

A CROSS-COUNTRY ANALYSIS OF EMISSION TRADING SYSTEMS WITHIN THE EUROPEAN UNION

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Abstract

In the context of global anthropogenic environmental degradation, primarily caused by economic activities, the urgent need for international cooperation and coordination in the implementation of green economic policies becomes increasingly evident. Emission trading systems (ETS) represent a key component of the global strategy for reducing greenhouse gas emissions and promoting sustainable economic development. By analyzing relevant literature and examples of best practices from different EU countries, using desk research methods, this paper demonstrates that emission trading systems (ETS) are effective in mitigating environmental harm while enhancing economic relations among countries, thereby promoting a green economy and sustainable development at a global level.

By examining the implementation of ETS across various EU member states, this paper illuminates the system's potential to significantly reduce environmental footprints, improve international collaboration, and drive economic development. It explores the diverse approaches to ETS integration within the EU, reflecting on the successes and challenges faced by different countries. This cross-country analysis provides valuable insights into the mechanisms through which ETS can serve as a catalyst for effective climate change mitigation, demonstrating the significant impact of aligning national policies with global sustainability goals.

Keywords: Emission Trading Systems, green economy, sustainable development, economic development, European Union, international economic relations

JEL Codes: Q01, Q58, O13, F18

INTRODUCTION

On World Water Day 2022, United Nations Secretary-General Antonio Guterres starkly characterized the plight of our planet, stating, "Drop by drop, this precious lifeblood is being poisoned by pollution and drained by vampiric overuse." These expressive words, while specifically addressing water resources, summarize a global concern for the overall state of the environment. The exploitation of non-renewable natural resources and the anthropogenic threats to our ecosystem represent critical issues today, with significant economic and broader implications. Economists are increasingly tasked with developing strategies for sustainable economic growth and development that avoid further harm to the environment and ensure the continued viability of human life on Earth.

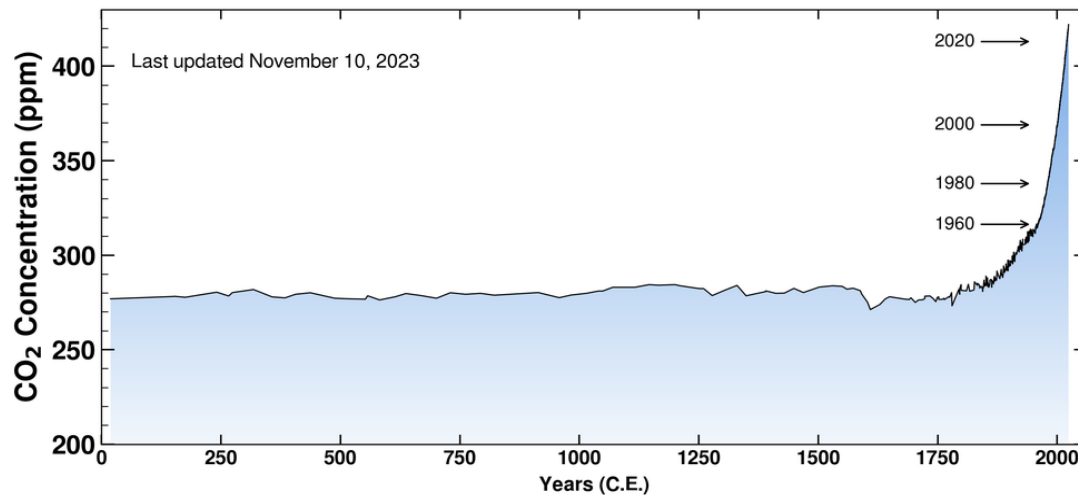
To comprehend the relevance of this challenge for economic theory and practice, it is instructive to consider historical data. The Keeling Curve, which tracks cumulative CO₂ levels in the atmosphere, illustrates a dramatic escalation in concentrations beginning with the First Industrial Revolution, as depicted in Figure 1. This surge can be attributed to the advent of the steam engine and subsequent technological advancements, which led to extensive use of fossil

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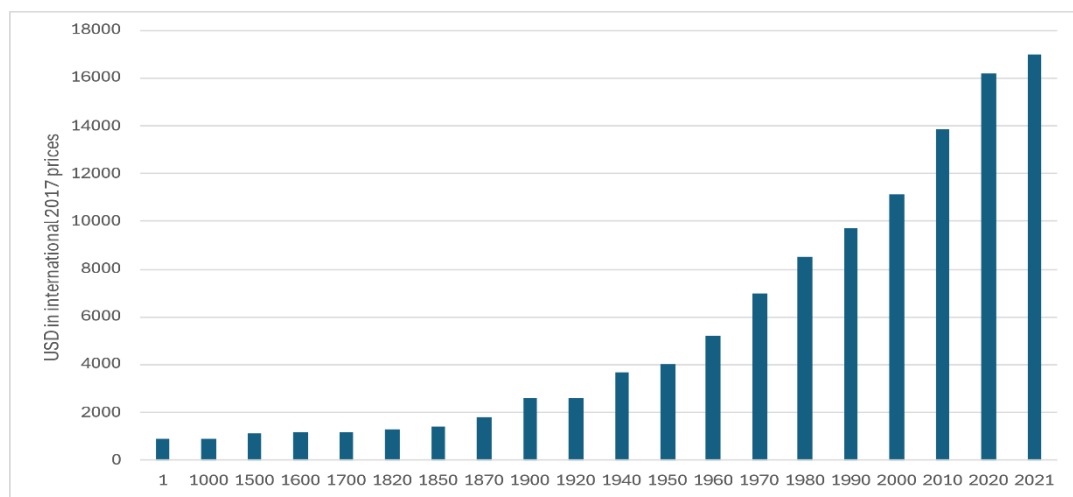
fuels for industrial activities. These activities release substantial quantities of CO₂ and other greenhouse gases, posing a profound ecological challenge and driving climate change, primarily through atmospheric warming.

Figure 1. Keeling Curve, graphic from Scripps Institution of Oceanography at UC San Diego



However, the industrial revolutions and the global economic momentum they bring can also be viewed from another angle. Alongside the detrimental effects on the environment, they have also brought about an increase in living standards and a general improvement in the quality of life on Earth, as evidenced by Figure 2.

Figure 2. Average global GDP per capita; Authors' representation based on data from World Bank (2023); Maddison Project Database 2020 (Bolt & van Zanden, 2020); Maddison Database 2010 (Maddison, 2009) available at ourworldindata.com³



Due to the reasons mentioned, it is clear why a key question for economists remains how to maintain economic growth with all its benefits without endangering the environment, and even reducing current levels of environmental degradation. The goals for such actions have been set by numerous international agreements, most importantly the Kyoto Protocol (1997) and the Paris Climate Agreement (2015), which quantify targets, specifically that to keep global

³ <https://ourworldindata.org/grapher/global-average-gdp-per-capita-over-the-long-run?tab=table>

warming at 1.5 degrees Celsius relative to pre-industrial levels, greenhouse gas emissions must peak by 2025 and be reduced by 43% by 2030 (Rogelj et al., 2016, p-1).

The phenomena leading to climate change vary in nature, but from the perspective of economic theory, they can be encompassed by the phenomenon of (negative) externalities. The fundamental problem of the climate challenge facing the global economy is that those who create emissions of harmful gases and other substances have not been paying for them, which is why one of the essential elements in curbing climate change is curbing negative externalities. According to Nordhaus (2017), the key to addressing the issue of those causing social harm not paying for it, while those who are suffering from it are not getting compensated, lies in "setting a price" for creating negative externalities. Field and Field (2016) explain that economic agents create pollution because they are not compelled to consider the negative social effects that pollution causes.

Following the above, the problem of pollution caused by economic activities is theoretically simple, or its solution is: to determine the price of social harm and compel those who produce it to pay for it. There are two basic mechanisms for such action: pricing instruments and quantity controls. The primary pricing instruments include taxes and permit trading systems. This research explores the use of the former by regulators to achieve the goals of the green economy set by the Paris Climate Agreement and the European Green Deal, i.e., to ensure green growth that implies further economic growth and development while ensuring the continued existence and use of natural resources (OECD, 2011).

Besides reviewing the theoretical basis of these instruments, the paper further explores how they are applied in practice in European countries and what potential there is for applying these instruments in the Western Balkans. Given that the green economy is generally one of the most current domains in economic science, this topic is relevant from the perspective of both environmental economics, as well as regional economies aspiring to become EU members and having some of the highest air pollution rates in Europe (Greenstone & Hasenkopf, 2023).

EMISSION TRADING SYSTEMS (ETS)

Emission trading systems, or emission trading schemes (ETS), alongside environmental taxes, serve as the primary tool for setting the price of pollution and attempting to internalize its cost into the expenses of pollution producers. In addition to this designation, these instruments are often referred to as market trading systems or emission trading schemes, while the term "cap and trade" is also commonly used for the same instrument. These instruments are more specific to environmental policy than taxes, which are broadly used to achieve several other economic policy goals, such as reducing inequality, generating revenue for the general government, etc. Emission trading systems take many different forms depending on the country in which they are applied, its economic system, the way they are administered, or the polluters they are intended to combat. These instruments also differ in how they measure pollution (emissions), set limits (caps), issue permits (both free and paid), and how these can be traded. Naturally, there is a difference in the price of permits between countries. ETS systems can be classified into three groups: offset trading, emission rate trading, and "cap and trade" (Keohane & Olmstead, 2016).

Market trading systems, also known as emission trading schemes and "cap and trade" schemes, are market-based approaches to reducing greenhouse gas emissions. The primary goal of these schemes is to address the negative external effects of climate change by limiting the total amount of emissions allowed for a group of companies or industries. By setting emission caps and allowing companies to trade permits, these systems encourage strategies for reducing

emissions that are cost-effective and promote the development of clean technologies. "Cap and trade" can help countries achieve their climate change mitigation goals and contribute to global efforts to limit global warming.

The regulatory authority, usually a governmental organization, sets a maximum threshold or cap for total emissions allowed for a specific set of companies or industries. This cap is typically determined based on a reduction target that aims to gradually reduce greenhouse gas emissions in line with global and national climate goals. The maximum limit is then distributed among the permits, called allowances or emission credits, where each permit grants the holder the right to emit a certain amount of emissions (such as one metric ton of carbon dioxide).

In practice, "cap and trade" primarily covers carbon dioxide emissions. However, in recent times, this instrument has also begun to be used more widely for other greenhouse gases. For example, in the United States, permits have expanded from carbon dioxide (CO₂) to sulfur dioxide (SO₂), nitrogen oxides (NO_x), and mercury (Fischer & Fox, 2007).

The regulatory authority allocates permits to participating companies. This can be achieved through various methods:

- Free allocation: Permits are allocated to companies based on historical emissions or other reference points. Free allocation can help reduce the potential economic impact on companies and prevent "carbon leakage," where companies relocate their operations to jurisdictions with less stringent climate regulations.
- Auction: Companies compete for a certain number of permits in a competitive auction process. The auction ensures that permits are initially allocated to those who value them most and can generate revenue for the government.
- Hybrid allocation: A combination of free allocation and auction can be used, depending on the specific design and policy goals of the cap and trade system.

Permit allocation, especially free allocation, is one of the key elements of a successful "cap and trade" system. There are several options for authorities regarding how to allocate permits, both among sectors and within a particular sector. The previously explained auctions have similar mechanisms in different legislations. However, free allocation can vary significantly. Models of free allocation include output-based measures, which consider the market share of each company within its industry and allocate permits accordingly, and lump-sum allocation (Fischer & Fox, 2007).

Permit allocation is a key aspect of the "cap and trade" system. Indeed, these are all important factors to consider when designing a cap and trade system, not only from the perspective of state revenue but also from the perspective of overall policy outcomes. When the government initially distributes permits for free, there truly are no direct revenues generated for the government. However, it is important to remember that the primary goal of such a system is to reduce emissions, with revenue generation coming as an additional benefit. If an appropriate cap is set and companies respond by reducing emissions to avoid buying additional permits, the system can still achieve its environmental goals. A drawback of giving permits for free is that it can result in unexpected profit for companies if they manage to pass on the costs of permits to consumers through increased prices, even though the permits are obtained at no charge.

Auctioning permits can help address the issue of unexpected profit. If companies have to buy permits, they cannot gain unexpected profit simply by passing costs onto consumers. This system also generates revenues for the state, which can be used to fund other climate mitigation activities or to reduce other taxes. However, this system can be politically more challenging to implement, as companies generally prefer free allocation, and it can impose a greater burden on certain sectors or companies.

Selling "excess" permits by regulators can serve as a safeguard if permit prices become too high. If the government retains some permits and sells them only when prices exceed a certain level, it can prevent price spikes and provide companies with greater certainty about the maximum price they might have to pay. However, this also effectively raises the cap, which can lead to overall higher emissions. It might also reduce the incentive for companies to invest in emission reductions if they believe they can always buy additional permits from regulators at a predictable price.

In practice, a combination of these methods can be used. Some permits may be allocated for free, especially at the beginning of the program, to help companies adjust. Other permits can be sold at auction to generate state revenues and reduce unexpected profits. The government may also retain some permits to stabilize prices. The optimal combination depends on the specific economic circumstances and policy goals. However, the overall effectiveness of the "cap and trade" system will always depend on the level of the cap and the extent of emission reductions that companies achieve in response to the price signal created by the system.

Companies that emit fewer emissions than their allocated permits can sell their excess permits to other companies that need more permits to cover their emissions. This creates a market for emission credits, where the price is determined by supply and demand. The trading mechanism encourages companies to find the most efficient ways to reduce emissions, as they can make a profit by selling excess permits or avoiding the costs of buying additional permits.

Companies must periodically report their emissions to regulators and prove that they have enough permits to cover their emissions. Those who fail to comply with regulations can face penalties, such as fines or the requirement to buy additional permits. Strict monitoring and enforcement are key to preserving the integrity of the system and ensuring that the cap effectively reduces emissions.

ETS IN EUROPEAN UNION – CROSS COUNTRY ANALYSIS

European Union Emissions Trading System (EU ETS), launched in 2005, is the largest and oldest cap and trade system for greenhouse gas emissions in the world, covering more than 40% of greenhouse gas emissions in the EU (Zaklan et al., 2021). It targeted high energy-consuming sectors such as electricity generation, heavy industry, and aviation within the European Economic Area (European Commission, 2022).

In the European Union Emissions Trading System (EU ETS), a unified EU-wide emissions quota for greenhouse gases has superseded the previous 27 national quotas, streamlining the allocation process across the member states. Emission units are predominantly allocated via auction mechanisms, although certain facilities continue to receive units free of charge. For these facilities, the EU has established harmonized rules for allocation, which are rigorously based on stringent greenhouse gas emission monitoring protocols. The EU ETS encompasses a diverse array of sectors that are significant contributors to greenhouse gas emissions. These include

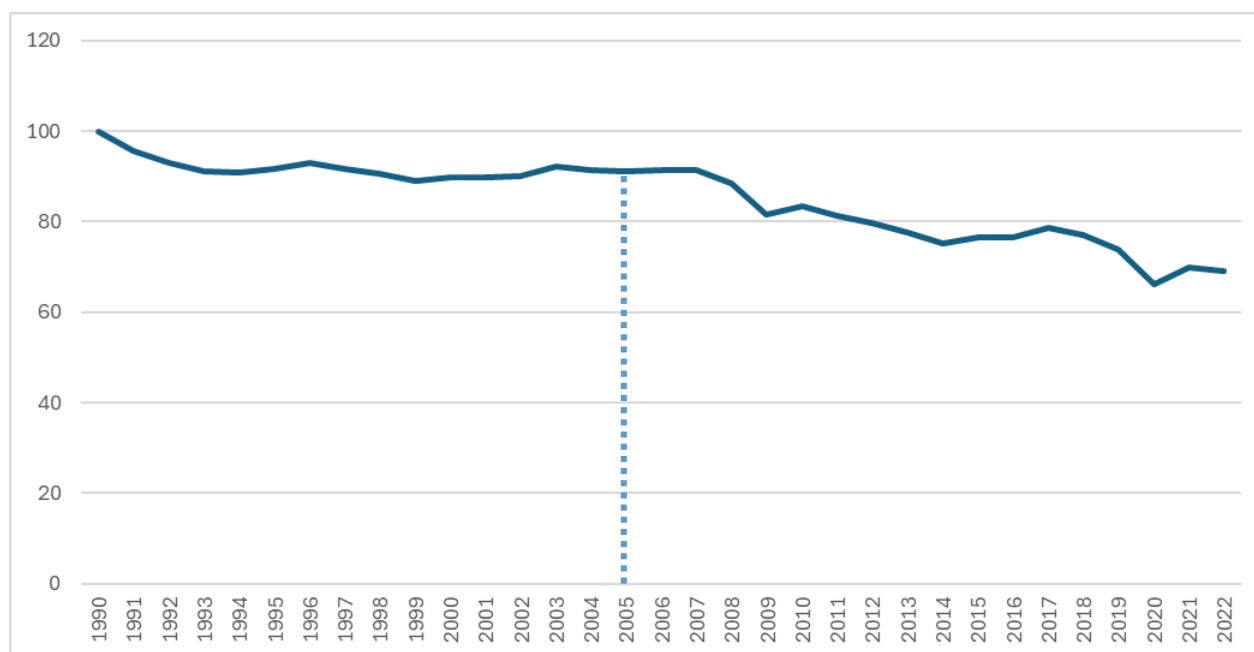
- Carbon dioxide (CO₂) emissions from the generation of electricity and heat, as well as from energy-intensive industrial sectors such as oil refineries, steel mills, and manufacturers of iron, aluminum, other metals, cement, lime, glass, ceramics, and pulp and paper.
- CO₂ emissions from civil aviation
- Nitrous oxide (N₂O) emissions from the production of nitric acid, adipic acid, caprolactam, glyoxal, and glyoxylic acid.

– Perfluorocarbon (PFC) emissions⁴

Bayer and Aklin (2020) state that the EU ETS saved approximately 1.2 billion tons of CO₂ between 2008 and 2016, representing a reduction of 3.8% compared to a scenario without carbon markets, which accounts for almost half of the emission reductions pledged by EU governments under their Kyoto Protocol commitments. Figure 3 depicts a significant decline in greenhouse gases after the introduction of the EU ETS in 2005, with net emissions falling to 69% compared to the 1990 level. (European Commission, 2023b) reported a decrease of 21% in emissions reported under the ETS from 2005 to 2020. This decline is attributed to the introduction of the ETS, affecting the shift to green technologies not only because of the introduction of pricing but also because of the constant cutting of the emissions cap, 1.74% per year on average from 2013 to 2020.

A study of installation levels measurement showed a 10% decrease in emissions from 2005 to 2012 in the countries participating in the EU's ETS (Dechezleprêtre et al., 2023). Moreover, the same study showed that despite initial fears, there was no significant negative effect on employment levels and profits across the covered firms. Similar compelling evidence of the non-existence of perceived negative effects of the emissions trading system is also offered by Joltreau and Sommerfeld (2019) who conclude that the ETS introduced in 2005 did not have adverse effects on the competitiveness of covered companies. Nevertheless, the rationale behind this development is somewhat concerning. The primary reasons why the ETS did not affect competitiveness include over-allocated permits, the passing on of costs to consumers, and the limited proportion of electricity in overall costs, which collectively indicate a policy oversight.

Figure 3 Net greenhouse gas emissions in EU 27, 1990=100; Authors' representation based on data from EUROSTAT (sdg_13_10)



Across different EU countries, the implementation and impact of the EU ETS vary significantly due to diverse economic structures, energy dependencies, and industrial activities. For instance,

⁴ https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

in Germany, a heavily industrialized nation, the EU ETS has spurred significant investments in renewable energy and technological innovations to reduce carbon emissions in manufacturing sectors. Contrastingly, in countries like Latvia and Estonia, the focus has been more on improving energy efficiency and transitioning from high carbon-intensive energy sources to more sustainable options due to their smaller industrial base (Flachsland et al., 2018).

The 2005 EU ETS also highlights significant sectoral differences in implementation. The power and aviation sectors, being subject to EU-wide regulations, exhibit a more uniform integration of ETS mechanisms. In contrast, industries like cement and steel have varied integration levels due to different local industrial policies and available technologies for emission reductions (European Commission, 2019).

The power sector across EU member states generally operates under stringent EU-wide regulations due to its substantial impact on carbon emissions. Most countries within the EU have adopted similar strategies to integrate renewable energy sources like wind, solar, and hydroelectric power to replace traditional coal-fired power plants. This shift is facilitated by the EU ETS through the allocation of emissions allowances, which are more economically manageable for renewable energy sources than for coal. The consistent regulatory environment across the EU aids in streamlining compliance and operational strategies for power companies, encouraging a unified move towards greener energy production.

The aviation sector, included in the EU ETS since 2012, follows EU-wide policies that require airlines to monitor, report, and verify their emissions, and to surrender allowances against these emissions. While all airlines operating within and into the EU are subject to these regulations, the impact is uniformly managed through standard procedures that ensure that airlines incorporate emission costs into their operational considerations. This sector's inclusion in the EU ETS exemplifies a targeted approach to a specific high-emission industry, leveraging EU-wide policy for consistent implementation.

The cement industry presents a contrast, particularly in how different countries have integrated ETS mechanisms based on local industrial strategies and technological availability. For example, countries like Germany and the Netherlands have advanced technologies for capturing and utilizing emissions from cement production, allowing them to more effectively reduce and manage their allowances. In contrast, nations such as Bulgaria and Romania face technological and financial barriers that limit their ability to reduce emissions as efficiently, leading to varied integration levels of ETS mechanisms within the sector. This disparity is often influenced by the availability of investment in green technologies and the economic prioritization of industry upgrades;

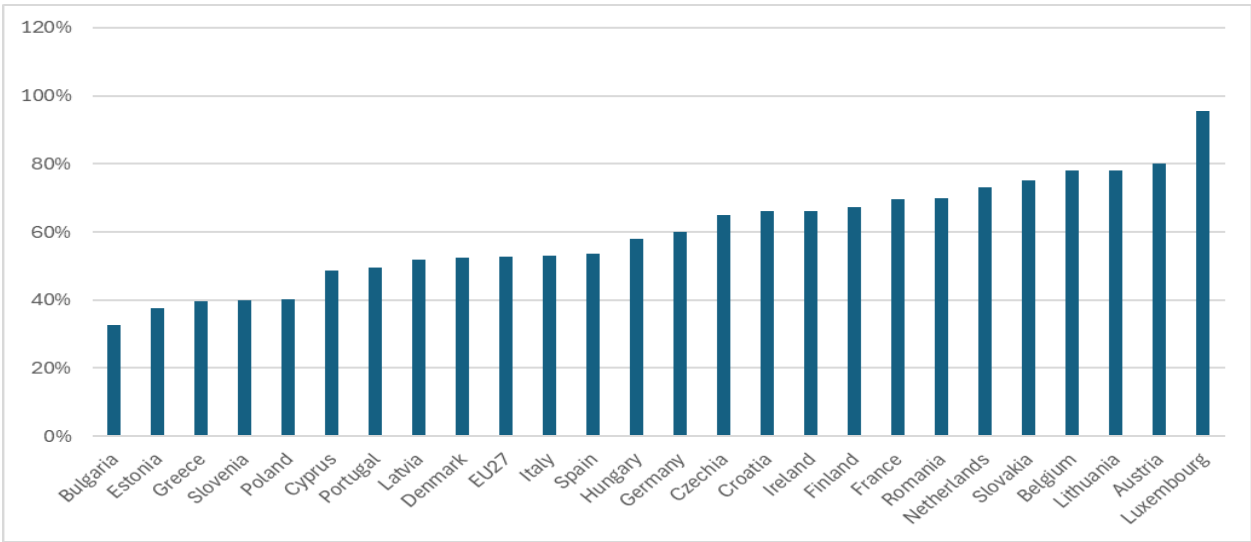
Similarly, the steel industry shows varied responses to the EU ETS. In Sweden, steel manufacturers have started transitioning to electric arc furnaces which use renewable energy, significantly lowering emissions and enhancing their compliance with the EU ETS. Meanwhile, in Italy, traditional blast furnaces still predominate, driven by the existing industrial infrastructure and slower adoption of new technologies. This leads to higher emissions and a greater need for emissions allowances, reflecting the challenges of retrofitting older industrial setups in compliance with EU ETS mandates (European Commission, 2022)

Moreover, the introduction of the Market Stability Reserve (MSR) in 2019 has been a critical development to address the surplus of allowances that might depress the carbon price. The MSR adjusts the supply of allowances to be auctioned, thus strengthening the EU ETS's capability to be an effective tool in reducing greenhouse gas emissions (European Commission, 2019). This has been particularly impactful in countries like Spain and Portugal, where emission levels from industries have been historically high.

Countries like France and the Netherlands have explored additional measures such as a carbon price floor to supplement the EU ETS and provide a stable investment environment for low-carbon technologies. This approach reflects a growing recognition that a robust price signal is crucial for achieving long-term decarbonization goals. An IMF analysis supports this view, highlighting that well-designed carbon pricing strategies, complemented by appropriate revenue recycling and enhancement of investment in green technologies, can enable more effective and equitable transitions across countries. This integrated approach helps in managing both macroeconomic and distributional impacts efficiently, ensuring that the goals of climate policy are met without detrimental effects on economic stability (Chen, 2020).

However, the level of autonomy that countries possess in implementing the ETS serves as a dual-purpose tool. While some countries, such as France and the Netherlands, have established a price floor, others have exercised their discretion to shield key national industries, occasionally at the expense of the collective goal of reducing greenhouse gas emissions. A crucial element in this context is the method of allowance distribution. Free distribution of allowances mitigates the intended impact of emission pricing by not fully internalizing the costs associated with greenhouse gas emissions. Müller and Teixedó (2021) conclude that if Poland auctioned its permits for the greenhouse gas-intensive energy sector, it would have reached decarbonization much faster, following the path of other industries and other countries. Figure 4 illustrates the significant variations among countries in their methods of allowance distribution. Furthermore, the rules of the EU ETS permit countries with a GDP per capita at or below 60% of the EU average in 2013 to opt out of ETS compliance in the electricity sector. This exemption is still utilized by Bulgaria, Hungary, and Romania today (Marcu et al., 2021).

Figure 4 Share of free allowances in total allowances under EU ETS in 2022, except for aviation and electricity; Authors' representation based on data from the European Environment Agency⁵



ETS IN THE CONTEXT OF THE EUROPEAN GREEN DEAL AND IMPLICATIONS ON WESTERN BALKANS COUNTRIES

The European Union’s commitment to fostering an environmentally sustainable economic trajectory is encapsulated in the European Green Deal. A critical component of this initiative is

⁵ <https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1>

the Fit for 55% package, which seeks to regulate greenhouse gas emissions to reduce them by 55% by 2030, thereby setting the stage for the Union to achieve carbon neutrality by 2050 (Pietzcker et al., 2021). Leveraging insights from prior environmental policies, the EU ETS is a fundamental aspect of this strategy, specifically through its comprehensive reform. The revised ETS aims to rectify the original system's deficiencies by expanding coverage to include additional sectors such as maritime transport and international aviation. A major focus of the reform is the gradual elimination of free allowances and the acceleration of emission reductions by lowering the emissions cap by 2.2% annually. Moreover, the Fit for 55 package proposes the creation of a new ETS that would extend beyond businesses to encompass buildings, road transport, and fuels for other sectors (European Council, 2022).

Another crucial element of the new environmental policy under the European Green Deal is the Carbon Border Adjustment Mechanism (CBAM). This mechanism seeks to mitigate carbon leakage by imposing a tariff-like charge on imports from countries that do not employ any form of carbon pricing, such as an emissions trading system or carbon tax (European Commission, 2023a). This charge aims to account for the carbon content of these goods and services. Given that the EU is a significant export market for the Western Balkans, the CBAM could notably impact these countries. The potential increase in the prices of their goods could diminish their competitiveness within the EU market. These countries have committed to align with the EU's Green Deal through the Sofia Agreement and the Green Agenda for the Western Balkans, which might prompt the development of their national emissions trading systems or even a regional system. Efforts in this direction are evident, for instance, in Montenegro, which has implemented an internal ETS for major public enterprises including the steel factory in Niksic, the aluminum factory in Podgorica, and the national power utility company. However, the high levels of air pollution in these countries underscore the urgency not only of compliance with EU standards and the avoidance of CBAM penalties but also of addressing domestic environmental challenges through the adoption of emissions pricing mechanisms.

CONCLUSION

The evaluation of Emission Trading Systems (ETS) across the member states of the European Union highlights the pivotal role of the EU ETS in driving the region's climate change mitigation efforts. As a cornerstone of the EU's strategy to address climate issues, the EU ETS has effectively reduced greenhouse gas emissions through a rigorous regulatory framework coupled with economic incentives for reducing emissions. However, the application of the EU ETS across various countries has shown considerable differences, reflecting the diverse economic landscapes and environmental priorities within the union. This diversity underscores the need for customized approaches that align with national conditions while upholding the goals and coherence of the overarching EU framework. Examples from Germany and Sweden demonstrate how combining ambitious national policies with the ETS framework can lead to significant investments in renewable energies and technological innovations. Conversely, countries like Bulgaria and Romania encounter challenges due to their limited technological and financial resources, impacting their capacity to fully benefit from the ETS.

The expansion of the EU ETS, especially through initiatives like the 'Fit for 55%' package under the European Green Deal, aims to enhance the robustness of the system. New measures, including the Carbon Border Adjustment Mechanism (CBAM) and the gradual elimination of free allowances, are intended to bolster the effectiveness and equity of the ETS. These adjustments are critical to maintaining the EU ETS as a key instrument in reducing emissions while promoting sustainable economic growth.

Looking ahead, the EU must continue refining the ETS by integrating scientific and economic research to address new challenges and support member states in meeting their environmental and economic goals. The future of the EU ETS will rely on ongoing improvements that emphasize transparency, fairness, and inclusivity, ensuring comprehensive engagement across all sectors and regions.

In sum, while the EU ETS has been central to Europe's environmental strategy, its continued success will depend on adaptive enhancements that align with evolving global sustainability targets and cater to the unique needs of each member state. Collective commitment will be essential in guiding the continent toward a more sustainable and environmentally responsible future, solidifying the EU's leadership in global climate initiatives.

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