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Research on the Impact of Barriers to Cross-Border Data Flows on Digital Services Trade Competitiveness
Mediation Effect Analysis Based on FDI in the Services Industry

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ABSTRACT : Barriers to cross-border data flows discourage multinational digital services enterprises from investing, which is bound to affect the competitiveness of a country's service trade. This paper explores the mechanism of barriers to cross-border data flows affecting the competitiveness of services trade and constructs a mediating effect model for empirical testing. The results show that barriers to cross-border data flows have a significant inhibiting effect on the competitiveness of digital services trade and can pass on the impact by reducing FDI. A sound ICT infrastructure and a high level of human capital can boost the country's competitiveness in digital services trade. It also shows that fiscal and market access restrictions, institutional establishment restrictions, and trade restrictions all reduce the competitiveness of trade in digital services.

Keywords - Barriers to cross-border data flows; Competitiveness; Digital services Trade

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1. INTRODUCTION

With the increasing trend of digitization of the global economy, the trade of digital services is becoming increasingly significant in the growth of the national economy. According to statistics, global digital services exports totaled US$3,192.59 billion in 2019, accounting for more than half of all services trade, with a growth rate of 3.75%[1], outpacing the global economic growth by 1.45% points over the same time. Without a doubt, digital services trade is playing a vital role in promoting economic recovery and reshaping the country's competitive advantage.

Digital services trade relies on the free flow of data across borders. However, the data flows have also given rise to problems such as leakage of sensitive national information and over-collection of personal information, which urges countries to impose restrictions on data flows to protect national and personal information security. At the same time, countries have more differences than consensus on the formulation of digital services trade rules and are unable to reach a unified trade rule system (Wang, 2021; Dai, 2020)[1][2], thus the underdeveloped international regulatory framework leaves more policy space for countries to implement barriers to digital services trade. Moreover, as digital trade is currently booming, countries are intent on

[1] Source:《White Paper on the Development of Digital Trade》 published by the China Academy of Information and Communication Technology in 2020

promoting their digital economies by imposing domestic trade restrictions, which leads to the formation of barriers to cross-border data flows.

Barriers to cross-border data flows may affect a country's digital services trade competitiveness, either directly or indirectly through the mediating role of FDI. On the one hand, barriers to cross-border data flows can protect countries' information security and economic interests (Reuben et al., 2014)[3], facilitate data concentration, promote intra-regional digital services trade, protect domestic digital services from competing with foreign companies (Stone et al., 2015)[4]and thus improve the country's digital services trade competitiveness. On the other hand, it may negatively affect domestic digital services trade (Stone et al., 2015)[4] and the entry of FDI (Goldfarb et al., 2018)[5]. In traditional industries, FDI may increase the productivity of domestic firms and the international market share of domestic multinational firms, giving the country an international competitive advantage. Therefore, barriers to cross-border data flows may enhance the competitiveness of the country's digital services or may reduce it ultimately. This paper explores whether barriers to cross-border data flows can protect digital services and improve competitiveness by analyzing the impact of barriers to cross-border data flows on countrys' digital services trade competitiveness while considering the intermediary effect of FDI.

The existing literature does not mention the impact of barriers to cross-border data flows on digital services trade competitiveness. Although some studies have highlighted the importance of digital trade policies in enhancing digital services trade competitiveness, they have focused more on the catch-up of development levels rather than assessing the impact on digital services trade. Furthermore, most of the literature on barriers to cross-border data flows and digital services trade competitiveness focuses on qualitative analysis, with less quantitative analysis. This paper will make an in-depth study of the existing form, formation, and impact of barriers to cross-border data flows on digital services trade competitiveness.

2. MECHANISM ANALYSIS

Based on the literature review, this paper argues that barriers to cross-border data flows affect trade competitiveness in digital services mainly through the competition effect, innovation effect, and cost effect.

2.1 Competition effect

The development of digital services relies on large investments in upfront information and telecommunication infrastructure, which creates a natural tendency to monopolize (Goldfarb et al., 2018)[5]. In addition, the efficiency of data uses increases with the quantity and quality of data (Rikap et al., 2020; Cockburn et al., 2018)[6][7], that is, data centralisation creates a ''data monopoly'' and continuously improves the efficiency of data use. So barriers to cross-border data flows can improve trade competitiveness in digital services. digital services trade competitiveness. However, due to the compliance costs of barriers to cross-border data flows, small firms will be blocked out of the market and restricted from participating in global value chains (Ferracane et al., 2018b)[8], thus losing the opportunity to compete with foreign companies, reducing production and innovation efficiency, and ultimately making the country losing trade competitiveness in digital services.

2.2 Innovation effect

On the one hand, barriers to cross-border data flows concentrate data and enhance data innovation and improve digital services trade competitiveness. Durand and Melberg (2020)[9] propose “data-driven innovation rent” to capture the benefits of increased innovation capacity from data centralization. There are significant synergies between data and continuous innovation. The centralized processing of data will trigger multiple continuous innovations (Fourcade et al. 2016)[10]. On the other hand, barriers to cross-border data flows to prevent the country from enjoying the external economies generated by international digital trade and weaken the country's competitiveness in the digital services trade. In traditional economies, learning from higher levels of production can increase a country's productivity, and access to advanced technological inputs

for innovative activities (Mathews, 2002; Hobday, 2005; Mathews et al., 2000)[11][12][13], which may also apply to digital services industries.

2.3 Cost effect

The barriers to cross-border data flows may increase the cost of firms' input, production, and transmission, weakening the competitiveness in digital services trade. Firstly, the Internet provides firms with the opportunity to acquire digital inputs. For example, digital firms can obtain open-source software on the global network, carry out international consulting and professional technical consulting services, etc. However, barriers to cross-border data flows may force digital firms to purchase inefficient intermediate inputs from domestic sources, resulting in higher prices of final digital goods and services. Secondly, restrictions on data flows may hinder international talent mobility, and collaboration, leading to higher labor costs and delays in product development. Thirdly, trade in digitally enabled services often requires the transmission or delivery of digital products in the form of data, which is more dependent on the free flow of data, while the fragmentation of the Internet caused by barriers is not conducive to expanding the scope of digital services trade.

In conclusion, from thorietical aspect, barriers to cross-border data flows have both positive and negative effects on digital services trade, so an empirical analysis is needed for examining the net impact.

3. INDENTATIONS AND EQUATIONS

3.1 Models and variables

In this subsection, we examine the effects of barriers to cross-border data flows on digital services trade. Reference to Xuan et al. (2015)[14] and Zhang (2014)[15], the regression model is specified as:

$$RCA_{it} = \beta_0 + \beta_1 DRI_{it} + \beta_2 FDI_{it} + \beta_3 HU_{it} + \beta_4 ICT_{it} + \beta_5 OPEN_{it} + \beta_6 TRADE_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (1)$$

where i and t represent country and year respectively. The explanatory variable RCA_{it} is digital services trade competitiveness in country i in year t, expressed by the RCA index[2]. The core explanatory variable DRI_{it} is the level of barriers to cross-border data flows, measured by a system of indicators constructed by collecting data restriction-related policies among countries. The variable FDI_{it} is the total stock of FDI, covering the impact of FDI on digital services and the manufacturing industry on digital service trade competitiveness, as hindering FDI can both achieve technological catch-up, which may rise digital services trade competitiveness (Liu, 2010; Azmeh et al., 2016; Johnson, 2010)[16][17][18], and lead to inefficient domestic production, which may reduce trade competitiveness in digital services (Yao et al., 2006; Jiang et al., 2005)[19][20]. HU_{it} is the human capital, which is the proportion of high education in the working-age population. ICT_{it} is the level of ICT infrastructure, measured by the number of secure servers per million people. $OPEN_{it}$ is the share of total exports and imports of services in GDP. $TRADE_{it}$ is the value of trade exports. β is the coefficient to be estimated. μ_i, γ_t are individual fixed effects and time fixed effects respectively. ε_{it} is the residual term.

For the core explanatory variable DRI, the level of barriers to cross-border data flows, this paper uses a system of indicators established by the entropy value method to measure it. Firstly, data restrictions[3] are further identified based on the concept of data localisation defined by the Office of the United States Trade Representative (USTR) and data restrictions defined by the European Centre for International Political Economy (ECIPE). Secondly, the objective weights assigned to the indicators are determined by calculating the value of variability of the indicator using the entropy value method with the formula (2) and (3):

$$E_j = -\frac{1}{\ln n}\sum_{i=1}^{n} p_{ij} \ln p_{ij} \quad (2)$$

[2] RCA index is the ratio between the share of digital services industry export in the total services trade export of a country (region) and the share of digital services industry export in the total world services trade export, which can be expressed as $RCA_{ij} = \frac{x_{ij}/\sum_{j=1}^{n} x_{ij}}{\sum_{i=1}^{m} x_{ij}/\sum_{i=1}^{m}\sum_{j=1}^{n} x_{ij}}$

[3] Data source: DTE database.

$$w_j = \frac{1-E_j}{k-\sum E_j} \quad (3)$$

where p_{ij} denotes the weight of the *ith* sample in the *jth* indicator, E_j is the entropy value of the *jth* indicator, *k* is the total number of indicators, w_j is the final weight of each indicator, the constructed indicator system is shown in the table1.

Table 1 System of Data Restriction Index

First grate indicators (weighting)	Second grade indicators (weighting)
Data limits (0.07)	Prohibition of data transfer or requirements relating to local processing (0.17)
	Local storage requirements (0.19)
	Conditional mobility mechanism (0.21)
	Minimum data retention period (0.07)
	Maximum data retention period (0.36)
Data privacy management (0.19)	Burdensome consent requirements for privacy subjects (0.27)
	The right of privacy subjects to be forgotten（0.11）
	Data protection impact assessment (0.19)
	Data Protection Officer (0.15)
	Data breach notification (0.15)
	Government access to personal data (0.13)
Platform intermediary liability (0.18)	Safety liability agreement (0.03)
	User identity requirements (0.26)
	Monitoring requirements (0.33)
	Are the notice and removal provisions too onerous (0.15)
	Financial penalties for notification of non-compliance (0.23)
Network review (0.19)	Blocking web content (0.29)
	Filtering web content (0.20)
	Discriminatory use of licensing systems (0.51)
Broadband and net neutrality (0.15)	Deliberate slowing down of foreign sites (0.25)
	Set network broadband priority for certain content (0.19)
	Restriction rules for cloud computing (0.28)
	Specific provisions for social networks (0.28)
Localised content (0.21)	Localised content requirements for business services (0.5)
	Public procurement localisation content requirements (0.5)

3.2 Data sources

This paper selects panel data on digital services industries in 34 countries from 2008 to 2019 for analysis, due to the continued development of new generation ICTs, the explosive growth phase of the global digital economy, and the impact of the COVID-19 pandemic during this period. The sample data include 29 OECD countries and 5 BRICS countries. The OECD consists of 38 economies with well-developed digital services trade, whose total digital services exports accounted for more than 60% of world exports in 2019; and digital services trade in BRICS countries such as China and India have also grown rapidly this year. Considering data integrity, nine countries[4] with serious trade data missing were excluded, leaving a final measurement range of 34 countries with relatively active digital services trade. The data sources and descriptive statistics for all variables are shown in Table 2.

[4] The nine countries are Lithuania, Colombia, Costa Rica, Iceland, Netherlands, Spain, Turkey, Mexico, and Israel.

Table 2 Descriptive Statistics of Major Variables

Variables	Meaning of variables (original units)	Data sources	Average value	Standard deviation	Minimum value	Maximum value
RCA	Revealed Comparative Advantage Index	UNCTAD database	0.965	0.132	0.809	1.391
DRI	Digital Trade Restrictiveness Index	DTE database	0.112	0.151	0	0.872
FDI	The logarithm of the stock of FDI (US$ million)	UNCTAD database	12.397	1.268	9.275	16.063
ICT	The logarithm of secure servers per million people (nos.)	World Bank database	7.558	2.174	0.182	12.533
HU	The proportion of the tertiary-educated workforce in the total working population	World Bank database	0.786	0.046	0.598	0.876
OPEN	Total exports and imports of trade in services as a percentage of GDP	UNCTAD database	0.284	0.426	0.041	3.043
TRADE	The logarithm of exports of trade in goods (US$ million)	UNCTAD database	5.674	0.524	3.568	6.911

Source: Stata 16.

3.3 Regression results

The model (1) is run in Stata 16 and the results of the White test and Wooldridge test both have a P-value of 0.000, and the hypothesis of the existence of heteroskedasticity and autocorrelation cannot be rejected, so the two-way fixed effects model should be estimated using OLS with panel-corrected standard errors. The regression results are shown in Table 3. Column (1) shows the OLS results for the panel-corrected standard errors. The VIF values in the multicollinearity tests conducted in this paper were all less than 10, so there was no multicollinearity in the constructed model.

Table 3 shows that barriers to cross-border data flows have a negative and significant effect (5% significant level) on digital services trade competitiveness, indicating that barriers to cross-border data flows reduce digital services trade competitiveness. Possible reasons for this are: (1) barriers to cross-border data flows increase the cost of digital businesses. Research by Leviathan Security shows that if a country cuts off its connection to the world's most dominant cloud service providers and changes its cloud service provider, it causes businesses to incur more costs; (2) barriers to cross-border data flows undermine the firms' innovation ability. By using data, firms can develop new products or services, create new industrial ecosystems, improve new business models, increase their ability to collect, transmit and analyze data, and drive innovation.

The effect of FDI on digital services trade competitiveness is negatively correlated (1% significant level), indicating that FDI inhibits the host countries' trade competitiveness in digital services. The entry of multinational firms intensifies market competition. With the gap between domestic and foreign firms, foreign firms can easily encroach on the markets of countries with lower levels of digital development and inhibit their development.

The regressions also show that ICT infrastructure and human capital rate are both positively impact (1% significant level) on digital services trade competitiveness, indicating that good infrastructure and high human capital can promote digital services trade competitiveness of a country. The degree of openness to trade in services and the export value of trade in goods are both negatively significant (1% significant level) on trade competitiveness in digital services, indicating that a high degree of openness can weaken a country's digital services trade competitiveness.

3.4 Country heterogeneity analysis

In this paper, the model is tested with a subsample of BRICS and OECD countries, the results are shown in columns (2) (3) of Table 3. The regressions show that the effect of barriers to cross-border data flows on digital services trade competitiveness is negative and significant in OECD countries, however, the coefficient is positive and insignificant in BRICS countries. The possible reason for this is that OECD countries have more developed digital economies and almost saturated digital markets, while digital firms prefer emerging markets where digital services are less developed, therefore, restrictions on data hinder digital firms in OECD countries from participating in the global market more than in BRICS countries.

It also finds that ICT infrastructure and human capital contribute more to rising digital services trade competitiveness in BRICS countries than in OECD countries, probably because BRICS countries have higher marginal output of capital and labor and higher development potential.

Table 3 Regression results

	(1)	(2)	(3)
Dependent variables	RCA	BRICS	OECD
DRI	-0.023**	0.013	-0.070***
	(0.010)	(0.049)	(0.015)
FDI	-0.011***	-0.012	-0.026***
	(0.003)	(0.011)	(0.005)
ICT	0.009***	0.032**	0.005***
	(0.002)	(0.011)	(0.001)
HU	0.456***	0.978**	0.288***
	(0.106)	(0.411)	(0.079)
OPEN	-0.040***	-0.178	-0.022***
	(0.006)	(0.384)	(0.006)
TRADE	-0.007***	0.038	-0.009**
	(0.002)	(0.027)	(0.003)
COUNTRIES	Controlled	Controlled	Controlled
YEARS	Controlled	Controlled	Controlled
CONSTANT TERM	0.734***	-0.011	1.105***
	(0.071)	(0.185)	(0.034)
N	314	46	268
Number of groups	34	5	29
R-squared	0.1882	0.5738	0.2502

The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively.

3.5 Robust Check

To test the robustness of the above regression, this paper replaces the core explanatory variable DRI with the Fiscal Restrictions & Market Access Index (FRMAI), Establishment Restrictions Index (ERI), and Trading Restrictions Index (TRI) constructed by ECIPE and the result in the columns (1) (2) (3) of Table 4. It shows that fiscal restrictions and market access, establishment restrictions, and trading restrictions are negatively related to digital services trade competitiveness, though the results for the establishment restrictions are not

significant. Different digital services trade restrictions all reduce digital services trade competitiveness, with trading restrictions having a more significant impact on digital services trade competitiveness. The regression results for different restrictions indexes show robustness with the same results for the control variables.

To further verify the robustness of the regression, this paper also replaces the explained variable with CA index[5] (CA), TC index[6] (TC), and international market share[7] (MS) for testing, the results are shown in the columns (4) (5) (6) of Table 4. It can be found that when the explanatory variables are replaced with TC Index, CA Index, and MS, the effect of barriers to cross-border data flows on trade competitiveness in digital services are all negative and significant, indicating that the finding that barriers to cross-border data flows have a suppressive effect on the rising of digital services trade competitiveness is robust.

Table 4 Robustness test

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables	RCA	RCA	RCA	TC	CA	MS
FRMAI	-0.063**					
	(0.020)					
ERI		-0.009				
		(0.008)				
TRI			-0.085***			
			(0.007)			
DRI				-0.162***	-0.010**	-0.001**
				(0.035)	(0.003)	(0.000)
FDI	-0.013***	-0.011***	-0.015***	-0.066***	-0.004***	0.001**
	(0.003)	(0.003)	(0.003)	(0.011)	(0.000)	(0.000)
ICT	0.008***	0.007***	0.012***	0.017***	0.000	0.001*
	(0.001)	(0.001)	(0.002)	(0.005)	(0.000)	(0.000)
HU	0.418***	0.459***	0.427***	-0.707**	-0.037***	0.007
	(0.080)	(0.109)	(0.091)	(0.247)	(0.006)	(0.004)
OPEN	-0.040***	-0.039***	-0.046***	0.022	0.002***	0.006*
	(0.005)	(0.006)	(0.007)	(0.012)	(0.000)	(0.003)
TRADE	-0.006**	-0.006***	-0.008***	0.015*	-0.000	0.001***
	(0.002)	(0.002)	(0.002)	(0.007)	(0.000)	(0.000)
COUNTRIES	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
YEARS	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
CONSTANT TERM	0.797***	0.735***	0.790***	1.196***	0.077***	-0.021***
	(0.039)	(0.068)	(0.066)	(0.310)	(0.009)	(0.002)
N	314	314	314	314	314	314
Number of groups	34	34	34	34	34	34
R-squared	0.2116	0.1838	0.2557	0.2121	0.2587	0.2052

The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively.

4. FURTHER ANALYSIS

Wang and Liu (2011)[21] find that FDI restrictions in services affect the impact of FDI on a country's services trade competitiveness. Due to the indistinguishability of data types, almost all data are difficult to cross national borders (National Board of Trade Sweden, 2014)[22], which requires firms to establish expensive and

5 The CA index refers the comparative advantage of imports from the comparative advantage of exports to obtain the true competitive advantage of the industry, which can be expressed as $CA_{ij} = RCA_{ij} - \frac{M_{ij}/\sum_{j=1}^{n} M_{ij}}{\sum_{i=1}^{m} M_{ij}/\sum_{i=1}^{m}\sum_{j=1}^{n} M_{ij}}$

6 The TC index refers to the difference between a country's import and export trade as a proportion of its total import and export trade, and can be expressed as $TC_{ij} = \frac{X_{ij}-M_{ij}}{X_{ij}+M_{ij}}$

7 Market share refers to the share of a country's exports of an industry in the global market of the same industry.

redundant data centers in each market, hindering FDI and thus affecting the country's digital services trade competitiveness. In conclusion, barriers to cross-border data flows may affect the country's digital services trade competitiveness by affecting the entry of FDI. In this paper, we choose FDI in services as a mediating variable to analyze the impact of barriers to cross-border data flows on digital service trade competitiveness. Drawing on Baron and Kenny (1986)[23] and Wen and Ye (2014)[24], the mediating effect model (4) is constructed as shown below:

$$RCA_{it} = \alpha_0 + \alpha_1 DRI_{it} + \alpha_2 HU_{it} + \alpha_3 ICT_{it} + \alpha_4 OPEN_{it} + \alpha_5 TRADE_{it} + \mu_{it}$$
$$SFDI_{it} = \varphi_0 + \varphi_1 DRI_{it} + \varphi_2 HU_{it} + \varphi_3 OPEN_{it} + \sigma_{it}$$
$$RCA_{it} = \beta_0 + \beta_1 DRI_{it} + \beta_2 SFDI_{it} + \beta_3 HU_{it} + \beta_4 ICT_{it} + \beta_5 OPEN_{it} + \beta_6 TRADE_{it} + \varepsilon_{it} \quad (4)$$

Based on the characteristics of the study data, this paper adopts a first-order cross-lagged panel model (CLPM) to conduct a mediation study of the longitudinal data, the mediating effect model (5) constructed is shown below:

$$RCA_{it} = \alpha_0 + \alpha_1 DRI_{it} + \alpha_2 HU_{it} + \alpha_3 ICT_{it} + \alpha_4 OPEN_{it} + \alpha_5 TRADE_{it} + \mu_{it}$$
$$SFDI_{it} = \varphi_0 + \varphi_1 DRI_{it} + \varphi_2 HU_{it} + \varphi_3 OPEN_{it} + \sigma_{it}$$
$$RCA_{i(t+1)} = \gamma_0 + \gamma_1 DRI_{it} + \gamma_2 SFDI_{it} + \gamma_3 HU_{it} + \gamma_4 ICT_{it} + \gamma_5 OPEN_{it} + \gamma_6 TRADE_{it} + \varepsilon_{iRCA_{(t+1)}} \quad (5)$$

The subscripts i represent countries, *t* and *t + 1* represent measurement time points, μ_{it}, σ_{it}, $\varepsilon_{iRCA_{(t+1)}}$ denote residual terms. α_1 denotes the total effect of barriers to cross-border data flows on digital services trade competitiveness. ϕ_1 denotes the direct effect of barriers to cross-border data flows on trade competitiveness in digital services, and $\varphi_1 \times \beta_2$、$\varphi_1 \times \gamma_2$ denote the mediating effect transmitted through foreign direct investment.

Table 5 Regression results of mediating effect model

	(1)			(2)		
	RCA	SFDI	RCA	RCA	SFDI	RCA
DRI	-0.024**	-0.707***	-0.004	-0.024**	-0.707***	0.009
	(0.010)	(0.200)	(0.016)	(0.010)	(0.200)	(0.022)
SFDI			0.011			0.014
			(0.007)			(0.009)
ICT	0.008***		0.002***	0.008***		0.000
	(0.002)		(0.001)	(0.002)		(0.002)
HU	0.447***	2.954***	0.029	0.447***	2.954***	0.050
	(0.101)	(0.663)	(0.078)	(0.101)	(0.663)	(0.074)
OPEN	-0.053***	0.645***	-0.044**	-0.053***	0.645***	-0.045**
	(0.008)	(0.069)	(0.019)	(0.008)	(0.069)	(0.018)
TRADE	-0.008***		-0.008**	-0.008***		-0.016***
	(0.002)		(0.003)	(0.002)		(0.002)
COUNTRIES	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
YEARS	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
CONSTANT TERM	0.616***	9.251***	0.856***	0.616***	9.251***	0.863***
	(0.085)	(0.581)	(0.077)	(0.085)	(0.581)	(0.125)
N	314	200	200	314	200	200
Number of groups	34	28	28	34	28	28
R-squared	0.1768	0.4849	0.1815	0.1768	0.4849	0.1907

The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The regression results are shown in Table 5 above. The results of the intermediation test show that the coefficient of barriers to cross-border data flows on services FDI passes the significance test, and further Sobel tests indicate that the intermediation effect holds (as shown in column (1) of Table 6). The total effect of barriers to cross-border data flows on digital services trade competitiveness is -0.1262, the indirect effect of services FDI on digital services trade competitiveness is 0.1258, and the direct effect of barriers to cross-border

data flows on digital services trade competitiveness is -0.2520. It shows that barriers to cross-border data flows restrict services FDI and make a country lose its trade competitiveness in digital services through lower services FDI. Barriers to cross-border data flows may reduce the innovation dynamics of domestic firms, restrict domestic firms from enjoying the demonstration effect and technology spillover effect brought by multinational advanced firms, and hinder the improvement of digital service trade competitiveness.

The results of the analysis of the mediating effect based on causal inference, as shown in column (2) of Table 5, and further Sobel tests indicate that the mediating effect holds (as shown in column (2) of Table 6). The total effect of barriers to cross-border data flows on digital services trade competitiveness is -0.1256, the indirect effect of services FDI on digital services trade competitiveness is 0.1284, and the direct effect of barriers to cross-border data flows on digital services trade competitiveness is -0.2540. In the long run, barriers to cross-border data flows also reduce trade competitiveness in digital services, while impacting through lower FDI in services.

Table 6 Sobel test results

	(1)				(2)			
	Coef	Std Err	Z	P>|Z|	Coef	Std Err	Z	P>|Z|
Sobel	0.126	0.035	3.601	0.000	0.128	0.035	3.629	0.000
Goodman-1 (Aroian)	0.126	0.035	3.571	0.000	0.128	0.036	3.600	0.000
Goodman-2	0.126	0.035	3.631	0.000	0.128	0.035	3.659	0.000

5. CONCLUSION

This paper explores the mechanisms of cross-border data flow barriers affecting digital service trade competitiveness and constructs a mediating effects model for empirical analysis. We find that barriers to cross-border data flows have a significant inhibiting effect on digital services trade competitiveness and can be passed on through lower FDI, however, this effect is significant in OECD countries and insignificant in BRICS countries. We also find that improved ICT infrastructure and higher levels of human capital can contribute to the competitiveness of a country's digital services trade and that this improvement is more pronounced in the BRICS countries.

Based on the above conclusions, this paper argues that it is undesirable to constitute barriers to cross-border data flows for protecting domestic firms, instead, it will reduce the trade competitiveness in digital services, which is not conducive to the healthy development of the national and global economy. In order to promote the development of digital services and improve digital services competitiveness, a balanced digital trade policy should be implemented to remove barriers to cross-border data flows and strengthen multilateral cooperation. Making full use of human capital and improving digital infrastructure also contribute to digital economy development and digital trade competitiveness rising.

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