How to Cite:
Abderraouf, M., Touati, H., & Tamma, S. (2025). Effectiveness of environmental standards in shaping trade volume: Evidence from non-oil advanced economies (1990–2021). *International Journal of Economic Perspectives*, *19*(5), 2588–2604. Retrieved from https://ijeponline.org/index.php/journal/article/view/1165

Effectiveness of environmental standards in shaping trade volume: Evidence from non-oil advanced economies (1990–2021)

Messaoudi Abderraouf
University of El-Oued, Algeria
Email: raouf8239@gmail.com

Hichem Touati
University of El-Oued, Algeria
Email: touati.hichem@gmail.com

Samir Tamma
University of El-Oued, Algeria
Email: samirtamma1984@gmail.com

***Abstract*---**This study aims to measure the impact of environmental standards and requirements on trade volume during the period (1990–2021), through a case study of non-oil advanced countries, namely: Belgium, Denmark, France, Germany, and Italy. A model was developed to assess the effect of environmental standards and requirements, expressed by two variables—environmental policy stringency and environmental taxes—on trade volume. To achieve the study objectives, a set of econometric approaches, methods, and tests were applied, including the unit root test for time series. For the empirical analysis, panel data were employed using the Mean Group (MG) and Pooled Mean Group (PMG) estimators, both of which are methods for cointegration estimation in the context of non-stationary panel data. The study concluded that there is a positive effect of environmental policy stringency on trade volume in non-oil countries, and a direct relationship between environmental taxes and trade volume. In other words, higher environmental taxes and stricter environmental policies lead to changes in trade volume that enhance domestic production and its international competitiveness, increase export competitiveness, and facilitate penetration of international markets and acquisition of market shares. This, in turn, strengthens the role of exports in shaping trade volume.

Submitted: 29 January 2025, Revised: 17 March 2025, Accepted 01 May 2025

Keywords---Environmental standards, Environmental requirements, Environmental taxes, Trade, Environmental policy stringency.

Introduction

Countries and economies around the world continue to strive to support and enhance economic growth by improving trade performance and penetrating global markets. However, this expansion in international trade has led to an increasing depletion of natural resources and greater emissions and industrial waste, both liquid and solid. Consequently, economic policymakers have begun to give more attention to environmental issues and the rights of future generations. This shift became particularly evident following the release of the Brundtland Report, *Our Common Future*, which is considered the first official document to present the concept of sustainable economic development by integrating the environmental dimension into the core of economic development, and by emphasizing the need to balance development objectives through trade flows on the one hand, and the costs and benefits of environmental standards on the other, in order to ensure their effectiveness in achieving the intended goals.

Regarding the economic relationship between compliance with environmental standards and requirements—whether through stricter environmental policy regulations or through the adoption and imposition of environmental taxes—many economists, international trade pioneers, and advocates of trade liberalization highlight the adverse effects of such practices on trade and international flows. This perspective was notably advanced by the American economist Jagdish Bhagwati, who asserted that "the environment and international trade are conflicting" (Afifi, 2004). In other words, the efforts made by each country to preserve its environment may harm its trade relations with other countries, as these efforts translate into additional costs of production, thereby undermining competitiveness in global markets and weakening the trade balance.

Although pollution taxes are considered among the most efficient environmental policy tools to protect the environment from misuse, they also imply the internalization of external costs by charging them to the polluter. This approach, adopted by advanced countries, reduces competitiveness and may decrease welfare due to the contractionary effects generated by such measures.

Free-trade advocates argue that liberalizing trade prior to harmonizing environmental standards is closely linked to the loss of competitiveness in international markets for industries subject to stringent environmental regulations. If other parties do not comply with the same environmental standards, the advantages enjoyed by less regulated competitors become illegitimate. As a result, interest groups exert political pressure on governments to lower environmental standards in order to ensure the survival and protection of their industries. Consequently, countries with stricter environmental regulations may face losses, while lobbying groups in these same countries may push for the imposition of tougher trade barriers to counter the unfair advantages gained by

foreign goods, leading to new trade disputes and protectionist measures grounded in environmental concerns.

This situation, as Bhagwati suggests, creates a clear contradiction between global trade liberalization policies on the one hand and environmental preservation policies on the other. While the former reduce relative costs, the latter raise the relative costs of products involved in international exchange, which may ultimately drive them out of the scope of international trade.

It is worth noting that the cost of compliance with environmental requirements, combined with environmental taxation, adds to the expansion of investments in industrial sectors and high-emission industries. This compels countries to raise import costs to maintain the competitiveness of domestic products, particularly through the imposition of environmental duties and taxes in response to the environmental degradation caused by imports. Thus, there arises an urgent need to reduce costs to preserve the competitiveness of domestic products both locally and internationally, especially when these products target export markets.

Moreover, countries with stricter environmental regulations face higher production costs, as they must invest in cleaner and more expensive production methods. This can render their goods less competitive in global markets, leading to a decline in exports and overall trade volume. Stricter environmental regulations may also deter foreign investors, who may perceive rising compliance costs as barriers to entry. This further reduces trade volume by limiting the production of goods intended for export.

In addition, under these environmental standards and related requirements, non-oil countries may have a narrower range of exportable goods compared to oil-exporting countries. This implies that stricter environmental regulations could have a more pronounced effect on specific industries, such as agriculture or manufacturing, thereby exerting a greater impact on overall trade volume. Furthermore, countries with weaker environmental regulations tend to benefit from lower production costs, gaining unfair or discriminatory competitive advantages due to the lack of standard harmonization. As a result, their exports become cheaper and more competitive in international markets. Conversely, countries enforcing stricter environmental regulations bear higher production costs, making their exports relatively more expensive and less competitive. This may lead to lower demand for their exports, the exclusion of certain goods from international competition, and the loss of market share. Hence, the inverse relationship between environmental requirements and trade volume can be attributed to the trade-off between economic competitiveness and environmental protection.

1. Research Problem

Since trade liberalization generally enhances economic performance, it simultaneously exerts pressure on the environment due to the extensive use of natural resources (both renewable and non-renewable). Therefore, the interaction between environmental standards and requirements and trade flows (exports and imports) constitutes a highly significant area of research and investigation, as

economies strive to achieve environmental sustainability and safeguard the rights of future generations to a decent life. With the growing interdependence of economies and the trend toward global integration through the mechanisms of globalization, this study examines the economic relationship between environmental standards—when translated into requirements and environmental regulations—and trade volume. Accordingly, the study seeks to answer the following question:

To what extent do environmental standards and requirements affect trade volume in non-oil advanced countries?

2. Research Objectives

The study aims to highlight the roles that environmental standards and requirements play as a tool for achieving balance and compatibility between the need to protect the environment and the need to pursue development, and to propose policies capable of maximizing benefits in line with the contexts and objectives of sustainable development.

3. Scope of the Study

- **Spatial scope:** The study focuses on a group of non-oil advanced countries, namely Belgium, Denmark, France, Germany, and Italy.
- **Temporal scope:** The period covered extends from 1990 to 2021.

I. Analysis of the Relationship Between Environmental Standards and Requirements and Trade Volume from the Perspective of Previous Empirical Literature

A number of empirical studies have investigated the relationship between environmental standards and requirements and trade flows in both developed and developing countries. In today's interconnected global economy, products are manufactured within international production networks, which, in the pursuit of expanding trade volume, are embedded in long global value chains. Within these chains, production stages vary in terms of value added, technological content, research and development intensity, and environmental impact. Through complex international supply and procurement networks, natural resources, raw materials, intermediate goods, semi-finished products, and final goods flow across sectors, production stages, countries, and regions, in line with trade liberalization and in compliance with international and regional environmental agreements and regulations.

- **He (2018)** found evidence of the effectiveness of environmental taxes in controlling industrial pollution, noting, however, that such taxes may not encourage the adoption of innovative technologies in the short term. This, in turn, affects the adaptability of exports and imports to new tax regimes in the short run.
- **Shang (2022)** analyzed the effects of environmental regulation and import trade on green technology innovation, concluding that environmental regulation both promotes and restricts green innovation, while import trade significantly enhances it.
- **Wei (2017)** emphasized that countries, based on their specific circumstances, develop corresponding environmental laws, regulations,

and standards. However, with increasing competition in international trade, such instruments—originally intended to protect the environment—have been used by some countries as tools to protect their trade and economic interests by establishing green trade barriers.

- **Shi (2018)** found that in heavily polluting industries, stricter environmental regulations reduce both the likelihood of firms exporting and the volume of their exports.
- **Ouyang (2020)** showed that the impact of environmental costs on export trade is mainly reflected in effects on trade advantages and the structure of export products, as much of the environmental and resource pressure is concentrated along export supply chains.
- **Lenzen (2003)** argued that the effect of environmental stringency on exports is significantly negative, indicating an inverse relationship between export values and countries' relative environmental sensitivity performance.
- **Cagatay (2006)** found similar evidence of adverse effects.
- **Mattoo (2013)** estimated that environmental taxes applied to all imported goods could address competitiveness and environmental concerns in high-income countries but would have severe consequences for their trade partners. In the absence of pollution havens, environmental taxes reduce trade volumes between any two countries when the exporting country applies higher taxes on polluting goods.

Rising carbon emissions, along with requirements related to health, safety, and environmental protection—such as measures for final goods standards, transport, manufacturing processes, production methods, inspections, certifications, approvals, quarantine procedures, statistical methods, sampling procedures, risk assessment methods, packaging requirements, and eco-labeling directly related to food and product safety—oblige countries, under the agreements they commit to, to comply with specific levels of such standards and requirements. This often forces them to import environmentally friendly materials, whether raw, semi-finished, or capital goods. These green products are usually more costly, which raises the final cost of goods incorporating such inputs and consequently reduces their competitiveness, leading to a decline in exports.

On the other hand, environmental standards may be used as a protectionist tool when foreign goods and services are subject to standards different from those applied to domestic goods and services, or when the standards imposed on foreign goods are not aligned with the intended environmental objectives. If differences in standards are merely procedural or regulatory, then such measures may serve non-trade purposes, exceeding environmental protection objectives, as they impose additional burdens on foreign goods and services compared to local ones. For instance, the imposition of additional requirements to verify the environmental emissions of certain goods. Developing countries are often the most affected by such practices, as they bear extra compliance costs, leading to a reduction in advanced countries' imports from these economies, and thereby reducing trade volume. Moreover, if variations in environmental standards stem from differences in social preferences or tastes—using standards as a means to achieve higher levels of welfare rather than environmental protection—then such standards effectively function as protectionist measures.

In conclusion, empirical literature indicates that environmental standards generally exert a positive effect on trade flows (total exports and imports of goods and services). However, it is important to note that the impact of these standards can vary depending on the economic structure, income level, and stage of development of each country. Therefore, to enhance trade flows and achieve developmental objectives, it is essential to address the inherent tension between maximizing trade as a means of economic growth, on the one hand, and protecting the environment through environmental standards and requirements, on the other. Achieving coherence and balance without compromising either dimension is necessary to realize both goals simultaneously.

II. Methodology and Tools

1. Study Variables

The study measured the impact of environmental standards and requirements on trade volume, while also incorporating GDP per capita as a complementary explanatory variable. The following table summarizes the study variables and their data sources:

Table 1: Study Variables and Data Sources

Indicator	Definition	Source
Complementary explanatory variable		
GDP per capita, PPP (current international $) (LGDP PC PPP)	GDP per capita is obtained by dividing gross domestic product by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without deducting depreciation of fabricated assets or depletion and degradation of natural resources. Data are expressed in current US dollars.	World Bank
Dependent trade-related variables		
Trade Volume (LXM)	Trade volume is the total value of exports and imports of goods and services, measured in current US dollars. It is the sum of exports (value of all goods and services provided to the rest of the world) and imports (value of all goods and services received from the rest of the world) over a specific period.	World Bank
Independent variables		
CO_2 Emissions (kilotons) (LCO2 E)	Carbon dioxide emissions result mainly from the burning of fossil fuels and cement production. They include CO_2 released during consumption of solid, liquid, and gaseous fuels, as well as gas flaring. Annual consumption-based data are sourced from the Global Carbon Project, expressed in tons of carbon.	World Bank
Environmental Tax Revenues (LERRT)	The OECD maintains the PINE (Policy Instruments for the Environment) database, originally developed with the European Environment Agency (EEA). It includes detailed qualitative and	

quantitative information on environmental taxes, fees, charges, tradable permits, deposit-refund systems, environmentally motivated subsidies, and voluntary approaches. Environmental taxes are an important policy tool for shaping relative prices of goods and services. The dataset covers OECD member countries, accession countries, and selected non-OECD economies since 1994, validated and complemented with tax statistics and national sources. | OECD Stats |

| **Environmental Policy Stringency Index (EPSI) (LEPSI)** | The OECD Environmental Policy Stringency Index (EPS) is a country-specific and internationally comparable measure of the degree of stringency of environmental policy. Stringency is defined as the degree to which environmental policies impose explicit or implicit costs on environmentally harmful behavior. The index is based on 13 policy instruments, mainly related to climate and air pollution, and ranges from 0 (not stringent) to 6 (most stringent), covering 40 countries over the period 1990–2021. | OECD Stats |

| **Final Consumption Expenditure (LFCE)** | Final consumption expenditure is the sum of household final consumption expenditure (private consumption) and general government final consumption expenditure (public consumption). Household consumption includes the value of goods and services acquired by households via cash purchases, own production, barter, or in-kind income, used to satisfy individual or collective needs. | World Bank |

Source: Compiled by the researchers based on various data sources.

2. Econometric Approaches Used

To achieve the objectives of the study and to answer the research question: *"How can environmental standards and requirements affect trade flows in non-oil countries?"* the statistical software **STATA 16** was employed to identify the environmental and economic indicators explaining trade performance. The data were analyzed using **multiple linear regression for panel data**. Panel data are two-dimensional: the first dimension is the cross-sectional units, represented here by five advanced non-oil countries (Belgium, Denmark, France, Germany, Italy); the second dimension is the time series, covering the period 1990–2021.
We attempted to estimate the proposed model, which consists of a panel for non-oil countries, with the **dependent variable: trade volume**, and the explanatory variables: **CO_2 emissions, final household consumption expenditure, environmental policy stringency, environmental tax revenues, and the trade balance**. The results were then analyzed and interpreted economically.

3. Results and Discussion

1. Unit Root Tests for the Variables of the Non-Oil Countries Model

The table below presents the results of unit root tests for the study variables at the level and after taking the first difference, using two tests: **Levin, Lin & Chu** and **Im, Pesaran & Shin**. The null hypothesis of both tests states that the time series has a unit root, while the alternative hypothesis states that the time series is stationary. If the p-value is greater than 5%, the null hypothesis is accepted, meaning the series has a unit root and is therefore non-stationary. Conversely, if the p-value is less than 5%, the alternative hypothesis is accepted, indicating stationarity of the series.

Table 2. Unit Root Tests

Variable	Test	Level / 1st Difference	p-value	Decision	Integration Order
LGDP PC PPP	Levin, Lin & Chu	Level	0.2995		I(1)
		1st Difference	0.0046		
	Im, Pesaran & Shin	Level	0.2931		
		1st Difference	0.0000		
LCO_2 E	Levin, Lin & Chu	Level	0.7181		I(1)
		1st Difference	0.0020		
	Im, Pesaran & Shin	Level	0.0921		
		1st Difference	0.0000		
LERRT	Levin, Lin & Chu	Level	0.2568		I(1)
		1st Difference	0.0000		
	Im, Pesaran & Shin	Level	0.5698		
		1st Difference	0.0000		
LEPSI	Levin, Lin & Chu	Level	0.8392		I(1)
		1st Difference	0.0004		
	Im, Pesaran & Shin	Level	0.0989		
		1st Difference	0.0000		
LFCE	Levin, Lin & Chu	Level	0.3590		I(1)
		1st Difference	0.0000		
	Im, Pesaran & Shin	Level	0.2166		
		1st Difference	0.0000		
LBC	Levin, Lin & Chu	Level	0.1312		I(1)
		1st Difference	0.0000		
	Im, Pesaran & Shin	Level	0.0330		
		1st Difference	////////		
LXM	Levin, Lin & Chu	Level	0.1418		I(1)
		1st Difference	0.0000		

Variable	Test	Level / 1st Difference	p-value	Decision	Integration Order
	Im, Pesaran & Shin	Level	0.0038		
		1st Difference	////////		

Source: Prepared by the researchers based on STATA 16 outputs.

From the results in the table above, we conclude the following:

- The variables **LGDPPCPPP, LCO_2E, LERRT, LEPSI, LFCE** are non-stationary at the level, since the p-value is greater than 5%. However, after taking the first difference, the p-value becomes less than 5%, which indicates that these variables are stationary at the first difference.
- For the variables **LBC and LXM**, the stationarity results differ between the two tests. The results of the **Levin, Lin & Chu** test show that these variables are non-stationary at the level (p-value > 5%), but become stationary after taking the first difference (p-value < 5%). On the other hand, the **Im, Pesaran & Shin** test indicates that these variables are stationary at the level (p-value < 5%). For the purposes of this study, we relied on the results of the Levin, Lin & Chu test; thus, the variables are considered stationary at the first difference.

From the above unit root tests, it is evident that the variables in the non-oil countries' model become stationary after taking the first difference and are therefore **integrated of order one, I(1)**. Consequently, we can investigate the possibility of a long-run relationship between the independent variables and the dependent variable.

2. Kao Cointegration Test Results

The following table presents the results of the **Kao cointegration test** between the variables: trade volume, GDP per capita (PPP), CO_2 emissions, final household consumption expenditure, environmental policy stringency, and environmental tax revenues. The null hypothesis states that no cointegration exists, while the alternative hypothesis indicates the existence of a cointegrating relationship among the study variables.

Table 3. Kao Cointegration Test Results

Test Statistic	p-value
-1.9593	0.0250

Source: Prepared by the researchers based on STATA 16 outputs.

Since the **p-value** is less than 5%, the null hypothesis is rejected, and the alternative hypothesis is accepted, confirming the existence of cointegration among the study variables. After establishing this cointegration relationship, we proceed to estimate the long-run equilibrium relationship between these variables.

3. Estimation of the Cointegration Model

In this section, we attempt to estimate the proposed model for non-oil countries using the **Panel ARDL (Auto-Regressive Distributed Lagged) model**, which relies on two main estimators:

- **MG (Mean Group) estimator**
- **PMG (Pooled Mean Group) estimator**

Table 5. Estimation Results of the Trade Volume Model for Non-Oil Countries (Long-Run, MG Method)

Dependent Variable: XM	Coefficient	Std. Error	z-test	Significance	Confidence Interval
LGDPPCPPP	0.3353159	0.1536979	2.18	0.029	0.0340735 – 0.6365583
LCO2E	-0.000677	0.3198474	0.00	0.998	-0.6275664 – 0.6262124
LERRT	0.1897812	0.0679974	2.79	0.005	0.0565088 – 0.3230536
LEPSI	0.1740149	0.1119620	1.55	0.120	-0.0454266 – 0.3934565
LFCE	0.7197258	0.1167752	6.16	0.000	0.4908507 – 0.9486010

Source: Authors' computation based on STATA 16 results

Table 6. Estimation Results of the Trade Volume Model for Non-Oil Countries (Short-Run, MG Method)

Dependent Variable: XM	Coefficient	Std. Error	z-test	Significance	Confidence Interval
__ec	-0.6014093	0.1435262	-4.19	0.000	-0.8827155 – -0.3201031
D.LGDPPCPPP	1.703541	0.1854123	9.19	0.000	1.34014 – 2.066943
D1.LCO2E	0.1326261	0.1216891	1.09	0.276	-0.1058802 – 0.3711324
D1.LERRT	-0.0262807	0.0678904	-0.39	0.699	-0.1593435 – 0.1067821
D1.LEPSI	0.0294672	0.0415092	0.71	0.478	-0.0518893 – 0.1108238
D1.LFCE	0.8907951	0.0432588	20.59	0.000	0.8060094 – 0.9755808
_cons	-1.507673	1.459384	-1.03	0.302	-4.368013 – 1.352667

Source: Authors' computation based on STATA 16 results

The error correction term (ECT) (-0.6014093) has the expected negative sign and is statistically significant at the 1% level (p = 0.000). This confirms the presence of a cointegration relationship and indicates short-run dynamics converging toward long-run equilibrium. Specifically, about 60% of short-run deviations are corrected within one time period, estimated at approximately 1 year and 8 months (1 / 0.6014093). This implies that if a shock affects the study variables, its impact on per capita GDP will last around one year and eight months before returning to equilibrium.

The estimated model outputs suggest that both environmental policy stringency and environmental taxes are positively associated with trade volume. This leads us to conclude that the relationship between environmental requirements and trade volume in non-oil countries is complex and influenced by multiple factors, including production costs, foreign investment, export diversification, the level and harmonization of standards among trade partners, as well as strategies to protect domestic industries and promote environmentally sustainable practices.

It is worth noting that any negative (inverse) short-run relationship between environmental requirements and trade volume may be temporary, as foreign manufacturers and domestic producers adapt their processes and products to meet new environmental requirements over the long term, thereby restoring import and export flows.

Furthermore, the relationship may reflect a trade-off between economic growth and environmental protection. Non-oil countries might prioritize economic growth and development over environmental concerns to enhance export capacity, which could lead to relatively lower environmental taxes or less stringent regulations, thereby boosting exports.

The direct relationship between environmental taxes and trade volume in non-oil countries can also be explained by economic and environmental factors. When environmental taxes are implemented, they internalize the external costs associated with production and consumption activities that generate negative environmental impacts. Within the context of non-oil countries, such taxes may stimulate adjustments that ultimately strengthen trade performance. Environmental taxes can have multiple effects on trade through various channels, including:

- Production Costs: Environmental taxes increase production costs for industries that heavily depend on natural resources or produce goods with high environmental impacts. Consequently, firms may face higher production costs, which lead to higher product prices. Increased production costs can erode the competitiveness of domestic industries in both domestic and international markets. As a result, foreign producers in other countries may be able to supply similar goods at lower prices, making imports more attractive to consumers in non-oil countries. This can lead to an increase in imports and, ultimately, an expansion in trade volume.
- Border Carbon Adjustments and Export Support Policies: Governments that implement such policies often aim to address concerns about carbon leakage and preserve the competitiveness of domestic industries. Border

carbon adjustments impose taxes on imports based on their carbon content, thereby leveling the playing field between domestically produced goods—subject to environmental taxes—and imported goods from countries with more lenient environmental regulations. This enhances domestic production and competitiveness, while also providing support mechanisms and incentives that enable domestic firms to access international markets and increase their share in global trade, thereby strengthening exports as a component of total trade.

- Human Capital Development: As countries, particularly those transitioning from oil dependency, shift toward sustainable industries, there is a growing demand for skilled labor in green sectors. This necessitates investments in human capital and education, leading to a more skilled, adaptable workforce that can drive economic growth in emerging industries.
- Competitiveness, Exports, and Structural Shifts in Production Patterns: Higher production costs may render domestically produced goods less competitive in international markets, potentially reducing export volumes in the short run for some industries—as supported by short-run estimation results. This negatively affects the trade balance in the short term. However, structural adjustments and long-term shifts in production methods aligned with environmental standards can eventually strengthen export performance, contributing to trade balance recovery and increased international trade.
- Import–Export Imbalances and Reciprocal Trade Effects: With stricter environmental policies and the imposition of environmental taxes on domestic production, net-importing countries may experience higher imports due to shifts in consumption patterns. Since domestic goods become more expensive, consumers may turn to cheaper imported alternatives, thereby raising import levels in the short run. Over the long run, the expansion of trade partners' economic growth—driven by rising aggregate demand and increased exports—further amplifies trade volume, creating reciprocal trade effects and feedback mechanisms that enhance the benefits of trade liberalization.
- Environmental and Climate Objectives and Green Trade: Non-oil countries often place greater emphasis on environmental and climate objectives. By applying environmental taxes, they can incentivize transitions toward greener industries and practices. This may reduce overall trade in high-emission goods, while simultaneously expanding trade in environmentally sustainable products, thereby reshaping the composition of trade.
- Environmental Taxes and Demands for Trade Liberalization: Environmental taxes and stringent environmental policies may increase pressure to liberalize trade. Higher production costs linked to such taxes can raise overall price levels and inflation, pushing governments to reduce tariffs and non-tariff barriers on imports in order to stabilize prices and inflation. This, in turn, can increase imports and trade volume.
- Intermediate Goods Flows in Global Value Chains under Environmental Taxes: In today's interconnected global economy, products are manufactured within complex international production networks. Different production stages vary in value added, technological intensity, and environmental impact. When some stages of production have high

environmental costs, they may be relocated to countries with lower environmental standards, or intermediate and final goods may be imported from such countries. This dynamic fosters greater flows of intermediate goods and increases overall trade volume.

- Economic Relocation and Carbon Leakage: Environmental taxes may prompt some industries to relocate production to countries with more lenient environmental regulations or lower taxes. This phenomenon, known as carbon leakage, does not reduce global environmental impacts significantly but shifts them geographically. Consequently, capital goods, inventories, and intermediate inputs flow across borders, increasing international trade among partner countries.
- Revenue Recycling Policies: Governments may recycle revenues generated from environmental taxes to support domestic industries in transitioning toward greener practices. By offering financial incentives, grants, or tax exemptions for firms investing in clean technologies, they encourage innovation, reduce the negative trade effects of environmental taxes, and even enhance trade performance in the long run.
- Green Subsidies and Support Measures: Alongside revenue recycling, governments often provide targeted green subsidies to industries and sectors facing higher environmental compliance costs. Such subsidies help offset rising production costs and maintain international competitiveness, ensuring the preservation and expansion of export market shares.
- Government Policy Design and Alignment of Environmental and Trade Objectives: The specific design and implementation of environmental taxes determine their impact on trade. Governments can craft tax systems that mitigate potential negative trade effects while still achieving environmental goals. By doing so, they ensure that trade expansion remains compatible with broader economic growth objectives and the benefits of international trade are maximized.

To sum up, it can be argued that the relationship between environmental taxes and trade volume in non-oil countries is complex and varies according to the specific context, policy design, and the economic and environmental characteristics of the country. Achieving a balance between environmental protection and trade facilitation is essential for sustainable development and the attainment of global environmental objectives. It is important to note that the impact of environmental taxes on imports and exports may differ depending on the specific tax policy design, the industrial structure of the non-oil country, and the extent to which consumers and firms adapt their behavior in response to tax interventions. Governments must therefore carefully consider these factors and adopt appropriate policies to achieve environmental objectives without undermining trade dynamics and flows among trading partners.

Moreover, governments and countries must evaluate the effectiveness and efficiency of environmental taxes in fostering trade flows, taking into account the design of the tax, its level, and the responsiveness of firms and consumers. For instance, a low tax rate may not provide sufficient incentives for firms to invest in cleaner production technologies, while excessively high tax rates may result in excessive compliance costs that reduce productivity (KOUNI, 2024).

Regarding the impact of environmental policy stringency, the model's results suggest a positive relationship, where stricter environmental standards and policies lead to an increase in trade volume. However, this effect is not statistically significant in the long run. In general, more stringent environmental policies in a non-oil country can enhance exports while simultaneously increasing imports through various economic mechanisms, market dynamics, the structure of the economy, and the nature of value added and comparative advantages. Accordingly, policies designed to promote sustainable practices domestically may have intended long-term effects in stimulating exports, while also generating unintended short-term effects that increase imports during the transitional phase of structural and institutional economic adjustment—eventually consolidating into a net increase in trade volume. The economic effects leading to higher trade volumes can be explained through the following mechanisms:

- **Outsourcing of Emission-Intensive Activities:** Stricter environmental regulations may drive certain industries to relocate production to countries with more lenient standards, a phenomenon known as carbon leakage. This reduces domestic production and increases imports of goods previously produced locally.
- **Demand for Green Products:** Stricter environmental policies stimulate demand for environmentally friendly products. If domestic industries cannot adequately meet this demand, consumers may turn to imports that comply with higher environmental standards.
- **Specialization and Comparative Advantage:** As non-oil countries shift toward cleaner, more sustainable industries, production of certain previously domestically produced goods may decline, increasing reliance on imports to meet domestic demand.
- **Technology and Knowledge Transfer:** Adopting stricter policies may drive non-oil countries to import advanced green technologies and expertise from other nations, increasing trade flows in technology-intensive goods.
- **Complementing Domestic Production in Renewable Energy:** Ambitious environmental and climate goals may necessitate imports of renewable energy equipment and components to complement domestic production and support sectoral expansion.
- **Raw Materials and Resource Conservation:** By reducing the depletion of natural resources, stringent policies create supply shortages in local raw materials and increase demand for sustainable resources, thereby leading to higher imports.
- **Access to Green Technologies:** When certain green technologies or products are unavailable or more costly to produce locally, stricter environmental policies encourage their importation at lower global costs.

Nevertheless, it is vital to balance environmental protection with export growth to ensure both economic and ecological sustainability. Careful policy design and support for industries transitioning to greener practices can maximize the positive effects of stringent policies on export opportunities in non-oil countries. The extent to which stricter environmental policies increase imports depends on multiple factors, including the scope of the policy, domestic production capabilities, the availability of green goods and technologies in international markets, and the broader economic context. Policymakers must therefore balance

environmental goals with trade dynamics to secure a sustainable and prosperous economy.

Parallel to this, some environmental advancements in emerging economies are attributable to economic reforms that indirectly enhance environmental quality. This creates a “win-win” scenario, where trade liberalization becomes a primary driver of economic growth and one of the most important sources of income and wealth, ultimately generating resources that contribute to environmental protection.

As for GDP, the results indicate a positive and statistically significant relationship with trade volume in both the short and long run (at the 1% and 5% significance levels). An increase in GDP, accompanied by rising income, stimulates imports and expands trade volume. Conversely, larger markets arising from higher GDP enhance economies of scale, improve domestic competitiveness, and facilitate exports, thereby reinforcing trade growth. Reciprocal trade effects, feedback loops, and the circular flow between imports, exports, and income generate dynamic impacts that deepen and expand trade volumes.

Several empirical studies support the findings of this research. For instance, **Chen (2022)** demonstrated that environmental taxes, stringent policies, and eco-innovation significantly improve environmental quality in OECD countries compared to non-members, providing evidence for the “green gains” hypothesis. **Abdelghani (2022)** emphasized the role of international environmental standards in enhancing the competitiveness of Egyptian textile exports, showing how compliance with environmental requirements has become essential for accessing global markets. Similarly, **Tao (2020)** highlighted the critical role of innovation, regulation, and environmental taxation in reducing carbon emissions and supporting the Environmental Kuznets Curve (EKC) hypothesis, which suggests that environmental sustainability improves after countries reach middle-income levels. **Brandi (2020)** also found that environmental provisions in trade agreements can reduce polluting exports while promoting green exports from developing countries, serving as effective policy tools to support the transition to a green economy.

Finally, achieving sustainable development requires pricing environmental resources in line with their social costs, by internalizing the negative externalities of pollution into the prices of goods and services (ABDELAZIZ, 2014). Moreover, adopting stringent environmental policies in non-oil countries can increase per capita GDP, as stricter regulations encourage more efficient use of resources across sectors such as manufacturing, agriculture, and construction—thereby improving productivity, innovation, and overall economic growth (MESSAOUDI, 2023). Most recent studies confirm that while the direct effects of these policies on international trade are modest, the long-term benefits for humanity—particularly in terms of environmental quality—are considerably greater (DEEP, 2015).

Conclusion

This study examined the effectiveness of environmental standards on trade volume. By analyzing and interpreting the effects of environmental standards, it sought to better understand the pathways through which economic, financial, and trade policies can contribute to integrating environmental requirements into their regulatory frameworks and environmental policies. Such integration can enhance domestic production and its competitiveness at the national level, strengthen export capacity, and drive structural transformations in production patterns, thereby enabling countries to penetrate international markets and capture market shares—ultimately reinforcing the role of exports in shaping national trade volume.

Based on the findings, it is essential that environmental standards and requirements aim to minimize the negative impact of economic activities on the environment and create an economic environment for the exchange of goods and services that supports environmental compliance and ensures environmental sustainability. The key results can be summarized as follows:

- **Trade volume in non-oil countries is positively affected by stricter environmental standards and policies.** The more rigorous the environmental requirements, the greater the increase in trade volume. However, this effect is not statistically significant in the long run. Nevertheless, stricter environmental policies in non-oil countries can increase exports and imports through various economic mechanisms, market dynamics, the structure of the economy, the nature of value added generated, and differing competitive advantages. Accordingly, policies designed to promote sustainable practices domestically have long-term targeted effects in stimulating exports.
- **Environmental taxes play an important role in expanding trade volume in non-oil countries.** When such taxes are applied, they aim to internalize the external costs associated with production and consumption activities that generate negative environmental impacts. Although exports in some industries may decline in the short term—affecting the trade balance—the structural transformations and shifts in production patterns aligned with environmental requirements over the long term can enhance the competitiveness of national exports. This, in turn, contributes to restoring balance in the trade account by boosting exports, ultimately leading to an increase in international trade volume.

References:

1. ABDELAZIZ, S. B. (2014). The Challenges of Liberalizing Foreign Trade for Developing Economies in Light of Sustainable Development Requirements (The Case of the Algerian Economy). *Al-Muthanna Journal of Administrative and Economic Sciences*, p. 214.
2. Abdelghani, S. M. (2022). The Role of Adherence to International Environmental Standards in Enhancing the Competitiveness of Egyptian Textile Exports during the Period 2010-2020. *Faculty of Political Science and Economics*.
3. ABDELLAOUI, O. (s.d.). Workshop on Trade and Environment.

4. Afifi, H. S. (2004). *Contemporary Trends in International Economics and International Trade: Current Issues in Trade* (Vol. Book 3, 1st edition). Egypt: Al-Masri Al-Lubnani Publishing House.
5. Brandi, C. S.-F. (2020). Do environmental provisions in trade agreements make exports from. pp. 22-1.
6. Cagatay, S. &. (2006). Degree of environmental stringency and the impact on trade patterns.
7. DEEP, k. (2015). *The World Trade Organization and Environmental Challenges.* Al-Halazouniya Publishing and Distribution House.
8. Hatem, S. A. (2004). *Contemporary Trends in International Economics and International Trade: Current Issues in Trade.* Egypt: Al-Masri Al-Lubnani Publishing House.
9. He, P. &. (2018). Environmental tax, polluting plants' strategies and effectiveness: Evidence from China. *Journal of Policy Analysis and Management*, pp. 493-520.
10. KOUNI, A. M. (2024, 01 14). Study of the long-term causal relationship between environmental standards and requirements and trade volume in China for the period 1990-2021. *Perspectives for Economic Studies*, pp. 69-88.
11. Lenzen, M. (2003). Environmentally important paths, linkages and key sectors in the Australian economy. *(1)14*, pp. 1-34.
12. Saleem, H., Chen, M., & Jiandong, W. (2022). The role of environmental taxes and stringent environmental policies in attaining the environmental quality Evidence from OECD and non-OECD countries. Frontiers in Environmental Science.
13. Mattoo, A. S. (2013). Trade effects of alternative carbon border-tax schemes. *Review of World Economics, 149*, pp. 587-609.
14. MESSAOUDI, A. (2023). *Trade and the environment in a changing world.* Joudah Publishing and Distribution House.
15. Ouyang, K. (2020). Impact of Environmental Costs on Export Trade. *In IOP Conference Series: Earth and Environmental Science. Vol. 598, No. 1*, p. 012025. IOP Publishing.
16. Shang, L. T. (2022). Environmental regulation, import trade, and green technology innovation. *Environmental Science and Pollution Research, (9)29*, pp. 12864-12874.
17. Shi, X. &. (2018). Environmental regulation and firm exports: Evidence from the eleventh Five-Year Plan in China. *Journal of Environmental Economics and Management*(89), pp. 200-187.
18. Tao, R. U. (2020). The dynamic effect of eco-innovation and environmental taxes on the carbon neutrality target in the emerging seven (E7) economies. *Journal of Environmental Management*.
19. Wei, G. (2017). (p. Analysis of Environmental Barriers in International Trade). Atlantis Press.
20. Wei, G. (2017). Analysis of Environmental Barriers in International Trade. *3rd International Conference on Economics, Social Science, Arts, Education and Management Engineering.* Atlantis Press.