

**EXPLORING THE ROLE OF GREEN FINANCE IN CLIMATE
VARIABILITY MITIGATION: EMPHASIZING RENEWABLE
ENERGY INVESTMENTS AND TRADE OPENNESS**



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(SPRING 2024)*

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DEDICATION

To my dear family, whose steadfast encouragement and support have been the foundation of my path, deserves recognition in this thesis. To my parents, who have always supported me and given me the groundwork for my achievement, I am grateful.

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I sincerely appreciate Almighty Allah for His constant love and strength throughout my entire life. I now have the means to conquer whatever challenge I face in life because of him. I would like to thank my supervisor for her unwavering efforts in bringing my dissertation to completion. My supervisor's professional guidance, overwhelming attitude and irresistible support has made this dissertation a possibility within limited span of time allowed. I would like to thank my family, as I am very grateful for their love and support through every thick and thin phase of my life. The success and accomplishments I have with my master's degree are mostly due to my family. For being my inspiration and source of unwavering support throughout my life, my parents deserve my sincere appreciation. Throughout my master's program, my friends have been a huge assistance, and I would want to thank them for their support.

ABSTRACT

The increasing emphasis on green finance as a critical tool to mitigate climate change highlights the need to understand its impact on carbon emissions, especially within emerging markets. This study aims to develop a comprehensive model that explores the relationship between green finance investments and carbon emissions, with a particular focus on the moderating roles of renewable energy investments and trade openness. To achieve this objective, a conceptual framework was proposed, suggesting that green finance investments are the primary driver of reduced carbon emissions, moderated by the levels of renewable energy investments and trade openness in the emerging market context.

Data for this study was collected from 19 emerging market countries identified by the International Monetary Fund (IMF) over an eleven-year period (2012-2022). Using secondary data sources such as the World Development Indicator (WDI) and the International Renewable Energy Agency (IRENA).

The results indicate that green finance investments significantly reduce carbon emissions, particularly when trade openness is considered as a moderating factor. However, the moderating effect of renewable energy investments on the relationship between green finance and carbon emissions was found to be insignificant. The study confirms the proposed model, showing that green finance investments are crucial in reducing carbon emissions, but their effectiveness can be significantly influenced by trade policies.

Given the pivotal role of green finance in addressing climate change, this study underscores the need for policymakers in emerging markets to not only promote green finance and renewable energy investments but also to craft trade policies that enhance the efficacy of these investments. This study provides both theoretical contributions and practical insights into the interplay between green finance, renewable energy, trade openness, and carbon emissions, offering a comprehensive understanding necessary for sustainable development in emerging markets.

Key Words: Green Finance Investment, Carbon Emissions, Trade Openness, Renewable Energy Investment, Foreign Direct Investment and Gross Domestic Products.

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INTRODUCTION

1.1 BACKGROUND

Climate change in the twenty-first century presents unprecedented and unseen threat to world stability that is beyond geographical and political borders. Increasingly obvious are the inverse effects of climate change, as seen by changing weather patterns, rising sea levels, and loss of species. To focus on these concerns, it is essential to study practical mitigating measures, of which green financing is becoming increasingly important. Redirecting financial flows towards sustainable development goals, especially in the areas of Trade Openness and Renewable Energy Investments, needs Green Finance. Green Finance should be given top priority if we are to efficiently allocate financial resources in favor of environmental sustainability and increased global economic resilience. Through the promotion of investments in sustainable initiatives, this strategy promotes economic growth in addition to helping to battle climate change. Green Finance is therefore a major force behind the international endeavor to lessen the effects of climate change and attain long-term stability and prosperity.

The connection between economic activity and environmental sustainability makes it vital to explore more narrowly how green financing may impact climate variability. This thesis implies that if green funding (GF) is provided, a rise in Renewable Energy Consumption (REC) can significantly decrease Carbon emissions, therefore adjusting the direction of climate change. Furthermore, it put forward that Trade Openness (TO) has two functions: on the one hand, it helps increase green technologies, on the other, it may raise emissions because of intensified economic activity.

Despite the developing attention to Green Finance, there is still a research Gap in quantifying its involvement to the reduction of climate variability. The present research repeatedly lacks a thorough model that combines many attributes of Green Finance, Trade Openness, and

Renewable Energy Investment use in the structure of a larger range of economic and natural resource factors. Likewise, Green Finance supports economic growth and the remarkable reduction of Carbon emissions in addition to reducing energy use (Zhu et al., 2021; Yi et al., 2023).

This thesis will look on how to close this gap by empirically examining the connection between green finance and Carbon emissions, augmented with control variables such as Gross Domestic and Foreign Direct Investment (FDI), may offer a more accurate comprehension of the economic surrounding environment. Green finance policies have the potential to foster the utilization of Renewable Energy sources by proposing financial incentives, either directly or indirectly. These inducements encourage investment in sustainable energy solutions (Bhattacharyya R , 2022) and help decrease the total cost accompanying with the generation of clean energy, making it more reasonable and available (spash CL, 2020). Reflecting the raising number of climate related issues that are happening on a worldwide scale, the chase of environmentally accountable financial practices is more principal than it has ever been. According to Du, G. (2023). Through the process of directing investments into ecologically sustainable projects, Green Finance plays a substantial part in the reduction of carbon intensity. Relating to the relationship between Green Finance, the implementation of Renewable Energy Investment, and carbon intensity, there is a major blankness in the existing literature, particularly in the context of top emerging market group. This is even though it is an important topic. Many research remains unknown as a result of the absence of comprehensive analysis. This is because acquiring knowledge of this relationship could give detailed understandings into the ways in which financial mechanisms can accelerate the move to low carbon energy systems in countries of emerging market group. Concentrating this gap is important for developing aimed policies that influence Green Finance to succeed in both economic growth and environmental sustainability in these quickly developing market group.

Renewable Energy Investment works as a crucial solution in the global attempt to reduce climate change, primarily due to its capacity to considerably reduce Carbon emissions. By transforming energy from natural sources such as sunlight, wind, and water, Renewable Energy technologies provide a cleaner and more sustainable substitute to fossil fuels, which are major sponsors to greenhouse gas emissions (Shahnazi and Shabani 2021). Energy consumption is a necessary

component of the production process and plays a vital role in steering economic development. It completely influences the efficiency and productivity of various industries, helping as an essential input in the creation of goods and services. Without adequate energy supplies, the capacity for economic activities would be severely limited, hindering growth and development (Pata 2018). Despite this, several studies have indicated that the utilization of renewable resources may not be sufficient or effective enough to realize their potential for lowering pollution. As a result of variables such as inefficient technology deployment, poor maintenance practices, and inappropriate integration into existing energy systems, these studies imply that the predicted environmental benefits of renewable energy can be threatened by several problems. (Pata and Caglar 2021). According to (Balsalobre-Lorente et al. 2021) the relationship between carbon emissions and renewable energy sources has been the subject of a great number of research. Based on the findings of these investigations, it has been established that renewable energy sources are advantageous to the environment. On the other hand, there is evidence that suggests that renewable resources might not be able to effectively reduce pollution. This could be attributed to inefficient or inadequate use of these resources (Pata and Caglar 2021). A key difficulty to investing in renewable energy is the risk associated with regulations (C. P., Micale, V., Frisari, G., Hervé-Mignucci, M., & Mazza, F. 2013).

The complicated nexus of Green Finance, which is an area where economic growth aligns with environmental stewardship, is studied for the purpose of this thesis. Additionally, the study stresses the importance of green investments, not just as a tool for environmental conservation but also as an initiator of economic flexibility and innovation. This is in appreciation of the important role that renewable energy plays. It recognizes both the promise and the constraints that openness to trade presents in terms of crafting a future that is sustainable. Through the integration of three dynamic components, namely Green Finance, Renewable Energy, and Trade Openness, the thesis intends to give a comprehensive perspective on sustainable development in the contemporary day and age. By means of this research, it is expected to contribute to a more accurate understanding that can help in global efforts towards both economic growth and environmental sustainability.

1.2 PROBLEM STATEMENT

Over the past decades, governments and environmental policymakers have increasingly emphasized the importance of green finance as a tool to combat climate change. However, the precise impact of green finance on carbon emissions remains insufficiently understood, especially when considering the moderating effects of renewable energy investments and trade openness. This lack of understanding poses a significant problem: without clear insights into these interactions, efforts to mitigate climate change may be less effective, leading to suboptimal allocation of financial resources and inadequate environmental policies.

Addressing this problem would allow Green Finance to be strategically utilized to its full potential, significantly reducing carbon emissions and accelerating the transition to a low-carbon economy. This would enable more efficient investments in renewable energy and better integration of trade policies to support environmental sustainability, ultimately leading to more effective climate change mitigation strategies.

The solution lies in conducting a comprehensive empirical examination of the impact of Green Finance investments on Carbon emissions, with a focus on the moderating roles of renewable energy investments and trade openness. By utilizing data from top emerging market groups identified by the International Monetary Fund (IMF), this study aims to provide a nuanced understanding of these interactions. The findings will inform policymakers and investors, enabling them to design more effective strategies for sustainable development and climate change mitigation in emerging markets.

1.3 RESEARCH GAP

While existing studies have explored the impact of Green Finance on Carbon emissions, there is a significant gap in understanding how this relationship is moderated by Renewable Energy Investments and Trade Openness. Current research, such as the study by Gang Du (2023), highlights the direct impact of Green Finance on reducing carbon intensity. However, it often overlooks how Renewable Energy Investments and Trade Openness can enhance or inhibit this effect.

Specifically, Trade Openness can facilitate the transfer of green technologies and practices across borders, potentially amplifying the positive impact of green finance on carbon emissions. Similarly, Renewable Energy Investments can play a crucial role in enhancing the effectiveness of Green Finance by providing sustainable alternatives to fossil fuels.

Therefore, there is a critical need to investigate the impact of Green Finance on Carbon emissions, considering the moderating roles of Renewable Energy Investments and Trade Openness. This comprehensive approach will provide more nuanced insights and inform the development of more effective policies for achieving sustainable development goals in emerging markets.

Contextual gap arises because existing studies have not sufficiently examined the combined and interactive effects of green finance, renewable energy investments, and trade openness in the specific context of emerging market groups. While there is substantial research on the direct impact of green finance on carbon emissions, the contextual interplay with renewable energy and trade openness remains underexplored.

Knowledge gap exists due to the lack of comprehensive understanding of how Renewable Energy Investments and Trade Openness moderate the relationship between Green Finance and Carbon emissions. The existing literature highlights the direct impacts but does not provide a detailed exploration of these moderating factors, which is crucial for developing more effective policies.

By addressing these gaps, the research aims to provide more nuanced insights into the impact of Green Finance on Carbon emissions within the context of emerging markets, considering the critical roles of renewable energy investments and trade openness.

1.4 RESEARCH QUESTIONS

1. What is the impact of Green Finance Investment on Carbon Emissions?
2. What is the moderating impact of Renewable Energy Investments on the relationship between the Green Finance Investment and Carbon Emissions?

3. What is the moderating impact of Trade Openness on the relationship between Green Finance Investment and Carbon Emissions?

1.5 RESEARCH OBJECTIVES

This study aims to address the following:

1. To analyze the impact of Green Finance Investment on Carbon Emissions
2. To explore the moderating impact of Renewable Energy Investments on the relationship between Green Finance Investment and Carbon Emissions
3. To investigate the moderating impact of Trade Openness on the relationship between Green Finance Investment and Carbon Emissions

1.6 SIGNIFICANCE OF RESEARCH

This research holds significant value across various sectors for several key reasons. First, by demonstrating the success of green financing projects, it may help to guide policy creation. These discoveries might help legislators create more efficient rules and regulations meant to lower Carbon emissions and combat climate change. Second, the report directs investors towards initiatives that guarantee sustainable growth in addition to reducing emissions by outlining the connection between green financing and renewable energy. This study also offers useful information for companies and countries trying to strike a balance between economic growth and environmental responsibility by looking at the function of Trade Openness. Regarding public awareness, the study emphasizes how financial choices affect the environment, which may increase corporate and consumer support of green finance. Lastly, this study closes a significant gap in the literature from an academic standpoint by providing a thorough investigation of the relationship between Green Finance, Trade Openness, and Renewable Energy consumption in the context of climate change. This thorough study builds a basis for further academic research in this important area and enhances the amount of information already in existence.

1.7 SCHEME OF THE STUDY

Introduction: This chapter will give an overview of the thesis and the discussion of the topic. Furthermore, it will highlight the research questions and objectives of this thesis. It will identify the research gap and demonstrate the research problems and finally will discuss the significance of the study.

Literature Review: This chapter is going to discuss existing literature and what did they say about the different variables this chapter is about. It will also discuss the different hypotheses that we will later do the analysis about them.

Methodology: In this chapter we will have a detailed discussion about the data methodology and source of the data. Whether we are taking primary data or secondary data, as well as the data collection. It will also tell the econometric models and analytical approach.

Data Analysis: presentation of the econometric analysis findings. Thorough data analysis, hypothesis testing, and a discussion of the results in light of the theoretical framework and body of current literature will all be included in this section.

Conclusions and Recommendations: this chapter will summarize the key findings of the thesis, as well will present conclusions on the findings. This chapter will also have the recommendations and limitations of the whole thesis and suggest for future research.

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter investigates how Green Finance lessens the effects of climate change, with an emphasis on investments in Renewable Energy and international trade patterns. Funding environmentally friendly projects is known as green finance. Its rising appeal reflects a wider understanding of the need to match financial activities with environmental objectives, particularly in the fight against climate change and in favor of renewable energy sources. Renewable Energy, such as wind and solar power, represents a significant shift in our approach to energy. Moving away from traditional, environmentally harmful methods, we are increasingly embracing these cleaner energy sources. This chapter discusses the vital role of Green Finance in facilitating investments in renewable energy and the past studies what they said about this. These investments play a vital role in decreasing the emission of gases that lead to climate change.

Trade Openness, or the extent to which countries freely trade with one another, also becomes quite important in this situation. Open trade can help more environmentally friendly energy technology to be exchanged and adopted. This chapter will look at how trade growth might improve green finance's efficacy either positively or negatively and help renewable energy projects be expanded and implemented.

Using new research to comprehend their interdependence and their combined effect on environmental sustainability, it will thoroughly examine the interaction between green finance, renewable energy investments, and international commerce. This investigation will also show possible policy paths and approaches for promoting a more robust and sustainable global energy environment.

2.2 THE IMPACT OF GREEN FINANCE INVESTMENTS ON CARBON EMISSION

Green finance investments, which put emphasis on supporting environmentally friendly projects and initiatives, have gained significant attention in recent years (Lebelle et al., 2020). Research on the impact of green finance investments on carbon emissions is still emerging, but it has been increasing in recent years (Li et al., 2024). The vital part Green Finance Investment plays in achieving the goals set out in the Paris Climate Agreement is explored in one study. This historic agreement seeks to cut human-induced carbon emissions to levels that, by the second half of the 21st century, can be naturally absorbed by forests and seas, therefore achieving net-zero greenhouse gas emissions. The report emphasizes how important Green Finance Investment is in directing funds to environmentally friendly projects and programs that advance this audacious objective. Green Finance Investment refers to economic activities, like project financing, investments, operations, and risk management linked to energy conservation, clean energy, environmental protection, and green transportation, that support environmental development and respond to climate change. Green bonds and other green finance investments are now widely used to support sustainable development and slow down climate change. More precisely, green bonds are debt instruments that are created expressly to finance ecologically beneficial initiatives (Segal et al., 2023). Some examples of these projects are investments in renewable and alternative energy sources, the construction of infrastructure, the distribution of energy from renewable sources, and the storage of energy extracted from renewable sources (Lebelle et al., 2020). Through the examination of pertinent sources, the purpose of this literature study is to conclude regarding the impact that green finance investments have on carbon emissions (Li et al., 2024). Investing in Green Finance, particularly those that are generated through the issuance of green bonds, has been found to have a positive impact on the amount of carbon emissions, as indicated by the conclusions of study which was conducted. The response of the market to green bond issuances and the effect that these bonds have on the financial performance of issuers are both subjects of research that are investigated in one piece of research (Lebelle et al., 2020). The study concluded that market players respect green bonds and that they may improve issuers' financial results. Furthermore, research highlights the fact that a broad range of initiatives aiming at mitigating the effects of climate change, including energy efficiency, pollution prevention,

sustainable agriculture, fisheries and forestry, clean transport, clean water, and sustainable water management, are funded by green bonds (Li et al., 2024). These initiatives help to promote a shift to renewable energy sources and to lower carbon emissions simultaneously. All things considered, the corpus of study shows that investments in Green Finance, especially those made via the issuance of green bonds are crucial to the achievement of environmental goals and the decrease of carbon emissions. Considering the said literature, this study sets forward the following hypotheses:

H₁: GFI has significant and negative impact on Carbon emission.

2.3 THE IMPACT OF RENEWABLE ENERGY ON CARBON EMISSION

Renewable energy has developed as a bright solution to alleviate carbon emissions and halt the challenges presented by climate change.

Many research have demonstrated the critical need of switching from fossil fuel-based energy sources to renewable energy sources as a basic strategy for lowering carbon emissions and tackling the problems brought on by climate change. The enormous promise of renewable energy to lower carbon dioxide emissions—a major factor in the phenomena of global warming—has been frequently emphasized during these studies. It is possible to drastically lower the quantity of greenhouse gases released into the atmosphere by switching to more ecologically friendly energy sources including solar, wind, hydro, and geothermal power. By reducing dependence on fossil fuels, which are both limited and emitting pollutants, this shift not only helps to lessen the detrimental effects of climate change but also advances sustainable development. The results of these studies taken together emphasize the necessity of adopting renewable energy technologies to achieve long-term environmental sustainability and guarantee a healthier earth for coming generations. Our ability to use renewable energy sources to combat climate change and pursue a more stable and sustainable future has immense promise.

The mounting danger of climate change, guided by greenhouse gas emissions like carbon dioxide (CO₂), obliges a global paradigm alter towards cleaner energy sources. Renewable Energy has emerged as a leader in this fight, offering a sustainable and environmentally friendly alternative

to traditional fossil fuels. An extensive amount of research emphasizes the vital role that renewable energy plays in lowering carbon dioxide emissions and thereby mitigating the effects of climate change. Studies on fellow countries of the Organization for Economic Co-operation and Development (OECD) by Balsalobre-Lorente et al (2023) and Sarkodie & Owusu (2022) exhibit a positive correlation between increased implementation of renewable energy technologies and reduced Carbon emissions. Similarly, the International Renewable Energy Agency (IRENA) (2023) report emphasizes how much wind, solar, and geothermal resources can be used to significantly lower Carbon emissions on a geological, technological, and economic basis. By 2050, they project, switching to an energy system based on renewables may cut Carbon emissions worldwide by up to 70% over baseline projections. However, the benefits of renewable energy extend far beyond Carbon emissions reduction. Reducing dependency on few fossil fuel sources through the switch to renewable energy encourages energy independence and lessens the geopolitical and economic instability linked to conventional fuel markets (Sovacool, 2020). Furthermore, air pollution from renewable energy sources is little to nonexistent, which results in better public health (Mendelsohn et al., 2008). The World Health Organization (WHO) projects that air pollution from fossil fuels causes millions of early deaths per year as of 2023. This load can be much lessened by using renewable energy. In addition, the fast-expanding renewable energy industry generates new employment in production, installation, and maintenance (IRENA, 2022). This encourages, inside a sustainable framework, economic diversification, job growth, and technological breakthroughs.

Nations can greatly lower Carbon emissions, enhance air quality, encourage energy independence, provide new employment possibilities, and contribute to a healthier world by moving towards a future powered by renewable energy. Making the most of renewable energy and guaranteeing a cleaner, healthier world for future generations need to address current issues through targeted research, investment, and legislative measures. Founded on the above literature, this study presents the following hypotheses:

H₂: REI has significant and negative impact on Carbon emission.

2.4 IMPACT OF RENEWABLE ENERGY INVESTMENTS ON GREEN FINANCE INVESTMENTS

The relationship between green finance and investments in renewable energy is a powerful two-way street that is helping to promote a sustainable future. The increasing amount of money being invested in wind, solar, and geothermal projects (IRENA, 2023), t A surge in demand for environmentally friendly financial instruments such as green bonds and clean energy venture capital is being observed (Chen et al., 2023). This results in the creation of a market for green finance that is both larger and more appealing, which in turn attracts new investors and encourages innovation within the sector. The idea that green investments are less hazardous is further strengthened by the fact that renewable energy projects that have been successful can have good effects on both the environment and the economy. In this way, financial institutions are encouraged to devote a greater portion of their resources to environmentally friendly financial products, which further contributes to the expansion of Green Finance (World Bank, 2024). A demonstration effect is also performed by high-profile renewable energy projects, which demonstrate the viability and potential of investments in clean energy. This is beneficial to investors because it increases their confidence in the sector, which in turn attracts additional capital from both traditional investors and impact-oriented investors (Flammer et al., 2021).

Green financing, on the other hand, is an extremely important factor in the process of supporting investments in renewable energy industries. Green financial instruments have the potential to assist in mitigating the perceived risks that are associated with renewable energy projects. These risks include the upfront expenditures and the unpredictability of the technology. It is possible to make renewable energy projects more appealing to investors using loan guarantees, risk-sharing systems, and green bonds, which would ultimately result in an increase in investment flows (IEA, 2023). This helps close the funding gap, particularly for poor countries who are having difficulty gaining access to traditional forms of financing (UNEP, 2024). Furthermore, green finance instruments can be structured to provide long-term financing choices, which is essential for renewable energy projects that have longer payback periods. This provides developers with the ability to design and carry out large-scale renewable energy projects with a greater degree of financial certainty (Agbola-Ibawa & Afolabi, 2021).

A positive feedback loop is the one produced by the reciprocal interaction between investments in green finance and renewable energy. Green funding is expanding mostly due to more investments in renewable energy, which facilitates further investments in clean energy projects. By fostering a sustainable financial ecosystem, this virtuous cycle expedites the shift to a future with reduced carbon emissions.

Problems still exist, though. To guarantee the legitimacy and effect of green investments and draw in more mainstream investors while lowering the possibility of greenwashing, green finance procedures must become more uniform and transparent (UNEP, 2024). Growing the renewable energy and green finance industries requires supportive regulatory frameworks that remove obstacles and encourage green investments(IEA, 2023). Finally, to fully realize their potential for quickening the shift to renewable energy, developing nations must strengthen their ability to create and oversee green financial instruments(World Bank, 2024).

By means of focused investments, legislative actions, and capacity development, we can use the potential of this green finance-renewable energy nexus to realize a future that is cleaner and more sustainable. Considering the literature discussed, the following hypothesis is as follows:

H₃: REI has significant moderating impact on relationship of GFI and Carbon emission.

2.5 IMPACT OF TRADE OPENNESS ON CARBON EMISSION

Both positive and negative associations have been found in the complicated relationship between trade openness and carbon dioxide emissions. On the one side, more trade openness frequently results in larger production levels to meet world demand (DergiPark, 2023). Particularly in nations dependent on fossil fuels, this can lead to a proportionate increase in energy use and Carbon emissions. The kinds of products being produced and consumed can also be influenced by trade patterns. If a nation specializes in producing products that are highly polluting, then more free trade might make Carbon emissions worse (MDPI, 2022).

The story isn't totally depressing, either. Reduced Carbon emissions per unit of output may result from Trade Openness facilitating the transfer of cleaner technologies and production techniques from industrialized to developing nations. (SciELO, 2021). Moreover, a transition to a service or

knowledge-based economy often linked to reduced Carbon emissions can be sparked by economic expansion brought on by Trade Openness (SpringerLink, 2023).

The final effect probably depends on several surrounding circumstances. The scale effect could cause developing countries to see a greater initial spike in emissions, while developed countries may gain more from technology transfer. The types of goods being traded also play a crucial role – trade in clean energy technologies or energy-efficient products can have a positive impact. At last, robust laws and policies supporting renewable energy can lessen the detrimental effects of Trade Openness on Carbon emissions (IEA, 2023).

Finally, there are other facets to the connection between trade openness and CO₂ emissions. Increased production and consumption can cause an upward trend, but more complex interactions or a downward trend can also result from elements like technological transfer, economic growth, and trade composition. Countries may use Trade Openness for economic growth while reducing its environmental impact and moving towards a low-carbon future by grasping these subtleties and putting into practice efficient environmental measures. Considering above literature, the following hypothesis is as follows:

H₄: TO has significant impact on Carbon emission.

2.6 IMPACT OF TRADE OPENNESS ON GREEN FINANCE INVESTMENTS

Academic research has shown both possible advantages and disadvantages of the complicated and developing relationship between Trade Openness and Green Finance Investments.

Certain research, on the one hand, alerts us to difficulties related to trade openness. A "pollution haven hypothesis" (Cole & Elliott, 2003) suggests that more trade opening can encourage polluting firms to move to nations with less stringent environmental laws. Growth in Green financing may be hampered by this when less expensive, more environmentally damaging industrial techniques gain favor (MDPI, 2022). Additionally, the "scale effect" (World Bank, 2024) holds that output levels frequently increase to satisfy global demand as nations become more integrated into the world economy. Increased pollution and energy use could follow from

this, which could lessen the urgent need for green financial instruments and technologies. (DergiPark, 2023).

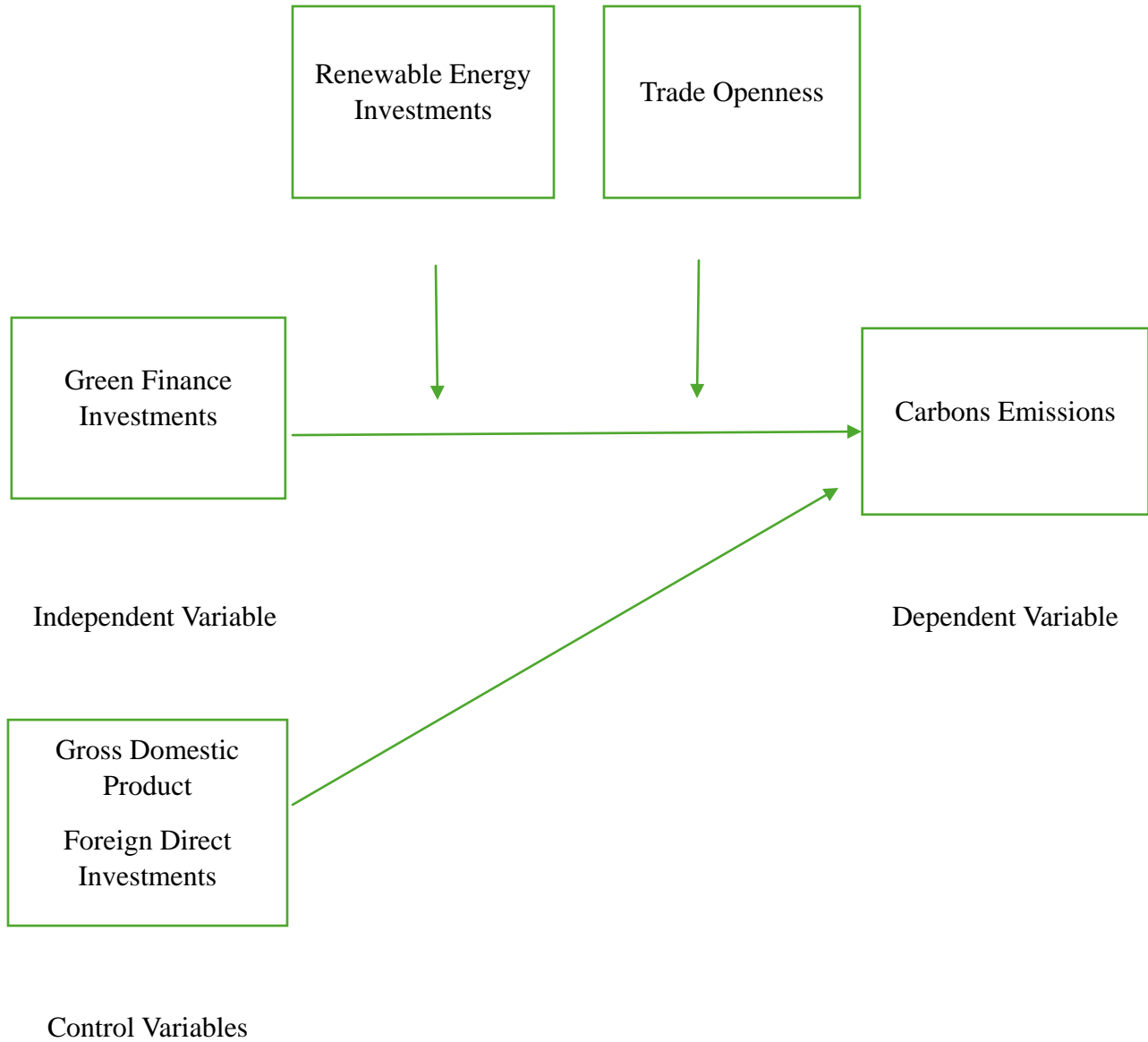
The story isn't totally depressing, though. Potential for green financing can also arise from trade openness. The International Energy Agency notes that increased global trade can result in a greater emphasis on international environmental norms(IEA, 2023). Cleaner production methods and technologies may be encouraged by this, which will encourage investments in green invention. Moreover, as stressed by the UN Environment Program, Trade Openness can help to transfer green technologies and knowledge from industrialized to poor countries(UNEP, 2024). By transferring technology, underdeveloped countries can be enabled to switch to more environmentally friendly manufacturing practices and new chances for green financial instruments to facilitate these changes. Trade of green goods, such as electric cars or energy-efficient appliances, can also increase Green Finance by generating new asset classes and drawing investments in environmentally friendly solutions(MDPI, 2022).

Trade Openness's impact on Green Financing ultimately depends on a few variables. As the World Bank (2024) points out, supportive government policies that promote clean technologies and discourage companies that produce a lot of pollution are essential. Green Financing can also be more favorably impacted by international collaboration on environmental laws and the advancement of green technologies. By utilizing the advantages of trade openness, such market diversification and technology transfer, and reducing the possible drawbacks with strong environmental regulations, nations can use trade to fully utilize green finance and accelerate the shift to a sustainable global economy. Drawing from the above literature, this study proposes the following hypotheses:

H₅: TO has significant moderating impact on relationship of GFI and Carbon emission.

2.7 CONCEPTUAL FRAMEWORK

Moderator variables



METHODOLOGY

3.1 DATA

The data is panel and secondary. This study uses deductive approach and is empirical in nature. The quantitative data technique is adopted for this study. Data comprises of IMF top emerging market groups i.e., Argentina, India, China, Brazil, Turkey, Indonesia, Mexico, South Africa, Poland, Columbia, Chile, Thailand, Spain, Egypt, Serbia, Malaysia, Armenia, Philippines, Iran.

This study looks at data from 2012 to 2022, which covers eleven years. This long time helps us understand trends and patterns for this research.

3.2 SAMPLE CRITERIA AND JUSTIFICATION

The sample selection for this study focuses on important factors. Firstly, it looks at emerging market groups recognized by the International Monetary Fund (IMF), like Argentina, India, China, Brazil, Turkey, Indonesia, Mexico, South Africa, Poland, and Spain. These countries play big roles in the global economy, so their data is important for our research. We're also using panel and secondary data sources to keep our information consistent and reliable from 2012 to 2022. This helps us study trends and patterns over eleven years. Plus, we're using a method that deals with numbers to analyze the data, making it easier to understand the economic changes in these countries.

This research centers on promising economies, so it picked countries that are significant players in the world economy. These countries help us study what we're interested in. It is using data sources that cover a lot and stay consistent over the eleven years we're studying. This helps us do a good analysis. Also, the way we're analyzing the data, using numbers and stats, is a good fit for studying economic trends, which is our main interest in understanding how emerging economies are changing.

3.3 VARIABLE MEASUREMENT

Name of Variable	Measurement	Source	Reference
Carbon emission	CO2 intensity (kg per kg of oil equivalent energy use)	WDI	Du, G. (2023)
Green Finance Investment	Green finance (GF) is measured as financial investment in multiple sources of renewable energy.	IRENA	Du, G. (2023)
Renewable Energy Consumption	REC is taken as final energy consumption in %	WDI	Du, G. (2023)
Trade Openness	Trade (% of GDP)	WDI	Pata, U. K., Dam, M. M., & Kaya, F. (2023)
Freign Direct Investment	Net inflows (% of GDP)	WDI	
Gross Domestic Product	GDP growth annual %	WDI	

3.4 ECONOMETRIC MODELS

In this section, we delve into the econometric models of this study, and it is as follows:

$$CO2_{i,t} = \alpha_{i,t} + \beta_1 TO_{i,t} + \beta_2 GFI_{i,t} + \beta_3 (TO_{i,t}) * (GFI_{i,t}) + \beta_4 (FDI, GDP)_{i,t} + e_{i,t}$$

$$CO2_{i,t} = \alpha_{i,t} + \beta_1 REC_{i,t} + \beta_2 GFI_{i,t} + \beta_3 (REC_{i,t}) * (GFI_{i,t}) + \beta_4 (FDI, GDP)_{i,t} + e_{i,t}$$

3.5 PANEL ESTIMATION MODELS

3.5.1 COMMON EFFECT MODEL

The common effect model offers a simplistic approach. Under this model, all countries within the panel are treated as having the same intercept and slope coefficients regarding their relationship. It assumes homogeneity across countries, overlooking potential variations in their responses to these factors. While the common effect model provides straightforward estimates. This could lead to biased estimates, particularly if individual countries exhibit distinct characteristics or responses to green finance initiatives.

3.5.2 FIXED EFFECT MODEL

The unobserved heterogeneity that exists between countries is taken into consideration by this model. Because of this, it is possible to estimate the consequences of any individual country. By way of illustration, the fixed effect model makes it possible for us to evaluate the way the investments in renewable energy and trade openness of each nation contribute to the reduction of climatic variability, considering the specific circumstances of each nation. Nevertheless, it is of the utmost importance to note that although the fixed effect model can produce reliable estimates, it may restrict the extent to which the findings can be generalized beyond the countries that were included in the analysis.

3.5.3 RANDOM EFFECT MODEL

A different approach is provided by the random effect model. This model provides efficiency benefits in comparison to the fixed effect model because it assumes that country-specific effects follow a particular distribution. The heterogeneity that is present in the panel data is captured by this method, which allows for variances in the responses of countries to green finance programs and investments in renewable energy.

When it comes to analyzing the influence of green financing on reducing climate variability, particularly with regard to investments in renewable energy and trade openness, the utilization of panel estimate models, such as the fixed effect and random effect models, can be of great assistance in gaining significant insights. These models make it possible to evaluate the effects of

specific countries while also controlling for unobserved heterogeneity. As a result, our comprehension of the intricate relationship that exists between green finance initiatives, investments in Renewable Energy, and Trade Openness helps us better grasp how these factors interact to reduce climate variability.

DATA ANALYSIS

4.1 INTRODUCTION

In this chapter we will delve into the explanation of the findings and the scrutiny of the data gathered from the secondary sources. At the end of this chapter, reader will be able to fully comprehend and understand all the data provided in this thesis, by understanding how it is collected and gathered, as well how organized and where it came from with the help of the analysis of this chapter.

4.2 DATA ANALYSIS

4.2.1 DESCRIPTIVE STATISTICS

Variable	Observations	Mean	Std. Dev.
WCO2	209	.0433583	.02251
WGFI	209	3.400925	4.334158
WTO	209	.6396093	.2776713
WREC	209	.1763345	.0976348
WGDP	209	.0335689	.0293621
WFDI	209	.0257992	.0125514

Table 1: Descriptive Stats

Green finance investment has a mean of 3.40 percent with a standard deviation of 4.33, suggesting that carbon dioxide levels change because of green finance investment by 3.40 percent. Trade Openness has a mean of 0.64 percent with a standard deviation of 0.28, suggesting that carbon dioxide levels change because of Trade Openness by 0.64 percent. Gross

Domestic Product has a mean of 0.03 percent with a standard deviation of 0.03, suggesting that Carbon Dioxide levels change because of GDP by 0.03 percent. Renewable Energy Consumption has a mean of 0.18 percent with a standard deviation of 0.10, suggesting that Carbon Dioxide levels change as a result of renewable energy consumption by 0.18 percent. Foreign Direct Investment has a mean of 0.03 percent with a standard deviation of 0.01, suggesting that Carbon Dioxide levels change because of Foreign direct investment by 0.03 percent.

Green Finance Investment has the highest mean value of 3.40 percent, indicating that it has the maximum impact on Carbon Dioxide levels. On the other hand, Foreign Direct Investment has the minimum impact on Carbon Dioxide levels, with the lowest mean value of 0.03 percent.

4.2.2 CORRELATION ANALYSIS

Correlation is when we measure the relationship between two or more variables. If the relationship is strong, we say there is a high correlation. If the relationship is weak, we say there is a low correlation. If the relationship is somewhat strong, we say there is a moderate correlation. The correlation coefficient ranges from -1 to +1.

	WCO2	WGFI	WTO	WREC	WGDP	WFDI
WCO2	1.0000					
WGFI	-0.2994	1.0000				
WTO	0.3727	-0.3747	1.0000			
WREC	-0.500	0.3994	-0.1685	1.0000		
WGDP	-0.1183	-0.0706	0.0886	0.0950	1.0000	
WFDI	-0.0353	0.0390	0.3014	0.3210	0.0665	1.0000

Table 2: Correlation Analysis

The above table 2 shows that the correlation analysis indicates that all values are below 0.5, leading to the conclusion that no multicollinearity is present in the data. The entire data for variables is winsorized, this means that data is free of heteroscedasticity.

4.2.3 REGRESSION ANALYSIS

Regression refers to the statistical concept that delineates the relationship between dependent and independent variables.

4.2.3.1 IMPACT OF GREEN FINANCE INVESTMENT ON CARBON DIOXIDE EMISSION UNDER THE MODERATING IMPACT OF RENEWABLE ENERGY CONSUMPTION

WCO2	Coefficient	Std. Err	z	Probability
WGFI	-.0000597	.0001534	-0.39	0.697
WREC	-.0375292	.0112418	-3.34	0.001
WGFIWREC	-.0001884	.0007292	-0.26	0.796
WFDI	-.0309131	.0240256	-1.29	0.198
WGDP	-.0135461	.0095303	-1.42	0.155
_Cons	.0505968	.0053102	9.53	0.000

Number of observations = 209
Adj R² = 0.3018

Wald chi2(15) = 52.02
Prob > chi2 = 0.0000

Table 3: Impact of Green Finance Investment on Carbon Dioxide Emission Under the Moderating Impact of Renewable Energy Consumption

The table 3 above shows that p-values of Green Finance Investment, Renewable energy consumption, Foreign Direct Investment and Gross Domestic Product are 0.697, 0.001, 0.198 and 0.155 respectively. Additionally, the p-value of interaction term is 0.796 which is insignificant and negative. Similarly, the value of our moderator, which is Renewable Energy Consumption, is p-value is 0.001 which is less than 0.05 is significant and is negative.

4.3 DISCUSSION

The main objective of this research is to study the impact of Green Finance Investment on Carbon Emissions under the moderating impacts of Renewable Energy Investments and Trade Openness. Carbon Dioxide is the dependent variable of this study, and the Green Finance Investment is the independent variable while the moderator variables are Renewable Energy and Trade Openness. To examine the impact of the above-mentioned factors, top 19 emerging market groups mentioned by the IMF are the target countries. WDI and IRENA are a secondary source of data that is employed in this study's data collection and analysis. To validate the impact of the variables in this study, data of top 19 emerging market groups mentioned by the IMF is gathered over the last 11 years (2012 – 2022) using WDI and IRENA. The significance level scale determines whether the research's hypotheses (H1, H2, H3, H4 and H5) are accepted or rejected. The findings of this model show that Green Finance Investment has a negative and significant impact on Carbon Emission when is under moderating effect of Trade Openness. The regression investigation illustrates that the p value of Green Finance Investment is 0.009 under the moderating impact of Trade Openness, which states that the moderator has a significant impact. However, the Trade Openness has found to have a positive impact on Carbon emissions, this is because when countries open to trade, they can easily import renewable energy technologies, energy efficient equipment and other green innovations. According to Sun, H., Attuquaye Clotney, S., Geng, Y., Fang, K., & Clifford Kofi Amisah, J. (2019) the relationship between Green Finance and Carbon emissions can be weakened by trade openness when it offsets the benefits that the environment is receiving from green finance achievements. Increased trade activities normally lead to higher emissions.

Furthermore, the findings of this model show that Green Finance Investment also has a negative and insignificant impact on Carbon Emissions when is under moderating effect Renewable Energy Consumption. The regression investigation illustrates that the p value of Green Finance Investment is 0.697 under the moderating impact of Renewable Energy Investment. The impact of Green Finance on Carbon emissions will be enhanced by the moderating effect of Renewable Energy Consumption. Particularly, when Renewable Energy Investments increase, the green finance effectiveness in reducing the Carbon emissions will be improved (Wang, X., Huang, J.,

Xiang, Z., & Huang, J. 2021).Renewable Energy sources like hydro, wind and solar compared to fossil fuels have zero Carbon emissions.

CHAPTER 5

CONCLUSION

5.1 CONCLUSION

Over the past several decades, the significance of green finance in addressing climate variability has become increasingly evident. This study has focused on the impact of green finance investments on carbon emissions, emphasizing the moderating effects of renewable energy investments and trade openness within the top emerging market groups.

Drawing from an extensive review of the literature on green finance, renewable energy, and trade openness, this research formulated a conceptual model to explore these relationships. The model incorporated green finance investments as the independent variable and carbon emissions as the dependent variable, with renewable energy investments and trade openness serving as moderating factors. Data from 19 emerging market countries, spanning 2012 to 2022, were analyzed using statistical methods, including descriptive statistics, correlation, and regression analysis, via Stata software.

The findings indicate that green finance investments significantly reduce carbon emissions, particularly when moderated by trade openness. This result underscores the positive impact of trade policies that facilitate the adoption of green technologies and practices. Conversely, while renewable energy investments are negatively correlated with carbon emissions, their moderating effect on the relationship between green finance and carbon emissions is not significant. This suggests that while renewable energy is crucial, its current implementation in these emerging markets may not yet be optimized to fully enhance the benefits of green finance.

In conclusion, this study highlights the critical role of green finance in mitigating carbon emissions and underscores the importance of trade openness in amplifying these effects. However, the insignificant moderating impact of renewable energy investments points to the

need for more targeted strategies to integrate and optimize renewable energy within the green finance framework. These insights contribute to theoretical understanding and offer practical implications for policymakers and investors aiming to leverage green finance for sustainable development in emerging markets.

5.2 RESEARCH LIMITATIONS

This study provides valuable insights into the impact of green finance investments on Carbon emissions, particularly in the context of emerging markets. Despite its contributions to the understanding of Green Finance, Renewable Energy, and Trade Openness, several limitations should be noted, offering opportunities for further research.

This study relied on secondary data sources, including the World Development Indicator (WDI) and the International Renewable Energy Agency (IRENA). While these sources provide comprehensive data, they may not capture all relevant variables influencing carbon emissions. Future studies could incorporate primary data collection methods, such as surveys or interviews, to gather more detailed information and enhance the analysis.

This study used Green Finance Investments, Renewable Energy Investments, and Trade Openness as the primary variables. However, other factors could also play significant roles in affecting Carbon emissions, such as technological advancements, regulatory frameworks, and public awareness. Future research should explore these additional factors to develop a more comprehensive understanding of the determinants of carbon emissions.

Moreover, the analysis employed econometric models, including descriptive statistics, correlation, and regression analysis. While these methods are robust, they have limitations in capturing complex, non-linear relationships. Future studies could use more advanced statistical techniques, such as machine learning algorithms or system dynamics modeling, to better understand the interactions between variables.

Another limitation is the assumption that all countries in the sample have similar levels of data accuracy and reporting standards. Variations in data quality across countries could affect the

reliability of the results. Future research could conduct sensitivity analyses to assess the impact of data quality on the findings.

5.3 RECOMMENDATIONS AND FUTURE RESEARCH

Although a significant number of areas of this study have been thoroughly addressed, it is possible that the overall effectiveness and reliability of the study could be improved by making some modest alterations. Alterations of a minor kind can be made to the length of time that the study is conducted, the demographic that is being targeted, the sample size, the sort of research being conducted, and other variables. There is the potential for the time limit to be extended in the future. The researcher might be able to acquire historical data more efficiently if they have specified a suitable time range. The researcher might have the possibility to accumulate data in a more thorough manner and to carry out an analysis that is more in-depth if the time horizon is expanded. There is potential for the validity and reliability of the entire research endeavor to be improved through increased use of historical data. Any mediating variables that are absent from the study could be included in subsequent research to make the investigation more comprehensive. It is possible that the inclusion of a mediating variable will make it possible for researchers to carry out in-depth examinations, which will result in deeper insights into the subject matter of this literature. Within the context of reducing Carbon emissions and combating climate change, researchers ought to investigate the long-term effects of Green Finance projects to determine whether these initiatives are both sustainable and beneficial. In order to determine how Green Finance impacts a variety of economic and environmental circumstances, researchers ought to conduct separate analyses of each region. When it comes to enhancing the efficiency and transparency of Green Finance initiatives, researchers ought to take into consideration technological developments by investigating the role those emerging technologies, such as blockchain and artificial intelligence, play.

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