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The United Kingdom's Environmental Tax Reflection on its Economic Growth

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Abstract:

A tax system is a crucial tool for achieving the government's environmental objectives, notably achieving future net-zero greenhouse gas emissions. Governments, scholars, and stakeholders have long acknowledged the potential of the tax system in this regard. This research aims to investigate the cause between environmental-related taxes and GDP in the United Kingdom by correlating various environmental tax measures with GDP, such as transportation tax, gas and diesel tax, and renewable energy concerning adjusted net savings. The annual time series data has been used from 2000 to 2020, gathered from reliable sources. The ADF unit root test, Johansson co-integration, and Granger causality tools are applied. The findings reveal some evidence of long-term causation between GDP and increasing environmental tax revenues and some causality evidence of medium-run going the other way. The ADF unit root includes the fact that the data are stationary at different levels, and the Johansson Cointegration shows the long-term correlation between environmental tax and economic growth, population has little impact on the long-term association.

Keywords: Tax Account, Tax revenue, Environmental tax, economic growth, Granger causality, Co-integration

الملخص:

يعد النظام الضريبي أداة حاسمة لتحقيق الأهداف البيئية للحكومة ، اذ يحقيق صافي انبعاثات غازات الاحتباس الحراري في المستقبل. لقد أدركت الحكومات والعلماء وأصحاب المصلحة منذ فترة طويلة إمكانات النظام الضريبي في هذا الصدد. يهدف هذا البحث إلى التحقيق في السبب بين الضرائب المتعلقة بالبيئة والناتج المحلي الإجمالي في المملكة المتحدة من خلال ربط مختلف التدابير الضريبية البيئية مع الناتج المحلي الإجمالي ، مثل ضريبة النقل وضريبة الغاز والديزل والطاقة المتجددة فيما يتعلق بصافي المدخرات المعدلة. تم استخدام بيانات السلاسل الزمنية السنوية من 2000 إلى 2020 ، التي تم جمعها من مصادر موثوقة. تم تطبيق اختبار جذر وحدة التغذية التلقائية للمستندات والتكامل المشترك "لجوهانسون" والطريقة السببية القياسية من "جرانجر" (Granger). تكشف النتائج عن بعض الأدلة على وجود علاقة سببية طويلة الأمد بين الناتج المحلي الإجمالي وزيادة عائدات الضرائب البيئية ، بالإضافة إلى بعض الادلة السببية على المدى المتوسط الذي يسير في الاتجاه الآخر. يتضمن جذر وحدة ADF حقيقة أن البيانات ثابتة على مستويات مختلفة ، ويظهر التكامل المشترك لجوهانسون العلاقة طويلة الأجل بين الضرائب البيئية والنمو الاقتصادي ، والسكان ليس لديهم تأثير يذكر على الارتباط طويل الأجل.

الكلمات المفتاحية: حساب الضرائب، الإيرادات الضريبية، الضرائب البيئية، النمو الاقتصادي، العلاقة السببية بين جرانجر(Granger)، الاندماج المشترك.

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پوختە:

سیستەمی باج ئامرازێکی گرنگە بۆ گەیشتن بە ئامانجە ژینگەییەکانی حکومەت، بەتایبەتی گەیشتن بە دەردانی گازی گەرمخانەیی کە سفری پاک لە داهاتوودا بێت. حکومەتەکان و زانایان و لایەنە پەیوەندیدارەکان لە مێژە دانیان بە توانای سیستەمی باجدا ناوە لەم ڕووەوە. ئەم توێژینەوەیە ئامانجی لێکۆڵینەوەیە لە هۆکاری نێوان باجی پەیوەست بە ژینگە و گەشەی ئابوری لە بەریتانیا بە پەیوەستکردنی ڕێوشوێنە جۆراوجۆرەکانی باجی ژینگە لەگەڵ بەرهەمی ناوخۆیی، وەک باجی گواستنەوە، باجی غاز و دیزڵ، و وزەی نوێبووەوە بە لەبەرچاوگرتنی کۆی پاشەکەوتی ڕێکخراو. داتاکانی زنجیرە کاتییە ساڵانە لە ساڵی ٢٠٠٠ تا ٢٠٢٠ بەکارهێنراون، کە لە سەرچاوەی متمانەپێکراوەوە کۆکراونەتەوە. تاقیکردنەوەی ڕەگی یەکەیADF ، هاوبەشی یەکخستنی جۆهانسۆن، و شێوازی هۆکارگەرایی ستانداردی گرانجەر بەکاردەهێنرێت. دۆزینەوەکان هەندێک بەڵگەی هۆکاربوونی درێژخایەن لە نێوان بەرهەمی ناوخۆیی و زیادبوونی داهاتی باجی ژینگەیی ئاشکرا دەکەن، هەروەها هەندێک بەڵگەی هۆکارگەرایی کە لە ماوەی مامناوەنددا بەلای دیکەدا دەڕوات. ڕەگی یەکەی ADF ئەو ڕاستییە لەخۆدەگرێت کە داتاکان لە ئاستە جیاوازەکاندا جێگیرن، و هاوبەشی جۆهانسۆن پەیوەندی درێژخایەنی نێوان باجی ژینگە و گەشەی ئابووری نیشان دەدات، دانیشتووان کاریگەرییەکی کەمی لەسەر پەیوەندی درێژخایەن هەیە.

وشەی سەرەکی: باجی ژمێریاری، داهاتی باج، باجی ژینگە، گەشەی ئابووری، هۆکارگەرایی گرانجەر، هاوبەشی یەکگرتن.

1. Introduction

Climate fiscal policy is one of the important advancements in public finance reform and environmental policy. The recent tax account system adjusts to shifting from taxing capital, corporate and individual income to the tax burden on pollution and natural resource usage (Benoit, 2000). The Environmental tax reform (ETR) mostly aims to reduce environmental damages and in return enhance both economic and environmental benefits (Ekins et al., 2010). In the ecological tax policy, these tax burden shifts are more focused on the factors that harm society and the environment which are called economic bad factors such as environmental pollution, resource waste, and depletion. Environmental tax in another way generates revenue recycling in countries, as the income that generates from a carbon tax or other environmental taxes could be used for society's benefit. Another advantage of environmental taxes is that create a double dividend. The first dividend is to reduce pollution and the second one is to decrease economic costs by generating revenue recycle and replacing other taxes that cause economic growth to be passive (Benoit, 2000).

Subsequently, the United Kingdom is a signatory to the Kyoto Protocol signed in 1997. The pact set a reduction goal of 8% of total greenhouse gas emissions compared to 1990 levels 2008–12.5 years for the UK and the EU as a whole. As a part of the 'climate change program, the UK approved a domestic goal for CO_2 emissions in November 2000. It was intended that CO_2 emissions would be 20% lower by 2010 than they were in 1990, and that they would be 60% lower by 2050, or 65 million tons of carbon dioxide (MTC). Moreover, Government's efforts to improve the environment are on a large scale. The objective of the British government is to leave the natural environment in a better state, which requires eliminating all CO_2 emissions by 2050 (Bailey et al., 2021). Hence, implementing environmental policy sometimes necessitates the use of tax mechanisms. Incentives for firms and individuals to improve their behavior may be provided by taxing products and services that affect the environment. For example, tax breaks might encourage taxpayers to purchase environmentally friendly goods and services. The employment of tax policies in conjunction with other policy instruments, such as regulation, may

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help accomplish environmental goals. In addition the importance of environmental taxes as a means of promoting environmental conservation has received advanced attention in the economics literature. A large portion of this interest arise from how well this strategy has worked in many nations, notably in countries that are considered eco-leaders in Europe (Bailey et al., 2021). The tax reform has two primary objectives; first, as mentioned shifting the tax burden from "goods" (such as money and labor) to "bad" (the polluting causes). And second, to increase society's well-being, environmental taxation should be seen as a device that not only reduces tax distortions and also reduces external costs (Ekins et al., 2012).

Over the past years, the United Kingdom was one of the European Union (EU) member states targeted to face climate change issues and attempt to reduce greenhouse gas emissions by setting an effective policy, and the environmental tax has accounted for one of the effective tools to combat this problem. Among the environmental taxes, the use of energy taxes was one of the main focuses by governments. Moreover, it has been argued that a hike in environmental taxes will not only benefit the environment but also encourage economic development in nations that are struggling to survive. This study's objective is to explore the long-run relationship between economic growth and environmental taxation in the United Kingdom and to determine how the environmental taxation will not just benefit the environment sakes but also boosts economic development. While, this study has found a big gap in conducting such as researches about the UK's economic reaction to imposing more environmental taxation. For this reason, the study hypothesis will be as follow;

H_0: The environmental tax hasn't an effect on increasing the economic growth
H_1: The environmental tax has an effect on increasing the economic growth

This paper is organized as follows; section 2 highlights the previous literature studies that have been conducted in this area, following section 3 shows materials, data, and methodology, the result analysis is shown in section 4, and finally, the conclusion and further suggestions are outlined in section 5 in this paper.

2. Literature review

In Europe, environmental taxes were first implemented in the early 1990s and have since been one of the most often utilized mechanisms for environmental policy. Numerous studies have examined the effect of taxes on both environmental and economic quality (Ekins, 1999; Ekins & Barker, 2001; Castiglione et al., 2014; Ekins et al., 2012; Castiglione et al., 2014) These research showed that environmental taxes had a beneficial effect on European economies. While, Taxes on carbon dioxide emissions, leaded gasoline, garbage and waste disposal, charges for road traffic, and vehicle excise fees are examples of positive effects. Some European nations have also found that environmental taxes has a beneficial effect on economic growth. Reinvestment of environmental tax revenues has resulted in reduced income taxes and higher investment in nations such as Denmark, the Netherlands, Norway, and Sweden, where leaders in environmental and economic growth have worked together (Scrimgeour et al., 2005).

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Even though environmental taxes may provide the essential environmental benefit, academics continue to debate the effect of these levies on economic growth. (Lin, al., 2011) used the CGE model to assess the effect of a carbon price on Australia's economy in a similar setting. They estimated that Australia's real GDP would decline by 0.68 percent in the short term after the implementation of a $23 price on CO2 emissions. In contrast, several studies have shown that environmental taxation policies may have a positive impact on the economy. When it comes to long-term economic development, Ono (2003) shows that environmental taxes have two conflicting impacts. The quality of the environment that future generations inherit improves when tax rates are high, suggesting a positive income impact. (Abdullah & Morley, 2014) has investigated the relationship between GDP and environmental taxes by utilizing several metrics of GDP and environmental taxes, using panel data of European countries. The finding results show long-term causation between economic development and greater income from environmental taxes, as well as evidence of short-term integration. Accordingly, Environmental and/or transportation taxes have a long-term causal influence on GDP and net adjusted savings, while the statistics on EU and OECD environmental and transportation taxes provide little evidence of the opposite. The findings were unaffected by factors such as population and environmental subsidies. An increase in eco-friendly tax policy doesn't seem to have a good influence on economic progress, this is based on the findings (Abdullah & Morley, 2014).

(Castiglione et al., 2014)'s study has also shown how environmental taxes differ throughout European countries. Taking into consideration the variability of European nations' production and consumption, as well as their environmental performance and quality of governance. On the contrary, In 2014, (Guo et al.) Used a computable general equilibrium model to study the impact of carbon taxes on China's economy. The result shows that the effects of a carbon price vary greatly depending on the kind of energy used. The coal sector would suffer the most from a carbon tax, although the coke and thermal power industries would also be adversely affected. As economic development will be modestly affected by a mild carbon tax, the simulations show that China can successfully decrease its carbon emissions. In addition, To stimulate economic development, (Hassan et al., 2020) recommends that environmental tax funds be used to expand education investment. Even in the presence of ETRs, environmental taxes have the potential to have a detrimental impact on economic growth.

More importantly, studies show that environmental quality and economic growth are interdependent, with the importance of institutional enforcement being highlighted in previous research (Castiglione et al., 2012; Cole 2007; Culas 2007). The model illustrates the significance of income per capita as a measure of output and consumption, as well as the need of reducing energy use across all socioeconomic classes. Because environmental tax revenues are often utilized to fund alternative energy sources, the influence of renewable energy production on environmental taxes is uncertain. According to the findings, governments should take advantage of the correlation between economic growth and institutional enforcement; in other words, the relationship between economic development and environmental awareness requires the implementation and enforcement of effective environmental regulations (Castiglione et al., 2014).

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Furthermore, an environmental tax and namely carbon price might have various impacts in different parts of the country. Many of the world's high-carbon goods come from poor areas that have an abundance of natural resources. Consequently, carbon taxes will raise the production costs of local enterprises, which is counterproductive to economic growth. Eastern provinces, however, focus on deep processing and high-tech businesses that produce less carbon dioxide. So, imposing a carbon price has a negligible influence on the economy (Zhang & Li, 2011).

Nevertheless, According to (Hassan et al., 2020)'s study, the macroeconomic link between environmental tax collections and economic growth is empirically shown in both the short and long term. Economic growth may be boosted by environmental tax revenues to a greater extent when GDP per capita is larger, to begin with. To foster economic development, governments considering environmental taxes or raising these levies to reduce CO2 emission must take the starting level of economic growth per capita into account. Taxing the environment in nations with low starting economic growth per capita (poor countries) slows economic development, whereas taxing the environment in countries with high initial GDP per capita speeds up economic growth (rich countries). This is why developing nations argue that employing taxes as an environmental policy tool may be a hindrance to development when they are just starting to realize the advantages of environmental policy. The results of the (Hassan et al., 2020) research also show that the link between environmental tax revenues and the pace of economic development differs if there is a method to disperse the funds earned from these taxes.

3. Materials, Datasets, and Methods

3.1. Environmental tax data

The index of environmental taxes revenue is based on the internationally accepted definition used by the European Union Statistical Office (Eurostat) and recognized by the foremost international organizations, such as the OECD. A tax having a physical unit as its basis and evidence that it has a particular effect on the environment is an environmental tax. Environmental tax revenue as a proportion of economic growth and total tax revenue, are the U.K. data used in this research as indicate in table 1.

Initially, the taxes on transportation and energy acted as an energy security tool. In the transportation sector, gasoline and diesel are the most frequently utilized fuels. On the other hand, the primary purpose of this form of tax is to generate money, with the cash gained from this transport-related tax reportedly being recirculated the transportation industry for road construction and maintenance. An additional component of this study is a measure of long-term economic growth known as "adjusted net savings" (ANS). The monetary worth of physical and human capital is included in ANS. whereas GDP assesses physical capital, a total of 21 years' time series data are included in this study, which spans from 2000 to 2020. The data was gathered from the Office for National Statistics (office for national statistics, 2022), the World Bank data (world bank data, 2022), OECD data (ORCD data, 2022), and statista.com(statista, 2022).

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Table 1. Definition of the variables.

Variables	Indication
GDP Constant	Y
Total environment tax to GDP (%)	ETaxY
Total environment tax to total taxation (%)	ETaxT
Transport taxes to GDP (%)	TranTaxY
Transport taxes to total taxes (%)	TranTaxT
Gas Tax (USD)	GTax
Fuel duty tax (Diesel Tax) (USD)	DTax
Adjusted savings: net national savings (current US$)	ANS
Renewable energy consumption (% of total final energy consumption)	RE
Population	POP

3.2. Methodology

In the first phase of this methodology, the popular Augmented Dickey Fuller (ADF) test is utilized to figure out the stationary of the data. Firstly, the ADF employed because it can only be used in a bivariate setting (Harris, 1992), When the time series component is sufficient, it has more strength than competitive tests. Johansson cointegration is used to determine the long term link between environmental taxes and economic development (Hjalmarsson & Österholm, 2010). Subsequent to Johansson cointegration test the famous Granger Causality test applied to figure the causality among variables. This is the test that shows the relationship between all variables over time (Kirchgässner et al., 2013), as shown in equation 1.

$$\ln Y_t = \beta_0 + \beta_1 \ln \mathrm{ETaxY}_t + \beta_2 \ln \mathrm{ETaxT}_t + \beta_3 \ln \mathrm{TranTaxY}_t + \beta_4 \ln \mathrm{TranTaxT}_t + \beta_5 \ln \mathrm{GTax}_t + \beta_6 \ln \mathrm{DTax}_t + \varepsilon \quad (1)$$

Where:

$\ln Y_t$ illustrate GDP, $\ln \mathrm{ETaxY}_t$ illustrate the percentage of total environment tax to GDP, $\ln \mathrm{ETaxT}_t$ illustrate the percentage of total environment tax to total taxation, $\ln \mathrm{TranTaxY}_t$ illustrate the percentage of transport taxes to GDP, $\ln \mathrm{TranTaxT}_t$ illustrate the percentage of transport taxes to total taxes, $\ln \mathrm{GTax}_t$ and $\ln \mathrm{DTax}_t$ illustrate gas and diesel tax respectively, and ε illustrate error term.

The models used the Augmented Dickey-Fuller (ADF) test to determine whether or not the data was stationary, suggesting that the null hypothesis (H0) had a unit root, indicating that the data was not stationary, hence suggesting that the alternative hypothesis (H1) was stationary, or otherwise, Equation 2 gives the ADF statistic, which can be calculated using this.

$$\Delta y_t = \alpha_i + \beta t + z y_{t-1} + z\Delta y_{t-1} + \epsilon_t \quad (2)$$

Where α_i illustrate constant, β illustrate coefficient on the trend, and ϵ_t is illustrate an error term.

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It is impossible for two or more non-stationary time series to deviate from equilibrium over time. Tests for cointegration reveal these anomalies. To find out how sensitive two variables are to the same average price over time, several tests were developed. The Johansen test(Hjalmarsson & Österholm, 2010) can be used to test cointegrating connections between multiple non-stationary time series data, which allows for more than one cointegrating connection compared to the Engle-test. Granger However, since a small sample size would lead to inaccurate conclusions, it is susceptible to asymptotic characteristics. To minimize problems caused by mistakes being carried forward to the next stage, the test may be used to discover the cointegration of several time series, as shown in equation 3.

$$X_t = \Pi_1 X_{t-1} + \ldots + \Pi_K X_{t-K} + \mu + e_t \quad \text{(For t =1, T)} \qquad (3)$$

Where:

X_t, X_{t-1}, and X_{t-K} represent a vector, Π_1 and Π_K represent coefficient matrices, μ represent an intercept vector, e_t represents errors

Following the use of the Johansen Co-integration test, the Granger Causality test is performed to evaluate causality among variables in terms of both GDP and total taxes. As with (Kirchgässner et al., 2013), long-term causality is assessed by the usual t-statistic, and short-run causality is quantified by the lagged explanatory variables using a t-test owing to the yearly nature of the data.

4. Results and discussion

It includes environmental taxes as a percentage of GDP in addition to total taxable income. In addition, Study have employed transport taxes as a fraction of GDP and total taxes to supplement the United Kingdom's diesel and gasoline levies. Other predictor variables include population which for United Kingdom data is the renewable energy data, which is the percentage of electricity generated from renewable sources. This is utilized due to the lack of adequate data on environmental subsidies. See Table 2 for a breakdown of the whole United Kingdom for which there are adequate statistics.

Table 2. Descriptive statistics

Variables\Statistics	Mean	Median	Maximum	Minimum	Std. Dev.
Y	2.55E+12	2.70E+12	3.11E+12	1.64E+12	4.53E+11
ETAXY	2.378452	2.385252	2.66081	2.175426	0.109639
ETAXT	7.427823	7.551811	8.1334	6.650858	0.383426
TRANTAXY	0.5045	0.513063	0.580647	0.412316	0.057146
TRANTAXT	1.575789	1.614505	1.829917	1.264957	0.184565
GTAX	1.33E+09	1.67E+09	3.34E+09	-9.67E+08	1.34E+09
DTAX	3.30E+10	3.41E+10	3.64E+10	2.85E+10	2.85E+09
ANS	-6.10E+09	-1.32E+10	6.45E+10	-8.25E+10	5.27E+10
RE	4.213179	3.3778	11.045	0.8528	3.384006
POP	62388151	62276270	66460344	58892514	2489234

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In terms of total tax income and economic growth, the summary descriptive data for transportation, total environmental taxes, gas tax, renewable energy, and diesel tax. As can be seen, the United Kingdom uses a medium environmental taxes as a percentage of economic growth, when compared to other EU countries. Denmark, for example, uses environmental taxes the most of any country, collecting approximately 5% of GDP and about 10% of total tax revenue(Abdullah & Morley, 2014), whereas the United Kingdom collected approximately 2.55 percent of GDP and 7.42 percent of total tax revenue. The findings of unit root tests using ADF methods are illustrated in table 3. The findings demonstrate that the variables are stationary at various levels; the indications of the ADF test are shown in equations 4 and 5.

$$\Delta y_t = \beta_1 + zy_{t-1} + \varepsilon_t \quad \text{Intercept} \quad (4)$$

$$\Delta y_t = \beta_1 + \beta_2 t + zy_{t-1} + \alpha_i + \varepsilon_t \quad \text{Trend, Intercept} \quad (5)$$

Table 3: ADF unit root tests result

	Probability Result at			
	level		1st difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
Y	0.0491	0.0635	0.0112	0.1573
ETAXY	0.3696	0.0428	0.0004	0.001
ETAXT	0.3375	0.0422	0.0008	0.0044
TRANTAXY	0.4404	0.0348	0.1255	0.0022
TRANTAXT	0.6816	0.0372	0.1131	0.0017
ANS	0.5002	0.0046	0.0259	0.0002
RE	0.1756	0.0727	0.0053	0.0269

The cointegration tests may be found in tables 4. The test was conducted in both directions for all variables, including Y as the dependent variable and ETaxY, ETaxT, TranTaxY, TranTaxT, GTax, and DTax as independent variables. There is evidence of a stable long-term co-integrating relationship only when environmental taxes are the dependent variable and when taxes are stated as a proportion of GDP. The Johansson test suggests that variables in tables 4 have a long-term association.

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Hypothesis	Trace Test			Max-eigenvalue test			
	Trace-Statistic	Critical-Value	Probability	Max-Eigen - Statistic	Critical-Value 5%	Probability	Result H0
Y, ETaxY, ETaxT							
None *	49.70033	35.0109	0.0007	34.68899	24.25202	0.0015	Reject
At most 1	15.01134	18.39771	0.1398	14.58023	17.14769	0.1138	Not Reject
At most 2	0.431105	3.841466	0.5114	0.431105	3.841466	0.5114	Not Reject
Y, TranTaxY, TranTaxT							
None *	50.65631	35.0109	0.0005	36.83542	24.25202	0.0007	Reject
At most 1	13.8209	18.39771	0.1943	13.81035	17.14769	0.1436	Not Reject
At most 2	0.010546	3.841466	0.9179	0.010546	3.841466	0.9179	Not Reject
Y, DTax, Gtax							
None *	50.28526	35.0109	0.0006	38.50082	24.25202	0.0004	Reject
At most 1	11.78443	18.39771	0.3253	11.52932	17.14769	0.2721	Not Reject
At most 2	0.255116	3.841466	0.6135	0.255116	3.841466	0.6135	Not Reject

Table 4. Johansen Co-integration test result

Based on these results, It conclude that although there is some evidence of a stable long-run relationship when Economic Growth are the dependent variable, there is no such evidence when ANS is the dependent variable. When cointegration is detected, the error correction factor is used into tests of causation.

The conditions of the Granger Causality test reveal that the null hypothesis H0 is rejected using the F-statistic technique. If the P-value is less than 10, the alternative hypothesis should be accepted and the null hypothesis should be rejected. The findings of Granger causality with varying delays are shown in Table 5.

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Table 5. Granger causality test results

H0	F-Statistic	probability	Result of H0
Lags: 2			
ETAXY does Granger Cause Y	2.97173	0.0865	Reject
Y does not Granger Cause ETAXY	0.77708	0.4800	Not Reject
ETAXT does not Granger Cause Y	1.2885	0.3087	Not Reject
Y does not Granger Cause ETAXT	0.33019	0.7246	Not Reject
TRANTAXY does not Granger Cause Y	1.94235	0.1828	Not Reject
Y does not Granger Cause TRANTAXY	0.35239	0.7095	Not Reject
TRANTAXT does not Granger Cause Y	1.46447	0.2669	Not Reject
Y does not Granger Cause TRANTAXT	0.06034	0.9417	Not Reject
ETAXT does not Granger Cause ETAXY	1.82405	0.2003	Not Reject
ETAXY does not Granger Cause ETAXT	2.42113	0.1277	Not Reject
TRANTAXY does not Granger Cause ETAXY	1.16833	0.3415	Not Reject
ETAXY does not Granger Cause TRANTAXY	0.0117	0.9884	Not Reject
TRANTAXT does not Granger Cause ETAXY	0.54237	0.594	Not Reject
ETAXY does not Granger Cause TRANTAXT	0.08619	0.9179	Not Reject
TRANTAXY does Granger Cause ETAXT	3.731	0.0524	Reject
ETAXT does not Granger Cause TRANTAXY	0.06051	0.9415	Not Reject
TRANTAXT does Granger Cause ETAXT	2.89921	0.091	Reject
ETAXT does not Granger Cause TRANTAXT	0.29474	0.7496	Not Reject
TRANTAXT does not Granger Cause TRANTAXY	0.04999	0.9514	Not Reject
TRANTAXY does not Granger Cause TRANTAXT	0.42047	0.6654	Not Reject
Lags: 5			
GTAX does not Granger Cause Y	0.18987	0.9539	Not Reject
Y does not Granger Cause GTAX	0.79481	0.5964	Not Reject
DTAX does Granger Cause Y	4.30834	0.0674	Reject
Y does not Granger Cause DTAX	0.23005	0.9337	Not Reject
DTAX does Granger Cause GTAX	4.88638	0.0533	Reject
GTAX does not Granger Cause DTAX	1.01409	0.4941	Not Reject
Lags: 1			
ANS does Granger Cause DTAX	6.16163	0.0238	Reject
DTAX does not Granger Cause ANS	1.52515	0.2336	Not Reject
Lags: 5			
ANS does Granger Cause GTAX	3.92579	0.0798	Reject
GTAX does not Granger Cause ANS	0.68691	0.6548	Not Reject
Lags: 1			
RE does not Granger Cause Y	0.00724	0.9333	Not Reject
Y does Granger Cause RE	3.41429	0.0844	Reject

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Granger causality findings for the United Kingdom GDP (y) concerning total environmental tax to GDP (ETaxY) and total taxation (ETaxT) indicate that total environmental tax to GDP (ETaxY) dose because the GDP (y) supports 8.65%, which is less than the critical value of 10%. Also, both transportation taxes (TranTaxY) and transportation tax (TranTaxT) do granger cause of total environmental tax to total taxation (ETaxT) Increase in population influences the transportation tax. The diesel tax (DTax) impacts economic growth (y), but the gas tax (GTax) does not affect GDP. The Adjusted net savings also known as actual savings, evaluate sustainable economic development, resulting in a rise in both diesel (DTax) and gasoline taxes (GTax). Renewable energy provides evidence of Granger causality, which ties environmental subsidies to economic development. This negative data indicates that expenditure on environmental protection has not yet led to technological spillovers and sustained development.

5. Conclusions

The tax system is critical for the government to achieve its environmental goals, such as reaching net-zero greenhouse gas emissions in the future. Governments, scholars, and stakeholders have long acknowledged the potential of the tax system in this regard. This paper aims to examine the link between environmental-related taxes and economic growth in the United Kingdom. is to correlate environmental taxes with GDP, including transportation taxes, gas and diesel taxes, and renewable energy concerning adjusted net savings.

This study also includes an evaluation of economic growth using adjusted net savings. ANS comprises the monetary values of physical and human capital, while GDP evaluates physical capital. The research contains 21 years' worth of time series data, spanning from 2000 to 2020. Utilized are the ADF unit root test, the Johansson co-integration, and the usual Granger causality approach. Economic growth and environmental-related taxes have a stable, long-term integrated connection, as shown by the results of unit root tests utilizing ADF techniques. According to the Granger causality test, the total environmental tax as a percentage of GDP (ETaxY) does increase as a result of total environmental taxation (ETaxT). Changes in population granger affect the transport tax, hence countries with more population growth have lower transport tax rates. The diesel tax (DTax) influences economic growth (y), but the gasoline tax (GTax) does not affect the gross domestic product (GDP) or adjusted net savings (ANS), resulting in an increase in both diesel (DTax) and gasoline (GTax) taxes (GTax). However, there is negative evidence of Granger causality from renewable energy, i.e., environmental subsidies to economic growth.

In general, the data show that richer countries are better able to bear the costs associated with environmental levies, although, as with prior results, the impact is sensitive to the used measure of environmental policy. The policy implications of this research indicate that environmental levies and the expansion of renewable energy must be related to economic development if nations are to achieve their pollution reduction objectives.

Recommend that few indicators increasing tax policies may stimulate economic growth. The policy interpretation is that more intelligent approaches are required for efficient instruments that simultaneously promote sustainable economics, manage natural resources, and efficiently control pollution levels. Therefore, the link between ecologically appropriate taxation and environmental

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growth via revenue recycling is essential. Future research may thus compare the level of such money recycling in environmental development to the tax loads of countries.

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