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Environmental taxes as a tool for the green economy and sustainable infrastructure development

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Abstract. In the article the role of environmental taxes in advancing the green economy and financing sustainable infrastructure development was invistagated. A comprehensive analysis of academic literature and research was undertaken to examine the theoretical foundations of environmental taxation and its economic implications. Practical insights were derived from case studies of European countries, focusing on the design and implementation of environmental tax systems and the strategic allocation of tax revenues toward green initiatives and infrastructure development. Additionally, statistical correlation and regression

analyses were conducted to evaluate the relationship between environmental tax revenue and explanatory variables.

The aim of the article is to evaluate the role and efficacy of environmental taxes as a strategic policy instrument for advancing green economic transitions and fostering sustainable infrastructure development in the energy sector.

Methods of the research include literature review of existing academic literature on environmental taxation, green economy practices and infrastructure financing; examination of case studies from European countries (Denmarks, Sweden, Finland, Austria and Netherlands); statistical correlation and regression analysis of environmental tax revenue data and range of explanatory variables.

Results of the research confirm that environmental taxes provide a significant revenue stream, particularly in countries with established carbon pricing mechanisms and energy taxes. These revenues have been effectively allocated to support renewable energy development, energy efficiency improvements, and green infrastructure projects. Countries with higher environmental tax rates exhibit reductions in carbon emissions and increased adoption of cleaner energy technologies. The analysis highlights a positive correlation between environmental tax revenue and investments in low-carbon infrastructure. Stronger fiscal signals, such as high implicit energy tax rates and investments in research and development (R&D), contribute to greater energy efficiency and technological advancements. These factors bolster the effectiveness of environmental taxation systems in driving sustainable economic transitions. The effectiveness of environmental taxes varies based on policy design and implementation. Countries with transparent revenue allocation mechanisms and integrated policies linking taxation to sustainability objectives achieve more substantial outcomes. Some factors, such as the share of renewables and energy import dependency, do not exhibit a direct or isolated impact on environmental tax revenues. Political resistance, equity concerns, and potential economic burdens on vulnerable populations remain challenges for widespread adoption.

Conclusions. Environmental taxes are a vital tool for advancing the green economy and financing sustainable infrastructure development. They not only provide economic incentives to reduce pollution and improve resource efficiency but also create a reliable revenue stream for funding essential green infrastructure projects. The study underscores the importance of aligning environmental tax policies with broader innovation and efficiency agendas to maximize their impact. While challenges such as political resistance and equity issues persist, transparent revenue allocation and integrated policy frameworks can enhance the effectiveness of environmental taxes.

Keywords: environmental taxation; sustainable development; renewable energy financing; infrastructure investment.

Екологічні податки як інструмент для розвитку зеленої економіки та стійкої інфраструктури

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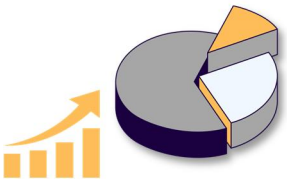
Анотація. У статті розглянуто роль екологічних податків у просуванні зеленої економіки та фінансуванні сталого розвитку інфраструктури. Для вивчення теоретичних засад екологічного оподаткування та його економічних

наслідків було проведено комплексний аналіз наукової літератури та досліджень. Практичні ідеї були отримані з прикладів європейських країн, зосереджених на розробці та впровадженні систем екологічного оподаткування та стратегічному розподілі податкових надходжень на екологічні ініціативи та розвиток інфраструктури. Крім того, було проведено статистичний кореляційний та регресійний аналізи для оцінки зв'язку між надходженнями екологічного податку та пояснювальними змінними.

Метою статті є оцінка ролі та ефективності екологічних податків як інструменту стратегічної політики для просування зелених економічних переходів та стимулювання сталого розвитку інфраструктури в сфері енергетики.

Методи дослідження включають огляд наявної академічної літератури з екологічного оподаткування, практик зеленої економіки та фінансування інфраструктури; вивчення прикладів європейських країн (Данія, Швеція, Фінляндія, Австрія та Нідерланди); статистичний кореляційний та регресійний аналіз даних надходжень від екологічного податку та діапазону пояснювальних змінних.

Результати дослідження підтверджують, що екологічні податки забезпечують значний потік доходів, особливо в країнах із встановленими механізмами ціноутворення на викиди вуглецю та податків на енергію. Ці доходи були ефективно розподілені на підтримку розвитку відновлюваної енергетики, підвищення енергоефективності та проектів зеленої інфраструктури. Країни з вищими ставками екологічного податку демонструють скорочення викидів вуглекислого газу та більше впровадження екологічно чистих енергетичних технологій. Аналіз підкреслює позитивну кореляцію між надходженнями від екологічного податку та інвестиціями в низьковуглецеву інфраструктуру. Сильніші фіскальні сигнали, такі як високі непрямі ставки податку на енергію та інвестиції в дослідження та розробки, сприяють підвищенню енергоефективності та технологічному прогресу. Ці



фактори підвищують ефективність систем екологічного оподаткування в стимулюванні стійких економічних змін. Ефективність екологічних податків залежить від розробки та впровадження політики. Країни з прозорими механізмами розподілу доходів та інтегрованою політикою, яка пов'язує оподаткування з цілями сталого розвитку, досягають суттєвіших результатів. Деякі фактори, такі як частка відновлюваних джерел енергії та залежність від імпорту енергії, не мають прямого чи ізольованого впливу на надходження екологічного податку. Політичний опір, проблеми справедливості та потенційний економічний тягар для вразливих верств населення залишаються проблемами для широкого впровадження.

Висновки. Екологічні податки є життєво важливим інструментом для просування зеленої економіки та фінансування сталого розвитку інфраструктури. Вони не лише створюють економічні стимули для зменшення забруднення та підвищення ефективності використання ресурсів, але й створюють надійний потік доходів для фінансування основних проектів зеленої інфраструктури. Дослідження підкреслює важливість узгодження політики екологічного оподаткування з ширшими планами інновацій та ефективності для максимізації їх впливу. Хоча такі виклики, як політичний опір і проблеми справедливості, залишаються, прозорий розподіл доходів і інтегровані рамки політики можуть підвищити ефективність екологічних податків.

Ключові слова: екологічне оподаткування; сталий розвиток; фінансування відновлюваної енергетики; інвестиції в інфраструктуру.

Problem statement. The concepts of sustainable development, green and blue growth, circular and resource-efficient economy are increasingly becoming the main topics for discussion and research among scientists and the public in the modern world. The unsatisfactory state of the environment and pressing economic challenges necessitate the search for effective mechanisms to combine economic

growth and environmental protection, implement environmentally friendly initiatives, and develop a green economy. Considering the social, economic, political and environmental challenges, the issue of ensuring the development of sustainable infrastructure in Ukraine remains one of the most pressing tasks of today.

One of the key elements of sustainable growth is the development of infrastructure that incorporates environmental aspects and helps to preserve the natural environment. This concept is the basis for implementing the principles of a green economy and sustainable infrastructure. The combination of natural and artificial elements that perform environmental functions is an effective tool for achieving this goal. In the context of global challenges related to climate change and biodiversity loss, green sustainable infrastructure is becoming increasingly important.

Traditional tax systems often fail to fully internalize environmental externalities, leading to resource depletion, greenhouse gas emissions, pollution, and long-term economic inefficiencies. As policymakers search for effective instruments to achieve environmental sustainability while ensuring economic growth and social equity, the potential role of environmental taxes as a policy tool remains inadequately explored and underutilized.

Recognizing the need for dedicated funding sources for green infrastructure, environmental taxes emerge as a critical tool. The environmental tax and the accumulated funds from it that can be used to finance sustainable infrastructure projects, which can become a driver for achieving the principles of a green economy and sustainable development, as well as reducing negative environmental impact. This creates a direct link between the cause of pollution and the consequence - financing the restoration of such pollution.

Analysis of the latest research and publications. Recent literature provides valuable insights into how environmental taxes can serve as catalysts for green transformations. Empirical studies employing panel data, econometric modeling, and cross-country comparisons demonstrate that countries imposing higher

environmental tax rates experience measurable declines in emissions intensity and a corresponding shift toward cleaner energy sources. For example, analyses of European Union member states highlight correlations between well-structured energy taxes and reductions in CO_2 emissions, alongside increased investment in renewable energy infrastructure [1].

Contemporary scholarly discourse on environmental taxation situates this policy instrument at the nexus of climate policy, fiscal reform, and sustainable infrastructure development. Recent econometric and panel-data such as those exploring the nexus between green investment, fiscal policy, environmental tax, energy price, natural resources, and clean energy, and their impact on sustainable development studies (Yan et al, 2023) [2], demonstrates the importance of well-designed fiscal policies in stimulating private sector investment in renewable energy initiatives, fostering energy efficiency, and expediting the transition to a low-carbon economy. The study [2] also emphasizes the correlation between environmental tax policies and the mitigation of carbon emissions, while examining funding mechanisms for renewable energy ventures and initiatives aimed at environmental conservation.

In parallel, the research Abbas et al in their research [3] confirms a significant positive correlation between green finance and renewable energy investments, indicating that increased access to green financing channels stimulates investment in renewable energy sources. Similarly, the findings suggest that environmental tax policies play a crucial role in incentivizing the shift towards cleaner energy sources by increasing the cost of polluting activities and making renewable energy more competitive. Moreover, the study [3] highlights the detrimental impact of geopolitical risk on renewable energy investments. Geopolitical instability, such as trade wars, political tensions, and global conflicts, can create uncertainty and discourage investment in long-term renewable energy projects.

Also, Israt Zahan & Shuai Chuanmin [4] emphasizes the significance of well-structured fiscal policies in stimulating private sector investment in clean energy

initiatives, thereby expediting the transition towards a low-carbon economy. It examines the correlation between environmental tax policies and the mitigation of carbon emissions, while also exploring the funding mechanisms for renewable energy ventures and initiatives aimed at environmental conservation.

The study by Wang and Yu [5] demonstrates a non-linear relationship between environmental tax rates and the level of green technology innovation. This non-linearity suggests that a simple linear increase in environmental tax rates may not consistently translate into a proportional increase in green technology innovation. Initially, as environmental tax rates rise, firms within these industries may experience a stronger incentive to invest in cleaner technologies to mitigate the increased costs associated with pollution. This initial phase likely witnesses a positive correlation between tax rates and innovation. However, as the tax rate continues to escalate, the relationship may become more complex.

Liu et al. in the research [6] demonstrates a significant positive impact of the Environmental Protection Tax Law on firms' environmental investments. The imposition of environmental taxes likely incentivizes firms to invest in pollution control technologies, adopt cleaner production processes, and improve their environmental performance to minimize tax liabilities.

The article Tao et al. [7] also highlights the significant impact of environmental taxes in driving eco-innovation and facilitating the transition to a low-carbon economy. By imposing costs on polluting activities, environmental taxes incentivize businesses to invest in research and development of cleaner technologies, adopt more sustainable production processes, and improve their environmental performance.

Identifying previously unresolved parts of the overall problem. However, recent studies underscore persistent data and methodological limitations. Many analyses focus on short- to medium-term impacts, neglecting the long-term structural changes environmental taxes may induce. There is also limited evidence on how to use environmental tax revenues to fund sustainable infrastructure projects.

While extensive research demonstrates the efficacy of environmental taxes in incentivizing green behavior and reducing pollution, a critical gap exists in our understanding of how to effectively utilize the generated revenues. While the “double dividend” hypothesis posits that environmental taxes can both reduce pollution and generate revenue for beneficial public investments, the previous researches offer limited insights into how to optimally allocate these revenues to fund sustainable infrastructure projects.

Although Ukrainian legislation provides for the targeted use of environmental tax funds to finance environmental protection measures, develop and implement innovative environmental solutions, and monitor the state of the environment, there is still a significant gap between the reality and the declared purposes of use. Therefore the analysis conducted in this article will allow identifying the potentiating factors of influence on the revenue from environmental taxes which could increase the efficiency and transparency of the use of these funds, including the introduction of a new area of use, which will be related to the development of green infrastructure in Ukraine to overcome the environmental problems of today.

Article objectives formulation (task statement).

1. Perform an in-depth analysis of existing academic research focusing on environmental taxation, green economy strategies, and approaches to infrastructure financing.

2. Analyze case studies from European countries, including Denmark, Sweden, Finland, Austria, and the Netherlands focusing on how these countries design and implement environmental tax systems and allocate the revenues toward green economy initiatives and infrastructure development.

3. Perform statistical correlation and regression analysis to evaluate the relationship between environmental tax revenue and a range of explanatory variables.

Summary of the main research material. Green infrastructure is one of the key elements of sustainable infrastructure, the interconnection of which is the

foundation of sustainable development. In today`s environment, the transition to sustainable infrastructure is a multifaceted task that requires advanced methodologies and significant financial resources.

Realizing the full potential of green sustainable infrastructure depends on adequate funding. Historically, infrastructure projects have tended to face significant underfunding. Given its relative newness, the variety of technologies used, and its decentralized nature, green sustainable infrastructure needs a solid financial foundation. To effectively meet its financing needs, a diversified financing system is needed that goes beyond traditional mechanisms, which are often subject to intense competition.

The issue of mobilizing financial resources for the development of sustainable infrastructure is becoming increasingly important in the context of global climate change. One promising tool to address this problem is the use of revenues from environmental taxes. This approach allows to simultaneously stimulate environmentally responsible behavior of economic entities and provide funding for projects aimed at preserving the environment.

The regulatory framework of European countries defines an environmental tax as a tax based on a physical unit that has a proven specific negative impact on the environment [8].

The main subgroups of environmental taxes are as follows:

- energy taxes (including CO2 taxes) - the group includes taxes on energy for transportation (most importantly gasoline and diesel) and for stationary use (fuel oil, natural gas, coal and electricity). Energy taxes include, for example, mineral oil and motor oil taxes, taxes on gasoline (leaded and lead-free), diesel fuel, fuel oil, naphtha, kerosene tax, natural gas tax, and electricity consumption tax;

- transportation taxes - this group includes taxes related to the ownership and use of motor vehicles, taxes on other transportation equipment (e.g., aircraft) and related transportation services (e.g., charter or scheduled flight fees), but only if they meet the general definition of environmental taxes. The group also includes “one-

time taxes related to the import or sale of equipment, or periodic taxes such as the annual road tax. This group includes, for example, tax on registration and use of motor oil, tax on imports and sales of vehicles, road tolls, luxury yacht and air passenger insurance taxes;

- pollution taxes - the group includes taxes on measured or estimated emissions into the air (except for CO2 taxes) and water, waste and noise management;

- resource taxes include taxes on the extraction of raw materials, except for oil and gas [9].

Energy taxes in the EU accounted for more than three-quarters of total environmental tax revenues (77% of the total) in 2022, far ahead of taxes on transport (19%) and pollution and resources (4%) (Figure 1). The funds collected through the accumulation of environmental taxes and fees in Europe are a significant source of funding for environmental protection measures and green infrastructure projects.

In the modern conditions of economic development, the energy sector is at the very heart of global economic activity, heavily influencing industrial productivity, household well-being, and overall environmental conditions. Transitioning this sector toward green, sustainable infrastructure is critically important because it encompasses a wide range of interventions that go beyond simply replacing fossil fuels with renewables. It involves modernizing power grids, integrating storage solutions to handle variable renewable generation, upgrading transmission lines, improving energy efficiency across industries, and enhancing system reliability and resilience. All these components rely on robust and consistent financing mechanisms.

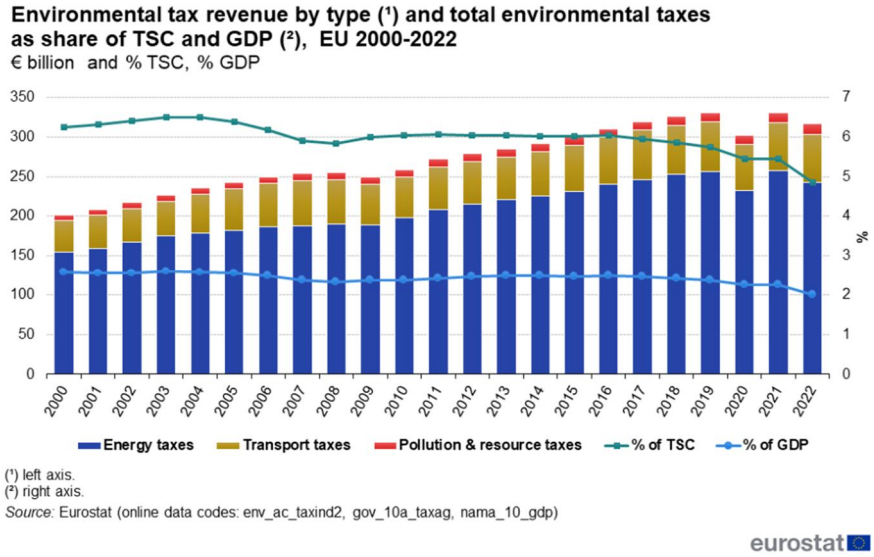


Figure 1 - Environmental tax revenues by type and total environmental taxes as a share of total government revenue from taxes and social contributions) and GDP, EU, 2002-2022 (EUR billion, %)

*Sour*ce: *[10]*.

Energy infrastructure projects are often characterized by substantial initial investment costs and extended payback periods. Traditional financing tools, typically geared toward shorter timeframes and more familiar technologies, may not adequately support the substantial upfront capital and patient financing needed for emerging green solutions.

The practice of using environmental taxes to finance sustainable infrastructure has become widespread around the world. Germany and Sweden are among the leaders in this area. Germany, in particular, has successfully used revenues from environmental taxes to develop renewable energy sources, improve the energy efficiency of buildings, and support environmentally friendly transportation. Sweden also has considerable experience in using carbon taxes to finance research into renewable energy sources and measures to reduce greenhouse gas emissions.

Considering the above-mentioned information in the research we`ve focused on identifying the potential key drivers of environmental tax revenues, gain initial insights into the direction and strength of these relationships, and ultimately lay the

groundwork for more comprehensive and nuanced analyses of the factors influencing total environmental tax revenues.

As green bonds have emerged as a significant financial instrument for channeling capital towards sustainable projects, playing a crucial role in the transition to a low-carbon economy to the following research 5 countries with the significant number of shares of green bonds issued by corporations and by governments in 2023 were selected for the futher correlation and regression analysis: Denmark, Sweden, Finland, Austria and Netherlands [11].

The analysis aims to investigate the relationship between environmental taxes revenue in the selected countries (Y) [12] and a range of explanatory variables (X_1-X_8) related to energy taxation in the period from 2013 till 2022 year:

X_1- Implicit tax rate on energy, Euro per tonne of oil equivalent (TOE) [13];

X_2 - Environmental protection investments of total economy, mln EUR [14];

X_3 - Energy productivity, Euro per kilogram of oil equivalent (KGOE) [15];

X_4 - Total energy supply by product, thousand tonnes of oil equivalent [16];

X_5 - Share of renewable energy in gross final energy consumption by sector, % [17];

X_6 - Energy import dependency by products, % [18];

X_7 - Gross domestic expenditure on R&D by sector, Percentage of gross domestic product (GDP) [19];

X_8 - Eco-innovation index [20].

In result the correlation matrix indicates how each explanatory variable relates to environmental taxes revenue (Y) and to one another (Table 1).

In the results we can identify that X_1, X_3 and X_7 positively correlated with Y. X_1 exhibited a moderately positive correlation with Y (0.426), suggesting that higher implicit energy taxation tends to be associated with higher total environmental tax revenues. X_3 showed a slightly positive correlation (0.243), indicating that economies with greater economic output per unit of energy tend to have somewhat higher environmental tax revenues. In its turn X_7 also demonstrated a positive

correlation (0.308), suggesting that higher R&D spending intensity often aligns with higher levels of environmental taxation.

Table 1

Matrics of correlation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) y	1.000								
(2) x1	0.426	1.000							
(3) x2	0.015	0.058	1.000						
(4) x3	0.243	0.724	-0.260	1.000					
(5) x4	-0.080	-0.224	0.842	-0.661	1.000				
(6) x5	-0.176	-0.316	-0.554	0.145	-0.590	1.000			
(7) x6	-0.298	-0.595	0.123	-0.395	0.322	-0.217	1.000		
(8) x7	0.308	0.727	-0.467	0.858	-0.774	0.266	-0.619	1.000	
(9) x8	-0.086	-0.187	-0.784	0.267	-0.811	0.892	-0.208	0.472	1.000

Source: completed by author.

On the other side X_2, X_4, X_5, X_6, X_8 weakly or negatively correlated with Y. X_2 exhibited a near-zero correlation (0.015), suggesting no straightforward linear relationship between these two variables. X_4 demonstrated a slightly negative correlation (-0.080), indicating that larger total energy supplies do not necessarily correlate strongly with higher environmental tax revenues. X_5 showed a negative correlation (-0.176), suggesting that countries with a higher share of renewables may not necessarily have higher environmental taxes. X_6 also exhibited a negative correlation (-0.298), implying that higher import dependence does not align with greater environmental taxation. X_8 showed a weakly negative correlation (-0.086), indicating little direct correlation with total environmental taxes.

Each variable was regressed individually on total environmental taxes, providing a baseline understanding of their isolated associations. While such models are limited (they do not control other factors), they help identify which variables have statistically significant relationships with Y.

The results of the panel regression modeling (Table 2) gain deeper insights into the factors that drive change.

Table 2

Results of estimating the impact of variables (X1-X8) on environmental tax revenues

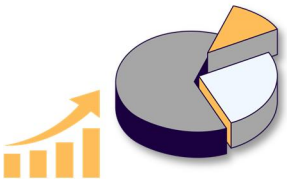
Environmnetal tax revenue	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
X_1	75.073	21.215	3.54	0.000	33.492	116.654	***
X_2	136	2.665	0.05	0.959	-5.088	5.36	
X_3	1239.889	627.182	1.98	0.480	10.634	2469.144	**
X_4	-0.049	0.187	-0.26	0.793	-0.416	0.318	
X_5	-225.228	188.278	-1.20	0.232	-594.246	143.789	
X_6	-220.614	140.526	-1.57	0.116	-496.039	54.811	
X_7	9541.022	4708.373	2.03	0.043	312.781	18769.263	**
X_8	-83.252	128.846	-0.65	0.518	-335.785	169.282	

*** p<.01, ** p<.05, * p<.1

Source: completed by author.

A one Euro/TOE increase in the implicit tax on energy is associated with a €75 increase in total environmental taxes. This strong, positive, and statistically significant relationship aligns with expectations-countries that impose higher energy-based taxes (or price signals) tend to collect more in environmental taxes overall. The overall R-squared for X_1 is 0.207, meaning about 20.7% of the variation in environmental taxes can be explained by the implicit tax rate alone.

There wasn`t identified the statistically meaningful relationship between the amount invested in environmental protection and total environmental taxes. This suggests that simply pouring resources into environmental protection does not necessarily translate into higher environmental tax revenue, at least not in a direct, linear fashion. Higher energy productivity (more economic output per unit of energy) is positively and significantly related to total environmental taxes. Economies that use energy more efficiently might have policy frameworks that include well-structured environmental taxation, or higher taxation could drive efficient improvements. R-squared for X_3 is 0.079, indicating modest explanatory power.



Total energy supply does not have a discernible linear impact on environmental tax revenue. Larger energy supply volumes do not automatically translate into higher or lower environmental tax totals. The proportion of renewables in the energy mix is not significantly linked to higher or lower environmental taxes. This could mean that while renewables are an environmental policy goal, their share alone does not dictate how much revenue is collected from environmental taxes.

Greater reliance on imported energy does not significantly predict total environmental taxes. Although negative, the lack of statistical significance means we cannot confidently assert a real relationship. Countries investing more heavily in R&D, particularly as a share of GDP, tend to collect higher environmental taxes. This may reflect broader strategic frameworks in advanced economies where technological innovation and environmental policy ambition go hand in hand.

The eco-innovation performance of a country does not show a statistically significant direct relationship with the level of environmental taxes collected. While eco-innovation can be a hallmark of progressive environmental policy, it may not directly correlate with tax revenues.

These findings suggest that environmental tax revenues are higher in contexts where energy is taxed more heavily, energy is used more efficiently, and there is a stronger emphasis on research and development. These factors possibly reflect integrated, forward-looking environmental policies that tie tax frameworks to broader innovation and efficiency agendas.

Environmental protection investments, total energy supply, share of renewables, energy import dependency, and the eco-innovation index do not show a clear, isolated impact on total environmental taxes in these simple models. Their lack of significance does not rule out complex or indirect relationships, but indicates that on their own, they do not explain much of the variation in environmental tax revenues.

The single-variable regression results highlight that countries with higher implicit energy taxes, greater energy productivity, and more substantial R&D

investments are associated with elevated levels of environmental tax revenue. These findings are consistent with the notion that strong fiscal signals on energy use, efficiency gains, and investments in knowledge and innovation frameworks support more robust environmental taxation systems. However, most variables examined do not exhibit a direct, statistically significant relationship with environmental tax revenues when considered in isolation. Further multivariate analysis, controlling for additional factors and examining interactive effects, would likely provide a more complete understanding of the drivers and outcomes of environmental taxation.

Conclusions. Environmental taxes have emerged as pivotal instruments for advancing the green economy and fostering sustainable infrastructure development. By internalizing the external costs of environmental degradation, these taxes incentivize eco-friendly behaviors while generating substantial revenue streams. In countries with robust carbon pricing mechanisms and energy taxation frameworks, environmental taxes have proven to be effective in mobilizing funds for investments in renewable energy, enhancing energy efficiency, and supporting low-carbon infrastructure projects. The research underscores a strong positive correlation between environmental tax revenues and technological advancements in clean energy. This relationship is amplified by the presence of strong fiscal signals, such as high implicit energy tax rates, and targeted investments in research and development (R&D). These factors not only drive the adoption of innovative energy solutions but also contribute to significant efficiency improvements, creating a virtuous cycle of sustainable economic growth.

However, the effectiveness of environmental taxation in achieving these outcomes is contingent upon several critical factors. Transparent mechanisms for revenue allocation are essential to ensure that tax proceeds are directed toward sustainability objectives. Integrated policy frameworks that align taxation with innovation, infrastructure development, and energy transition goals further enhance their impact. Nevertheless, challenges such as political resistance, potential

economic burdens on vulnerable populations, and equity concerns remain significant barriers to widespread adoption and implementation.

To maximize the impact of environmental taxes, policymakers must address these challenges through inclusive and adaptive strategies. This includes designing equitable tax systems that minimize regressive effects, fostering stakeholder engagement to build political support, and ensuring alignment with broader innovation and efficiency agendas. Ultimately, well-structured environmental taxes are not merely fiscal tools but critical drivers of sustainable economic transitions, contributing to climate change mitigation and the long-term resilience of infrastructure systems.

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