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The Impact of Regional Digital Trade Rules on Global Value Chains

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Abstract: Based on bilateral trade data from 62 exporting and importing countries (regions) between 2007 and 2021, this study employs the ADB database to measure the global value chain (GVC) participation of exporting countries (regions) and the TAPED database to calculate the depth index of digital trade rules. It explores the mechanisms through which regional digital trade rules influence GVC participation. The findings are as follows: First, digital trade rules in regional trade agreements (RTA) significantly enhance the GVC participation of exporting countries (regions). Second, heterogeneity analysis reveals two key insights: (1) From the perspective of different types of digital trade rules, the depth indices of e-commerce clauses, data flow clauses, new data clauses, cross-cutting issues clauses, and digital intellectual property clauses all promote GVC participation among signatory countries (regions), with new data clauses having the most pronounced effect. (2) From the perspective of heterogeneity in country-pair types among RTA signatories, deeper digital trade rules in RTAs between developing-developing country pairs and developed-developed country pairs positively promote GVC participation of exporting countries (regions). Therefore, exploring the impact of regional digital trade rules on global value chain (GVC) participation holds significant theoretical and practical importance for China in formulating digital trade policies and enhancing its position within the global value chain.

Keywords: Regional Trade Agreements; Digital Trade Rules; GVC Participation

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1.Introduction

The rapid advancement of digital technologies is reshaping the global economic landscape. As an emerging form of trade, digital trade has become a crucial engine driving global economic growth. Against this backdrop, digital trade rules within Regional Trade Agreements (hereinafter referred to as “RTAs”) have emerged and gradually become essential tools for countries to formulate digital trade policies and participate in global digital governance. By the end of 2024, the number of RTAs in force globally has reached 374, with their digital trade rules covering various domains such as e-commerce, data-specific provisions, new data economy issues, cross-cutting issues between e-commerce and data-specific regulations, and intellectual property rights. Global Value Chains (GVC), as the primary form of international division of labor, directly influence a country’s income distribution and industrial competitiveness in international trade.

In recent years, regional digital trade rules have witnessed vigorous development. From the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) to the Regional Comprehensive Economic Partnership (RCEP) and the

Digital Economy Partnership Agreement (DEPA), the content of digital trade rules has been continuously deepening, while their scope of coverage has been expanding. These rules not only address traditional issues such as cross-border data flows, electronic signatures, and consumer protection but also encompass emerging areas like artificial intelligence and digital currencies. This evolution has provided institutional safeguards for the healthy development of digital trade.

GVC participation serves as a critical indicator of a country's depth and breadth of involvement in international division of labor. With the widespread adoption and application of digital technologies, GVC is undergoing a digital transformation, wherein digital trade has become a pivotal link connecting various segments of global value chains. Digital trade rules exert a profound influence on GVC participation through several mechanisms, including the reduction of transaction costs and digital trade barriers, enhancement of transaction efficiency, and facilitation of knowledge and technology spillovers.

2.Research Design

2.1 Model Design

Based on the basic specification of the trade gravity model, this paper selects control variables by drawing on the approaches of Donglin Li and Chunding Li (2024), as well as Yuhong Sun (2022). To examine the impact of digital trade rules on global value - chain participation, the following econometric model is specified in this paper:

$$Lngvc_{ijt}=\beta_0+\beta_1 Index\_total_{ijt}+\beta_2 Lngdp_{ijt}+\beta_3 Ec\_fr_{ijt}+\beta_4 Dist\_w_{ijt}+\beta_5 Pgdp_{ijt}+\beta_6 Free_{ijt}+\beta_7 Gdpsim_{ijt}+\lambda_{ij}+\lambda_{it+}\lambda_{jt}+\varepsilon_{ijt}$$

Among them, i, j, and t represent the exporting country (region), importing country (region), and time respectively. $Lngvc_{ijt}$ is the explained variable, representing the global value chain participation index; $Index\_total_{ijt}$ is the explanatory variable, used to measure the depth index of RTA digital trade rules; $Lngdp_{ijt}$, Ec_fr_{ijt}, $Dist\_w_{ijt}$, $Pgdp_{ijt}$, $Free_{ijt}$, $Gdpsim_{ijt}$ are a series of control variables, representing the differences in economic scale, economic freedom, geographical distance, factor endowment, trade openness, and economic similarity between the exporting country (region) and the importing country (region) in period t respectively. The data sources are the WDI database, The Heritage Foundation, the CEPII database, the CEPII database, the WDI database, and the WDI database respectively; λ_{ij}、λ_{jt}、λ_{it} are fixed effects, including country - pair fixed effects and country - time fixed effects; ε_{ijt} is the random disturbance term.

2.2 Data Sources

2.1.1 Explained variable (Lngvc)

The global value chain participation index calculated by the method of Borin and Mancini (2019) and based on the ADB database is selected, and a logarithmic transformation is performed. The explained variable in this paper is the sum of the forward participation and backward participation decomposed from the bilateral export volume of 62 countries (regions) globally from 2007 to 2021, that is, the total global value chain participation. It is sourced from the Asian Development Bank (ADB) database.

2.1.2 Explanatory variable (Index_total)

The explanatory variable in this paper is the depth index of digital trade rules calculated based on the RTAs signed by countries (regions) around the world from 2007 to 2021. The data is sourced from the TAPED database. The measurement method draws on the approach of Jiang Gao and Bin Sheng (2018), which standardizes the depth of each clause in regional trade agreements to analyze the position of the integration degree of the digital trade rule depth of the agreement in the overall sample.

Table 1 Descriptive Statistics

Variable	Meaning	Obs	Mean	Std. Dev.	Min	Max
Lngvc	global value chain participation index	56730	4.535	2.811	0	12.037
Index_total	the depth index of RTA digital trade rules	56730	0.131	0.229	0	1
Lngdp	economic scale	55278	2.287	1.685	0	9.401
Ec_fr	economic freedom	56730	15.245	17.121	0	90.2
Dist_w	geographical distance	56730	6110.166	4293.834	55	18312
Pgdp	factor endowment	55278	28.72	28.178	0.002	193.414
Free	trade openness	55278	14.092	43.955	0	524.706
Gdpsim	economic similarity	55278	0.118	0.087	0	0.25

According to the descriptive statistics of each variable in Table 1, it can be seen that there are a total of 56,730 observations for the core variables in the sample data. The average value of the global value chain participation (Lngvc) is 4.535, and the standard deviation is 2.811. There is a certain degree of difference in the global value chain participation of various countries. Moreover, the minimum value is 0 and the maximum value is 12.037, indicating that in the research sample, the global value chain participation of some countries (regions) is relatively high. The average value of the digital trade rule depth index (Index_total) is 0.131, and the standard deviation is 0.229. Among the RTAs signed by countries (regions), the emphasis on digital trade rules varies. The maximum value of the digital trade rule depth index is 1, while the average value is 0.131, indicating that the depth of most RTA digital trade rules still remains at a relatively low level.

3.Empirical Test

3.1 Baseline Regression

Table 2 presents the regression results of the depth index of digital trade rules on the global value chain participation. From the regression results, it can be seen that at the 1% significance level, the coefficient of the depth index of digital trade rules is 0.1454. The depth index of digital trade rules can significantly affect the global value chain participation of the signatory countries (regions) and has a positive promoting effect. The main reason for this is that the digital trade rules in RTAs can effectively reduce transaction costs, simplify the trading process, and lower trade barriers. As a result, they promote more frequent trade exchanges among countries (regions) and enhance their own global value chain participation.

Table 2 Results of the Baseline Regression

	(1)	(2)
VARIABLES	**lngvc**	**lngvc**
Index_total	0.1454***	0.1347***
	(0.0280)	(0.0281)
Lngdp		-0.2602***
		(0.0217)
Economic_freedom		0.0001
		(0.0007)
Dist_w		0.0013***
		(0.0005)
Pgdp		-0.0018***
		(0.0006)
Free		-0.0000
		(0.0002)
Gdpsim		-2.6360***
		(0.3064)
Constant	4.5161***	-2.1318
	(0.0040)	(2.8705)
Observations	55,278	55,278
Adjusted R-squared	0.979	0.979
ij FE	YES	YES
it FE	YES	YES
jt FE	YES	YES

Robust standard errors in parentheses：*** p<0.01, ** p<0.05, * p<0.1

The same applies to the following tables.

3.2 Robustness Test

According to the results of the baseline regression, it can be preliminarily determined that the depth of digital trade rules

has a promoting effect on global value chain participation. To ensure the robustness of the results, this paper will conduct robustness tests from three aspects: replacing the explanatory variables, dividing the research sample period, and performing endogeneity tests.

3.2.1 Replace the explanatory variables

The scoring method for digital trade rules remains the same as before, but the calculation method for the digital trade rule depth index has changed. The depth (di) represents the degree of legal protection that the digital trade rules covered by the RTA receive during the implementation process (Hofmann et al., 2017). This paper draws on the method of Yu Peng et al. (2021) and constructs the total RTA digital trade rule depth index by using the ratio of the total score of digital trade provisions in RTAs signed by a country to the number of provisions. The specific calculation formula is as follows:

$di_{it}=depth_{it}/n_{it}$

According to the regression results of the robustness test in Table 3, the depth index of digital trade rules can still promote the participation of the signatory countries (regions) in the global value chain. Meanwhile, it indirectly indicates that changing the measurement method of the digital trade rule depth index has not altered the conclusion of the baseline regression, reflecting the robustness of the regression results.

Table 3 Robustness Test I

	(1)	(2)
VARIABLES	**ln1gvc**	**ln1gvc**
Di_total	0.1768***	0.1592***
	(0.0352)	(0.0354)
Lngdp		-0.2597***
		(0.0217)
Economic_freedom		0.0001
		(0.0007)
Distw		0.0013***
		(0.0005)
Pgdp		-0.0018***
		(0.0006)
Free		-0.0000
		(0.0002)
Gdpsim		-2.6295***
		(0.3065)
Constant	4.5166***	-2.2179
	(0.0041)	(2.8698)
Observations	56,730	55,278
Adjusted R-squared	0.979	0.979
ij FE	YES	YES
it FE	YES	YES
jt FE	YES	YES

3.2.2 Divide the research sample interval

After countries (regions) sign RTAs, there is an obvious time - lag in the effectiveness. That is, the signed RTAs cannot have an effective impact on the local trade in the year of entry into force, and the obvious effects can only be seen in subsequent

years. To improve the utilization rate of the research sample, this paper draws on the method of Lin Xi et al. (2018) and divides the research interval with a two - year gap. That is, the research years are 2007, 2009, 2011, 2013, 2015, 2017, 2019, and 2021. The data for the above years are re - regressed, and the regression results are shown in Table 4.

As can be seen from Table 4, this testing method also produces results similar to those of the baseline regression. Moreover, when dividing the research sample interval, the magnitude of the regression coefficient of the explanatory variable even increases. This indicates that the way of dividing the research sample interval can also reflect the promoting effect of the digital trade rule depth index on the global value chain participation of the signatory countries (regions), which proves the robustness of the baseline regression results.

Table 4 Robustness Test II

	(1)	(2)
VARIABLES	**lngvc**	**lngvc**
Index_total	0.1849***	0.1682***
	(0.0375)	(0.0378)
Lngdp		-0.2703***
		(0.0295)
Economic_freedom		0.0001
		(0.0009)
Dist_w		0.0010
		(0.0007)
Pgdp		-0.0017**
		(0.0009)
Free		0.0002
		(0.0003)
Gdpsim		-2.8353***
		(0.4129)
Constant	4.5213***	-0.7435
	(0.0054)	(4.5070)
Observations	30,256	29,532
Adjusted R-squared	0.978	0.978
ij FE	YES	YES
it FE	YES	YES
jt FE	YES	YES

3.2.3 Endogeneity test

Although the use of joint fixed effects of economies and economy-year fixed effects in the previous text can address the endogeneity problem to a certain extent, there still exists the issue of reverse causality in the study of the impact of the depth of digital trade rules on global value chain participation. This paper will solve the endogeneity problem from the following two aspects.

First, in order to deal with the reverse causality, this paper follows the approach of Xi Lin and Xiaohua Bao (2018). It removes the depth index of digital trade rules in bilateral RTAs while retaining the depth index of digital trade rules in multilateral RTAs, and then conducts a re-regression after merging the data. The reason for this is that the data on global value chain participation decomposed from bilateral trade will affect bilateral RTAs, but has a relatively small impact on

multilateral RTAs. The results of the re-regression are shown in Table 5. After removing the depth index of digital trade rules in bilateral RTAs, the original regression results have not undergone any substantial changes. Moreover, compared with the coefficient of the digital trade rule depth index in Table 2, this regression coefficient is larger, indicating that the depth of digital trade rules in multilateral RTAs has a more significant impact on global value chain participation.

Table 5 Endogeneity Test I

	(1)	(2)
VARIABLES	**lngvc**	**lngvc**
Index_total	0.3256***	0.3085***
	(0.0466)	(0.0466)
Lngdp		-0.3474***
		(0.0549)
Economic_freedom		-0.0022
		(0.0014)
Dist_w		0.0006
		(0.0010)
Pgdp		-0.0025**
		(0.0011)
Free		-0.0014
		(0.0018)
Gdpsim		-3.9710***
		(0.7316)
Constant	5.6358***	4.7106
	(0.0159)	(3.4345)
Observations	21,690	21,482
Adjusted R-squared	0.977	0.978
ij FE	YES	YES
it FE	YES	YES
jt FE	YES	YES

Second, introduce instrumental variables to alleviate the endogeneity problem. Referring to the widely recognized approach in the academic community, this paper takes the average value of the depth indices of digital trade rules among all pairs of countries other than a specific country as the instrumental variable. The specific calculation formula is as follows:

$Index\_total_{ijt}^{iv}=\sum_{k\neq i} index\_total_{kjt} / N_{kjt}$

$Index\_total_{ijt}^{iv}$ refers to the instrumental variable,

$\sum_{k\neq i} index\_total_{kjt}$ represents the sum of the depth indices of digital trade rules for all country pairs other than country i in year t, and N_{kjt} refers to the number of pairs of all other countries except country i in the same year. The results of the two-stage regression using the instrumental variable method are shown in Table 6. According to the regression results of the first stage,

it can be seen that the correlation between the selected instrumental variable and the core explanatory variable is significant. The regression results of the second stage are significantly positive at the 1% statistical level, which is consistent with the results of the baseline regression, proving the robustness of the results.

Table 6 Endogeneity Test II

	The first stage	The second stage
VARIABLES	**index_total**	**lngvc**
index_total		4.3960***
		(0.2362)
iv	-1,890.0004***	
	(0.0008)	
lngdp	0.0000	-0.1533***
	(0.0000)	(0.0155)
Economic_freedom	-0.0000**	-0.0052***
	(0.0000)	(0.0007)
Dist_w	0.0000***	0.0000
	(0.0000)	(0.0000)
pgdp	0.0000	0.0011**
	(0.0000)	(0.0004)
free	0.0000	-0.0143***
	(0.0000)	(0.0004)
gdpsim	-0.0000**	3.5334***
	(0.0000)	(0.3114)
Constant	246.8875***	4.1739***
	(0.0001)	(0.1150)
Observations	55,278	55,278
Adjusted R-squared	1.000	0.212
ij FE	YES	YES
it FE	YES	YES
jt FE	YES	YES

4.Conclusion and Implications

This paper is based on the bilateral trade data of 62 exporting countries (regions) and importing countries (regions) from 2007 to 2021. It measures the global value chain participation of exporting countries (regions) using the ADB database, calculates the depth index of digital trade rules through the TAPED database, explores the mechanism of interaction between regional digital trade rules and global value chain participation, and conducts robustness tests, endogeneity tests and index replacements. The research conclusions are as follows: First, the digital trade rules in regional trade agreements can significantly promote the improvement of the global value chain participation of exporting countries (regions). Second, from the perspective of heterogeneity, it can be divided into two categories: (1) from the perspective of different types of digital

trade rules, the depth indices of five types of digital trade rules, namely e-commerce provisions, data flow provisions, new data provisions, cross-cutting issue provisions and digital intellectual property provisions, can all promote the global value chain participation of signatory countries (regions) at the 1% significance level. Among them, the new data provisions have the most obvious promoting effect. (2) from the perspective of the heterogeneity of the types of country pairs among RTA signatory countries (regions), for the types of country pairs between developing countries-developing countries and developed countries-developed countries, the deeper the digital trade rules involved in the RTAs they sign, the more it can promote the global value chain participation of exporting countries (regions). However, the digital trade rules in RTAs signed by the type of country pairs between developed countries and developing countries have a negative impact on the global value chain participation of exporting countries (regions).

At present, the international situation is complex and trade exchanges among countries are frequent. Promoting the construction of a digital trade rule system has become the core content of the new international trade rules. As the second largest economy in the world, China occupies an important position in global digital trade. In the process of moving towards a powerful digital trade country, under the multilateral and regional frameworks such as the WTO, RCEP and CPTPP, China should actively participate in digital trade rule negotiations, enhance its international discourse power in digital governance, and promote the construction of an open, inclusive and inclusive digital trade rule system. In the process of formulating digital trade rules, fully consider the interests and demands of developing countries. Under multilateral frameworks such as the United Nations and the G20, promote the establishment of digital cooperation platforms, and facilitate exchanges and cooperation among countries in the fields of digital technology and digital trade, so as to promote the construction of a more fair and reasonable international digital trade order.

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