

The Impact of Environmental Regulation on Trade Flows in OECD Countries

Evidence from Generalized Panel Unconditional Quantile Regression

Okba AbdelaouiEl-Oued University
okbabde@gmail.com**Brahim Ben Moussa**El-Oued University
brahimmousa1979@gmail.com**Yacine Rehouma**El-Oued University
yacinerhoma85@gmail.com

Received:15/03/2024 Accepted: 28/05/2024 published 20/11/2024

Abstract:

The study aims to measure the impact of environmental standards and requirements on trade flows in the Organization for Economic Cooperation and Development (OECD) countries from 1990 to the end of 2021. The study measured the impact of environmental policy stringency, environmental taxes, carbon emissions, and renewable energy on imports and exports as variables indicative of environmental regulation. Unconditional Quantile Regression methods were used to estimate the study model. The study concluded that there is a complex relationship between environmental regulation and trade flows, where the impact of stringent environmental policies, environmental taxes, carbon emissions, and renewable energy use varies significantly among countries with different levels of import and export activities. Specifically, while the stringency of environmental policies and carbon emissions may enhance business activities in countries with moderate imports and exports, they hurt countries at the lower and upper ends of the trade spectrum. The adoption of renewable energy promotes countries with above-average trading activities. However, it may hinder trade in countries with low imports and exports. On the other hand, environmental taxes promote trade in countries with low trade flows while hindering it in the rest of the countries under study.

Keywords: Environmental Regulation, Environmental Policy Stringency, Environmental Taxes, Exports, Imports.

Jel Classification Codes: F18, F12, Q56

I. INTRODUCTION

Determinants of trade flows and the justifications for their occurrence between countries. National, international, and institutional economic policy efforts have been centered around establishing the organizational and legal framework aimed at eliminating all barriers that hinder the free flow of trade, ensuring the smoothness of its flows, maximizing the efficiency derived from its freedom, eliminating all discriminatory practices that could distort trade routes, and granting unfair advantages to countries that hinder the optimal allocation of resources and reduce the expected welfare to be created.

With the development of the global economy, its increasing growth, the expansion of trade exchanges, and their increasing volume, issues have begun to emerge, especially in the environmental field, to address environmental issues within the core of interest of governments and non-governmental institutions. The economic discourse has diversified between those who believe that trade issues should be discussed outside trade topics and those who see them as the essence of trade topics and the determinants of their fair advantages. In this context, opinions have differed on the nature of the effects arising from considering environmental dimensions through pricing mechanisms and other tools, as this mechanism may impose additional costs on industries that harm their competitive advantages and affect the desired economic goal of trade liberalization associated with reducing the prices of tradable goods and enhancing economic welfare.

Bhagwati (2002a) suggests that the environment and international trade are conflicting. Bhagwati (2002b) strongly opposes the links that connect more liberal trade measures with business and environmental regulations and argues that these policy objectives should be addressed separately from trade by international governmental bodies and other non-governmental organizations .

Porter's hypothesis (Porter, 1995), which states that strict environmental regulations can drive innovation and enhance the competitive advantage of any country. By imposing stricter standards, companies are encouraged to invest in clean technologies and processes, improving environmental performance without sacrificing economic growth. Strict environmental regulations can enhance competitiveness by promoting innovation. This can elevate competitive advantages and dynamics, encouraging countries to engage in trade and expand international commerce. As Xu, X (2000) points out, no evidence supports the hypothesis that new trade barriers are created to compensate for the impacts of stricter environmental systems. Sartzetakis and Constantatos (1995) also indicate that free trade conditions should lead not only to similar environmental standards but also to similar regulatory systems .

This study aims to test the relationship between trade flows, both exports and imports, in countries of the Organization for Economic Cooperation and

Development (OECD) and analyze the impact of environmental regulation on their trends to examine whether environmental regulation has constituted barriers hindering the smooth flow of trade. Alternatively, it has formed a mechanism to enhance trade flows among the countries under study while achieving the desired environmental objectives.

In examining the effects of environmental regulation on exports, several studies have concluded the positive effects of environmental regulation and environmental taxes on exports. Luis and Dunn (2023) indicate that environmental regulation significantly impacts exports, and it has been shown that strict environmental regulations related to emission control in Kenya enhance export intensity. According to Xinjun et al. (2022), environmental regulation positively influences the quality of exports of carbon-intensive manufacturing industries, leading to improvements in capital, labor, energy, and total green worker productivity.

Similarly, a study by Juan and Ziyi (2022) found that ecological systems are inversely U-shaped related to export trade, initially suppressing it due to increased costs but ultimately encouraging technological innovation and improving efficiency and competitiveness. According to Chen et al. (2023), air pollution significantly hinders the growth of agricultural export trade, but ecological systems can mitigate this negative impact. Additionally, voluntary environmental regulation in export destination countries significantly impacts solar energy industry exports in China. In contrast, the bilateral gap in voluntary regulation has a negative effect (Sun et al., 2023). From Sdiri's perspective (2023), environmental commitment is crucial in enhancing product and process innovation, positively contributing to exports, and promoting company innovations.

Regarding environmental taxes and their impact on exports, it has been found that environmental taxes have a significant impact on exports. This was confirmed by a study by Kuang, H., & Xiong (2022), indicating that environmental regulations have greatly influenced companies' production behavior. Based on data on implementing environmental taxes in China, researchers concluded that environmental taxes have significantly improved the quality of export products. The analysis shows that the increased quality of export products from regulated areas can be attributed to encouraging innovation in enterprises and reducing resource misallocation. This has led to achieving dual returns for economic development and environmental protection. Maria (2023) points out that imposing taxes on polluting export goods has implications for a country's welfare, both in terms of domestic welfare and in the presence of existing taxes. Sung supports Jin et al. (2021), where it is shown that environmental policies, such as environmental taxes, increase green exports

between high-income countries and achieve stability in demand and local production.

Yongsheng et al. (2023) refer to the trade-off that occurs under the implementation of environmental taxes and foreign direct investment flows. Environmental taxes negatively impact the location choices of foreign-invested companies, reducing the number of newly registered foreign-invested companies, which is reflected in their exports. Conversely, they bring some economic benefits by making the foreign investment structure cleaner and more advanced. Despite this trade-off, Juan and Ziyi (2022) conclude that environmental regulations can encourage technological innovation and improve efficiency and long-term competitiveness, contributing to export trade development.

On the other hand, some studies have found a reverse impact of environmental regulation on exports. According to Liang, Ding et al. (2022), the impact of environmental regulation on the innovation of export companies in China is negative, with heavy and medium pollution-intensive industries experiencing a decrease in innovation capability. A study by Feng and Zhang (2023) concluded that the restrictions imposed by local governments on environmental objectives significantly negatively impact the export competitiveness of institutions, with weaker effects on polluting industries, processing trade institutions, and labor-intensive and capital-intensive industries. Xia, Ali (2023) confirms that stricter environmental disclosure does not encourage companies' participation in exports, but the remaining export volume of exporting companies in the market increases. According to Haiyan, Luo et al. (2022), export trade in China can indirectly prevent environmental pollution through existing market incentive restrictions and interactions with elements such as technological innovation and energy structure. This result is confirmed by Sokolova (2023), stating that the environmental regulation of trading partner countries is negatively related to the volume of Russian exports but has a positive relationship in regions conducive to innovation activity and active environmental policy.

Looking at the impact of environmental regulations on imports, experimental studies confirm that environmental regulation has a significant effect on imports. A study by Juan and Ziyi (2022) found that stringent environmental policies hinder trade, especially concerning environmentally friendly goods listed in the Organization for Economic Cooperation and Development. Comparing the effects on exports and imports, Kang and Gapay (2023) indicate that stricter environmental regulations decrease carbon dioxide emissions embodied in exports in exporting economies but increase carbon dioxide emissions embodied in imports. However, Zhe Dai et al. (2021) argue that these stringent regulations can boost demand for environmentally friendly products. Imports under strict environmental regulation can contribute to maximizing the benefits of green technological innovations. Lina confirmed this

result, and Shang (2021) found that import trade positively impacts green technology innovation, especially in regions with stronger environmental regulations. It is worth noting that environmental and stringent environmental regulations impact reshaping trade routes and their geographical distribution. In this context, Trang and Tran (2021) concluded that China's restrictions on waste imports have reshaped global waste trade, redirecting waste flows to low- and middle-income countries in East Asia, the Pacific, Europe, and Central Asia.

In the same context, many research studies have focused on studying the impact of environmental taxes on imports. A study by Bruno et al. (2023) analyzed the effects of an environmental tax on imported products that generate pollution and waste. They found that such a tax could reduce the volume of polluting products and generate additional revenues for specific projects. Carl, Gagné Lota, and Tamini (2021) explain that the relationship between environmental taxes and demand for environmental goods follows a bell-shaped curve. They found that increasing the tax rate could reduce bilateral trade in environmental goods above a specific tax rate. Maria Llop (2023) studies the welfare effects resulting from imposing taxes on polluting exported goods and finds that the welfare effects in open economies are complex and depend on various factors. Jung and Kim (2017) analyzed the effects of environmental regulations on business performance in manufacturing sectors. They found that environmental taxes could reduce the international competitiveness of manufacturing sectors and limit imports. A study by Aaditya et al. (2013) suggests that border taxes based on carbon content in imports or domestic production could address competitiveness and environmental concerns in high-income countries but with potentially negative consequences for trading partners

II. Methods and Materials:

The research focuses on the practical aspect of this study on countries of the Organization for Economic Cooperation and Development (OECD). Temporally, the study covers the period from 1990 to the end of 2021.

1. Study Variables:

In order to address the study's problem and achieve its objective, two models will be estimated. The first model measures the impact on imports, while the second model measures the impact on the volume of imports of goods and services. Therefore, the models aim to estimate the impact of environmental regulation on trade flows. By examining the impact of Environmental Policy Stringency (EPS), Environmentally Related Tax Revenue (RDE), Research and development expenditure (EPS), Patent applications, residents (EPS), CO2 emissions (CO2EME), Environmentally adjusted multifactor productivity growth

(EAMPG), Total renewable energy (TRE), Households and NPISHs Final consumption expenditure (current (FCE), Gross fixed capital formation (GFCF) on imports (IMP) and exports (EXP).

2. Study Methods:

The estimation methodology relies on unconditional quantile regression techniques introduced by Firpo et al. (2007). The objective is to investigate how independent variables impact the distribution of the dependent variable, enabling the examination of various effects of the independent variables on the dependent variable. This regression type avoids issues related to heterogeneity in data distribution. This regression model is more robust than the Ordinary Least Squares (OLS) method because it addresses issues such as heterogeneity, outliers, and structural change. The model does not rely on strong assumptions about the error term, with the parameters of β^*_τ indicating the marginal effects on the quantile τ of Y. The model does not consider changes in the other independent variables, and the parameters are estimated using a recentered influence function (RIF) in the specified form:

$$RIF(y, q_\tau, F_y) = q_\tau + \frac{\tau - I(y \leq q_\tau)}{f_y(q_\tau)}$$

Where: q_τ represents the value of the dependent variable with the rank corresponding to the quantile τ and estimated through the non-parametric approach provided by Kernel. F_y represents the distribution function of the dependent variable, and $f_y(q_\tau)$ represents the marginal density function of the dependent variable at the quantile τ , $I(y \leq q_\tau)$, a function defined for values of the dependent variable that are lower than the quantile τ .

This regression model yields two sorts of parameters. The first type illustrates the impact of variable X on the specific quantile τ of the Y distribution. The second part of the analysis examines the impact of changes in the distribution of independent variables (policy effect) on a specific quantile τ of the Y distribution, while also considering the constant impacts of each country in the model.

These methods and tools must be presented precisely and clearly without exaggeration so that other researchers can re-examine or verify them. The author can describe the tools and methods used in the form of a scheme, table or diagram to explain methods used.

III. Results and discussion :

1.Results of the import model:

The unconditional quantile conventional standard error estimates showed a statistically significant positive impact of environmental policy stringency on the

import quantiles Q50, Q75, and Q90. However, the results revealed a negative impact of environmental policy stringency on the imports in quantiles Q10 and Q25 related to the distribution of imports, indicating that environmental policy stringency exerts positive effects in countries with medium and high imports while negatively affecting countries with below-average and weak import levels. These results retained their statistical significance with bootstrapped standard errors.

Analyzing the effect of strict environmental policies on imports at various quantiles shows a complex relationship. In countries with medium to high import levels (Q50, Q75, and Q90 quantiles), tougher environmental laws are statistically linked to higher import levels in these categories. In countries with significant import activity, there may be a higher ability to handle the costs of following strict environmental standards or a stronger inclination towards environmentally friendly items, which could be pricier. Countries with below-average or weak import levels may find rigorous environmental rules more burdensome, resulting in a decline in imports, as indicated by the negative impact observed in the lower quantiles (Q10 and Q25). This uneven impact highlights the significance of taking into account the diverse capabilities and economic situations of countries when enacting and assessing the outcomes of environmental policy.

As estimated, there is also a statistically significant positive impact of environmental tax revenues on imports in quantile Q10 and a statistically significant negative impact of environmental tax revenues on imports in quantiles Q50 and Q75. These results maintain their statistical significance with bootstrapped standard error estimates, in addition to the statistical significance of the negative impact in quantile Q90 in these estimates, indicating that environmental tax revenues contribute to increasing imports in countries with low import levels while having an inverse effect on imports in countries with medium and high import levels.

Environmental tax revenues' effects on imports over quantiles demonstrate how tax policy affects trade dynamics. Environmental taxes may boost imports in countries with low import levels, as seen by the lowest quantile (Q10). Environmental taxes may increase imports of greener, more efficient, and environmentally friendly goods. In contrast, environmental taxes prevent importation in countries with medium to high imports, as seen by the median (Q50) and higher quantiles (Q75 and Q90). Environmental restrictions may raise costs, making imports less appealing. These connections remain statistically significant after controlling for bootstrapped standard errors, demonstrating their robustness. These findings suggest that environmental tax policies and commerce

interact complexly, with import effects varying wildly depending on a country's baseline import activity.

As the estimates also showed a statistically significant positive impact of carbon emissions on imports in the Q50 quantile, in addition to a statistically significant negative impact of carbon emissions on trade openness in the Q90 quantile, these results maintained their statistical significance with bootstrapped standard errors estimates, indicating that carbon emissions contribute to increasing imports in countries with medium import levels. However, they contribute to reducing imports in countries with high import levels.

Carbon emissions' impact on commerce, particularly imports and trade openness, across quantiles illuminates environmental-economic processes. Carbon emissions and imports are positively correlated at the median import level (Q50 quantile). This shows that carbon emissions increase imports up to a certain point. Higher economic activity and energy use may increase imports. In countries with high import levels (Q90 quantile), carbon emissions have a statistically significant negative impact on trade openness, suggesting that beyond a certain point, the environmental cost or policy interventions related to carbon emissions outweigh the economic benefits, reducing imports. Bootstrapping standard errors to validate statistical significance improves the findings, demonstrating a complicated connection between economic activity, trade policy, and environmental considerations that varies by import amount. Policymakers must consider this nuance to balance trade growth and environmental sustainability.

The estimates also showed a statistically significant negative impact of total renewable energies on imports in quantile Q25, as well as a statistically significant positive impact of total renewable energies on imports in quantiles Q75 and Q10. These results maintained their statistical significance with bootstrapped standard errors, indicating that total renewable energies contribute to increasing imports in countries with above-average and below-average import levels while reducing imports in countries with below-average import levels.

The impact of total renewable energies on imports shows how renewable energy affects import behavior depending on import quantities. Renewable energy sources reduce imports statistically in countries with below-average import levels (quantile Q25). Renewable energies may help these countries become self-sufficient, eliminating the need to import energy and related products. Renewable energies enhance imports in countries with above-average import levels (quantiles Q75 and Q100). This may be due to the need to import technologies and equipment for renewable energy infrastructure development and maintenance, or it may reflect a broader economic trend where countries investing in renewable energy also trade more. The fact that these conclusions hold even with bootstrapped standard errors proves their resilience. Thus, renewable energy development may reduce imports in lower-importing countries

by promoting energy independence while boosting imports in higher-importing countries.

The results also show a statistically significant positive impact of environmentally modified multifactor productivity growth on imports in the Q25 and Q10 quartiles; these results maintain their statistical significance with bootstrapped standard error estimates in addition to the statistical significance of the positive impact on the Q90 and Q75 quartiles, indicating that environmentally modified multifactor productivity growth contributes to increasing imports for all countries except those with average imports.

The results also show a statistically significant negative impact of the number of patents on imports in the Q10 quantile, indicating that patents reduce imports in countries with low import levels. These results remained statistically significant with bootstrapped standard error estimates.

Furthermore, the results also reveal a statistically significant positive effect of research and development expenditure on imports in the Q50 quantile, meaning that spending on research and development contributes to increasing imports in countries with medium import levels. These results also maintained their statistical significance with bootstrapped standard error estimates.

The results also indicate a statistically significant positive impact of household consumption on imports in the Q10 and Q25 quantiles. These results remained statistically significant with bootstrapped standard error estimates. Additionally, the results show a negative impact of household consumption on imports in the Q75 and Q50 quantiles, with bootstrapped standard error estimates, suggesting that household consumption contributes to increasing imports in countries with below-average and low import levels while reducing imports in countries with medium and above-average import levels.

Moreover, the results demonstrate a statistically significant negative impact of investment on imports in the Q25 quantile and a statistically significant positive impact on imports in the Q75 and Q50 quantiles. These results maintained their statistical significance with bootstrapped standard error estimates, indicating that investment contributes to increasing imports in countries with medium and above-average import levels while reducing imports in countries with below-average import levels.

2.Results of the export model:

Unconditional quantile conventional standard error estimates showed a statistically significant positive effect of environmental policy stringency on exports within the Q50, Q75, and Q90 quantiles. At the same time, the results indicated a negative impact of environmental policy stringency on exports in the Q10 and Q25 quantiles related to export distribution. This suggests that

environmental policy stringency has positive effects on countries with medium and high levels of exports while negatively affecting countries with below-average and weak export levels. These results remained statistically significant with bootstrapped standard error estimates.

The findings show that environmental policy stringency affects exports differently across quantiles, depending on a country's export potential. In particular, strict environmental policies appear to boost exports for countries in the medium to high export quantiles (Q50, Q75, and Q90), suggesting that they may have the infrastructure, technology, and financial resources to adapt to and benefit from such regulations, possibly by improving green technologies or producing environmentally friendly goods that are increasingly demanded. Countries at the lower end of the export distribution (Q10 and Q25 quantiles) have a negative impact, suggesting they may struggle to afford strict environmental policies due to limited resources or technological capabilities. These findings are robust because bootstrapped standard error estimates did not change the statistical significance of these effects. The complicated relationship between environmental policy stringency and export success emphasizes the need for specific policy interventions considering countries' varying capacities and circumstances at different export proficiency levels.

As estimated, there is also a significant positive impact of environmental tax revenues on exports in quantile Q10 and a significant negative impact of environmental tax revenues on exports in quantile Q50, Q75, and Q90. These results maintain their statistical significance with bootstrapped standard errors, indicating that environmental tax revenues increase exports in countries with low export levels. In contrast, they have the opposite effect on exports in countries with medium and high levels.

The analysis reveals a differential impact of environmental tax revenues on exports across varying levels of export activity. Specifically, in the lowest export quantile (Q10), a significant positive effect suggests that countries with initially low export levels benefit from environmental taxes, potentially by promoting environmentally friendly goods that find favorable markets internationally. However, this positive impact only extends to countries with higher levels of exports (Q50, Q75, and Q90), where a significant adverse effect is observed. This suggests that the additional costs imposed by environmental taxes erode the competitive edge of countries with medium to high export levels, making their products less attractive in the global market. The maintenance of statistical significance with bootstrapped standard errors reinforces the robustness of these findings, highlighting the complex relationship between environmental taxation and export performance that varies significantly across different export intensity levels.

The models' estimates show a statistically significant positive impact of carbon emissions on imports in quantile Q50 and a statistically significant

negative impact of carbon emissions on imports in quantiles Q90 and Q10. These results have retained their statistical significance with bootstrapped standard errors, indicating that carbon emissions contribute to increasing exports in countries with medium export levels. However, they contribute to decreasing exports in countries with high and low export levels.

The model's calculations reveal a link between carbon emissions and trade, particularly exports. Carbon emissions may boost exports in medium-export countries at the median (Q50). This may indicate that industrial activity linked to carbon emissions is balanced in these nations, promoting export development without reaching diminishing returns or regulatory limits at greater pollution levels. The situation changes dramatically at the lower (Q10) and upper (Q90) quantiles. The negative impact on exports in low- or high-export countries suggests a tipping point. Carbon emissions may harm the environment or reduce efficiency in low-export countries. In high-export countries, strict environmental rules or market responses to sustainability concerns may cause harm. The robustness of these findings with bootstrapped standard errors suggests a complicated interaction between economic activities, environmental damage, and global trade dynamics.

As the estimates also showed, there is a statistically negative impact of total renewable energies on exports in the Q25 quantile and a statistically positive impact of total renewable energies on exports in the Q75 quantile. These results maintained their statistical significance with bootstrapped standard error estimates, indicating that total renewable energies contribute to increasing exports in countries with above-average export levels while decreasing import in countries with below-average export levels.

Renewable energy deployment and export dynamics are complex and depend on a country's export performance. Increasing renewable energy adoption correlates negatively with exports for countries in the lower 25th percentile of export levels (Q25). This suggests that economies with limited export capabilities may not immediately see export growth due to high costs or shifting resources away from existing export sectors. However, at the top 75th percentile (Q75), renewable energies improve exports, showing that countries with strong export policies can use renewable energy to boost exports. Bootstrapped standard error estimates show that these impacts are consistent, indicating the dependability of the data and suggesting a dual function for renewable energies based on exports. This bifurcation emphasizes the need for nuanced energy and economic policies considering a country's export context, highlighting renewable energy's potential to boost economic growth in well-positioned countries but warning against short-term export challenges in others.

The results also show a statistically significant positive impact of environmentally modified multifactor productivity growth on exports in the Q25 quantile. These results maintain their statistical significance with estimates: bootstrapped standard errors in addition to the statistical significance of the positive impact on the Q90 and Q75 quantiles, meaning that environmentally modified multifactor productivity growth contributes to increasing exports for all countries, unlike countries with medium and low exports levels.

We record a statistically significant negative impact of the number of patents on exports in the Q10 quantile, meaning that patents reduce exports in countries with low export levels. These results maintain their statistical significance with estimates: bootstrapped standard errors.

The study concludes that research and development expenditure has a statistically significant negative impact on exports in the Q25 median quantile, meaning that research and development expenditure contributes to reducing exports in countries with below-average export levels. These results did not maintain their statistical significance with estimates: bootstrapped standard errors.

The results show a statistically significant positive impact of household consumption on exports in the Q10 and Q25 quantiles. These results maintain their statistical significance with estimates: bootstrapped standard errors. The results also show a negative impact of household consumption on exports in the Q75, Q50, and Q90 quantiles with estimates: bootstrapped standard errors, indicating that household consumption contributes to increasing exports in countries with below-average and weak export levels while reducing exports in countries with medium and above-average export levels.

The results confirm a statistically significant negative impact of investment on exports in the Q10 and Q25 quantiles and a statistically significant positive impact on exports in the Q75 and Q50 quantiles. These results maintain their statistical significance with estimates: bootstrapped standard errors, indicating that investment contributes to increasing exports in countries with medium and above-average import levels while reducing exports in countries with below-average and weak export levels.

IV. Conclusion:

The results of this analysis shed light on the complex relationship between environmental policies, carbon emissions, the utilization of renewable energy sources, and the dynamics of international trade, whether in the context of imports or exports. The findings highlight a complicated relationship in which the influence of rigorous environmental rules, carbon emissions, and the utilization of renewable energy sources differs dramatically amongst nations with varying degrees of import and export activity. To be more specific, increasing the stringency of environmental policies and reducing carbon emissions may

increase trade activity in nations that have medium levels of imports and exports; nevertheless, it appears that these factors have a detrimental impact on nations that are at the lower and upper ends of the trade spectrum. In a similar vein, the implementation of renewable energy sources has the potential to boost trade in countries that have above-average trade activities. However, it may hinder trade in countries with lower imports and exports.

The evidence suggests that a one-size-fits-all approach to environmental regulation may not be practical in fostering sustainable trade growth. Instead, tailored economic policies and instruments are needed to balance environmental sustainability goals and international trade competitiveness. In light of these findings, the following policy recommendations are proposed:

- * Flexible environmental policy frameworks should recognize nations' varying capacities and economic conditions. Depending on a country's trade activity, policies could be graded or altered to meet high but feasible environmental goals.
- * Improved access to green technologies and innovation can help all trade levels adapt to and benefit from severe environmental rules. Financial incentives, R&D grants, and international technology transfer collaboration are essential.
- * Environmental policies may hurt commerce, but tax credits or subsidies for enterprises that decrease their ecological footprint can mitigate this. This would incentivize corporations to invest in sustainability without jeopardizing competitiveness.
- * Trade policy could promote renewable energy technology and service imports and exports. Tariff reductions simplified customs procedures, and green product certification standards can enhance commerce in this area, helping countries accomplish environmental goals and boost economic growth.

*Building Low-Trade Activity Country Resilience, Countries with minimal imports and exports can benefit from exceptional support initiatives to build resilience and sustainable trade. Training, infrastructure investment, and financial support may help diversify economies and increase green commerce.

Countries can better balance environmental sustainability and global competitiveness by enacting these policies. Multilateral institutions must facilitate dialogue, provide technical help, and mobilize resources for sustainable development. Creating a mutually reinforcing environment for economic progress and environmental preservation will enable a sustainable and prosperous future.

Referrals and References:

- Aaditya, Mattoo., Arvind, Subramanian., Arvind, Subramanian., Dominique, van, der, Mensbrugge., Jianwu, He. (2013). Trade effects of alternative carbon border-tax schemes. *Review of World Economics*, 149(3):587-609. doi: 10.1007/S10290-013-0159-0
- Bhagwati, J. N. (2002a). *Free Trade Today*. Princeton University Press.
- Bhagwati, J. N. (2002b). *The wind of the hundred days: How Washington mismanaged globalization*. MIT press.
- Bruno, Ramamonjisoa., Thierry, Razanakoto., Z.H., Rabemananjara. (2023). Analysis of the impact of an environmental tax on the import of polluting products: case of madagascar. *International Journal of Applied Science and Engineering Review*, 04(02):60-81. doi: 10.52267/ijaser.2023.4205
- Carl, Gagné., Lota, D., Tamini. (2021). Environmental Taxation and Import Demand for Environmental Goods: Theory and Evidence from the European Union. *Environmental and Resource Economics*, 78(2):307-352. doi: 10.1007/S10640-020-00534-W
- Chen, H., Zhou, J., Liang, J., Zang, D., Twumasi, M., & Shen, Q. (2023). Study on the Impact of Air Pollution on Agricultural Export Trade. *Sustainability*. <https://doi.org/10.3390/su15031775>.
- Feng, Z., & Zhang, L. (2023). Environmental target constraints and enterprise export competitiveness—Exploring the sustainable development of China's external trade. *Sustainable Development*. <https://doi.org/10.1002/sd.2860>.
- Firpo, S., Fortin, N. M., & Lemieux, T. (2009). Unconditional quantile regressions. *Econometrica*, 77, 953–973.
- Haiyan, Luo., Xiao'e, Qu., Yanxin, Hu. (2022). The Mechanism of the Impact of Export Trade on Environmental Pollution: A Study from a Heterogeneous Perspective on Environmental Regulation from China. *Sustainability*, 14(24):16330-16330. doi: 10.3390/su142416330
- Juan, Huang., Ziyi, Wu. (2022). Impact of Environmental Regulations on Export Trade—Empirical Analysis Based on Zhejiang Province. *International Journal of Environmental Research and Public Health*, 19(19):12569-12569. doi: 10.3390/ijerph191912569
- Juan, Huang., Ziyi, Wu. (2022). Impact of Environmental Regulations on Export Trade—Empirical Analysis Based on Zhejiang Province. *International Journal of Environmental Research and Public Health*, 19(19):12569-12569. doi: 10.3390/ijerph191912569
- Juan, Huang., Ziyi, Wu. (2022). Impact of Environmental Regulations on Export Trade—Empirical Analysis Based on Zhejiang Province. *International Journal of Environmental Research and Public Health*, 19(19):12569-12569. doi: 10.3390/ijerph191912569
- Jung-Ah, Hwang., Yeonbae, Kim. (2017). Effects of Environmental Regulations on Trade Flow in Manufacturing Sectors: Comparison of Static and Dynamic Effects of Environmental Regulations. *Business Strategy and The Environment*, 26(5):688-706. doi: 10.1002/BSE.1965
- Kang, J., & Gapay, J. (2023). Factors Affecting Carbon Dioxide Emissions Embodied in Trade. *SSRN Electronic Journal*. <https://doi.org/10.22617/wps230479-2>.

-
- Koenker, R., & Bassett Jr, G. (1978). Regression quantiles. *Econometrica: journal of the Econometric Society*, 33-50.
- Kuang, H., & Xiong, Y. (2022). Could environmental regulations improve the quality of export products? Evidence from China's implementation of pollutant discharge fee. *Environmental Science and Pollution Research*, 29(54), 81726-81739
- Liang, Ding., Yingna, Wu., Yuetong, Ma., Li, Zhang. (2022). Environmental Regulation and the Innovation Performance of Chinese Export Firms: A Quasi-Natural Experiment based on the Law of Promoting Cleaner Production. *SAGE Open*, 12(4), 1-13. doi: 10.1177/21582440221129257
- Lina, Shang., Deqing, Tan., Suling, Feng., Wenting, Zhou. (2021). Environmental regulation, import trade, and green technology innovation. *Environmental Science and Pollution Research*, 1-11. doi: 10.1007/S11356-021-13490-9
- Luis, W., Dunn. (2023). Does stringent environmental regulations influence export performance in a low technical capacity economy? A quasi-natural experiment based on Kenya's new environmental protection law. doi: 10.21203/rs.3.rs-2817289/v1
- Maria, Llop. (2023). Environmental Taxation and International Trade in a Tax-Distorted Economy. *Economics*, 17(1), 2-12. doi: 10.1515/econ-2022-0038
- Maria, Llop. (2023). Environmental Taxation and International Trade in a Tax-Distorted Economy. *Economics : the Open-Access, Open-Assessment e-Journal*, 17(1) doi: 10.1515/econ-2022-0038
- Porter, M. E., & Linde, C. V. D. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of economic perspectives*, 9(4), 97-118.
- Quintana, P., Reinoso, A., Martínez-Zarzoso, I., & Zegarra, T. (2023). Environmental Provisions in Trade Agreements. *Latin American Journal of Trade Policy*. <https://doi.org/10.5354/0719-9368.2023.73027>.
- Sartzetakis, E.S., Constantatos, C. (1995). Environmental regulation and international trade. *J Regul Econ* 8, 61–72. <https://doi.org/10.1007/BF01066600>
- Sdiri, H. (2023). DO ENVIRONMENTAL COMMITMENT AND INNOVATION INFLUENCE EXPORT INTENSITY? FIRM-LEVEL EVIDENCE FROM TUNISIA. *International Journal of Innovation Management*. <https://doi.org/10.1142/s1363919623500263>.
- Sokolova, Y. (2023). Modeling of the Nexus Between Environmental Regulations of Trade Partners and Export Volumes: Analysis of Russian Regions. *Journal of Applied Economic Research*. <https://doi.org/10.15826/vestnik.2023.22.4.038>.
- Sun, Y., Lou, J., Sun, H., & Pan, T. (2023). Voluntary environmental regulation and export performance of Chinese solar energy industry. , 11. <https://doi.org/10.3389/fenrg.2023.1098071>.
- Sung, Jin, Kang., Sun, Lee. (2021). Impacts of Environmental Policies on Global Green Trade. *Sustainability*, 13(3):1517-. doi: 10.3390/SU13031517
- Trang, Tran., Hiromasa, Goto., Takuma, Matsuda. (2021). The Impact of China's Tightening Environmental Regulations on International Waste Trade and Logistics. *Sustainability*, 13(2):987-. doi: 10.3390/SU13020987

- Xia, Y., Ali, S., & Tian, X. (2023). Environmental information disclosure and firm export: evidence from China. *Economic Research-Ekonomska Istraživanja*. <https://doi.org/10.1080/1331677x.2023.2180060>.
- Xinjun, Gao., Wenhui, Zhang., Qing, Guo, and, Dike, Zhang., Yi, Kang, Feng. (2022). The Impact of Environmental Regulation on the Export Quality of China's Manufacturing Industry under the CBAM Framework. *Frontiers in business, economics and management*, 6(3):157-164. doi: 10.54097/fbem.v6i3.3453
- Xu, X. (2000). International Trade and Environmental Regulation: Time Series Evidence and Cross Section Test. *Environmental and Resource Economics* 17, 233–257. <https://doi.org/10.1023/A:1026428806818>
- Yongsheng, Lin., Qiu, Yin., Bo, Yuan., Zhanfeng, Dong., Wei, Wei. (2023). Does the environmental tax influence the siting of foreign-invested manufacturing enterprises? Evidence from China. *Journal of Environmental Planning and Management*, 1-26. doi: 10.1080/09640568.2023.2205570
- Zhe, Dai., Yunzhi, Zhang., Yunzhi, Zhang., Rui, Zhang. (2021). The Impact of Environmental Regulations on Trade Flows: A Focus on Environmental Goods Listed in APEC and OECD. *Frontiers in Psychology*, 12 doi: 10.3389/FPSYG.2021.773749

Annexs

Annex 1: Imports of goods and services Non-robust:

variables	Q10	Q25	Q50	Q75	Q90
Environmental Policy Stringency	-.763***	-.289***	.241***	.651***	.602***
Environmentally Related Tax Revenue	.689***	.012	-.108**	-.166***	-.077
CO2 emissions	-.511	-.288	.536***	.358	-.715***
Environmentally adjusted multifactor productivity growth	.007*	.006**	.002	.004	.002
Patent applications	-.72***	-.091	-.065	.056	.007
Research and development expenditure	.028	-.191	.249***	-.022	-.084
Total renewable energy	.267***	-.202***	-.01	.202***	.028
Households consumption expenditure	3.69***	4.184***	-.32	-.836***	-.301
Gross fixed capital formation	-.56	-1.258***	1.071***	.47**	-.24
_cons	-52.327***	-45.456***	1.258	29.765***	48.357***
Observations	1056	1056	1056	1056	1056

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: STATA16.0 program outputs

Annex 2: Imports of goods and services Bootstrap:

variables	Q10	Q25	Q50	Q75	Q90
Environmental Policy Stringency	-.763***	-.289***	.241***	.651***	.602***
Environmentally Related Tax Revenue	.689***	.012	-.108**	-.166***	-.077**
CO2 emissions	-.511	-.288	.536**	.358	-.715**
Environmentally adjusted multifactor productivity growth	.007**	.006**	.002	.004**	.002*
Patent applications	-.72***	-.091	-.065	.056	.007
Research and development expenditure	.028	-.191	.249***	-.022	-.084
Total renewable energy	.267*	-.202***	-.01	.202***	.028
Households consumption expenditure	3.69***	4.184***	-.32*	-.836***	-.301
Gross fixed capital formation	-.56	-1.258***	1.071***	.47*	-.24
_cons	-52.327**	-45.456***	1.258	29.765***	48.357***
Observations	1056	1056	1056	1056	1056

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: STATA16.0 program outputs

Annex 3: Exports of goods and services Non-robust:

variables	Q10	Q25	Q50	Q75	Q90
Environmental Policy Stringency	-.622***	-.316***	.294***	.569***	.538***
Environmentally Related Tax Revenue	.615***	-.005	-.158***	-.131**	-.093*
CO2 emissions	-1.549***	-.178	.482**	.232	-.82***
Environmentally adjusted multifactor productivity growth	.005	.006*	.003	.003	.003
Patent applications	-.481***	.018	.008	.025	.053
Research and development expenditure	.168	-.217*	.163	-.041	.09
Total renewable energy	-.031	-.183***	-.005	.211***	.042
Households consumption expenditure	4.167***	4.685***	-.368	-.808***	-.406
Gross fixed capital formation	-1.234***	-1.692***	1.149***	.541***	-.079
_cons	-34.723***	-49.579***	1.038	28.913***	47.809***
Observations	1056	1056	1056	1056	1056

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: STATA16.0 program outputs

Annex 4: Exports of goods and services Bootstrap:

variables	Q10	Q25	Q50	Q75	Q90
Environmental Policy Stringency	-.622***	-.316**	.294***	.569***	.538***
Environmentally Related Tax Revenue	.615***	-.005	-.158***	-.131**	-.093***
CO2 emissions	-1.549**	-.178	.482**	.232	-.82**
Environmentally adjusted multifactor productivity growth	.005	.006**	.003	.003**	.003**
Patent applications	-.481***	.018	.008	.025	.053
Research and development expenditure	.168	-.217	.163	-.041	.09
Total renewable energy	-.031	-.183**	-.005	.211***	.042
Households consumption expenditure	4.167***	4.685***	-.368*	-.808***	-.406*
Gross fixed capital formation	-1.234***	-1.692***	1.149***	.541**	-.079
_cons	-34.723***	-49.579***	1.038	28.913***	47.809***
Observations	1056	1056	1056	1056	1056
*** $p < .01$, ** $p < .05$, * $p < .1$					

Source: STATA16.0 program outputs