

**Seminar in Applied Finance**  
**The role of green finance in supporting the low-carbon transition**

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## **Introduction**

Industrial development in the 20<sup>th</sup> century had some negative consequences, environmental negative aspect is one of them. In the modern days, it is important to deal with sustainability across different sectors. That is also the case for finance. Therefore, sustainable finance is becoming a big topic with investors investing in sustainability (green finance) such as renewable energy, green bonds, green loans et cetera. It is worth to explore the relation between sustainable finance investments and change in carbon emissions, environmental concerns in general.

### **1.1 Relevance**

To begin with, even in modern days, there is a large percentage of society, who does not believe the climate change exists. This problem was examined by Afzali et al. (2023) in the article Climate change denial and corporate environmental responsibility, where they found, that countries with higher percentage of climate change denial have worse performance of corporate environmental responsibility. Reasons to invest in sustainable finance might be various, other than profit, one might want to make an impact, to feel better. This behavior was researched by Heeb et al. (2023), one of their findings on a representative sample of the Swiss population was, that the opportunity to invest in a climate-conscious fund does not erode in individuals` support for climate regulation. Bauckloh et al. (2023) examined the missing risk factor in CAPM, which they consider to be the brown premium – the premium for the fact the company is polluting, therefore more sensitive for potential green government regulations. They also concluded that only those investors, who do not have environmental taste are profiting from this as they are getting pollution premium. Kashif (2022) found, that a higher rated ESG portfolio does not have different downside risk compared to lower rated ESG portfolio, therefore suggesting, that investing on ESG criteria is a style based rather than risk based. This might implicate positive approach of society towards measures of ESG. On the other hand, Gilchrist et al. (2021) claim, that environmentally responsible practices not only enhance shareholder value but also the value accrued to nonfinancial stakeholders. They also provide an updated overview of research developments in relation to green bonds and syndicated loans.

Tran et al. (2020) researched factors affecting investments via green mechanisms with a focus on Vietnamese market, one of the main drivers were awareness on accessing green capital.

One of the goals of this paper will be to investigate relationship between green finance and the transition to a low-carbon economy. This problem was researched by Monasterolo et al. (2022), they focused on green financial sector initiative in emerging markets and developing economies. The paper investigates the transmission channels through which it affects the availability and cost of capital for high- and low-carbon goods, investments, output, and greenhouse gas emissions. Li et al. (2022) specifically investigated if green finance facilitated China`s low-carbon economic transition on 30

Chinese provinces between 2001 and 2019. They used the Global Malmquist-Luenberger index as a measure. Findings of Li et al. (2022) were that green finance can significantly contribute to the transformation of low-carbon economy.

Yang et al. (2022) examined if renewable energy investments have effect on carbon dioxide emissions reduction, they used data from 2010 to 2019 from 13 different countries. They found that increasing renewable energy investment scale can indirectly reduce carbon dioxide emissions through the technique effect and increase carbon dioxide emissions through the multiplier effect. Particularly, they found that increasing investment in wind energy is significant in reducing carbon dioxide emissions. The contrary effect was observed for increased investments in solar and bioenergy. This paper will also focus on the question of how well different green finance mechanisms are promoting sustainable development. Bhutta et al. (2021) analyzed factors associated with the impact of green bonds` on issuers fundamental performance measures to meet ESG objectives. The review of Bhutta et al. (2021) emphasized that financing is essential to support sustainable development with green bonds being one of the instruments. They say that growth of green bonds popularity is secured by favorable regulatory environment and improvement in disclosure quality. Other impact highlighted by the authors is the characteristics of the issuer and the fact if they provide some advantages over other financial securities. Tolliver et al. (2019) created an extensive overview of green bonds issued in 96 countries between 2008 and 2017, they claim, that the examined portfolio of green bonds is associated with over 108 million tons of carbon dioxide in greenhouse gas emissions reductions and over 1500 gigawatts in renewable energy capacity. The study is examining green bonds in relation to the Paris Agreement under the United Nations Framework Convention on Climate Change and the Sustainable Development Foals (SDGs) of the United Nations Development Program. Zhu et al. (2023) claim that green finance plays a significant role in the low-carbon economy as they correct capital mismatch, promote green technology innovation.

## **1.2 Research questions**

The paper focuses on answering following two research questions stated in this section. What is the relationship, in terms of changes in carbon emissions and investment in renewable energy, between green finance and the transition to a low-carbon economy?

How do different categories of green finance mechanisms, such as green bonds and green loans, compare as to how effective they are at promoting sustainable development?

### **1.3 Methodology**

Research conducted on the selected topics is based on reading various up to date articles published in relevant journals and their critical analysis. Therefore, this paper serves as an overview of already performed research by other authors and summarizes their results and opinions into one paper. Many papers from various authors were selected in order to fully understand and present results and specially to answer the research questions stated above. The rating of scientific journals is also considered in the choice of papers used for conducting further research.

### **Green finance mechanisms**

Green finance is becoming trendy in recent years, not only for its relevance of climate change and efforts for economical sustainability, but as stated by many researchers, also for the possibility of diversification, managing risk and even by offering further premia in case of environmental distress. The goal of green finance mechanisms is to structure financial activities in order to create a better environmental outcome. As stated by S. Fleming (2023) the value of green bonds traded is over \$2.3 trillion and the volume is still growing, while issuing green bonds by volume is the most popular in US, China, and France. Green finance, born as a fresh economic approach in response to this context (Liu et al., 2019), underscores the effective use of resources and the shifting of environmental risks via interest transmission methods. These methods involve financial investments and funding endeavors based on the principle of honoring sustainable development (Lee et al., 2021). In this section we will define what is meant by green financial mechanisms, how they are used in practice and the idea how they promote sustainable development.

### **1.4 Definition of green finance mechanisms**

In this section I will define how green finance mechanisms work, how they are specified and for what purpose they are established. The most direct approach would be to directly invest into green projects such as renewable energies, but the market offers a broader range of green finance products. We can think of products such as green bonds, which are aligned with ESG measures.

Numerous governments, such as Finland and the UK, have established precise objectives aiming to eliminate carbon emissions. Achieving this goal proves challenging due to the inherent risks within these projects. To streamline financing for such endeavors and bypass administrative obstacles, the market has introduced green financial instruments. Among these, green bonds emerge as an alternative to traditional bonds, serving as a debt mechanism aligned with Environmental, Social, and Governance (ESG) goals (Bhutta et al., 2022).

Other products in green finance environment include renewable and sustainable equity such as mentioned above, example of such investment might be direct investments into solar panels. Another

popular option is investing in green mutual, which are set up in a same manner as regular mutual funds with the distinction of investing into environmentally friendly companies. Investor might also choose to invest directly into green stocks. However, green finance does not only include investment opportunities as it also includes products such as green mortgages offering attractive interest payments (Jones, 2023). Lastly, I would like to mention green credit cards, which offer rewards for using green financing.

## 1.5 Promotion of sustainable development

Many countries have set a goal in regards of their sustainable development, such as reducing carbon dioxide emissions. For example, to avert a global environmental catastrophe, the Chinese government has not only pledged earnestly to the international community regarding reaching a carbon peak and achieving carbon neutrality (Xi, 2017) but has also exhibited resolute determination in realizing sustainable development objectives by fostering the establishment of a low-carbon economy (Li et al., 2018). Nevertheless, significant hurdles persist in the evolution and advancement of China's low-carbon economy. Some scholars argue that due to the influence of a planned economy era, limited resources tend to channel or get assigned to the heavy industry sector, resulting in short-term profitability (Abbasi et al., 2021). Yuan et al. (2020) suggest that the promotion of green finance or investment in low-carbon projects can bridge the divide between private and social costs incurred by polluting businesses by integrating environmental expenses. This, in turn, allows for a more efficient allocation of resources between polluting and environmentally friendly industries, aligning with societal and environmental demands. Additionally, they note that scaling up green financial resources enhances the efficiency of capital movements over time and across regions, contributing to a decrease in environmental pollution.

Bhutta et al. (2021) state: *“financing is an essential factor to support sustainable development, and there are some challenges to gather finances for environment-friendly projects. Green bonds are one of the financial instruments to finance such task, and they provide capital to fund green projects. We argue that the favorable regulatory environment and improvement in disclosure quality are essential factors for the growth of green bonds.”* Therefore, understanding how effectively green bonds promote sustainable development is crucial, to understand the real effect of use of such green instruments. The central focus revolves around the nature of projects funded via green bonds. Various regulators globally establish distinct criteria that link financing to these specific green bonds (Schumacher, 2020). Bhutta et al. (2021) found that green bonds are essential source of financing for environmentally friendly projects and therefore being a crucial part of achieving the goals set up in the Paris agreement. They also mention that there is a need of getting cheaper finance for sustainable future, and to achieve that it is important to gain trust of stakeholders on the use of proceeds of green bonds.

Tolliver et al. (2019) researched further the use of green bonds for the Paris agreement and sustainable development goals. They state that both the Paris agreement under the United Nations Framework Convention on Climate Change and the SDGs of the United Nations Development Programme entail substantial investments, which needs to be cost-efficient and ensure its longevity. They found that publicly reported green bonds invested in by fifty-three organizations from 96 countries from 2008 to 2017 in their study, are associated with over 108 million tons of carbon dioxide equivalent in greenhouse gas emissions reductions and growth of renewable energy capacity by 1500 gigawatts. That is by allocating \$58 billion in total over the span of 9 years. However, they also suggest improving green bond post-issuance reporting and they also suggest how to apply future green bonds in expanding Paris and SDG agendas.

Nguyen et al. (2022) researched the impact of green financing on sustainable development on multiple cases in Vietnam. They found that the Covid-19 pandemic has caused uncertainties in most of the business sectors, therefore commercial banks are less likely to finance uncertain projects even if they were to positively impact the environment and prioritize projects with greater economic benefits to cover for losses caused by the pandemic. Meaning that the sustainability is one of the goals of the banks, but prioritization of projects with certain economic efficiency exists. Given the lack of governmental supports they state the banks will play an important in the green finance initiative.

## **Green finance and transition to a low-carbon economy**

As highlighted by Grossman (1995), economic actions exert influence on environmental progress via scale, technique, and structural impacts. These effects serve as a theoretical foundation for investigating how green finance functions in optimizing the allocation of capital, fostering advancements in green technology, and driving improvements in industrial sectors. Such effects will be investigated in the following chapters.

### **1.6 Low-carbon economy**

Green finance significantly influences and moderates a low-carbon economy via its scale, technique, and structural impacts. More precisely, it aids in building a low-carbon economy by rectifying capital imbalances, boosting innovation in green technology, and refining industrial frameworks. The metric of economic output per unit of carbon emissions, known as carbon productivity (CP) and initially introduced by McKinsey consultancy in 2008, is regarded as a pivotal measure for quantifying a society's and economy's low-carbon advancement (Liu & Zhang, 2021).



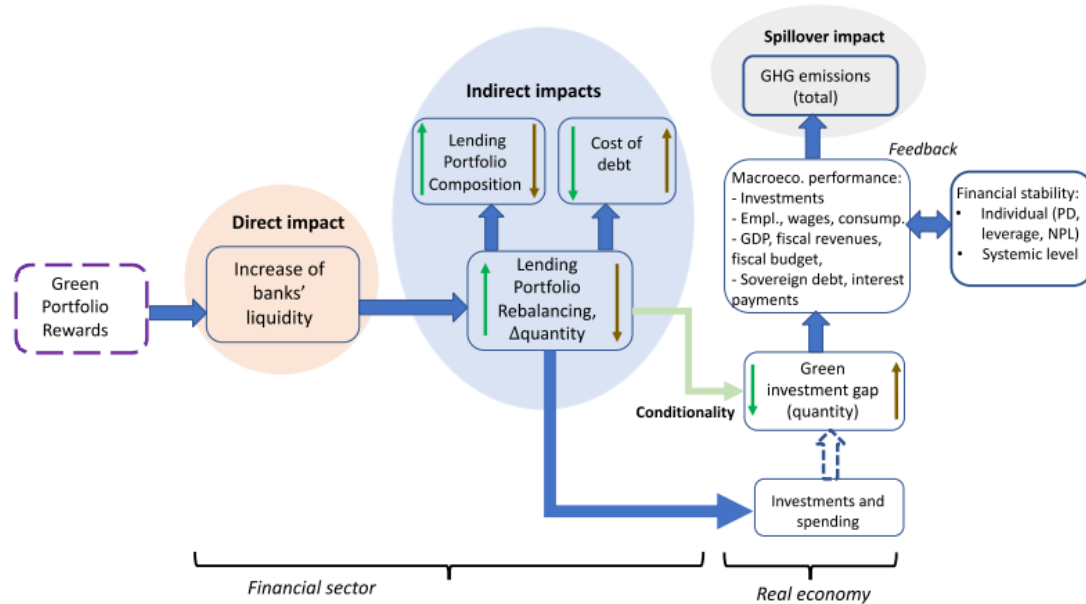
## 1.7 Effect of green finance on low-carbon economy transition

Zhu et al. (2023) utilized a dataset covering China's provinces from 2005 to 2019 to explore how green finance impacts the low-carbon economy. Their findings highlight three primary effects of green finance—scale, technique, and structural—which collectively guide and moderate the low-carbon economy, with scale having the most significant impact. Green finance influences economic output and carbon emissions by optimizing capital allocation, fostering green technology innovation, and improving industrial structure. While it fosters local low-carbon development and spatially spills over to neighboring regions, its broader implementation is essential. Additionally, regional differences affect the relationship between green finance and the low-carbon economy, where certain thresholds determine its effectiveness in optimizing scale and structure while green technology consistently contributes positively in the long term.

Monasterolo et al. (2022) investigated the role of green financial sector initiatives in the low-carbon economy transition. They state that the effectiveness of green financial sector initiatives in supporting reductions in greenhouse gas emissions relies on a country's commitment to a decarbonization trajectory driven by economic policies. When a country credibly commits to a NetZero path by phasing out fossil fuel subsidies and implementing measures aiding affected sectors, it justifies higher capital costs for high carbon-emitting firms, aligning with financial assessments. Therefore, the adjustments in capital costs and accessibility facilitated by green financial sector initiatives work best when they complement comprehensive climate economic policies, ensuring sustainable transition efforts over time. Conversely, without a credible commitment to a NetZero trajectory, green financial sector initiatives effectiveness diminishes, as interest rates, capital costs, and risk assessments for low-carbon firms eventually revert to levels resembling those of high-carbon entities. Taking climate change into consideration from the investors point of view and recognize that climate change represents a new type of risk for finance and is recommended by Bertram et al. (2021) to assess this new risk, including through climate stress tests, which has already been implemented by several central banks. They also recommended investors to disclose climate risks on their balance sheets. The green finance affects the transition to low-carbon economy through many channels as stated by Monasterolo et al. (2022) – the price/interest rate channel, the quantity channel (lending to the real economy and investors` portfolio rebalancing.

**Figure 1**

*Effects of policies rewarding green portfolios*

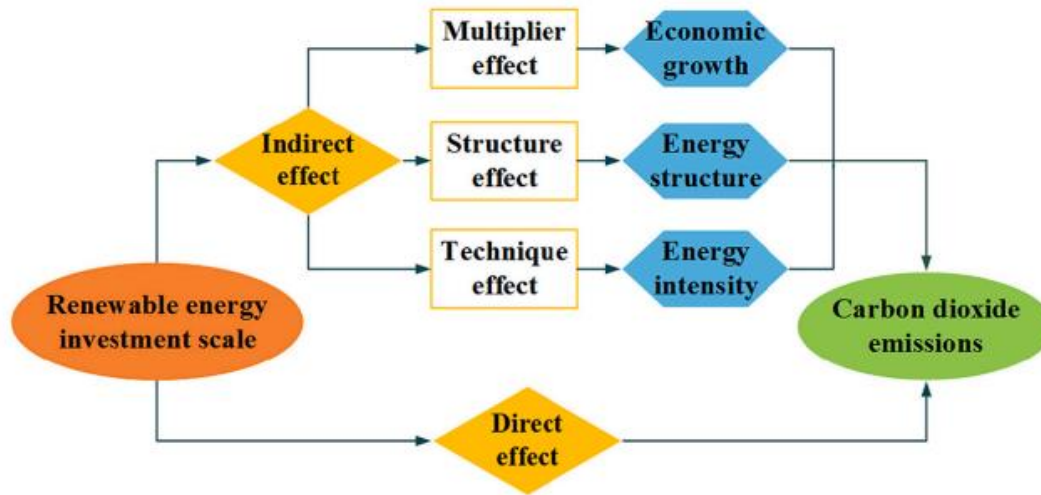


Source: Monasterolo et al., 2022

In the graph above Monasterolo et al. (2022) show the effect of policies rewarding green portfolios. The effect is not only direct in increasing banks liquidity, but the bank is motivated to hold „greener“ portfolios in order to get more liquidity, therefore lending more to green subjects and developing the green finance products further on. The end effect is the reduction of emissions.

### 1.8 Investments in green finance and its effects

Yang et al. (2022) analyzed the effect of renewable energy investments (REI) on carbon dioxide emissions from two aspects of scale and structure on the data of thirteen countries, which invested heavily in renewable energy systems over the last ten years. The effects of such investments are presented in the picture bellow.

**Figure 2***Indirect effects of renewable energy investment scale on carbon dioxide emissions*

Source: Yang et al., 2022

They found, that increasing REI scale can increase carbon dioxide emissions, specifically by promoting growth and it can reduce carbon dioxide emissions by reducing energy intensity. They also found that increasing investment in solar energy and bioenergy can increase carbon dioxide emissions, while wind has the contrary effect. The increase of carbon dioxide emissions due to increase of REI scale is explained by increase in GDP caused by the investments. Even so, REI scale can restrain carbon dioxide emissions through the “technique effect” mechanism. Therefore, governments should continue to increase REI scale.

## Conclusion

In the wake of 20th-century industrial development, the adverse environmental impacts necessitate contemporary solutions focusing on sustainability across sectors, including finance. Sustainable finance incorporated green finance mechanisms like renewable energy investments, green bonds, green loans, or new green policies from countries, which are gaining momentum in the recent years. This paper's objective was to explore the relationship between sustainable finance investments and the shift in carbon emissions and broader environmental concerns as well as the effect of investments in renewable energy.

Various research studies provide insights into the significance of sustainable finance, revealing its diverse impacts. Further investigations highlight the financial implications of environmental consciousness, shedding light on the influence of green finance instruments such as green bonds on issuers' fundamental performances aligned with Environmental, Social, and Governance (ESG) objectives.

Key studies deal with the relationship between green finance mechanisms and the transition to a low-carbon economy. They emphasize the pivotal role of green finance in fostering green technology innovation, and refining industrial structures, offering an accessible stream to finance green projects in general. Understanding the effectiveness of green finance instruments like green bonds in promoting sustainable development emerges as a critical aspect, with global regulators setting specific criteria linking financing to these eco-friendly investments. While green bonds and green loans especially after government support can generate attractive return on investment while taking the climate risk into consideration.

Furthermore, empirical findings highlight the impacts of renewable energy investments on carbon dioxide emissions, describing the relationship between the scale of REI and carbon emission reductions. While REI scale may stimulate GDP growth, it can also indirectly suppress carbon dioxide emissions through the technique effect, especially in wind energy investments. However, investments in solar and bioenergy might have contrary effects on carbon dioxide emissions, indicating the differences between different forms of renewable energy investments and their environmental outcomes.

Overall, the synthesis of various research findings showcases the pivotal role of green finance in steering global economies toward sustainability. As governments and financial institutions continue to expand green finance mechanisms, these initiatives will play a crucial part in a transition to a low-carbon economy and mitigating environmental challenges. The synthesis of the perspectives presented in this paper offers a comprehensive understanding of the dynamics between green finance, environmental concerns, and the pursuit of a more environmentally conscious future.

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## List of abbreviations

CAPM	Capital Asset Pricing Model
CP	Carbon Productivity
ESG	Environmental, Social, Governance
GDP	Gross Domestic Product
REI	Renewable Energy Investments
SDG	Sustainable Development Goals
UK	United Kingdom



## **Declaration of authorship**

The role of green finance in supporting the low-carbon transition

I hereby declare that the present paper is entirely my own work and without the use of any unauthorized assistance. Any content which has been taken verbatim or paraphrased from other sources has been identified as such. This paper has not been submitted in any form whatsoever to an examining body. Previously published work has been cited as such.

Vaduz, 29.11.2023

Bc. Matej Ingrst

29.11.2023

**X** Matej Ingrst

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Signed by: FC341AE