Research on the Impact of Environmental Clauses in Regional Trade Agreement on Export Carbon Content

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ABSTRACT

With the deepening of Regional Trade Agreement (RTA) from border rules to intra-border rules, environmental clauses have become an important component of RTA intra-border rules. The relationship between RTA environmental clauses and the export carbon content of industrial products is the core issue discussed in this article. It selects the export trade data (1995~2018) of 66 countries participating in the signing of 409 environmental rules in the RTA as samples, builds an expanded gravity model, and examines the impact of RTA environmental clauses on the carbon content of industrial export unit trade. Research has shown that the signing of RTA environmental clauses is beneficial for reducing carbon content in industrial trade, among which, North-North cooperation, South-South cooperation, and the signing of RTA environmental clauses between non-Asia Pacific countries are more significant for reducing carbon content, while North-South cooperation and the signing of RTA environmental clauses between Asia Pacific countries are not very significant for reducing carbon content. China should enhance the scope and intensity of environmental clauses in future RTA negotiations and force domestic reforms through high-level RTA negotiations, gradually improving domestic environmental regulatory measures and achieving the goal of high-quality economic development in China.

Keywords: Regional Trade Agreement, Environmental clauses, Industry, Carbon content.

1. INTRODUCTION

In recent years, strengthening close cooperation among countries around the world in the field of environmental governance and seeking a balance between trade liberalization and environmental protection has become a universal consensus in the international community. Countries are increasingly utilizing RTA for cooperation on environmental issues, including environmental clauses or entire environmental chapters in RTA. Some countries have also adopted environmental provisory clauses outside of RTA. In the past two decades, the environmental clauses included in RTA have shown a trend of increasing quantity and deepening commitment depth. Before 2016, approximately 85% of RTAs signed globally included environmental clauses (Morin et al., 2018).

In recent years, many scholars have studied the trade effect of RTA from the perspective of the heterogeneity of RTA clauses. Since Viner (1950), scholars have regarded RTA as a "blind box", using virtual variables to measure whether to sign a RTA. Based on this, in order to further explore RTA and comprehensively consider the factors of clause heterogeneity, some scholars have started from the agreement text, and established a more comprehensive and reliable RTA deep indicator system to conduct empirical research based on whether the clauses covered by the agreement have legal effect and enforcement (Hofmann et al., 2017; Mattoo et al., 2020; Li Yanxiu, Mao Yanhua, 2018; Han Jian, Wang Can, 2019). Early research on environmental clauses in RTA mainly focused on text analysis method (Egger, Larch, 2008; RV, 2009; Jinnah, Morgera, 2013). In addition, some scholars have conducted research on the trade effect of RTA environmental clauses from the perspective of heterogeneity in RTA environmental clauses, but the conclusions are inconsistent. Some scholars point out that RTA environmental clauses are

beneficial for improving the competitiveness of RTA contracting parties' green product sectors, thereby promoting green trade between both parties. The study by Prakash and Potoski (2006) suggested that RTA covering environmental clauses helped promote the dissemination of environmentally friendly technologies among contracting parties. Brandi et al. (2020) found that RTA environmental clauses encouraged the export of green products of contracting parties through the study of structural gravity model. Sun Yuhong et al. (2021) also used the same method and found that RTA environmental clauses promoted the export of environmental products from APEC member countries. On the other hand, some scholars' research suggests that the advantages brought by the relaxed environmental clauses of RTA environmental clause contracting parties have suppressed bilateral trade (Morin, Rochette, 2017; Berger et al., 2020).

2. THEORETICAL ANALYSIS AND HYPOTHESIS PROPOSAL

Theoretical analysis and hypothesis are divided into two aspects:

2.1 Environmental Clauses in RTA Affect Carbon Content in the Unit Trade of Exported Industrial Products

With the gradual inclusion of environmental clauses in RTA, global division of labor continues to deepen, and the impact of global value chain participation on implied carbon emission intensity is of great significance. The environmental clauses of RTA belong to deeply integrated post-border rules, which can effectively reduce trade policy uncertainty and generate trade creation effect. The establishment of environmental dispute resolution mechanism and market access system for polluting products through the signing of Free Trade Agreement (FTA) environmental clauses reflects the trend of member countries strengthening mutual coordination in environmental protection policies. The FTA environmental clauses can play a role in regulating Chinese industries, achieving energy conservation and emission reduction goals, and also profoundly affect the international competitiveness of export products (Wang Jun et al., 2021). Based on the above discussion, this article proposes the following hypothesis:

Hypothesis 1: The RTA environmental clauses will reduce the carbon content in unit trade of industrial exporting countries.

2.2 Regional Factors Act on RTA, Affecting the Carbon Content in the Unit Trade of Industrial Exporting Countries

As a typical post-border measure, whether environmental clauses can be effectively implemented and whether their trade effect can play are closely related to the domestic economic development level, environmental quality, and institutional execution ability of the contracting parties. Developed countries have a higher level of regulation, and their industrial structure and production technology are also cleaner and greener. On the contrary, most developing countries are still in the development stage before the environmental inflection point, and in order to achieve economic growth, they tend to adopt loose domestic environmental regulations and extensive economic development methods. The impact of RTA environmental clauses on trade may depend on the environmental quality of the importing and exporting countries. Countries with high environmental quality tend to have environmentally friendly economic structures and are more likely to comply with environmental clauses in RTA, as well as adjust their production and export structures (Brandi et al., 2020). If the contracting party itself has a high environmental quality and is on the path of green economy development, the cost of complying with RTA environmental clauses will be relatively reduced, thereby enhancing the role of environmental clauses. Based on the above reasons, this article proposes the following hypothesis:

Hypothesis 2: The trade effect of environmental clauses in RTA is influenced by the domestic economic development level and environmental institutional policies of the contracting parties.

3. MODEL SPECIFICATION AND DATA PROCESSING

Model specifications and data processing include: model specification, explained variable and core explanatory variable.

3.1 Model Specification

This article uses the gravity model and the basic principle of dual margin to establish the following empirical model:

$CO2_{ijt} = \alpha_0 + \alpha_1 RTA_{ijt} + \delta_{ij} + \lambda_t + \varepsilon_{ijt}$

α_0 represents the intercept term, which refers to the carbon content in the unit trade of industrial product exporting countries when not affected by RTA environmental clauses. The subscript i represents the exporting country of industrial products, the subscript j represents the importing country of industrial products, and t represents the time. $CO2_{ijt}$ represents the carbon content in the unit trade exported by country i to country j in month t. $CO2_{ijt}$ is the explained variable of the model, representing the carbon content in the unit trade emitted by industrial exporting countries. RTA_{ijt} is the core explanatory variable of this article, representing the coverage rate of environmental clauses in RTA signed between the two countries.

$CO2_{ijt}=(A1*A2+A3*A4)/\text{total emissions}$ $CO2_{ijt} = (A1 + A2 + A3 + A4)/sum\_emi$

Among them, A1 represents EXGR DCO2PSH, reflected in the domestic CO2 emissions in the total export volume and industry partner share; A2 is EXGR FCO2PSH, reflected in the foreign CO2 emissions in the total export volume and industry partner share; A3 represents EXGR DCO2, reflected in the domestic CO2 emissions in the total export industry; A4 is EXGR_ FCO2, reflected in the foreign CO2 emissions in the total export industry; sum_emi is the total carbon dioxide emissions.

The explained variable substituted in the robustness test is: (A5*A6+A7*A8)/total emissions. Among them, A5 represents EXGR INTDCO2PSH, reflected in the domestic CO2 emissions in the total export volume of intermediate products and partner share industries; A6 represents EXGR INTFCO2PSH, reflected in the foreign CO2 emissions in the total export volume of intermediate products; A7 represents EXGR INTDCO2, reflected in the domestic carbon dioxide emissions in the total industrial exports of intermediate products; A8 represents EXGR INTFCO2, reflected in the foreign CO2 emissions in the total industrial exports of intermediate products.

3.3 Core Explanatory Variable

The core explanatory variable of this article, RTA_{ijt}, is the coverage rate of the country's signed RTA environmental protection clauses. The signing

Estimated coefficient α_1 depicts the degree to which RTA affects the carbon content of industrial product exporting countries. If α_1 is negative, it indicates that the RTA environmental clauses have a promoting effect on reducing carbon content in industrial exporting countries. δ_{ij} represents the constant fixed effect between exporting and importing countries (country to country), λ_t represents a time fixed effect, and ε_{ijt} represents the random disturbance term of the model.

3.2 Explained Variable

The explained variable $CO2_{ijt}$ in this article is the carbon content in the unit trade of industrial product exporting countries. The exporter and importer are 66 countries (regions) that have signed RTA environmental clauses, and the data is from the OECD database.

The explained variable is a combination of the following four indicators:

and entry-into-force time of RTA clauses, as well as the scoring data in 295 environmental aspects, are all from the WTO database and TREND database. By analyzing the environmental protection clauses in 409 RTAs as of 2018, this article draws on the "clause counting method" proposed by Hofmann et al. (2017) to calculate the depth of environmental clauses in RTAs concluded and still in effect by 66 countries from 1995 to 2018. The calculation method is as follows:

$$RTA_{ijt} = ENV = \sum_{k=1}^{295} provision_k/295$$

Among them, $provision_k$ is a virtual variable. If a RTA contains a specific environmental clause, it is assigned a value of 1, otherwise it is 0. Therefore, this study sequentially aggregates the assigned values of 295 environmental clauses and assigns the same weight to each clause to obtain the environmental clause depth index ENV of RTA. This article standardizes the depth of environmental clauses through a weighted approach, making the results easier to interpret and analyze. The higher the environmental clause depth index, the more environmental clauses covered by the RTA, and the stronger its constraining force on the environment (Brandi et al., 2020).

4. EMPIRICAL ANALYSIS

Empirical analysis is composed of baseline regression, robustness test and heterogeneity test.

4.1 Benchmark Regression

The benchmark regression of this article adopts a triple fixed effect to explore the impact of signing RTA environmental clauses on industrial carbon emissions, as well as the three effects of fixed country pair, exporting country and year, and importing country and year.

The regression analysis results are shown in "Table 1", and the estimated coefficient of the core

explanatory variable is significantly negative, which is consistent with expectations, indicating that signing an RTA with environmental clauses has a negative impact on the carbon content of industrial product export unit trade, meaning that the carbon content of industrial exporting countries will decrease after the environmental clauses of the signed RTA come into effect.

Table 1. The regression analysis

$CO2_{ijt}$	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
RTA_{ijt}	-.0157567	.0029151	-5.41	0.000	-.0214703	-.0100431
_cons	.0809762	.0002699	300.05	0.000	.0804473	.0815052

4.2 Robustness Test

The robustness test is divided into three parts.

4.2.1 Substituted Explained Variable

The substituted explained variable is the carbon content in the unit trade of intermediate products. The regression results are shown in "Table 2", and the estimated coefficient of the core explanatory variable is still significantly negative, that is, after the signing of the RTA environmental clause takes effect, the carbon content in the unit trade of industrial intermediate products in the exporting country will decrease. This is consistent with the results of the benchmark regression, which confirms the robustness of the benchmark regression.

4.2.2 Substituted Core Explanatory Variable

The substituted core explanatory variable is the virtual variable fta (with a value of 0 or 1), which

represents whether to sign the FTA environmental clauses. The regression results in "Table 2" are still significantly negative, indicating that the carbon content in the unit trade of industrial products in exporting countries after the signing of the FTA environmental clauses takes effect will decrease. This is consistent with the results of the benchmark regression, which again verifies the robustness of the benchmark regression.

4.2.3 Excluding the Impact of Financial Crisis

The financial crisis situation from 2008 to 2010 was relatively severe, which had a certain impact on the export trade of industrial products in 66 countries. To eliminate the interference of the financial crisis situation, this article excludes data from 2008 to 2010 and only considers product exports from other times. The regression results in "Table 2" indicate that the estimated coefficient of the core explanatory variable is still significantly negative, consistent with the results of the benchmark regression.

Table 2. The robustness test

y/x	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]	Sample size
Substituted explained variable	-.0157638	.0022711	-6.94	0.000	-.0202152	-.0113123	102480
Substituted core explanatory variable	-.0036953	.0009009	-4.1	0.000	-.005461	-.0019295	91561
Excluding the impact of financial crisis	-.0147059	.0030925	-4.76	0.000	-.0207673	-.0086446	80086

4.3 Heterogeneity Test

Heterogeneity test is composed of developing/developed countries and Asia Pacific/Non-Asia Pacific countries.

4.3.1 Developing/Developed Countries

To explore the impact of RTA environmental clauses signed by countries with different levels of development on their industrial export carbon content, this article categorizes countries into three types: North-North cooperation between developed countries, South-South cooperation between developing countries, and South-North cooperation between developed countries and developing countries. This article uses North-North cooperation countries as a benchmark to explore the differences in the coverage of FTA environmental clauses between North-South cooperation countries and South-South cooperation countries.

According to the regression results in "Table 2", there are differences in the impact of RTA environmental clauses signed by countries with different levels of development on the carbon content in the unit trade of exporting countries. The signing of RTA clauses in North-North cooperation and South-South cooperation has a significant impact on the reduction of carbon content in industry, with South-South cooperation being the most significant. The degree to which North-South cooperation reduces carbon content is not significant. The possible reason is that the signing of RTAs covering environmental clauses among developing countries will encourage contracting parties to restrict their exports and reduce exports of non-green products; however, due to the significant differences in domestic environmental legislation between developed countries and developing countries, even if both parties sign RTAs covering environmental clauses, their implementation is constrained by the heterogeneity of local environmental regulations, which makes it difficult for relevant clauses to be smoothly implemented and affects the effectiveness of RTA environmental clauses.

4.3.2 Asia Pacific/Non-Asia Pacific Countries

To explore the impact of RTA environmental clauses signed by Asia Pacific countries and non-Asia Pacific countries on their industrial export carbon content, this article categorizes countries into two types: Asia Pacific countries and non-Asia Pacific countries.

According to the regression results in "Table 3", compared to non-Asia Pacific countries, the signing of RTA by Asia Pacific countries is not very significant. The possible reason is that based on short-term and medium-term development trends, the demand for industrial products with high carbon content (such as oil) in the Asia Pacific region will continue to increase, resulting in high and rapid growth of carbon emissions. Therefore, compared to non-Asia Pacific countries, the function of restraint of RTA environmental clauses signed by Asia Pacific countries is relatively limited.

Table 3. The heterogeneity test

$CO2_{ijt}$, /RTA_{ijt}	North-North regional cooperation	South-North regional cooperation	South-South regional cooperation	Cooperation between non-Asia Pacific countries	Cooperation between Asia Pacific countries
Coefficient estimated value	-.0107101	.0076231	-.0873119	-.0180217	.0209701
t value	-2.93	1.61	-9.42	-5.81	2.13
p value	0.003	0.108	0.000	0.000	0.034
Country fixed effect	YES	YES	YES	YES	YES
Time fixed effect	YES	YES	YES	YES	YES

5. CONCLUSION AND POLICY IMPLICATIONS

This chapter contains two parts: conclusion and policy implications.

5.1 Conclusion

This article empirically studies the impact of the signing of RTA environmental clauses on the carbon content of industrial exports in 66 countries (regions) from 1995 to 2018. The results indicate that, first, signing RTA environmental clauses has a negative impact on the carbon emissions of industrial product exporting countries, that is, the carbon content in the unit trade of industrial products in exporting countries after the signing of the FTA environmental clauses takes effect will decrease. Second, there are differences in the impact of RTA environmental clauses signed by countries with different levels of development on the carbon content in the unit trade of exporting countries. The signing of RTA environmental clauses in North-North cooperation and South-South cooperation has a significant impact on the reduction of carbon content in industry, with South-South cooperation being the most significant. The degree to which North-South cooperation reduces carbon content is not significant. Third, compared to non-Asia Pacific countries, the signing of RTA by Asia Pacific countries is not very significant. Signing environmental clauses in the Asia Pacific region has a weaker effect on weakening carbon content in the unit trade compared to other regions, while signing environmental clauses in non-Asia Pacific regions has a stronger effect on weakening carbon content in the unit trade.

5.2 Policy Implications

The first is to actively participate in the signing of RTA, with particular emphasis on the coverage of environmental clauses. RTA is an important factor for countries to integrate into the global value chain and accelerate the process of regional integration. It's needed to gradually upgrade and improve existing trade agreements, encourage countries around the world to join global production and share the value chain. Efforts should be made to rationally select partner countries, focus on the depth of RTA rather than quantity, and construct a high-level RTA network guided by the value chain.

The second is to initiate new negotiations on FTA with more countries, especially developing countries, deepen existing cooperation in FTA, enhance the coverage and legal binding force of environmental clauses in FTA, and promote China's FTA to move closer to high-level international agreements. In terms of environmental clauses, it is necessary to actively engage in negotiations in areas that are currently less covered by China's FTA, and strengthen the operability and practical binding force of environmental clauses.

The third is to accelerate the process of building a green trade system. It's important to accelerate the construction of a modern environmental governance system internally, deepen the reform of the ecological civilization system, promote high-level environmental legislation and law enforcement, and improve the environmental governance system with the participation of multiple entities. Meanwhile, it's also needed to steadily carry out green trade cooperation with the outside world, actively participate in the formulation of relevant trade rules and standards, and promote the formulation of favorable environmental trade standards for China from a practical perspective.

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