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Environmental Taxation: New Evidence for Energy Taxes

Maja Grdinić
Faculty of Economics, University of Rijeka, Croatia
mgrdinic@efri.hr

Maja Klun
University of Ljubljana, Faculty of Public Administration, Slovenia
maja.klun@fu.uni-lj.si

Žiga Kotnik
University of Ljubljana, Faculty of Public Administration, Slovenia
ziga.kotnik@fu.uni-lj.si

ABSTRACT

The intensity of exploitation of natural resources has increased over the past decades, making environmental protection policy one of the most important priorities of government institutions. Various economic instruments, including taxation, may help policy makers in the EU meet environmental targets, among them a more secure and competitive green economy in Europe. The focus of this paper is on empirically investigating the direct effect of environmental taxes and the indirect effect of environmental expenditures sourced from environmental taxes on greenhouse gas (GHG) emissions in the energy sector. The research applied the panel data analysis method to selected EU member states for the 1995–2010 period. The results show that the direct effect of environmental taxes on GHG emissions in the sector energy is statistically significant and negative. The indirect effects of environmental taxes resulting from environmental expenditures in the industrial and governmental sectors were found to be even stronger than the direct effect of taxes alone.

Keywords: *government policy, air pollution, climate, environmental taxation*

JEL: Q28, Q53, Q54, H23

1 Introduction

Climate change poses a wide range of risks to mankind and all living things on Earth. Since total anthropogenic greenhouse gas (GHG) emissions have increased continuously from the 1970s to 2010, policy-makers are striving to find the most optimal solution to limit the effects of climate change.

The *Intergovernmental Panel on Climate Change* alleges that the combustion of fossil fuels for energy constitutes one of the leading sources of GHG emissions. Therefore it is not surprising that the energy sector represents one of the main fields of environmental taxation as a tool for dealing with global warming.

The purpose of this article is to assess whether environmental taxes significantly contribute to the mitigation of the greenhouse gas effect, expressed in CO_2-equivalents, in the energy sector. A number of similar efforts to address and improve (environmental) taxation and governmental performance have taken shape over the last decade (e.g. Ayala, Pedraja, & Salinas-Jimnez, 2008; Dečman, Stare, & Klun, 2010; Morley, 2012; Kotnik, Klun, & Škulj, 2014). The effects of environmental taxes are divided into direct effects (degree of taxes collected) and indirect effects (public expenditures for environmental purposes sourced from environmental taxes). In this respect, the article provides deeper insight into the theme of environmental taxes.

The main results of the analysis generally confirm that environmental taxes directly and indirectly have a significant negative impact on GHG emissions in the energy sector. The indirect effects of environmental taxes resulting from environmental expenditures were found to be even stronger than the direct effect of taxes alone. The remainder of the paper is organized as follows: section two presents a review of literature on the role of economic instruments with a special focus on environmental taxes, and section three describes the data and methodology used for testing the effect of environmental taxes and expenditures on GHG emissions in the energy sector. The empirical results are then examined. In the final part, conclusions and some practical policy advice are presented.

2 Literature Review

The intensity of the exploitation of natural resources has increased over the past decades, making environmental protection policy a top priority of governmental institutions. In this framework, all European Union (EU) member states currently apply a variety of economic instruments (environmental taxes, fees and charges, tradable permits, deposit-refund system, subsidies, etc.) to implement the targets stipulated in EU environmental policy (Kurtinaitytė-Venediktovienė, Pereira, & Černiauskas, 2014, p. 332).

Various economic instruments, including taxation, may help policy makers to meet environmental targets in the EU, one of which being a more secure and competitive green economy in Europe. The EU is the world leader in the projection, admission and implementation of strict environmental policies (Costantini & Mazzanti, 2012). As the main objective of environmental tax reform (ETR)[1] is to reduce labour and investment taxation and to raise revenues by taxing pollution, ETR should generate higher rates of economic growth. This policy is often regarded as producing a double dividend (DD), in that the environment is improved while the economy benefits through reductions in distortionary taxes (Bosquet, 2000). The first dividend is the environmental goal and entails the reduction of carbon emissions, i.e. introducing carbon and energy taxes (such as taxes on resource use or cuts to environmentally harmful subsidies) in order to reduce the use of fuels that produce carbon dioxide. The second dividend mainly refers to reductions in social security contributions and other forms of taxation directly related to the cost of labour. The positive side of the DD in the context of ETR has been pointed out by authors such as Oates, 1995 and Pearce, 1991. Regardless of the positive effects of the DD, some studies (Goulder, 1995; Parry & Oates, 1998; Eissa, Blundell, & Blow, 2000) have shown that these effects depend on pre-existing tax levels.

An environmental tax is a tax whose base is a physical unit (or a proxy of a physical unit) of something that has a proven, specific negative impact on the environment (Eurostat, 2015). The primary purpose of environmental taxes is to reduce pollution through the "polluter pays" principle. Most studies (Bosquet, 2000; Do Valle, Pintassilgo, Matias, & André, 2012) that have dealt with assessments of the impact of environmental taxes and ETR have shown that these taxes have a positive impact on the environment.

Although the literature does not uniformly accept the notion of the DD and its implied positive impact on the economy, the interdependence between reductions in public funding and taxes on pollution cannot be refuted. For this reason, some authors (Brett & Keen, 2000; Haibara, 2009; Do Valle et al., 2012) have shown that revenues from environmental taxes are often used to finance specific spending programs and that they provide an additional source of revenue for state and local budgets, which means that environmental taxes are used for purposes other than to minimize the effects of distortionary taxes.

Studies such as López, Vinod and Wang (2008), López, Galinato and Islam (2011) and López and Galinato (2007) have analysed the link between environmental taxes and GHG emissions. They concluded that directing government spending toward social and public goods, including the mitigation of climate change, leads to a significant reduction in the environmental burden. Higher public expenditure for environmental protection therefore reduces levels of greenhouse gases and other harmful emissions. In their work, Pezzey and Park (1998) showed that increasing taxes on energy or introducing these taxes in

1 According to the EEA (2005) environmental tax reform (ETR) refers to "changes in the national tax system where the burden of taxes shifts from economic functions, sometimes called 'goods', such as labour (personal income tax), capital (corporate income tax) and consumption (VAT and other indirect taxes), to activities that lead to environmental pressures and natural resource use, sometimes called 'bads'".

a country's tax system helps reduce CO_2 and SO_2 and enhance the quality of air, water and soil and the environment in general.

3 Data Description and Methodology

The empirical analysis is based on a sample of 17 EU countries. The sample size reflects the fact that limited data is available for environmental indicators. The sample includes Austria, Bulgaria, Czech Republic, Denmark, Germany, Latvia, Hungary, Romania, Spain, France, Italia, Malta, Portugal, Netherlands, Finland, Sweden and the United Kingdom. The criterion for the selection of countries was the availability of data on the direct and indirect effects of environmental taxes and data on GHG emissions in the energy sector.

Studies by Baltagi (2013) and Wooldridge (2003) form the basis for the methodologies used in the research. These authors suggest joining cross sectional data and time series in a panel. The model was used to investigate the direct effect of environmental taxes on GHG emissions in the energy sector and the indirect effect of environmental taxes on GHG emissions in the energy sector as a result of environmental expenditures on GHG emissions. Environmental taxes and expenditures were expected to result in a reduction in GHG emissions. The question was therefore the magnitude of the effect of each component.

Equation 1 represents the direct effect of a change in environmental taxes on changes in GHG emissions in the energy sector and the indirect effect of environmental taxes on changes in GHG emissions in the energy sector as a result of changes in environmental expenditures.

$$\Delta I_t = \alpha_0 + \sum_{j=1}^{L} \alpha_j \Delta T_{j(t-k)} + \sum_{k=L+1}^{L+M} \alpha_k z_{(t-m)1} + \sum_{j=1}^{N} \beta_j \Delta E_{j(t-l)} + u_1 \qquad (1)$$

I	CO_2 (equivalent) emissions in the energy sector
$\Delta I_t = I_t - I_{(t-1)}$	First difference between CO_2 (equivalent) emissions in the energy sector (I) in two consecutive years
E	Environmental expenditures (N categories)
$\Delta E_t = E_t - E_{(t-1)}$	First difference between environmental expenditures (E) in two consecutive years
T	Direct effect of environmental taxes (L categories)
$\Delta T_t = T_t - T_{(t-1)}$	First difference between direct effects of environmental taxes (T) in two consecutive years
j	Counter by category (direct effect of environmental taxes, environmental expenditures)
t	Time period (1995–2010)
k, l, m	Time lags
α, β	Coefficients (parameters to be estimated)
zt_1	Control variables
u_1	Idiosyncratic structural errors

First, differences in the dependent and explanatory variables were used to observe the impact of changes in the explanatory variables on the dependent variable and to eliminate fixed effects. In line with best practices from other studies (Morley, 2012; López et al., 2011; Bernauer & Koubi, 2006), control variables (government expenditure on public goods, GDP per square kilometre, etc.) were also used in the model. Standard OLS regression was performed and potential heteroscedasticity (due to the panel data) was checked; robust regression analysis was also performed to ensure the results were not excessively influenced by outliers. Time lags and first differences in the explanatory variables were used in Equation 1, and a Hausman test was performed to check for potential endogeneity.

The empirical model may be written in the following way:

$$\Delta ENERGY = \alpha + \beta_1 \Delta TAX + \beta_2 \Delta EXPI + \beta_3 \Delta EXPG + \beta_4 \Delta GDP + \beta_5 \Delta TGE + \beta_6 \Delta GPG + u \quad (2)$$

where $ENERGY$ is a yearly change in CO_2 (equivalent) emissions in the energy sector (tonnes of CO_2 equivalent per 1,000,000€ GDP), TAX is a yearly change in energy taxes, including fuel for transport (€ per 1,000€ GDP), $EXPI$ is a yearly change in environmental expenditure for the reduction of GHG emissions in the industrial sector (€ per 1,000€ GDP), $EXPG$ is a yearly change in environmental expenditure for the reduction of GHG emissions in the governmental sector (€ per 1000€ GDP), GDP is a yearly change in GDP per square kilometre, TGE is a yearly change in total general government expenditures (in millions of € per 1,000,000€ GDP), GPG is a yearly change in government expenditure on public goods (as a % of total government expenditure), and u is the error term. Descriptive statistics of the variables used in the analysis are presented in Table 1.

4 Empirical Results

Table 1 shows descriptive statistics of the variables used in the analysis.

Table 1: Descriptive statistics of the variables

Variables	Median	Mean	Standard deviation	N
ENERGY	–17.74	–45.56	208.32	255
TAX	–0.33	–0.08	2.26	221
EXPI	0.00	0.04	1.05	221
EXPG	0.00	0.00	0.36	238
GDP	1.89	3.65	4.43	272
TGE	4.66	4.64	0.66	255
GPG	1.70	1.76	0.41	255

Number of obs =221

Source: Eurostat (2014), authors

Table 2: Correlations

	ENERGY	*TAX*	*EXPI*	*EXPG*	*GDP*	*TGE*	*GPG*
ENERGY	1.00						
TAX	–0.28	1.00					
EXPI	–0.23	0.00	1.00				
EXPG	–0.17	–0.02	0.06	1.00			
GDP	0.27	0.01	–0.03	0.00	1.00		
TGE	0.41	–0.03	–0.05	–0.04	0.02	1.00	
GPG	–0.35	–0.03	0.06	0.08	–0.07	–0.45	1.00

Number of obs =221

Source: authors

Table 2 presents correlations among the used variables. No obvious multicollinearity is present because correlations between variables do not show extreme values. Table 3 presents the variance inflation factor (VIF) and tolerance values, which are within the accepted boundaries.

Table 3: Variance inflation factor and tolerance

Variable	VIF	Tolerance
GPG	1.27	0.789393
TGE	1.25	0.797646
EXPG	1.01	0.989834
EXPI	1.01	0.991412
GDP	1.01	0.993736
VIF mean	1.09	

Number of obs =221

Source: authors

Table 4 shows empirical estimates for a standard OLS regression, a regression with robust standard errors (corrected for heteroscedasticity) and robust regression estimates (taking into account outliers). All coefficients are statistically significant at the 1% level and have the expected sign (a negative sign means a favourable effect on the change in CO_2 (equivalent) emissions in the energy sector). The empirical results closely match those reported in the literature (e.g. Bernauer & Koubi, 2006; Do Valle et al., 2012; Brett & Kenn, 2000). Higher environmental taxes translate into a reduction in GHG emissions in the energy sector, while higher total general government expenditures tend to increase GHG emissions in the energy sector.

The paper focuses on the direct and indirect effects of environmental taxes. The direct effect of environmental energy taxes on CO_2 (equivalent) emissions in the sector energy was shown to be negative and quite strong (–9.33***) both quantitatively and statistically. The sign and statistical significance of the coefficient do not change across different methods of estimation. The size of the coefficient does drop to –1.81** in the Huber regression, but even here it remains negative and statistically significant. This means that an increase in the direct effect of environmental taxes tends to contribute to the reduction of GHG emissions in the energy sector. This finding is consistent with the results of studies that have shown that environmental taxes have an impact on the reduction of GHG emissions and other emissions (Halkos & Epameinondas, 2013; Corbacho, Fretes Cibils, & Eduardo, 2013; López & Galinato, 2007). The direct effect of environmental taxes can be observed through the use of different fiscal and economic instruments in EU countries, e.g. taxes, environmental deposits, tax allowances and (in) direct subsidies. These instruments, and especially the last two, are generally more stimulative than taxation alone because industrial polluters invest in green technologies in order to obtain subsidies and partly avoid paying environmental taxes.

Table 4: Estimates of GHG emissions in the energy sector

Variable	Coeff.	OLS	Robust OLS	Huber robust regression
TAX	β_1	–9.33*** (1.74)	–9.33*** (2.74)	–1.81** (0.87)
EXPI	β_2	–12.93*** (3.74)	–12.93** (6.08)	–3.86** (1.87)
EXPG	β_3	–27.76** (10.72)	–27.76 *(15.31)	–10.76** (5.38)
GDP	β_4	4.00*** (0.84)	4.00*** (0.70)	0.93** (0.42)
TGE	β_5	35.28*** (7.11)	35.28 ***(7.64)	18.75*** (3.56)
GPG	β_6	–32.45*** (10.49)	–32.45 ***(12.44)	15.66*** (5.26)
Const.	α	-162.71*** (44.59)	–162.71*** (50.14)	–137.86*** (22.37)
N	221	221	221	221

Results of OLS, robust OLS and Huber robust regression are shown.
The yearly difference in CO2 (equivalent) emissions from energy sectors (energy) is a dependent variable.
Standard errors are reported in parentheses; ***, ** and * denote statistically significant values at 1, 5 and 10% respectively in a two-tailed test.

Source: Eurostat (2014) and authors

The results also reveal indirect effects of environmental taxes on GHG emissions in the energy sector resulting from environmental expenditure in the industrial sector (–12.93***) and governmental sector (–27.76**). This suggests that public appropriations for activities for the elimination, prevention or reduction of CO_2 (equivalent) emissions are also very important in reducing the effects of global warming. The overall properties of the regression equation are quite good, with an adjusted R-square of 0.38.

Apart from explanatory variables, the model includes several control variables. Most environmental economics studies (e.g. Antweiler, Copeland, & Taylor, 2001; Bernauer & Koubi, 2006; Kotnik et al., 2014; Morley, 2012) include variables that measure the economic activity of a country. The coefficients of the GDP per square kilometre and total general government expenditure variables in the model show a positive and statistically significant effect on GHG emissions in the energy sector at 1%. Higher levels of economic activity suggest higher GHG emission levels in the energy sector. This is consistent with the evidence presented by Antweiler et al. (2001) and Carlsson and Lundström (2001), who found that the government size and economic activity of a country have a positive effect on CO_2 and other air emissions. Similarly, Bernauer and Koubi (2006) suggest that an increase in governmental spending, as an indicator of higher levels of economic activity, leads to more pollution. Halkos and Epameinondas (2013) proved that higher levels of government spending result in higher levels of ambient emissions, and Bernauer and Koubi (2006) showed that more government spending goes hand in hand with more GHG and other emissions. An expansion in the size of government is likely to result explicitly in the improved welfare of society as a whole when this expansion is demand-driven (citizen-over-state) and when it aims at the provision of a pure public good or the correction of an externality. This evidence (coefficients of the GDP variables) could contradict Environmental Kuznets Curve theory. The Environmental Kuznets Curve (EKC) hypothesis predicts an inverse U-shaped relationship between per capita income and certain types of pollution (Asghari, 2012). At the initial stages of industrialization, growth leads to increased water and air pollution; later, pollution can decrease if the right institutions are in place because as they become rich, countries can afford to pay to clean up the environment. EKC theory predicts that the coefficient on the squared income term is negative, so the pollution curve ultimately turns down. However, some authors (e.g. Frankel & Rose, 2005) have argued that CO_2 is a global pollutant and as such is not applicable to the EKC.[2] This is also confirmed by the empirical results of this research, which could be viewed as further evidence in support of the so-called free-rider problem: countries are not willing to reduce emissions on their own for fear of becoming less competitive.

The empirical results also show a statistically significant and negative effect for the government expenditure on public goods variable (–32.45***). Government expenditure on public goods is spending for research and development, education, health, etc. In comparison with expenditures on private goods, expenditures on public goods could alleviate the effects of market failure and complement, rather than substitute, private-sector spending. Thus the reallocation of government spending from private (that is, environmentally-intensive) to public goods could give priority to human-intensive activities. The latter have a relatively smaller environmental footprint, which explains the negative sign of the GPG variable.

Table 5 reveals some minor differences between the fixed and random effects models. This could be due to the omission of time and country variables. A Hausman test was used to check the endogeneity of the explanatory variables. Since the hypothesis was not confirmed, there is a strong probability that

2 Authors investigating EKC in relation to air pollutants (SO_2, particular matter (PM_{10}), NO_2) have gotten supportive (e.g. Frankel, 2003) or mixed results (e.g. Bradford, Schlieckert, & Shore, 2000).

endogeneity is not present in the model and that coefficients of interests are not correlated with unobserved variability. The results from the random effects model and robustness estimates reported above, and especially those from the Huber regression estimates, indicate that the model is fairly robust. The direct and indirect effects of environmental taxes on CO_2 (equivalents) emissions in the energy sector are therefore confirmed.

Table 5: Estimates of CO_2 (equivalent) emissions in industrial processes: fixed effects, random effects and Hausman test

Variable	Fixed Effects	Random Effects
TAX	–9.43*** (1.63)	–8.81*** (1.62)
EXPI	–11.07*** (3.36)	–11.74*** (3.45)
EXPG	–22.78** (9.73)	–25.99** (9.91)
GDP	3.76 (3.84)	3.90*** (1.27)
TGE	70.02*** (17.27)	37.26*** ** (9.24)
GPG	–81.47*** (19.09)	–42.48*** *(12.72)
Const.	–234.76*** (75.09)	–153.69*** (53.44)
N	221	221
Hausman test	0.4259	

Results from fixed effects model, random effects model and Hausman test are shown.

Yearly difference in CO2 (equivalent) emissions in the energy sector (energy) is a dependent variable.

Standard errors are reported in parentheses; ***, ** and * denote statistically significant values at 1, 5 and 10 % respectively in a two-tailed test.

Source: Eurostat (2014) and authors

5 Conclusion

The results of the analysis suggest that the use of environmental taxes in the European Union has had a statistically significant and negative effect on GHG emissions in the energy sector. This was confirmed by OLS, robust OLS and a Huber regression. Comparison of the fixed and random effects models did not reveal considerable differences. Indirect effects of environmental taxes resulting from environmental expenditures in the industrial and governmental sectors were found to be even stronger than the direct effect of taxes alone. This suggests that direct funding of environmental protection activities aimed specifically at the prevention, reduction and elimination of GHG emissions has a more favourable environmental impact than direct taxation, even though the latter also tends to reduce GHG emissions.

Some policy guidelines may be derived from the results. The findings provide broader insight into evaluations of environmental policy measures and could assist in the search for the optimal equilibrium between the direct and indirect effects of environmental taxation when articulating economic instruments for environmental protection with the aim of mitigating the effects of climate change. This may help to design effective public appropriations and maximize environmental impacts. The methodology used here may be applied to related sectors such as water and soil pollution, or more broadly to fields like education or health. A prerequisite for the analysis is the existence of adequate input-output data. Opportunities for further research are in widening the dataset to include non-EU member states and deepening the dataset with regional data as such data becomes available in the future.

The results also provide support for studies which suggest that the Environmental Kuznets Curve (EKC) is not valid for GHG emissions. On the contrary, there is evidence in support of the free-rider problem, because CO_2 (equivalents) are global externalities and there is no reason for individual countries to take action on their own without a mechanism for international cooperation.

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***Maja Grdinić, PhD**, is Postdoctoral Research Assistant at the University of Rijeka, Faculty of Economics, Croatia for the courses Public Finance, Comparative Tax Systems, Tax Systems of European Union and Corporate Taxation. After she graduated from the Faculty of Economics in Rijeka in March 2008 she worked in an insurance company. From November 2008 she has been working at the Faculty of Economics in Rijeka. In April 2015 she defended her doctoral dissertation titled The Interdependence of Tax Structure and Economic Growth in Selected Countries of Central and Eastern Europe and the Republic of Croatia at the Faculty of Economics, Rijeka, Croatia.*

***Maja Klun, PhD**, is Associate Professor in the Department of Economics and Public Sector Management at the Faculty of Administration, University of Ljubljana, Slovenia. She currently acts as Vice-Dean for Scientific Research at the faculty. Her areas of research interest encompass Public Sector Economics, Public Finance and International Economics. She has actively participated in more than thirty international conferences and published many professional and scientific articles in various domestic and international publications (International Review of Administrative Sciences, FinanzArchiv, Transylvanian Review of Administrative Sciences, etc.). Since 2007 she has been a contracting partner for government activities in the field of Better regulation, especially in measurement of administrative costs.*

***Žiga Kotnik, PhD**, is Assistant in the Department of Economics and Public Sector Management at the Faculty of Administration, University of Ljubljana, Slovenia. He received his PhD in Statistics from University of Ljubljana in 2014. His areas of research encompass Public Sector Economics, Environmental Economics and Economics of the EU. Since 2009 he has presented his work at international conferences and symposia and published several articles and monographic chapters. His primary teaching areas are Public Sector Management, Statistics, Basic Statistics and Project Management. In 2012, the Student Council of the University of Ljubljana awarded him a Certificate for the best pedagogue.*

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POVZETEK

1.01 Izvirni znanstveni članek

Okoljski davki: novi dokazi za davke na energijo

V zadnjih desetletjih se je intenzivnost izkoriščanja naravnih virov močno povečala. Zaradi tega je politika varstvo okolja postavila kot eno najpomembnejših prednostnih nalog vladnih institucij. Različni ekonomski instrumenti, skupaj z obdavčenjem, lahko pomagajo oblikovalcem politik v Evropski uniji pri izpolnjevanju okoljskih ciljev, med drugim k bolj varnemu in konkurenčnemu zelenemu gospodarstvu v Evropi.

Okoljski davki so ekonomski instrumenti varovanja okolja, katerih glavni namen je spodbujanje zmanjševanja obremenitev okolja z uporabo načela »povzročitelj plača«, po katerem se stroški, nastali s škodo, povzročeno okolju, vsaj delno vključujejo med proizvodne stroške. Večina zbranih prihodkov okoljskih davkov je vir državnega proračuna, del pa je prihodek občinskih proračunov in je namenjen financiranju lokalnih programov varstva okolja. Namen okoljskih davkov je, da onesnaževalec plača »ceno« za vsako tono emisij. Če onesnaževalec zmanjša izpuste emisij, je nagrajen z nižjim plačilom davka.

Izdatki za varstvo okolja so odraz prizadevanja za preprečevanje onesnaževanja, ki nastane s proizvodnjo blaga in storitev. Izdatki za varstvo okolja so opredeljeni kot znesek denarja, ki je porabljen za vse dejavnosti preprečevanja onesnaževanja. Ti podatki zajemajo naslednje gospodarske dejavnosti: investicije za varstvo okolja, tekoče izdatke za varstvo okolja ter subvencije, izdane za okoljevarstvene dejavnosti.

Emisije toplogrednih plinov (TPG) so okoljski kazalniki za področje varstva zraka in podnebja. Različni toplogredni plini so vrednoteni po njihovem potencialu za globalno segrevanje, zato so končne emisije izražene v ekvivalentih CO2. Med toplogredne pline štejemo ogljikov dioksid (CO2), metan (CH4), dušikov oksid (N2O), perfluorirane ogljikovodike (PFC), fluorirane ogljikovodike (HFC) in žveplov heksafluorid (SF6). Popis toplogrednih plinov Eurostata je v celoti skladen z nacionalnimi registri toplogrednih plinov, ki jih pripravljajo v državah članicah EU. Emisije toplogrednih plinov (CO2 ekvivalente) merimo v naslednjih sektorjih: energija, industrijski procesi, kmetijstvo, uporaba topil in drugih izdelkov ter v sektorju odpadki.

Namen članka je empirična analiza vpliva neposrednih okoljskih davkov in posrednega vpliva okoljskih davkov prek okoljskih izdatkov na emisije toplogrednih plinov (TGP) v energetskem sektorju. V raziskavi so bili uporabljeni panelni podatki časovnih vrst izbranih držav članic EU za časovno obdobje 1995–2010.

Rezultati analize kažejo, da je neposreden vpliv okoljskih davkov na emisije toplogrednih plinov v energetskem sektorju statistično značilen in vpliva na zmanjševanje toplogrednih plinov v izbranem sektorju. Posredni vpliv okoljskih davkov prek okoljskih izdatkov v industrijskem sektorju in sektorju država je celo močnejši od neposrednega učinka okoljskih davkov, njihov učinek je prav tako negativen. To pomeni, da ima neposredno financiranje okoljevarstvenih dejavnosti, ki so namenjene posebej za preprečevanje, zmanjšanje in odpravo emisij toplogrednih plinov, bolj ugoden vpliv na okolje kot sama neposredna obdavčitev, čeprav slednja prav tako pripomore k zmanjševanju emisij toplogrednih plinov. Rezultati so bili ocenjeni z metodo najmanjših kvadratov (OLS), robustno metodo najmanjših kvadratov in Huber regresijo. Primerjava modelov s fiksnimi in slučajnimi učinki prav tako ni razkrila prisotnosti bistvenih statističnih razlik v modelih, kar kaže na odsotnost endogenosti v modelih. To pomeni, da že osnovni model ustrezno kontrolira tako fiksne vplive kot časovne vplive, zaradi tega modela s fiksnimi in slučajnimi vplivi ne dajeta značilno boljših rezultatov.

Iz empiričnih rezultatov lahko izpeljemo nekatere smernice za okoljsko politiko. Ugotovitve raziskave zagotavljajo širši vpogled v vrednotenje ukrepov okoljske politike in bi lahko pomagale pri iskanju optimalnega ravnovesja med neposrednim in posrednim vplivom okoljskega obdavčenja pri opredelitvi ekonomskih instrumentov za varstvo okolja z namenom ublažitve posledic podnebnih sprememb. Razvita metodologija se lahko uporablja v sorodnih sektorjih, kot sta onesnaževanje voda in tal ter sektor odpadki, ali bolj na splošno na področjih, kot sta izobraževanje in zdravstvo. Osnovni pogoj za analizo je obstoj ustreznih vhodno-izhodnih podatkov. Priložnosti za nadaljnje raziskave so v razširitvi nabora podatkov, vključitvi držav, ki niso članice EU, ter razširitvi nabora podatkov z regionalnimi okoljskimi podatki, ko bodo v prihodnosti slednji na voljo.

Rezultati analize kažejo tudi podporo študijam, ki zagovarjajo, da okoljska Kuznetsova krivulja (EKC) ne velja za emisije toplogrednih plinov (CO2 ekvivalente). Nasprotno, obstajajo dokazi v podporo problema »free riderstva« (zastonjkarje), ker so emisije toplogrednih plinov globalne eksternalije in za posamezne države ni pravega razloga, da bi ukrepale same, brez ustreznega mehanizma mednarodnega sodelovanja.