Green Bonds as Catalysts for Job Creation in OECD Countries

A Quantitative Exploration of Labor Market Impacts

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Preface and acknowledgements

Ironically, the opening chapter of this thesis marks the ending of my academic journey - a path that began with vocational education and led me to the esteemed halls of Delft University of Technology. The remarkable voyage is filled with unforgettable moments, experiences, and lessons that I will cherish forever. Pursuing this masters has been one of the best choices of my life. Not only did I learn new skills, but I also deepened my understanding of management, innovation, financial markets and economics. Reflecting on these two enriching years of this Master's program fills me with great joy. I felt I was surrounded my like-minded people, and learned to be proud of my achievements. Within days of joining the program, I connected with some individuals instantly who now have a permanent place in my heart. They taught me that the journey itself holds as much significance- if not more- than the destination. They would remind me sometimes to "live a little". Júlía, Renzo, Fin, Felix, Marleen, Nikki, Saskia, and Masa; I deeply appreciate you all. To my cousin Thomas and my sister Winnifred, the anchors in my life: words fall short in describing our deep bond, but know that our shared journey, aspirations, and passion define us. Special appreciation to Anouk, for always providing me with love and understanding, in both easy and difficult times. Your unwavering support has been a cornerstone of my journey. I would like to extend my appreciation to my graduation committee. Foremost I want to thank Dr. Aleksandrina Ralcheva, whose guidance has been instrumental in shaping this thesis. Without her insights, I would have navigated this journey with more difficulty. My sincere thanks also go out to my chair Dr. Jos Blank and second supervisor Dr. Fátima Delgado Medina, your invaluable feedback has refined my work and provided me with new perspectives. Last but not least I would like to thank my parents for always having faith in me, telling me that I can do whatever I put my mind on, you have always told me nothing is unreachable. I am beginning to see the world through the lens of possibility and potential as you always envisioned for me. And to Rolf, your quiet support and presence have not gone unnoticed; thank you.

I look back with gratitude and forward with excitement and anticipation, ready to write the next chapters of my life's story.

Executive Summary

The global emphasis on environmental sustainability has led to the rise of "green finance," a financial paradigm focused on environmentally friendly investments. Central to this paradigm are green bonds, designed to fund climate and environmental projects. Their growth has been significant, but their true impact, especially in the face of concerns like greenwashing, requires critical assessment. Understanding the influence of green bonds on labor markets is crucial, as it provides insights into the broader economic implications of this sustainable financial movement. The United Nations' Sustainable Development Goals (SDGs) serve as a guiding framework for global sustainability efforts. These goals, ranging from eradicating poverty to ensuring environmental protection, aim for realization by 2030. Green bonds, influenced by these SDGs, address the global sustainable financing gap, estimated between \$5 to \$7 trillion annually. They resonate with core SDG principles, particularly in areas like economic growth and job creation within green supply chains. The SDGs, therefore, form the backbone of the green bond evolution, with specific alignments like SDG Goal 8, which emphasizes "Decent Work and Economic Growth." However, as the green bond market grows, so do concerns about its authenticity and transparency. One such concern is "greenwashing," where initiatives are misleadingly promoted as environmentally-friendly without substantial backing. For instance, while the European Investment Bank's (EIB) investments in clean transport projects have positively impacted European economies, some green bonds have been criticized for lacking transparency in their fund deployment.

The primary aim of this study is to delve into the influence of green bond issuance on labor market dynamics, specifically focusing on job creation and destruction. Understanding these parameters is vital as they offer insights into the health and vibrancy of an economy. Acquiring data on green bonds presented challenges. Comprehensive databases, while rich in information, often come with substantial access costs. The primary resource for this research was the Climate Bonds Initiative (CBI). However, the selective nature of the CBI's database meant that not all green bonds in the market were accounted for. The data extraction process was manual, resulting in a dataset that covered green bond issuance from 23 OECD countries from 2014 to 2022. In addition to green bond data, this study also considers short-term interest rates and Domestic Credit to Private Sectors by Banks. These variables are crucial as they play significant roles in influencing lending and investment behaviors, and they offer alternative financial channels to green bonds. The research is underpinned by two main hypotheses. The central hypothesis posits that green bonds have a direct impact on labor markets, potentially leading to either job creation or destruction. A secondary hypothesis suggests that the impacts of green bonds vary across industries, meaning that certain sectors may benefit more than others from green bond issuance. This research delves into the nuanced relationship between green bond issuance and employment dynamics within OECD countries. Findings indicate a significant correlation: for every 1% increase in green bond issuance, there's a corresponding 0.05% rise in employment on average. Considering the green bond market has witnessed a staggering 90% annual growth since 2016, understanding this relationship becomes paramount. While the overarching data suggests a positive correlation between green bond issuance and employment, it's essential to note that the impact is not uniform across all industries. This observation aligns with the hypothesis that while some sectors may see job growth due to green bond issuance, others might experience job losses.

Different industries exhibit varied reactions to green bond issuance. For example, sectors like Agriculture and Manufacturing tend to show a negative correlation, possibly due to the capital-intensive nature of sustainable projects in these areas. On the other hand, sectors such as Human Health and Social Work Activities demonstrate a positive correlation, likely attributed to the labor-intensive nature of green initiatives in these fields. An intriguing observation is that while green bonds generally bolster employment, they have a minimal effect on reducing job vacancies, as evidenced by a slight negative coefficient of -0.009 between the Job Vacancy Rate (JVR) and green bond issuance. This research, while comprehensive, has certain limitations. Relying on the job vacancy rate and employment as indicators for job creation and destruction might not encapsulate the full dynamics of the labor market. Additionally, the granularity of the data used could be enhanced for a more nuanced analysis. The study's focus on 23 countries, sourced from the ICMA green bond database, might not reflect the complete global implications of the green bond market on labor dynamics. Green bonds are undeniably pivotal in guiding the global transition towards sustainability. However, their influence on employment is complex and multifaceted. This research emphasizes the need for a deeper understanding of the nuanced effects of sustainable finance on the broader economic canvas. As global priorities continue to tilt towards environmental sustainability, the insights from this study can serve as a beacon for policymakers and industry leaders. It's crucial to harness the potential of green bonds effectively while being aware of their diverse impacts across different sectors.

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List of acronyms

ESG Environmental, Social and Governance

EIB The European Investment Bank

SDGs Sustainable Development Goals

GDP Gross Domestic Product

GBP Green Bond Principles

OECD The Organization for Economic Cooperation and Development

CBI The Climate Bonds Initiative

UN United Nations

MLP Multi-Level Perspective

AI Artificial Intelligence

ICMA The International Capital Market Association

SVB Silicon Valley Bank

SNAT Supranational Organizations

EUGB European Green Bonds Standards

BRI Belt Road Initiative

FDI Foreign Direct Investment

GBI Green Bond Issuance

JVR Job Vacancy Rate

ILO The International Labour Organization

ISIC International Standard Industrial Classification of all economic activities

RIS Relative Industry Size

VIF Variance Inflation Factor

IQR Interquartile Range

SRI Socially Responsible Investment

TBL Triple Bottom Line

MDG Millenium Development Goals

EGD European Green Deal

DiD Difference-in-Difference

NGEU The Next Generation European Union

1 Introduction

The increasing global focus on environmental sustainability has profoundly reshaped the economic direction in recent years (Lewandowski, 2016). This evolution is based on increasing environmental awareness and the imperative for sustainable economic trajectories. This has led to the emergence and growth of "green finance" (Krusthelnytska, 2017). Central to this financial paradigm are green bonds, brought to life for their potential to catalyze sustainable economic activities and enhance employment opportunities. However, alongside their potential benefits, green bonds have also been critiqued for instances of greenwashing. While new standards aim to address these concerns, a comprehensive evaluation of their role in achieving sustainable objectives remains a critical area of research.

Green finance represents a broad spectrum of financial activities aimed at promoting environmentally friendly investments and stimulating the development and implementation of low-carbon technologies. Green finance operates by channelling financial investments into sustainable development projects, environmental products, and policies that encourage more sustainable economies (Krusthelnytska, 2017). While green finance is a holistic approach towards sustainable development, it is often confused with similar concepts such as sustainable finance and climate finance. Each of these terms carries distinct characteristics. Climate finance, although closely related, is narrower in scope, focusing primarily on investments linked to climate change-mitigation and adaptation (Buchner, Brown, & Corfee-Morlot, 2011). Sustainable finance, on the other hand, is more expansive, incorporating environmental, social, and governance (ESG) considerations into business or investment decisions. This form of finance seeks a balance between economic performance and long-term societal benefits (Boffo & Patalano, 2020). It is important to note that green finance, while primarily focused on environmental aspects, forms an essential component of sustainable finance, addressing both ecological and economic imperatives (Bebbington, Unerman, & O'DWYER, 2014). Within green finance, the novel green bond has emerged.

Essentially, a green bond is a type of fixed-income instrument that is explicitly intended to raise capital for climate and environmental projects (Flammer, 2021). Green bonds provide a unique opportunity for organizations to secure funds for green projects, offering investors an attractive investment proposition that balances competitive returns with a clear environmental impact. This combination of financial return and environmental responsibility creates an incentive for investors, fostering the growth of the green bond market (Schneibel, Koenig, & Maier, 2022). Originating in 2007 with the issuance of the first green bonds by the European Investment Bank (EIB) and the World Bank (Deschryver & De Mariz, 2020), the green bond market has experienced unprecedented growth. The rapid expansion has been fueled by a combination of increasing investor demand for sustainable investments, growing regulatory pressures on companies and governments to reduce their carbon footprint, and the competitive advantage green bonds offer in terms of lower borrowing costs compared to traditional bonds (Akomea-Frimpong, Adeabah, Ofosu, & Tenakwah, 2022; FundsEurope, 2022). Green bonds have initiated a paradigm shift in the capital market by enabling the reallocation of capital from conventional to more sustainable ventures. These financial instruments, by directing funds towards environmentally sustainable projects, have the potential to stimulate job creation in green industries, contributing to GDP growth, and helping achieve the United Nations Sustainable Development Goals (SDGs) (Glomsrød & Wei, 2018; Nilsson et al., 2018).

However, one important question arises: Why not green bonds over other types of financing such as conventional bonds or bank loans? The answer lies in the nature and promise of the green bonds. With conventional bonds, transparency regarding the use of proceeds is not guaranteed. Investors in conventional bonds have limited insight into where the money is deployed. In contrast, green bonds, by design, come with an implied commitment. This can lead to signalling effects that can be translated to better terms of issuance, including lower interest rates given the increased demand from ESG-focused investors (Flammer, 2021). Furthermore, the issuance of green bonds can enhance the reputation of firms or countries as sustainable and responsible entities, which can be a valuable in a landscape that is becoming increasingly conscious about environmental impacts (MacAskill, Roca, Liu, Stewart, & Sahin, 2021). The regulatory and tax incentives provided in some regions for green bond issuance also present a financially attractive proposition compared to traditional bank loans or conventional bonds (Zhao et al., 2022). The diversification of funding sources through green bonds can provide a prudent financial strategy to mitigate risks associated with over-reliance on a single source of funding like bank loans (Zhao et al., 2022).

The popularity of the green bonds brought concerns of greenwashing. Critics argue that without strict standards, the green market is sensitive to misuse, with companies potentially overstating or falsely promising environmental benefits (Shi, Ma, Jiang, Wei, & Yue, 2023). Greenwashing is not only deceptive but is also undermining the actual purpose of the green bonds. Recognizing the potential pitfalls, regulators are moving towards standardized green bond frameworks, such as the Green Bond Principles (GBP), EU Green Bond Standard and the Climate Bond Standard. The hope is that by implementing robust guidelines, the scope of greenwashing can be significantly reduced (Badenhoop, 2022). However, while the standards raise optimism, the efficiency of these measures remains under-explored. Tuhkanen and Vulturius (2022) underscore this issue, revealing that a mere seven out of the 20 largest European corporate green bond issuers through 2018 allocated proceeds from their green bonds at the project level. This lack of transparency and accountability raises questions about the genuine impact of green bonds on environmental sustainability. This thesis fills a void in a relatively uncharted domain. Beyond the environmental implications, it seeks to delve into the role and impact of green bonds in stimulating sustainable economic growth. It aims to provide an understanding of the relationship between green bond issuance and labor market dynamics, such as employment, job creation and job destruction. By performing a detailed exploration of this emerging area in green finance, this research objective is to identify if green bonds, with their renewed standards, can drive meaningful economic change and job creation. Furthermore, it aims to contribute to the ongoing academic discussion and inform policy-making decisions in this field. The following research question is formulated:

What is the impact of green bond issuance on the creation of sustainable jobs in European economies?

The objective of this study is twofold: to offer a comprehensive analysis of green bonds' influence on European countries' sustainable development and to determine their effect on sustainable job creation. To achieve this, the research will employ models linking green bond issuance to labor markets, accounting for potential non-linear effects and controlling for variables such as unemployment and interest rates (Bhutta, Tariq, Farrukh, & Raza, 2022; Flammer, 2021).

The research uses data sourced from the Climate Bonds Initiative (CBI) spanning 2014-2022, focusing on green bond issuance across 23 OECD countries and its potential impact on employment dynamics. The empirical strategy is based on two central outcome variables: job vacancy rates and employment. The first model examines the aggregate employment in countries, seeking a relationship between green bond issuance and overall employment dynamics. The same model is used to possibly identify a relationship between the job vacancy rate and green bond issuance. In contrast, the second model delves deeper , offering an industry-specific perspective to identify variations in response to green bond issuance.

The results show that green bonds significantly influence employment, with a 1% increase in issuance leading to a 0.046% rise in employment, a notable impact given the green bond market's 90% annual growth since 2016 (Goldman Sachs Asset Management, 2023). However, this positive trend is not universal across industries, with sectors like Administrative and support (N) benefiting, while others like Agriculture (A) face declines or even job destruction. The decline in the job vacancy rate alongside increased employment suggests green bonds are fostering sustainable job opportunities in an efficient labor market. Yet, it is important to recognize the varied industry impacts and the potential hurdles such as mismatch theory and capital-labor substitution during the green transition. This research is limited by its reliance on proxies for job creation and job destruction and the narrowed dataset for green bonds, indicating directions for more comprehensive future studies.

This study aligns with the Management of Technology (MOT) program by exploring the nexus of sustainable financing mechanisms, specifically green bonds, and their economic implications. The MOT program has a focus on the connection between technology management, market dynamics, and the overall economic and financial landscape. By assessing the influence of green bonds on sustainable economic growth and job creation, this research explores the sustainable finance landscape with green bonds and by doing so offers insights into the decision-making processes concerning technological investments and innovations.

2 The Evolution of Green Bond Financing

2.1 Sustainable development goals (SDGs)

The pressing need for sustainable development has been at the forefront of global discussions for decades (Nordhaus, 1977). Spearheading this movement, the United Nations introduced the Sustainable Development Goals (SDGs) as a comprehensive framework to guide global efforts. These 17 multifaceted goals aim to address challenges from eradicating poverty to ensuring environmental protection, with a target realization by 2030. While several frameworks evaluate countries' progress towards the SDGs, one prominent model is the one proposed by Nilsson, Griggs, and Visbeck (2016), later refined in 2018 (Nilsson et al., 2018). This model evaluates and ranks nations based on their SDG achievements. The Multi-level Perspective (MLP) tool serves as an effective theoretical tool, explaining the dynamics of green and sustainable finance within larger societal transformations (Nilsson et al., 2016). In this context, the MLP underscores three pivotal levels: landscape, regime, and niche. The interactions across these levels result in socio-technical transitions, driving the evolution of financial paradigms (Nilsson et al., 2018). Green bonds fit as niche innovations coming from larger landscape pressures like climate change and the SDGs. With the global goal to close the sustainable financing gap of \$5 to \$7 trillion annually (United Nations, 2014), green bonds emerge as an invaluable asset. They not only address the immediate financial gap but also resonate with the core principles of the SDGs (ICMA, 2022). It's pivotal to understand that the rise of green bonds is not just a financial trend but rather an evolution propelled by the SDGs themselves.

Highlighting specific alignments, the Green Bond Principles (GBP) and certain SDG targets intersect, notably in areas concerning economic growth and development. For instance, SDG Goal 8, advocating for "Decent Work and Economic Growth," intersects with green bonds in arenas like job creation, especially within green supply chains. The potential impact of green bonds extends even further. Using the United Nations' data as a background, an initial exploration reveals profound inter-linkages. For instance, SDG Goal 8.1, which vouches for "Sustainable Economic Growth," is woven into the fabric of green bond issuance. Figures 1 and 2 showcase these connections, highlighting synergies with Goals 6, 7, and 14, while also revealing potential trade-offs.

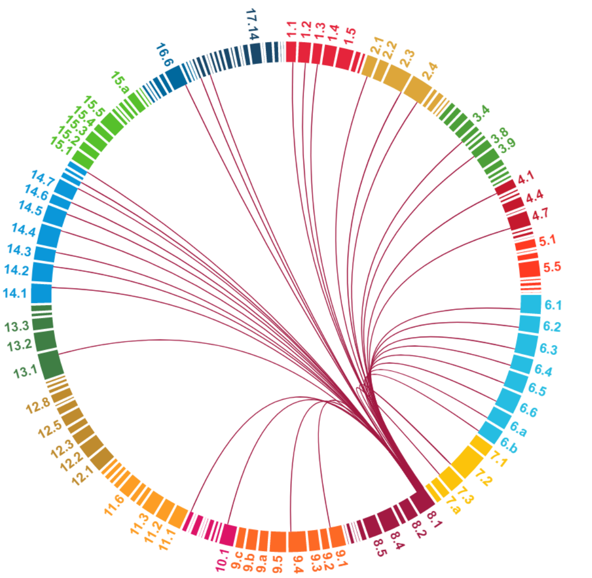

Figure 1: Synergies of Sustainable Development Goal 8.1 (Joint Research Centre (JRC), 2023)

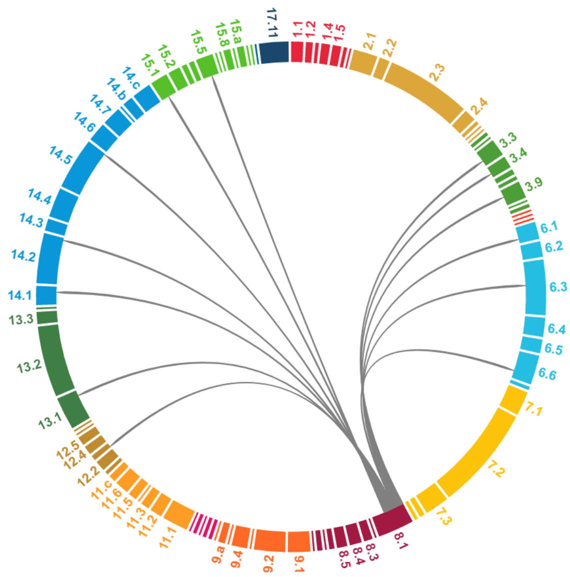

Figure 2: Trade-offs of Sustainable Development Goal 8.1 (Joint Research Centre (JRC), 2023)

Serving as foundational pillars, the SDGs not only influence the trajectory of green finance but also establish the research's underpinnings. While the SDGs offer an overarching structure, the core research spotlights the tangible impacts of green bonds. Hence it must be noted that the SDGs are the backbone of this financial evolution.

A full mapping of the SDGs and Green Bond Principles with a deep dive in goals that are aligned is provided in Appendix A.

2.2 Green Finance and Sustainable Finance: An Evolution towards Sustainable Development

The 21st century saw the global financial industry awaken for the need for sustainability and environmental responsibility. With the global challenges of climate change, biodiversity loss, and increasing inequalities, there is a growing consensus for financial strategies that align with sustainable development (Morton, Pencheon, & Squires, 2017). Green finance and sustainable finance, though related, refer to different dimensions of this emerging paradigm. Green finance primarily emphasizes on investments that generate positive environmental outcomes, such as projects addressing renewable energy, pollution reduction, and conservation. Sustainable finance, on the other hand, envelops a broader scope - incorporating (ESG) factors (Hong, Karolyi, & Scheinkman, 2020). For instance, while a solar panel project would be classified under green finance, a project that promotes gender equality in underprivileged communities might find support under sustainable finance, given its social focus. A more detailed explanation on sustainable finance terminology is presented in B.

The growth trajectory of green and sustainable finance has been significant. As of 2020, assets under sustainable finance strategies amounted to over $30 trillion, reflecting a 68% surge since 2014 (Henisz, Koller, & Nuttall, 2019). This growth is not just a signal of increasing investor consciousness but also signifies the economic potential these strategies hold in terms of market performance, job creation, and risk mitigation. The development of green bonds can be seen in figure 3. However, there are challenges. A significant concern is the lack of standardized criteria to define what is 'green' or 'sustainable', leading to potential misuse and ambiguity. This has given rise to 'greenwashing', where projects are falsely presented as environmentally-friendly without significant evidence (de Freitas Netto, Sobral, Ribeiro, & Soares, 2020).

The European Investment Bank's (EIB) shows a positive example of sustainable finance. Their investments in clean transport projects across Europe have reduced carbon emissions while simultaneously positively impacting local economies (European Investment Bank, 2022). On the other hand, some green bonds have been criticised for not being transparent about how their funds are used, highlighting the need for stricter standards (Axios, 2023) Technologies, such as blockchain, can offer solutions to some of these challenges. They can provide a transparent record of transactions, ensuring that green bond funds are used for their intended purpose. Furthermore, artificial intelligence (AI) can be used to monitor and verify the environmental impact of projects, further enhancing transparency and accountability.

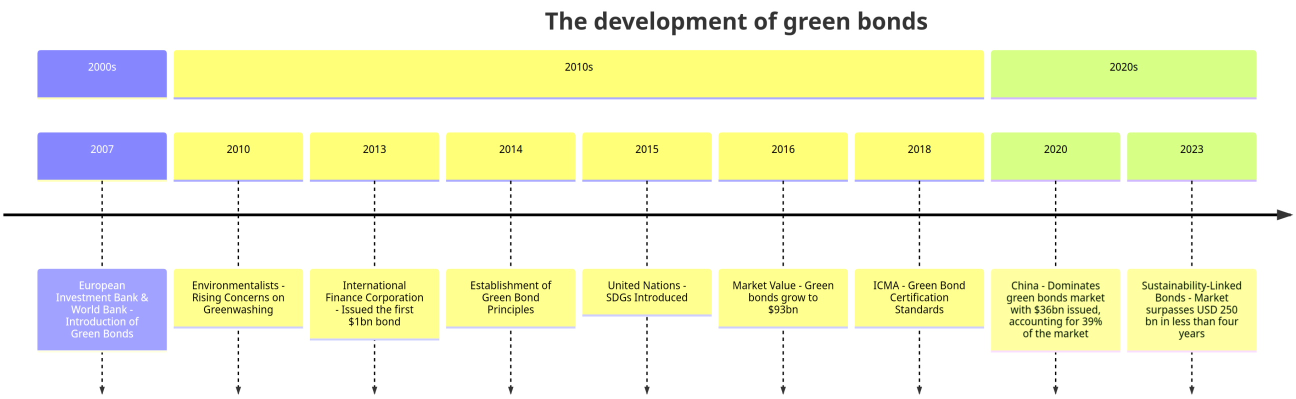

Figure 3: Development of the green bond - A timeline (own image)

2.3 Status Quo of Green bonds

Beginning with a definition: green bonds, as identified by the International Capital Market Association (ICMA), are "any type of bond instrument where the proceeds will be exclusively applied to finance or refinance, in part or in full, new and/or existing eligible green projects and which are aligned with the four components of the GBP" (International Capital Market Association, 2022). While this research will utilize this definition, it is worth noting that various institutions have put forth their own interpretations, which are catalogued in appendix B. Notably, the European Investment Bank and the World Bank are principal issuers of green bonds. Their commitment towards financing projects resonates with the United Nations' Sustainable Development Goals, exemplifying the global thrust towards sustainability (Migliorelli, 2018). The growing interest in green bonds is shown in figure 12, where a near-exponential growth in issuance is happening. By 2022, green bonds' issuance soared to a value of approximately 275 billion euros. This figure shows the growing interest, particularly from financial corporates and sovereign entities. A pivotal moment in the sovereign green bond space occurred when the Dutch finance ministry, a triple-A rated government, ventured into green bond issuance, amplifying the trend further (Berrou, Dessertine, & Migliorelli, 2019).

Note: The figure has a cutoff of data in 2022. The most recent data for 2022 is elaborated in appendix C.

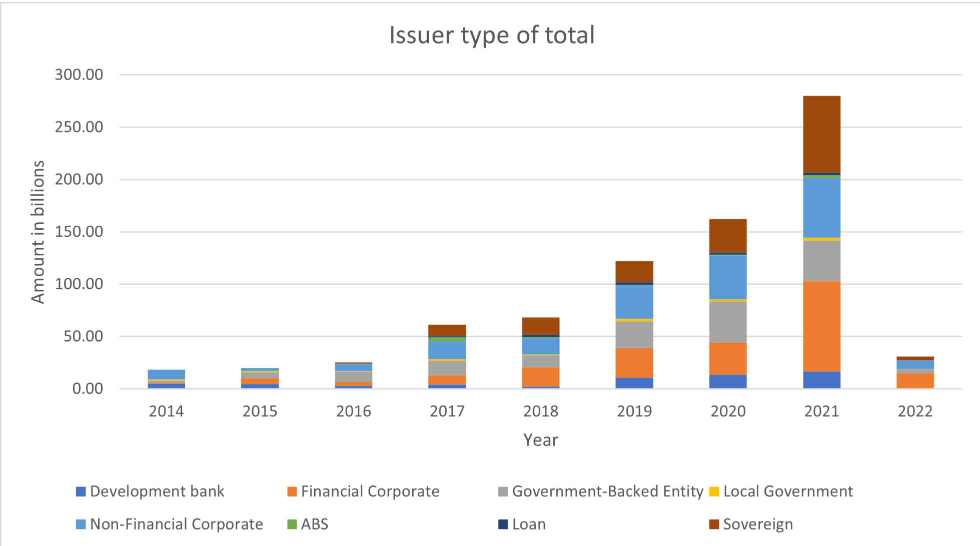

Figure 4: Green Bond Issuance from 2014 to current (own image, based on (Climate Bonds Initiative, 2023))

A regional breakdown in figure 5 demonstrates the dominance of Europe's robust economies in the green bond market. With France leading at 160 billion euros issued, Germany and the Netherlands closely follow with 145 billion Euros and 70 billion Euros respectively.

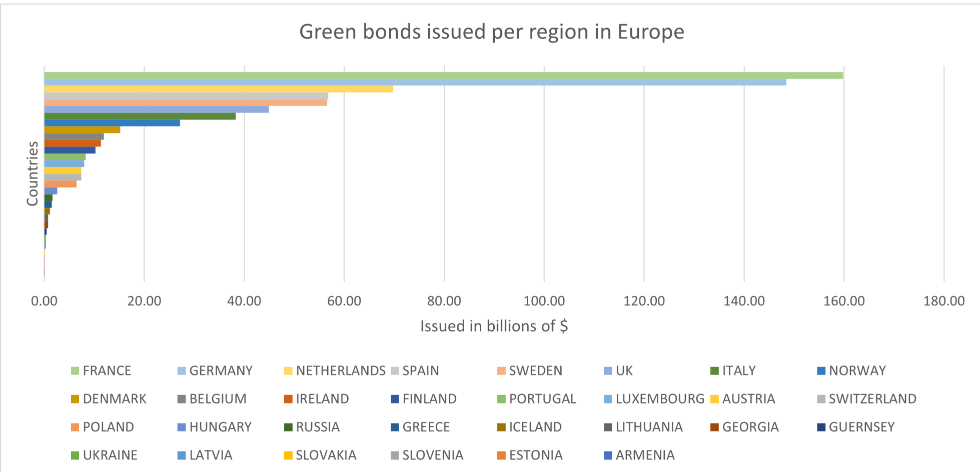

Figure 5: Green bonds issuance per region $ (own image based on (Climate Bonds Initiative, 2023))

The year 2023 started energetically for the green bond market. The first quarter alone witnessed the addition of $125 billion worth of bonds, totalling to a cumulative volume of $2,3 trillion (Bloomberg, 2023). Despite facing a momentary dip due to the Sillicon Valley Bank (SVB) debacle, the market rebounded in April. Germany emerged as a primary contributor, accounting for a sizable 12% of the total green bond issuance. Following closely were China and supranational organizations (SNAT), with the private sector, particularly financial corporates, constituting over half the issuances.

However, the spotlight on green bonds has illuminated certain challenges. The concept of 'greenwashing' is prominent, where issuers might falsely label bonds as 'green' without evidence of the environmental benefits. Such practices threaten the market's integrity. Concerning was a study by Axios (2023), it unveiled that a mere 28% of green bonds contain explicit terms holding issuers accountable to their environmental pledges. In response, the European Union, in 2023, pioneered the European Green Bonds Standard (EUGBS). Embedded within the European Green Deal framework, the EUGBS prescribes that a minimum of 85% of proceeds be allocated to activities that are in line with the Taxonomy Regulation (Macchiavello & Siri, 2022). This initiative is supposed to be the most prominent action against greenwashing.

Reinforcing the need for transparency, the recent banking failures involving Silvergate Bank, the SVB, and Signature bank highlighted the need for genuine and effective green bond offerings. Recognizing the dual challenge of supporting green initiatives while maintaining credibility, the International Capital Market Association (ICMA) has brought forward the Green Bond Principles (GBP). These guidelines make a framework for issuers, emphasizing disclosure on the use of proceeds, project evaluation, funds management, and the project's environmental footprint (International Capital Market Association, 2022). Through the GBP, the ICMA aspires to improve transparency, strengthening the green bond market's integrity.

A full visualisation of the green bond market with her trends is visualized and elaborated in appendix C.

3 Literature review and hypotheses development

3.1 Review of Studies on Green Bonds and Sustainable Finance

The first research on green bonds was a panel dataset of 300 billion in green bonds issued in 49 countries between 2007 and 2017, which tried to determine the drivers of the green bond market (Tolliver, Keeley, & Managi, 2020). Thereafter in 2019, a study was done on the proceeds allocations of green bonds by using a circle plot analysis to locate the allocation trends within the green sectors. They found that renewable energy and other projects that address high-priority carbon reduction targets receive bigger proportions of green bond proceeds than other projects. The vast majority of literature is focused on examining the connection between green bonds and green energy consumption. For example, the study of (Wang, Zhao, Jiang, & Li, 2022) finds that green bonds issuance has multiple economic and social advantages. Similar to this study, yet geographically delineated to the Peoples Republic of China and using the Wavelet Power Spectrum, Sun, Guan, Cao, and Bao (2022) finds a positive impact on green energy development. Other research investigates green financing tools and claims that this causes GDP growth through enhancing private participation in green projects (Zhang, Liu, & Baloch, 2022).

McKinnon (1973), King and Levine (1993), and Christopoulos and Tsionas (2004) established a causal link between financial development and economic growth. Other authors state that a bi-directional relationship and state that financial and economic development actually reinforce each other (Patrick, 1966), (Blackburn & Hung, 1998). Although the concept and these studies are dated, they are still highly relevant in terms of green bonds. Glomsrød and Wei (2018) argues that diverting green finance from fossil fuel industries could increase GDP through job creation in the renewable energy sector. (Wang et al., 2022) further analyzed that green bonds contribute to sustainable development, (Feng et al., 2022) emphasized that governmental policies are crucial in promoting green finance for the post-COVID-19 economic recovery. The study analyzes a group of countries in the Belt Road Initiative [1] (BRI) through a time period of 2008-2018. The study finds that government policies are crucial to implementing green financing tools for green recovery of the economy after the COVID-19 time period. Moreover, (Uddin, Jayasekera, Park, Luo, & Tian, 2022) shows that green finance can have spillover effects on local and global economies and that green finance provides a better basis for achieving sustainable development. In other research, green bonds were helpful in providing advantages for shareholders leading to improvement in the green capital markets (Tang & Zhang, 2020). Understanding the possible ways green bonds

[1] The BRI is a program consisting of 149 countries all over the world with the ambition to develop two new trade routes concerning China with the rest of the world

can have an impact on financial markets and economic development is crucial for positioning the paper in the body of literature.

One possible channel through which green bonds could contribute to sustainability goals is by increasing investment in environmentally friendly projects, such as renewable energy infrastructure and clean transportation initiatives. By providing a reliable and transparent means of financing these projects, green bonds may incentivize more private investment in sustainable projects and reduce reliance on government funding. The study of (Tolliver et al., 2020) supports this idea, stating that all countries in Europe try to promote green financing tools, and green bonds are among the most appropriate instruments. This statement points to the importance of this research in Europe. Another channel in terms of economic growth could be because green bonds provide a competitive advantage to issuers by providing lower borrowing costs than traditional bonds. This can lead to an increase in investment in green projects, which in turn can lead to job creation and economic growth. On top of that, the transparency and reporting requirements for green bonds possibly increase investor confidence, which is why they can attract more investment capital. This relates back to the fact that sustainable business models have less volatility in earnings (Umar, Ji, Mirza, & Naqvi, 2021). This means that borrowers with less credit risk means lenders such as banks can benefit from lower capital requirements. Through another mechanism, such as financial deepening, financial development can actually lead to environmental degradation.

This dynamic is closely related to the Jevons Paradox, where improvements can paradoxically result in increased consumption and utilization of resources (Alcott, 2005). Hypothetically this would work as follows: Financial development attracts foreign direct investment (FDI), which in turn encourages economic growth. Economic growth often leads to higher energy consumption which leads to environmental degradation (Shahbaz, Nasir, & Roubaud, 2018). Just as the Jevons Paradox posits that increased efficiency in resource use might lead to greater overall consumption due tue reduced costs, the broader accessibility and deepening of financial markets can induce greater economic activity, potentially intensifying environmental impacts. When markets flourish and credit becomes more available to consumers, it increases purchasing power and demand for energy-intensive products. This will also lead to higher levels of pollution as these products are consumed in greater quantities (Agbloyor, Gyeke-Dako, Kuipo, & Abor, 2016). Regulators play a vital role in shaping the green finance industry in promoting green finance (Chen & Feng, 2019). Finally, in the EU, adopting these environmentally friendly practices has actually shown to improve financial flexibility and access to credit markets (Fernández-Cuesta, Castro, Tascon, & Castano, 2019). Therefore, it is interesting to do further research in the context of EU countries.

The role of green bonds in shaping the dynamics of job creation and destruction is a complex issue. It is underpinned by several economic theories and empirical observations. Firstly, it must be acknowledged that investment plays a critical role in job creation. As a fundamental factor of Keynesian economics, an increase in investment leads to an expansion in aggregate demand, stimulating economic activity and, followed by, job creation. Green bonds, serving as a vehicle for channelling private capital into green projects, are thus likely to contribute to job creation through their investment stimulus effects (Lund & Hvelplund, 2012).However, the extent of this job creation could be influenced by various factors. One is the relative labor intensity of different sectors. Economic sectors vary widely in their labor intensity, which refers to the amount of labor employed per unit of capital or output. Renewable energy sectors, such as wind and solar power, are often more labor-intensive than traditional fossil fuel sectors. This means that a shift in capital from fossil fuels towards renewable energy, facilitated by green bond issuance, is likely to result in net job creation (Bulavskaya & Reynès, 2018; Dvořák, Martinát, der Horst, Frantál, & Turečková, 2017). This process of job creation is also influenced by technological change, which can lead to shifts in labor demand across different skill groups. For example, renewable energy technologies might require more specialized skills than traditional energy technologies, potentially increasing the demand for skilled labor and decreasing the demand for unskilled labor. This could contribute to a "greening" of jobs but could also result in skill mismatches in the labor market (Aldieri, Grafström, Sundström, & Vinci, 2020).

The geographic delineation of job creation is relevant. When industries shift towards renewable energy, jobs might be created in different locations based on the distribution of renewable resources, presence or absence of policies, and differences in labor and energy costs. For example, manufacturing jobs in the renewable energy sector have been transitioning from countries in the Global North to those in the Global South [2] , while jobs in

[2] The terms 'Global North' and 'Global South' serve as general classifications rooted in historical, economic, and geopolitical contexts. Notably, the 'Global South' includes countries with diverse economic profiles. China, for instance, while geographically and historically categorized within the 'Global South,' stands as one of the world's leading economies. In this context, the shift in manufacturing jobs is primarily driven by factors such as production costs and industrial capacity, which are favorable in many countries traditionally classified as being in the Global South (Odeh, 2010).

project planning, installation, and maintenance tend to remain local (Sooriyaarachchi, Tsai, El Khatib, Farid, & Mezher, 2015).

The impact of green bond issuance on job creation could also be amplified through multiplier effects. Multiplier effects occur when an initial increase in spending leads to further rounds of spending, amplifying the initial impact. For example, the investment stimulated by green bond issuance could lead to increased demand for goods and services in the economy, leading to further job creation (Feyrer & Sacerdote, 2011). However, there could also be job destruction effects. As economies transition towards greener growth paths, certain sectors such as coal mining or oil drilling might decline, leading to job losses. Green bonds could contribute to job destruction in these sectors by accelerating this contraction. However, such job destruction might be outweighed by job creation in renewable energy and other green sectors (Sun, Gao, Tian, & Guan, 2023).

3.2 Hypotheses development

The literature presents a diverse range of findings on the relationship between green bonds, economic activity and labor market dynamics. While some studies, such as (Lund & Hvelplund, 2012) and (Sun et al., 2023), suggest that green bonds can stimulate investment in sustainable projects leading to job creation, others argue that they might result in job losses in sectors not aligned with sustainable growth. While both are possible it is likely that both job creation and destruction will happen at the same time. This is called the notion of creative destruction Schumpeter (1942). Given the economic significance of labor market dynamics and the rising prominence of green bonds, it is crucial to delve deeper into this relationship. Since the direction of the effect is not clear, two hypotheses are formulated:

***H_{1a}*:** Green bond issuance is correlated with job creation

***H_{1b}*:** Green bond issuance is correlated with job destruction.

The second hypothesis is derived from the more sector-specific impacts of green bonds. The studies by (Dvořák et al., 2017) and (Bulavskaya & Reynès, 2018) highlight that labor-intensive industries such as the renewable energy sector, might witness net job creation as capital shifts towards them. However, it is essential to underline that the effects and implications of green bonds can vary significantly across industries. Specifically, industries with a lot of potential for sustainable transformation such as agriculture and mining can witness this shift quicker, or more significantly. Agriculture, which plays a key role in ensuring food security has a strong capacity to move into more sustainable practices such as organic farming, agroforestry and permaculture. Green bond financing projects in this industry could boost innovations that combine productivity together with sustainable responsibility, leading to bigger impacts in this industry.

Mining, traditionally associated with significant environmental degradation, stands at a crossroad. As the global push towards sustainability gains momentum, sectors like mining, which have historically been perceived as less environmentally friendly, might find it challenging to attract financing from green bonds. This could be due to the criteria for environmental impact and sustainability that projects need to meet to be eligible for green bond financing. Furthermore, with the idea of green bonds and the pressure on industries to transition to sustainable practices, it is possible that investments in traditional mining projects decline, leading to job contractions in areas that fail to adapt. A shift like this could accelerate the evolution of the mining industry towards practices that are less destructive, conserving resources, reducing waste, and minimizing habitat disruption. Techniques such as reclamation might become standard practice, driven by both a need for industry sustainability and potential access to green bond capital. However, reclamation, while crucial, is a remedial approach and might not offset the potential job losses from reduced traditional mining activities. Moreover, as industries grow towards sustainable practices backed by green bond financing, minerals essential for green technologies, such as lithium for batteries, may witness a surge in demand. It presents an avenue where green bond financing could indirectly influence job creation in certain mining sectors aligned with the sustainable development agenda. While the potential exists for specific segments of the mining industry to benefit from the transition to sustainable practices and green technology demand, it is equally plausible that segments of the industry might face job destruction due to decreased investments in conventional mining projects. By focusing on specific industries, the aim is to provide a more nuanced understanding of the implications of green bonds issuance within the realm of green finance. The second hypothesis is formulated as:

H2: Green bond issuance affects employment positively in sectors aligned with sustainable growth such as Agriculture (A) and Information and Communication (J).

3.3 Summary

The existing literature unveils nuances surrounding the connection between green bonds, their economic impacts, and ensuing labor market implications. Important works by (McKinnon, 1973), (King & Levine, 1993), (Christopoulos & Tsionas, 2004), and (Glomsrød & Wei, 2018) state the essence of green bond and their potential to boost GDP growth while still fostering sustainable development. Most of the literature highlights the nexus between finance and growth, as delineated in chapter 3.1, there remains a gap concerning empirical evaluations of green bonds and their role in Schumpeterian's creative destruction[3].

Figure 6 represents the conceptual framework for the research. Showing the pathway of capital markets in the context of green bonds. Traditionally, capital markets have been the way for both governments and corporate bodies to raise capital through bond issuance. The capital, funneled through conventional bonds, is typically distributed across all types of projects. Fundamental economic reasoning here is that an infusion of capital spurs economic activity according to the Keynesian multiplier effect (Jahan, Mahmud, & Papageorgiou, 2014) and ultimately leading to job creation.

New in the scene are the green bonds, a significant financial instrument. Unlike conventional bonds that funnel capital to all types of projects, they direct capital exclusively towards sustainable projects. The premise is that the bonds, by focusing on these projects, might also spur economic activity and foster job creation. However, the link is still hypothetical in the concerns of greenwashing.

The framework below speculates a shift in capital - both in capital and human. The shift is perceived to migrate from conventional (non- sustainable) towards sustainable sectors. It is tempting to assume there is a redirection from the amount of conventional bonds towards green bonds, hence concrete evidence is not available. The question here is if this capital redirection, especially human capital, indeed boosts job creation within sustainable industries. The effect of green bonds are supposed to have a broader impact. Even though beyond the scope of this research, green bonds are said to have a positive impact on increased decency of work, further industry innovation and infrastructure, greater amount of affordable and clean energy and further climate actions (United Nations, 2014).

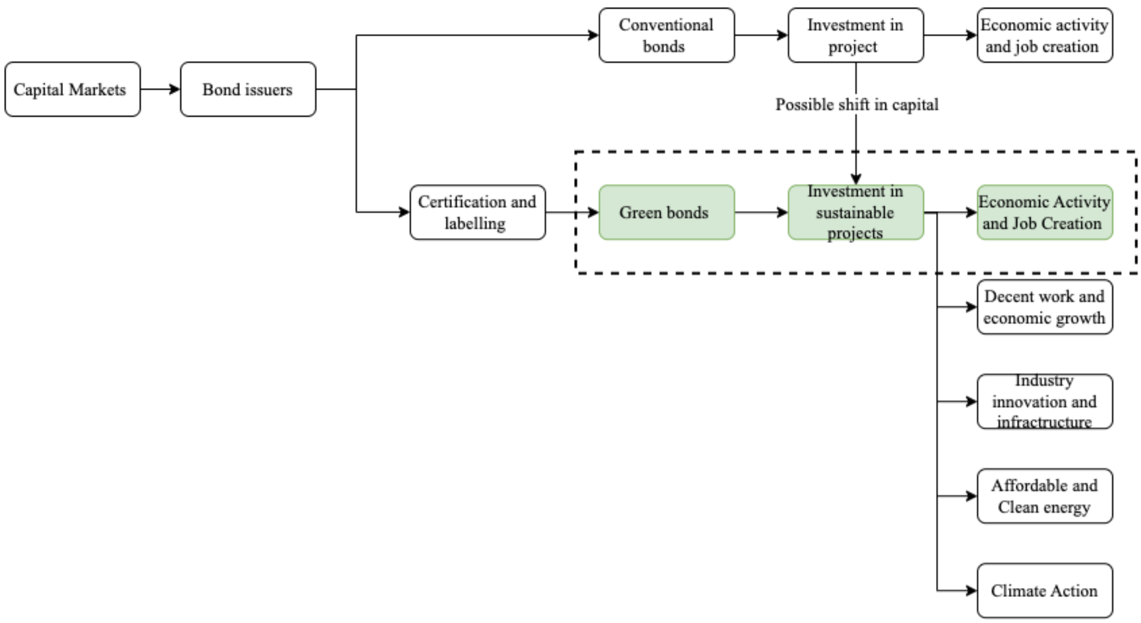

Figure 6: Conceptual framework for the research (own image)

[3]Schumpeter's doctrine of creative destruction posits that emergent technologies will replace their antecedents (Schumpeter, 1942).

4 Data and variables

In this research, the aim is to examine the influence of green bond issuance on labor market dynamics, more specifically job creation and destruction. Since data on job creation is not directly available, proxies were chosen instead. Intertwined dynamics of the job vacancy rate and employment levels can serve as a proxy to show certain patterns of job creation or destruction within an economy. Specifically, when a lower job vacancy rate is observed coupled with lower employment this can indicate potential issues in the job market, possibly stagnation or job destruction. On the other hand, a low job vacancy rate with higher employment might suggest that most of the available jobs are filled, pointing toward an efficient labor market. A high job vacancy rate combined with low employment can indicate mismatches in the labor market, where the needed skills required by the workforce are not met. The last combination is a high job vacancy rate combined with high employment, this might suggest that the economy is growing and jobs are being created faster than they can be filled. This is the proxy for job creation.

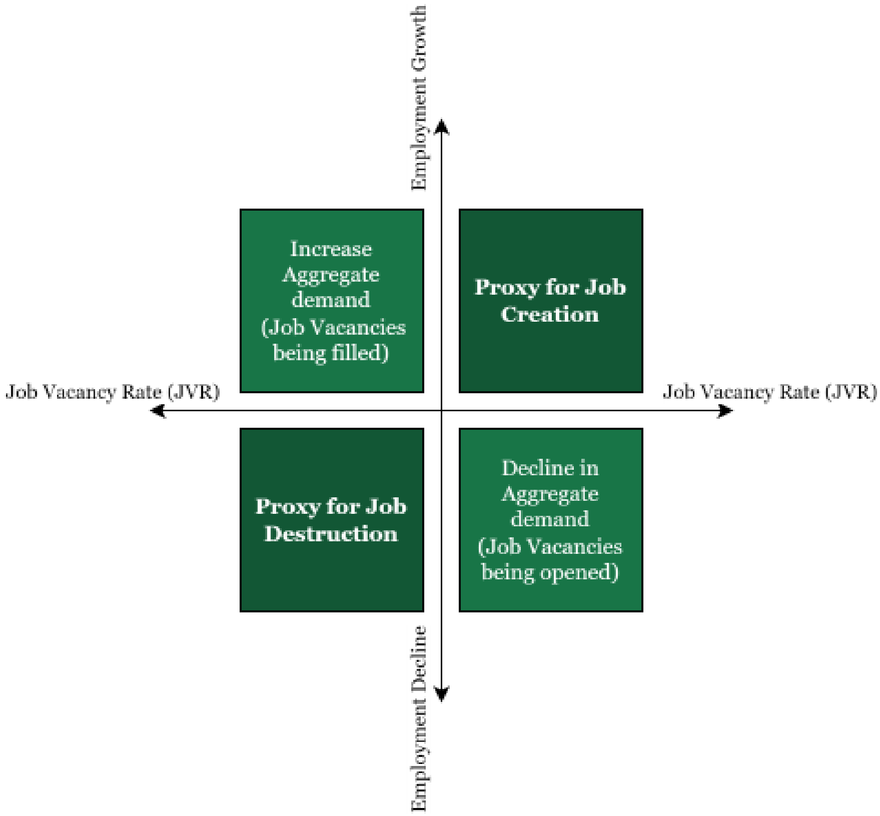

Figure 7: Proxy for job creation and destruction with employment and job vacancy rate (Own image)

Note: Visual representation of how models can be interpreted as a proxy for job creation or destruction. With the four planes each representing an increase or decline in the Job Vacancy Rate (JVR) or change in employment in the specific industries

The primary resource for green bond data has been the Climate Bonds Initiative (CBI). The CBI, with its overarching mission to mobilize global capital for climate action, screens self-labelled bonds. Upon deeming them eligible based on criteria such as alignment with the Climate Bonds Certification, Green Bond Principles, and specific industry descriptions like Energy, Transport, Land Use & Marine Resources, Water, and Waste, these bonds are integrated into their Green Bond Database. However, it's worth noting the selective nature of this database. While it does encompass bonds meeting the criteria from 2014 to 2022, it excludes non-aligned green bonds and Social & Sustainability Bonds. Consequently, there exist more self-labeled green bonds in the market than this study can account for. The CBI's database does not offer export features for granular data. For this reason, data was manually extracted. This led to the compilation of a dataset encompassing green bond issuance from 47 OECD countries over the years 2014 to 2022, the totalling amount of green bond issued in this dataset is approximately 1.6 trillion dollars. Initially, the ambition was to integrate the job vacancy rate as a pivotal research indicator. However, comprehensive JVR data was unobtainable for the entirety of the chosen OECD countries. This limitation restricted the in-depth examination to 23 countries.

Table 1: Comparison of Countries in Dataset

Common Countries		**Unique Countries**	
Austria	Italy	Armenia	Mexico
Belgium	Latvia	Australia	New Zealand
Czechia	Lithuania	Bulgaria	Republic Of Korea
Estonia	Luxembourg	Canada	Romania
Germany	Netherlands	Chile	Russia
Greece	Norway	Colombia	Serbia
Hungary	Poland	Costa Rica	Turkey
Iceland	Portugal	Croatia	Ukraine
Ireland	Slovakia	Cyprus	United States
Switzerland	Slovenia	Denmark	
Sweden	Spain	Finland	
United Kingdom		France	

Employment data (per industry) is compiled for these 23 OECD nations from four distinct sources: The Worldbank, International Labour Organization (ILO), OECD Library, and Eurostat. Primary reliance was on data from the ILO and OECD, while the Worldbank and Eurostat data were used to fill in gaps. The ILO, a UN body, emphasizes promoting decent work for social justice. The extracted data represents employment for working-age individuals based on the ISIC's 4th revision. Given the usage of different ISIC revisions by the data sources, potential discrepancies and their impact will be addressed in Appendix D, including an outline of the ISIC classifications.

4.1 Dependent variable

This research employs the Job Vacancy Rate (JVR) as a metric to empirically investigate the impact of green bond issuance on job dynamics. The JVR offers a window into the labor market by connecting overall employment numbers with the total job vacancies available within a country. As the hypothesis suggests a correlation between green bond issuance and job fluctuations, fluctuations in the JVR serve as a reflection of this potential link.

For a comprehensive analysis, not just the overall employment data is considered, but also the industry-specific figures. The data for these industries was aligned with the International Standard Industrial Classification of All Economic Activities (ISIC) revision 4, a standard devised to ensure consistent research and statistical examination on a global scale. Gathering this data was not without its challenges, as OECD nations often use varied ISIC classification revisions. To prevent this inconsistency, data from multiple classifications is synthesized into one cohesive dataset.

4.2 Independent variables

Green bond issuance in dollars is chosen as the independent variable since data on green bond allocation in industries is not available. The annual volume of green bonds issued within the specific time period can be used. This measure is expressed in absolute terms in billions of USD in the specific year. Green bonds can be issued by different institutions, governments and corporations. The issuer of the green bonds pledged to allocate the funds raised towards projects that are expected to generate sustainable outcomes. The details of these projects are laid out in a framework named the Green Bond Principles (GBP). The green bonds differ in structure and can have different coupon rates, maturities and underwriting processes. Only domestic green bonds are taken into account. This means that the issuance of supranational organisations, which counts for roughly 10,2%[4] is excluded. The data is from a reputable source (ICMA, 2022) and the bonds are regulated by market authorities with third-party reviews to validate the green credentials of these bonds. This makes this variable robust and reliable for empirical calculations.

[4]The amount of green bond issuance by supranational organizations in Europe is roughly calculated to be 153 billion USD over the years from 2014 until 2022. This is based on only calculations using data from Climate Bonds Initiative (2023)

4.3 Control variables

Population size Population size is a common control variable in econometric studies, utilized to account for the inherent economic variations among different countries. A larger population often refers to a larger economy, which can significantly influence the coefficient of interest. For instance, countries with larger populations tend to have larger labor markets and more consumers, impacting both the demand and supply dynamics in bond markets. In panel data regression, controlling for population size is crucial as it helps accommodate the cross-sectional heterogeneity among different countries over time, potentially mitigating omitted variable bias.

Unemployment Unemployment is an economic indicator, often serving as a signal of an economy's health. It denotes the proportion of the labor force that, although unemployed, remains actively engaged in job-seeking activities. Elevated unemployment rates typically go with economic inefficiencies or even recessionary periods, whereas low rates might signify economic robustness. From an economic perspective, unemployment affects both the demand for green bonds and the JVR. Times marked by high unemployment, people have less money to spend, it lowers private consumption which is extended to reduced investments in instruments including green bonds. Moreover, the unemployment rate does not suddenly change from high to low in one month. It is likely to be similar the next months. This can be a cause for autocorrelation in the model.

Interest Rates Short-term interest rates, which primarily dictate borrowing costs and savings returns over short horizons, are important factors influencing lending, and investment behaviours. Elevated short-term rates enhance the appeal of bonds and fixed-income instruments compared to equities due to potentially higher yields. An uptick in these rates could improve green bond demand. Hence on the other side, more costly borrowing by these rates discourages potential bond issuers. As for the JVR, short-term interest rates have substantial influence on businesses, both for growth and retraction. Much like unemployment, short-term interest rates may show autocorrelation, making historical rates potentially indicative of current values. A positive coefficient here indicates that as interest rates climb, so does green bond issuance, with other factors remaining unchanged.

Relative Industry Size In examining industry-level dynamics, the relative size of an industry (RIS) versus overall employment across industries is a vital control variable. The magnitude and contribution of a particular industry within a countries economy is captured by this variable. Industries responsible for larger employment proportion might show heightened job creation merely to their size. Conversely, sectors with smaller employment proportions might not impact the results at all. Incorporating the industry employment proportion against the overarching employment matrix ensures that observed green bond effects on employment are not just mirroring the growth trajectories or sizes of specific industries.

Domestic Credit to Private Sector by Banks Another pivotal control variable is the domestic credit extended to the private sector by banks. These loans represent an alternative financial channel. By controlling for this variable, the study seeks to isolate the specific effects of green bonds from other prevalent financing mechanisms in the market. An economy with a lot of bank credit might see less reliance on bond financing, influencing the patterns of green bond issuance. Conversely, if bank credits are scarce, bond issuance, including green bonds, might surge as businesses seek alternative capital sources.

Table 2: Summary of Variables in Model 1 and Model 2

Type	**Name**	**Symbol**	**Unit**	**Source**
Dependent	Job Vacancy Rate	JVR	%	EuroStat
Dependent	Employment	EMPL	People (Log)	Worldbank
Independent	Green Bond Issuance	GBI	USD Billions (Log)	Climate Bonds Init.
Control	Population	POP	People (Log)	OECD Data
Control	Unemployment	UNemp	% of workforce	Worldbank
Control	Interest rate	INTR	%	OECD Data
Control	Relative Industry Size	RIS	% of country employment	-
Control	Domestic credit	DOMcr	% of GDP	Worldbank

Table 3 provides a snapshot of key economic indicators over the observed period. The log-transformed Green Bond Issuance (GBI) indicates a left-skewed distribution with a mean of 13.25, and a relatively moderate variability. Similarly, the Employment and Population, both log-transformed, show marginal leftward and normal skews respectively, as deduced from their means and medians. In contrast, the Job Vacancy Rate and Unemployment rates both show right-skewed distributions. Particularly, the considerable range in unemployment reflects possible economic disparities during specific periods or regions. Interest Rates show a volatile environment, evidenced by the presence of negative rates and a significant range ending at 9.97%. Domestic Credit also shows broad variability, with data ranging from 27.86% to as high as 183.93% of GDP. In summary, the indicators highlight a varied economic landscape with certain areas, like interest rates and unemployment, showing considerable fluctuations, while others, such as population, remain relatively stable. The statistics do not reflect the underlying relationships between the variables.

Table 3: Descriptive statistics for various indicators.

	Obs.	**Mean**	**Median**	**Std.**	**Min**	**Max**
Green Bond Issuance	198	3.41	0.39	8.00	0.00	62.64
Employment	540	8.22	8.42	1.41	5.11	10.69
Job Vacancy Rate	405	1.80	1.60	1.04	0.40	6.20
Unemployment	473	7.90	6.36	4.93	2.01	27.47
Interest rates	514	0.54	0.21	1.45	-0.82	9.97
Domestic Credit	524	86.79	84.18	36.52	27.86	183.93
Population	563	15.87	16.10	1.43	12.67	18.24

4.4 Econometric Models

The central hypothesis, as delineated in chapter 3, marks an impact of green bonds on labor market dynamics, primarily because of a possible shift in human capital from non-sustainable to sustainable ventures. This shift is materialized through the occurrence of job creation or destruction in different industries. To show these dynamics, the empirical strategy is based on two central outcome variables: job vacancy rates and employment. A two-step empirical approach is adopted, based on panel data models. These models are meant for accounting for unobserved time-constant country heterogeneity and temporal shocks.[5]

In the first model, the focus lies on the aggregate employment in countries, not taking into account different industries. It seeks to find a relationship between green bond issuance—the primary independent variable—and employment dynamics. The second model introduces a more detailed perspective, analyzing the industry-specific impacts. By employing a three-dimensional panel data model, this approach allows for a deeper understanding of industry variations in response to green bond issuance. Given the nature of green bond issuance data, a natural logarithm transformation is utilized. Such a transformation facilitates better interpreting and limits the influence of extreme values. The logarithm of zero is undefined, therefor one has been added for all values, a small value compared to the median of 0.39 billion for green bonds.

$$\text{JVR}_{ct} = \alpha + \beta_1(\text{GBI}_{ct}) + \text{Control Variables}_{ct} + \lambda_c + \tau_t + \epsilon_{ct} \tag{1}$$

$$\text{EMPL}_{ict} = \alpha + \beta_1(\text{GBI}_{ct}) + \text{Control Variables}_{ct} + \lambda_i + \mu_c + \tau_t + \epsilon_{ict} \tag{2}$$

Considering the two hypotheses (chapter 3), job creation and job destruction are one of the possible outcomes of the models. If both the job vacancy rate and the employment decrease, it suggests a decline in the labor market suggesting job destruction. However, the expectation is to see an indication for job creation, with both the coefficient for job vacancy rate, and employment being positive. The log transformation of the employment variable makes the model elastic, meaning that the relationship is proportional, a 1% change in one direction of GBI results in the coefficient, multiplied by that 1% for employment.

[5]Temporal shocks encompass events that are time-specific and exert influence across all units under observation. Examples include political happenings, financial crises, natural disasters, and globally consequential events such as the COVID-19 pandemic, which has demonstrably affected the economic variables (Barrero, Bloom, & Davis, 2020).

4.5 Pearsons' R and Variance Inflation Factor (VIF)

Before continuing with the regressions, it is important to understand the relationship between the variables. The underlying relationship between the independent variable and control variables can significantly impact the regression results. When highly correlated, this can lead to multicollinearity which makes it difficult to isolate the effects of the main predictor of interest.

The correlation matrix presented in table 4 below provides a snapshot of the linear relationships between all variables. The preliminary analysis using the Pearson's R found no significant concerns of multicollinearity.

Table 4: Pearson's R correlation matrix for selected variables

	const	**GBI**	**POP**	**UNemp**	**DOMcr**	**INTR**
const	nan	nan	nan	nan	nan	nan
GBI	nan	1.00***	0.33***	-0.14*	0.36***	-0.16**
POP	nan	0.33***	1.00***	0.17**	0.22***	-0.28***
UNemp	nan	-0.14*	0.17**	1.00***	0.14*	-0.24***
DOMcr	nan	0.36***	0.22***	0.14*	1.00***	0.00
INTR	nan	-0.16**	-0.28***	-0.24***	0.00	1.00***

Note: This table presents the Pearson's R correlation matrix for the given variables. The matrix is useful for examining the relationship and strength of the linear relationship between pairs of variables.
*,**,*** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively.

To further address the potential of multicollinearity, the Variance Inflation Factor tool is employed. A VIF value greater than 10 is generally considered to indicate high multicollinearity. The VIF values shown in table 5 below are all below the threshold of 10, suggesting that multicollinearity is not a concern in these regression models.

Table 5: Variance Inflation Factor (VIF)

Variable	VIF Factor
Green Bond Issuance	1.3688
Population	1.2486
Unemployment	1.1910
Domestic Credit to Private Sector by Banks	1.2282
Interest rates	1.1759

5 Empirical findings

5.1 The effect of green bond issuance on employment

5.1.1 Baseline results

The results shown in table 16 provide a preliminary insight into the relationship between green bond issuance and employment levels within OECD countries. Column 1, showcases a simple model without any controls or fixed effects.The formula is as follows:

$$\text{EMPL}_{ct} = \beta_0 + \beta_1 \times \text{GBI}_{ct} + \epsilon_{ct} \tag{3}$$

The β estimate is positive and significant at the 1-percent threshold. The coefficient signifies the elasticity of employment with respect to GBI. Economically argued, this suggests that a 1-percent increase in GBI is correlated to a 0.046 percent increase in employment on average. This means that for example for the Netherlands, for every 1% issuance of green bonds, approximately 4,4 thousand jobs are filled. In other words, for every million euro's in green bonds issued in the Netherlands, employment goes up by 33 people.

Given the log-log model, the effect remains consistent across the different magnitudes of GBI.

Introducing control variables shows that with a coefficient of 0.978, population proves to be an important predictor. A nearly one-on-one relationship is found between population growth and employment growth [6]. Yet even with the introduction of this control variable, the GBI remains a significant determinant of employment. The dynamics shift further upon including more control variables. In column 3, unemployment shows an inverse relationship with employment which is an intuitive result. Further including the short-term interest rates does not change the relationships significantly. However, the coefficient is statistically significant suggesting that within this model framework, interest rates may not be a significant predictor for employment levels in relation to GBI.

Column (5) incorporates domestic credit to the private sector by banks(also known as bank loans). This variable is statistically significant at the 1-percent level, suggesting that an increase in such credit could potentially boost employment. The GBI coefficient becomes statistically insignificant in this specification. Noteworthy to mention is the introduction of fixed effects (FE) in columns (6) and (7), both for country and year. The model is most complex at (7), the formula is shown below:

$$\text{EMPL}_{ct} = \beta_0 + \beta_1 \times \text{GBI}_{ct} + \beta_2 \times \text{POP}_{ct} + \beta_3 \times \text{UNempl}_{ct} + \beta_4 \times \text{DOMcr}_{ct} + \alpha_{\text{Country}_c} + \gamma_{\text{Year}_t} + \epsilon_{ct} \tag{4}$$

By including fixed-effects, the aim is to capture unobservable time-invariant country-specific factors and time-specific global shocks. The coefficients here are not significant, potentially due to overfitting of the model. As can be seen the R-squared in the first model is likely already overfitted, combining the fixed effects with the control variables with little observation can lead to estimation bias (Raudenbush, 2008).

[6]An alternative regression model was run where the impact of the population is included in the dependent variable. This is done by taking a ratio of employment relative to the population. The results can be found in Appendix E

Table 6: The effect of green bond issuance on aggregate employment in OECD countries

	Employment						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	7.6875***	-7.2836***	-7.3084***	-7.3311***	-7.3367***	8.2753***	-5.6306*
	(0.105)	(0.066)	(0.061)	(0.060)	(0.058)	(0.003)	(1.809)
Green Bond Issuance	0.0459***	0.0020***	0.0014***	0.0015***	-0.0001	0.0002	0.0001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Population		0.9782***	0.9832***	0.9843***	0.9823***		0.8750***
		(0.004)	(0.004)	(0.004)	(0.004)		(0.114)
Unemployment			-0.0063***	-0.0060***	-0.0072***		0.0049***
			(0.001)	(0.001)	(0.001)		(0.001)
Interest Rates				0.0067	0.0048		0.0058
				(0.004)	(0.003)		(0.004)
Domestic credit to Private Sector by Banks					0.0012***		-0.0049*
					(0.000)		(0.002)
Country FE	No	No	No	No	No	Yes	Yes
Year FE	No	No	No	No	No	Yes	Yes
Observations	184	184	184	184	179	184	179
Entities	23	23	23	23	23	23	23
R-Squared	0.118	0.997	0.998	0.998	0.999	0.003	0.687
Covariance Type	Robust	Robust	Robust	Robust	Robust	Robust	Robust

Note: This table presents panel estimations of the effect of Green Bond Issuance on Employment in OECD countries over the 2013-2021 period. The sample includes the countries specified in chapter 4. Green bonds, Population, and employment have been log-transformed.
*,**,*** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively.

5.1.2 Industry level results

This three dimensional panel starts with the model worked with in chapter 5.1.1, this time the employment is on a different granular level, denoted with the formula shown below:

$$EMPL_{cit} = \beta_0 + \beta_1 \times GBI_{ct} + \beta_2 \times POP_{ct} + \beta_3 \times UNempl_{ct} + \beta_4 \times DOMcr_{ct} + \alpha_c + \delta_i + \gamma_t + \epsilon_{cit} \tag{5}$$

Fixed effects for Country, Industry and Year are all examined separately. Starting with Column (1) that refrains from including any fixed effects. All variables appear statistically significant in this model. Particularly, the GBI shows a positive relationship with employment, with a coefficient of 0.054, significant at the 1-percent level. This correlation suggests that as green bond issuance rises, employment tends to increase, holding other factors constant. Column (2) introduces country fixed effects, capturing unobservable country-specific characteristics. The significance of the GBI variable disappears in this model. One potential explanation for this shift might be that individual country characteristics—such as regulatory frameworks, environmental policies, or unique economic conditions—might be influential enough to overshadow the isolated effect of GBI on employment. Year and industry fixed effects are progressively incorporated in the next models. These fixed effects offer a more detailed lens, accounting for global shocks and industry-specific trends. The specifications (especially from Column (3) onwards) reveal robust results for most variables. For instance, even with the inclusion of Year and Industry fixed effects in Column (5), the GBI coefficient remains significant with a value of 0.053. This further reinforces the correlation and idea that green financing plays a consistent role in influencing employment outcomes, especially when controlling for global trends and industry-specific interpretations.

From an economic perspective, the positive correlation coefficient for GBI implies that a unit increase in the issuance of green bonds correlates with a rise in employment levels. To put this into perspective: if there is a 1-percent increase in green bond issuance, it is correlated with a 0.053 percent (or 5.3 basis point) increase in employment, all else being equal. For a country with, 1 million employed individuals, this translates to an additional 530 jobs. Furthermore, the impacts of fixed effects analysis are also highlighted by the Lags (Years) in Columns (7), (8), and (9). These columns explore the potential lagged effects of the explanatory variables on employment. The significance across different lags suggests that the effects of some factors on employment might not be immediate but can build up over the next years. However, the mismatch in granularity can lead to inaccuracies in this model. The predictors are now treated as the same for all industries within a country for a given year. This means that the model assumes the effect of GBI is the same across industries. The limitation that the predictor variables are on a country-year level results in the model assuming a uniform effect of all predictors across all industries.

In conclusion, the initial models present a clear correlation between green bond issuance and employment. However, when fixed effects are factored-in, the relationship becomes more complex, especially considering that the predictors apply uniformly across industries. This means the assumption is that every industry in a country reacts the same way to changes in these predictors, which may not always be the case. Despite this limitation, the data still points to an important trend: in OECD countries, there's a notable connection between green finance and job outcomes. This emphasizes the valuable role sustainable financing plays not just for the environment, but also in supporting economic growth and stability.

Table 8: The effect of GBI on employment in OECD countries

	Employment								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	8.524***								
	(0.157)								
Green Bond Issuance	0.054***	0.007	0.062***	0.046***	0.053***	0.008	0.051***	0.050***	0.048***
	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)
Relative Industry Size	24.521***	25.092***	24.502***	17.713***	17.689***	18.492***	17.580***	17.557***	17.495***
	(1.020)	(0.934)	(1.018)	(2.045)	(2.039)	(1.188)	(2.041	(2.043)	(2.042)
Unemployment	0.047***	0.058	0.043***	0.048***	0.044***	0.058	0.043***	0.042***	0.041***
	(0.011)	(0.037)	(0.012)	(0.010)	(0.011)	(0.048)	(0.011)	(0.011)	(0.011)
Interest Rates	0.251***	-0.075	0.241***	0.232***	0.222***	-0.001	0.215***	0.204***	0.195***
	(0.251)	(0.135)	(0.072)	(0.062)	(0.065)	(0.140)	(0.064)	(0.065)	(0.065)
Domestic credit to Private Sector by Banks	0.006***	-0.012	0.004***	0.005***	0.004***	-0.001	0.004***	0.005***	0.005***
	(0.006)	(0.007)	(0.002)	(0.001)	(0.002)	(0.007)	(0.001)	(0.001)	(0.002)
Country FE	No	Yes	No	No	No	Yes	No	No	No
Year FE	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Lags (Years)	No	No	No	No	No	No	1	2	3
Observations	3314	3314	3314	3314	3314	3314	3314	3314	3314
R-Squared	0.20	0.33	0.19	0.34	0.34	0.48	0.34	0.34	0.34
Covariance Type	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust

Note: This table presents 3D panel estimations of the effect of Green Bond Issuance on Employment in OECD countries over the 2013-2021 period. The sample includes the countries specified in chapter 4. Green bonds, Population, and employment have been log-transformed.
*,**,*** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively.

5.1.3 The impact of Green Bonds - An industry Analysis

A separate analysis is conducted on the industry level, estimating the impact of green bond issuance on employment. The same panel data model is used as in the baseline model.

A preliminary overview of the results in table 10 and 11 reveal a varying correlation between Green Bond issuance and employment across different industries. Some industries, like Agriculture, Forestry, and Fishing (ECO_ISIC4_A), Manufacturing (ECO_ISIC4_C), Electricity, Gas, Steam, and Air Conditioning Supply (ECO_ISIC4_D), Water Supply; Sewerage, Waste Management and Remediation Activities (ECO_ISIC4_E), and Construction (ECO_ISIC4_F), show a negative correlation. Sectors like Administrative and Support Service Activities (ECO_ISIC4_N), Human Health and Social Work Activities (ECO_ISIC4_Q), and Activities of Extraterritorial Organizations and Bodies (ECO_ISIC4_U) show a positive correlation.

Given that the variables related to Green Bond Issuance and employment have been log-transformed, essentially, the elasticity of employment regarding green bond issuance is examined. For instance, considering the Manufacturing sector (ECO_ISIC4_C) with a coefficient of -0.016, a 1% increase in Green Bond issuance would lead to approximately a 0.016% decrease in employment, all else being equal. The logarithmic transformation offers a nuanced insight: the relative change in employment for every relative change in Green Bond issuance, emphasizing the percentage impact rather than absolute changes.

The constants across industries, representing the expected level of employment when all influencing variables are zero, display inconsistent significance. In the case of sectors like Agriculture (ECO_ISIC4_A) and Mining and Quarrying (ECO_ISIC4_B), the insignificant constants could point towards a potential oversight of crucial industry-specific determinants of employment not covered in the model.

The observed negative relationship between green bond issuance and employment in sectors such as Agriculture and Manufacturing can be attributed to the capital-intensive nature of sustainable projects within these realms. As industries pivot towards more environmentally friendly endeavors, there's often an inherent shift towards technological investments, potentially sidelining manual labor in the process. For example, the emergence of automated sustainable farming could momentarily diminish the demand for traditional agricultural labor (Arrow, Chenery, Minhas, & Solow, 1961).

Socially, green initiatives introduce tensions. Local communities that are used to traditional practices are faced with economic shifts. Workers skilled in conventional sectors may encounter job displacement or need to reskill (Li, 2022). Systemically, green bonds can increase supply chain issues, especially of they are bound to non-sustainable practices. This aligns with Schumpeter's notion of creative destruction (Schumpeter, 1942). Possibly a policy paradox is in play. While advocating for sustainability, policymakers sustain traditional industries with subsidies to ensure economic stability. This results in a conflicting message. However, for a truly sustainable future, there needs to be a harmonized approach that integrates green financing with policies that ensure economic resilience and inclusivity. The positive relationship in sectors like Human Health and Social Work Activities could be attributed the direct labor requirements of green initiatives within these sectors. Some industries are centered around human resources, such as healthcare and social work. The intrinsic nature of these sectors emphasizes human interaction, care, and expertise. As green initiatives in Human Health and Social Work Activities often involve community outreach, education, and personalized care, they naturally necessitate a larger workforce (Bowen, Kuralbayeva, & Tipoe, 2018).

The relationship between green bond issuance and employment is complex and varies by industry. Some industries see job losses, possibly because sustainable projects in these areas might use more technology and less manual labor. Others see job gains, perhaps because green projects in these areas need more hands-on work. Factors like population and interest rates also play a role in how each industry responds. Overall, it is clear that green bonds can have different impacts on jobs depending on the industry, and it is essential to consider the unique effects when considering the broader role of sustainable finance in the economy.

Table 10: Summary of estimations per industry **(Part 1)** - The effect of GBI on Employment per Industry

	Industry (category according to ISIC Rev.4)											
Variable	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
const	-0.625	-1.416	-4.149***	-3.480***	-5.684***	-2.309***	-2.869***	-2.645***	-4.110***	-2.649***	-2.779***	-1.516**
	(0.426)	(0.872)	(0.454)	(0.338)	(0.313)	(0.250)	(0.291)	(0.247)	(0.317)	(0.223)	(0.518)	(0.695)
Green Bonds	-0.016**	-0.002	-0.015***	-0.005*	-0.006*	-0.009***	-0.002	-0.003	-0.004	-0.001	0.003	0.001
	(0.006)	(0.008)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.005)
POP	0.745***	0.675***	1.146***	0.890***	1.032***	0.942***	1.004***	0.955***	0.985***	0.898***	0.886***	0.744***
	(0.030)	(0.060)	(0.029)	(0.022)	(0.019)	(0.016)	(0.019)	(0.015)	(0.022)	(0.014)	(0.033)	(0.043)
DOMcr	-0.006***	0.002	-0.007***	-0.004***	-0.007***	-0.000	-0.001	-0.003***	0.002**	0.003***	0.005***	0.006***
	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
INTR	0.104*	0.877***	-0.014	0.091***	0.148***	0.015	0.005	0.012	-0.042	-0.038*	-0.070**	0.064
	(0.055)	(0.130)	(0.033)	(0.024)	(0.024)	(0.025)	(0.016)	(0.015)	(0.046)	(0.021)	(0.033)	(0.056)
UNemp	0.083***	-0.009	-0.036***	-0.020***	0.003	-0.041***	-0.006**	-0.020***	0.026***	-0.035***	-0.035***	-0.090***
	(0.009)	(0.011)	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)	(0.002)	(0.004)	(0.003)	(0.004)	(0.012)
R-squared	0.688	0.755	0.948	0.923	0.951	0.955	0.978	0.973	0.946	0.968	0.918	0.802
Country FE	No	No	No	No	No	No	No	No	No	No	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	160	125	168	154	151	168	168	168	168	168	168	168
Covariance Type	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust

Note: The table presents the results of the panel estimation per industry. The dependent variable employment. The independent variables are the amount of green bonds issued (Green Bonds), Log population (POP), the domestic credit provided by the financial sector (DOMcr), the unemployment rate (UNemp), and the interest rate (INTR). The asterisks denote the significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Summary of estimations per industry **(Part 2)** - The effect of GBI on Employment per Industry

	Industry									
Variable	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(X)
const	-2.525***	-4.745***	-2.875***	-2.016***	-3.143***	-2.001***	-5.135***	-55.934***	-13.157	43.243
	(0.195)	(0.234)	(0.198)	(0.205)	(0.258)	(0.447)	(0.308)	(14.507)	(10.515)	(47.135)
Green Bonds	-0.001	0.007***	-0.002*	0.001	0.009***	-0.002	-0.004	0.003	0.154**	0.472*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.110)	(0.071)	(0.258)
POP	0.894***	1.033***	0.964***	0.917***	0.981***	0.820***	1.016***	3.347***	0.943	-2.564
	(0.013)	(0.015)	(0.013)	(0.013)	(0.018)	(0.030)	(0.021)	(0.840)	(0.595)	(3.476)
DOMcr	0.006***	0.002***	0.001	0.002***	0.007***	0.000	0.003***	0.113***	0.038**	-0.044
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.034)	(0.018)	(0.117)
UNemp	-0.033***	-0.029***	-0.008***	-0.017***	-0.051***	-0.014***	-0.027***	0.040	0.091	-0.0635
	(0.005)	(0.006)	(0.002)	(0.002)	(0.003)	(0.005)	(0.004)	(0.073)	(0.082)	(0.459)
INTR	-0.051*	-0.085***	0.006	0.031*	-0.049	0.054**	-0.049	2.832***	1.529	-3.649
	(0.026)	(0.031)	(0.018)	(0.016)	(0.032)	(0.022)	(0.038)	(1.064)	(1.062)	(6.063)
R-squared	0.962	0.974	0.981	0.982	0.970	0.930	0.955	0.390	0.187	0.196
Country FE	No	No	No	No	No	No	No	No	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	168	168	168	168	168	158	162	110	81	40
Covariance Type	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust	Robust

Note: The table presents the results of the panel estimation per industry. The dependent variable employment. The independent variables are the amount of green bonds issued (Green Bonds), Log population (POP), the domestic credit provided by the financial sector (DOMcr), the unemployment rate (UNemp), and the interest rate (INTR). The asterisks denote the significance levels: *** p<0.01, ** p<0.05, * p<0.1.

5.2 Job Vacancy Rate

From table 12, a key initial observation can be done: GBI, which is log-transformed, consistently shows a significant negative correlation with JVR across models (1), (2), and (3). To interpret the semi-elastic coefficient of -0.0093 from model (1), it would be the case that a 1% increase in green bond issuance is associated with a 0.0093 unit decrease in the JVR.
This suggests a similar story than the economic shifts that have happened before. When industries move towards new practices—in this case, sustainable financial practices—they often slow down their hiring at first. Initially, there's a dip in available jobs, but over time, this trend often reverses and job openings increase (Qiushuang Ren & Zhang, 2022). The relationship between green bond issuance and the job vacancy rate suddenly is not statistically significant in model (4) when fixed effects are excluded. This highlights the importance of regional and yearly differences. Country-specific rules about green bonds or even the global economy's year-to-year changes can affect job vacancies in ways that the data might not fully capture.

The inconsistency in the significance of control variables, such as Population (POP) and private sector credit (DOMcr), further complicates the picture. The varying results for POP might suggest that there's more to explore, like how age distribution or education levels in individual countries influence the job market. Education is particularly interesting since sustainable industries might require different skill levels.

The last model (model 4) brings another straightforward observation. When unemployment is high, job vacancies are typically low, a foundational economic concept known as the Beveridge curve (Nickell, Nunziata, Ochel, & Quintini, 2003). The reason being, that more people are looking for jobs than there are jobs available. However, some variables in do not show clear patterns in their significance across models. More specialized analyses could shine a light on these nuances.

Table 12: The effect of GBI on JVR in OECD countries

	JVR			
	(1)	(2)	(3)	(4)
Constant	1.9425***	17.125	23.999	1.3417**
	(-0.065)	(25.725)	(22.046)	(0.5952)
GBI	-0.0093**	-0.0097**	-0.0089**	-0.0029
	(0.0038)	(0.0038)	(0.0040)	(0.0080)
POP		-1.0032	-1.4349	0.0936**
		(1.6241)	(1.3911)	(0.0458)
DOMcr		0.0097**	0.0071	0.0006
		(0.0043)	(0.0062)	(0.0020)
INTR		0.3926	0.3889	-0.0106
		(0.2486)	(0.3889)	(0.1138)
UNemp			0.0269	-0.1345***
			(0.0388)	(0.0165)
Country FE	Yes	Yes	Yes	No
Year FE	Yes	Yes	Yes	No
Observations	175	170	170	170
Entities	23	23	23	23
R-Squared	0.0266	0.1459	0.1490	0.3417
Covariance Type	Robust	Robust	Robust	Robust

Note: This table presents panel estimations of the effect of Green Bond Issuance on JVR in OECD countries over the specified period. Green bonds and Population have been log-transformed and treated accordingly.
*,**,*** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively.

5.3 Sensitivity Analysis

5.3.1 Subsample analysis

In the dataset, Czechia and Germany stand out for their green bond issuance, albeit for different reasons. Czechia has the smallest footprint, contributing less than 1% to the total Green Bond Issuance (GBI). In contrast, Germany dominates with a substantial 15% of the total GBI. This difference (Table 14). Here, the GBI coefficient consistently reveals a strong positive association with aggregate employment across nations. Other significant variables include DOMcr (Domestic credit to the private sector) and INTR (Interest Rate). The consistent significance of the unemployment rate (UNemp) across these nations reaffirms its expected inverse relationship with aggregate employment. Interestingly, when Czechia is excluded from the analysis, the results surge, while omitting Germany causes a notable decline. This further signals a correlation between green bond issuance and employment, more issuance means a more significant impact.

5.3.2 Outlier analysis

To ensure the robustness and validity of the panel regression results, an outlier analysis was conducted on the dataset. Outliers can ave an effect on the regression results, leading to biased or inconsistent estimates. This analysis is focused on two key variables: Green bond issuance and employment. The Interquartile Range (IQR) method was used to identify and remove outliers. The statistical dispersion is calculated as the difference between the 75th (Q3) and 25th (Q1) percentile of the data. Outliers are defined as observations that fall below Q1, or above Q3. After identifying the outliers, the initial analysis from chapter 5.1.2 (See table 8, model (5)) holds.

The outliers are analysed, in four different diagnostic plots. The residuals versus Fitted Value Plots (figure 8 is used to detect non-linearity, unequal variances and outliers. The majority of the outliers in the dataset are distributed around the horizontal line suggesting that the assumptions of linearity and homoscedasticity are reasonably met. The Histogram of Residuals (figure 9 is a visual representation of the distribution. The figure shows a bell-shaped curve centered around zero, indicating that the residuals are normally distributed.The Quantile-Quantile (figure 10) plot is made to further assess normal distribution. The observations following the diagonal line, except some minor deviations state that the overall assumption of normality is met. The last visualisation is the Scale-Location Plot (figure 11 and is meant to check the assumption of a constant variance of the residuals. A clustering of points can be seen around (12,1), but no clear funnel shape is visible. The assumption of homoscedasticity is not violated. The results show similar coefficients as found in the base model where outliers were included, with a slightly smaller coefficient for green bond issuance. This shows that outliers did not significantly impact the results.

5.3.3 Further robustness tests

As can be seen in table 3, the green bond issuance data is highly skewed. The reason for this is that there are a significant amount of zero values in the dataset for green bond issuance. The zero values in this case do not mean that data is missing, it simply means that no green bonds were issued for the corresponding country-year combination. Two robustness test were done to analyse the impact. First a regression is run in which countries that did not issue green bonds for at least half of the time-frame are excluded. In this regression, Greece, Hungary, Slovakia, Slovenia and Estonia are excluded. The results do not significantly differ from the baseline analysis. The results can be found in appendix G.1.

The second robustness test excludes all the zero values from the analysis. Countries with zero values were excluded, zero values in between non-zero values have been linearly interpolated. The results show a coefficient of 0.043, meaning that a 1% increase in green bonds results in approximately 0,43% increase in employment, and significant on the 1% threshold. This result is slightly lower than the baseline result. The variables domestic credit to private sector by banks and interest rates have lost their significance compared to the other models. The results are presented in Appendix G.2.

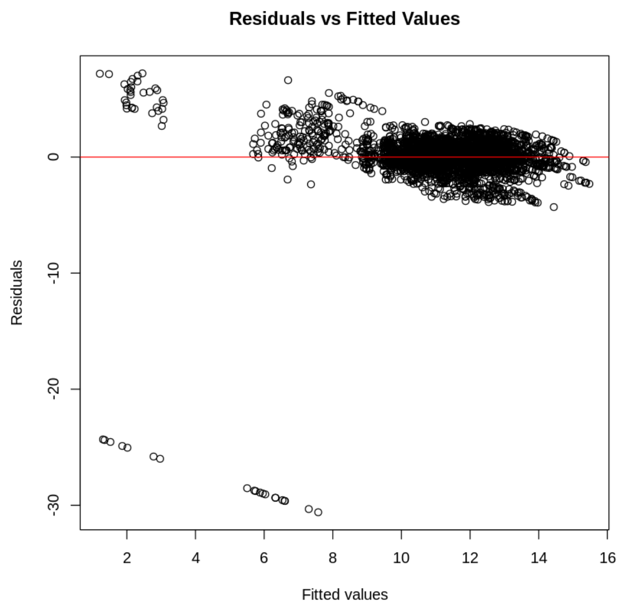

Figure 8: Outlier Analysis - residuals vs fitted values

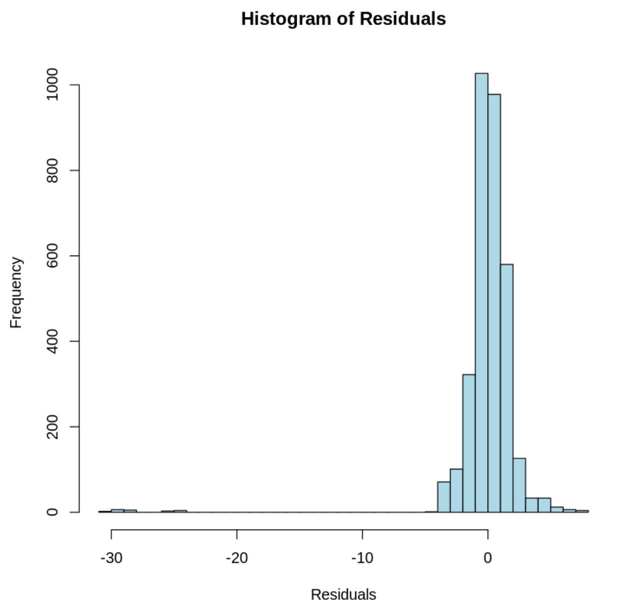

Figure 9: Outlier Analysis - Histogram of Residuals

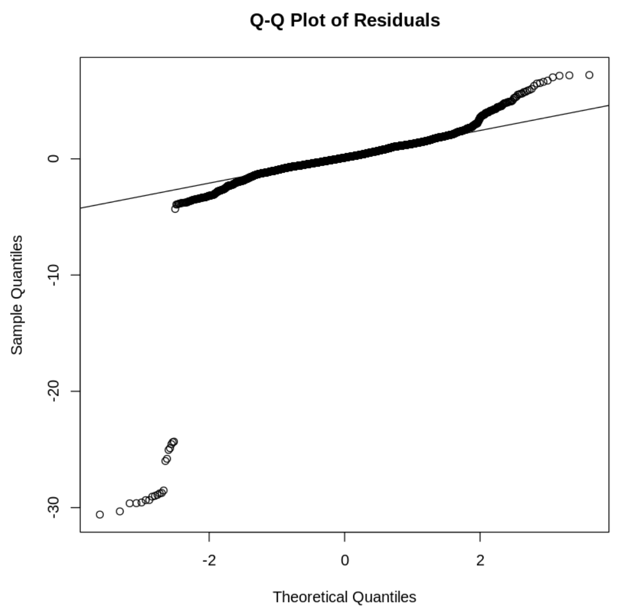

Figure 10: Outlier Analysis - Q-Q plot

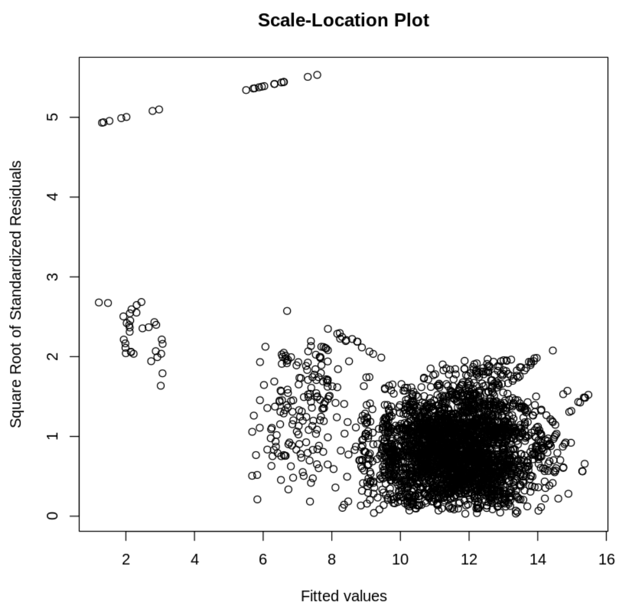

Figure 11: Outlier Analysis - Scale-Location plot

Table 14: Subsample Analysis - The effect of GBI on aggregate employment -

	Dependent variable: Aggregate Employment											
	Austria	Belgium	Czechia	Estonia	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania
GBI	0.056***	0.054***	0.060***	0.045***	0.039***	0.051***	0.057***	0.052***	0.055***	0.046***	0.058***	0.056***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)
RIS	18.035***	17.524***	18.408***	16.662***	17.865***	18.036***	17.902***	17.981***	17.812***	17.404***	17.844***	17.826***
	(2.087)	(2.109)	(2.063)	(1.825)	(2.068)	(2.168)	(2.084)	(2.030)	(2.120)	(2.083)	(2.105)	(2.104)
DOMcr	0.003**	0.004***	0.005***	0.004***	0.006***	0.005***	0.005***	0.006***	0.003*	0.005***	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
INTR	0.257***	0.237***	0.155**	0.143**	0.327***	0.242***	0.184***	0.648***	0.207***	0.247***	0.193***	0.194***
	(0.067)	(0.067)	(0.067)	(0.059)	(0.067)	(0.067)	(0.070)	(0.076)	(0.068)	(0.066)	(0.067)	(0.067)
UNemp	0.052***	0.046***	0.053***	0.031***	0.065***	0.063***	0.048***	0.056***	0.045***	0.034***	0.049***	0.046***
	(0.011)	(0.011)	(0.011)	(0.010)	(0.015)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Observations	3,139	3,162	3,139	3,148	3,173	3,141	3,142	3,266	3,157	3,188	3,170	3,170
R-Squared	0.346	0.344	0.336	0.368	0.343	0.336	0.339	0.363	0.340	0.342	0.346	0.343

	Luxembourg	Netherlands	Norway	Poland	Portugal	Slovakia	Slovenia	Spain	Sweden	Switzerland	UK
GBI	0.050***	0.053***	0.055***	0.052***	0.055***	0.054***	0.049***	0.049***	0.054***	0.054***	0.055***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
RIS	17.762***	18.144***	18.386***	18.076***	17.359***	17.101***	16.716***	17.117***	17.921***	17.680***	17.565***
	(2.241)	(2.146)	(2.183)	(2.120)	(2.095)	(2.125)	(1.779)	(2.095)	(2.141)	(2.065)	(2.084)
DOMcr	0.006***	0.004**	0.007***	-0.004	0.227***	0.226***	0.147***	0.012	0.042***	0.044***	0.054***
	(0.002)	(0.002)	(0.002)	(0.076)	(0.067)	(0.066)	(0.056)	(0.013)	(0.011)	(0.011)	(0.011)
INTR	0.154**	0.233***	0.348***	-0.004	0.227***	0.226***	0.147***	0.202***	0.205***	0.218***	0.178***
	(0.066)	(0.068)	(0.071)	(0.076)	(0.067)	(0.066)	(0.056)	(0.067)	(0.068)	(0.067)	(0.067)
UNemp	0.032***	0.046***	0.036***	0.043***	0.044***	0.044***	0.037***	0.012	0.042***	0.044***	0.054***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.009)	(0.013)	(0.011)	(0.011)	(0.011)	(0.011)
Observations	3,191	3,156	3,162	3,154	3,154	3,140	3,165	3,154	3,162	3,251	3,224
R-Squared	0.358	0.337	0.347	0.346	0.343	0.326	0.386	0.338	0.339	0.342	0.337

Note: This table presents the estimates of the sub-sample analysis. In the column the country that is excluded from the analysis with the corresponding estimates. Green bonds and Population have been log-transformed and are treated accordingly. *,**,*** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively.

5.3.4 Difference-in-Difference Analysis

The initial findings indicate a clear correlation between green bond issuance and employment dynamics. However, the result lack a baseline for a robust causal interpretation. The Difference-in-Difference (DiD) Analysis is employed aimed to identify an eligible interaction that could determine the impact of GBI on employment. Central to this analysis is the European Union's Green Deal (EGD) from 2019. The EGD is a plan designed to make Europe the first 'bloc' to be climate neutral by 2050 (Fetting, 2020). It underscores the importance of sustainable finance and green investments. Within this framework, green bonds play a pivotal role in mobilizing private capital towards sustainable and green projects as discussed in chapter 3. The EGD seems to have spurred an increased green bond issuance across most countries.This surge is most visible in countries such as Germany, Italy, the Netherlands, and Sweden. Contrarily, countries outside the European Union like Iceland, Norway and the UK show a more subdued trends or even a decline, with Switzerland being the exception. Referring to the data in Appendix C.1, Switzerland's increase raises questions about the validity of its inclusion in the control group. Potential external factors might be influencing Switzerland. Furthermore, the Recovery and Resilience Facility, an important part of the European Unions commitment for green expenditures promises that 37% of the Next Generation EU (NGEU), will be mobilized through green bonds until 2026 (Fetting, 2020).

The analysis used the countries in the European Union that were directly impacted by the EGD to form the treatment group. The control group consists of countries not in the European Union but did issue green bonds in the dataset: Switzerland, Iceland, Norway and the United Kingdom. These nations, while economically developed were not directly subject to the mandates of the EGD. Table 24 in Appendix G.3 presents the results of the DiD analysis. The treatment variable which is binary (1 for EU countries and 0 for control countries) is not statistically significant. This is desirable and implies that both groups had parallel trends in employment prior to the EGD. The core assumption of the analysis is therefor met. The post treatment variable captures the average change in employment after the EGD, and shows a negative and significant coefficient -1.943, indicating a general employment decline. The DiD interaction term is the coefficient of interest. It captures the difference in change between control and treatment countries. The positive and significant value of 1.723 implies that on average employment in the treatment group grew more than the control group after the implementation of the EGD.

While the DiD analysis provides some insightful perspectives on the impact of the EGD on green bond issuance and subsequent employment dynamics, it is important to remain critical of these findings. The surge of issuance of Switzerland in the control group raises concerns about the model's assumptions. Moreover, the EGD is broad in nature and might stimulate green projects in response to the carbon tariffs that led to changes in employment. While the results are statistically significant, the real-world economic impact may differ.

A visualisation of the findings is presented in appendix G.3

6 Discussion and practical implication

6.1 Discussion of main results

This research established a noteworthy connection between green bond issuance and employment dynamics. Specifically, a 1% rise in green bond issuance is correlated with a 0.05% increase in employment on average. The impact seems modest, however the relationship gains significance considering the growth of the green bond markets, mounting to a 90% annual growth since 2016 (Goldman Sachs Asset Management, 2023). Additionally, a negative coefficient of -0.009 was found between JVR and green bond issuance. This implies that the amount of vacancies relative to the total labor force declines as a result of green bond issuance.

Whilst the effects of green bond issuance had a positive effect on aggregate employment, the analysis on industry show different impacts on industries. Industries Administrative and support (N), Human Health (Q), and extraterritorial organizations (U) show similar results as the aggregate employment, with industry (U) seeing triple the aggregate effect of the first model with a coefficient of 0.154. However, industries such as Agriculture,forestry and fishing (A), Manufacturing (C), Electricity (D), Water supply (E) and Construction (F) show an inverse relationship between green bond issuance and green bond issuance.

The observed decrease in the job vacancy rate coupled with an increase in aggregate employment suggests a more efficient labor market in the context of green bond issuance. It implies that as green bonds are issued, fewer job positions are available relative to the total labor force, and more individuals are employed. This can be due to the fact that green bond issuance is driving investments in sustainable projects and are creating job opportunities. As these projects get funded they absorb more of the labor force, leading to a decrease in the job vacancy rate. The industries benefiting from these green bonds are most likely better aligned with sustainability goals. The decrease in the job vacancy rate combined with a decrease in employment for industries (A), (C), (D), (E) and (F) show an interesting picture. This suggests a contraction in the labor market, with both less job vacancies open, but not because they are being filled. These industries might be facing challenges in transitioning, potentially leading to layoffs or hiring freezes.

6.2 Theoretical contributions and implications

The interaction between the Job Vacancy Rate (JVR) and unemployment offers a understanding of labor market dynamics, in the context of green bond issuance. The two variables, exhibiting cyclical behavior (Abraham & Katz, 1986), serve as indicators of the economic health of a region and can be of big importance in predicting future economic trajectories. During economic downturns, firms often struggle with decreased demand for their products and services (Kurtz, Ong, Lau, & Bozic, 2014). Such reduced demand forces firms to go lay-offs, hiring freezes, and wage cuts. As a result, unemployment rises while the JVR lowers. The findings of this research resonate with this behavior. Green transitions, especially in their early stages, require significant investments, potentially leading to a temporary hiring slump and a consequent rise in unemployment. In contrast, economic upswings result in increased demand, leading to a surge in job vacancies and a possible dip in unemployment rates (Kurtz et al., 2014). The labor market responds with firms actively recruiting to meet the demand. However, this research underscores that the positive effects of green bond issuance are not uniformly felt across all industries.

The Beveridge curve offers a graphical representation of the inverse relationship between unemployment and the JVR. Cyclical factors create movements along this curve (Nickell et al., 2003). For instance, recessions typically show as an upward and rightward move on the curve, meaning a heightened unemployment and less job vacancies. However, shifts in the Beveridge curve itself signify structural changes in the labor market, potentially triggered by policy impacts, technological innovations, or transitions like the one towards sustainable practices (Nickell et al., 2003). In the context of this research, green bond issuance, facilitating the shift towards sustainable practices, can be perceived as a catalyst for such structural changes. Knowledge about these mechanics can equip policymakers with tools to respond to labor market fluctuations early, mitigating negative impacts and maximizing growth periods. Furthermore, potential shifts in the Beveridge curve, caused by green bond issuance, prove the need for labor markets to remain flexible. Rapid technological advancements might result in the need for evolving skillsets, even when job vacancies are available. This is called the Mismatch theory, which suggests that a negative correlation between job vacancies and unemployment could stem from a skills gap.

Okun's Law, formulated by Arthur Okun (Prachowny, 1993), shows a negative correlation between unemployment and real GDP. It asserts that a 1% rise in unemployment corresponds to a GDP that's approximately

3% below its potential. This correlation points to the importance of inefficiencies in the labor market and the output loss as a result due to unemployment. In the context of green bond issuance, if certain sectors, notably industries (A), (C), (D), (E), and (F), witness employment dips as a result of green bond issuance, it could potentially translate to a GDP that lags behind its potential. This underscores the need to ensure that the transition to sustainable practices, does not go paired with substantial job losses, given their broader economic implications.

Capital-labor substitution shows how firms are able to change capital for labor and the other way around. If labor costs escalate, firms might move towards capital investments, like machinery or technology, to sustain production levels. On the other hand, high capital costs might make firms rely more heavily on labor. In the context green bond issuance, if the mobilized funds are channeled into significant green technological or machinery investments, it could potentially lower labor demand in certain sectors. This might be the observed employment contraction in the specific industries after green bond issuance. It is important to recognize that while capital might replace labor in the short run, they complement each other in the long run. The shift towards sustainable practices could require both capital and a skilled and adaptive labor force.

The Economic Growth Theory, divided into the Neoclassical and Endogenous Growth Theories, offers more insights. The Neoclassical variant says that labor, capital, and technology are the primary drivers of economic growth (Solow, 1999). However, sustained growth in the long run builds only on technological progress. In the context of green bond issuance, capital infusion into sustainable ventures can catalyze short-term growth. Yet, for longer lasting sustainable growth, technological innovations in green sectors are a must. In the Endogenous Growth Theory, emphasis lays on the fact that economic growth is an intrinsic outcome of an economic system, and that it can not be influenced by externalities (Smulders et al., 2002). So the internal actions such as policy interventions, R&D, and human capital investments can result in sustained economic growth. Green bonds are considered to be capital investments in this place, thereby fostering economic endogenous growth.

6.3 Green Bonds: Criticism Challenges and the road ahead

Despite the promising prospect of green bonds as a driving force for sustainable investment, several challenges and criticisms exist about the effectiveness. The challenges lie in issues of standardization and the integration of technology to enhance transparency (Deschryver & De Mariz, 2020). Furthermore, a universal benchmark for evaluating the authenticity and impact of green projects funded by these bonds remains criticised (Baldi & Pandimiglio, 2022). This has resulted an opportunity for greenwashing.

To address this lack of standardization calls for an international consensus. The creation of an institution that has a complete oversight and included representatives from all sectors including from marginalized and indigenous communities, is of importance. This body would be tasked with establishing, reviewing, and enforcing universal standards for green bonds, ensuring that the bonds' proceeds are genuinely allocated to projects with positive environmental impacts. The incorporation of blockchain technology stands as a potential game-changer in enhancing the credibility of green bonds (Christodoulou, Psillaki, Sklias, & Chatzichristofis, 2023). By offering an immutable, transparent, and publicly accessible ledger of transactions, blockchain can track the flow of funds from investors to projects. This transparency would not only mitigate the risk of greenwashing but would also serve to boost investor confidence. Each green bond issuance and the corresponding proceeds of funds can be recorded and verified, ensuring accountability.

To enhance inclusivity in the green bond market, especially for developing nations and smaller communities, it is important to integrate education and skill development. This should involve partnership between educational systems, and green finance training. Boosting green startups and advanced research is key. By establishing innovation hubs and providing grants and investor access, a sustainable environment can be created to drive 'green' solutions. The credibility of green bond projects rests on clear issuance criteria, monitoring, and consistent impact reporting. Greenwashing should be penalized by international bodies with potential blacklisting of the market. This ensures funding is directed only towards authentic green initiatives. Policy refinement, informed by annual reviews and global benchmarks, can enhance the efficacy and impact of the green bond market.

By combining these elements into the core of the green bond ecosystem, green bonds can become a trusted tool for genuine environmental and economical impact. This would position green bonds at the core of a sustainable future. A roadmap with a more detailed information is presented in Appendix H

6.4 Limitations and future research

One of the main limitations of this research is the use of job vacancy rate and employment as proxies for job creation/destruction. While a correlation is observed between green bond issuance, a lower job vacancy rate, and higher employment on average which does not necessarily prove job creation and only points in the direction of efficient labor markets. In the regression on the effect of green bonds on employment the data consists of different granularity. This results in a limitation because the analysis does not capture nuanced shifts in the labor market. It would offer a more detailed result when the green bonds issued could be categorised over the same industries such as the research of Yagan (2015) did for capital tax reforms. Furthermore, this research relied on the green bond database from ICMA which was then narrowed down to a dataset of only 23 countries. The limited scope of the research means that now all green bonds that were globally issued were considered. The selective approach might not provide an holistic view of the global green bond market and its implications on the labor markets. This goes coupled with the limited number of observations that can potentially bias the model . A larger dataset with more countries and observations can yield more robust results (Guadagnoli & Velicer, 1988).

While this research does find significant correlation between variables, there is no proof of causality. While the robustness checks provide insights, the validity of the DiD analysis is in question since the equal trends assumption is not confidently met with the trend of Switzerland in the control group. In addition, the testing approach undertaken during the research, involving multiple tests increases the risk of false positive outcomes. Each additional test comes with a risk of a Type I error, which in total could compromise the validity of the findings (Kalnins, 2018). Corrections can be done when doing multiple comparisons, such as the Bonferroni correction which can be employed in future studies (Weisstein, 2004). The comparison between conventional bonds and green bonds remains an interesting topic for analysis. While there is extensive research on the so called 'greenium' [7] , interesting would be to investigate the interaction between the two in terms of demand, and issuance dynamics.

Another point of discussion is the generalizability. While OECD nations provide a robust framework for analysis given their strong financial markets and regulatory environments, the dynamics of green bonds could be significantly different in non-OECD regions. Other economies for example in the Global South might show different trends with their unique challenges and opportunities regarding green bond issuance. Therefor, extrapolating the findings from OECD focused research to a global context could lead to over-generalizations or misinterpretations. Future studies should aim for a more diversified geographic sample.

Given the limitations mentioned, several paths for future research is present. Future studies could include a more broad dataset, both in the terms of numbers of countries, but also in terms of timespan. Alternative ways and proxies can be created as proxies for job creation, finding a more accurate representation of labor market dynamics. To mitigate the risk of omitted variable bias, future research can include a broader set of control variables and fixed effects. Furthermore, picking up on the European Green Deal and the Next Generation EU package, with its intent to raise 37% of capital through green bonds, presents a promising path for future difference-in-differences (DiD) analysis (Fetting, 2020).

Researchers should closely monitor the issuance, performance, and impacts of these bonds. Technological advancements, particularly in the realms of blockchain, artificial intelligence, machine learning, and digital reporting platforms, will revolutionize the green bond and broader sustainable finance ecosystem. Future research should focus on how best to integrate these technologies into the green bond issuance and monitoring processes. Such integration could provide more robust oversight, increase efficiencies, and potentially unlock new avenues for sustainable financing, ensuring that the green bond market remains both credible and impactful. Despite the potential, little research was done. The work of Christodoulou et al. (2023) this year, underscores the need for further studies focused on integration of these technologies into green bond issuance to improve traceability and standardization which are the main concerns of critics.

Generally accepted is the notion that green bonds have global potential. However, often indigenous populations are not properly informed or have the right access (Ferrando et al., 2021). Future research should aim at identifying ways how green bonds can play a role in prioritizing the well-being of these communities and foster both ecologically and economical growth.

[7] Greenium or green-premium refers to the savings an issuer makes on the coupon payment because of the bond being labelled as 'green' (Larcker & Watts, 2020)

7 Conclusion

The relationship between green bond issuance and its impact on the labor market has been the focus of this research. Delving deep into the dynamics of the labor market, two primary indicators were analyzed: the Job Vacancy Rate (JVR) and employment. The findings reveal an inverse correlation between the JVR and green bond issuance. As green bonds in the market increase, the JVR tends to decrease. This suggests that as the green bond market grows, there are fewer unfilled job positions relative to the total labor force. On the other hand, employment exhibits an overall positive relationship with green bond issuance. This upward trajectory in employment, combined with a declining JVR, shows an efficient labor market. As green bonds are issued, it shows that not only is employment rising, but job vacancies are also being promptly filled.

Hence, these findings have to be interpreted with a certain nuance. The simultaneous increase in employment and decrease in JVR does not straightforwardly indicate job creation. Neither does it conclusively point towards the concept of creative destruction. A higher JVR and employment were set as proxies for job creation, as discussed in the data collection section 4, but with a lower JVR this merely suggest efficient labor economics. The labor market's response to green bond issuance is multifaceted, and the observed dynamics could be a result of various underlying economic mechanisms. However, diving deeper into the industry-specific impacts of green bond issuance, a more complex picture emerges. While the aggregate data suggests a positive labor market response, the industry analysis indicates that certain sectors, specifically industries (A), (C), (D), (E), and (F), face a decline in employment with the rise of green bond issuance. Agriculture (A), in particular, witnesses the most significant decline. For every 1% increase in green bonds issued, employment in the agriculture sector is correlated with a drop of 0.016%. While this percentage might seem smaller at first glance, given the exponential growth of the green bond market, its implications are substantial. The observed job destruction in these industries can be attributed to various possibilities. It is possible that as industries switch towards more sustainable operations, significant investments are made leading to hiring freezes or even layoffs. Technological advancements reducing the need for labor are a possibility of job losses in some industries. Thirdly, it is possible that the regulatory and policy scene is seeing significant change and industries are having troubles adapting to comply to new stringent regulations, leading to operational downsizing.

Several hypotheses were made, their validity was tested against the empirical findings. The first hypothesis (1a) stated that green bond issuance is correlated with job creation. The results of this research do not give support to this hypothesis. The initial proxy for job creation was anchored on the premise of a rising job vacancy rate. However, the findings indicate that while employment generally increases with green bond issuance, the job vacancy rate declines. This suggests that while more people are employed, there are fewer unfilled positions relative to the total labor force. Thus, it's challenging to conclusively state that there is job creation. Instead, the labor market appears to be operating efficiently, filling vacancies as they open. The second hypothesis (1b) stated that green bond issuance is correlated with job destruction. This hypothesis finds supports. While the overarching effect of green bonds on employment is positive, certain industries exhibit a decline in available jobs with the rise in green bond issuance. Specifically, industries (A), (C), (D), (E), and (F) face this decline. This suggests that while the broader market might benefit from green bonds, specific sectors might experience job losses, indicating a nuanced impact of green finance on the labor market. This leads to the answering of the last hypothesis (2), that stated that green bond issuance affects employment positively in sectors aligned with sustainable growth. This hypothesis does not find support from the empirical findings, however, it holds true that for some sectors green bond issuance affects employment positively and for some negatively. The relationship between green bond issuance and its impact on labor dynamics in various industries is intricate. While it was anticipated that sectors aligned with sustainable growth would see a positive employment effect, the data suggests otherwise. For instance, the Agriculture sector (A) witnessed a decline in employment with green bond issuance. On the other hand, industries like (O) and (U) experienced employment growth. This underscores the complexity of capital-labor substitution dynamics in the context of green finance and the multifaceted response of different industries.

To conclude, while green bonds hold potential in driving sustainable economic practices, their influence on the labor market is complex. The findings from this research emphasize the need for a deeper understanding of industry-specific impacts and specific strategies to ensure that the transition to a green economy is both sustainable and inclusive. Moreover, this study bridges a gap in the existing literature by providing an intricate, industry-level analysis of green bond effects on employment dynamics. It lays a foundation for future research on sustainable finance and its nuanced impacts across different sectors, making sure that economic factors are properly considered in wider discussions about sustainability.

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A Mapping the Sustainable Development Goals

A.1 Introduction to SDGs

The 21st century was an era marked by rapid technological advances, globalization, and an increased awareness of our planet's fragility. The realization came that the challenges we face are intertwined and demanded a unified response. Responding to this, in 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, a universal call to action to eradicate poverty, protect the planet, and ensure prosperity for all. Central to this agenda are the 17 Sustainable Development Goals (SDGs), each with specific targets to be achieved over the coming 15 years (United Nations, 2017).

The start of the SDGs can be traced back to the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012. Leaders recognized the need for a cohesive and integrated approach to sustainable development, different from the Millennium Development Goals (MDGs) that were set in 2000 (Kumar, Kumar, & Vivekadhish, 2016). While the MDGs focused primarily on poverty alleviation and were directed towards developing countries, the SDGs take a more holistic approach, addressing economic, social, and environmental dimensions of sustainability. Importantly, the SDGs have a global focus by nature, applying to all countries regardless of their economic status.The SDGs are not just asp irrational goals; they represent a global consensus on the most pressing challenges of our time. From combating climate change (Goal 13) to ensuring quality education (Goal 4), these goals recognize the interconnections of global challenges and the need for collaborative solutions.

Several reasons underscore the significance of these sustainable development goals:

1. Universality: SDGs are universal, addressing challenges in both the Global North and Global South
2. Inclusivity: The SDGs are formulated through a process, with contributions from governments, society and the private sector
3. Comprehensiveness: The 17 Goals and 169 targets address a variety of issues, recognizing that solutions must be integrated and interdisciplinary
4. Accountability: The SDGs come with a monitoring framework, allowing countries to track their progress

A.2 Origins of the SDGs

In the year 2000, world leaders gathered at the United Nations to adopt the Millennium Declaration, leading to the establishment of eight Millennium Development Goals (MDGs) to be achieved by 2015 (Kumar et al., 2016). These goals were:

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Improve maternal health
- Combat HIV/AIDS, malaria, and other diseases
- Ensure environmental sustainability
- Develop a global partnership for development

While the MDGs made significant impacts in several areas, such as halving the number of people living in extreme poverty and achieving gender equality in primary education, they also faced criticism Fehling, Nelson, and Venkatapuram (2013). Some viewed them as too narrow, overlooking key global challenges like inequality, economic growth, and peace and justice Attaran (2005); Fehling et al. (2013). Moreover, they were primarily directed at low and middle-income countries, leaving out challenges in developed countries. Recognizing both the successes and limitations of the MDGs, the international community began the transition to a more comprehensive and inclusive set of goals. This led to the formulation of the SDGs (Organization et al., 2015). The process to develop the SDGs was one of the most inclusive in the history of the United Nations. It began with the Rio+20 Conference in 2012, where member states agreed to launch a process to develop a set of universally applicable goals. This was followed by an Open Working Group proposal for Sustainable Development Goals, which involved 70 countries. Furthermore, the United Nations conducted several thematic and national consultations, engaging with over 10 million people across countries (United Nations, 2014) . These consultations ensured that the SDGs reflected a wide range of perspectives and priorities from governments, civil society, the private sector, and the general public. These efforts resulted in the United Nations Sustainable Development Summit in September 2015, where world leaders adopted the 2030 Agenda for Sustainable Development, including the 17 SDGs.

A.3 Overview of the 17 goals

Figure 12: Overview of the 17 SDGs (United Nations Environment Programme Finance Initiative, 2004)

A.4 Interconnections of the SDGs

The issuance of green bonds has seen substantial growth in the past decade, with a notable alignment to some of the 'Seven Supertrends' SDGs. The issuance [8] is distributed as follows:

- SDG 6 (Clean Water and Sanitation): 11% of green bond issuance is directly attributed to initiatives that aim to provide clean water and improve sanitation infrastructure. This investment is vital, especially for emerging economies where access to clean water can dramatically improve health outcomes and reduce disease prevalence.
- SDG 7 (Affordable and Clean Energy): Holding the lion's share, 40% of the green bond market directly supports projects that advance affordable and clean energy solutions. This not only reduces the carbon footprint but also ensures that energy is accessible to all, fostering economic development.
- SDG 9 (Industry, Innovation, and Infrastructure): The green bond market has been a boon for sustainable industry and innovation. 25% of issuance goes towards low carbon buildings, while another 15% supports low carbon transport systems. These investments are essential for creating resilient infrastructure that meets the needs of the present without compromising future generations.

[8]Numbers about attribution of green bonds towards SDGs is based on information of 2018 from United Nations Statistics Division (2018)

- SDG 11 (Sustainable Cities and Communities): Urban areas are at the heart of global challenges and opportunities. Green bonds support projects that make cities inclusive, safe, resilient, and sustainable.
- SDG 13 (Climate Action): The very essence of green bonds is to counteract climate change, making this SDG a core focus. Investments here support initiatives that reduce carbon emissions and adapt to changing climate conditions.
- SDG 15 (Life on Land): Green bonds also play a role in protecting our ecosystems. 3% of the green bond issuance finances sustainable forestry and agriculture. Notably, in countries like Brazil, half of the green bonds issued have components that promote sustainable forestry or agriculture. This is crucial for biodiversity preservation and ensuring sustainable use of terrestrial resources.

Relatively new research underscores the tangible benefits of green bonds. They significantly influence emission reductions and boost renewable energy production. Countries with a higher propensity to issue green bonds are more likely to meet their sustainability goals, especially concerning renewable energy production and carbon emission reductions (Alamgir & Cheng, 2023). These countries demonstrate the strength of sustainable finance in driving actual sustainable outcomes.

The Green Bond Principles (GBP) serve as voluntary guidelines that emphasize transparency, accuracy, and integrity in the green bond market. The alignment between GBP and SDGs is evident in the shared commitment to environmental objectives. GBP ensures that funds are allocated to genuinely sustainable projects, reinforcing the achievement of SDGs. This intertwined relationship between SDGs and GBP ensures that green bonds are not just financial instruments but tools for genuine global change.

A.5 Synergies and Tradeoffs

The Sustainable Development Goals (SDGs) present a roadmap to a better and more sustainable future for everyone. However, diving deeper into these goals reveals intricate interactions, both synergies and trade-offs, especially when viewed through the lens of the labor market and green bonds.

A.6 The connections of SDGs, Labor Market, and Green Bonds

The drive for clean energy is closely linked to Goal 8.2, which focuses on diversifying, innovating, and upgrading for economic productivity. A shift toward cleaner energy sources can potentially create new job opportunities in the renewable energy sector while potentially phasing out employment in traditional fossil fuel industries. This direct interlinkage showcases a synergy between environmental sustainability and economic productivity in the labor market (Breu et al., 2021).

Target 8.2 emphasizes the significance of diversification and innovation in promoting economic productivity. An enhanced focus on sustainable practices, such as green bonds, can serve as a platform for innovative financial products that simultaneously cater to environmental concerns and boost economic growth (Gannon et al., 2022). Target 8.3, promoting policies to encourage job creation and growing enterprises, can be closely associated with the green bond market. Green initiatives funded by green bonds can lead to job creation in sectors like renewable energy, sustainable agriculture, and green construction (Griggs, Nilsson, Stevance, McCollum, et al., 2017). However, certain trade-offs emerge. Efforts to increase economic productivity might clash with objectives like improved water quality, unless waste is re-worked as potential commodities for recycling or energy production (Bandari, Moallemi, Lester, Downie, & Bryan, 2022).

SDG12 (responsible production and consumption) and SDG13 (climate action) show potential trade-offs. While sustainable consumption might mean a short-term economic cost, the long-term benefits related to climate action can potentially outweigh these costs. These complexities underline the importance of a nuanced policy approach, as underlined in the research of De Neve and Sachs (2020).

From a labor market perspective, the shift toward sustainable practices, fueled by green bonds and related financial instruments, can redefine job structures. While certain industries might face challenges, new avenues, especially in green technologies and sustainable practices, can emerge as major employers. The complexities of SDGs demand a multifaceted approach, integrating policy coherence with practical application (MIOLA, BORCHARDT, NEHER, BUSCAGLIA, et al., 2019). Analyzing the SDGs individually can aid in crafting targeted policies that recognize both the synergies and trade-offs. Particularly in the context of the labor market and green bonds, understanding these interactions can make room for sustainable development that can foster both economic growth and environmental and social well-being.

B Sustainable Finance

B.1 Terminology

Green Finance Green finance primarily revolves around financial initiatives that foster environmental benefits. From solar energy projects to sustainable agriculture, green finance is every sector that has an ecological footprint. The green bond market, which exclusively lays its focus on financing environmentally friendly projects, has witnessed a considerable uptick in recent years, signaling the market's heightened interest in environmental concerns (Migliorelli, 2021). Such initiatives not only benefit the environment but often yield financial returns on par with, or exceeding, traditional investments.

Climate finance A specialized part of green finance, climate finance has a focus on investments that directly relate to climate change mitigation and adaptation (Giglio, Kelly, & Stroebel, 2021). Its domain extends from backing technologies that reduce greenhouse emissions to financing infrastructure resilient to climatic changes. Instruments such as the Equator Principles [9] are gradually becoming pivotal for environmental and social risk assessments in projects, solidifying the fundamental ethos of climate finance (Migliorelli, 2021). Given the growing impacts of climate change, these financial tools are expected to gain more prominence.

Sustainable finance With a more holistic view, sustainable finance is the umbrella for the principles of green and climate finance and adds societal and governance aspects which evolved to the ESG (Environmental, Social, Governance) framework.Fatemi and Fooladi (2013) writes how sustainable finance means more than just allocating funds to sustainable projects. It encompasses a "re-calibration" of the financial systems and models to intrinsically promote sustainability (Cunha, Meira, & Orsato, 2021). For sustainable finance to truly reach its potential, a shift is required, embedding sustainability as fundamentals of the financial system (Cunha et al., 2021).

B.2 Technology and sustainable finance

Blockchain Blockchain technology stands as a pivotal tool to enhance the traceability and accountability of funds raised through green bonds. It can create a permanent, decentralized ledger of transactions, ensuring every financial transaction related to a green bond is recorded transparently. This feature allows investors and regulators to trace the flow of funds and verify their utilization for the intended green projects. Furthermore, blockchain's inherent transparency can help mitigate the risks of greenwashing by providing a verifiable record of fund usage, thus boosting investor confidence.

Smart Contracts The introduction of smart contracts, which are self-executing contracts with terms directly written into code, can automate the payout and management of funds raised through green bonds. These contracts can be programmed to release funds only when certain pre-agreed and verifiable environmental milestones are achieved. This ensures that the financing is directly contributing to positive environmental outcomes. By automating this process, smart contracts can reduce administrative costs, enhance efficiency, and ensure alignment with environmental objectives.

Artificial Intelligence and Machine Learning AI and ML can emerge as crucial players in monitoring and verifying the environmental impact of green bond-funded projects. By analyzing datasets, the technologies can provide real-time information into the performance of green projects, ensuring they are on track to meet their pre-set objectives. Furthermore, AI and ML can automate the reporting process, providing investors and regulators with accurate data on the environmental impact of the green bond financing. This enhances the accountability and transparency and provides a more clear picture of the environmental benefits being achieved.

Digital Reporting Platforms Digital reporting platforms could streamline the reporting and monitoring process for green bonds. By providing a centralized platform where data on the environmental impact of green projects can be collected, analyzed, and shared in real-time, these platforms significantly enhance transparency and accountability. They provide investors, regulators, and other stakeholders access to timely and accurate

[9] The Equator Principles (EP) are guidelines adopted by financial institutions for assessing environmental and social risks in large projects. Established in 2013, they promote responsible development and environmental stewardship, applying to various financial products with specific criteria. The principles emphasize concerns like climate change and biodiversity, and are periodically reviewed to stay relevant (Equator Principles, 2013).

information, making it easier to assess the performance and impact of green bond financing. Furthermore, by standardizing the reporting process, digital reporting platforms help address the challenge of inconsistent reporting standards in the green bond market, contributing to greater clarity and confidence in green bond financing. This is already actively being done by platforms such as the Climate Bonds Initiative, however, a clear platform on the global scale is lacking.

Incorporating these technological advancements can significantly help mitigating the challenges associated with green bond financing. It ensures that the funds raised are utilized efficiently and effectively for their intended environmental purposes.

C Green Bond trends

Over the years, the market has witnessed an upward trajectory, with notable spurts of growth and evolving trends, especially in the light of a global shift towards environmental consciousness. An exploration of the green bond market trends with a focus on the 2021 to 2023 year period is presented. The pictures below are retrieved from Climate Bonds Initiative (2023)

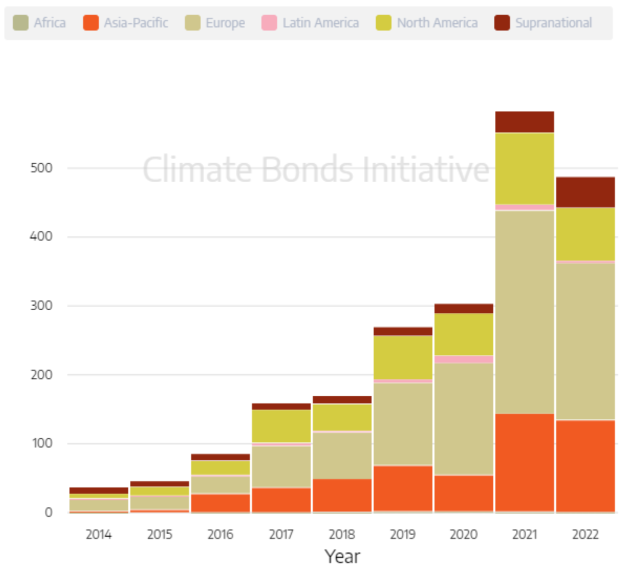

Figure 13: Green Bond Issuance - Per Region

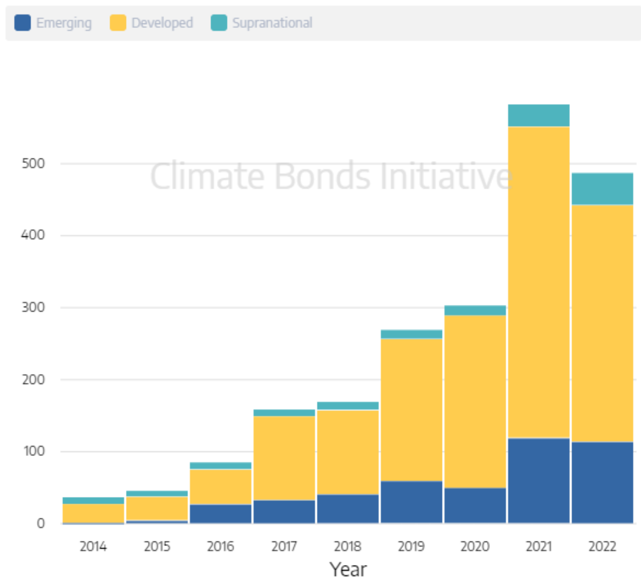

Figure 14: Green Bond Issuance - Emerging, Developed, Supranational

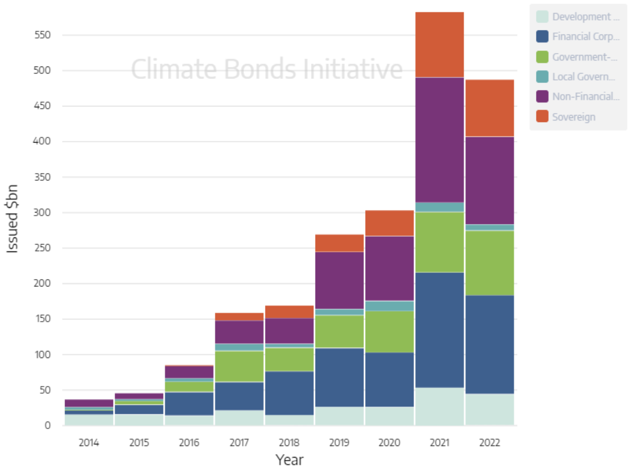

Figure 15: Green Bond Issuance - Per Institution

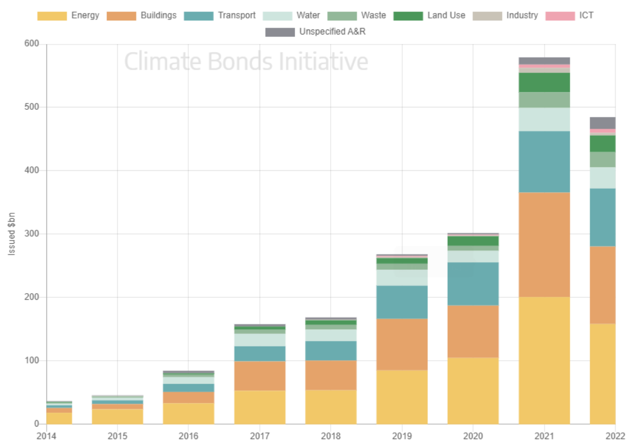

Figure 16: Green Bond Issuance - Per Sector

C.1 Data collected on labelled green bond issuance volumes

Table 15: Data for European Countries from 2014 to 2022 (in millions of Dollars)

COUNTRY	2014	2015	2016	2017	2018	2019	2020	2021	2022
AUSTRIA	627	0	0	363	0	945	1708	2727	7650
BELGIUM	0	45	0	0	6253	2687	3812	4329	7912
CZECHIA	0	0	0	0	0	0	0	1016	485
ESTONIA	0	56	0	0	0	0	0	0	0
GERMANY	4183	5552	5020	9956	7617	18719	42411	62462	61159
GREECE	0	0	0	0	0	832	665	1182	231
HUNGARY	0	0	0	0	0	0	2197	971	2697
ICELAND	0	0	0	0	233	98	439	1056	297
IRELAND	0	0	11	0	3459	2776	2709	4597	3489
ITALY	698	0	407	3384	2386	5997	4533	25360	14911
LATVIA	0	85	28	24	0	0	0	177	106
LITHUANIA	0	0	0	342	376	22	53	28	25
LUXEMBOURG	0	0	268	0	998	1721	2177	6973	3759
NETHERLANDS	1715	4195	7541	5002	8286	16074	18331	28459	26685
NORWAY	461	868	623	670	3473	3943	6260	13692	9023
POLAND	0	0	779	154	1244	2470	0	1835	654
PORTUGAL	0	0	0	0	695	1924	2559	2743	1299
SLOVAKIA	0	0	0	0	0	0	0	157	604
SLOVENIA	0	0	0	15	85	0	0	0	0
SPAIN	635	0	994	4703	5000	6260	9254	19631	15143
SWEDEN	1741	1693	3266	4902	6413	10495	13326	16282	11250
SWITZERLAND	0	163	816	741	325	2329	1777	3689	2308
UNITED KINGDOM	6	737	0	2222	3767	2161	4778	35894	18415

C.2 Market Dynamics

The conflict between Russia and Ukraine in 2022 sent shockwaves through the global capital markets. This geopolitical event triggered a sequence of economic impacts including energy price hikes, inflation surges, and increased interest rates. The impacts of this geopolitical event extended to the global 'labeled' bonds market, inducing a 24% decline Year Over Year (YOY), although maintaining a 5% share of the total debt volumes, mirroring the figures from 2021 (Climate Bonds Initiative, n.d.).

Within the labeled bonds, the green label continued to dominate, consisting of 56% of Global Social Securities plus (GSS+) volumes. This dominance led to a cumulative total of green bonds to reach USD 2.2 trillion globally. This underscores the acceptance of green bonds in the global financial landscape.

Data from Climate Bonds Initiative (2023) unveils a distinct geographical and sectorial delineation of green bond volumes. Developed markets (DM) were dominant and accounted for 67% of the 2022 green bond volume, followed by emerging markets (EM) at 23% and Supranational issuers at 9%. Notebly, Supranational volumes increased substantially with an increase of 43% compared to 2021. This upswing was predominantly fueled by the EU's extensive green bond program, which since the start in October 2021, had issued a cumulative total of USD 39.9 billion over four deals. The private sector emerged as a significant player in the green bond market ecosystem, with corporates contributing 54% of the issuance in 2022. Within this, financial corporates contributed to 29% of volumes, while non-financial corporates followed with 25%. European corporates were notably active, with German commercial bank Helaba and Danish multinational power company Orsted being the leaders. Government-backed entities are a niche in the green bond market, contributing just under 20% of the green bond issuance in 2022, marking a 6% rise compared to 2021. This growth trajectory was led by the EU, which reopened its 2037 deal thrice, amounting to a total of EUR 6.5 billion (USD 6.9 billion).

C.3 Use of Proceeds (UoP)

The green bond proceeds allocation retained a significant focus on the Energy, Buildings, and Transport sectors, collectively contributing to 77% of the total green debt volume in 2022. However, this is slightly less than the years before, hinting at projects being financed in a more broad spectrum.

C.4 Regulatory Developments

The European Union has fortified its commitment to countering greenwashing in the bond market by putting forward a set of standards. These new mandates state that to get the "green" label, a substantial 85% of the funds collected by the issuance must be funneled towards activities aligning with the EU's taxonomy delineating sustainable investments. The inception of these regulations, although voluntary, marks a shift in the green bond market. A "minority" of the $500 billion green bonds issued last year would qualify for the new voluntary label, as per the new regulations. The compliance with these rules could potentially constrict the securities available to green bond funds, hence aiming to provide investors with a transparent system of disclosures, ensuring authenticity and transparency in green bond issuance.

D International Standard of Industrial Classification

Aggregate Economic Activity			Sections ISIC- Rev. 4	Sections ISIC- Rev. 3	Sections ISIC- Rev. 2
Agriculture			A	A, B	1
Non Agriculture	Industry	Manufacturing	C	D	3
		Construction	F	F	5
		Mining and quarrying; Electricity, gas and water supply	B, D, E	C, E	2, 4
	Services	Market Services (Trade; Transportation; Accommodation and food; and Business and administrative services)	G, H, I, J, K, L, M, N	G, H, I, J, K	6, 7, 8
		Non-market services (Public administration; Community, Social and other services and activities)	O, P, Q, R, S, T, U	L, M, N, O, P, Q	9
Not elsewhere classified			X		0

Figure 17: International Standard of Industrial Classifications (International Labour Organization, 2023)

E Alternative regression model - Impact of green bonds on aggregate employment

Table 16: The effect of GBI on aggregate employment in OECD countries (employment ratio)

	Employment relative to population size					
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-7.618***	-7.556***	-7.566***	-7.628***	-7.604***	-7.608***
	(0.008)	(0.013)	(0.012)	(0.012)	(0.000)	(0.011)
Green Bond Issuance	0.001**	0.001	0.001*	0.000	0.000	0.000
	(0.050)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment		-0.007***	-0.007***	-0.008***		0.004***
		(0.001)	(0.001)	(0.001)		(0.001)
Interest Rates			0.010*	0.009**		0.007**
			(0.005)	(0.004)		(0.000)
Domestic credit to Private Sector by Banks				0.001***		-0.004**
				(0.001)		(0.000)
Country FE	No	No	No	No	Yes	Yes
Year FE	No	No	No	No	Yes	Yes
Observations	184	184	184	179	184	179
Entities	23	23	23	23	23	23
R-Squared	0.019	0.205	0.226	0.422	0.001	0.127
Covariance Type	Robust	Robust	Robust	Robust	Robust	Robust

Note: This table presents a summary for an alternative regression model in chapter 5.1.1. The model includes the population variable in the dependent variable. The table shows estimations of the effect of Green Bond Issuance on Employment ratio in OECD countries over the 2013-2021 period. The sample includes the countries specified in chapter 4. Green Bond Issuance and Employment have been log-transformed. *,**,*** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively.

F Impact of Green Bond Issuance On Industries with lagged effects

Table 18: Summary of estimations per industry (lagged) - Part 1

	A	B	C	D	E	F	G	H	I	J	K
const	-0.777*	-1.379	-4.149***	-3.480***	-5.593***	-2.309***	-2.869***	-2.665***	-4.110***	-2.630***	-2.779***
	(0.426)	(0.872)	(0.454)	(0.338)	(0.313)	(0.250)	(0.291)	(0.247)	(0.317)	(0.223)	(0.518)
GBI	-0.022***	-0.001	-0.015***	-0.005*	-0.004	-0.009***	-0.002	-0.003	-0.004	-0.001	0.003
	(0.006)	(0.008)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
POP	0.754***	0.674***	1.146***	0.890***	1.026***	0.942***	1.004***	0.956***	0.985***	0.897***	0.886***
	(0.030)	(0.060)	(0.029)	(0.022)	(0.019)	(0.016)	(0.019)	(0.015)	(0.022)	(0.014)	(0.033)
DOMcr	-0.005***	0.002	-0.007***	-0.004***	-0.007***	-0.000	-0.001	-0.003***	0.002**	0.003***	0.005***
	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
INTR	0.098*	0.875***	-0.014	0.091***	0.151***	0.015	0.005	0.012	-0.042	-0.038*	-0.070**
	(0.055)	(0.130)	(0.033)	(0.024)	(0.024)	(0.025)	(0.016)	(0.015)	(0.046)	(0.021)	(0.033)
UNemp	0.081***	-0.009	-0.036***	-0.020***	0.004	-0.041***	-0.006**	-0.020***	0.027***	-0.035***	-0.036***
	(0.009)	(0.011)	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)	(0.002)	(0.004)	(0.003)	(0.004)
Country FE	no	no	no	no	no	no	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	151	124	161	154	151	161	161	161	161	161	161
Entities	23	23	23	23	23	23	23	23	23	23	23
R-squared	0.694	0.754	0.948	0.923	0.950	0.955	0.979	0.973	0.946	0.968	0.918
Covariance Type	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust

Note: This table presents three-dimensional panel estimations of the lagged (1 year) effect of Green Bond Issuance on Employment in OECD countries over the 2013-2021 period. The sample includes the countries specified in chapter 4. Green bonds, Population, and employment have been log-transformed.*,**,*** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively.

Table 19: Summary of estimations per industry (lagged) - Part 2

	L	M	N	O	P	Q	R	S	T	U	X
const	-1.453**	-2.532***	-4.762***	-2.870***	-2.016***	-3.177***	-2.001***	-5.135***	-55.934***	-13.158	43.243
	(0.195)	(0.234)	(0.198)	(0.205)	(0.258)	(0.447)	(0.308)	(14.507)	(10.515)	(47.135)	(0.000)
GBI	0.002	-0.001	0.007***	-0.003*	0.001	0.009***	-0.002	-0.004	0.003	0.155**	0.472*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.110)	(0.071)	(0.258)
POP	0.740***	0.895***	1.035***	0.964***	0.917***	0.983***	0.820***	1.017***	3.347***	0.943	-2.564
	(0.013)	(0.015)	(0.013)	(0.013)	(0.013)	(0.018)	(0.030)	(0.021)	(0.840)	(0.595)	(3.476)
DOMcr	0.006***	0.007***	0.002***	0.001	0.002***	0.007***	0.000	0.003***	0.113***	0.038**	-0.044
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.034)	(0.018)	(0.117)
INTR	0.069	-0.051*	-0.085***	0.006	0.031*	-0.049	0.054**	-0.049	2.833***	1.529	-3.649
	(0.026)	(0.026)	(0.031)	(0.018)	(0.016)	(0.032)	(0.022)	(0.038)	(1.064)	(1.062)	(6.063)
UNemp	-0.090***	-0.033***	-0.029***	-0.008***	-0.017***	-0.051***	-0.014***	-0.027***	0.040	0.091	-0.064
	(0.005)	(0.005)	(0.006)	(0.002)	(0.002)	(0.003)	(0.005)	(0.004)	(0.073)	(0.082)	(0.459)
Country FE	no	no	no	no	no	no	no	no	no	no	no
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	160	125	161	154	151	161	161	161	161	161	161
Entities	23	23	23	23	23	23	23	23	23	23	23
R-squared	0.803	0.962	0.974	0.981	0.983	0.970	0.930	0.956	0.391	0.188	0.197
Covariance Type	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust	robust

G Robustness - Excluding countries with many zero values

G.1 Excluding countries with multiple zero values

Table 20: Robustness - Excluding Greece, Hungary, Slovakia, and Slovenia: The effect on employment

	Employment	
	Coefficient	Standard Error
Green Bond Issuance	0.053***	(0.005)
Relative Industry Size	17.689***	(2.039)
Domestic Credit to Private Sector by Banks	0.004***	(0.002)
Interest Rates	0.223***	(0.066)
Unemployment	0.044***	(0.011)
Observations	3,314	
R-Squared	0.343	
Fixed Effects	Yes	
Covariance Type	Robust	

Note: This table presents regression results excluding Greece, Hungary, Slovakia, and Slovenia, evaluating the effect on employment. The coefficients are reported with their standard errors in the adjacent column. Green Bond Issuance and Employment have been log-transformed. *,**,*** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively.

G.2 Excluding zero values

Table 22: Robustness - Excluding zero values: The effect on employment

	Employment	
	Coefficient	Standard Error
Green Bond Issuance	0.043***	(0.004)
Relative Industry Size	14.794***	(1.386)
Domestic Credit to Private Sector by Banks	0.001	(0.001)
Interest Rates	-0.012	(0.041)
Unemployment	0.024***	(0.006)
Observations	2456	
R-Squared	0.442	
Fixed Effects	Yes	
Covariance Type	Robust	

Note: This table displays regression results of GBI's impact on employment after handling zero values. Countries exhibiting consecutive zero values were excluded, and isolated zero values were interpolated. Green Bond Issuance and Employment have been log-transformed. Coefficients are presented alongside their standard errors. *,**,*** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

G.3 Robustness - Difference-in-Difference (DiD) Analysis

Table 24: Robustness - Difference-in-Difference (Did) Analysis

	Employment	
	Coefficient	Standard Error
Intercept	9.564***	(0.222)
Green Bonds	0.047***	(0.004)
Relative Industry Size	21.146***	(0.684)
DOMcr	0.002	(0.001)
INTR	0.119*	(0.052)
UNemp	0.023**	(0.007)
treatment	0.142	(0.144)
post_treatment	-1.943***	(0.204)
did_interaction	1.723***	(0.220)
Observations	2,174	
R-Squared	0.353	
Fixed Effects	Yes	
Covariance Type	Robust	

Note: This table presents regression results evaluating the effect on employment. The coefficients are reported with their standard errors in the adjacent column. Green Bond Issuance and employment have been log-transformed. *,**,*** indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels respectively.

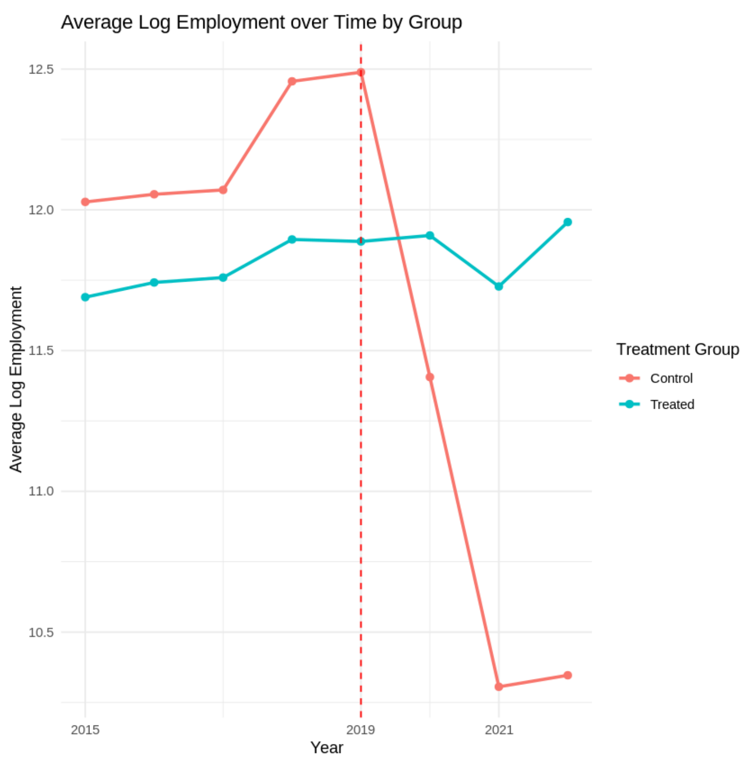

Figure 18: Robustness - Difference-in-Difference plot

H Green Bonds Roadmap

Based on the criticism and challenges found (presented in chapter 3) a roadmap for green bonds is proposed.

Targeted Education and Training programs A foundational understanding of green industries and their nuances is essential for all stakeholders involved in the green bond issuance process. By conducting a skills gap analysis, the areas of deficiency within the industry can be identified. Collaborations with educational institutions can lead to curricula that address these gaps. Furthermore, promoting and subsidizing green skills training programs can accelerate the upskilling of professionals. Continuous monitoring and adaptation ensure that the training remains relevant to industry needs.

Ecourage startups and R&D Innovation is the bedrock of sustainable solutions. Encouraging research and development can lead to breakthroughs that make green projects more viable and efficient. Establishing green innovation hubs or incubation centers can provide startups with the resources they need. Financial incentives, such as tax breaks or grants, can stimulate R&D activities. Connecting innovators with investors through green bond-funded programs can ensure adequate funding for promising projects. Hosting annual innovation challenges can foster a competitive environment for new solutions.

Stringent Criteria and Monitoring for Green Bond-Financed projects To maintain the credibility of green bonds, it's crucial that the projects they finance are genuinely sustainable. Identifying key sectors for the green transition ensures that funds are directed where they are most needed. Redirecting public investments to sustainable projects can set a precedent for private investments. Fostering international collaborations can open avenues for green trade. Regular assessments ensure that economic policies align with sustainability targets.

Greenwashing concerns tackled with transparent criteria and monitoring Greenwashing, where projects are falsely presented as environmentally friendly, undermines the integrity of green bonds.Developing clear and strict criteria for green bond eligibility ensures that only genuine projects get funded. Independent monitoring bodies can provide unbiased assessments of projects. Regularly publishing reports on the impact of green bond-funded projects ensures transparency. Entities found greenwashing should face penalties or blacklisting to deter such practices.

Refining policies for promoting green finance The landscape of green finance is dynamic, and policies need to evolve to remain effective. Conducting annual reviews of green bond impacts can provide insights into their effectiveness. Engaging stakeholders in policy dialogues ensures that all perspectives are considered. Implementing policy changes based on feedback and changing global standards keeps the framework updated. Benchmarking against best practices in other OECD countries can provide direction for improvements.

A detailed figure of the roadmap for green bonds is presented in figure 19 below.

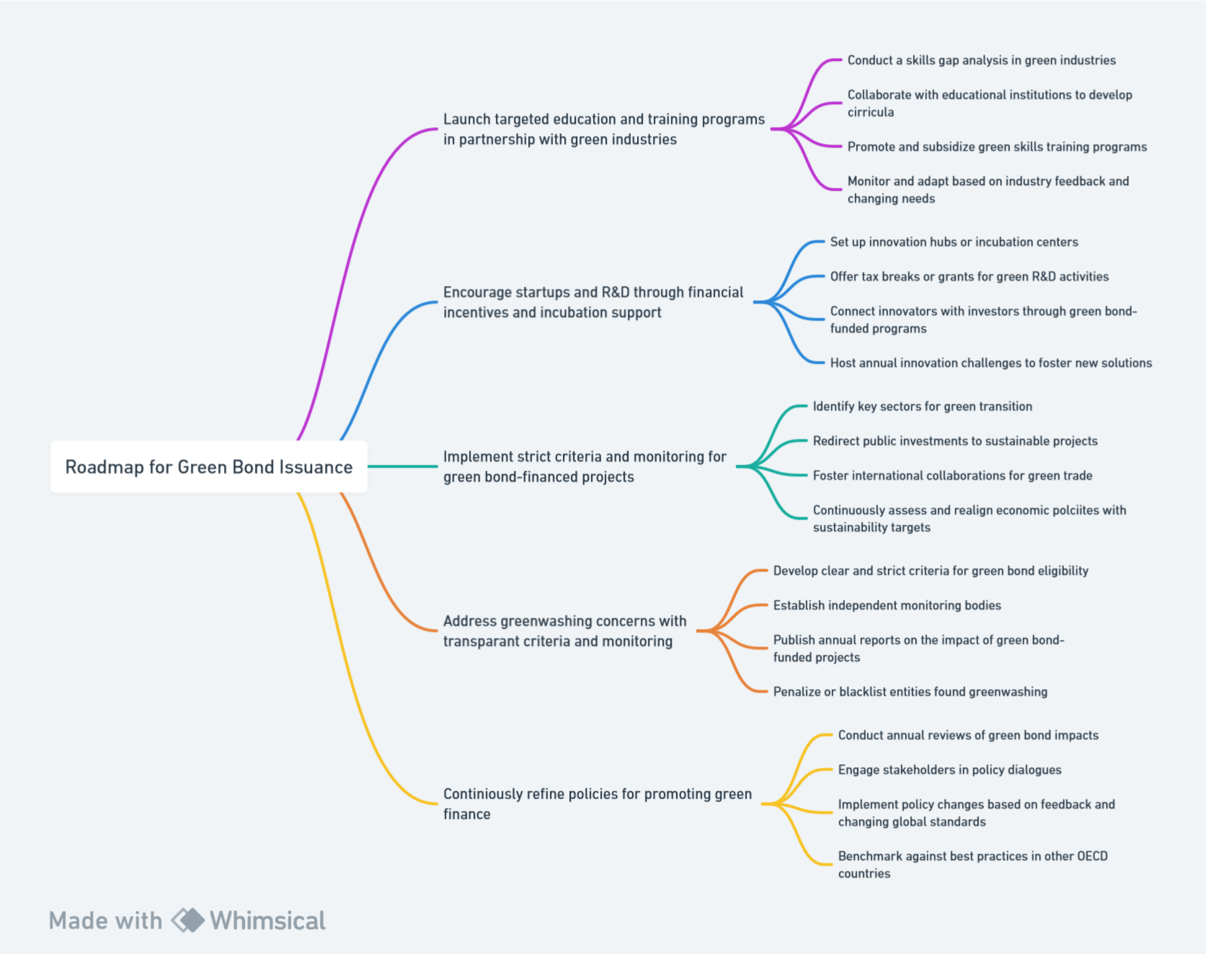

Figure 19: Roadmap for green bonds (own image)