

The Impact of the Implementation of RCEP on China's High-Tech Industry and Policy Implications

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Abstract. Taking the entry into force of the Regional Comprehensive Economic Partnership (RCEP) in 2022 as a quasi-natural experiment, this paper systematically analyzes the impact and mechanisms of RCEP on China's exports of high-tech products, based on panel data from 2011 to 2023 and employing the difference-in-differences (DID) method. The empirical results indicate that the implementation of RCEP has significantly boosted China's exports of high-tech products to RCEP member countries, and this finding remains robust after a series of robustness checks. Furthermore, a mechanism analysis using the International Property Rights Index (IPRI) reveals that RCEP has significantly promoted the growth of China's high-tech exports by enhancing the level of property rights protection. Heterogeneity analysis shows that industries such as life sciences and computer-integrated manufacturing have benefited significantly, while sectors like optoelectronics, aerospace, and telecommunications have been less affected. In addition, ICT-related exports demonstrate a notable synergistic driving effect on the overall high-tech industry exports. Based on the findings, it is recommended to provide targeted support for high-tech sectors that benefit the most, while also optimizing policies to address weaknesses in underperforming areas. Efforts should be strengthened in promoting ICT-integrated innovation and improving property rights protection to comprehensively enhance the international competitiveness of China's high-tech industries.

Keywords: RCEP, High-tech Industry, Difference-in-differences(DID), Export Trade, Protection of property rights

1. Introduction

With the continuous deepening of globalization and profound changes in the international economic environment in recent years, regional trade agreements have become an important means of promoting economic cooperation and exchanges among countries. As one of the largest free trade agreements in the world, the Regional Comprehensive Economic Partnership (RCEP) officially came into force on January 1, 2022, covering fifteen major Asia-Pacific economies including China, Japan, South Korea, Australia, and the ten ASEAN countries. By lowering tariffs, simplifying trade procedures, and harmonizing rules and standards, RCEP promotes the liberalization and facilitation of trade and investment in the region, and fosters deep integration of industrial and supply chains among the member states [1,2].

The high-tech industry is the core driving force for optimizing and upgrading the national economic structure and enhancing international competitiveness [3]. For China, the high-tech industry is not only an important engine for innovation-driven development, but also a key sector for achieving export transformation and upgrading, and integrating into the global value chain [4]. However, due to factors such as international trade barriers, intellectual property protection, industrial support capacity, and market access, the expansion of China's high-tech products in the international market has long faced numerous challenges [5]. The entry into force of RCEP, which covers a series of practical measures including tariff reduction, investment facilitation, intellectual property protection, and services trade liberalization, is likely to have far-reaching impacts on the export structure and cooperation model of China's high-tech industry [6,7].

In recent years, scholars have empirically analyzed the impact of RCEP on the transformation of China's trade structure and industrial development from various perspectives, such as the macroeconomy, manufacturing, agricultural products, and the digital economy. [8] used a dynamic GTAP model to demonstrate that the implementation of RCEP helps to mitigate the impact of China-US trade frictions and promotes China's deeper participation in the division of labor in the Asia-Pacific industrial chain. [9] pointed out that RCEP reduces electromechanical trade barriers and enhances the export potential of China's electromechanical products, especially to ASEAN, India, and Australia, although disadvantages persist in high-end equipment vis-à-vis Japan and South Korea. [10] found that RCEP improves China's agricultural import security and food security, and diversification helps disperse risks; [11] emphasized that the complementarity of agricultural products within the region outweighs competition, thereby providing a foundation for agricultural cooperation. [12] empirically demonstrated that the development of the digital economy in RCEP member countries directly promotes China's cross-border e-commerce exports, with transportation and institutional quality improvements serving as indirect drivers. Overall, RCEP significantly facilitates the upgrading of China's trade and industrial structure, brings new trade opportunities, and strengthens regional cooperation. However, there remains a lack of systematic, micro-level quantitative evaluation in the academic literature focusing on the high-tech industry in the aftermath of RCEP's implementation, particularly with respect to the performance of China's high-tech products across different sub-industries, the heterogeneity of regional exports, and the associated policy effects.

Against this backdrop, this paper regards the entry into force of the RCEP agreement as a natural experiment, and employs a difference-in-differences model to analyze, from the empirical perspective of trade flows, the effects and mechanisms of RCEP implementation on China's high-tech industry exports. Specifically, this paper focuses on changes in the trade of high-tech products between China and RCEP member countries, examines the role of the policy in boosting export volume and facilitating structural upgrading, and further dissects the underlying mechanisms and heterogeneity across specific high-tech sub-industries. Finally, based on the empirical regression results, targeted policy recommendations are proposed to advance China's deepening of regional cooperation and the enhancement of global competitiveness in the high-tech industry. This study aims to provide theoretical support and practical reference for understanding the trends of internationalization of China's high-tech industry under the RCEP framework, as well as to furnish a scientific basis for relevant departments to optimize policy making and promote high-quality opening-up.

2. Manuscript preparation model, variables, and data

2.1. Model specification

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This paper adopts the difference-in-differences (DID) method to evaluate the impact of the entry into force of the RCEP agreement on China's high-tech industry exports. Considering that export flows are influenced by multiple factors and that there exist unobservable individual and time effects, the following DID panel regression model is constructed:

$$\ln(\text{export}_{it}) = \alpha + \beta \text{DID}_{it} + \gamma X_{it} + \mu_i + \lambda_t + \epsilon_{it} \quad (1)$$

Where, $\ln(\text{export}_{it})$ denotes the total value of China's high-tech industry exports to country i in year t . Due to large disparities in data and the existence of zero values, the export data are log-transformed after adding one. did_{it} is the policy shock dummy variable reflecting the impact after RCEP came into effect: it takes a value of 1 if, in a year after 2022, the export destination is an RCEP member country, and 0 otherwise. X_{it} is a matrix of control variables, including economic size, population, trade costs, R&D investment, etc. μ_i and λ_t are country and year fixed effects, respectively, to control for unobservable country-specific and time-specific factors. ϵ_{it} is the error term capturing other unobservable influences. β is the core coefficient of interest, measuring the size and direction of the impact of RCEP's entry into force on China's high-tech industry exports. If $\beta > 0$, it indicates that RCEP significantly promotes China's high-tech industry exports and positively contributes to export structural upgrading; if $\beta < 0$, it implies that the RCEP policy did not have a positive effect and may even have had a negative impact.

The regression employs country-clustered robust standard errors and absorbs country and time fixed effects to ensure reliability and validity of estimates. This model effectively identifies the net change in China's high-tech industry exports before and after RCEP's implementation, thereby providing an evaluation of the policy effect.

2.2. Variable descriptions

2.2.1. Dependent variable

The dependent variable is China's high-tech product export value (export_{it}) to major trading partners. The statistical data come from the UN Comtrade database. The scope and classification of high-tech products follow [13], specifically using HS2007 six-digit codes for identification and categorization. To ensure consistency with the official statistics of China, the classification standard is based on the Customs Statistical Express for Key Export Commodities (2025) [14]. High-tech products are divided into nine major categories. The classification of high-tech industry subsectors and their corresponding HS2007 six-digit codes, has been removed for brevity. Researchers who wish to access the detailed category definitions and full HS code listings may contact the author directly to obtain the complete information.

2.2.2. Core explanatory variable

The core explanatory variable is the policy shock of RCEP's entry into force on China's high-tech industry exports, measured by the DID interaction term:

$$DID = Treat \times Post$$

Treat: Dummy indicating whether the export destination country is an RCEP member (excluding China itself — includes 13 members: Japan, South Korea, Australia, New Zealand, Singapore, Indonesia, Malaysia, the Philippines, Thailand, Vietnam, Brunei, Cambodia, Laos, Myanmar). Treat = 1 if yes, otherwise 0.

Post: Dummy indicating the post-policy period. As RCEP entered into force on January 1, 2022, Time = 1 for years 2022 and after, otherwise 0.

Thus, DID = 1 represents destination countries that are RCEP members and observations in the period after RCEP's entry into force; DID = 0 applies to the control group (non-members or pre-RCEP years).

2.2.3. Control variables

Drawing on literature related to high-tech product exports and classic empirical studies of trade flows, the following five categories of control variables are selected:

lngdp: Logarithm of partner country GDP (constant 2015 USD) [15]; expected positive effect.

lnpopulation: Logarithm of partner country population [16]; reflects market size; expected positive effect.

lnconst_costs: Logarithm of variable trade costs, proxied by geographical distance $\times$ annual average international oil price [17]; expected negative effect.

lntrade_open: Logarithm of trade openness, measured by trade (goods & services) as a percentage of GDP [18]; expected positive effect.

lnictexport: Logarithm of China's ICT product trade with the partner country; expected positive correlation with high-tech exports.

2.3. Data sources

High-tech product export data come from the UN Comtrade database. Macro and population data are taken from the World Bank's World Development Indicators (WDI), including country GDP (constant 2015 prices) and population. Variable trade cost distances are taken from the CEPII geodist database; oil prices are from the IMF. Trade openness data are from the World Bank and OECD. ICT trade data come from UNCTAD.

The time span is 2011–2023. After excluding countries/regions with missing data for some years or product categories and eliminating abnormal or negative values, the final balanced panel consists of 156 countries/regions and 1,965 valid observations for empirical analysis.

3. Empirical results analysis

3.1. Data sources

Table 1 reports the stepwise regression results regarding the impact of RCEP's entry into force on China's high-tech industry exports.

Column (1) analyses the effect of RCEP's implementation on high-tech product exports, controlling only for country and year fixed effects. The result shows that the coefficient of *did* is positive and significant at the 5% level, indicating that RCEP significantly increased China's high-tech industry exports.

Columns (2)–(6) sequentially add various control variables — GDP, population, variable trade costs, trade openness, and ICT export value — to the baseline model. The size and significance of the *did* coefficient remain essentially stable (all significant at the 5% level), further confirming the robustness of the results. Among them, ICT-related product exports (*lnictexport*) have a significant effect on high-tech industry exports, with a high coefficient of 0.871, indicating a close relationship between the ICT industry and high-tech exports.

Table 1. Baseline regression results

Variable	(1)	(2)	(3)	(4)	(5)	(6)
<i>did</i>	0.124** (0.061)	0.126** (0.060)	0.130** (0.063)	0.129** (0.063)	0.128** (0.063)	0.129** (0.063)
<i>lngdp</i>		0.028 (0.101)	0.029 (0.102)	0.028 (0.101)	0.028 (0.100)	
<i>lnpopulation</i>		-0.197 (0.183)	-0.195 (0.184)	-0.196 (0.184)	-0.196 (0.184)	-0.197 (0.184)
<i>lnconst_costs</i>			-0.042 (0.061)	-0.042 (0.061)	-0.042 (0.061)	
<i>lntrade_open</i>				-0.019 (0.039)	-0.019 (0.039)	
<i>lnictexport</i>						0.871*** (0.025)
Time FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
N	2170	2145	2145	2091	1965	1965
R ²	0.957	0.959	0.959	0.959	0.958	0.992

Note: ***, **, and denote statistical significance at the 1%, 5%, and 10% levels, respectively; standard errors are robust to heteroskedasticity and clustered at the country level.

3.2. Robustness tests

3.2.1. Parallel trends test

To verify whether the treatment group and the control group maintained the same development trend before the entry into force of RCEP, this paper adopts the parallel trends testing method proposed by

[19]. The specific setting is as follows:

$$\text{str}_{it} = \alpha + \sum_{k=-5, k \neq 0}^2 \beta_k \text{DID}_{i,t+k} + \mathbf{X}_{it}\gamma + u_i + v_t + \epsilon_{it} \quad (2)$$

where $\text{DID}_{i,t+k}$ represents a time dummy variable for the (k)th period relative to RCEP's entry into force. It takes the value 1 for the corresponding year and 0 otherwise. $\mathbf{X}_{it}$ is the set of control variables, u_i and v_t denote country and year fixed effects, respectively, and ϵ_{it} is the disturbance term. By examining whether the estimated coefficients of the interaction terms for periods before the policy (pre5 to pre2) significantly deviate from zero, we can determine whether the treatment and control groups followed consistent trends before policy implementation.

To improve robustness, the period immediately before policy implementation (pre1) is excluded as the baseline to avoid short-term fluctuations. The regression includes all time dummy variables, control variables, and fixed effects, with coefficients meancentered using the average of pre5 to pre2 as the baseline.

Figure 1 shows that, in the four years before RCEP's entry into force, coefficients are statistically insignificant and close to zero, indicating similar export trends between treatment and control groups, thus meeting the parallel trends assumption. After RCEP's implementation, coefficients become significantly positive, reflecting faster growth in China's hightech exports. The confidence intervals for prepolicy periods all include zero, while those for the policy year and subsequent years do not, confirming that RCEP had a robust and significant positive effect. These results support the validity of the DID approach and the reliability of the findings.

3.2.2. Placebo test

To further verify the robustness of the baseline regression results and avoid spurious correlations arising from model specification or data characteristics, this paper uses a placebo test as an auxiliary check. The specific procedure is as follows: a set of "pseudo" treatment countries and a "pseudo" policy implementation year are randomly designated; a new DID variable is then generated; the regression is re-estimated to observe the distribution of DID coefficients under a scenario with no genuine policy shock.

In each iteration, 13 countries are randomly chosen as a pseudo-treatment group, and a random year is set as the pseudo-policy start. A placebo_DID variable is generated, and the regression is run with the same controls and fixed effects as the baseline. This is repeated 500 times, recording coefficients and pvalues.

Figure 2 shows that placebo DID coefficients cluster around zero, with a symmetric bellshaped kernel density and very few significant results. The baseline DID coefficient (0.129) lies far outside this distribution, with a much lower pvalue, indicating that the observed positive effect of RCEP is unlikely to result from random variation or model artifacts, and is both statistically and economically meaningful.

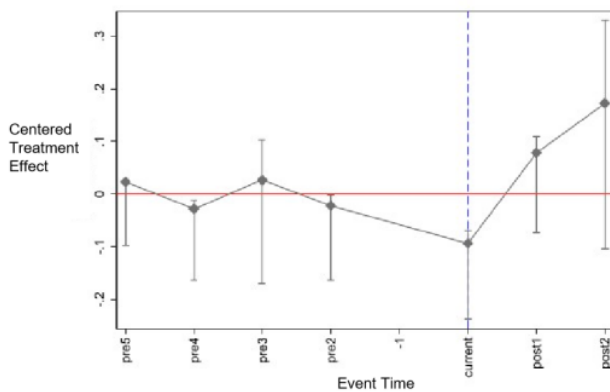


Figure 1. Parallel trends test

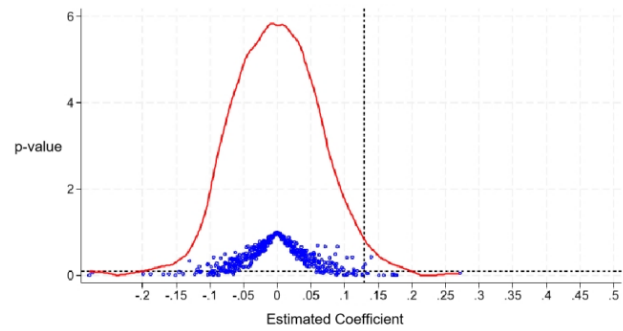


Figure 2. Placebo test

3.2.3. PSM-DID test

To further validate the robustness of the baseline regression results and to reduce the influence of initial differences between the treatment and control groups, this paper applies the propensity score matching combined with the difference-in-differences (PSM–DID) method as a re-examination. Specifically, propensity scores are first estimated based on covariates, and samples are matched; the DID regression is then repeated on this matched sample, effectively mitigating possible sample selection bias.

Table 2. Presents the comparison between the PSM–DID results and the baseline DID regression

	PSM-DID	DID
did(RCEP Entry into force)	0.156** (0.071)	0.129** (0.063)
Control	YES	YES
Time FE	YES	YES
Country FE	YES	YES
N	1711	1965
R ²	0.993	0.992

It can be seen that after propensity score matching, the promoting effect of RCEP’s entry into force on China’s high-tech industry exports remains significant (PSM–DID coefficient = 0.156, $p = 0.030$), and the coefficient value is highly consistent with the baseline regression (0.129, $p = 0.043$). This further confirms that the implementation of RCEP can effectively bolster China’s high-tech industry exports.

4. Mechanism analysis and heterogeneity analysis

4.1. Mechanism analysis

Building on the earlier empirical results, and to further explore the mechanisms through which the entry into force of RCEP affects China’s high-tech industry exports, this paper examines “property rights protection” as a potential mediating channel. Existing studies suggest that the signing and

implementation of free trade agreements, in addition to reducing tariff barriers and facilitating investment and trade, can also promote the international competitiveness and export growth of high-tech industries by strengthening intellectual property protection and standardizing investment dispute resolution mechanisms [20].

Based on this, the International Property Rights Index (IPRI), sourced from the Property Rights Alliance, is introduced into the analysis to assess whether RCEP boosts China's high-tech industry exports by enhancing property rights protection. A two-stage model strategy is adopted.

4.1.1. Stage one: impact of RCEP on property rights protection level

The following regression is estimated to assess the effect of RCEP (did) on the property rights protection score (IPRI_{score}) of member countries:

$$IPRI_{scoreit} = \alpha + \beta \cdot didit + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

Here, $IPRI_{scoreit}$ denotes the level of property rights protection in country i in year t ; $didit$ is the difference-in-differences treatment effect (RCEP member country $\times$ post-entry-into-force period); X_{it} represents control variables consistent with those in the baseline regression; μ_i and λ_t are country and year fixed effects; ε_{it} is the random disturbance term. A positive and statistically significant β indicates that RCEP has, in the short run, significantly promoted the level of property rights protection in member countries.

The estimated coefficient of did is 0.155 and passes the 5% significance level test ($p < 0.05$). This implies that, within the scope of the sample, after RCEP entered into force, the average level of property rights protection in the member countries experienced a significant improvement — that is, RCEP has indeed played a positive role in strengthening the intellectual property protection environment within the region.

4.1.2. Stage two: interaction effect of “RCEP $\times$ property rights protection” on high-tech industry exports

Given that Stage One finds RCEP significantly enhances the property rights protection environment in member countries, we further test whether this improvement, when combined with RCEP, promotes China's high-tech industry exports. The specific model is:

$$\ln export_{it} = \alpha + \theta \cdot (did \times IPRI_{score})_{it} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (4)$$

Here, $(did \times IPRI_{score})_{it}$ is an interaction term between the DID variable and the level of property rights protection, used to identify the effect on China's high-tech industry exports under the joint influence of “RCEP implementation” and “improved property rights protection.” A positive and significant θ implies that strengthening intellectual property protection can enhance the promoting effect of RCEP on high-tech exports.

Table 3. Impact of RCEP on property rights protection level in member countries and the interaction effect on high-tech exports

VARIABLES	IPRIscore	lnexport
did	0.155** (0.0770)	
didIPRIscore		0.0219** (0.00944)
Constant	26.18*** (5.672)	13.66*** (4.352)
Control	YES	YES
Time FE	YES	YES
Country FE	YES	YES
N	1283	1283
R ²	0.996	0.993

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; robust standard errors clustered at the country level are in parentheses.

The coefficient of the interaction term is 0.0219 and is positive at the 5% significance level ($p < 0.05$), indicating that the improvement in property rights protection brought about by RCEP has a significant positive transmission effect on China's high-tech industry exports: as the property rights protection level in member countries increases, China's high-tech exports gain more under the RCEP framework. This suggests that the enhanced intellectual property protection environment works in tandem with RCEP's trade and investment facilitation measures, thereby promoting more effective entry of high-tech products into international markets. At the same time, $\ln \text{ictexport}$ in this specification also exhibits a significant positive effect, further supporting the earlier conclusion of strong complementarity between the high-tech industry and the ICT industry.

4.2. Heterogeneity analysis

To examine sectoral heterogeneity, the study divides China's hightech industry into nine subsectors and runs separate regressions. Results show that RCEP's impact varies notably: its promotion effect is strongest in life sciences and computerintegrated manufacturing, while optoelectronics and communications experience weak or even negative effects.

ICT exports consistently display a significant positive influence in most sectors, highlighting their key driving role. Some macro variables, such as partner GDP and population, also matter, reflecting market and cost conditions. Overall, these results suggest that policy measures should consider industry differences, strengthening support for sectors with strong gains and designing tailored strategies for less responsive ones.

5. Main findings and policy implications

5.1. Main findings

Using the entry into force of RCEP in 2022 as a natural experiment and panel data from 2011–2023, the study applies a DID model with multiple robustness checks. Results show that RCEP significantly boosted China's hightech exports to member countries, with ICTrelated trade exerting a strong complementary effect.

Mechanism analysis reveals that RCEP enhanced member countries' property rights protection, which in turn strengthened China's hightech export growth. Heterogeneity analysis indicates notable gains in life sciences and computerintegrated manufacturing, but limited or negative effects in optoelectronics, aerospace, and communications.

5.2. Policy implications

For sectors showing strong benefits — such as life sciences and computerintegrated manufacturing — policies should focus on increasing R&D, streamlining approvals, and encouraging use of RCEP's rules of origin to expand market presence. For weaker sectors — including optoelectronics, aerospace, and communications — targeted strategies such as innovation subsidies, service platforms, and market diversification are needed.

Crosssector integration of ICT and hightech industries should be promoted, alongside stronger regional intellectual property cooperation to safeguard firms abroad. Trade facilitation measures like simplified customs, faster clearance, and participation in RCEP supply chain restructuring can further enhance competitiveness.

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