The Impact and Mechanism of Trade Rules on Digital Services Trade Competitiveness: An Empirical Analysis Based on Regional Trade Agreements

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Abstract: *Drawing upon data from regional trade agreements involving 131 countries and their partner nations between 2005 and 2023, this empirical study examines how the breadth and depth of digital trade rules within regional trade agreements influence a country's competitiveness in digital services trade. Employing a two-way fixed effects model, the study uses the digital services trade competitiveness index as the dependent variable, with the breadth and depth of digital trade rules as core explanatory variables, while controlling for factors such as economic development levels and national characteristics. Results indicate that both the breadth and depth of digital trade rules significantly enhance digital services trade competitiveness, a conclusion validated through robustness tests and endogeneity treatment. Mechanism analysis reveals that digital trade rules enhance competitiveness through two pathways: reducing institutional distance and lowering data flow costs. Based on these findings, China should actively participate in and lead the development of digital trade rules, promote the implementation of high-standard provisions, and narrow institutional gaps with partner countries through regional trade agreements to enhance its international competitiveness in digital services trade.*

Keywords: Trade rules, Digital services trade competitiveness, Institutional distance.

1. Introduction

As a vital vehicle for internationalisation and outward-oriented economies, digital trade constitutes both a cornerstone of the digital economy and a core driver propelling China towards becoming a trade powerhouse. With revolutionary advances in digital technologies reshaping international trade structures, digital services trade — emerging as a new trade form following goods and services trade—exerts increasingly profound influence on the global economic landscape. Statistics from the World Trade Organisation reveal that global exports of digital services reached US$4.25 trillion in 2023, accounting for 54.3% of total global service trade exports. This figure clearly demonstrates the remarkable growth momentum and economic influence of global digital services trade, further confirming its pivotal role within the international trading system.

Digital trade has profoundly transformed the methods and substance of traditional trade, while also systematically restructuring the global value chain division of labour. In response to the rapid expansion of digital trade, the global digital economic and trade rules framework is undergoing swift evolution, presenting a complex landscape where multilateral, regional and bilateral rules coexist and interlock. However, current global negotiations on digital trade rules face numerous challenges. Differences among nations in digital development levels, governance philosophies and policy objectives have hindered consensus on critical issues such as cross-border data flows, digital intellectual property rights and platform responsibilities. Against this backdrop, an increasing number of nations are actively advancing digital trade rules through bilateral or regional trade agreements to compensate for shortcomings in multilateral institutional provision. Such regional trade agreements not only offer stability and predictability for digital trade at the institutional level but also vigorously promote the development of global digital trade practices, underscoring the critical institutional support role of the rules system for digital trade. It is noteworthy that, owing to significant disparities among economies in digital technology foundations, industrial competitiveness, and regulatory traditions, while progress on digital trade rules remains sluggish at the multilateral level, they are flourishing within regional trade agreements. By the first half of 2023, over 130 bilateral or regional free trade agreements and dedicated digital trade agreements incorporating digital trade provisions had been signed globally.

Therefore, this study, starting from the institutional design of digital trade rules within regional trade agreements, systematically examines their mechanisms of influence and empirical effects on the competitiveness of digital services trade. This not only contributes to expanding the theoretical framework of global digital governance but also serves as an active academic response and theoretical exploration to China's strategic orientation of "establishing a new system for a higher-level open economy." Furthermore, it provides theoretical underpinnings and policy references for China's efforts in constructing digital trade rules and enhancing competitiveness, thereby tangibly serving the strategic goal of "building a trade powerhouse."

2. Literature Review

2.1 Digital Trade Rules

Given divergent developmental needs among nations, a unified consensus on a multilateral digital trade rules system under the World Trade Organisation (WTO) framework remains elusive. Against this backdrop, digital trade

provisions within regional trade agreements have emerged as a core component of international digital economic cooperation and governance implementation in the current digital trade governance process (Han Jian et al., 2019). Existing research not only examines the overall framework of these rules but also delves into their specific components. Yang Lianxing et al. (2023), adopting a more macro-level perspective on the rule architecture, found that trade agreement conclusion, overall deepening, horizontal deepening, and vertical deepening can all promote digital trade. Dai Zhongqiang and Sun Quangang (2024) quantified the depth of intellectual property protection within FTAs to analyse the quality of countries' exported products. They found that the quality of a country's exports is influenced by the depth of rules, and that this depth can significantly enhance the quality of exports from North-North and South-North countries, depending on the country type and product category. Building upon this, scholars further examined whether the effects of single rules can satisfy both trading parties. In this regard, Liu Bin et al. (2021) analysed the impact of regulatory convergence on digital trade, finding that rules meeting the requirements of both trading parties can better promote digital trade development. Moreover, the "template" standards of different countries vary, yielding differing outcomes.

2.2 Research on Digital Services Trade

As digital trade continues to evolve, its scope and depth are expanding. Digital trade represents an innovative evolution of traditional trade in the digital economy era, establishing a new commercial paradigm through modern information networks. Utilising advanced information and communication technologies, it facilitates the efficient circulation and interaction of physical goods, digital products and services, and diverse knowledge resources. This transformation not only accelerates the deep transition from consumer internet to industrial internet but also serves as a key engine driving the intelligent development of manufacturing. Xiong Hongru et al. (2021) identified several pressing challenges currently confronting the digital trade sector: a lack of unified, consensus-based rules governing cross-border data flows; significant disputes over the taxation and administration of digital products and services; divergent national stances on the localisation of data storage (including related infrastructure); and the absence of consensus on classification standards and market access conditions for cloud computing services. there are numerous demands for enhanced protection of digital intellectual property rights; and the supporting regulatory framework for trade facilitation remains insufficiently clear. With the vigorous rise of digital trade, numerous countries and regions will inevitably engage with greater enthusiasm in establishing a digital trade rules system (Chen Weitao and Zhu Shiying, 2019). Compared to traditional services trade, spatial and geographical constraints on digital services trade are gradually diminishing. However, emerging technological innovations and evolving business models present new complex challenges to its development. As a trade form highly dependent on regulatory frameworks, the international regulatory structure for digital services trade is regarded as a key factor shaping its developmental trajectory.

2.3 Research on Digital Trade Rules in the Context of Digital Services Trade

From the perspectives of gross value and value added, Lin Xi and Bao Xiaohua (2018) utilised the WTO's Regional Services Trade Agreements database to construct trade indicators. Their analysis revealed that regional services trade agreements promote both gross value and value-added exports. For both trading parties, the impact of such agreements on partner countries exceeds that on the home country. Countries holding dominant positions in trade agreement negotiations generally experience faster subsequent export growth than other signatories (Seiermann, 2018). Conversely, implementing data restriction policies hinders digital services exports (Ferracane & Marel, 2019). Empirical findings indicate that digital trade rules (particularly provisions on e-commerce and data flows) significantly enhance trade flows in ICT goods (Sun, Yu-Hong et al., 2022). Similarly, deepening regional digital rules substantially boosts digital services exports, with this effect being more pronounced in high-income countries (Peng, Yu et al., 2021; Tao, Ai-Ping and Zhang, Zhen, 2022).

2.4 Literature Review

A review of existing literature indicates that current research on digital trade rules primarily focuses on measurement methodologies and bilateral analyses of their impact on trade value-added and trade effects. Furthermore, studies examining the implications of digital trade rules predominantly adopt depth-based analytical approaches. Secondly, while existing research on digital services trade has thoroughly explored both intrinsic and extrinsic determinants, it predominantly concentrates on the single dimension of exports, with limited attention paid to the competitiveness of digital services themselves.

Against this backdrop, this paper utilises data from 2005 to 2023 on regional digital trade rule agreements between countries and their partner nations to analyse their impact on digital services trade competitiveness and the underlying mechanisms. Compared with existing research, this paper makes three principal contributions: Firstly, whereas prior studies predominantly analyse depth as a singular dimension, this paper incorporates both breadth and depth into its analytical framework. It constructs a more comprehensive digital trade rules analysis system and empirically validates the significant promotional effects of both dimensions on digital services trade competitiveness, thereby addressing gaps in existing literature concerning competitiveness dimensions. Second, prior studies on the impact of digital trade rules predominantly focus on their effects on bilateral trade flows (such as ICT product trade volumes or value-added in services trade), without sufficiently exploring how they shape a nation's core competitiveness in digital services trade. This paper elevates the analytical perspective from the bilateral to the national level, examining how digital trade rules enhance the overall international competitiveness of a country's digital services sector through means such as optimising the institutional environment. Third, this paper not only verifies the direct promotional effect of digital trade rules on services trade competitiveness but also identifies cost effects through mechanism testing, providing new theoretical

perspectives and empirical evidence for understanding how digital trade rules enhance competitiveness.

3. Mechanistic Hypotheses

3.1 Direct Effects

1) Digital trade rules within regional trade agreements establish a more predictable, efficient, and secure business environment for digital services trade by enhancing the completeness and enforceability of institutional frameworks. The "breadth" of these rules constitutes a crucial dimension for advancing trade facilitation and competitiveness. This breadth manifests as the diversification of covered provisions, such as simultaneously incorporating clauses on e-commerce, data flows, intellectual property, and emerging issues. This creates a comprehensive, tightly interconnected network of rules that systematically addresses institutional barriers across all stages of digital trade. Digital services trade exhibits multi-faceted, cross-sectoral complexity, with cross-border data flows being a central negotiation issue (Fefer, 2019). Regulating e-commerce while neglecting data governance, or emphasising data flows without adequate intellectual property protection, would create regulatory vacuums. Such gaps heighten policy uncertainty and impede trade development. Expanding the scope of rules entails comprehensive coverage across market access (e-commerce provisions), movement of key production factors (data-related provisions), innovation incentives (digital intellectual property provisions), and future-oriented institutional frameworks (emerging issues provisions). This provides clear, consistent guidance for enterprises conducting cross-border operations along the value chain, significantly reducing policy risks and compliance costs arising from rule gaps or fragmentation. Furthermore, broadening the scope enhances synergies between different provisions. Stringent intellectual property protection provisions safeguard digital content security during data flows, further fortifying overall transaction reliability. Market access provisions directly lower cross-border operational barriers, complementing trade facilitation measures to enhance customs clearance and delivery efficiency. Such complementary arrangements collectively shape a stable, trustworthy digital trade ecosystem, bolstering overall competitiveness.

Rule depth fosters a high-quality business environment for digital trade by strengthening obligations and enforcement mechanisms, thereby incentivising innovation and promoting long-term investment. Unlike shallow rules confined to declarations of principle (such as "recognising the importance of data flows" or "encouraging cooperation"), deep rules manifest as concrete, verifiable commitments. For instance, within data provisions, rules evolve from the general "should provide appropriate protection" to the specific "accession to and implementation of the WIPO Copyright Treaty," alongside "establishing clear statutory damages standards and robust criminal liability measures." Such in-depth provisions significantly reduce costs and uncertainties for enterprises in rights enforcement, while effectively deterring infringements. This, in turn, incentivises increased R&D investment, fostering sustainable competitive advantages. Moreover, deep rules typically incorporate regulatory transparency mechanisms (such as requiring advance publication of draft regulations and soliciting public comment) alongside binding dispute resolution procedures. This substantially curtails the scope for host governments to arbitrarily adjust policies or erect hidden non-tariff barriers. As Rachel (2019) observes, digital intellectual property infringement itself constitutes a non-tariff barrier within digital trade. Strengthening digital IP protection not only curbs imitation by other nations but also reduces exporters' costs in preventing infringement and pursuing post-incident redress, thereby encouraging more proactive expansion of export scale. At the enterprise level, enhanced policy predictability encourages firms to undertake long-term, strategic asset investments (such as establishing regional R&D centres or data hubs) rather than merely engaging in tentative, short-term exports. This long-term investment behaviour, underpinned by institutional trust, constitutes the very foundation for building a nation's core competitiveness in digital services trade.

Hypothesis 1a: The broader the scope of digital trade rules signed within regional trade agreements, the more pronounced the enhancement of digital services trade competitiveness;

Hypothesis 1b: The greater the depth of digital trade rules adopted in regional trade agreements, the more pronounced the enhancement of digital services trade competitiveness;

3.2 Indirect Effects

Data Flow Costs: Trade costs constitute both the foundational prerequisite for the existence of global value chains and a key factor shaping a nation's comparative advantage (Zeng et al., 2021). Within this framework, regional trade agreements (RTAs) serve as pivotal institutional arrangements for reducing trade costs. Their digital trade rules systematically lower the aggregate costs of cross-border operations for enterprises and enhance international competitiveness. This not only alleviates member states' concerns regarding traditional tariff distortions but also effectively unlocks the potential for cooperation within digital value chains. Specifically: Firstly, specific rules such as easing restrictions on cross-border data flows and promoting paperless trade significantly reduce information search and contract enforcement costs, thereby optimising cooperation processes and enhancing resource allocation efficiency (Sun, et al., 2021).Second, deepening and strengthening intellectual property rules accelerates the dissemination and application of digital technologies, overcomes geographical constraints on cooperation, and reduces transnational communication costs. This enables participants to leverage their comparative advantages for deeper synergy and specialisation within digital value chains. Moreover, provisions such as duty-free electronic transmission and non-discriminatory treatment of digital products substantially reduce the institutional costs of cross-border data flows, facilitating the global circulation of R&D factors and knowledge spillovers (Liu Bin and Zhen Yang, 2022). This not only enhances the economic viability and convenience for enterprises to access global digital resources but also lowers overall operational costs by optimising the global allocation of factors. In summary, high-quality digital trade rules systematically reduce the institutional and transaction costs of bilateral digital trade, thereby establishing significant efficiency and price

advantages for domestic digital service providers. Simultaneously, they free up strategic resources for innovation and industrial upgrading, becoming a crucial driver for the sustained enhancement of international competitiveness.

Hypothesis 2: The inclusion of digital trade rules in regional trade agreements can reduce data flow costs, thereby promoting a nation's competitiveness in digital services trade.

4. Empirical Model Design

4.1 Model Specification

Drawing upon the model specification methodology of Sun Yuhong et al. (2022), the following model is established:

$$TC = \beta_0 + \beta_1 RTA_{ijt} + \beta_2 Z_{ijt} + \mu_i + \lambda_j + \delta_t + \varepsilon_{ijt} \quad (1)$$

Where subscripts i, j, and t denote the exporting country, partner country, and year respectively; RTA_{ijt} represents the digital trade rules — encompassing depth and breadth — included in the regional trade agreement signed between country i and country j in year t. Z denotes the set of control variables, where μ_i and λ_j represent the fixed effects for the exporting country and partner country respectively, and δ_t denotes the time fixed effect. β_0 is the intercept term, and ε_{ijt} is the random error term.

4.2 Variable Selection and Data Sources

1) Dependent Variable

This study adopts the Digital Services Trade Competitiveness (TC) Index as the dependent variable, which effectively measures a country's overall competitive position and comparative advantage in digital services trade. The TC Index is calculated as the ratio of a country's digital services trade surplus to its total trade value, expressed as:

$$TC = \frac{\text{Digital service trade export} - \text{Import of digital service trade}}{\text{Digital service trade export} + \text{Import of digital service trade}} \quad (2)$$

Ricardian comparative advantage theory emphasises that a nation should specialise in producing and exporting goods where it possesses relative efficiency. The TC index effectively captures a country's relative efficiency and competitive edge in digital services through net export values. This index aligns with Porter's definition of international industrial competitiveness within his theory of national competitive advantage, namely a nation's capacity for profitability and market share acquisition in global markets. Moreover, the TC Index not only reflects static competitiveness; its time-series variations can also be utilised to analyse the dynamic evolution of a nation's digital services competitiveness.

2) Core Explanatory Variable

The core explanatory variable in this study is the level of digital trade rules, measured across two dimensions: breadth and depth, both assessed using cumulative levels. Rule breadth refers to the diversity of digital trade provisions covered by regional trade agreements (RTAs) (Hofmann et al., 2017). To quantify this indicator, following Liang Junwei et al.

(2024), this study employs a clause list comprising 124 specific rules to assess each RTA signed and entered into force by a country on a clause-by-clause basis: a score of 1 is assigned if a rule is covered by the agreement, and 0 otherwise. The final score is obtained by summing all individual scores, representing the total breadth of a country's digital trade rules and reflecting the comprehensiveness and scope of its rule coverage.

$$Breadth_{it} = num(provision_{it}^k) \quad (3)$$

Rule depth measures the degree of legal enforcement safeguards for digital trade rules covered by regional trade agreements (RTAs) (Hofmann et al., 2017). Drawing upon the methodologies of Peng et al. (2021) and Liang et al. (2024), this study assigns graded scores to each digital trade provision based on the strength of its legal binding force. The specific steps are as follows: First, if a provision is incorporated into a trade agreement, it is assigned 1 point; otherwise, 0 points. Second, for provisions already incorporated, if the agreement explicitly states binding obligations, an additional 2 points are awarded. Finally, the total score for all digital trade provisions in a country's RTAs is aggregated and divided by the total number of provisions to construct the country's overall digital trade rules depth index and heterogeneity index. The specific calculation formula is as follows:

$$di_{it} = \frac{depth_{it}}{n_{it}} \quad (4)$$

Where two countries have concluded multiple regional trade agreements, the maximum depth of digital trade rules from among the agreements in force is selected. Data on RTA digital trade rules is sourced from the TAPED database developed by the University of Lucerne.

3) Control Variables

First, the economic development level variable is measured using the logarithmic difference of GDP between the exporting country and its trading partner (lnGDP) and the logarithmic difference of per capita GDP (lnagdp). Based on the gravity model, the total GDP of both countries directly reflects the absolute market size, which significantly influences trade flows and structure. Where the per capita GDP disparity between two countries is substantial (large absolute value of lnGDP), trade between them is likely more grounded in comparative advantage (Heckscher-Ohlin model). This implies developed nations export capital / technology-intensive goods, while developing nations export labour/resource-intensive goods (inter-industry trade). Secondly, the proportion of domestic ICT goods exports relative to total merchandise exports (ICT) was selected. Greater concentration of an economy's exports in high-tech products like ICT typically signifies stronger technological innovation capabilities, a more advanced industrial structure, and a higher position in the international division of labour. The aforementioned data originates from the World Bank database.

Secondly, national characteristic variables were selected. Drawing upon Guo Jiwen and Ma Shuzhong (2022), the following variables were chosen: distance variable (lndist), employing the logarithm of the straight-line distance between the capitals of exporter country i and trading partner country j;

whether exporter and partner countries are contiguous (contig); whether they share a common language (comlang_off); and whether a colonial relationship existed between them (colony).All data are sourced from the CEPII database.

5. Empirical Analysis

5.1 Descriptive Statistics

This study examines the impact of digital trade rules within regional trade agreements (RTAs) signed between 131 countries and their partners from 2005 to 2023. A two-way fixed-effects model was constructed to assess the effect of digital trade rules in RTAs on a country's digital services trade competitiveness. The data structure comprises three levels: "home country—partner country—year", yielding 62,703 observations. Table 2 presents the descriptive statistics for the main variables.

Table 2: Descriptive Statistics

Variable	Sample Size	Mean	Standard Deviation	Minimum	Maximum
TC	62703	-0.096	0.295	-0.974	0.818
width total	62703	24.932	19.357	0	78
depth total	62,703	0.252	0.202	0	0.803
lngdp	62,703	0.258	2.987	-9.009	10.263
lnagdp	62,703	0.105	1.712	-5.582	5.582
ICT	62,703	5.183	7.693	0	51
lndist	62703	8.104	1.05	4.088	9.856
colony	62703	0.026	0.16	0	1
comlang off	62703	0.169	0.375	0	1
contig	62703	0.068	0.251	0	1

5.2 Benchmark Regression

Table 3: Benchmark Regression

Variable	(1)	(2)	(3)	(4)
width_total	0.001***	0.001***		
	(5.56)	(5.82)		
depth total			0.050***	0.056***
			(6.61)	(6.92)
lngdp		-0.362***		-0.362***
		(-15.17)		(-15.19)
lnagdp		0.379***		0.379***
		(15.61)		(15.63)
ICT		-0.002***		-0.002***
		(-5.36)		(-5.36)
lndist		0.002***		0.002***
		(3.36)		(4.01)
colony		-0.001		-0.001
		(-0.43)		(-0.24)
comlang off		0.003**		0.003**
		(2.24)		(2.04)
contig		-0.003		-0.003
		(-1.05)		(-1.06)
Constant term	-0.107***	-0.062***	-0.109***	-0.068***
	(-52.79)	(-8.15)	(-54.56)	(-8.75)
Exporting country fixed effects	Yes	Yes	Yes	Yes
Partner country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Sample size	62,703	62,703	62,703	62,703
R^2	0.831	0.836	0.831	0.836

Note: Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

To examine the impact of depth and breadth of RTA digital trade rules on digital services trade competitiveness, Table 3 reports the effects of trade rule breadth (width_total) and depth (depth_total) on digital services trade competitiveness (TC). Regression results from the two-way fixed effects model indicate that, regardless of whether control variables are included in the model specification, the coefficient estimates for the core variables width_total and depth_total remain consistently positive at the 1% significance level. This confirms that digital trade rules exert a stable positive influence on digital services trade competitiveness, thereby validating Hypotheses 1a and 1b.

5.3 Robustness Tests

1) Substitution of Explanatory Variables

Table 4: Robustness Test with Alternative Explanatory Variables

VARIABLES	(1)	(2)	(3)
z	0.009***		
	(5.82)		
index total		0.047***	
		(7.18)	
total			0.001***
			(7.18)
lngdp	-0.362***	-0.362***	-0.362***
	(-15.17)	(-15.19)	(-15.19)
lnagdp	0.379***	0.379***	0.379***
	(15.61)	(15.63)	(15.63)
ICT	-0.002***	-0.002***	-0.002***
	(-5.36)	(-5.33)	(-5.33)
lndist	0.002***	0.003***	0.003***
	(3.36)	(4.29)	(4.29)
colony	-0.001	-0.001	-0.001
	(-0.43)	(-0.24)	(-0.24)
comlang_off	0.003**	0.003**	0.003**
	(2.24)	(2.07)	(2.07)
contig	-0.003	-0.002	-0.002
	(-1.05)	(-0.97)	(-0.97)
Constant term	-0.050***	-0.071***	-0.071***
	(-7.56)	(-8.94)	(-8.94)
Exporting country fixed effects	Yes	Yes	Yes
Partner country fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Sample size	62,703	62,703	62,703
R^2	0.836	0.836	0.836

Note: Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Drawing upon Zhong Tenglong et al. (2025)'s standardisation of trade rule breadth within regional trade agreements to analyse its impact on digital services trade competitiveness, the regression results are presented in Table 4 Column (1). The core explanatory variable coefficient is positive and significant, indicating that digital trade rule breadth exerts a significant positive effect on digital services trade competitiveness. This aligns with the benchmark regression results, confirming the robustness of the findings.

Drawing upon Cui, Ri-ming et al. (2024)'s methodology for measuring trade rule depth, we standardised and summed the depth scores of each digital trade rule provision covered by the agreement. This composite score was then divided by the theoretical maximum achievable value for this index. The resulting index, ranging between 0 and 1, directly quantifies the quality of a given agreement's digital trade rules and its relative standing within the overall sample.The regression results, as shown in Column (2) of Table 4, reveal that the regression coefficients for the core variables are significant and consistent with the benchmark regression results presented earlier, indicating that the estimation results in this paper are relatively robust.

Drawing upon Zhang Zhiming et al. (2024)'s methodology for measuring trade rule depth, regional digital trade rule depth scores were calculated under the consideration of legal bindingness, yielding the regression results presented in Column (3) of Table 4. The regression coefficients are significant and consistent with the benchmark regression results, indicating that the estimation results in this paper are robust.

2) Changing the Clustering Criterion

In the preceding regression, the clustering criterion was fixed at exporting country-partner country. Here, both exporting and partner countries were fixed. The regression results are shown in columns (1) and (2) of Table 5. After re-selecting the clustering criterion, the magnitude and significance of the regression coefficients for the core variables remained largely unchanged compared to the benchmark regression results presented earlier. This indicates that digital provisions within RTAs promote the competitiveness of services trade, suggesting that the estimation results in this paper are robust.

3) Adjusting the Sample Time Period

The baseline regression covered the period 2005–2023. Here, the sample timeframe was adjusted to 2007–2023. The regression results are presented in columns (3) and (4) of Table 5. After adjusting the sample period, the regression coefficients and significance levels for the core variables – rule depth and rule breadth – remained consistent. This confirms that digital provisions within RTAs enhance competitiveness in services trade, further indicating the robustness of the estimation results.

Table 5: Robustness Test

Variable	(1) TC	(2) TC	(4) TC	(5) TC
width_total	0.001*		0.001***	
	(1.89)		(5.17)	
depth_total		0.056**		0.045***
		(2.08)		(6.43)
lngdp	-0.362***	-0.362***	-0.379***	-0.380***
	(-4.00)	(-4.01)	(-17.23)	(-17.25)
lnagdp	0.379***	0.379***	0.393***	0.393***
	(3.93)	(3.94)	(17.58)	(17.60)
ICT	-0.002	-0.002	-0.002***	-0.002***
	(-0.93)	(-0.93)	(-4.14)	(-4.17)
lndist	0.002	0.002	0.002***	0.003***
	(1.14)	(1.31)	(4.06)	(4.74)
colony	-0.001	-0.001	-0.001	-0.001
	(-0.32)	(-0.18)	(-0.37)	(-0.19)
comlang_off	0.003	0.003	0.002*	0.002
	(1.16)	(1.06)	(1.74)	(1.56)
contig	-0.003	-0.003	-0.001	-0.001
	(-0.80)	(-0.81)	(-0.65)	(-0.64)
Constant term	-0.062**	-0.068***	-0.056***	-0.062***
	(-2.50)	(-2.69)	(-8.26)	(-8.94)
Exporting country fixed effects	Yes	Yes	Yes	Yes
Fixed effects for partner countries	Yes	is	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Sample size	62,703	62,703	60,334	60,334
R^2	0.836	0.836	0.848	0.848

Note: Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

4) Endogeneity Tests

The regression results after introducing instrumental variables are presented in Table 6. Columns (1) and (2) display the first

and second stage regression results for breadth endogeneity, while columns (3) and (4) present the first and second stage regression results for depth endogeneity. The Kleibergen - Paaprk LM statistic tests the correlation between the instrumental variables and the endogenous variables, while the Kleibergen - Paaprk Wald F statistic is used to examine whether the instrumental variables suffer from weak identification. The regression results in Table 6 satisfy all testing criteria, thus ruling out both "insufficient identification" and "weak identification" of the instrumental variables, confirming their appropriate selection. Following the introduction of instrumental variables, the core explanatory variable coefficients remain significantly positive, indicating that digital trade rules enhance the competitiveness of digital services trade. The regression results demonstrate robustness.

Table 7: One-Period Lagged Endogeneity

Variable	(1) Phase One width_total	(2) Second Stage TC	(3) Phase One depth_total	(4) Second Stage TC
L.width_total	0.904***			
	(310.53)			
width_total		0.001***		
		(5.67)		
L.depth_total			0.906***	
			(340.13)	
depth_total				0.053***
				(6.29)
lngdp	-0.025	-0.360***	0.001	-0.361***
	(-0.08)	(-15.72)	(0.02)	(-15.74)
lnagdp	-0.060	0.373***	-0.001	0.373***
	(-0.19)	(16.12)	(-0.14)	(16.14)
ICT	0.031***	-0.002***	0.001***	-0.002***
	(3.63)	(-5.65)	(3.29)	(-5.65)
lndist	-0.668***	0.002***	-0.008***	0.002***
	(-28.51)	(3.40)	(-34.04)	(3.93)
colony	-0.211**	-0.002	-0.003**	-0.001
	(-2.21)	(-0.62)	(-2.31)	(-0.46)
comlang_off	0.041	0.002	0.001	0.002
	(0.63)	(1.38)	(1.17)	(1.18)
contig	-0.370***	-0.001	-0.004***	-0.001
	(-4.39)	(-0.29)	(-5.11)	(-0.28)
Exporting country fixed effects	Yes	Yes	Yes	Yes
Partner country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Sample size	57773	57,773	57,773	57,773
R^2		0.033		0.034
Kleibergen-Paap rk LM	1084.394 [0.000]		1298.361 [0.000]	
Kleibergen-Paap rk Forest F	9.6×10^4 16.38		1.2×10^5 16.38	

Note: Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

5.4 Mechanism Testing

1) Data Mobility Costs

Following Liu and Zhen (2022)'s methodology for selecting cross-border flow cost indicators, we employ the proportion of telecommunications sector revenue relative to total trade value to characterise each country's cross-border data flow intensity. Dividing this intensity by the maximum cross-border data flow intensity yields a metric for cross-border data flow costs. Regression results are presented in Table 8, columns (3) and (4).

Results indicate negative coefficients for both breadth and depth of trade rules, suggesting that digital trade provisions within regional trade agreements help reduce cross-border

data flow costs between nations. Lower data flow costs enable digital enterprises or platforms to rapidly expand services globally at minimal marginal cost, eliminating the need to rebuild data centres or infrastructure in each country. Greater scale yields lower average costs and enhanced competitiveness. Moreover, the reduction in data flow costs significantly lowers operational expenses, directly translating into increased corporate profits or decreased product prices. This enhances price competitiveness and elevates a nation's digital services trade competitiveness, thereby validating Hypothesis 3.

Table 8: Mechanism Testing

VARIABLES	(1) Institutional Distance	(2) Institutional Distance	(3) Data flow costs	(4) Data flow costs
width total	-0.003***		-0.002***	
	(-4.48)		(-4.87)	
depth total		-0.344***		-0.198***
		(-5.89)		(-6.61)
lngdp	-0.006	-0.005	0.413***	0.414***
	(-0.14)	(-0.10)	(5.31)	(5.33)
lnagdp	0.024	0.023	-0.530***	-0.531***
	(0.55)	(0.54)	(-6.88)	(-6.91)
ICT	-0.001	-0.001	0.002**	0.002**
	(-0.88)	(-0.93)	(2.47)	(2.46)
lndist	0.165***	0.162***	-0.004*	-0.006***
	(16.65)	(16.29)	(-1.95)	(-2.88)
colony	0.024	0.021	-0.002	-0.004
	(0.48)	(0.42)	(-0.19)	(-0.46)
comlang off	-0.024	-0.022	-0.011	-0.010
	(-0.77)	(-0.71)	(-1.58)	(-1.42)
contig	-0.163***	-0.163***	0.016	0.016
	(-4.46)	(-4.46)	(1.46)	(1.48)
Constant term	-0.277***	-0.233***	-7.372***	-7.343***
	(-3.16)	(-2.64)	(-307.77)	(-299.97)
Exporting country fixed effects	Yes	Yes	Yes	Yes
Partner country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
N	62703	62703	62703	62703
R^2	0.574	0.575	0.924	0.924

Note: Robust t-statistics in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

6. Policy Recommendations

This paper constructs measures of depth and breadth for digital trade rules based on the regulatory attributes of different types of digital trade provisions within RTAs. Using global digital services trade competitiveness data from 2005 to 2023, it empirically examines the impact of the breadth and depth of RTA digital trade rules on participating countries' digital services trade competitiveness. The findings reveal that both the breadth and depth of RTA digital trade rules significantly enhance a country's digital services trade competitiveness, with these effects confirmed through robustness and endogeneity tests. These rules reduce cross-border data flow costs, thereby elevating national competitiveness in digital services trade.

Firstly, actively participate in and lead the formulation of digital trade rules to enhance influence within multilateral and regional mechanisms. Establish research bases for digital trade rules in collaboration with academic institutions such as the Chinese Academy of Social Sciences and the Institute of International Trade and Economic Cooperation. Leveraging China's strengths in cross-border e-commerce and digital payments, proactive forward-looking research should be

conducted to provide theoretical underpinnings for proposing a distinctive "Chinese solution". Initiate or spearhead the establishment of a digital trade rules dialogue mechanism among countries along the "Digital Silk Road", strengthening exchanges and cooperation in digital trade with these nations. This will foster regional consensus on digital governance, creating a favourable external environment for Chinese digital enterprises to expand internationally.

Secondly, we shall focus on advancing the implementation of high-standard digital trade provisions. The agreement text shall explicitly stipulate the "enforceability" of digital trade clauses, incorporating them within the scope of the dispute settlement mechanism (DSM). Ambiguous, non-binding language shall be avoided to ensure effective enforcement of these provisions and robustly safeguard the legitimate rights and interests of Chinese enterprises and investors. We shall advocate for the establishment of a dedicated chapter on digital trade, providing clear definitions for all clauses and specifying concrete obligations.

Thirdly, narrow regulatory divergences with partner nations through Regional Trade Agreements (RTAs). Establish a "regulatory consistency" chapter within RTAs, prioritising mutual recognition of electronic authentication, data protection standards, and digital product safety standards to reduce compliance costs for enterprises operating across different countries and regions. Prioritise bilateral "Digital Partnership Agreements" with ASEAN and RCEP member states, concentrating on concrete projects such as mutual recognition of digital identities and interconnection of electronic invoicing systems. Gradually expand the scope of cooperation to enhance regional digital trade facilitation.

References

[1] Chen Weitao, Zhu Shiying. Research Progress on Digital Trade Theory and Rules [J]. Economic Dynamics, 2019, (09): 114-126.

[2] Cui, R. M., Guo, Z. Z., & Chen, Y. S. (2024). Impact of digital trade rules in regional trade agreements on export domestic value added. International Trade Issues, (05), 54-69.

[3] Dai Zhongqiang, Sun Quangang. Depth of Intellectual Property Protection in Free Trade Agreements and Export Product Quality: A Quantitative Study Based on Asia-Pacific Regional Trade Agreement Texts [J]. Statistical Research, 2024, 41(2): 40–52.

[4] Guo Jiwen, Ma Shuzhong. Differentiated Import Preferences in Destination Countries and China's Cross-Border E-Commerce Exports: A Discussion on the Logic of Trade Evolution [J]. Economic Research Journal, 2022, 57(03): 191-208.

[5] Han Jian, Cai Jiwei, Xu Yayun. Digital Trade Negotiations and Rule Competition: A Quantitative Study Based on Regional Trade Agreement Texts [J]. China Industrial Economics, 2019, (11): 117–135.

[6] Hou Junjun, Wang Yindan. A Measurement Study of Digital Trade Rules in US-EU-China RTAs [J]. Comparative Studies of Economic and Social Systems, 2022, (02): 60-72.

[7] Hou Junjun, Wang Yindan, Wang Zhenguo. Digital Trade Rules and the Position of Chinese Enterprises in

Global Value Chains [J]. China Industrial Economics, 2023, (04): 60-78.

[8] Lin Xi, Bao Xiaohua. How Do Regional Service Trade Agreements Affect Service Trade Flows? — A Perspective Based on Value-Added Trade [J]. Economic Research Journal, 2018, 53(01): 169–182.

[9] Liu Bin, Zhen Yang, Li Xiaofan. The Impact of Regulatory Convergence on Digital Trade: An Examination of the Digital Content Industry Using WIOD Data [J]. World Economy, 2021, 44(7): 3–28.

[10] Liu Bin, Zhen Yang. Digital Trade Rules and Cross-Border Flow of R&D Factors [J]. China Industrial Economics, 2022(7):65-83.

[11] Liu Zhizhong, Chen Qianying. Digital Trade Rules and the Dual Margins of Service Exports: A Quantitative Study Based on RTA Texts [J]. Research on the World Economy, 2022, (09): 34-47+135-136.

[12] Peng Yu, Yang Bizhou, Shen Yuliang. How RTA Digital Trade Rules Affect Digital Service Exports: A Perspective Based on Heterogeneity in Agreement Provisions [J]. International Trade Issues, 2021(04):110-126.

[13] Peng Yu, Yang Bizhou. Third-Country Trade Effects of Regional Trade Agreement Digital Trade Rules: Transfer or Spillover? [J]. International Trade Issues, 2023, (01): 36-54.

[14] Sun Yuhong, Yu Meiyue, Shang Yu. The Impact of Regional Trade Agreement Digital Trade Rules on Services Trade Exports: Evidence from APEC Members [J]. Nankai Economic Research, 2022,(03):142-160.

[15] Tao Aiping, Zhang Zhen. The Impact of the Digital Economy on the Development of Trade in Services: An Empirical Study Based on National-Level Panel Data [J]. East China Journal of Economics and Management, 2022, 36(05): 1-14.

[16] Xiong Hongru, Ma Yuan, Chen Hongna, et al. Digital Trade Rules: Key Issues, Practical Challenges and Construction Strategies [J]. Reform, 2021, (01): 65-73.

[17] Yang Lianxing, Wang Qiushuo, Zhang Xiumin. Deepening Free Trade Agreements, Digital Trade Rules and Digital Trade Development [J]. World Economy, 2023, 46(4): 32–59.

[18] Zhang Zhiming, Lin Lin, Zhou Yanping. Study on the Impact of Deepening Regional Digital Trade Rules on Cooperation in the Asia-Pacific Digital Industry Value Chain [J]. Statistical Research, 2024, 41(09): 72-85.

[19] Zhong Tenglong, Zhang Xiaotao, Bi Wenjing. Regional Trade Agreement Digital Trade Rules and Goods Export Trade [J]. Economic Dynamics, 2025, (08): 172-190.

[20] Ferracane M, Marel E. Do Data Policy Restrictions Inhibit Trade in Services? [R]. Robert Schuman Centre for Advanced Studies Research Paper No. RSCAS, 2019, 29.

[21] Fefer RF. Data flows, online privacy, and trade policy [J]. Congressional Research Service, 2019.

[22] Hofmann, Claudia, Alberto Osnago, and Michele Ruta. "Horizontal depth: a new database on the content of preferential trade agreements." World Bank Policy Research Working Paper 7981 (2017).

[23] Kogut, B., Singh, H.. The Effect of National Culture on the Choice of Entry Mode. Journal of International Business Studies, 1988, 19 (3) :411-432.

[24] Mattoo, Aaditya, Alen Mulabdic, and Michele Ruta. "Trade creation and trade diversion in deep agreements." Canadian Journal of Economics/Revue canadienne d'économique 55.3 (2022): 1598-1637.

[25] Rachel F F. Data Flows, Online Privacy and Trade Policy [R]. Congressional Research Service Working Paper, 2019.

[26] Seiermann, J. Only Words? How Power in Trade Agreement Texts Affects International Trade Flows. United Nations Conference on Trade and Development, 2018.

[27] Zeng K, Lu Y, Li Y W. Trade Agreements and Global Value Chain (GVC) Participation: Evidence from Chinese Industries[J]. Economics & Politics, 2021, 33(3): 533–582.