbon emissions and green economic recovery. In addition, the results showed that logistics operations use energy and fossil fuel, and the findings also showed that the amount of fossil fuel and non-green energy sources creates a significant harmful effect on the environmental sustainability, in addition to having a negative impact on economic growth. Inadequate transportation-related infrastructure and logistics services are other significant contributors to CO_2 and overall emissions of greenhouse gases. According to the findings, sustainable energy development can be advanced by fostering the growth of green finance. This can be accomplished by employing a variety of metrics that pertain to the three dimensions of economic development, financial development, and environmental development.

Keywords: green recovery, energy consumption, CO_2 emission, 25 emerging countries, green economic development

1 INTRODUCTION

Since the beginning of the industrial revolution, the financial sector has been an important driving force behind the expansion of human civilization (Lv et al., 2021). The global financial sector's primary responsibility is to find productive uses for the world's savings, and this is where it excels (Wu and Zhu, 2021). The enhancement of people's quality of life is made possible by the intelligent application of their investments. However, due to the collapse of the financial system, people have invested their savings in environmentally harmful projects and real estate bubbles, including projects that contribute to the acceleration of climate change that humans cause (Thiruchelvam et al., 2018; Cai et al., 2022). In the past, the business world paid little attention to the ecosystem, which paved the way for the development of or a worsening of environmental problems such as the destruction of

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habitats and the depletion of natural resources, and climate change and pollution (He et al., 2022). Although the financial sector plays an important part in anthropogenic (that is, the impact that humans have on the environment), very little has been done to incorporate environmental concerns into the financial sector. Throughout the past few years, the business world's focus on environmentally responsible investments has helped advance the cause of sustainable growth. Taghizadeh-Hesary and Yoshino (2019) claims that green financial instruments can be of assistance in the movement toward a greener environment. In the course of this process, financial intermediaries and markets have developed various types of financial instruments, such as green bonds, green home mortgages, green loans for commercial buildings, environmental home equity programmes, "go green" auto loans, small business administration express loans, and climate credit cards (Iqbal et al., 2019; Huang et al., 2022; Liu et al., 2022). In addition, Australia has launched its first environmental deposit initiative, which is comprised of medium-to-long-term financing tools that not only finance environmentally friendly projects and business activities, but also support sustainable development and climate-related projects directly (Zhao et al., 2017; Khokhar et al., 2020; Mohsin et al., 2021).

The requirement that all industries, from upstream to downstream, be accountable for both direct and indirect CO_2 emissions associated with the supply of raw materials and components is one reason why there is a focus on life cycle CO_2 emissions. Another reason is that reducing emissions can be accomplished by focusing on life cycle CO_2 emissions (Shahbaz et al., 2013). Therefore, it is essential to identify the supply chain paths that drive life cycle CO_2 emissions changes and provide policymakers and decision-makers with the data on the critical ways to reduce CO_2 emissions effectively. In addition, it is important to identify the supply chain paths that drive changes in CO_2 emissions from the combustion of fossil fuels. In order to effectively cut CO_2 emissions, it is very important to identify critical factors that affect life cycle CO_2 emissions over time. This can be done by conducting a life cycle analysis. Green supply chain management (also known as GSCM) is a relatively new concept that has surfaced as a solution to the problem of how to boost long-term economic profits while also improving environmental performance (Ohajionu et al., 2022). Because many common industrial materials used in manufactured products can be considered harmful or "hazardous" to the environment to a greater or lesser extent, one of the significant environmental concerns with the integration of clean technologies into supply chain processes is the detoxification of industrial pollutants (Chuc et al., 2021). This is a topic that has received very little attention in academic literature. As a result, everyday consumer products must be evaluated for their risk to society.

Many studies of the relationships between fossil fuel consumption, carbon dioxide emissions, and economic development have been published using various approaches. As far as we know, users have employed fossil fuels, carbon dioxide emissions, the Tana and Yamamoto methodologies, binary linear causality, multilinear causality, and vector error correction models (VECM), according to the literature. However, fossil fuel consumption, carbon dioxide emissions, and economic progress are not linear. For example, (Wang and Zhang, 2021), indicate that shifts in economic events and institutions lead to fundamental alterations in energy consumption patterns over time (Anser et al., 2020; Khokhar et al., 2020; Rao et al., 2022). This leads to nonlinear and nonlinear correlations between energy utilization and economic growth (Hiemstra and Jones, 1994), and others have worked to address these constraints. The Granger test, which was subsequently accepted, was presented in (Topcu and Payne, 2017). Researchers in China investigated the Granger linear and multivariate nonlinear causation between the consumption of fossil fuels, emissions of carbon dioxide, and the growth of the Chinese economy. This method allows for the evaluation of linear and nonlinear correlations. It is possible to investigate the independent, linked, and combined effects of China's economic growth, consumption of fossil fuels, and emissions of carbon dioxide. These multiple linear and nonlinear Granger causation findings are more fascinating and suggestive than previous studies. Still, they are also from the government in making decisions concerning the utilization of fossil fuels, CO_2 emissions, and economic expansion. Additionally, they are essential for decision-makers making their own choices. In order to gain a deeper comprehension of this issue, our team carried out a co-integration analysis on the relationship between China's consumption of fossil fuels, the country's carbon dioxide emissions, and its economic growth using the Johansen co-integration and the ARDL limit checks.

As a result of this investigation, the following findings are significant. First, we explain green financing and respond to scholarly questions about its impact on economic development. This study aims to develop a theoretical framework for the impact of green financing on economic growth. Second, this article examines the significance of the Green Recovery (Gebreslassie, 2021). Green recovery and economic development have received little attention because of Fintech's influence. A better understanding of the development impact of green recovery and its indirect impact on the link between green healing and economic growth is now possible to assess. Third, this research aims to provide new insights into how supply chain performance reduces carbon intensity.

The rest of this article is structured as follows: 1—introduction. **Section 2** contains the relevant literature. Selection of methods and variables in **Section 3**, detailed results, and discussion are found in **Section 4**. **Section 5** concludes with policy recommendations and conclusions.

2 LITERATURE REVIEW

In order to achieve a green recovery, a thorough examination of the factors that influence growth is required. The selected green recovery indicators are changes in public spending (Jiang and Ma, 2019). As shown in previous studies, changing the composition of public expenditure has a significant impact on economic and environmental degradation. However, public spending and green economic recovery have not been studied in the United States (Zhuo and Qamruzzaman, 2022). A study by Wang et al. (2020) finds that a

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growth in population education spending stimulates the "Composition Effect," supporting the use of greenhouse gases and the pavement approach to new types of economic development (Li et al., 2021). Additional funding for research and innovation can encourage nations to adopt environmentally friendly, cleaner technologies and increase the use of renewable energy (Gondal et al., 2018). As a result of these innovations, resources are conserved, and a cleaner product is produced (Yadav et al., 2020). Finally, the "Technique Effect" can reduce greenhouse gas emissions at a minimal cost.

Several countries worldwide have enjoyed steady economic growth over the past few decades. However, as a result of their economic progress, these countries have become greater sources of CO_2 emissions. Many studies have examined the relationship between economic growth and carbon emissions in countries with substantial economic growth. However, more research is needed to determine the impact of public spending on the green economic recovery growth in the 25 emerging countries with the highest future economic growth potential. It is difficult to predict which country will make such rapid economic progress using the current methods.

In order to promote and build large markets, the 25 emerging countries need to establish a mutual understanding among them. Modern industrial manufacturing has replaced agriculture as the primary means of economic growth in many emerging economies today. Similarly, the 25 emerging countries and Africa are putting a lot of effort into their industrial sectors to support their growth goals (Zhu et al., 2008). It is reasonable to assume that the 25 emerging countries may have become more reliant on energy resources to maintain and improve their output. The 25 emerging countries' regions initiative's primary goal is to foster cooperation among the participating countries to address global warming concerns and economic advancement. The ecological concerns of developed countries have been the subject of numerous studies. However, research into these issues is still in its infancy from emerging countries' perspectives, particularly those affiliated with the 25 emerging countries' regions. In addition, the risk that the green economic recovery will be stifled by environmental degradation is difficult to overcome (Rao and Holt, 2005). As a 25 emerging countries region, it can have an impact on the economies of its member countries. It is possible to raise living standards and meet growth targets based on energy (Chiou et al., 2011; Ikram et al., 2021). There may be several reasons for the failure to achieve green economic recovery growth at this time, including a heavy reliance on NRE, ineffective environmental planning, and insufficient public funding for these fields.

A "green economic recovery growth index" is first established in this study using the popular direction distance approach (Seuring and Müller, 2008). Economic and environmental fluctuations were taken into account during the index-building process. This index fluctuated throughout the research. The two-step GMM method was used to estimate the effect of education and R&D expenditure on the growth of the green economy, the next step in the process. Results showed that the impact was statistically positive and that the composition and technical effects were present. In all cases, the composition effect was more prominent than the technical effect (Ikram et al., 2021). Further, this study examined how the influential channels of future public spending affect the growth of the green economy. The study's findings showed that increasing public spending on information technology (IT) could boost industries that depend on human capital.

Technology advancement can be accelerated by public investment in R&D. This finding contributes to the literature of knowledge about the role of public spending in the green recovery action; it provides conceptual understanding. Public spending impacts the market structure, but no definitive studies have proven it. Increased consumer spending can reduce market failure by providing empirical evidence in the presence of composition and technique effects. According to the findings of this study, an increase in government spending is associated with an increase in green economic recovery. It is essential to consider the interrelationship between Public Policy measures, energy conservation, economic development, and environmental protection through the green recovery movement. According to this study, government spending on public properties can help stimulate green economic Recovery (Govindan et al., 2014). This research concludes with a list of policy recommendations for 25 emerging countries and regions to implement to achieve sustainable economic growth. In addition, the study shows that the sample nations differ in terms of their abundance of resources. In order to take advantage of public funds for eco-economic recovery development, a variety of development plans should be implemented in different countries.

2.1 The Green Economic Recovery of the Selected Study Area

In the green recovery movement, terms such as resource-efficient, low-carbon, and socially inclusive describe it. Efforts to reduce greenhouse gas emissions, improve energy and resource efficiency, avoid biodiversity loss, or improve the environment are critical components of a green economic recovery." Green economic recovery has gained worldwide attention as a novel economic structure that reduces pollution, conserves resources, and boosts the economy (G. Zhang et al., 2021). Green Recovery has been defined briefly in previous research. International organizations like UNEP (2011) claim that green recovery is a strategic concept under which "green growth" is analyzed. Sustainable development and green recovery have been linked in Nieto et al. (2018)'s study using bibliometric analysis of dimensional characteristics of green recovery. This research was carried out in the second phase using a Generalized moment of method (GMM) approach. In 2020, North America will produce 5.3 billion tons of carbon dioxide emissions. In the first and second phases, green financing, non-fossil energy use, and carbon intensity are investigated. Ever since this research began, it has become clear that a green recovery can fully support economic growth by positively impacting three different aspects of the environment: the ecological environment, economic efficiency, and the economic model.

There is a lot of information about how the green economy is recovering and growing. Numerous studies show that green recovery can reduce carbon emissions and conserve green resources.

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According to other research, green growth has emerged to ensure economic growth while protecting the environment and creating jobs. Huo et al. (2019) used energy input and output measurements to study the expected direction of Canada's green recovery under various scenarios. China's cities' green business growth was also examined by Bagheri et al. (2018), as well. The extent of green economic recovery growth in Chinese cities was also examined by Ullah et al. (2021), who used various resources.

On the other hand, many previous studies concentrated on the role of determinists in promoting green growth. Examples of this are found, which examine the effects of population density and educational attainment on the green economic Recovery of Chinese cities. Green Recovery in Chinese-speaking emerging countries was boosted by the work of (Majumdar and Sinha, 2019) (Thiruchelvam et al., 2018). Using the quintile formula, he examined how the lack of best practices and performance influenced green development in these Chinese in the 25 emerging countries. According to another study (Khan et al., 2021), the abundance of natural and green resources influences the development of green growth in China. They conclude that cities with sufficient resources are Sarkis (2003). Sulfur dioxide and lead concentration emissions will be reduced by 4 and 7%, respectively, if public spending on public welfare rises by 10%, according to (Mensah et al., 2019), a panel data analysis of 38 countries.

A study by (Ghorbanpour et al., 2021) examined the economic benefits of clean energy investment in 25 emerging economies. To create jobs and improve social welfare, he said the United States needed to set policy directions for a renewable energy-based economy. It was found that government expenditure in developing nations can affect economic development by using panel data for 20 years. Public spending, according to them, is associated with higher economic growth. While this is going on, there is not enough research on how RD spending affects green economic recovery. According to Yang and Lin (2020), the state's investment in research and development influences green development. As a result of their study, Rehman Khan et al. (2021) examined the impact of financial instruments on 25 developing countries as they moved toward an eco-friendly economic recovery stage. According to him, this green economic recovery transition is being hindered by 25 emerging countries. According to them, financial instruments particular to the country's green economic recovery goal should be determined. According to the available literature, some studies have been done on government spending and environmental pollution. However, academics are still debating whether or not public spending can directly impact the 25 emerging countries' economic recovery and development. This study aims to fill the knowledge gap in this area by conducting empirical research.

2.2 Supply Chain and CO_2 Emission

Existing research (for example, (Cariou et al., 2019; Mensah et al., 2019; Cadavid-Giraldo et al., 2020)) has recommended that among the variables that impact carbon emissions by organizations of the supply chain, emission reduction technologies constitute the fundamental driver of long-term growth in the economy and reduction in carbon emissions. This is because emission reduction technologies can cut carbon emissions while increasing economic growth. Consequently, these aspects constitute an essential component of an effective method for curbing carbon emissions and reining in the rise in global temperature. As a result, many researchers have implemented emission reduction technologies to investigate low-carbon decision-making across the supply chain. Numerous researchers have investigated the impact that the low-carbon preference of consumers has on the supply chain in light of the findings that consumers have a good selection of green labels (C. Wang et al., 2021), and are willing to buy green products (Guild, 2020), and are willing to pay more for low-carbon products (Adeleke and Josue, 2019; Gupta and Sen, 2019; Taghizadeh-Hesary and Yoshino, 2019). For example, Wang and Zhi (2016) stated that the environmental consciousness of consumers motivates businesses to select a site closer to the area of consumption and use local suppliers. This is because consumers want companies to do their part to reduce their environmental impact. By developing a theoretical model for the low-carbon preference of customers, Ye et al. (2022) proposed an optimal production strategy for supply chain businesses. This was accomplished by (Ren et al., 2020). According to M. Wang et al. (2021), in the scenario of a desire for low carbon emissions, retailers' profits will grow when producers' earnings are positive. This research examined the influencing methodology of both aspects of carbon emission transfer and other emission reduction policy choices in the supply chain. This research examined the effecting mechanism of the carbon emission transfer in the supply chain that comprehensively considers the influence of both the time lag of emission reduction technologies and the low-carbon preference of consumers. Based on this model, the paper investigates the influencing mechanism of both factors.

3 METHODOLOGY AND VARIABLE SELECTION

The second phase of this investigation uses the two-step General Method of Moment (GMM) approach and development to explain the concept and respond to academic inquiries (Seuring and Müller, 2008). With this study, we're hoping to grasp better how green financing affects economic growth. This article examines the significance of Green Recovery (C. Zhang et al., 2021). Fintech's impact on the importance of green recovery and economic development has been overlooked. A better understanding of the development impact of green recovery and its indirect impact on the link between green recovery and economic growth is now possible to assess. This study aims to provide new insights into how green recovery works in reducing carbon intensity so that green governance in the 25 emerging countries can be better informed and propose new strategies for mitigating modification in green recovery throughout the world. As a final goal of this research, many policy recommendations for increasing economic growth through green recovery will be presented to regulators. GMM analysis examines the link between green recovery and economic development in the first phase of this research. This investigation defecates using a two-step generalized moments (GMM) approach in the second phase. In 2020, North America will produce 5.3 billion tons of carbon dioxide emissions. Green financing, non-fossil energy use, and carbon intensity are investigated in the first and second phases (Benzidia et al., 2021). Ever since this research began, it has become clear that a green recovery can fully support economic growth by positively impacting three different aspects of the environment: the ecological environment, economic efficiency, and economic structure.

Aside from its positive environmental and economic benefits, promoting a green recovery has a minor effect on the link between green recovery and economic efficiency. As a %age of 2019 levels, European emissions will fall by nearly 13% in 2020, while emissions in 25 emerging countries will fall by about 2.5%. However, resources and the environment are being overused due to this procedure.

3.1 Green Economic Recovery Indicator and Methods

The Radial Distance Function (RDF) can model environmental and energy issues. This model has received significant interest with the advantages of modeling both good and bad production. In terms of the relationship between green recovery and economic efficiency, it will have only a marginal effect. Increased non-fossil fuel dependency and decreased carbon intensity were observed during the second phase of the green recovery industry (Rehman Khan et al., 2018). When the amount of carbon dioxide released increases, it inhibits the growth of non-fossil energy consumption and investment in green projects. This has a negative impact on green financing. Limiting investment in environmentally friendly projects makes it more challenging to expand non-fossil energy consumption by increasing carbon intensity. The study's policy recommendations include, for example, more extensive use of financial technology. EPA estimates that by 2020, the 25 emerging countries will produce 16.75 billion tons of carbon dioxide, which is a significant amount. Green recovery and economic growth are examined using the GMM analysis in the first phase of this research. In this investigation's second phase, GMM is used to defecate. Both phases look at the connection between green financing, non-fossil energy use, and co2 emission. Ever since this research began, it has become clear that a green recovery can fully support economic growth by positively impacting three different aspects of the environment: the ecological environment, economic efficiency, and economic structure.

Aside from its positive environmental and economic benefits, promoting a green recovery has a minor effect on the link between green recovery and economic efficiency. First, this research examines the link between green recovery and economic growth using the General Method of Moment (GMM) analysis. Second, the green recovery industry enlarged dramatically. The development rate of green recovery increased, non-fossil fuel dependency increased, carbon intensity decreased, and green recovery created an environmental disclosure framework to track local government efforts to improve green recovery effectiveness. This investigation defecates in the second phase using a generalized two-step moments (GMM) approach. As of 2020, North America will be the second-most polluted region, producing 5.3 billion tons of CO_2 emissions. Green financing, non-fossil energy use, and carbon intensity are all investigated in the first and second stages of the project. Since the beginning of this study, it has been discovered that green recovery can completely support economic growth by positively affecting three areas of the ecological environment, economic efficiency and economic structure.

Financial technology and green recovery should be better integrated, and environmental disclosure framework should be established. According to this study, long-term and short-term policies should be designated as interventions (M. S. Mubarik et al., 2021). In the private sector, green financing should be encouraged. Increasing demand for non-fossil energy, establishing a trading market and implementing green recovery policies. The (RDF) Performance Index measures the gap between the Optical Performance and Decision-Making Unit's current performance. All performance indices are impacted when DMU is allowed to simultaneously increase mandatory production and reduce the production of (DMU). The Green Economic Recovery (GER) was first constructed using a radial direction distance function. Suppose each DMU uses m number of information to generate the expected required production number and F-number (CO_2) of $X \in R^{\wedge m}$ $Y \in R^{\wedge r}$ unwanted production. This research builds the subsequent production function by taking multiple information and multiple productions:

$$P(x)\{(x, y, z)\colon\ x\ can\ produce\ y\ and\ u \tag{1}$$

$$If\ \ (X, Y, U)\,\epsilon\, P(X)\ and\ U = 0\ then\ Y = 0 \tag{2}$$

Achieve both desirable and undesirable outcomes at the same time. The directional output distance function is proposed in this case. Then we can write, D=(y,d,u). Accurately assessing technical efficiency can be done by measuring radial efficiency.

(Nabeeh et al., 2021) proposed and used the radial in this study.

Directional distance is calculated as follows:

$$\vec{D}\left(x, y; d_y, d_u\right) = max\left\{\beta\colon \left(y + \beta d_y, u - \beta d_y\right) \in P(x)\right\} \tag{3}$$

Non-parametric and parametric DEA methods are the most commonly used methods for assessing the root mean square error (RDF). The DEA method can estimate pollutants at a lower price if the research focuses on measuring technical efficiency and the parametric method. The technical efficiency of the k DMU in each high-energy industry sub-industry is calculated using a DEA type model in this article:

$$\begin{aligned}
&\vec{D}\left(X_k, Y_k, b_k; d_y, d_u\right) = max\beta_k \\
&\qquad\qquad \text{S.T} \\
&\sum\nolimits_{j=1}^{i} x_{mj}\,\lambda_j \le x_{mk} \quad (\text{m} = 1, 2, 3, \ldots, \text{M}) \\
&\sum\nolimits_{j=1}^{j} y_{rj}\,\lambda_j \ge y_{rk} + \beta y_{rk} \quad (\text{r} = 1, 2, 3, \ldots, \text{R}) \\
&\sum\nolimits_{j=1}^{j} u_{fj}\,\lambda_j = u_{fk} - \beta u_{fk} \quad (\text{f} = 1, 2, 3, \ldots, \text{F}) \\
&\sum\nolimits_{j=1}^{j} \lambda_j = 1 \quad (\text{j} = 1, 2, 3, \ldots, \text{J}) \\
&\lambda_j \ge 0 \quad (\text{j} = 1, 2, 3, \ldots, \text{J}),\ 1 \ge \beta \ge 0
\end{aligned} \tag{4}$$

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For example, u (f,j) represents the mathematical input of the J DMU, R expected production, and F unexpected production, all of which are represented by x ((m),j)), y ((r,j)), and There is a wide range of intensity. It is unclear how much weight is given to the production potentials of D, M, U, and J. All four are input, expected output, and under-performance. In the first and second phases, green financing, non-fossil energy use, and carbon intensity are investigated. Ever since this research began, it has become clear that a green recovery can fully support economic growth by positively impacting three different aspects of the environment: the ecological environment, economic efficiency, and economic structure—the DMUK's potential for further growth. The maximum ratio of the development of ideal production of (DMU) to the contraction of bad production is represented by the objective function "maximum" _j (j) _k (k). The ideal product in this study is the total production value of GDP. The poor production is CO_2 emissions (Mount CO_2). Disposal be reflected by obstruction $\{\sum_{(j=1)}^{j} u_{(fj)}\lambda_j = u_{fk} - \beta u_{fk}\}$. Because it is impossible to reduce directly (CO_2) emissions using existing technologies for the development of green economic recovery, the assumption of weak disposal is appropriate. Energy, capital, and labor use are all indicators of a green economic recovery, and the output required is the input vector X. (GDP) is included in vector Y as an indicator, while (CO_2) emissions are included in vector U in order to represent the economic recovery of a country that is not wanted.

$$GER = 1 - \beta_k \tag{5}$$

If zero is equal, the (1- k) country is equal to green economic recovery, an effective country in terms of the country, and is located on an effective border. However, the inefficiency of the (DMU) K (1- k) can be reduced in a positive case. By reducing CO_2 emissions and increasing overall production by a factor, the (DMU) can achieve the best performance level in reality. The amount of CO_2 in the air as carbon intensity rises; restricts the growth of non-fossil energy utilization, investment in green projects, and the emergence of green financing. Suggestions made in this study include integrating financial technology better. US Environmental Protection Agency estimates that by 2020, the 25 emerging countries will produce 16.75 billion tons of CO_2. In the first phase of this research (Yang, 2021), GMM analysis examines the link between green recovery and economic growth.

$$\beta_k Y_k (1 - \beta_k) y_k u_k (1 - \beta_k) u_k$$

3.1.1 Variable Selection

During the Green economic recovery, social, economic, and environmental benefits are balanced. In any country's supply chain, the efficiency of the input factors must be taken into account. Suggestions made in this study include integrating financial technology better. US Environmental Protection Agency estimates that by 2020, the 25 emerging countries will produce 16.75 billion tons of CO_2. GMM analysis examines the link between green recovery and economic growth in the first phase of this research. This investigation defecates using a two-step modified moments (GMM) approach in the second phase. In the first and second phases, green financing, non-fossil energy use, and carbon intensity are investigated. Ever since this research began, it has become clear that a green recovery can fully support economic growth by positively impacting three different aspects of the environment: the ecological environment, economic efficiency, and economic structure. It will also have a minimal effect on the link between green recovery and economic efficiency if it promotes the impact of green recovery on the environment. In other words, it means that production and operation activities can produce the desired results and the ability to create even more (Gurtu et al., 2016). This means sacrificing output for the greater good when it comes to resources. A GER's inputs and outputs are described in detail in this study (model). Labour, capital and total energy consumption were the three inputs, and GDP and CO_2 emissions were the two outputs. Expected and unanticipated outputs are two types of output. Each country's economic situation is measured by its regional gross domestic product. From 2010 to 2019, the paper examines the annual data of 25 emerging countries. The World Bank collects relevant data on labor, capital, and GDP, while the International Energy Agency collects data on total energy consumption and CO_2 emissions.

3.2 Model Estimations

Various financial and economic patterns can be accurately predicted using the General Method of Moment (GMM) estimation techniques. This estimation technique is used (Hansen, 1982) when using MPEs. Data allocation must be thoroughly understood when performing MPEs but is not necessary when performing GMM estimates. In this case (Zhu et al., 2012), a specific moment from the original model is required for the procedure to work. MLE computation takes a long time if the data distribution is unknown, whereas the computation of (GMM) count is a piece of cake in the same situation. In the first and second phases, green financing, non-fossil energy use, and carbon intensity are investigated. Ever since this research began, it has become clear that a green recovery can fully support economic growth by positively impacting three different aspects of the environment: the ecological environment, economic efficiency, and economic structure. The link between green recovery and economic efficiency will be slightly weakened due to promoting the positive effects of green recovery on the environment and economy. Nearly 13% less carbon dioxide will be released into the atmosphere in Europe and 25 emerging countries in 2020 compared to 2019. Using data from the Global Carbon Atlas (Sheu and Chen, 2012) there has been an increase in the United States' carbon intensity of 585 million tons (14.5 trillion pounds), but since 2005, it has decreased by 12%. An environmental disclosure framework is being developed to track local government efforts to improve the efficiency of green recovery. The first phase of this research examines the link between green recovery and economic growth using the General Method of Moment (GMM) analysis. Such a model could be a log-normal stochastic fluctuation model. For example

$$GER_{it} = a + \beta GEPI_{i,t-1} + \gamma PS_{it} + \theta X_{it} + u_t + v_i + \varepsilon_{it} \tag{6}$$

In this case, the intercept is α, and the unknown coefficients are β, γ, and θ. 〖PS〗_ It denotes the per capita fiscal funding for

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TABLE 1 | Descriptive Statistics

	CO_2	GF	GER	IS	R&D	GDPC	TI
Mean	6.4525	3.8566	7.5666	5.4567	10.8965	8.4112	2.5687
Median	6.1326	3.5642	7.1447	5.1278	10.3745	8.2369	2.4296
Minimum	0.2356	0.0052	0.1222	2.8569	1.7445	2.7856	0.0096
Maximum	10.552	5.8963	11.556	9.4587	15.2356	10.5689	5.7456
St. Dev.	1.5689	2.5694	1.8885	1.3756	1.8856	2.8234	1.0053
Prob.	0.0023	0.0000	0.0004	0.0009	0.0045	0.0000	0.0096

education or R&D (PCRD: per capita research and development spending or PCEDU: per capita education spending). 〖GER〗 _(i,t-1) is the first lagging term of 〖GER〗 _it. We include it because we believe that the green performance index in the late period has a vibrant effect on the current green performance growth index. There are some control variables that X (it) refers to. In this case, u (t), v (i), and _(it) are all fixed-effect variables. However, the differencing method may lead to some issues. Differentiating the data removes any personal effects that may be present. It is also possible to convince a poor instrument using instrumental variables when the Time variable T is a significant issue. A one-step system GMM supposes that the first differences have a negative correlation, and the two phases System-GMM assume the same. The GMM estimator enables the activation of more instruments, resulting in increased efficiency (Govindan et al., 2015).

3.2.1 Variable Selection

We used CO_2 emissions as a dependent variable, while the primary independent variable used in the study are green finance, green economic recovery, and supply chain performance index. The principle component analysis is used to measure the supply chain performance index. We use three factors of the supply chain, including quality of trade and transport-related infrastructure, the frequency with which shipments reach consignee within schedule, and the efficiency of the customs clearance process. As the author believes that the secondary industry usually has a suppressive effect on the green recovery and is more polluting, this article uses the industrial structure ratio for the entire industry to represent industrial structures. As a result, all control variables are studied from 2010 to 2019 to have the same study period as GERs. The link between green recovery and economic efficiency can be slightly affected by logarithmic data. Increased non-fossil fuel dependency and decreased carbon intensity were all observed during the second phase of the green recovery industry. When the amount of carbon dioxide released increases, it inhibits the growth of non-fossil energy consumption and investment in green projects (Musa and Chinniah, 2016). This has a negative impact on green financing. Financial technology and green recovery should be better integrated, and environmental disclosure framework should be established. According to this study, long-term and short-term policies should be established as interventions. In the private sector, green financing should be encouraged. Increasing demand for non-fossil energy, establishing a trading market and implementing green recovery policies.

4 EMPIRICAL RESULTS AND DISCUSSION

4.1 Green Economic Recovery

For the 25 emerging countries to produce 16.75 billion tons of carbon dioxide estimated by the United States Environmental Protection Agency. Over 60% of the carbon dioxide emissions in the 25 emerging countries and 31% of global carbon dioxide emissions are attributed to China alone (EPA). GMM analysis examines the link between green recovery and economic growth in the first phase of this research. This research defecates using a two-step generalized moments (GMM) approach in the second phase. In 2020, North America will produce 5.3 billion tons of carbon dioxide emissions. This research takes a dump using a two-step generalized moments (GMM) approach in the second phase. In 2020, North America will produce 5.3 billion tons of carbon dioxide emissions. In the first and second phases, green financing, non-fossil energy use, and carbon intensity are investigated. Afterward, the Asian country's study was calculated using the equation (GER) as a guide (5). GR **Table 1** shows the final year from 2010 to 2018. Dak Luck, Jia Lai, Fu Yin, and Kwang BANA are the best-performing countries in the 25 emerging countries, as shown in **Table 1**, where the (GER) is valued at 1. It has also been observed that the (GER) has gradually decreased from 2010 to 2019 in areas of the 25 emerging countries, including Malaysia and Indonesia, Israel, and the Philippines, where green development has experienced an upward shift (Zaid et al., 2018) Year-to-year growth and decline is exceptionally unexpected and definite. Furthermore, this year's (GER) significance reached 0.78, with the highest annual tendency, making it the most significant year yet (Khan et al., 2021). In addition, the (GER) table of the 25 emerging countries examined in this study calculated the improvements made from 2010 to 2019.

As shown in **Table 2** below, each emerging country's environmental performance was measured from 2010 to 2019. Two-step generalized moments (GMM) are used in the second phase of this investigation to defecate. North America will produce 5.3 billion tons of CO_2 in 2020, making it the second most polluted region globally. Both phases look at the connection between green financing, non-fossil energy use, and carbon intensity. It has been discovered since the beginning of this study, which focused on the environment, economic efficiency, and the economic structure, that green recovery can fully support economic growth. Green Recovery's positive environmental and economic impacts will have a minor effect on the link between green recovery and economic efficiency (Yeh and Chuang, 2011). Nearly 13% less carbon dioxide will be released into the atmosphere in Europe and 25 emerging countries in 2020 compared to 2019. Overuse of resources and harm to the environment results from this procedure. Using information from the Global Carbon Atlas (GCA), since 1990, the CO_2 emission of the United States has increased by 2%, but since 2005, this number has decreased by 12%. The first phase of this research examines the link between green recovery and economic growth using the General Method of Moment (GMM) analysis. It then makes policy proposals such as better integrating financial technology and green recovery and creating an environmental disclosure framework to track local

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TABLE 2 | Green Economic recovery index.

Province	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Luxembourg	0.46	0.33	0.30	0.30	0.31	0.36	0.31	0.53	0.40	0.41
Singapore	0.27	0.51	0.31	0.20	0.20	0.27	0.14	0.40	0.23	0.22
Ireland	0.26	0.30	0.21	0.21	0.65	0.20	0.14	0.22	0.24	0.23
Qatar	0.27	0.31	0.29	0.23	0.18	0.20	0.26	0.35	0.26	0.26
Bermuda	1.00	1.00	1.00	0.98	0.96	0.97	1.00	1.00	0.98	0.98
Cayman Islands	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Switzerland	1.00	0.97	0.87	0.97	0.91	0.83	0.93	0.91	0.87	0.86
United Arab Emirates	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Brunei Darussalam	0.97	1.00	0.96	0.95	0.73	0.76	0.74	0.77	0.67	0.63
United States	0.87	0.66	0.62	0.66	0.72	0.60	0.58	0.64	0.56	0.54
San Marino	0.83	0.57	0.33	0.33	0.26	0.30	0.24	0.29	0.09	0.03
Norway	0.83	0.77	0.59	0.63	0.55	0.54	0.48	0.55	0.42	0.38
Denmark	0.78	0.74	0.69	0.69	0.69	0.76	0.67	0.59	0.62	0.61
Hong Kong SAR, China	0.90	0.86	0.69	0.62	0.53	0.64	0.60	0.74	0.56	0.52
Netherlands	0.82	0.64	0.51	0.57	0.44	0.44	0.36	0.56	0.35	0.31
China	0.90	0.68	0.90	0.96	0.90	1.12	0.81	1.05	1.04	1.07
Iceland	0.86	0.95	0.82	0.86	0.92	0.86	0.86	0.78	0.82	0.81
Austria	0.56	0.50	0.48	0.55	0.49	0.64	0.59	0.74	0.68	0.71
Sweden	0.72	0.83	0.61	0.72	0.43	0.56	0.55	0.69	0.53	0.50
Germany	0.72	0.75	0.56	0.57	0.61	0.64	0.61	0.59	0.56	0.54
Australia	0.72	0.88	0.86	0.87	0.83	0.90	0.59	0.90	0.81	0.81
Belgium	0.68	0.69	0.62	0.64	0.64	0.86	0.72	0.72	0.75	0.77
Kuwait	0.51	0.42	0.49	0.57	0.49	0.56	0.51	0.53	0.55	0.56
Finland	0.47	0.44	0.34	1.24	0.33	0.44	0.46	0.60	0.56	0.56
Canada	0.40	0.49	0.27	0.33	0.25	0.52	0.44	0.62	0.52	0.54

TABLE 3 | Results of System GMM estimation.

Dependent Variable CO_2 Emissions			
Variables	**(1)**	**(2)**	**(3)**
CO_2 Lag_1	0.8341***	0.8934***	0.998***
	(0.0389)	(0.07895)	(0.0569)
GF	−0.067***	—	—
	(−0.345)	—	—
GF Lag_1	—	−0.067***	—
	—	(−0.123)	—
GER	—	—	−0.0345***
	—	—	(−0.234)
IS	−0.053***	−0.0502***	−0.0813***
	(−0.207)	(−0.282)	(−0.362)
R&D	−0.0781***	−0.0321***	0.0327***
	(−0.176)	(−0.429)	(−0.609)
GDPpc	0.954***	0.887***	0.862***
	(0.032)	(0.073)	(0.098)
TI	−0.598***	−0.603***	0.735
	(−0.8095)	(−0.918)	(−0.902)
Intercept	−2.735***	−3.047***	−3.297***
	(−11.295)	(−9.387)	(−9.294)
AR (1)	0.010	0.010	0.001
AR (2)	0.190	0.256	0.254
Sargan test	0.761	0.793	0.832

Note p-Value in the Variable Analysis and Standard Errors in the Asian-Pacific Area $p=<0.1$*, and* $p \geq 1$.

government efforts to improve green recovery effectiveness (Kazancoglu et al., 2018). This investigation defecates using a two-step generalized moments (GMM) approach in the second phase. In 2020, North America will produce 5.3 billion tons of carbon dioxide emissions. In the first and second phases, green financing, non-fossil energy use, and carbon intensity are investigated.

4.2 Econometric Estimation

The integrity of the two-stage system GMM estimates is evaluated using the Sargan and auto-regressive tests. First, the null hypothesis that "all instrumental variables are exogenous" is accepted because the p value of the Sargan test in this article is greater than 0.05. This means that all of the tools that were chosen for this article are considered to be legitimate. In the second step of the process, an autocorrelation test, also known as an AR test, is carried out on the system GMM disturbance term. The p value for the AR (1) test is 0.0123, which is less than or equal to 0.05, whereas the p value for the AR (2) test is 0.2231, which is greater than or equal to 0.05. The original hypothesis of significant autocorrelation is not the random disturbance term of the accepted model, and the selected first-order lag period is considered to be valid. As a result, the dynamic panel model that was constructed for this paper should be considered reasonable on the whole.

In **Table 3**, the lagging first-order CO_2 emissions were found to be statistically significant at the 1% level. The previous year saw an increase in CO_2 emissions of 1%, and it is anticipated that the CO_2 emissions for the current year will increase by 0.8341%. This demonstrates that the most recent adjustment to CO_2 emissions and the adjustment to CO_2 emissions in the past were closely related to one another, and that the adjustment process for CO_2 emissions was a dynamic adjustment process. The findings show that the coefficient of green finance is negative, it can be deduced that the growth of green finance has a negative correlation with the CO_2 emissions. At the same time, it was successful in passing the test at the significance level of 1%. The improvement of the

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green finance development level will effectively reduce the CO_2 emissions, indicating that green finance has a clear and obvious negative effect on the adjustment of the CO_2 emissions. The CO_2 emissions will decrease by 0.1129% for every 1% that the current green finance development level increases.

The GMM estimate for financial expenditure on technology innovation is 0.598, which indicates that fiscal spending is essential, with a value of over 5%. Even though the estimated coefficient on educational expenditures is only 0.09%, it becomes statistically significant at a 1% level. According to the estimates, investing in education and R&D has a positive effect on the growth of the green economy. These positive outcomes demonstrate compositional and technical results in the hypothesized situation. Researchers (Rajeev et al., 2017; Majumdar and Sinha, 2018) found that toxic emissions can greatly decrease. Around 16.75 billion tons of carbon dioxide will be produced by 2020, according to the US Environmental Protection Agency (EPA). China accounts for more than 60% of the 25 emerging countries' carbon dioxide emissions and 31% of the world's carbon dioxide emissions.

North America will produce 5.3 billion tons of CO_2 in 2020, making it the second most polluted region globally. In the first and second stages, we look into the relationship between green financing, non-fossil energy use, and carbon intensity. Ecological sustainability, economic efficiency, and economic structure have all been found to benefit from green recovery since its inception in this study. In addition, it will have only a minor effect on the correlation between green recovery and economic efficiency because it encourages the positive impact of green recovery on the environment and the economy. Nearly one-third of Europe's 2020 emissions will be lower than in 2019, while emissions in 25 emerging countries will be about two-thirds lower than in 2019. In the end, the overuse of resources and environmental damage occurs as a result of this process. The Global Carbon Atlas says that (GCA, 2019). There has been an increase in the United States' carbon intensity of 585 million tons (14.5 trillion pounds), but since 2005, it has decreased by 12%. GMM analysis examines the link between green recovery and economic growth in the first phase of this research. This study recommends integrating financial technology with green recovery and creating an environmental disclosure framework to track local government efforts to improve green recovery effectiveness. The second phase of this investigation defecates using a two-step generalized moments (GMM) approach. The estimated results also show that education expenditures are nearly twice as effective as R&D expenditures as a co-efficient. According to (Zhao et al., 2021), the composition's effect significantly outweighs the techniques.

The results of the control variable also have a meaning full impact on CO_2 emissions. The findings shows that industrial structure is predicted to have a negative and statistically significant impact on environmental quality. According to M. Mubarik et al. (2021), the development of green economic recovery can be encouraged by implementing ecological regulations. Data shows that the scale effect of production is positive in terms of data and significant at a 5% or higher level. The earth carries all living things and human production. Economic activity will be impossible without land. National wealth increases, but it has a limited impact on economic growth and may adversely affect even if technology is continually invested. Moreover, the estimated result of the time interval of independent variables is probably negative and statistically significant at least 5% of the time. This new trend indicates that green economic recovery growth is shifting in a new direction. The growth in the green economy is expected to slow down slightly, but it is expected to rebound. The developing countries believe that increasing GDP growth is more important than environmental protection in the game of political control. A significant GDP growth statistic is most sought after (Lotfi et al., 2021). Environmental regulations and laws are being loosened due to this enormous process, which leads to further environmental degradation (Jabbour and De Sousa Jabbour, 2016). The link between green recovery and economic efficiency will have a negligible effect (Ali et al., 2020). There was a significant increase in non-fossil fuels and a decrease in carbon intensity during the second phase of green recovery. Toxic emissions are significant obstacles to the rapid growth of non-fossil energy consumption and, as a result, to the development of green financing. Financial technology and green recovery should be better integrated, and environmental disclosure framework should be established. According to this research, long-term and short-term policies should be established as interventions. In the private sector, green financing should be encouraged. Green recovery policies are being implemented, non-fossil energy demand rises, and a trading market is being established.

TABLE 4 | Results of the impact of supply chain performance on CO_2 emissions.

Dependent Variable CO_2 Emissions			
Variables	**(1)**	**(2)**	**(3)**
CO_2 Lag_1	0.941***	0.961***	0.839***
	(0.039)	(0.085)	(0.031)
SCI	−0.023***	—	—
	(−0.103)	—	—
GF*SCI	—	−0.167***	—
	—	(−0.123)	—
GER*SCI	—	—	−0.201***
	—	—	(−0.234)
IS	−0.045***	−0.043***	−0.069***
	(−0.176)	(−0.240)	(−0.308)
R&D	−0.066***	−0.027***	−0.028***
	(−0.150)	(−0.365)	(−0.518)
GDPpc	0.811***	0.754***	0.733***
	(0.027)	(0.062)	(0.083)
TI	−0.508**	−0.513**	−0.625**
	(−0.688)	(−0.780)	(−0.767)
Constant	2.325***	2.590***	2.802***
	(9.601)	(7.979)	(7.900)
Adjustment R2	0.698	0.841	0.838
AR-1	0.556	0.736	0.785
AR-2	0.817	0.792	0.819

4.3 Supply Chain Performance

The study's findings on the influence of the performance of the supply chain on CO_2 emissions are presented in **Table 4**. At a confidence level of 1%, there is a significant inverse correlation between the quality of the logistics services and the amount of CO_2 emissions. A one % improvement in supply chain performance will result in a 0.023% decline in the quality of logistics services. On the other hand, shipments priced more competitively will result in a significant reduction in energy consumption, which will help build green economic growth and reduce the harmful effect of carbon emissions on the environment. According to (Rehman Khan et al., 2018) logistics activities are highly reliant on energy consumption, and a more significant number of logistics operations required a higher level of energy consumption. The findings provided further evidence that activities related to logistics have a positive correlation with the expansion of a country's economy. On the other hand, polluted logistics operations create a disaster for both the long-term viability of the environment and people's lives. The researcher suggested alternative energy sources to promote environmentally friendly practices in the logistics industry to lower CO_2 emissions, greenhouse gas emissions, and global warming (Khan and Qianli, 2017).

5 CONCLUSION AND POLICY IMPLICATIONS

According to the research, green recovery can be achieved and prioritized. Government spending on green economic recovery has focused on previous research works. Analysis of quantitative data from the study shows that the green economic recovery index, influenced by political factors and based on literature review, has fluctuated from year to year, increasing and decreasing. According to GMM estimates, both composition and technology have an impact. In terms of the link between green recovery and economic efficiency, it will have a negligible effect. There was a significant increase in non-fossil fuels and a decrease in carbon intensity during the second phase of green recovery. In order to expand non-fossil energy consumption, investment in green projects, and the development of green financing, increasing carbon intensity interferes.

In the first and second stages, we look into the relationship between green financing, non-fossil energy use, and carbon intensity. Ecological sustainability, economic efficiency, and economic structure have all been found to benefit from green recovery since its inception in this study. In addition, it will have only a minor effect on the link between green recovery and economic efficiency because it promotes the positive impact of green recovery on the environment and the economy. Nearly one-third of Europe's 2020 emissions will be lower than in 2019, while emissions in 25 emerging countries will be about two-thirds lower than in 2019. In the end, the overuse of resources and environmental damage occurs as a result of this process.

5.1 Policy Recommendation

1. Financial technology and green recovery should be better integrated into the environmental disclosure framework, and long-term and short-term priority policies should be established. The private sector should encourage the use of green finance.
2. Initiation of a non-fossil energy trading market and implementation of green recovery policies. GDP aids green recovery's growth. This effect is localized and has only a slight bearing on how closely GDP is linked to green recovery in technological innovation and human resources recruitment.
3. In the second phase, the green recovery industry exploded, green recovery development rates rose, non-fossil fuel dependency grew, and carbon intensity decreased. "In terms of the link between green recovery and economic efficiency, it will have a negligible effect. There was a significant increase in non-fossil fuels and a decrease in carbon intensity during the second phase of green recovery.
4. Carbon intensity Increasing carbon intensity hinders the growth of non-fossil energy consumption, investment in green projects, and, consequently, green financing. Financial technology and green recovery should be better integrated, and environmental disclosure framework should be established. According to this study, long-term and short-term policies should be set as interventions.
5. The private sector should promote green financing. Green recovery policies are being implemented, non-fossil energy demand rises, and a trading market is being established. In addition, it will have only a minor effect on the link between green recovery and economic efficiency because it promotes the positive impact of green recovery on the environment and the economy. Europe's emissions will fall by nearly 13% in 2020 compared to 2019 levels, while Asia-emissions Pacific will fall by about 5%. In the end, the overuse of resources and environmental damage occurs as a result of this process.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary materials, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of Interest: Author LZ was employed by the company Hefei Gepujin Intelligent Technology Co., Ltd.

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