

# A Research on the Impact of Digital Service Trade Barriers on IFDI

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**Abstract.** Relying on the OECD-DSTRI database's digital services trade restriction index, this paper explores the impact of digital services trade barriers on IFDI by combining IFDI data from 41 countries from 2014-2019. The findings show that trade barriers to digital services have a significant dampening effect on the level of IFDI in each country, especially in the five sub-indicators in the area of infrastructure and connectivity, where the negative impact is most prominent. In addition, from the perspective of countries at different levels of development, digital services trade barriers have a more significant dampening effect on IFDI in developed countries. The findings of this paper provide empirical support for promoting IFDI growth by reducing trade control barriers and promoting trade liberalization in digital services.

**Keywords:** IFDI; digital services trade barriers; disincentives.

## 1. Introduction

In recent years, with the rapid development of digital information technology, digital service trade, as an emerging form of trade, is gradually changing the production and delivery of traditional services. In November 2019, "The Guiding Opinions on Promoting The High Quality Development of Trade" issued by the State Council clearly pointed out the need to accelerate the pace of the development of digital trade and to enhance the digitization of trade, which not only provides a new impetus to promote the high-quality development of China's service trade, but also becomes an important means to stabilize foreign trade efforts. However, at the same time, this trend also puts forward higher requirements on the degree of openness of China's service trade in the future. The global digital services trade restrictiveness index released by the Organization for Economic Cooperation and Development (OECD) shows that during the period of 2014-2022, the average level of global digital services trade barriers shows an upward trend, increasing from 0.178 to 0.194. Specifically, in 2022, 14 countries, including South Africa, India, China, Indonesia, Argentina, Russia and Poland, had a higher level of digital services trade restrictiveness index. Among OECD member countries, the index rises from 0.115 in 2014 to 0.14 in 2022, while in non-OECD countries, the index rose slightly from 0.24 in 2014 to 0.241 in 2022. These data show an increasing trend of the global barriers to trade in digital services as a whole.

Barriers to trade in digital services have become a hot topic of academic interest. However, most studies have focused mainly on areas such as value chains, export product quality, and imports. In contrast, there are relatively few studies on the relationship between trade barriers to digital services and inward foreign direct investment (IFDI). Since the global financial crisis in 2008, the sluggish recovery of the world economy, coupled with the impact of the new crown epidemic, has further slowed down the inflow of IFDI in various countries. Therefore, it is particularly important to study the relationship between IFDI and barriers to trade in digital services in the context of the rapid development of digital economy.

## 2. Literature review

The Organization for Economic Co-operation and Development (OECD) has conducted a comprehensive compendium of restrictive measures affecting trade in digital services and constructed

a digital services trade restriction index through quantitative processing. The index comprehensively examines the barriers to trade in digital services in major countries around the world, reflecting the complexity and diversity of the global regulatory environment for digital trade (Ferencz, 2019). Meltzer (2016) argues that barriers to trade in digital services are usually created to maintain data security and protect the development of national industries. However, more scholars focus on the negative impacts of barriers to trade in digital services. For example, Ferracane and Marel (2021) point out that barriers to trade in digital services inhibit trade growth, and that data flow restrictions increase the difficulty of data access and search costs, impede imports of service factors, and have a particularly dampening effect on data-intensive trade.

Qi Junyan and Qiang Huajun's (2021) study shows that bilateral digital services trade restrictions have a significant hindering effect on services exports, and that restrictions in exporting countries have a greater negative impact than those in importing countries. Gong Xinshu and Liu Yue (2022) use the trade gravity model to empirically test that the implementation of bilateral digital services trade restrictions significantly inhibits the import of digital services. Based on the OECD Digital Services Trade Restrictions Index, Yu Shihai and Du Zizhe (2022) et al, empirically analyze the impact of digital services trade restrictions introduced by 50 economies around the world on the digital transformation of manufacturing industries. They constructed digital transformation indicators for manufacturing industries using inter-country input-output data and network readiness indexes, and concluded that trade restriction measures on digital services in each country significantly hinder the digital transformation of manufacturing industries. Zhao Xiaofei and He Zhuo (2022) analyzed from the perspective of the value chain that trade barriers to digital services shorten the length of the value chain through two ways, namely, reducing the input of service factors and increasing the cost of trade in intermediate goods.

The above literature provides a theoretical basis for the analysis of this paper. In recent years, barriers to trade in digital services have been increasing in various countries, which will inevitably have an impact on the level of IFDI in various countries. However, there is relatively little literature on digital service trade barriers and IFDI in existing studies. This paper explores the impact of digital services trade barriers on IFDI based on the digital services trade restriction index from the OECD database and IFDI data from the WDI database. Compared with the existing literature, the marginal contribution of this paper is that it enriches the research in this area by shifting the research focus to the yet to be fully explored relationship between barriers to trade in digital services and IFDI.

### **3. Theoretical mechanisms and research design**

#### **3.1. Theoretical analysis**

In recent years, there has been a gradual increase in the number of studies on the relationship between trade barriers and foreign direct investment (IFDI). Borchert et al. (2012) empirically analyze the characteristics of regulatory barriers in different countries and in different service sectors, and find that within-border restrictions inhibit the inflow of IFDI in the service sector, thereby reducing the likelihood of cross-border service transactions. Mustilli and Pelkmans (2012), using an index of intra-border barriers to services trade in EU countries, find that lowering barriers can increase intra-EU services trade and services IFDI by 7% and 4%, respectively. In addition, most scholars believe that barriers to trade in digital services have a negative impact on trade. Xiang Benwu (2009) used a panel cointegration model and a panel error correction model to conclude that exports contribute to OIFDI. Jifeng Zhang and Ping Huang (2013) and Erdou Su and Jun Xue (2020) also argue that there is a mutually reinforcing relationship between exports and investment.

Based on the above research, this paper proposes the hypothesis that the growth of barriers to trade in digital services is detrimental to national IFDI. Specifically, barriers to trade in digital services inhibit the willingness and ability of multinational enterprises to invest by increasing transaction costs, restricting the flow of data, and lowering the input of service factors. Such barriers not only increase the operating costs of firms, but also erode the return on investment, thus negatively affecting IFDI.

### 3.2. Econometric modeling

In order to verify the above research hypothesis, this paper constructs the following econometric model based on the existing studies:

$$\ln fdi_{it} = \beta_0 + \beta_1 dstri_{it} + \sum_{j=2}^7 \beta_j Z_{jit} + \psi_i + \gamma_t + \varepsilon_{it} \quad (1)$$

In equation (1),  $\ln fdi_{it}$  is the level of IFDI in country  $i$  at time  $t$ ,  $dstri_{it}$  is the digital barriers to trade in services in country  $i$  at time  $t$ , and  $Z_{jit}$  represents a set of control variables, including the level of economic development ( $\ln gdp$ ), labor costs ( $hdi$ ), quality of national institutions ( $wgi$ ), investment openness ( $fdiopen$ ), education level ( $el$ ), credit level ( $cq$ ), and knowledge and technology level ( $\ln kno$ ).  $\psi_i$  is an unobservable and time-invariant individual characteristic,  $\gamma_{it}$  is a time fixed effect, and  $\varepsilon_{it}$  denotes a random disturbance term.

### 3.3. Variables selection and data description

(1) IFDI levels ( $\ln fdi$ ). Data on IFDI flows for 41 countries from 2014 to 2019 are selected and obtained from the World Bank database. In this paper, we refer to the method of Busse and Hefeker (2007) and process the relevant statistics of the explanatory variables to improve the stability and accuracy of the model.

(2) Barriers to trade in digital services ( $dstri$ ). This paper adopts the Digital Services Trade Restriction Index (DSTRI) published by OECD to measure the level of digital services trade barriers in each country. The index integrates several aspects of restrictive measures and can better reflect the degree of openness of countries in the field of digital services trade.

(3) Control variables. In order to comprehensively analyze the impact of barriers to trade in digital services on IFDI, this paper also controls a series of variables that may have an impact on IFDI, as follows:

① Level of economic development ( $\ln gdp$ ): the GDP of each country is used as a measure, and the data comes from the World Bank database. Differences in the level of economic development can have a significant impact on the costs and profits of investing firms.

② Labor cost ( $hdi$ ): the Human Development Index published by the United Nations Development Program is used to express this. Differences in labor costs affect firms' investment decisions.

③ Quality of the country's institutions ( $wgi$ ): six specialized indicators from the Global Governance Indicators database published by the World Bank are summed and averaged to indicate the quality of the country's institutions.

④ Investment openness ( $fdiopen$ ): measured using the ratio of the country's net foreign investment inflow to GDP, with data from the World Bank database. The higher the investment openness, the lower the barriers faced by foreign investors.

⑤ Educational attainment ( $el$ ): measured by the tertiary education enrollment rate, data from the World Bank database. Higher levels of education can help attract high-quality foreign direct investment.

⑥ Level of credit ( $cq$ ): measured using domestic credit provided by the financial sector as a percentage of GDP, data from the World Bank database. The level of credit affects the ease of financing for foreign firms.

⑦ Knowledge technology level ( $\ln kno$ ): the total number of patent applications in the country is used as an indicator of the knowledge technology level. The level of knowledge and technology is an important factor for foreign-funded enterprises when making investment decisions.

### 3.4. Descriptive statistics

**Table 1** Results of descriptive statistics of variables

Variable	Description	Observations	Mean value	Standard deviation	Minimum value	Maximum value
<i>lnfdi</i>	IFDI Levels	264	7.862	6.765	-13.401	13.838
<i>dstri</i>	Barriers to Trade in Digital Services	264	0.146	0.089	0.021	0.380
<i>lngdp</i>	Level of economic development	264	13.118	1.566	9.771	16.878
<i>hdi</i>	Labor costs	264	0.869	0.076	0.618	0.962
<i>wgi</i>	Quality of national institutions	264	0.892	0.718	-0.787	1.859
<i>fdiopen</i>	Investment openness	264	3.537	11.739	-41.651	81.247
<i>el</i>	Educational attainment	264	67.701	24.292	0	148.531
<i>cq</i>	Level of credit	264	87.866	45.046	0	191.818
<i>lnkno</i>	Level of knowledge and technology	264	8.051	2.764	0	14.248

Table 1 demonstrates the results of descriptive statistics for each variable. As can be seen from the table, the maximum value of barriers to trade in digital services (*dstri*) is 0.38 and the minimum value is only 0.021, indicating that there is a significant difference in the restrictions on trade in digital services between countries. Its mean value is 0.146, indicating that the average level of digital services trade barriers is relatively high across countries.

## 4. Empirical studies

### 4.1. Analysis of baseline estimation results

**Table 2** Variable VIF test results

Variable	VIF	1/VIF
<i>dstri</i>	1.89	0.528
<i>lngdp</i>	4.09	0.244
<i>hdi</i>	5.23	0.191
<i>wgi</i>	4.86	0.205
<i>fdiopen</i>	1.07	0.938
<i>el</i>	1.55	0.645
<i>cq</i>	1.59	0.629
<i>lnkno</i>	4.43	0.225

Before performing the benchmark regression, a multicollinearity test was performed on each variable to avoid the effect of multicollinearity on the results. The test results show that the variance inflation factor (VIF) of each selected variable is less than 10, indicating that the modeling setup does not have serious multicollinearity problems.

**Table 3** Benchmark regression results

Variable	(1) IFDI	(2) IFDI	(3) IFDI	(4) IFDI	(5) IFDI	(6) IFDI
<i>dstri</i>	-13.502 *** (4.879)					
<i>ic</i>		-10.254** (5.173)				
<i>et</i>			-30.950 (26.669)			
<i>ps</i>				5.349 (31.646)		
<i>ip</i>					-41.895	
<i>ob</i>					(38.469)	-32.760* (18.477)
<i>lngdp</i>	0.365 (0.397)	0.362 (0.403)	0.556 (0.403)	0.488 (1.82)	0.404 (0.408)	0.558 (0.399)
<i>hdi</i>	-17.09* (9.592)	-12.184 (9.408)	-15.710 (10.348)	-10.206 (9.987)	-11.560 (9.457)	-12.535 (9.447)
<i>wgi</i>	-2.094** (0.952)	-1.962** (0.963)	-1.197 (0.968)	-1.491 (0.941)	-1.471 (0.937)	-1.708* (0.942)
<i>fdiopen</i>	0.305*** (0.028)	0.305*** (0.029)	0.307*** (0.028)	0.304*** (0.028)	0.302*** (0.028)	0.300*** (0.028)
<i>el</i>	0.035** (0.016)	0.034** (0.016)	0.034** (0.016)	0.032** (0.016)	0.033** (0.016)	0.033** (0.016)
<i>cq</i>	0.008 (0.009)	0.006 (0.009)	0.006 (0.009)	0.005 (0.009)	0.007 (0.009)	0.005 (0.009)
<i>lnkno</i>	0.609*** (0.235)	0.598** (0.237)	0.514** (0.237)	0.540** (0.237)	0.553** (0.236)	0.520** (0.236)
Constant	13.334* (7.701)	8.447 (7.339)	8.984 (7.993)	4.457 (7.481)	6.600 (7.329)	6.207 (7.161)
individual effect	yes	yes	yes	yes	yes	yes
time effect	yes	yes	yes	yes	yes	yes
N	264	264	264	264	264	264

Note: Standard errors in parentheses; \*, \*\*, and \*\*\* indicate significant at the 10%, 5%, and 1% levels, respectively.

Since the estimation analysis using panel data is usually plagued by heteroskedasticity, contemporaneous correlation and autocorrelation between groups, this paper uses the feasible generalized least squares (FGLS) method, which eliminates heteroskedasticity, contemporaneous correlation and autocorrelation between groups at the same time. Column (1) of Table 3 presents the results of the baseline estimation of the impact of liberalization of trade in digital services on IFDI. We can see that the estimates of *dstri* are significantly negative at the 1% level, indicating that barriers to trade in digital services have a significant dampening effect on IFDI across countries. Meanwhile, from the estimation results of the control variables, it can be seen that although the level of economic development (*lngdp*) positively affects IFDI, the estimation results are not significant,

probably because the IFDI absorbed by countries with a high level of economic development is more knowledge-intensive investments, but today knowledge-intensive industries are more asset-light abroad (Bruno Casella and Lorenzo Formenti (2018); labor costs (*hdi*) are significantly negative at the 10% level, suggesting that rising labor costs dampen countries' IFDI; but the quality of national institutions (*wgi*) is significantly negative at the 5% level, which may be caused by the fact that the IFDI of emerging economies such as those represented by developing countries such as China, Brazil, and so on, are at a higher level, but the governance indices published by the World Bank are indeed all at a lower level; the openness to investment (*fdiopen*) shows a significant positive correlation effect at the 1% level, indicating that countries with higher investment openness are more capable of absorbing international direct investment; the level of education (*el*) is significantly positive at the 5% level, indicating that higher levels of education help countries to absorb IFDI; the level of credit (*cq*) also has a positive effect on IFDI, but the effect is not significant, probably because countries' domestic governmental financial sector. However, the effect is not significant, probably because the financial sector of the domestic government of each country provides less and less financing to foreign firms; the level of knowledge and technology (*lnkno*) is significantly positive at the 1% level, which indicates that an increase in the level of knowledge and technology of the country has a significant promotion effect on IFDI. This is because the OECD database published barriers to trade in digital services includes five sub-indicators, namely infrastructure and connectivity (*ic*), electronic transactions (*et*), payment systems (*ps*), intellectual property rights (*ip*) and other digital trade barriers (*ob*), after exploring the impact of digital services trade barriers on IFDI, this paper would also like to explore the impact of the sub-indicators of digital services trade barriers on the country's IFDI, and the estimation results are presented in columns (2), (3), (4), (5), and (6) in Table 3, where it can be seen that Infrastructure and connectivity (*ic*) shows a significant negative impact at the 5% level, and other digital barriers to trade (*ob*) shows a significant dampening effect at the 10% level, as can be seen in the case of e-transactions (*et*), payment systems (*ps*) and intellectual property rights (*ip*) do not have a significant effect on IFDI, probably due to the presence of a high number of 0-values for these three sub-indicators published in the OECD database.

#### 4.2. Robustness Tests

Table 4 Robustness test

	(1) IFDI	(2) IFDI	(3) IFDI	(4) IFDI
<i>dstri</i>		-13.862 <sup>***</sup> (4.795)	-13.476 <sup>***</sup> (4.853)	-13.213 <sup>***</sup> (4.819)
<i>stri</i>	-14.406 <sup>***</sup> (5.361)			
<i>up</i>			-0.354 <sup>*</sup> (0.031)	
control variable	control	control	control	control
Constant	9.705 (7.295)	14.721 <sup>*</sup> (7.562)	12.207 (7.685)	13.123 <sup>*</sup> (7.604)
individual effect	yes	no	yes	yes
time effect	yes	no	yes	yes
N	261	261	261	261

Note: Standard errors in parentheses; \*, \*\*, and \*\*\* indicate significant at the 10%, 5%, and 1% levels, respectively.

In order to ensure the reliability of the study, this paper carries out robustness tests from four aspects: replacing explanatory variables, replacing research methodology, omitted variables and reduced-tail treatment; in column (1) of Table 3 this paper replaces the explanatory variables with the digital trade restriction index published in the OECD database, and the estimation results show that the same has a significant inhibitory effect on the country's IFDI at the 1% level; in column (2) of Table 3 this paper replaces the estimation methodology from the fixed-effects model to ordinary least squares, and no longer fix the country and time, the estimation results show that the impact of digital trade barriers to services is still negative and significant; in order to prevent the problem of omitted variables when exploring the impact on IFDI in this paper, referring to the practice of Fu Lei and Zhou Liqing (2022), the urbanization rate is introduced as a control variable, and the urbanization rate is measured by the ratio of a country's urban population to its total population, and the data is obtained from the OECD database, which is also significant at the 1% level for national IFDI. The urbanization rate is measured by the ratio of a country's urban population to its total population, and the data are obtained from the WDI database. The regression results in column (3) of Table 3 show that the coefficient of the barriers to trade in digital services is still significantly negative, which indicates that the estimation results in this paper are not affected by the omitted variables, and that they still have a significant inhibitory effect on the IFDI; in order to avoid that outliers have a negative impact on the estimation results, this paper performs a 5% shrinkage of explanatory variables before estimation, which is the same as that of Table 3 (4). From the estimation results in column (4) of Table 3, it can be seen that the estimation results of *dstri* after changing the sample size are basically consistent with the baseline estimation results, which further indicates that the core findings of this paper are robust.

### 4.3. Heterogeneity analysis

**Table 5** Heterogeneity analysis

	(1) OECD	(2) Non-OECD
<i>dstri</i>	-15.625** (7.184)	-0.189 (0.607)
control variable	constant	constant
constant	12.712 (15.152)	-5.805*** (0.846)
individual effect	yes	yes
time effect	yes	yes
N	210	54

Note: Standard errors in parentheses; \*, \*\*, and \*\*\* indicate significant at the 10%, 5%, and 1% levels, respectively.

In order to study the heterogeneity between developed and developing countries, and with reference to the peer practice, this paper categorizes the OECD countries in the sample as developed countries and the non-OECD countries as developing countries. From the estimation results in column (1) of Table 4, it can be seen that there exists a significant inhibitory effect of digital services trade barriers in developed countries on national IFDI at the level of 5%. However, from the estimation results in column (2) of Table 4, it can be seen that although there is also a negative impact of digital services trade barriers in developing countries on IFDI, the impact factor is not significant, probably because developed countries attract more IFDI by virtue of their technological, services, This is probably because developed countries, with their advantages in technology, services, innovation and capital, attract more IFDI in high-tech industries, so the restriction of digital services trade barriers is more prominent.

## 5. Research findings and policy recommendations

### 5.1. Conclusions of the study

Based on the digital services trade restriction index of OECD-DSTRI database, this paper analyzes the IFDI data of 41 countries from 2014-2019 through a fixed-effects model and draws the following main conclusions:

(1) Barriers to trade in digital services have a significant inhibitory effect on the level of IFDI in each country, indicating that reducing trade control barriers and promoting the liberalization of trade in digital services are important means to promote IFDI growth.

(2) Among the five sub-indicators of barriers to trade in digital services, barriers in the area of infrastructure and connectivity are the most significant impediment to IFDI. Barriers to trade in digital services have a significant impact on the level of IFDI in various countries.

(3) There is heterogeneity in the impact of barriers to trade in digital services on the IFDI of countries at different levels of development, and their impediment to the IFDI of developed countries is more significant, which may be related to the fact that the IFDI attracted by developed countries is more concentrated in high-tech industries.

### 5.2. Policy recommendations

Based on the above conclusions, this paper puts forward the following policy recommendations:

(1) Promote international negotiations on digital service trade rules: Against the background of the booming development of global digital trade, China should actively participate in the formulation of digital service trade rules under the framework of the WTO, enhance its discourse power in the global governance of digital service trade, and promote the formation of a fairer and more open digital trade environment.

(2) Strengthening policy coordination and regulatory integration: China should strengthen coordination and integration with its trading partners in various policy areas of digital service trade, and gradually eliminate restrictive barriers to the export of digital services on the premise of safeguarding data security and promoting the healthy development of its own digital service industry, so as to provide a better environment for its own enterprises to go out and for foreign enterprises to come in. "Gradually eliminate restrictive barriers to the export of digital services on the premise of safeguarding data security and promoting the healthy development of the domestic digital service industry, so as to provide institutional facilitation for domestic enterprises going out and foreign enterprises coming in.

(3) Enhancing infrastructure connectivity and intellectual property protection: Information and communication infrastructure is the basic link of digital service trade, while intellectual property protection is the core of safeguarding the interests of enterprise innovation. China should focus on strengthening the openness of infrastructure connectivity, effectively enforcing intellectual property laws, opening up channels for data sharing and mutual recognition of systems with trading partner countries, and improving the legal environment for domestic innovation protection, so as to enhance the international competitiveness of China's trade in digital services.

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