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Empirical research on green taxation: a literature review

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Department of Accounting

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"We are each a patchwork quilt of those who have loved us. Those who have believed in our futures. Those who showed us empathy and kindness or told us the truth, even when it wasn't easy to hear. Those who told us we could do it, when there was absolutely no proof of that." (Swift, 2022)

Resumo

Esta dissertação realiza uma revisão sistemática da literatura sobre a fircalidade verde, com o objetivo de consolidar evidências empíricas acerca da sua aplicação, efeitos e tendências em evolução. Utilizando a abordagem PRISMA, foram inicialmente identificados 164 artigos na base de dados Scopus, dos quais resultou uma amostra final de 48 estudos empíricos após a aplicação dos critérios de inclusão. A análise crítica incide sobre a forma como a fircalidade verde tem sido definida e quantificada como variável dependente e independente em diferentes contextos de investigação. Através da análise bibliométrica com recurso ao Excel e ao VOSviewer, foi possível mapear redes de coautoria, coocorrência de palavras-chave e a distribuição geográfica dos estudos. A investigação evidencia que a utilização mais comum da fircalidade verde é a avaliação do seu impacto nas emissões de CO₂, no uso de energias renováveis, nas tendências de investimento e no crescimento económico, embora os resultados variem conforme os diferentes contextos. A produção científica é dominada pela Ásia, sobretudo pela China, refletindo tanto a dimensão dos problemas ambientais como as fortes reformas políticas em curso. O estudo conclui que, embora a fircalidade verde surja como um instrumento fundamental de política para garantir a sustentabilidade, a sua eficácia depende do desenho proporcional do imposto, da distribuição das receitas e do enquadramento institucional e cultural em que é aplicada. As conclusões apresentam contributos relevantes para decisores políticos, investigadores e profissionais que pretendem conceber sistemas de fircalidade verde eficientes e equitativos.

Palavras-chave: Fircalidade verde; Revisão sistemática; Fircalidade; VOSViewer

Jel: H20; H23; Q50

Abstract

This thesis undertakes a systematic literature review of green taxation in an effort to consolidate empirical evidence of its application, effects, and changing trends. Employing the PRISMA approach, 164 articles were initially identified in Scopus of which the final sample of 48 empirical studies was collected after application of inclusion criteria. The criticism is regarding how green taxation has been defined and quantified as a dependent and independent variable in research settings. Through bibliometric analysis with Excel and VOSviewer, the capacity to co-authorship map networks, co-occurrence map keywords, and geographic distribution of studies was enabled. The research highlights that the most common use of green taxation is to find its impact on CO₂ emissions, usage of renewable energy, trends in investment, and economic growth, although findings are in the middle of combining other contexts. Asian production dominates among the research, mostly China, which reflects both the magnitude of environmental issues as well as strong policy revolutions. The study concludes that although green taxation emerges as a key policy tool in guaranteeing sustainability, its efficiency relies on the proportional design of tax, revenue distribution, and institutional and cultural settings under which it is taxed. The findings are beneficial to policymakers, researchers, and practitioners who seek to design efficient and equitable green tax systems.

Keywords: Green tax; Systematic review; Taxation; VOSViewer

Jel: H20; H23; Q50

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1. Introduction

1.1. Motivation

Environmental issues have increasingly shaped economic, political, and social discussions, reflecting widespread concerns about the sustainability of the planet. Human actions, such as pollution, habitat destruction, and climate change, have been exacerbated over the past few years, calling for sensible solutions that reconcile economic development with the protection of the environment. In this regard, economic tools such as green taxation have gained increasing popularity, with a perspective towards suppressing environmental costs and encouraging less environmentally damaging practices.

Applicability of green taxes has increased due to the growing pressure on natural resources and need to mitigate the detrimental effects of human actions on the environment and climate. As much as they are mechanisms for the reallocation of environmental costs, green taxes also serve as economic signals, which urge consumers and businesses to go green. And throughout green taxes produce revenue that can be invested in public environmental policies thereby giving a framework that serves the sustainability goals.

Scientific and academic interest in green taxation has grown exponentially, partly driven by global commitments such as the Paris Agreement and other global climate action plans. Institutions such OECD have cited green fiscal policies as useful options for reducing greenhouse gases and supporting low-carbon transitions (OECD, 2019). Such worldwide momentum has brought large and diverse literature, so that it is challenging but valuable to gather present facts and track recent research developments.

The choice of the research topic is thus motivated by the desire to understand how green taxation is implemented, its global impact, as well as the emerging trends in environmental fiscal research. In addition, the topic has practical application, since its findings can be employed to guide public discourse on policy and provide a literature synthesis for researchers, policymakers, and other stakeholders interested in promoting environmental sustainability.

Overall, the foundation for undertaking this subject arises from the gravity of the existing environmental concern, the growing importance of green taxes as economic instruments and policy instruments, and the hope of being able to contribute to scientific knowledge and real-world solutions for designing a friendly environment for the future.

1.2. Research objectives

In an initial phase, this research aims to describe the concept of green taxation, explaining its appearance and its purposes. Particular attention is placed on understanding the different types of taxes, paying special attention to green taxes and their implications globally.

Furthermore, the study aims to analyse how green taxation operates, identifying who the implementers of the taxation are and how it impacts the intended goals. This includes how the taxes influence consumption patterns and behavioural choices by encouraging or discouraging specific activities and thereby generating, or failing to generate, the desired outcomes.

Additionally, regard is taken to the role of governments and regulatory bodies in managing activities and utilizing these instruments to generate fiscal revenues. Despite the fact that revenue generation is not the primary purpose of green taxation, it remains a significant implication of these policies.

More specifically, since this is an empirical research, the thesis is directed by two general research questions: what is presently known about green taxation and what are the main results that have been produced by current studies?

This research also seeks to uncover gaps within the literature, such as questions or issues that remain insufficiently or inadequately addressed. Finally, it examines how the theme of green taxation is being explored, by whom it is being studied, and the main trends that characterize this research.

1.3. Justification and contribution of the theme

Green taxation is a multidisciplinary subject in the sense that it is related to numerous disciplines, such as economics, agriculture, industry, and health, among others. Empirical studies within the subject can thus provide helpful information on the different impacts of such taxation in different areas.

In the current scenario of rising climate change, the implementation of green taxation has become more universal. The need to reduce pollution levels has made the policy instrument more significant and with it has come a growing literature more extensive and more diverse in scope. This dispersal of studies brings to the fore the need to synthesize common findings in order to ascertain which actions have been effective in stemming environmental degradation, which remain ineffective, and which are still pending, and the reason for their non-implementation.

Moreover, research in this field can help the academic community by looking at areas of the existing literature that are lacking, thereby guiding future research to address outstanding issues. It also helps elucidate the methodological schemes most employed so that researchers can better assess which schemes may be best for their own research.

Finally, since the primary aim of this study is to synthesize evidence on green taxation, the findings not only have implications for academia but also are highly applicable to policymakers all over the world. Through making sense of the current evidence, this research provides a

resource that can assist governments in designing and implementing more effective solutions to their unique issues and thus make the current measures more efficient.

1.4. Methodology

The study methodology used in this thesis is a systematic literature review, as outlined in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. This methodology has been selected as it facilitates transparency, reproducibility, and analytical rigor by employing pre-specified eligibility criteria and facilitating screening processes. The review seeks to examine the application and impact of green taxation, which demanded a focus on strictly empirical studies, hence excluding opinion pieces as well as theoretical models only.

Data collection was carried out using the Scopus database, selected based on its wide coverage and interdisciplinary scope. The keyword applied was "green tax," and 164 records until December 2024 were found. Then, a multi-step filtering was conducted. Firstly, only journal articles were kept; secondly, the sample was limited to English publications; thirdly, five records with no full-text availability were dropped; and lastly, articles with no empirical evidence were excluded. After screening, the final sample included 48 articles. The entire process was described according to the PRISMA flow design to guarantee transparency of inclusion and exclusion criteria.

Two databases were thus established. One, substantive in nature, dealt with the content of the articles, documenting objectives, methodology, data, and results systematically to facilitate comparison and synthesis. The second contained bibliometric information such as article title, year of publication, journal, authors, affiliations, and geographical location. Several variables were coded in a systematic format: authorship was coded as individual or collective, as well as author productivity and institutional affiliations.

For analysis, two main tools were used, namely Microsoft Excel and VOSviewer. Excel was used for the consolidation and organization of the data, and for the production of descriptive statistics in the form of pivot tables, frequency tables, and charts. VOSviewer was used for the production of bibliometric maps, in which co-authorship networks, keyword co-occurrence, and other relational structures within the dataset could be represented.

1.5. Dissertation structure

The present thesis is composed of five chapters. Chapter one, being an introduction, sets out the study objectives, outlines its main contributions and motivation, provides an overview of the methodology applied, and explains the overall structure of the work.

Chapter two comprises the Literature review, where the theoretical aspects of green tax are explained, and the most important findings of previous research on the subject are presented.

Chapter three describes the methodological approach, detailing the data collection process, variables employed, and techniques employed in analysing them.

Chapter four contains the results of the analysis of the collected data, that is the bibliometric results from the dataset used.

Finally, chapter five sets out the conclusions and contributions of the present research, summarizes its major limitations, and outlines suggestions for future research.

2. Literature review

2.1. Definition of green taxation

After the Industrial Revolution, technological advancements became significant, leading to overall higher consumption, particularly of fossil fuels such as coal, oil, and natural gas (Zandalinas et al., 2021). Climate change subject first emerged during the eighteenth century with the Industrial Revolution, however, it remains a gigantic problem even today, becoming a global problem only in the mid-twentieth century (Bilgili, 2024). It is forecasted that until this mid-century, the release of carbon dioxide will be maintained at current levels, which will create a major threat to ecosystems. The emissions may disrupt climate balance and conduct and impose important impacts on the quality and availability of natural resources (Ongan et al., 2023; Ali et al., 2021).

Following arguments of Abro et al. (2023), Fernandes et al. (2021), and Tawiah et al. (2021), environmental and economic development complement each other. Wang (2022) also notes that economic growth is causing considerable environmental consequences, while natural resources are still being drained and ecosystem services, on which such resources depend, are increasingly being degraded through pollution (Okombi & Ndoum Babouama, 2024). Such impacts are best described as negative externalities (Xu & Li, 2024).

In an effort to address and mitigate these challenges, governance systems and government policy could be helpful when responding to climate change. Taxation is not only a source of revenue for the state but also a regulatory tool. Governments can control the actions of society by encouraging or discouraging certain conduct (Sarkodie et al., 2020). From the perspective of tax theory, demand for some goods or services will tend to decrease if their price rises due to the imposition of tax charges (Pigou, 1932), cited by (W. Xu & Li 2024).

Policy measures instituted with a purpose to counter environmental problems generally belong to economic, regulatory, or institutional types (Perman et al., 1999), cited by (Ortega-Rodríguez et al., 2024). Economic policy instruments are those like fees, financial incentives, or taxes. Regulatory instruments are prohibitions or regulations of the quantity of specific behaviours, goods, or methods, such as the imposition of quotas (e.g., quotas of cars) or zoning laws allocating specific locations to heavy industries. Institutional instruments focus on social responsibility and generation of standards, such as the introduction of eco-labels.

According to Bala and Khatoun (2024), green taxation is the charging or taxing of goods or activities that negatively affect the environment. With the mutual interest of society and the government in the mitigation of the effects of climate change and realizing that government policies regarding the environment are crucial in addressing such challenges (Sarkodie et al., 2020), taxation takes a crucial stage. While preparing such policies, an attempt must be made

to balance the two major objectives of taxation in a way that as effective a green tax system emerges as possible (Elmi et al., 2023, cited in Liu, 2024).

Wang et al. (2022) point out that environmental taxes also have a positive impact on the well-being of the population. Based on their research, green taxes are good for issues of the environment, as well as improving happiness and life satisfaction. Specifically, they demonstrate that green taxation is positively correlated with happiness, whereas green taxation acts as a mediator between happiness and environmental administration.

While creating these policies, it is also important to consider the four categories of green taxes described by the OECD: environmental pollution taxes, energy taxes, vehicle and transportation taxes, and resource taxes (Liu, 2024). The categories act as a benchmark to frame legislation, with the goal being that the tax system basis itself accordingly with the best fits the specific region, citizens, or policy context. As cited by W. Xu & Li (2024), Bao (2020) detects that different polluters respond differently to tax system designs, and thus differentiation becomes a requirement.

Bala and Khatoon (2024) also argue that there must be proportionality of environmental taxes to what they cause to the environment, otherwise, these policies fail to live up to their potential. This reflects the "polluter pays" principle advocated by Pigou (1932), as cited by W. Xu & Li (2024), in which external environmental costs are internalized, by encouraging polluters to make less environmentally damaging decisions rather than less costly, more polluting ones (Xu & Li, 2024). In addition, green taxes make products that degrade the environment more expensive and thus might shift consumers' perception of green products: they are no longer perceived as being expensive but begin to seem relatively cheap compared to their non-green counterparts (Cobbold et al., 2024).

Finally, to enable effective implementation of green tax law, collaboration between tax authorities and environmental protection agencies is important. As much as it is the role of tax authorities to collect taxes in a proper manner, environmental agencies determine the levels of pollution, thereby linking emissions to a proper tax amount (Ren et al., 2024).

In determining the appropriate degree of taxation, governments should be realistic and ensure that tax burdens are proportional and sensible. To ensure such steps are effective, regulatory agencies should initially establish clear objectives and determine target levels of emissions, which in turn become the basis for ascertaining specific measures (Choi et al., 2010) cited in (Sabău-Popa et al., 2024)

Uddin et al. (2023) say that inefficient use of revenues generated from green taxes can yield effects contrary to their aim, thereby frustrating progress in the direction of sustainability.

Furthermore, the design of green taxes needs to consider the character of different activities and products in relation to their pollution potential. To this extent, not only is it possible to restructure current taxes, but it is also recommendable to introduce new and more precise taxation measures, and to abolish those which unintentionally promote polluting activities (Raisová, 2012), cited by (Ortega-Rodríguez et al., 2024).

Ahmed et al. (2022) hold the view that the foundation of climate policy is improvement of environmental law and green taxation. By addressing the weaknesses of the present economic policies, the entire system can be improved. This is already occurring, as financial instruments strengthening the green economy are evolving towards balancing environmental sustainability and maintaining economic growth (Tsai, 2024).

The literature recognizes the direct and indirect effects of green taxation on energy consumption. On one hand, Yang et al. (2020) demonstrate that environmental taxes reduce carbon emissions resulting from fossil fuels, thereby avoiding the negative effects of non-renewable energy consumption while encouraging renewable energy consumption simultaneously. On the other hand, Bashir et al. (2022) confirm that the imposition of green taxes significantly boosts the generation of renewable energy. In support of this, Fang et al. (2023) estimate that clean energy output rises by approximately 3.4868×10^{10} kWh following a 1% rise in green taxes. While the relationship between green taxes and clean energy production is positive, it is comparatively modest initially. Moreover, the marginal impact is decreasing as taxes increase, implying that a green taxation increase too fast or too high will inhibit further growth in clean energy generation.

In the short term, as Sabău-Popa et al. (2024) point out, there are two main issues to be tackled in implementing these policies. In the first place, it concerns to address management policy, which depends a lot on the price elasticity of polluting products. If elasticity is high, modest price changes can lead to big changes in consumption. If elasticity is low, tax rates must be higher to achieve a noticeable change in consumption patterns.

Where demand is relatively inelastic, big reductions in polluting products' consumption, and consequently in CO₂ emissions, big price increases are required. It is because consumers, since they are less price-sensitive, require a greater economic incentive to abandon polluting goods and shift to more environmentally friendly ones.

Xu and Li (2024) argue that green tax systems put more pressure on the highly polluting entities through proportionally higher tax, thereby encouraging companies to reduce their environmental impact. Reduction can be achieved through the adoption of greener activities and innovations in production processes, as well as the design of cleaner products. But, as all these authors emphasize, the success of such initiatives is highly dependent on the capacity

of the regulatory institutions to assess pollution amounts and to establish associated levels of taxation. In this regard, the principal is: the greater the pollution produced, the greater must be the tax burden, and thus the greater the expense for the entity. Further, Xu and Li (2024) underline devising a tangible "breakpoint" for pollution levels to know at what level an entity should cease operations or be prohibited from accessing public resources.

The foregoing deliberation directly relates to the understanding of proportionality in taxation. Silva et al. (2018) highlight the importance of ascertaining the break-even point for environmental taxes. Once a certain tax threshold is reached, the better option may be to reduce the burden rather than keep reinvesting back the proceeds into renewables, as over-taxes risk restraining economic growth. On the complementary side, Silva, Soares, and Pinho (2020) recommend that proceeds from environmental taxes should be strategically invested in order to incentivize renewable energy projects to actually minimize emissions. Simultaneously, such revenues can assist in generating fiscal space to reduce other taxes in the system, which, as highlighted by Bala and Khatoon (2024), boosts efficiency and equity. Together, these contributions suggest that both the scale of taxation as well as the distribution of revenues are essential in ascertaining the effectiveness of green tax mechanisms.

International experience equally illustrates the diversity of outcomes associated with green taxation. Sabiote-Ortiz (2010) highlights the fact that cultural and institutional differences between countries are key drivers of environmental tax reception and success. Salman and Wang (2024) empirically confirm this dispersion, showing that in 2021, the Nordic countries were the leading renewable energy sources of the overall energy supply, with Iceland achieving a record 88.9%. South Korea, on the other hand, had the lowest percentage, with renewable power constituting only 2.1% of its supply. These results indicate the extent to which national context influences the adoption and success of green taxation policies.

For instance, Sweden implemented higher carbon taxes on citizens and households in 1991, which made citizens shift towards the utilization of bicycles and public transport (Liu, 2024). Recently, at the 75th United Nations General Assembly General Debate of 22 September 2020, Chinese President Xi Jinping expressed that China would further enhance its efforts at the national level by adopting more efficient environmental policies with a goal to become carbon neutral before 2060 (Liu, 2024). But green taxation is not an absolute success. Degirmenci and Aydin (2024) observe that while Finland and other countries demonstrate positive environmental impacts of green taxation, in some contexts, Austria being one of them, the impacts have actually been unfavourable.

Empirical studies also show the mixed effects of green taxation at different levels of development. Luan et al. (2024) show that an increase in green taxes by 1% decreases carbon

emissions by 0.092% in developing countries, and a cut in green taxes by 1% enhances carbon-intensive output by 0.030%. These findings confirm the requirement to carefully modify tax rates according to economic conditions.

The use of cultural variables can also be tested using Hofstede's cultural dimensions theory. Hofstede and Bond (1984) developed this model in an attempt to measure population characteristics that influence collective behaviors. Follow-up studies by Hofstede et al. (2010) and in follow-up studies, (Ortega-Rodríguez et al., 2024) Kumar et al. (2014) and Chwialkowska et al. (2020), proved that collectivist societies are more inclined to be pro-environmental minded because in these cultures the group prioritize the common good over individual interests. Hence, collectivist populations are more inclined to be favourably disposed towards environmental policies such as the green tax. On the contrary, more individualist societies, where self-interest is predominant, have weaker acceptance of such taxes. Theoretical assumptions for these arguments have been justified by empirical evidence in Ortega-Rodríguez et al. (2024), whose survey of 117 business administration students demonstrated that the higher a country is on Hofstede's individualism scale, the worse are the attitudes towards green taxation and policies concerning it.

Summing up, research indicates that the effectiveness of green taxation depends not only on the proportionality of the tax design and strategic financial allocation but also on institutional and cultural settings that assist in defining public tolerance. Even though fiscal measures can impose direct pressure on corporations to innovate and reduce emissions, their effectiveness depends on how willing societies are to internalize environmental costs, a factor that varies profoundly differently across nations and cultures.

It must also be considered differing levels of economic development in each country. Developed and developing nations are both engaged in the problem of environmental pollution-induced climate change, and the majority employ green taxation to reduce its effects (Wanting & Zhi-Hua, 2018; Sabău-Popa et al., 2024). Industrialized countries, however, have a greater obligation to reducing their emissions, not only because they are the biggest emitters in the past but also because they have greater financial and technological capabilities to implement the cuts. They also have an additional role to help less developed countries transition, through financing greener options and offering incentives for environmentally friendly operations (Afshan & Yaqoob, 2023).

The corporate social responsibility (CSR) also highlights divergence among developed and developing countries. Abbas (2020) finds outstanding divergence in CSR practices, whereas Li and Yang (2022) find that in developed economies CSR is mainly defined as a responsibility of business which must be institutionalized in the business strategy so that it can

meet the established requirements. In fact, to companies in developed settings, CSR is more than just climate action; it serves as a foundation for competitive strategy, enhancing market standing and overall business performance (Úbeda-García et al., 2021).

In contrast to other firms, developing country firms have been required to deal with social inequality, resource constraints, and market uncertainty, thereby shifting their priorities towards immediate needs such as increased access to education, healthcare, and essential services (Niazi et al., 2023; Sadiq et al., 2022; Singh & Misra, 2021). In this context, CSR activities are even more focused towards public awareness and minimal social requirements as compared to higher environmental objectives (Deb et al., 2024). Ahmed et al. (2019) also add that developing nations are less willing to put in place green policies and commit to investing in green innovations due to being capital-intensive practices with little short-term monetary benefits.

Nevertheless, it has been found that even in developed countries, the determinants of environmental compliance are evolving. Companies increasingly recognize that being eco-friendly generates more visibility, enhances brand identity, and inspires customers, investors, and revenues, and thus becomes a source of competitive advantage in global markets (Niazi et al., 2023). This shows that progressively, effort is being focused on integrating environmental sustainability into both business identity and long-term profitability.

Most times, outside stakeholders will find organizations to be credible when they go green, whereas this is the reverse for businesses when they are not in compliance with environmental tax policy. In such cases, stakeholders may reconsider their investment and overall interaction with the company (Xu & Li, 2024). This being the case, there is a need to study the evolution of environmental tax policy and measures, by identify which ones have led to positive results over time.

Other than economic policies, technological progress in the use of renewable energy has played a pivotal role in combating climate change. The heightened use of renewable energy resources has led to reductions in environmental degradation, while the use of non-renewable energy resources continues to increase CO₂ emissions (Jabeen et al., 2025). A broad consensus in literature is that investment in cleaner production and green energy is required in order to achieve sustainable economic development (Abro et al., 2023; Fernandes et al., 2021; Tawiah et al., 2021; Bala & Khatoon, 2024). Li et al. (2018) also point out that businesses will be more inclined to be aligned with ESG standards and invest in renewable energy projects if they are incentivized with monetary means such as green loans with lower interest rates.

Technology development in the renewable energy market is therefore directly associated with investment practice, and this again largely depends on government intervention. Drawing

on Voica et al. (2015), green loans and similar financial products can encourage enterprises to invest more in sustainable investment, promoting innovation in clean energy. This is consistent with recent evidence demonstrating that support for green finance plays an important role in the evolution of renewable energy technologies and clean solutions (Wang & Fan, 2023; He et al., 2023).

Additionally, to attract companies to invest in going green, taxation must be imposed to reduce their taxable amount. Fu and Tang (2022) argue that the emergence of greener businesses can only be supported by a system of operation based on taxation and subsidization aimed at sustainability.

According to Lanoie et al. (2008), Jin et al. (2022), Bhatti et al. (2023), Rawoof et al. (2023), Ur Rehman et al. (2023), Xue et al. (2024), Yan et al. (2024), Shabbir et al. (2023), Wang et al. (2023), Cao et al. (2022), and Liu et al. (2022), there are two types of legislative actions that can encourage ecological innovation: the supply-push and the demand-pull approaches (Ahmad et al., 2024). The supply-push strategy reduces the cost of producing innovation. This can be achieved by policy interventions to stimulate finance government projects through tax relief and by stimulating R&D training and education. All these interventions finally create a demand-pull effect by increasing overall green production.

But while there are provisions for increasing renewable energy investment, at an initial stage they may have the reverse of what is wanted and reduce investment. Later on, after the tax system becomes more developed, a significant increase in green energy investment will occur, as wanted initially (Yang et al., 2020).

However, Cobbold et al., (2024), suggest that although incentives given to companies or individuals are effective, they are not as effective as taxation in general, as companies and consumers will react quicker to taxes than to subsidies. In parallel, the classification of green taxes as inhibitors will also inhibit innovation since added costs will be diverted to other uses rather than innovation (Atanassov & Liu, 2020; Luo & Wu, 2023).

2.2. Green taxation metrics

The following section demonstrates various green taxation metrics employed in the reviewed studies, together with a summary of how these measures have been applied in empirical models. It is important to note that the definition of the green tax variable is not uniform across the literature; rather, it is defined through a range of fiscal, social, and economic indicators, reflecting both the heterogeneity of tax systems and the diversity of sustainability objectives pursued by governments.

In the majority of studies, green taxes are utilized as independent variables, whose purpose is to examine their effects on different outcomes such as CO₂ emissions, energy consumption, labour productivity, and the adoption of renewable energy. This line of research typically seeks to determine whether higher revenues from environmentally related taxes encourage firms to adopt cleaner technologies, reduce dependence on fossil fuels, and contribute to ecological sustainability.

By contrast, another strand of the literature treats green taxation as a dependent variable, focusing on the extent to which different factors, whether considered individually or jointly, shape the level and structure green taxes.

To systematize these findings, the following tables provide an overview of the variables employed across the literature. Each table specifies the variables related to green tax, the direction of its relationship with other variables (e.g., whether they increase, reduce, or exhibit no significant association with green taxes), and the corresponding studies in which these relationships have been empirically tested.

Presented in this way, the tables not only summarize the empirical approaches used to analyse green taxation but also display the wide range of conceptualizations of the variable across the literature. Finally, it should be noted that some studies within the sample do not directly include green taxation as either an independent or dependent variable. Nevertheless, as these works met the inclusion criteria established for this review, they were retained and analysed within the broader scope of the thesis.

2.2.1. Green taxation as an independent variable (x)

The authors applied the green tax variable in the table below as an explanatory variable for other subjects. This implies that their primary aim was to analyse the impact of green taxation outcomes across a range of related subjects.

In order to facilitate a more targeted examination of the subjects related to this variable, Table 2 has been created. A glance through the table reveals that several researchers have conducted similar studies with similar variables, sometimes coming up with converging results, and at other times divergent findings.

For instance, Uche et al. (2024), Afshan and Yaqoob (2023), and Zhang et al. (2024) all found a negative relationship between green taxes and CO₂ emissions, indicating that rising green taxation is responsible for CO₂ emissions reduction. Contrary to this, Dong et al. (2023) found that green taxes have zero effects on CO₂ emissions individually and, in some cases, can even be associated with a positive relationship. At the same time, Filipiak and Wyszowska

(2022), looking at greenhouse gas emissions in total rather than CO₂ alone, found no significant link between green taxation and CO₂ emissions.

The remaining variables analysed are green investments, which provided more consistent results. Zhang and Guo (2024) and Cheng et al. (2022) both concluded that green taxes and green investments have a positive relationship with each other, a finding that is in line with higher levels of agreement in the literature.

Along with CO₂ emissions and green investments, the table also displays a wide variety of other variables covered across the literature, each examined separately. They include variables associated with energy consumption, renewable energy, and overall economic or environmental outcomes. Overall, the evidence suggests that while some variables, such as green investments, show stronger positive relationships, others remain contested, leaving room for further empirical investigation.

Dependent variable	Relation	Authors
User Costs Renovation Grant	+	(Fernández et al., 2024)
Corporate diversification	+	(Ren et al., 2024)
Firms' idiosyncratic risk	-	(Xu and Li, 2024)
Labor share	+ labour share of non-heavily polluting enterprises - labour share of heavily polluting enterprises	(Wei et al., 2023)
Export technology complexity	+	(Zhang and Liu, 2023)
ROE	+	(Liu et al., 2023)
Economic growth	-	(Mohammed, 2019)
Green energy investment	+	(Zhang and Guo, 2024)
Load Capacity Factor	+ (Spain and Finland); - (Austria)	(Degirmenci and Aydin, 2024)
Carbon neutrality	+	(Li et al., 2024)
Energy carbon emission; Annual climate temperature change	- -	(Uche et al., 2024)
Renewable energy technologies	+	(Bala and Khatoon, 2024)
Green innovation	+	(Cobbold et al., 2024)
Environmental sustainability	+	(Luan et al., 2024)
CSR	+	(Deb et al., 2023)
Total greenhouse gas emission; Transport-related emissions	- -	(Khurshid et al., 2023)
Load capacity factor; Carbon dioxide emission	+ -	(Afshan and Yaqoob, 2023)

Green renewable energy resources index	-	(Yao et al., 2023)
Transport-related GHG emissions	-	(Khurshid et al., 2023)
Fossil energy consumption; Clean energy generation	- +	(Fang et al., 2023)
Carbon emissions per capita	Weak and +	(Dong et al., 2023)
Exposure of population to air pollution	-	(Zhang et al., 2024)
Greenhouse gas emissions	(No relation)	(Filipiak and Wyszowska, 2022)
Subjective happiness of residents	+	(Wang et al., 2022)
Energy consumption; Energy intensity	- +	(Ahmed et al., 2022)
Environmental protection investments	+	(Cheng et al., 2022)
Energy poverty	-	(Salman and Wang, 2024)
Total pollution emission index	-	(Lai et al., 2020)
Labor productivity	-	(Sedehi and Esfahanian, 2019)
Number of new vehicles registered	-	(Yan and Eskeland, 2018)
Technology efficiency	-	(Zarate-Marco and Vallés-Giménez, 2013)
Industrial waste	-	(Vallés-Giménez et al., 2010)
CO2 emissions	-	(Zhang et al., 2024)
Average housing price	+	(Brotman, 2019)

Table 2.2.1. Relationship between green tax (independent variable) and other themes

2.2.2. Green taxation as a dependent variable (Y)

On the other hand, some researchers have employed green taxation as a dependent variable. In these studies, authors examined the consequences of rising or falling levels of green taxes.

As can be seen from Table 2.2.2, providing an overview of the major variables employed by researchers to explain green taxes, a wide range of variables has been employed, in some cases in parallel across different studies.

An examination of Table 2.2.2 reveals that authors have explored the green tax relationships in various themes, including sustainable economic growth (Sabău-Popa et al., 2024a), the job effects of green taxation on countries (Andreoni, 2019), and other economic and environmental effects. Other authors have even specifically addressed the impact of variables such as GDP and primary energy consumption on green taxes and always obtained positive relations for both variables (Sabău-Popa et al., 2024a; Sabău-Popa et al., 2024b).

We also observe that certain countries have relations that differ from the general trend, and they are exceptions to results, as can be seen in the table too (Andreoni, 2019).

The remaining variables appear more dispersed, having mixed impacts on green taxation. In some cases, they have a positive (+) impact, while in others there is a negative (-) impact, and in many instances no statistically significant relationship has been established, as illustrated by the table below.

Independent variable	Relation	Authors
GDP; Human Development Index; Waste generated; Waste treatment; Net greenhouse gas emissions; Supply, transformation, and consumption of resources; Primary energy consumption; Public expenditure for environmental protection; Private investment and gross value added in circular economy sector; Climate-related economic losses; Consumption of raw material	+ No significant relationship + - No significant relationship + + - No significant relationship - No significant relationship	(Sabău-Popa et al., 2024)
GDP per capita; Primary energy consumption; CO2 emissions; Supply transformation and consumption of renewable sources and waste	+ + No significant relationship No significant relationship	(Sabău-Popa et al., 2024)
Tax intensity effect; Economic structure effect; Economic activity growth effect	- (exception: France, UK, Greece, Italy, Slovenia, Estonia, Latvia) + (exception: UK, Greece, Italy, Portugal, Spain; Hungary) +	(Andreoni, 2019)
Environmental effect; Employment effect	- +	(Maxim et al., 2019)
Output per worker; Energy intensity; Ratio of renewables to non-renewables	- - +	(Silva et al., 2018)

Table 2.2.2. Relationship between green tax (dependent variable) and other themes

2.2.3. Others

While the majority of studies create a direct link between green taxation and other research topics, there are authors who cover the topic only descriptively, without incorporating it into empirical models or making an explicit link to other variables. Prominent examples of such an approach are Ahmad et al. (2024) and Bostan et al. (2016). Apart from this, some of the studies in the sample are founded primarily on questionnaire-based surveys, such as studies by Suna et al. (2024), Ortega-Rodríguez et al. (2024), Ariffin et al. (2023), Uddin et al. (2023), Kim and Hyun (2021), Yokessa and Murette (2019), and Pakdaman et al. (2019).

3. Methodology

As defined by Moher et al. (2016), systematic literature reviews are grounded on predefined criteria for eligibility and follow a methodological protocol in order to reduce bias and increase reproducibility. The method applied in this chapter for this thesis is detailed below.

The method employed here is a systematic review of the literature, grounded in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach. This approach was adopted as it provides a routine and systematic means of reviewing past research to allow greater reliability in synthesising conclusions and results. The purpose of the review is to consider the practice of green taxation and the impacts that have been generated. The analysis is thus purely on empirical research and not opinion articles or theoretical frameworks.

The data collection was done using the Scopus database, which was chosen because of its broad interdisciplinary coverage. The first search used the keyword "green taxation" and then narrowed down further using the keyword "green tax", resulting in 164 records. After limiting the sample to journal articles alone, 130 records remained. Restricting the sample to publications in the English language, nine items were removed, leaving 121 articles. Five of these were unavailable as full texts, leaving 116. Finally, opinion pieces and single-concept articles based on theoretical models with no evidence from data were removed, leaving a final sample of 48 articles.

A summary of these steps is provided in the table below to enable visualization of the selection process.

	Total publications
Total	164
Articles	130
English	121
Unavailable articles	116
Empirical articles	48

Table 2.2.1. All articles eligible for this study

After the last sample of articles was established, a database was constructed within Excel to systematically sort information retrieved from each study. The created database provided the possibility for not only content analysis and synthesis, but also for comparison of results from article to article, to ascertain results, methodological approaches, and developing patterns in the literature. In parallel, a database was formatted in CSV format and exported from VOSviewer to create bibliometric maps as an easier and clearer way to visualize data.

In total, the selected sample has 48 articles, and the next table shows the principal bibliographic data they hold: title, year of publication, authors, and publication journal.

Authors	Article	Year of publication	Journal
Adnan Khurshid, Khalid Khan, Javier Cifuentes-Faura	2030 Agenda of sustainable transport: Can current progress lead towards carbon neutrality?	2023	Transportation Research Part D
Claudia Diana Sabău-Popa, Alexandra Maria Bele, Mirela Bucurean, Sorina Ioana Mociar-Coroiu, Naiana Nicoleta Tarcă	A Panel Analysis Regarding the Influence of Sustainable Development Indicators on Green Taxes	2024	Sustainability
MaïmounaYokessa, Stéphan Murette	A Tax Coming from the IPCC Carbon Prices Cannot Change Consumption: Evidence from an Experiment	2019	Sustainability
Jun Zhang, Samia Khalid, Hamid Mahmood	Assessing the effectiveness of environmental policies in the OECD countries: An advanced panel data estimation study	2024	Energy & Environment
Xiaodong Lai, Zhiming Liu, Sumei Luo	Assessment on the effectiveness of environmental regulation in China—evidence from a panel data analysis	2020	Environmental Science and Pollution Research
Dianfei Luan, Hamid Mahmood, Samia Khalid, Bashir Ahmad Fida	Asymmetric Impact of Green Innovation and Taxation on Environmental	2024	Journal of the Knowledge Economy

	Sustainability in Developing Countries		
Ming Zhang, Manfeng Guo	Attracting Private Investment to Renewable Energy Projects in India	2024	Utilities policy
Guochang Fang, Gang Chen, Kun Yang, Weijun Yin, Lixin Tian	Can green tax policy promote China's energy transformation?- A nonlinear analysis from production and consumption perspectives	2023	Energy
Beata Zofia Filipiak, Dorota Wyszowska	Determinants of Reducing Greenhouse Gas Emissions in European Union Countries	2022	Energies
Claudia Diana Sabău-Popa, Alexandra Maria Bele, Adrian Negrea, Dorin Cristian Coita, AdrianaGiurgiu	Do Energy Consumption and CO2 Emissions Significantly Influence Green Tax Levels in European Countries?	2024	Energies
Adnan Khurshid, Khalid Khan, Yufeng Chen, Javier Cifuentes-Faura	Do green transport and mitigation technologies drive OECD countries to sustainable path?	2023	Transportation Research Part D
Bo Cheng, Baoyin Qiu, Kam C. Chan, Hongxia Zhang	Does a green tax impact a heavy-polluting firm's green investments?	2022	Applied Economics
Kai Zhang, Dongyuan Liu	Does Green Finance Promote Export Sophistication? An Analysis of the	2023	Sustainability

	Moderating Effect Based on Green Taxes		
Muhammad Naveed Ahmad, Xiaoguang Zhou, Sagheer Muhammad, Malik Shahzad Shabbir	Does green tax theory affect the environmental sustainability and protection?	2024	Environment, Development and Sustainability
Hussaini Bala, Ghousia Khatoon	Effect of green taxation on renewable energy technologies: an analysis of commonwealth and non-commonwealth countries in Sub-Saharan Africa	2024	Environmental Science and Pollution Research
Jingjing Wang, Decai Tang, Valentina Boamah	Environmental Governance, Green Tax and Happiness - An Empirical Study Based on CSS (2019) Data	2022	Sustainability
Yangqiu Ren, Guoliu Hu, Qing Wan	Environmental Protection tax and diversified transition of heavily polluting enterprises: Evidence from a quasi-natural experiment in China	2024	Economic Analysis and Policy
Anabel Zarate-Marco, Jaime Vallés-Giménez	Environmental tax and productivity in a decentralized context: new findings on the Porter hypothesis	2013	European Journal Of Law And Economics
Valeria Andreoni	Environmental taxes: Drivers behind the revenue collected	2019	Journal of Cleaner Production
Nihal Ahmed, Adnan Ahmed Sheikh, Zeeshan Hamid,	Exploring the Causal Relationship among	2022	Energies

Piotr Senkus, Ricardo Cosio Borda, Aneta Wysokinska-Senkus, Waldemar Glabiszewski	Green Taxes, Energy Intensity, and Energy Consumption in Nordic Countries: Dumitrescu and Hurlin Causality Approach		
Yanfeng Li, Jingru Liu, Yanlei Li	Exploring the impact of renewable energy, green taxes and trade openness on carbon neutrality: New insights from BRICS countries	2024	Heliyon
Emmanuel Uche, Narasingha Das, Nicholas Ngepah	Green environments reimagined through the lens of green finance, green innovations, green taxation, and green energies. Wavelet quantile correlation and rolling window-based quantile causality perspective	2024	Renewable energy
Billie Ann Brotman	Green federal tax credits impact on US housing prices	2019	International Journal of Housing Markets and Analysis
Zaimah Zainol Ariffin, Aryati Juliana Sulaiman, Zainol Bidin, Che Zuriana Muhammad Jamil	Green Tax Policy Model: Towards Green Growth Environment	2023	PaperASIA
Maruf Rahman Maxim, Kerstin K. Zander, Roberto Patuelli	Green Tax Reform and Employment Double Dividend in European and Non-European Countries: A Meta-	2019	International Journal of Energy Economics and Policy

	Regression Assessment		
Mikidadu Mohammed	Green Tax Shocks and Economic Growth	2019	International Journal of Energy Economics and Policy
Jaime Vallés-Giménez, Anabel Zárate-Marco, Carmen Trueba-Cortés	Green Taxes in a Federal Context: An Empirical Model for Industrial Waste in Spain	2010	The Review of Regional Studies
Shiyu Yan, Gunnar S. Eskeland	Greening the vehicle fleet: Norway's CO2-Differentiated registration tax	2018	Journal of Environmental Economics and Management
Cristina Ortega-Rodríguez, Julio Vena-Oya, Jesús Barreal, Barbara Józefowicz	How to finance sustainable tourism: Factors influencing the attitude and willingness to pay green taxes among university students	2024	Green finance
Ionel Bostan, Mihaela Onofrei, Elena-Doina Dascălu, Bogdan Fîrţescu, Carmen Toderaşcu	Impact of sustainable environmental expenditures policy on air pollution reduction, during European integration framework	2016	Amfiteatru Economic
Shun Yao, Tongxin Li, Ying Li	Promoting sustainable fossil fuels resources in BRICS countries: Evaluating green policies and driving	2023	Resources Policy

	renewable energy development		
Wei Dong, Xiaomi Hou, Guowei Qin	Research on the Carbon Emission Reduction Effect of Green Taxation under China's Fiscal Decentralization	2023	Sustainability
Muhammad Salman, Guimei Wang	Rural energy poverty alleviation in OECD nations: An integrated analysis of renewable energy, green taxation, and the United Nations agenda 2030	2024	Renewable energy
Alejandro Fernández, Marietta Haffner, Marja Elsinga	Subsidies or green taxes? Evaluating the distributional effects of housing renovation policies among Dutch households	2024	Journal of Housing and the Built Environment
Susana Silva, Isabel Soares, Carlos Pinho	Support to renewable energy sources and carbon capture and sequestration: comparison of alternative green tax reforms	2018	Applied Economics Letters
Emmanuel Yamoah Cobbold, Yaya Li, Emma Serwaa Obobisa	Technology transfer and innovation through trade; assessing the role of low carbon technologies imports on domestic green innovation	2024	The Journal of Technology Transfer

Tunahan Degirmenci, Mucahit Aydin	Testing the load capacity curve hypothesis with green innovation, green tax, green energy, and technological diffusion: A novel approach to Kyoto protocol	2024	Sustainable development
Haeok Liz Kim, Sunghyup Sean Hyun	The anchoring effect of aviation green tax for sustainable tourism, based on the nudge theory	2021	Journal of Sustainable Tourism
Reyhaneh Sedehi, Homa Esfahanian	The Effect of Green Taxes on Labor Productivity in the Iranian Economy	2019	Iranian Economic Review
Yu Liu, Limei Cao, Kuan Wan	The impact of China's VAT reform policy on financial performance of listed companies in China's cultural industry	2023	Economic Research- Ekonomiska Istraživanja
Kazi Mohammed Kamal Uddina, Md. Mominur Rahmanb, Shuvabrata Sahac	The impact of green tax and energy efficiency on sustainability: Evidence from Bangladesh	2023	Energy Reports
Zhenhuan Xu, Chenxi Li	The impact of green tax system on idiosyncratic risk: evidence from China's environmental protection tax law	2024	Applied Economics Letters
Mohsen Pakdaman, Samaneh Khademi, Mohammad Taghi Ghaneian, Hosien Zareian, Mohammad	The Interaction between Industries and Executive Agencies (The Department of	2019	Journal of Environmental Health and

Hassan Ehrampoush, Mohamadali Morovati Shrifabadi	Environment and Administration of Economic and Finance) to Reduce Pollution: A Qualitative Study		Sustainable Development
Ke-Cheng Zhang, Adnan Safi, Bilal Kchouri, Arindam Banerjee, Lu Wang	The three greens: Innovation, finance, and taxes—Performance analysis and future implications	2024	Journal of Innovation & Knowledge
Yanlei Sun, Md Mominur Rahman, Xu Xinyan, Abu Bakkar Siddik, Mohammad Ekramol Islam	Unlocking environmental, social, and governance (ESG) performance through energy efficiency and green tax: SEM-ANN approach	2024	Energy Strategy Reviews
Sahar Afshan, Tanzeela Yaqoob	Unravelling the efficacy of green innovation and taxation in promoting environmental quality: A dual-model assessment of testing the LCC theory in emerging economies	2023	Journal of Cleaner Production
Bishawjit Chandra Deb, Md. Mominur Rahman, Mohammad Haseeb	Unveiling the impact on corporate social responsibility through green tax and green financing: a PLS-SEM approach	2023	Environmental Science and Pollution Research
Xiahai Wei, Feng Jiang, Yu Chen	Who pays for environmental protection? The impact of green tax reform on labor share in China	2023	Energy Economics

Table 2.2.2. Articles used in the empirical study

After the sample was established, three databases were constructed separately. The first, presented in the literature review chapter, dealt with the content of the articles, including the variables used to describe green tax and how they relate to it. The second and third databases regard the article typology and the characterization of the authors, respectively. These contained bibliometric information such as the article title, year of publication, and journal, in addition to author-level variables like name, institutional affiliation, type of authorship, productivity, and the country and continent of publication of the institution.

Regarding the variable “article name”, each article received a separate entry as all the titles were unique and independent of one another. For variables “year of publication” and “journal”, duplicate information was collapsed to avoid excessive duplication.

For the variable “author”, each author was enumerated separately. The variable “type of authorship” was analysed in two ways. Firstly, by distinguishing between single-authored (individual) and multi-authored (collective) production, and secondly, by categorizing articles into five groups according to the number of authors per article (one author, two authors, three authors, four authors, and five or more authors).

The variable “authors’ productivity” was also categorized into three groups, according to the number of articles published by each author in the sample (one published articles, two published articles or three published articles). For “country” and “continent” variables, classification was done according to the author's institutional affiliation at the time of publication, if multiple affiliations were given, the first institution was considered.

Analysis of the data was conducted with VOSviewer and Microsoft Excel. Excel was used for the consolidation and organization of data, taking advantage of its features, such as, pivot tables, formulas, conditional formatting, frequency tables, and charts, to filter, sort, and summarize information. VOSviewer was used to generate bibliometric maps, enabling the visualization of the relationships in the dataset through the grouping together of related items. This enabled the detection of the relations among citations, keywords, and collaborations among authors. To ensure accuracy, support files were created to merge similar terms and correct inconsistencies.

Briefly, these databases provided a solid foundation for the content and bibliometric analyses. The results of these analyses are presented in the following chapter.

4. Results

In this chapter, it is discussed the results achieved through processing the information collected according to the objectives and questions set in previous parts of the thesis. The findings are presented, considering various bibliometric indicators, and accompanied by appropriate tables and figures.

4.1. Article typology

Year of publishing

Between 1994, when the first article on this topic was published, and November 2024, the years with the fewest publications were 2010, 2013, 2016, 2020, and 2021, each of which recorded only one article published. In contrast, the year 2024 registered the highest number of publications, with a total of 18 published articles.

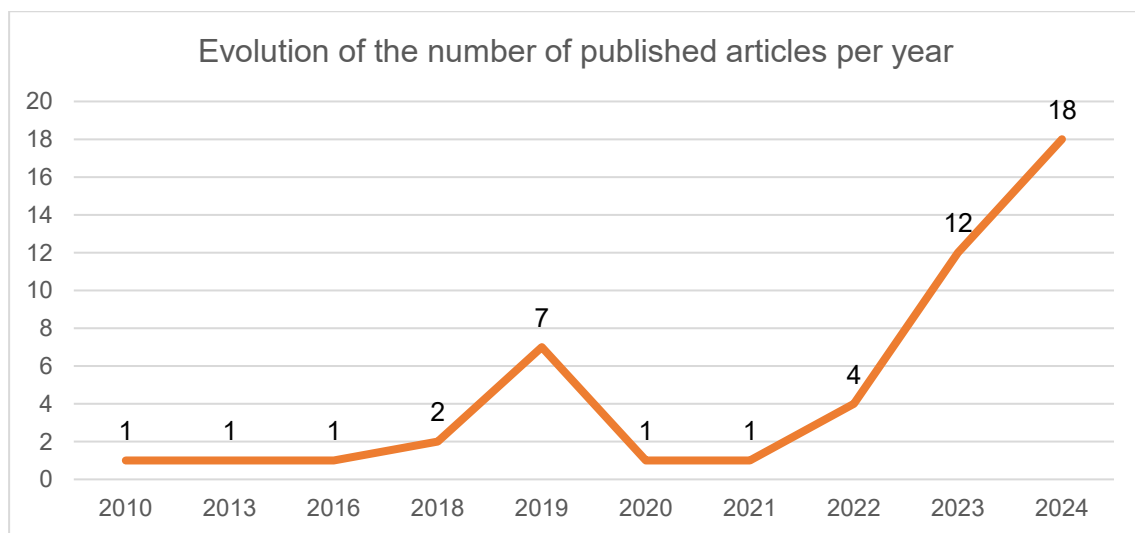


Figure 4.1.1. Evolution of the number of published articles per year

The 2019 peak reflects the boost in momentum from the Paris Agreement (Khurshid et al., 2023) and the European Green Deal (European Commission, 2019). The downward trend in 2020 and 2021 reflects the COVID-19 pandemic, which altered research agendas. The trend has resumed growth since 2022, driven by green recovery policy, controversy regarding the EU Carbon Border Adjustment Mechanism (CBAM) (Cao et al., 2025), and the increasing pressure for climate action.

Journal

The 48 articles analysed were published across 36 different academic journals. The journal with the highest number of publications was Sustainability, which accounted for five articles. This was followed by Energies and Environmental Science and Pollution Research, each with three published articles. The majority of the journals (64,42%) published only one of the analysed articles, while 16,67% of the journals published two.

Journal	Number of articles	%
Amfiteatru Economic	1	2,08%
Applied Economics	1	2,08%
Applied Economics Letters	2	4,17%
Economic Analysis and Policy	1	2,08%
Economic Research-Ekonomska Istraživanja	1	2,08%
Energies	3	6,25%
Energy	1	2,08%
Energy & Environment	1	2,08%
Energy Economics	1	2,08%
Energy Reports	1	2,08%
Energy Strategy Reviews	1	2,08%
Environment, Development and Sustainability	1	2,08%
Environmental Science and Pollution Research	3	6,25%
European Journal Of Law And Economics	1	2,08%
Green finance	1	2,08%
Heliyon	1	2,08%
International Journal of Energy Economics and Policy	1	2,08%
International Journal of Energy Economics and Policy	1	2,08%
International Journal of Housing Markets and Analysis	1	2,08%
Iranian Economic Review	1	2,08%
Journal of Cleaner Production	2	4,17%
Journal of Environmental Economics and Management	1	2,08%
Journal of Environmental Health and Sustainable Development	1	2,08%
Journal of Housing and the Built Environment	1	2,08%
Journal of Innovation & Knowledge	1	2,08%
Journal of Sustainable Tourism	1	2,08%
Journal of the Knowledge Economy	1	2,08%
PaperASIA	1	2,08%
Renewable energy	2	4,17%
Resources Policy	1	2,08%

Sustainability	5	10,42%
Sustainable development	1	2,08%
The Journal of Technology Transfer	1	2,08%
The Review of Regional Studies	1	2,08%
Transportation Research Part D	2	4,17%
Utilities policy	1	2,08%
Grand Total	48	100%

Table 4.1.1. Distribution of articles per journal

Citations

To identify the most cited articles within the sample, a density graph was created, including only the articles that received at least three citations. As shown in the figure below, the three most cited articles are: “2030 Agenda of Sustainable Transport: Can Current Progress Lead Towards Carbon Neutrality?” by Khurshid (2023), cited 69 times; “Can Green Tax Policy Promote China’s Energy Transformation?—A Nonlinear Analysis from Production and Consumption Perspectives” by Fang (2023), cited 68 times; and “Environmental taxes: Drivers behind the revenue collected” by Andreoni (2019), cited 51 times. These three citation rates suggest that these three articles have contributed to influencing later research in the area.

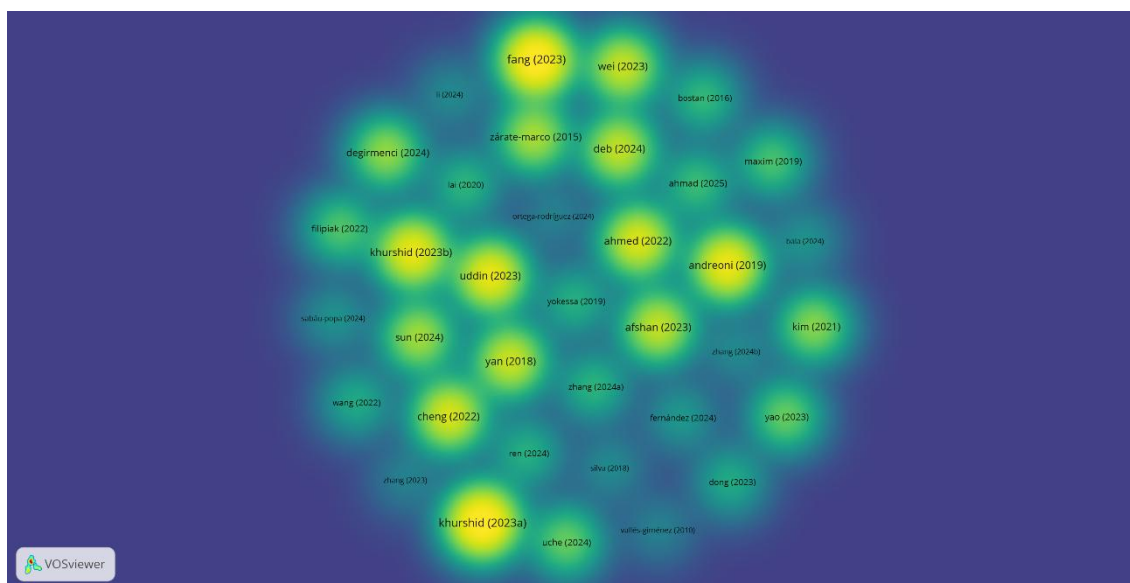


Figure 4.1.2. Most cited articles

Keywords

Aiming to examine the topics most closely associated with green taxation, a keyword analysis was conducted from the keywords provided in the 48 selected articles. A bibliometric visualization was drawn based on VOSviewer. This program displays each keyword as a circle, the size of the circle corresponds to the frequency of occurrence, and the distance between

keywords reflects the closeness between keywords. Lines connecting the circles indicate a connection between them, highlighting thematic relationships.

The keyword analysis reveals that the most frequent word is “green tax”, appearing in all 48 articles, and serves as a central node connected with all the other terms. The second most frequent keyword is “environment”, present in 25 articles, followed by “tax” and “sustainability”, which are in 19 and 18 articles, respectively. The results reflect the interdisciplinary nature of green taxation and its close relationships with broader environmental and sustainability-related themes.

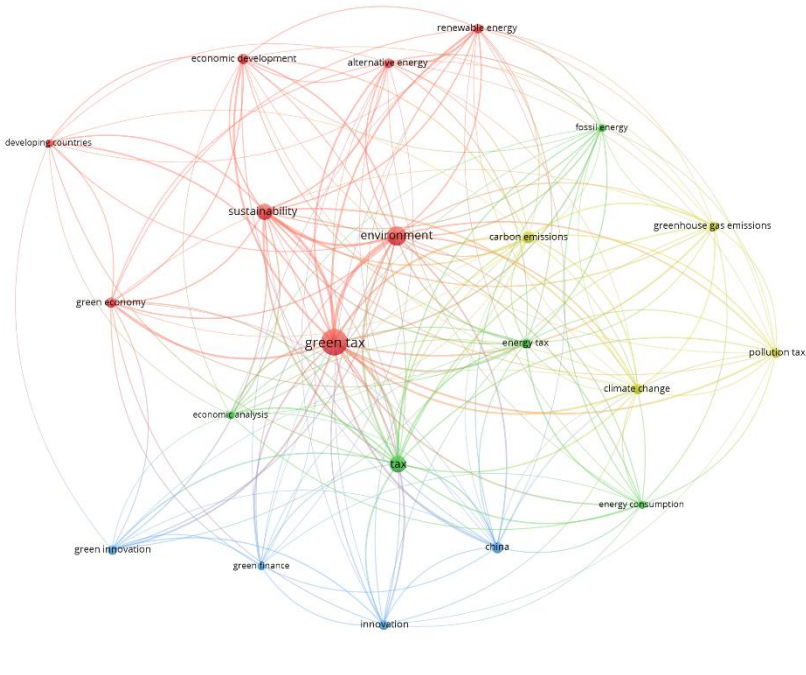


Figure 4.1.3. Keywords used in the articles

4.2. Characterization of authors

Number of authors

Across the 48 analysed articles, a total of 139 authors were identified. Only three articles were single-authored, indicating that the majority of the research was conducted collaboratively. The remaining 45 articles were collaboratively written, suggesting the prevalence of collaborative authorship in the field.

Authorship type	No. Articles	%
Individual	3	6,25%
Collective	45	93,75%
Total	48	100%

Table 4.2.1. Authorship type

A more detailed analysis reveals that articles with three authors are the most common, comprising 38% of the sample, followed by those with two authors, which comprise 27% of the sample. In contrast, single-authored articles are the least common, comprising only 6% of the total sample.

No. of authors per article	No. of articles	%
Articles with 1 author	3	6,25%
Articles with 2 authors	13	27,08%
Articles with 3 authors	18	37,50%
Articles with 4 authors	6	12,50%
Articles with 5 or more authors	8	16,67%
Total	48	100%

Table 4.2.2. Number of authors per article

A more detailed analysis shows that 10 authors published more than one article within the sample. Of these, nine authors each contributed to two different articles, namely Adnan Khurshid, Alexandra Maria Bele, Anabel Zárata-Marco, Claudia Diana Sabău-Popa, Hamid Mahmood, Jaime Vallés-Giménez, Javier Cifuentes-Faura, Khalid Khan, and Samia Khalid. The most dynamic author was Md. Mominur Rahmanb, who authored three articles, which is the most productive contributor in the dataset.

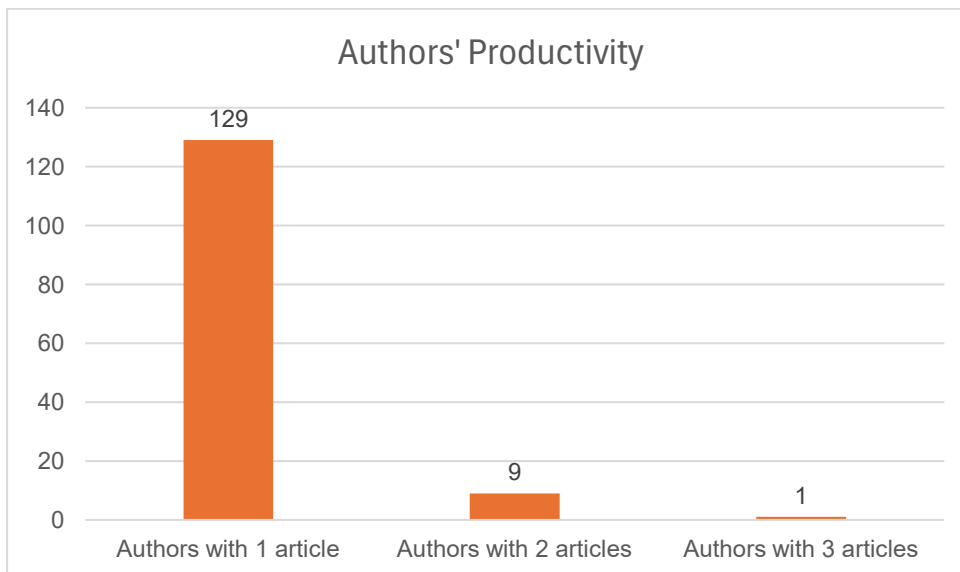


Figure 4.2.1. Authors' productivity

Author collaboration

To analyse the group of authors with more than one publication in the sample and to explore the collaborative relationships among them, a bibliometric co-authorship network was constructed using VOSviewer. In the resulting visualization, each author is represented with a circle, and co-authorship ties are represented as lines connecting the nodes. These connections indicate a collaboration on publication.

The network reveals the presence of five distinct author clusters. The largest cluster consists of three authors: Adnan Khurshid, Javier Cifuentes-Faura, and Khalid Khan, who have co-authored articles. Additionally, there are three clusters with only two participants: one includes Alexandra Maria Bele and Claudia Diana Sabău-Popa; another comprises Hamid Mahmood and Samia Khalid; and the third features Jaime Vallés-Giménez and Anabel Zárate-Marco.

One author, Md. Mominur Rahman, appears as an unconnected node. This indicates that the author either published individually or collaborated exclusively with authors who do not meet the graph's inclusion threshold—specifically, those with only one publication in the dataset, and who therefore were excluded from the visualization. In this case, the author published the articles not individually but with other authors presented in the sample that don't have more than one article published, therefore, are excluded of this specific analysis as they don't meet the threshold criteria.

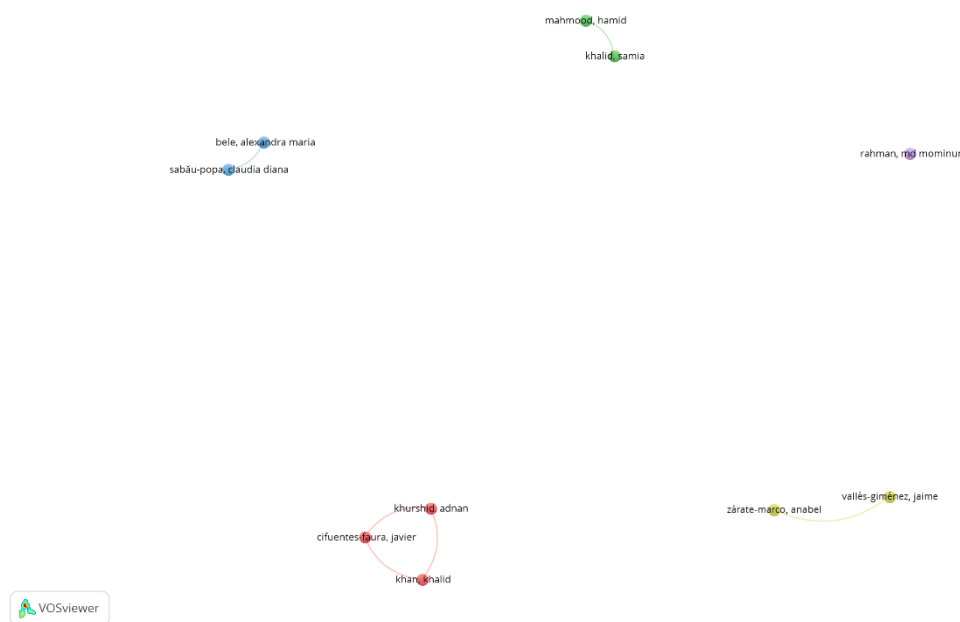


Figure 4.2.2. Author collaboration

Geographical affiliation

The geographical affiliation analysis aims to identify the countries and continents most represented in the sample, based on the institutional affiliations of the authors at the time of publication. For this reason, the country of the institution with which each author was affiliated formed the basis of classification.

On the continental level, it is noted that there is at least one affiliated author per continent. The representation, however, is uneven. Africa is the least represented continent, with a single

author from an African-based institution. In contrast, Asia is the most represented continent, with 90 out of 139 affiliated authors, accounting for approximately 65% of the total number. This is indicative of a high density of research output on the topic within institutions based in Asian countries. Considering other continents, 42, 4, and 2 authors are related to an institution based in Europe, America, and Oceania, respectively.

Continents	No. of authors	%
Africa	1	0,72%
America	4	2,88%
Asia	90	64,75%
Europe	42	30,22%
Oceania	2	1,44%
Total	139	100%

Table 4.2.3. Continent of authors' affiliation

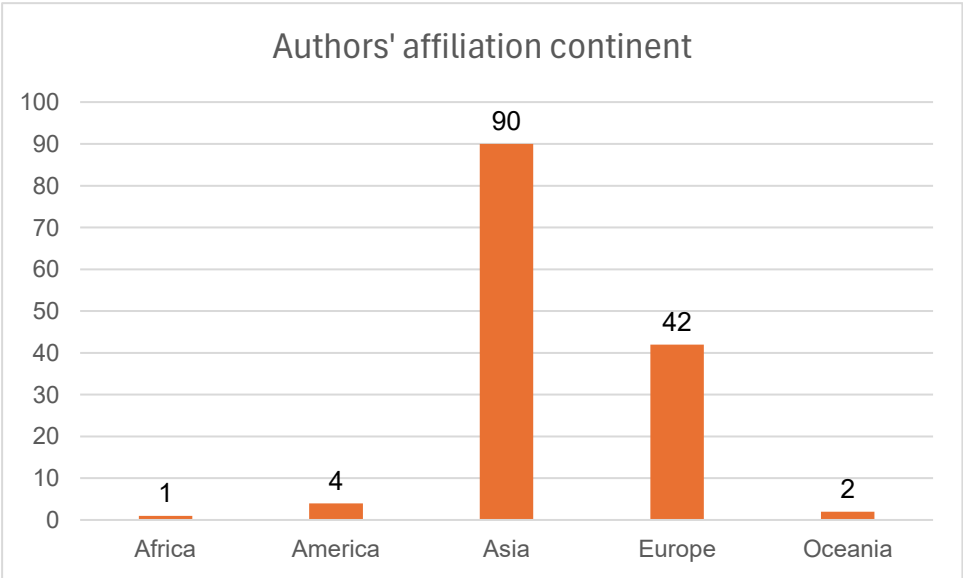


Figure 4.2.3. Continent of authors' affiliation

In addition to the continental distribution, the analysis also considered the affiliation countries of the institutions to which the authors belong. Out of the 139 authors in the sample, 58 authors belong to institutions located in China, representing approximately 42% of the total, and thus China is the most well-represented country.

Also, on the Asian continent, Iran follows second with 8 related authors, and Bangladesh, Malaysia, and Pakistan, with 5 authors each. Iraq, Lebanon, and the Republic of Korea have 2 authors each, and Oman, Thailand, and the United Arab Emirates each have 1 related author.

Outside of Asia, the European continent is the second most represented, with eleven nations. In Europe, Romania and Spain are the most prominent with 13 and 7 affiliated authors, respectively. Other European countries are represented to a lesser extent.

The African and Oceanian continents are each represented by only one country - South Africa and Australia, respectively - while the American continent occupies an intermediate position, with authors affiliated with institutions in Peru and the United States of America.

Continent	Country	No. of affiliated authors	%
Africa	South Africa	1	0,72%
Africa Total		1	0,72%
America	Peru	2	1,44%
	USA	2	1,44%
America Total		4	2,88%
Asia	Bangladesh	5	3,60%
	China	58	41,73%
	Iran	8	5,76%
	Iraq	2	1,44%
	Lebanon	2	1,44%
	Malaysia	5	3,60%
	Oman	1	0,72%
	Pakistan	5	3,60%
	Republic of Korea	2	1,44%
	Thailand	1	0,72%
	United Arab Emirates	1	0,72%
Asia Total		90	64,75%
Europe	France	3	2,16%
	Germany	1	0,72%
	Italy	1	0,72%
	Netherlands	3	2,16%
	Norway	2	1,44%
	Poland	5	3,60%
	Portugal	3	2,16%
	Romania	13	9,35%
	Spain	7	5,04%
	Turkey	3	2,16%
	UK	1	0,72%
Europe Total		42	30,22%
Oceania	Australia	2	1,44%
Oceania Total		2	1,44%
Total		139	100%

Table 4.2.4. Country of authors' affiliation

Asia, and particularly China, accounts for the greatest number of publications on green taxation. Since it reflects not just the scale of China's environmental problem, as the world's biggest emitter of CO₂, but also the strong policy reform the country has undertaken, such as

the Environmental Protection Tax Law, approved in 2016 and decreed in 2018 (Sun and Zhang, 2023).

Government spending on sustainability research, as encouraged by the target of achieving carbon neutrality by 2060 (Zhao et al., 2022) and vast academic subsidies, has also stimulated greater activity. Similar, though smaller, tendencies can be observed in other Asian economies in situations of high growth, dependence on fossil fuels, and pressing sustainability targets.

Europe comes second, with Romania being a very active player. The European Union's historical global leadership in environmental taxation, as demonstrated through the Emissions Trading System (EU ETS) (Witkowski et al., 2021), cited by (Filipiak and Wyszowska, 2022), the European Green Deal in 2019 (European Commission, 2019), and the commitment done in 2021 of the European countries to reduce emissions by 55% by 2030, provides a strong foundation for scientific investigation.

5. Conclusion

5.1. Objectives and results

Academic journals play a central role in both professional and academic circles, as major sources for the dissemination of scientific knowledge. Through publication in such channels, professionals and specialists across the globe gain access to, evaluate, and exchange information regarding the state of the research in specific areas of study.

The present study covers 30 years and is mostly focused on green taxation research characterization, with particular care being put into systematizing the empirical literature. In addition to this main objective, two specific objectives were set: the first concerns the studied research profile and content, while the second is for the researchers' profile.

In the case of the first objective, green taxation was either used as a dependent variable or an independent variable in some articles. The majority have considered green tax as an independent variable in order to analyse how green taxation can influence several topics, such as greenhouse gas emission, CO₂ emissions, load capacity factor, green investments, among others. On the other hand, studies that used green taxes as an independent variable aimed to explain issues such as sustainable economic development, the employment effect of green taxes across countries, and other economic and environmental effects.

The most frequent usage as an independent variable, mainly to analyse the impacts on CO₂ emissions, green investment, renewable energy, or economic growth, accentuates its nature as an interventionist policy with immediately tangible impacts on sustainability performance. Conversely, whenever green taxation is an explanatory variable, its social, economic, and institutional determinants are considered in its setting and intensity. Double empirical justification supports that green taxation is both the result and the proof of structural change linked to sustainable development. It is a political and cultural output as well as a technical budgetary instrument to reflect society's will towards internalizing green costs. Together, these findings suggest that green taxation literature can't be assessed as a bibliometric representation of research productivity per se.

Regarding the profile of the studies, more specifically the article typology, it can be concluded that the majority of the articles in the selected sample were published in 2024, which indicates a rising academic interest towards the subject, and suggests that the trend is likely to prevail in the foreseeable future as well.

The recent increase in publication frequency is not only witnessing the quantitative expansion of the subject but is also approaching a qualitative shift in the scientific relevance of green taxation. The peak in 2024 suggests that the issue has increasingly come to occupy

the very core of international research agendas, being driven by international political motives, such as the Paris Agreement and the European Green Deal. This stimulus demonstrates that green taxation is increasingly recognized as a prime economic and environmental policy instrument. It also indicates that the topic is still one of consolidation of theoretical and methodological approaches, and research yields continue to evolve in terms of priority and focus.

As for the journals in which these articles appear, no such trend can be identified due to the highly distributed presence of publications: 36 journals out of 48 articles. The most highly represented of these is Sustainability, with five articles, followed by Energies and Environmental Science and Pollution Research, both of which have three articles, and the remaining journals had either one or two articles published.

Regarding the articles' citations, the ones that have played a fundamental role in shaping subsequent research in the field are *"2030 Agenda of Sustainable Transport: Can Current Progress Lead Towards Carbon Neutrality?"* by Khurshid (2023), cited 69 times; *"Can Green Tax Policy Promote China's Energy Transformation?—A Nonlinear Analysis from Production and Consumption Perspectives"* by Fang (2023), cited 68 times; and *"Environmental taxes: Drivers behind the revenue collected"* by Andreoni (2019), cited 51 times.

The most frequently associated keywords for green taxation—apart from "green tax," which understandably appeared 48 times as the primary inclusion criterion—are "environment", which featured in 25 articles, followed by "tax" and "sustainability", with 19 and 18 appearances, respectively. This not only reflects the interdisciplinary character of green taxation research but also its close connections with overall arguments on environmental policy and sustainable development.

At the authorship level, only three articles were single-authored, and the remaining 45 articles were co-authored, reflecting a dominance of collaborative research in the field. The most frequent type of co-authored articles was articles with three co-authors.

Across the sample, 139 authors were identified. Of these, ten authors published more than one article within the sample, nine of whom contributed with two different articles, and one author, Md. Mominur Rahmanb, with three.

The demonstration that only ten authors had two or more papers published indicates the scattered nature of the topic, with contributions largely unconnected and with few recurring author networks. While this kind of trend can be seen as a weakness, suggesting the absence of established research systems, it is also an opportunity. Low author duplication suggests an open, emergent field in which there are opportunities for new researchers to establish

themselves as leaders and to establish research agendas on the existing empirical foundations.

Also, the authors' collaboration analysis identified five main collaborations. The larger cluster consisted of three authors, three clusters consisted of two authors each, and a single cluster consisted of only one author, whose collaborations were below the minimum inclusion level, since the authors had only one publication in the dataset. The limited recurrence of collaborative efforts highlights the need for stronger international and interdisciplinary cooperation, capable of moving beyond isolated case studies and advancing toward broader, comparative conclusions.

Considering the authors' affiliation, all continents are represented, with Asia leading the way, followed by Europe, America, Oceania, and Africa, which was the least represented in this sample. At the national level, China is the most contributing country, not only at the continental level but also at the world level, and Romania is the one in Europe. The remaining countries show similar levels of contribution.

That geographically clustered prevalence of papers in Asia, and China in general, is also noteworthy. Overall, it attests to the size of the region's environmental issues and the premium that has come to be placed on financial tools as a means of energy transition and carbon neutrality. In the Chinese context, environmental law activism and the state's goal of going carbon-neutral by 2060 sparked a wave of scholarship driven by institutional encouragement and government prodding. Such regional dominance raises concerns regarding the external validity of findings obtained in one specific cultural and institutional context. The comparatively limited availability of evidence from nations in, for example, Africa and America limits the literature's capacity to capture the diversity of challenges and institutional strengths influencing the take-up and effectiveness of green taxation around the globe. Also noteworthy is how green taxation has been employed in the literature.

Considering the findings outlined, this research contributes to a better understanding of the current state of research on green taxation, considering both the thematic content of the articles and the authorship behind them.

Green tax research needs to be sensitive to the maturity of the field, responsive to geographical imbalances that chart its course, and recognize the strengths of integrative and comparative approaches. Advances in the future will rely less on the doubling of research questions and more on the ability to launch interdisciplinary debate and build evidence across various national contexts. It is only by such cross-border, collaborative efforts that the literature will move beyond fragmented observations and develop into cumulative, generalizable

knowledge capable of shaping the crafting of effective, equitable, and sustainable environmental fiscal policies.

5.2. Study limitations

However, as this work is based upon a bibliometric approach, it has some weaknesses that belong to its nature. Bibliographical work never achieves complete coverage, as it is always possible that corresponding authors or field contributions have not been covered. Moreover, the exclusive reliance on the Scopus database and the placing of limitations on the keywords used and selected may lead to biased results among the authors and works considered.

In addition, the dynamic and rapid nature of green taxation studies also means that the findings could quickly become outdated as new policies and empirical evidence are published. The review is also limited by English-language domination of search databases, which may not be representative of non-English-speaking contexts. Secondly, methodological and conceptual variation of green taxation across the literature makes it impossible to draw universal conclusions because the studies differently define the term. Finally, the focus on empirical research ensured practical relevance but excluded theoretical studies that might enhance conceptual understanding. Despite these limitations, the approach offers a strong basis for synthesizing current knowledge on green taxation.

5.3. Suggestions for future research

Additional research could explore the geographical scope of investigation since environmental taxation remains a poor research area in Africa, America, and Southeast Asia despite being strongly related to sustainable development. Methodological breakthrough could also be explored by the combination of bibliometric analysis with systematic reviews or meta-analyses, which would enrich the evidence base by both providing quantitative mapping and qualitative depth concerning the manner of understanding and measuring green taxation empirically.

Additionally, as green taxation is a field of investigation at the interface of economics, law, political science, and environmental science, among other subjects, follow-up questions with an interdisciplinary approach could generate a more complete picture of fiscal instruments for sustainability.

Finally, expanding the set of databases monitored with bibliometric analysis to others, such as Google Scholar, and introducing complementary keywords such as Environmental Tax Reform would give a larger and more representative sample. This would, therefore, present a more accurate and complete picture of the green taxation literature hypothesis.

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