GHG Emissions in EU Countries

Subjects: Agricultural Economics & Policy

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Economic activity leads to an increase in the thermal pollution of the atmosphere. The increasing concentration of greenhouse gas (GHG) emissions enhances the natural greenhouse effect and determines the increase in global air temperature. The reduction of GHG emissions is one of the priorities of the EU countries. The majority of studies show that financial support and environmental taxes are one of the most effective measures for the mitigation of the negative consequences of climate change. The EU countries employ different environmental support measures and environmental taxes to reduce GHG emissions.

GHG emissions support environmental taxes

1. Background

Economic activity leads to an increase in the thermal pollution of the atmosphere. The increasing concentration of greenhouse gas (GHG) emissions enhances the natural greenhouse effect and determines the increase in global air temperature. GHG emissions are largely generated by the burning of fossil fuel and the growth of industrial and agricultural production followed by increased waste.

The European Union (EU) is expected to meet its 2020 GHG emission reduction target of 20% compared with 1990. In 2018, GHG emissions in the EU including the United Kingdom (EU-28) were 26% lower than 1990 levels. The decade's sharpest emissions cut was then observed in 2019, with a 3.6% reduction in the EU-28 in just 1 year. In 2018, GHG emissions in the EU-28 were 23.2% lower than the 1990 levels, totaling 4392 million tons (Mt) of carbon dioxide equivalent (CO_2). According to preliminary national estimates, EU-28 emissions fell by 3.6% from 2018 to 2019. With these latest values, the EU-28's emissions were 26% below the 1990 levels in 2019 (Eurostat DB information).

Progress towards 2020 targets is more diverse at the national level. In 2018, 11 member states (Austria, Belgium, Bulgaria, Cyprus, Estonia, Finland, Germany, Ireland, Luxembourg, Malta and Poland) had emission levels in effort-sharing sectors higher than their respective annual targets. Preliminary estimates indicate that, in 2019, these same 11 countries, as well as Czechia, had emission levels higher than their 2019 targets. To reach their national 2030 emission reductions targets in the Effort Sharing legislation sectors, a total of 21 member states will have to increase the pace of their average annual reductions in GHG emissions compared with the pace that they achieved between 2005 and 2018. Notably, Greece and Hungary already reported emission levels in 2018 that were below their national 2030 targets [1].

The EU has its sights set on 1990. The EU's total GHG emissions exclude emissions from land use, land use change and forestry, and include all emissions from aviation [2].

Hence, the statistical data suggest that the EU's GHG emission trends differ from country to country. To manage this process, relevant treaties were signed: the Paris Agreement on climate change, the European Green Deal, etc. However, these international treaties do not specify the measures to be used by countries in order to reach these goals and countries determine these measures independently. According to researchers, economic measures for pollution management include environmental taxes, emission allowance system and subsidies. Environmental taxes are targeted at consumers and producers and are seen as improving environmental protection, dispersing sources of pollution, and a significant source of government revenue. An emission allowance system is a system that takes advantage of the market when reducing emissions, where one interested party sells an emission allowance to another interested party; it is seen as an alternative to pollution taxes. Subsidies aim to improve environmental protection by encouraging less production, reducing pollution costs and encouraging innovation. However, subsidies, unlike environmental taxes, do not generate additional revenue, that is, government expenditure [3][4][5][6][7][8].

The research studies show differences among the effectiveness of the climate-change-related measures employed by different countries. Research shows that the initial EU countries with more developed, but also more polluting industries seek a more rapid reduction of GHG emissions. These countries allocate more financial resources for climate transition to non-polluting technologies, have implemented environmental tax reform (ETR) and have been introducing new environmental taxes. Environmental taxes are considered to be one possible way of addressing the GHG issue, with a particular focus on a carbon dioxide tax [8][9][10][11][12].

2. Theory

To avoid the irreversible negative consequences of climate change, the world's countries entered the Paris Agreement on climate change. The treaty establishes a global action plan to keep the increase in global average temperature to well below 2 °C and to pursue efforts to limit the increase to 1.5 °C above pre-industrial levels (of 1750).

In 2019, the European Council encouraged the countries to put more efforts into the fight against climate change and requested the Commission to accelerate the work in the pursuit of a neutral effect of the EU on climate pursuant to the EU's international commitments under the Paris Agreement. As a result, the Communication on the European Green Deal was passed and set out a goal of ensuring climate neutrality by 2050. The EU countries agreed to pursue a 55% reduction of GHG emissions by 2030.

The EU countries have made climate mitigation one of the three main priorities in its COVID-19 recovery. In 2020, the leaders of member countries agreed that at least 30% of its multi-annual budget and recovery fund agreed in July 2020 is to be spent on achieving the EU's climate neutrality goal by 2050 and meeting its increased 2030 emissions reduction goal. However, the EU has still not agreed on the exact level of that goal. In the framework of

the European Green Deal the EU is planning to revamp almost all of its climate legislation and complement it with additional measures. This includes strengthening the role of the European institutions, especially the EC, in setting the EU's emissions trajectories post-2030.

The measures chosen in the pursuit of the EU's climate neutrality goal should be sufficiently efficient and effectively lead to a reduction of GHG emissions. To curb the pollution, specific economic measures have been undertaken. The environmental policy measures, namely environmental taxes; environmental incentives, such as subsidies and trade permits; and other regulatory instruments, are considered to be a considerable contribution to environmental protection and economic growth [7][13][14]. Pinglin He et al. have identified three environmental tax development stages in the OECD countries. In the first period, between 1970 and 1980, the OECD proposed implementing the "polluter pays" principle and internalizing external costs. In the second period, from 1980 and mid-1990, a considerable share of the OECD countries implemented pollution and energy taxes aimed at protecting the environment and changing consumers' behavior. In the third stage, from mid-1990, environmental taxes developed into environmental tax systems in the OECD countries. According to Aydin and Esen [15], policy measures influencing the market have recently been gained an increasingly strong position. They are considered to be more cost-effective compared to other measures and to promote the spread of environmentally friendly technologies and innovations in this area.

A number of research studies analyzing the effect of environmental taxes have been conducted in the light of the emerging need to assess the effect of various environmental policy measures given the wide diversity of environmental policy measures and the growth of environmental issues. Due to conflicting research findings, they aimed to explain the factors that influence environmental degradation. A study was conducted by Onofrei, Vintilă, Dascalu, Roman & Firtescu [16] to empirically assess the effects of environmental taxes on GHG emissions in ten European countries in the period 1994–2012. The study was aimed at identifying the direct effect of environmental taxes on GHG emission and assessing the effect of the environmental costs. The results of this study were in line with an earlier study including the EU members and Norway in the period 1995–2006 by Morley [17] and showed that the environmental taxes had a strong effect on reducing pollution, i.e., GHG emissions. Meanwhile, the study by Onofrei et al. [16] did not confirm that environmental costs would have a significant effect on GHG emissions reduction. These results were not consistent with the opposite, i.e., the significant effect of environmental costs on pollution reduction identified by other authors [18]. These studies also assessed the effect of the redistribution of the environmental tax revenues on economic growth. The introduced environmental taxes may be combined with a reduction of the tax burden, whether that be reducing the corporate profit or personal income tax rate, thereby contributing to economic growth. In their study, Pinglin He et al. [14] explored the link between an environmental tax, gross domestic product (GDP), the unemployment rate, GHG emissions, nitrogen oxide emissions and sulfur oxide emissions, and analyzed the environmental and economic effect of environmental tax reform in the 36 OECD countries in the period 1994–2014. The authors also aimed at substantiating the "double-dividend" effect of environmental taxes. The "green dividend" effect emerges as environmental taxes influence polluting behavior and lead to greater costs for the polluter, thereby promoting environmental protection. The "blue dividend" effect appears as the environmental taxes influence the growth of the gross domestic product, promote employment and greater economic efficiency. The authors have conducted a comprehensive analysis of the previous studies on the

"double dividend" effect. The majority of the studies have supported the position that an environmental tax can improve the environment and that there is a green dividend. They have also shown a trend whereby the green dividend effect of environmental taxes is more significant than the blue dividend effect. In a few studies, the blue dividend effect is viewed as a non-obvious effect, as it promotes employment, but does not provide sufficient evidence about its effect in terms of promotion of economic growth. In general, the analysis conducted by the authors has suggested that, where the study covers a period of more advanced environmental tax systems with a share of the countries having already implemented environmental tax reform (ETR), fewer studies manage to support the considerable effect of environmental taxes on the reduction of pollution. According to research data by Pinglin He et al. [14], environmental taxes contribute significantly to the reduction of nitrogen oxide emissions in the long run, while significantly reducing sulfur oxide emissions in the short run. However, contrary to Onofrei et al. [16] or Morley [17], the researchers did not provide substantiation for a significant positive effect on the reduction of GHG emissions during their studies. However, this research conclusion, namely, that environmental taxes are an insufficiently effective measure in terms of changing polluters' behavior and promoting environmental protection, was supported by Silajdzic and Mehic [19]. This study also partially supports the blue dividend effect in 36 OECD countries, as environmental taxes positively influence economic growth; however, no such effect has been identified for the promotion of employment. It should be noted that no studies on the effect of environmental taxes have been found for individual countries, although the proportion of environmental tax revenue in the total tax revenue of OECD countries is quite different. There are no studies on the effect of different environmental incentives chosen by the countries independently.

In the efforts to promote the convergence of the two pillars of sustainable development, namely, environmental protection and economic growth, discussions and controversies caused by divergent research results have been emerging. Hence, researchers have also explored the opposite relationship, i.e., the environmental effect of economic growth. Silajdzic and Mehic [19] sought to assess the Environmental Kuznets Curve (EKC) hypothesis claiming that there is an inverted U-shaped relationship between economic growth and environmental degradation. Economic growth and industrialization are gradually degrading the environment up to a certain moment (usually referred to as the threshold income level), followed by a stage of improvement in environmental quality. This study analyzed the 1995–2015 Eurostat data and assessed the effect of environmental taxes on CO_2 emissions and the link between economic development and environmental degradation in 15 countries of Central and Eastern Europe (referred to as the "emerging market economies"). The fully-modified least squares (FM-OLS) model showed the presence of an inverted U-shaped relationship between economic growth and environmental degradation. This is partly due to a technological effect stemming from the use of more effective, environmentally friendly innovations and growing efficiency. It was also determined that the scale effect was most evident on environmental degradation, when it is considered that an economic activity is always environmentally damaging, as an increase in production and consumption means more intensive use of environmental resources. In particular, this supports the role of technological progress with the view towards the more efficient use of energy in industrial sectors. The key reason behind the limited effectiveness of environmental taxes was claimed to be not effective enough energy taxes and their link to former GHG emissions. This means that energy taxes are not effective for the majority of the industrial activities that either do not have or have limited alternatives of shifting to lower energy consumption [19].

Although transport taxes have been found to have a negative effect on GHG emissions, their effect in terms of the reduction of GHG emissions is insignificant. As a result, transport taxes predominantly have an effect on individual consumption behavior. This leaves open the question of which market measures, including environmental taxes, are the best policy measures for the more effective reduction of pollution. According to the researchers, the effect of environmental taxes is likely to depend on the industry structure and its diversity, modernization, the level of industrial development and the accessibility of technological solutions.

The question of how environmental taxes could be turned into an effective pollution mitigation measure is raised. According to Aydin and Esen [15], the effectiveness of environmental taxes may be related to fuel-price elasticity of demand, where inelastic demand leads to a reduction in tax effectiveness. The review of studies by other researchers also shows that significant tax incentives, including those afforded to the energy-intensive sectors, have demonstrated the limited effect of a carbon tax on GHG emissions. With the majority of the studies employing a linear assessment of results, in 2010 Lopez and Palacios noticed a highly non-linear link between energy taxes and pollution. Aydin and Esen [15] chose to employ a nonlinear perspective for the period of 1995–2013 in order to determine the impact of environmentally related taxes on carbon dioxide (CO_2) emissions in 15 EU member states. According to data from the World Bank, Eurostat and EIA, and by applying the dynamic panel threshold regression (PTR) model, the presence of an asymmetric dependence between environmental taxes and their effect on pollution reduction was found, meaning that after exceeding the threshold level, the effect of environmentally related taxes (excluding transport taxes) on CO_2 emissions would change from insignificantly positive to significantly negative [15]. This meant that environmental taxes would not have a significant effect on the growth of CO_2 emissions until a certain threshold, above which they would contribute considerably to the mitigation of environmental pollution. According to the empirical findings, environmental taxes help improve the quality of the environment after they have exceeded a certain critical value. The taxation of GHG emissions signals additional emerging costs to the polluters and the incentive to opt for more environmentally sustainable solutions. This research also showed that urbanization and GDP per capita had a statistically significant and positive effect on CO_2 emissions. The researchers identified the lack of a more significant effect of the transport tax on the CO_2 emissions, as the transport tax remained insignificant both below and above the threshold. As a result, the researchers made the assumption that the taxation was too low and did not have an effect on the polluters' behavior. Environmental taxes are among the most prominent tools that can be adopted in the fight against environmental pollution and climate change [15][18], and are highly important in the reduction of pollution and improvement of environmental quality in the EU countries [16]. It was concluded that the effectiveness of environmental taxes could be increased by considering the reasons for ineffectiveness in certain areas of pollution. This would involve the selection of an appropriate tax rate from which the tax would become effective, and the combination of the tax object with other economic pollution mitigation measures, i.e., subsidies.

With the types of subsidies and provision tools becoming increasingly diverse in the last two decades, the issue of the definition of subsidies remains open. Subsidies, including tax relief, are chosen as an alternative to environmental taxes with the same goals of improving environmental protection by promoting lower production and pollution, and more innovation. Within the last two decades following the introduction of special energy and carbon dioxide taxes in the EU, the EU member countries provided special partial tax relief to relevant industries with a

view towards maintaining their competitiveness. However, tax relief measures and other special tax provisions reduce the efficiency and effectiveness of environmental taxes aimed at reducing CO_2 emissions [15]. The environmental effect of subsidies manifests itself through their effect on output volumes, the composition of the economy and the level of production and consumption. Fossil fuel, agricultural and fisheries subsidies have been claimed to artificially increase production output, reduce global prices, distort international markets and international trade and reduce economic efficiency [3][8][20][21][22][23].

With the types of subsidies and provision tools becoming increasingly diverse in the last two decades, the issue of definition of subsidies remains open [23][24][25][26]. International organizations have not reached a consensus on a single definition of an energy subsidy and the most appropriate measurement methodology for energy subsidies. It is also not agreed as to whether the value of non-internalized externalities should be included in subsidy accounting. As a result, there are considerable differences in the calculations of energy subsidy values, making it even more difficult to identify whether the subsidies reach the anticipated goals.

One of the key commitments under the Paris Agreement is to mitigate GHG emissions by reducing carbon dioxide (CO_2) emissions from fossil fuels. The recent efforts by international organizations have been aimed at abandoning fossil fuel subsidies on a global scale. According to Coady et al. [20], abandonment of fuel price support based on the 2015 level would lead to a CO_2 decrease by up to 22% and a decrease in premature air pollution deaths in emerging and developing Europe. A reduction in carbon use would account for the major share of the reduction. The assessment and monitoring of energy subsidies is aggravated by the complexity of such subsidies. According to Wooders et al. [23], the majority of countries possess the data on direct fund transfer subsidies and have the capacity to assess their complexity. Meanwhile, the data on price support, tax relief, revenue loss or risk transfer subsidies are more difficult or complicated to assess, or difficult to obtain in general. In research studies, the assessment of the environmental effect of energy subsidies is usually limited to the assessment of the effect of the consumed fossil fuel [20], as the complexity of energy subsidies, the overlap of their effects and the issue of the inclusion of subsidy externality [26] prevent researchers from performing a reliable assessment of their effect on GHG emissions and the environment in general.

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