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In this paper, I intend to analyze the relationship between global trade and biodiversity. The preservation of biodiversity is crucial for the health of our planet and the survival of countless species but the relationship between global trade and biodiversity is often overlooked in this academic discussion, as researchers tend to focus more on the environmental problem as a whole and not shedding a light on the biodiversity problem. Since the emergence of greener politics around the world, the environmental cause has become more relevant in political agenda and population thoughts. Therefore, I seek to bring attention to this important issue and provide quantitative evidence to inform the debate. In this paper, I aim to respond to the question: Do sustainable clauses affect positively biodiversity? To answer this question, I will present a quantitative analysis between trade agreements and a biodiversity index constructed with eBird. For my literature review, I will introduce concepts of environmentalism, trade, biodiversity and how relationship of globalization and biodiversity occurred during the recent history. Furthermore, it is discussed the rise of regulation and social standards, and how environmental clauses affects sovereignty.

As environmental problems have become complex problems as globalization increases, and a permanent solution is unlikely. Environmental problems can be divided into two types: Local and Global (FRANKEL, 2004). This division does not consider the causality of the problem, but the area affected by it. So as environmental problems affect in different forms multiple countries, as for public pressure to global warming, they are mostly classified as a global problem. In this form, besides being classified as a global problem, it can be caused by a local agent, that have advantages by doing the action. As an example, in Brazil many farmers initiate fire in Amazon, due to different reasons: First, in short term increases soil fertility and reduce pests facilitating the process of cultivation (PIVELLO, 2021); Second, for land clearing, fire is a cheap and effective way of cleaning a forest area for cultivation of crops or livestock. Both practices can lead to a fire outbreak in the forest, causing permanent damage to the environment. Therefore, these farmers obtain advantages by using practices that affects the whole World. As effect of balance between momentaneous advantages vs long term cause a problem of orchestration between countries. (PIVELLO, 2021); As a measure to mitigate the orchestration problem, it was in 1972 during Stockholm Conference on the Human Environment that environmentalism was marked as a global issue. Additionally, NGOs play an important role in bringing awareness and promoting international cooperation on environmental problems (COGAN; HURD; JOHNSTONE, 2016). However, the use of institutions does not eliminate all problems. As an example we have the case of Brazil, which besides having signed different agreements that indicated a pro-environmental position, and being recognized across the world as an important character in the environmental agenda, was during the mandate of Jair Bolsonaro the number of burning rose sharply, IBAMA lost the power of action, prospector started to dominate indigenous areas and mass variety of species of animals and plants were put in danger. This evolution demonstrates a position of Brazil that was not known in the last decades. Furthermore, President Bolsonaro raised the tension between countries, as during declarations denied the accusations, and attacked other countries for trying to intervene in the Sovereignty of Brazil. As a backslash, European countries such as Germany, froze more than 150 million reais, Macron declared public criticism of Brasilia’s position, and with private investors fearing the uncertainty, the costs of denying the environmental problem were increasing. As it is, environmental problems are an international issue, with orchestration difficult, and foreign investment can be perceived differently depending on the actor interests.

Developing countries suffer more pressure from international trade than Developed countries since they on average have more land-use potential and typically high biodiversity (ORTIZ et al. 2021). This pressure often results in demand from Developed countries to developing ones. Free trade can lead to increased economic growth, which in turn allows more resources to be devoted to environmental protection and improved standards (ANTWEILER; COPELAND; TAYLOR, 2001). However, it can also incentivize companies to race to the bottom to find the cheapest places to produce goods and favor cheaper production without considering environmental consequences. As a result, the net effect of free trade on the environment is unclear. To mitigate the negative impacts of free trade, companies agreed to voluntarily adhere to the TPR, Transnational Private Regulation, which established international standards for labor and environmentalism (BARTLEY, 2007). Environmental regulations can also have an indirect impact on trade by making it more expensive to produce certain goods. For example, if a country requires companies to use cleaner production methods, that will raise the cost of production and make those goods more expensive to export. In this manner environmental regulation can be used as a protectionist tool by the States, as firming trade agreements with environmental clauses can increases the cost of productions in other countries.

Another aspect used by States in their environmental discourse, is that environmental action made by other actors have the objective to diminish their sovereignty. International investment can diminish sovereignty, bringing disputes between investment and sovereign countries. Countries continue to increase These disputes tend to be protracted and expensive, diverting resources away from other pressing needs. They often result in awards of large sums of money to the investor, which can erode the state’s fiscal position. The state may be required to make changes to its laws or regulations to comply with the award, which can infringe on its sovereignty. Finally, the state may be subject to international sanctions if it fails to comply with the award, which can further undermine its sovereignty (MOEHLECKE, 2019). As an example, the Brazilian Amazon case demonstrates the impact of international investment on environmental interventionism. As private investors and other countries showed reluctance to invest due to Brazil's negligence in dealing with the fires in 2019, the possibility of international intervention was raised. In conclusion, investments, and agreements besides the positive aspects to the economy serve to control part of a state’s decisions, and not adhering to them may prove harmful to the country. This conclusion brings different aspects to the field of biodiversity, in one way it may have a positive effect on biodiversity, since trade agreements with sustainability clauses may influence the political space in a country. On the other hand, it may bring negativity to it, since countries will first prior their good, not considering how biodiversity will affect the rest.

Biodiversity is essential to the functioning of ecosystems and the provision of ecosystem services, such as clean air and water, soil fertility, and climate regulation. The problem of biodiversity has been increasing during the last decades; the vertebrate population is estimated to have declined 68% since 1970 (ORTIZ et al. 2021). Given the importance of the problem, different goals were established, during the 10th meeting of the Conference of the Parties of the Convention on Biological Diversity, the 20 Aichi goals were established in the Strategic Plan for Biodiversity for 2011-2020. However, none of the goals have been achieved by 2020 (ORTIZ et al. 2021). Furthermore, global trade can have negative impacts on biodiversity, as it can lead to increased production and consumption of goods and services that can contribute to habitat destruction, pollution, and the introduction of invasive species. Is estimated that cropland species richness is 40% lower than in primary vegetation (ORTIZ et al. 2021). Therefore, it is important to consider the impacts of trade negotiations on biodiversity and to ensure that environmental protections and conservation measures are integrated into trade agreements. In recent years, there has been a growing recognition of the importance of biodiversity in trade negotiations, and efforts to incorporate biodiversity considerations into trade policy have been made, this fact will be further discussed during the empirical results.

The expansion of the agricultural land area in regions with high biodiversity and the displacement of local biodiversity, including by invasive species, has led to negative impacts on biodiversity through many current international trade patterns. However, international trade could also be utilized to alleviate biodiversity loss. One example is the BioTrade Initiative established by the United Nations Conference on Trade and Development, which allows countries to harmonize economic development with biodiversity conservation by trading biodiversity-based goods and services, such as ornamental flora and fauna, food products, and extracts from plants. Public-private partnerships, such as the Tropical Forest Alliance 2020, are also aiming to align climate, forest, and development goals in the soy, cattle, palm oil, and wood pulp sectors in Colombia to achieve zero-deforestation commitments (Tropical Forest Alliance, 20). A deeper understanding of the interactions between production, international trade, and biodiversity is necessary to design policies and programs based on evidence to reduce the negative impacts of trade.

**Methodology**

The variety of different outcomes results in an uncertain scenario, where is hard to define the real intentions behind the actions. In this paper I do not seek to understand the intentions behind States actions or why they implement it, my focus is to quantify the impacts of this actions in biodiversity. The main study issue of this paper concern the impact of environmental clauses included in trade agreements on biodiversity. In this way, this paper seeks to understand if the inclusion of environmental clauses in trade agreements impacts positively the biodiversity conservation. As result of this objectives, my hypothesis is:

**H: Countries that incorporate sustainability clauses into their trade agreements exhibit stronger biodiversity conservation outcomes.**

To test my hypothesis, a standard regression is conducted in a panel data with fixed effects. The variable of interest is the percentage of trade agreements with environmental clauses that a country has (DESTA project). The dependent variable of interest is Shannon-Wiener Index constructed using eBird dataset. For the controls, it includes data for democracy, GDP, imports, and exports as percentage of GDP (World Bank), Outdoor air pollution and Energy Consumption per capita of Fossil fuels, Coal, and Gas (Our World in Data).

This paper uses fixed effects model for different reasons. First, including fixed effects will allow control for unobserved heterogeneity among countries. This is important because of the different climate, geology, resources, and flora. Since the study aims to understand an impact on biodiversity, controlling those aspects are especially important, since they can affect the population of many different species.

Additionally, fixed effects allow control for institutional characteristics such as culture and Religion, which can influence the view of a country about many different species. However, using fixed effects has one main downgrade: it is possible only to control stable variation across time. So, if the heterogeneity is changing the intensity across time the estimator will not be appropriate. Although this limitation, in this paper it is assumed that large changes in this heterogeneity does not happen fast enough to pose a threat to the results.

During the research for this paper, I had difficulty on finding a biodiversity index for different countries and with usable time-series for a model. As solution, in this paper I will construct a biodiversity index for many countries utilizing as a source the dataset of eBird. Further details of these dataset will pe presented in this article but is important to address that utilizing birds as way to measure biodiversity can provide a reliable proxy as birds have the ability to flee from a region if the environment is not beneficial for it. This index will utilize the Shannon-Wiener Index that is a stablished index in biodiversity research. This index is an observation type index, that is, it relies on species observation for its construction. In this form, will utilize observations presented on eBird dataset, quantify it, and apply to the model equation. The result is an information statistic index, in which all the species are represented in one sample, and they are randomly sampled. The equation for the index is:

Where **p** is the proportion of individuals of one species of the total of individuals in the sample and **n** is the number of species (Nolan, 2006).

As for my independent variable, I will construct a model based on the types of environmental clauses that each country has signed during the time-series. To construct this model, I will utilize data from Desta Project with XX analysis. This study mapped all the possible forms that an environmental clause is presented in Trade Agreements, where it marked for each an agreement different characteristics. By using this analysis, I will map all the clause types signed by countries and separate these clauses in the time-series. For example, a country can have signed a trade agreement with 4 types of clauses in 1990, if this country sign another agreement in 1992 with 4 types of clauses, First I will see if they are different types of clauses, the ones different will be marked for this country, the others will be discarded, as they are already marked for this country. By doing this I will have an environmental commitment index for different countries in a long time-series.

Because my research covers a wide range of topics, is needed to employ a variety of data sources. Five separate public datasets were used, which are identified and described below.

**1.eBird**

For my dependent variable I will use a constructed Shannon-Wiener Index with source in the eBird dataset. eBird is a collaborative database that maps appearance of bird species around the world. This dataset is the largest biodiversity-related citizen science projects, it includes more than 100 million observations. Besides being a collaborative dataset, eBird have an expert-based checklist filters to maintain the data quality, for more details about the criteria please refer to their website. Using this base, I can quantify the number of appearances by year and region of different species for each country in de dataset. Besides presenting a detailed area where the observation occurred, for this study I am using only the country where the observation happened. This study did, however, have several shortcomings. Some countries can have more data than others since they have more volunteers making the observations.

**2.DESTA project + TREND**

For my independent variable, i.e., the types of environmental clause signed by a country I use a combination of two datasets. First, the Desta Project database – This dataset presents a complete record of all trade agreements negotiated since World War II, ranging from simple trade agreements to sophisticated economic integration zones and free trade agreements, including Preferential Trade Agreements. It is possible to create a country-year panel of 176 countries using this dataset, which had information about the number of treaties a country was involved in for that year.

Second, the TREND dataset. This dataset is part of a study of Jean-Frédéric Morin (2018) and is used by several institutions to map how many environmental clauses each State have signed. In this study the authors classify over 670 agreements between 1945 and 2016, in over 270 ways to address environmental inside Trade Agreements. With this dataset combined um DESTA Project is possible to map each country signed the Trade Agreements, and which environmental clauses were included on it.

To better qualify my study, I will only count the first time that a country had signed an environmental clause and maintaining as a constant during time. This method proves more adequate to reality, because once a country signed an environmental clause it should follow independent if it will sign a similar clause in the future. Furthermore, this method prevents me of the Trade quantity bias, i.e., it does not favor countries with more Trade Agreements.

One limitation of this study is that I do not distinguish between the various sorts of agreements since significant results require a large sample size.

**3.VDEM**

Another dataset included in my analysis is the Varieties of Democracy (VDEM), which is a massive collection of data on democracy, politics, free speech, and other relevant topics. Despite its magnitude, we only extract high-level indicators of democracy in various countries. According to its website, the VDEM dataset provides a multidimensional and disaggregated dataset that reflects the complexity of democracy as a system of rule that extends beyond the mere occurrence of elections.

The dataset includes a wide range of information, such as freedom of speech and the strength of a country's many powers. This dataset was created in collaboration with experts and academics from around the world.

For my research, I focused on the highest-level democracy indicators developed by these experts. The polyarchy democracy index is used, which seeks to capture Dahl's seven institutions of a polyarchy, indicating a shared sense of what democracy implies. The index's seven dimensions are freedom of association, suffrage, clean elections, elected executive, freedom of speech, independent and alternative information sources, and responsive policymaking. In addition, we employ indices that assess a country's (i) liberal democracy, (ii) participatory democracy, (iii) deliberative democracy, and (iv) egalitarian democracy. This dataset contains observations for 179 different countries.

**4.World Bank**

To control for potential confounding factors in the analysis, it includes data from the World Bank dataset. It specifically extracts macroeconomic statistics in US dollars, such as imports, exports, and total GDP. While these variables appear simple, they give essential background for this study and enable us to account for any economic issues that may influence our results. These variables will be used as controls in the regressions to guarantee that any observed correlations between the key variables of interest are not merely coincidental.

**5.Our World in Data**

To further control for potential confounding factors, it includes data for Outdoor Air pollution and Energy Consumption. Both variables intend to control pollution. The first one is often used as a proxy for pollution and serves as a good variable to understand emissions from cars, and industry. Another variable used to understand pollution is the Energy matrix. When searching for results for pollution research often uses tax in energy as a proxy to tax in pollution. For this manner of analysis, it will include Energy Consumption by specific sources, such as Fossil Fuels, Coal, and Gas since these sources tend to create meaningful impacts on biodiversity.

**Model**

For my main analysis, I conducted a standard regression with fixed effects model. As previously stated, my dependent variable will the biodiversity index constructed for this paper, using the eBird dataset. I regress this variable with control variables for Pollution, Energy consumption, GDP, Imports and Exports, VDEM index, and lastly my independent variable, the clauses signed by each State. In the following text I will explain the choice these variables.

First, it is included Outdoor Air Pollution and Energy consumption, both variables intend to control for pollution in a country. These is important to differentiate countries, because countries with less air pollution have arguably more regards towards environment. Therefore, is expected a negative coefficient during the regressions.

Another variable included is the GDP, in log. This variable is used because countries with a larger GDP are more predominant in global economy. In this way, countries have more incentives to negotiate with them, and they have more economic resource to negotiate. As larger GDP are mostly represented by developed countries, where less percentage of land represents natural biomes, thus making easier to protects. Additionally, these countries tend to suffer more public pressure for environmental politics and have more resources for it. It is expected a positive coefficient during the regression.

It is included Imports and Exports because it is a usual measure for economic openness. So, if a country is more open to trade it is arguably more influenced by global ideas, such as global warm, resulting in more public pressure and politics that regards environmental protection. As a result, is expected a positive coefficient during the regression.

VDEM index is included in a form to represent the population capability to influence in politics. Since environmental politics are often costly to specifics groups of interests, such as Bancada Ruralista in Brazil, the implementation of this politics depends on how well established the States Institutions are. This variable is susceptible to the accession of populists’ leaders, and so it can have a contrary effect on the regression. Although the accession of populists’ leaders can affect in the impact in the regression, the VDEM variable is expected to have positive effect in the regression, since hardly populist leader will be predominant in the data.

**World Count: 3394**

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