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Investigating the Effects of Environmental Tax Revenues on Economic Development: The Case of Nordic Countries

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Abstract: The topic of environmental taxation is becoming increasingly significant, particularly in its role in promoting sustainable development. Environmental tax policy can be used as an active tool for improving environmental quality and economic development. The primary aim of this study is to detect which environmental tax revenues influenced economic development in Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) for the period 2013–2022. The empirical findings of various panel models confirm that energy tax revenues and transport tax revenues have significant and positive effects on economic development measured by GDP per capita. Additionally, pollution tax revenues have a positive but not significant impact on GDP per capita in these countries. Nordic countries should focus on a greater share of these revenues in their total tax structure, especially pollution tax revenues, to provide desirable implications and effects on economic development in the Nordic region.

Keywords: taxes; environment; economic development; Nordic countries; different panel data analysis

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1. Introduction

The continuous economic growth driven by rapid industrialization has led to significant environmental strain, creating a complex dilemma between economic growth and environmental quality in this century [1]. The most effective option for countries to enhance welfare with limited resources in the face of unlimited desires is sustainable development that considers economic, societal, and environmental factors [2]. The challenge of integrating economic development with environmental governance, along with identifying the factors and mechanisms that can improve energy efficiency, reduce greenhouse gas emissions, and foster a green economy, has attracted global attention [3]. Amid growing concerns about environmental protection, a key factor involves renewable energy, not just for its potential to reduce carbon emissions but also for improving energy security [4]. Energy efficiency is a crucial segment of environmental efficiency and sustainability [5]. Enhancing energy efficiency and addressing environmental issues through the implementation of environmental regulations and eco-friendly tax forms are identified as the main driving forces behind climate change policy [6]. Likewise, environmental taxes represent a significant approach to promote energy efficiency and pollution mitigation [7], and they can enhance energy efficiency by stimulating the use of clean energy [8]. In the context of

Pigouvian tax theory, altering the energy production framework and improving energy efficiency can be accomplished by raising taxes on fossil fuel energy and providing fiscal support for renewable energy production [9].

By imposing taxes on fossil fuels, like coal and oil, which produce adverse effects, such as pollution and climate change, policymakers can internalize the societal expenses linked to their utilization. This approach can motivate a transition toward cleaner and sustainable energy alternatives, like wind and solar power, ultimately supporting environmental protection and decreasing dependence on fossil fuels. Moreover, offering financial backing for the development of renewable energy can stimulate interest in eco-friendly technologies and facilities, facilitating a shift toward a greener and more eco-friendly energy system. Quite often, a rapid economic growth rate is a major barrier to attaining green economy goals [10]. In the initial stages of the Environmental Kuznets Curve (EKC), where fast economic growth is observed to have adverse effects on the environment, economies face the pressing need to address climate change, reduce carbon emissions, and establish eco-friendly environments [11]. By recognizing the importance of mitigating environmental impacts early in the growth process, economies can proactively implement policies and initiatives to transition toward a greener and more sustainable path, ultimately aiming to reverse the negative environmental consequences associated with rapid economic expansion.

In recent decades, environmental pollution has become one of the most significant global challenges alongside issues such as unemployment, poverty, inequality, and financial crises [12], as well as armed conflicts. To mitigate the risks posed by climate change to financial stability, the importance of transition to sustainable economies has been emphasized since the onset of the global COVID-19 pandemic crisis [13]. Having a comprehensive evaluation of the socioeconomic and environmental effects of environmental taxes is crucial [14]. Likewise, environmental taxes have gained significant attention as they aim to tax economic activities [15]. Environmental taxes can be defined and presented in several ways. These taxes are among the most crucial policy tools for internalizing negative externalities [16]. Also, environmental taxation is a key component of environmental policy instruments, along with fees, subsidies, charges, and tradable permits [17], as well as quotas. The four types of environmental taxes are energy, transport, pollution, and resource taxes [18]. Environmental taxes, such as carbon taxes and resources taxes, are common instruments used with the price control method to manage energy consumption [19] and greenhouse gas emissions [20]. These tax forms have become a crucial method for curbing excessive energy consumption and reducing pollution [21], as well as including a resource extraction tax making natural resources more expensive compared to other inputs [22]. For instance, there are charges imposed for using natural environmental resources (water abstraction, harvesting of biological resources, extraction of mineral ores, landscape changes, and cutting of trees) [23]. An environmental tax is an economic instrument designed to incorporate the costs of environmental pollution and ecological damage into production expenses and market prices, thereby allocating environmental resources through market mechanisms [24]. Also, environmental tax revenues are utilized as a metric for evaluating climate regulation measures [25]. Furthermore, environmental taxes are effective tools for addressing the country's environmental challenges [26] and significantly influencing green growth [27]. Utilizing green taxation as a tool for environmental protection, the government can successfully manage pollution emissions and influence the direction of economic development [28]. Additionally, Vlahinić Lenz and Fajdetić [29] indicated that environmental taxes can correct the negative climate influence, and countries in the world, specifically the EU (European Union), should use environmental taxes more and encourage economic growth based on low-carbon technologies. Similarly, Norouzi et al. [30] highlighted the use of environmental taxes as a method to efficiently allocate resources to enhance social welfare. Accordingly, Sharif et al. [31] confirmed the positive influence of environmental taxes and economic growth on green technology innovation in ASEAN countries from the standpoint of government obligations to include environmental taxes as a policy instrument in their environmental programs and agendas.

Bian and Zhao [32] cited two categories of environmental regulation policies: subsidization and taxation. Under subsidization, governments provide financial incentives to manufacturers to invest in green technology aimed at reducing pollution. Also, this can be supported through different financial instruments secured with the support of banks, such as green loans [33] or comparable products and services. Conversely, governments have the option to levy taxes on manufacturers according to their pollution emissions. Rakpho et al. [34] indicated that the implementation of environmental policy through environmental taxation mechanisms could stimulate various economic sectors. The study of Liu et al. [35] showed that environmental taxes highlight a company's performance by increasing environmental investments. Similarly, Guo and Huang [36] highlighted that carbon taxes and subsidies for reducing emissions are two frequently used environmental instruments. Song et al. [37] pointed out supportive measures, such as R&D tax incentives, to provide subsidies to companies engaged in the creation of environmentally friendly product innovations. Likewise, Yi et al. [38] pointed out that subsidies are more effective than taxes at encouraging green innovation. Therefore, the government ought to strengthen the use of incentive mechanisms, such as green taxes, feed-in tariffs, and various green penalties [39]. In line with that, Muhammad et al. [40] indicated that environmental tax policy should be supported by public support by encouraging positive environmental attitudes that begin from an early age through social and education campaigns. Similarly, Ali et al. [41] cited that governments should foster a sustainable environment mindset, motivating individuals to adopt eco-friendly practices to advance environmental sustainability. Liu et al. [42] highlighted that environmental tax and governance enhance the quality of the environment in the long run.

Environmental tax regulations are commonly implemented as highly effective measures for reducing emissions compared to other climate protection policies [43]. In addition, environmental taxes are a growing economic policy tool that has been implemented for decades in various countries, particularly in developed countries [44]. Since the 1990s, several OECD member countries, including Belgium, Denmark, Finland, and Sweden, have introduced environmental tax reforms [45]. In recent decades, environmental and carbon-related taxes have also become significant elements of economic policy in emerging and developing countries, such as China, India, Indonesia, Thailand, Singapore, and Vietnam [46]. However, Shahzad [47] indicated that several countries of the OECD and Europe, such as Norway, Belgium, Germany, France, Turkey, the UK, etc., have applied environmental and energy tax policies over the past three decades, and despite these efforts, they continue to face challenges related to energy and climate change issues. Accordingly, developed countries have implemented environmental taxation policies to address environmental externalities and promote cleaner production and sustainable development [48].

When it comes to Nordic countries, this term is used unambiguously for Denmark, Norway, Sweden, Finland, and Iceland. These countries serve as prime instances of implementing environmental taxes across various sectors [49] and were pioneers in implementing carbon taxes during the early 1990s [50,51], whereas Denmark is the first country in the EU to adopt green tax reform [52]. Research from Denmark shows that the implementation of environmental taxation can influence energy consumption toward more eco-friendly practices [53]. Based on the aforementioned, Nordic countries have extensive experience with Environmental Tax Reform, being early adopters of carbon taxes as a tool for environmental and economic recovery during a regional crisis (the early 1990s) and the global financial crisis in 2008 [54,55]. Furthermore, Andreoni [56] indicated that in the aftermath of the global financial crisis, economies such as Denmark, Germany, Netherlands, and Sweden loosened some environmental regulations to boost competitiveness and stimulate economic growth. These countries also impose taxes on energy, transport, air pollution, and waste [57]. Although specific national policies differ, the Nordics typically use environmental tax revenues to offset taxes that hinder economic growth, encourage green initiatives to enhance productivity, and send price signals to promote energy efficiency and deter pollution [54,58]. Khastar et al. [59] highlighted that the carbon tax policy in

Finland has proven to be highly effective in lowering carbon emissions but has harmful effects on social welfare. Similarly, Khastar et al. [60] identified the negative implication of applied carbon tax policies on gross domestic product in Finland. Certainly, Hájek et al. [61] showed that Nordic countries highlight the negative but minor effects of environmental taxes by applying both pooled ordinary least squares and fixed effects models.

Research that assesses environmental tax revenues and their influences on economic development holds significant importance for Nordic countries for several reasons. Firstly, Nordic countries are renowned for their strong dedication to sustainability and environmental conservation. Policymakers in these countries can better understand the efficiency of their environmental policies and make informed decisions on future initiatives and activities. Secondly, environmental tax revenues play a vital role in financing environmental protection measures and advancing sustainable practices. Also, these findings can help policymakers design more efficacious environmental policies. In essence, research on environmental tax revenues and economic development is crucial for Nordic countries to uphold the ongoing success of their environmental activities and promote sustainable economic growth. Likewise, this study expands the current theoretical opus of research related to environmental taxation and economic growth and development. Simultaneously, the results allow for the identification of crucial environmental tax revenues influencing economic development, offering a new perspective on the nature and intensity of their relationship. This research addresses a specific gap concerning the relationship between environmental tax revenues and economic development by determining and explaining which taxes influence economic development in Nordic countries and to what extent.

This article is structured as follows: It begins with an introduction, followed by a literature review that discusses previous empirical studies on environmental taxes and economic growth. The third part covers the methodological framework, outlining the variables, econometric procedures, and prerequisites necessary for suitable panel regression models. The fourth part delves into the empirical analysis of environmental taxes and economic growth within the Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) from 2013 to 2022. This part includes various panel data estimations, such as static and dynamic models, to identify the potential implications of environmental taxes on economic growth. The final section summarizes the findings and conclusions, offering suggestions for future research and highlighting the limitations of this research.

2. Literature Review

There are numerous studies confirming the significance of tax revenues for economic growth or economic development, with some more recent studies, such as [62–71]. The general conclusions of these studies mostly indicate a significant relationship between these components and how tax revenues can be an important driver of economic progress. The proposed aggregate indicator that considers economic sustainability while also taking into account its impact on society and the environment is the gross domestic product per capita [72]. Within tax revenues, increasing attention is being paid to environmental taxes and their potential implications for economic growth and development. Loganathan et al. [73] confirmed unidirectional causality from the carbon tax and economic growth in Malaysia for the period 1974–2010, whereas a similar study by Loganathan et al. [74] pointed out the negative effect of green taxation on carbon emissions in Malaysia for the period 1970–2018. Additionally, Wolde-Rufael and Mulat-Weldemeskel [75] highlighted that environmental taxes decline CO_2 emissions and promote renewable energy in Latin America and Caribbean countries. However, Radulescu et al. [76] identified the negative influence of environmental taxes on economic growth in Romania, which is different from the EU area, for the period 1996–2015.

Karydas and Zhang [77] pinpoint the modeling circumstances that can lead to greater economic growth as a result of higher energy taxes. Their study demonstrates that a rise in energy taxes can boost growth when there is mobility of labor between the manufacturing and R&D sectors, along with limited substitution options in manufacturing among labor

and energy inputs. Also, Andreoni [56] revealed that economic growth contributes to greater environmental tax revenues. Analyzing panel data from 31 OECD countries from 1994 to 2013, the study of Hassan et al. [78] discovered that environmental tax revenues are negatively associated with the real GDP per capita in the short run and long run. This research also highlights that their relationship differs among countries, but countries with higher initial GDP per capita levels tend to experience a more positive influence on economic growth rates from environmental tax revenues. In the study of Bădîrcea et al. [79], ARDL and Granger causality tests indicated that environmental taxes played a crucial role in reducing greenhouse gas emissions in the long run in both Romania and Sweden in the period 1995–2017. Additionally, in Romania, a bidirectional causality between economic growth and greenhouse gas emissions was observed in the long run, whereas in Sweden, the causality was unidirectional from economic growth to greenhouse gas emissions. Busu and Trica [80] identified the significant and positive impact of environmental tax forms on economic growth in the European Union during 2010–2017. Esen et al. [81] analyzed 15 EU countries from 1995 to 2016 and confirmed that environmental tax revenues can significantly reduce ecological deficits beyond a specific threshold level. The analysis results show that different threshold values exist for tax revenues impacting fishing, forest, grazing land, and total footprint ecological balance. The threshold values for fishing, forest, and grazing land variables are 2.1%, 2%, and 2.4%, respectively. When tax revenues fall below a certain threshold, they negatively impact the ecological balance, resulting in an increased ecological deficit. Conversely, if tax revenues exceed this threshold, they help reduce the ecological deficit. For the total footprint variable, there are two key thresholds: 3.1% and 4.5%. This implies that tax revenues below 3.1% negatively impact ecological balance, exacerbating the ecological deficit. In the range between 3.1% and 4.5%, tax revenues have a neutral or potentially ameliorative effect on the ecological deficit. However, revenues exceeding 4.5% contribute positively to ecological balance, helping to reduce the deficit. This suggests that environmental tax revenues can only influence environmentally damaging behavior above specific threshold levels. Mirović et al. [82] verified the long-run nexus between environmental taxes and economic growth in the EU from 1994 to 2018. Additionally, this study confirmed that environmental tax revenues have a positive influence on GDP in selected countries. Also, for EU countries, Dogan et al. [83] suggested that energy taxes and environmental taxes negatively affected renewable energy deployment from 1995 to 2019. Karmaker et al. [84] confirmed unidirectional causality between environmental taxes, gross domestic product, research and development, and technological innovation in 42 countries from 1995 to 2018. Based on the obtained findings of this study, environmental taxes can be important in enhancing technological innovation in high- and middle-income countries. Using various panel techniques, such as the common correlated effects mean group (CCEMG) and augmented mean group (AMG), fully modified ordinary least squares (FMOLS), and dynamic ordinary least squares (DOLS), the results confirm that a 1% increase in environmental taxes stimulates growth in technological innovation (i.e., green patents) by 0.57, 0.78, 1.47, and 1.52 percent on average. Alola and Nwulu [85] identified that an increase in energy tax is related to a decrease in greenhouse gas (GHG) emissions and energy intensity in Nordic economies from 1995 to 2020. Moreover, the analogous situation is with pollution tax and resource tax, while transport tax influences both the GHG emissions and energy intensity but is not significant. Tchapchet-Tchouto et al. [86] analyzed the effects of environmental taxes on economic growth for 31 European economies from 2009 to 2019. Their empirical findings confirmed that an increase in environmental taxes negatively influenced economic growth in the observed countries. Finally, Mirović et al. [87] confirmed that environmental tax revenues significantly and positively influenced the economic growth in the Visegrad group (Czechia, Hungary, Poland, and Slovakia) for the period 1995–2018.

We show that environmental taxes are effective in reducing carbon emissions and promoting renewable energy. Likewise, the effect of environmental taxes on economic growth varies by country and region, whereas countries with higher initial GDP per

capita tend to experience a more positive influence on growth from environmental taxes. These findings highlight the complex and contextual nature of the relationship between environmental taxes and economic growth.

3. Materials and Methods

The details of the variables can be found in Table 1. This research analyses the five Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) for the period 2013–2022. The timeframe for analysis is defined based on the data availability for environmental taxes in these countries. The study incorporates yearly data sourced from the Eurostat database and applies the statistical software STATA 13.0 version for conducting our research.

Table 1. Variable description.

Variable	Calculation	Symbol	Data Source	Potential Influence
Gross domestic product per capita	Constant prices; PPP: 2021 USD	GDPpc	World Bank	/
Energy tax revenues	% share of total tax revenues	ETR	Eurostat	+
Transport tax revenues	% share of total tax revenues	TTR	Eurostat	+
Pollution tax revenues	% share of total tax revenues	PTR	Eurostat	+

The model includes gross domestic product per capita as a dependent variable, while energy tax revenues, transport tax revenues, and pollution tax revenues are explanatory variables. The designed model and developed hypotheses are presented based on the study of [86,87]. To investigate whether environmental taxes, such as energy tax, transport tax, and pollution tax, affect economic development, the main hypothesis and subsequent auxiliary hypotheses are determined as follows:

H_1. *Environmental tax revenues positively influence the economic development in Nordic countries.*

$H_{1.1}$. *Energy tax revenues positively influence the economic development in Nordic countries.*

$H_{1.2}$. *Transport tax revenues positively influence the economic development in Nordic countries.*

$H_{1.3}$. *Pollution tax revenues positively influence the economic development in Nordic countries.*

The conceptual model was established based on the variables and hypotheses (Figure 1). The research implies both static and dynamic panel models, encompassing temporal and spatial dimensions. Panel model estimation was employed to analyze the impact of specific environmental taxes on economic growth in Nordic countries.

$$GDPpc_{it} = \alpha_0 + \beta_1 ETR_t + \beta_2 TTR_t + \beta_3 PTR_t + \mu_{it} \quad (1)$$

where GDPpc is gross domestic product per capita, ETR is the energy tax revenue, TTR is the transport tax revenue, and PTR is the pollution tax revenue. According to Table 1, we anticipate positive influences on GDPpc from ETR, TTR, and PTR, where it is expected that a higher share of revenues from this tax type contributes to greater economic growth and development.

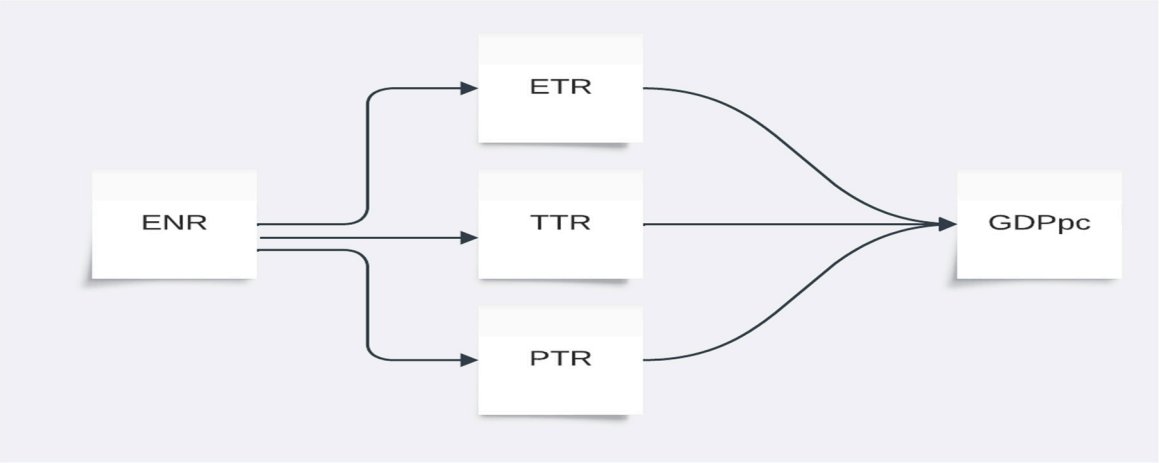

Figure 1. Conceptual model.

4. Empirical Results and Discussion

We analyzed the influence of environmental taxes on economic growth in Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) for the period 2013–2022. The empirical analysis encompasses static and dynamic models to accurately identify the environmental taxation implications on economic growth in the specified economies. This study investigates the influence of energy tax revenues, transport tax revenues, and pollution tax revenues on the economic growth for the observed period. Firstly, this segment of the research includes descriptive statistics, panel unit root tests, multicollinearity analysis, and cross dependence, followed by a range of panel models, such as a pooled ordinary least squares (POLSs) model, random effects (REs) model, fixed effects (FEs) model, and general method of moments (GMMs) model. The use of the GMMs enables the control and mitigation of the potential endogeneity problem, which is in line with [88–90].

Based on Table 2, we notice that the mean GDPpc was USD 66.296,34 in Nordic countries from 2013 to 2022. Norway had a mean GDPpc of USD 87.061,4, which is more than other compared countries. Specifically, Denmark, Iceland, and Sweden registered average GDPpc values of USD 65.712,3, USD 62.276,6, and USD 60.454,6, respectively. At the bottom is Finland, with a mean GDPpc of USD 55.976,8, which is far less than the economy of Norway. Analyzing the selected tax forms, the average environmental tax revenues was 5.97% of total tax revenues for the observed period. Mean energy tax revenues were 3.69%, while transport tax revenues and pollution tax revenues were 1.88% and 0.34% of total tax revenues. Within Nordic countries, Denmark reached the highest environmental tax revenues share of 8.95% of total tax revenues in 2013, while the smallest share was identified in Norway (2.97% of total tax revenues in 2022). When it comes to energy tax revenues, a similar situation was found where Denmark registered a maximum share of 5.11% of total tax revenues and Norway a minimum share of 1.98% of total tax revenues. Furthermore, the highest share of transport tax revenues was found in 2016 (3.32% of total tax revenues in Denmark) and 2022 (0.8% of total tax revenues in Norway). Finally, the greatest share of pollution tax revenues was in Iceland (1.17% of total tax revenues in 2021) and Finland (0.04% of total tax revenues in 2021 and 2022). In summary, the given data show that Denmark had the highest shares in environmental tax revenues and energy tax revenues, while Norway had the lowest shares in both categories. Also, Denmark and Iceland had the greatest shares of transport tax revenues and pollution tax revenues for the analyzed period.

Table 2. Descriptive statistics.

Variable	GDPpc	ETR	TTR	PTR
		Denmark		
Mean	65,712.3	4.12	2.94	0.39
S.D.	3291.12	0.68	0.43	0.07
Max.	71,224	5.11	3.32	0.54
Min.	61,176	3.15	2.03	0.33
		Finland		
Mean	55,976.8	4.48	1.97	0.08
S.D.	1874.04	0.17	0.28	0.04
Max.	58,402	4.77	2.24	0.14
Min.	53,464	4.2	1.4	0.04
		Iceland		
Mean	62,276.6	3.02	1.55	0.95
S.D.	3031.51	0.45	0.27	0.14
Max.	65,795	3.66	1.94	1.17
Min.	57,977	2.14	1.2	0.66
		Norway		
Mean	87,061.4	3.14	1.96	0.19
S.D.	2026.69	0.45	0.65	0.02
Max.	91,069	3.44	2.62	0.23
Min.	84,283	1.98	0.8	0.16
		Sweden		
Mean	60,454.6	3.72	0.99	0.09
S.D.	2244.42	0.32	0.03	0.04
Max.	64,622	4.32	1.02	0.14
Min.	56,707	3.25	0.93	0.06
		Nordic countries		
Mean	66,296.34	3.69	1.88	0.34
S.D.	11,227.85	0.71	0.74	0.33
Max.	53,464	5.11	3.32	1.17
Min.	91,069	1.98	0.8	0.04

This study incorporates various panel unit root tests, including the Levin–Lin–Chu test, Im–Pesaran–Shin test, and the Breitung test to assess stationary characteristics and provide insight into the data, which are similar to the panel stationary approach in the study of [91]. Applying various panel unit root tests, we checked the stationary at the level and the first difference for selected variables. The findings of the LLC test show that all variables are stationary at a level of 5% and 10%, as well as the first difference at a significant level of 1%. Similarly, the IPS test indicates that GDPpc, ETR, and PTR are stationary at levels of 5% and 10%, while TTR is not stationary at levels. However, all variables are stationary at first difference at levels of 5% and 10%. Finally, the Breitung test points out stationarity at levels of 5% and 10% for all variables and the first difference at significant levels of 1%, 5%, and 10% (Table 3).

We utilized the VIF test to verify the selection of suitable explanatory variables. With a mean test value of 1.43, the threshold values for VIF are typically set between 2.5 and 10 [92,93]. Thus, it can be inferred that there is no presence of multicollinearity among the independent variables (Table 4). The results of the cross-dependence tests are presented in Table 5.

Table 3. Panel unit root tests.

Variable	LLC Test		IPS Test		Breitung Test	
	Level	First. Diff.	Level	First. Diff.	Level	First. Diff.
GDPpc	−2.239 (0.012)	−7.611 (0.000)	−2.117 (0.017)	−2.557 (0.004)	−1.343 (0.089)	−3.988 (0.000)
ETR	−1.986 (0.039)	−4.282 (0.000)	−1.613 (0.053)	−2.547 (0.005)	−1.795 (0.036)	−4.112 (0.000)
TTR	−1.997 (0.023)	−5.362 (0.000)	−1.232 (0.108)	−2.478 (0.007)	−2.514 (0.006)	−2.992 (0.001)
PTR	−1.442 (0.075)	−5.750 (0.000)	−2.164 (0.015)	−2.405 (0.007)	−2.089 (0.018)	−2.459 (0.007)

Table 4. Multicollinearity test.

Variable	VIF	1/VIF
ETR	1.63	0.6132
TTR	1.35	0.7387
PTR	1.31	0.7662
Mean value	1.43	

Table 5. Cross-dependence tests.

Test	Statistic	Prob.
Pesaran CD	0.487	0.626
Friedman CD	5.553	0.235
Frees CD test	0.603	0.256 10% 0.343 5% 0.519 1%

Various cross-dependence tests, such as the Pesaran CD test, Friedman CD test, and Frees CD test, were applied to assess the presence of cross-dependence in the panel data. The findings indicate the absence of cross-dependence (CD) in five panels of the observed countries. All three CD tests cannot reject the null hypothesis of cross-sectional independence. (The *p*-values are above 0.05.)

Table 6 shows a comparative view of various panel models, such as the pooled ordinary least squares (POLSs) model, random effects (REs) model, fixed effects (FEs) model, and general method of moments (GMMs) model, which estimated the influence of selected variables on economic development in Nordic countries from 2013 to 2022. As we can see, the applied models indicate a positive impact of environmental tax revenues on economic growth. Using a panel regression model prompts questions of whether to incorporate fixed or random effects. In these instances, it is recommended to conduct a specification test based on the differences between the fixed effects and random effects estimator, known as the Hausman test [94]. Based on the value of the Hausman test, we can conclude that the fixed effects model is an adequate model for estimating environmental taxation on economic development. The results of the selected model verify that a 1% increase in energy tax revenues enables higher GDPpc by 0.189%. Furthermore, the greater level of transport tax revenues by 1% enhances GDPpc by 0.171%, while pollution tax revenues positively affect GDPpc but not significantly. Additionally, the results of the GMMs model confirm that the previous value of GDPpc significantly affects current GDPpc, as well as the significant influence of energy tax revenues, transport tax revenues, and pollution tax revenues on GDPpc at various significant levels of 1%, 5%, and 10%. To be precise, the growth of these tax forms by 1% improves GDPpc by 0.188%, 0.161%, and 0.102% for the observed period. Based on the positive influence of energy tax revenues and transport tax revenues on GDPpc, the auxiliary hypotheses $H_{1.1}$ and $H_{1.2}$ can be verified. However,

pollution tax revenues positively affect GDPpc but are not significant, which suggests that the auxiliary hypothesis $H_{1.3}$ cannot be confirmed. Therefore, we can conclude that the general hypothesis H_1 can be partially confirmed.

Table 6. Different panel modeling.

Variable	POLSs	REs	FEs	GMMs
GDP_{t-1}				0.344 (0.000)
Δ ETR	0.199 (0.001)	0.193 (0.003)	0.189 (0.002)	0.188 (0.001)
Δ TTR	0.147 (0.003)	0.151 (0.003)	0.171 (0.014)	0.161 (0.006)
Δ PTR	0.062 (0.121)	0.052 (0.644)	0.014 (0.676)	0.102 (0.097)
R-squared	0.584	0.601	0.642	/
F-value	0.000	0.000	0.000	0.000
Hausman test		27.01 0.000		
Sargan test				33.48 0.245

5. Conclusions

Environmental tax policy serves as a tool to encourage sustainable practices and discourage activities that harm the environment [95]. This type of tax can have an active role in green development [96]. Hence, environmental taxes play a crucial role in addressing environmental challenges within the economy, aligning economic incentives with environmental objectives, and promoting sustainable development. This aligns with Hao et al. [97], who identified environmental growth as an essential strategy for achieving sustainable development. On the one hand, they can stimulate market subjects toward environmentally friendly behavior and operations, while on the other hand, these taxes ensure an additional level of budget revenues. Addressing environmental protection issues seems to be more present in developed countries, as these economies have reached an appropriate level of development and have the capacity for greater investments in socially acceptable activities and projects. Moreover, implementing environmental taxes on industries that harm the environment and redirecting them toward eco-friendly sectors through incentives can lead to beneficial structural transformation in industrial sectors [98]. In that way, environmental taxes positively influence the new type of employment and promote the emergence of new sectors [99]. The electric vehicle (EV) sector is a good example because it reduces the emission of harmful gases and the dependence on fossil fuels. Encouraging the production and use of EVs through subsidies and other incentives can contribute to the transition to a more sustainable industry ecosystem. Conversely, developing countries, as well as underdeveloped countries, often prioritize economic progress without considering the potential direct or indirect implications for environmental protection. These taxes must be high enough to discourage the use of dirty technologies while simultaneously providing subsidies and incentives that will allow for a higher presence of environmentally friendly initiatives and practices in business. This perspective could be integrated into further research analysis, emphasizing how developing and underdeveloped economies should prioritize economic progress over environmental concerns. In this way, space is opened for a higher investment level that will generate a certain number of jobs while reducing the risk of environmental pollution. This enables a win-win situation for policymakers, ensuring adequate economic growth and environmental protection. This is in line with Bi et al. [100] and Bashir et al. [15], who indicated that environmental taxes are pricing instruments used to adjust energy consumption behaviors and achieve mutual benefits

for both the environment and economic growth. Therefore, it becomes imperative for policymakers to optimize the trade-off between economic growth and ecological protection [101]. To this end, Youssef and Dahmani [102] defined environmental taxes as critical tools in identifying the relationship between economic, social, and environmental aspects. This study highlights urbanization as an important factor, showing that areas with a high population density tend to have greater levels of GHG emissions, but simultaneously, environmental taxes, especially carbon taxes, serve as an effective tool in reducing GHG. Policymakers should create dynamic environmental tax structures and policies to enable a desirable influence on economic growth. This is in line with Đurović Todorović et al. [71], who emphasized the importance of aligning the tax structure with the macroeconomic framework to ensure positive effects on economic development.

Empirical research enables information support and guidance to policymakers in Nordic countries, assisting in the understanding of the importance of environmental taxes in relation to economic growth in this region. Also, the obtained results can serve developing countries and underdeveloped countries when defining and implementing policies and strategies regarding environmental taxation. Specifically, this study's findings can guide these nations in designing environmental tax policies that balance economic growth with sustainability goals, considering their unique economic structures and development needs. By assessing the influence of selected variables, energy tax revenues and transport tax revenues could benefit economic progress in the long run. Based on the positive effects of tax forms, long-term effects can be derived from additional policies and strategies designed for environmental taxation. This will yield the long-term benefits of an adjusted tax policy that balances economic progress and environmental protection. Considering the increasing role of environmental taxes in the context of environmental protection, policymakers should develop a dynamic environmental tax structure to enable positive effects on economic progress. Meanwhile, the economic structures of Nordic countries vary, influencing the emphasis placed on different sectors. For instance, energy-intensive industries are more significant in Sweden and Norway than in Denmark. Also, Olafsson et al. [103] indicated that increased use of geothermal energy reserves for aluminum production has resulted in higher carbon dioxide and overall greenhouse emissions in Iceland. Additionally, Denmark and Norway adopt a more expansive approach toward the sectors and technologies it encompasses, whereas Sweden concentrates more specifically on the forest industry [104]. The results of Alola and Adebayo [105] highlighted that growth in GDP has created more obstacles for strategies aimed at controlling greenhouse emissions, as GDP has a positive influence on GHG emissions. This is due to the fact that the primary economic activities in Finland, particularly in the industrial and manufacturing sectors, still depend on a mix of fossil fuels, thereby continuing to contribute to environmental issues despite economic growth. Therefore, the environmental tax structure should be designed according to the economic performance of each country, customizing individual environmental tax forms.

5.1. Policy Implications

The policy implications of the effect of environmental tax revenues on economic development in Nordic countries are significant. Although these economies are prime examples of successfully implementing environmental taxes, Nordic countries should continue to promote sustainable development. Namely, environmental tax revenues can be used to support sustainable initiatives, such as renewable energy projects, energy efficiency programs, and waste management systems. Further examples can be related to solar power plants [106], hydropower plants, geothermal energy systems [107], solid waste reuse and recycling [108], etc. Policymakers should earmark a portion of environmental tax revenues specifically for sustainable development projects, creating clear guidelines for their allocation. This ensures that tax revenues have an everlasting impact on both environmental protection and economic progression. Furthermore, these taxes can incentivize businesses to create and adopt cleaner practices and technologies, and Nordic countries can encourage innovation and create new economic opportunities in the green economy. Environmental

taxes can help reduce carbon emissions by making polluting activities and practices more expensive. Therefore, governments should implement complementary policies, such as tax credits or subsidies, for businesses that invest in sustainable technologies or adopt greener practices. By internalizing the environmental costs of economic activities through taxes, Nordic countries can establish fair competition for business and promote sustainable activities. This initiative could boost their competitiveness in the global market and attract environmentally conscious consumers. Accordingly, policymakers ought to regularly adjust environmental taxes to reflect the true cost of environmental harm, ensuring that they remain effective in promoting sustainability. This should include regular reviews to adapt tax rates to changing economic, environmental, and social conditions. Here, the potential occurrence of environmental leakage should be considered, which can cause harmful effects because of the relocation of production facilities to countries with less strict environmental regulations in the race to achieve better global competitiveness. To combat this, Nordic countries must coordinate internally to prevent such relocation and ensure that environmental standards are upheld globally.

Considering the United Nations' Sustainable Development Goals (SDGs), governments can promote greener practices through taxation, which, in turn, can foster innovation in renewable energy and sustainable industries, leading to a decrease in environmental degradation. This shift not only helps achieve SDG 13 (Climate Action) by mitigating climate change but also supports SDG 8 (Decent Work and Economic Growth) by fostering new green job opportunities. Ultimately, the strategic use of environmental tax revenues can drive a transition toward a low-carbon economy, balancing economic growth with environmental sustainability. In line with that, we can conclude that environmental taxes are effective instruments that can drive both environmental protection and economic development. The funds collected can be reinvested in sustainable initiatives like renewable energy and green infrastructure, contributing to long-term economic growth. Additionally, these revenues can be used to lower other taxes, such as income or corporate taxes, boosting economic efficiency and delivering a "double dividend" by fostering growth while minimizing environmental damage. It implies the appropriate allocation of environmental taxes to reduce distortionary taxes that hinder economic efficiency. Moreover, environmental taxes can help generate employment in green sectors, stimulate innovation, and enhance competitiveness by motivating companies to implement cleaner technologies. This encourages the shift toward more sustainable consumption and production patterns, ultimately reducing pollution and the depletion of natural resources. Another advantage is improved public health, as lower pollution levels can reduce healthcare costs and increase workforce productivity. By reducing pollution and environmental degradation, environmental taxes can lead to better public health outcomes, which, in turn, increase workforce productivity. Cleaner air and water, reduced waste, and fewer harmful emissions contribute to a healthier population and lower healthcare costs. However, it is crucial that policymakers carefully craft these tax policies to ensure fairness, protect lower-income populations from disproportionate impacts, and address the potential risk of businesses relocating to regions with less stringent environmental regulations. The transparent and effective allocation of tax revenues is essential to maximize both environmental and economic benefits while ensuring continued public support. Transparency in how environmental tax revenues are allocated is critical to maintaining public trust and ensuring that these funds are used effectively and fairly to achieve both environmental and economic goals. Finally, the mentioned policy implications are aligned with the principles of sustainable development, innovation, and emission reduction, as well as competitiveness in the global arena.

5.2. Limitations and Future Research Directions

This study has limitations, such as the absence of other environmental indicators, such as primary production, renewable energy sources, carbon emissions, etc. These indicators could be essential for understanding the full impact of environmental tax policies, as they directly influence both environmental sustainability and economic growth. The main

limitation of the study is a small database, i.e., the time 2013–2022, defined according to publicly available data. Insufficient transparency and a limited database may affect the robustness of the results. These limitations can be overcome with future research that could build upon the current study by utilizing larger databases or alternative empirical methodologies. Expanding the dataset will allow for a more accurate assessment of long-term trends and effects, leading to more robust conclusions. Focusing solely on tax variables allows for a more detailed examination of the specific relationship between tax policy and economic development in a more targeted and interpretable manner. Future research will focus on the European area, especially Eastern Europe and Western Balkan countries, where there are not as many studies examining the relationship between these variables in comparison to Western European countries, namely, the European Union. Comparative analyses could uncover unique dynamics and provide insights into how environmental tax policies can be tailored to different economic contexts. Although this study does not focus on Keynesian Theory, it opens the door for future research to explore this framework further. Additionally, investigating the hump-shaped Laffer curve could provide insights into the optimal design of environmental taxes. Employing simultaneous equation modeling with non-linear terms could help account for potential feedback loops and improve the robustness of the analysis. By incorporating a broader range of environmental indicators, utilizing larger and more detailed databases, expanding the regional focus, and accounting for potential feedback loops, future research can build on the current study's findings and provide deeper insights into the complex relationship between environmental taxes and economic development.

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