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Impact of Digital Service Trade Barriers and Cross-Border Digital Service Inputs on Economic Growth

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Abstract: In this digital era, digital service trade has brought significant benefits to the global economy. However, this trade also poses considerable challenges to international trade regulations. This study aims to analyze the impact of cross-border digital service trade on the economic growth of importing countries while determining how digital trade barriers moderate this effect. We established a theoretical model that meticulously delineates various restrictive regulatory measures that can hinder digital service inputs. We further developed a comprehensive and detailed trade barrier index based on these measures. A three-dimensional fixed effects panel regression model was used to analyze data from six types of digital services in 48 economies from 2005 to 2021. The findings indicated that cross-border digital service inputs enhance importing countries' economic growth, highlighting the substantial economic value of these inputs. However, trade barriers in digital services were also found to diminish this positive effect. Specifically, an increase in the digital service trade barriers in importing countries constricts the range and quality of selectable digital services, which might adversely impact national economic growth. The inhibitory effect is stronger for countries with a "Limited Model" for personal data transfers and processing.

Keywords: importing countries; sustainable economy; analytical modeling; practical research

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1. Introduction

Amid the ongoing recovery of the global economy and the evolution of the digital economy, technologies such as artificial intelligence and big data have become crucial drivers of digital transformation. These technologies have led to the emergence of innovative industrial models and business opportunities [1]. Digital technologies have facilitated international transactions of traditional services as well as emerging forms of global service trade, thus enabling the growth of digital service trade. According to the United Nations Conference on Trade and Development, digital service imports reached $3.10 trillion in 2021 across 180 countries, marking a 19.5% annual increase. The share of digital service imports in service import trade surpassed 55%, highlighting the rising prominence of this novel trade trend. The top five countries in digital service imports in 2021 were the United States, Ireland, Germany, the United Kingdom, and The Netherlands.

Digital service trade is a new operational mode produced by the deep integration of digital technology and service trade. This form of trade adds a fresh dimension to globalization; various countries have acknowledged its importance in national development plans and actively explored models for its advancement. For instance, China's Fourteenth Five-Year Service Trade Development Plan has introduced digital trade and encouraged the innovative growth of digital service trade and expansion of digital service imports.

Effective data utilization is closely associated with service trade [2]. Digital service trade, based on data transmission via the internet and other digital technology, inherently digitizes trade objects and methods [3,4]. Digitization and platformization are the most important characteristics of digital service trade, allowing it to become a channel for the global flow of data elements. Given this, this study empirically analyzes the impact of cross-border digital service investments on the economic growth of importing countries. It examines how digital service trade barriers, as the important institutional variable, moderate the relationship between the two from the perspective of the inflow of data elements to provide a decision-making basis and path choice to further unlock foreign trade potential and cultivate new growth forces.

The remaining parts of this study are as follows. Section 2 is an overview of the relevant research literature. Section 3 proposes research hypotheses. Section 4 sets out the three-dimensional baseline panel fixed effects models and extended baseline regression model, then describes the quantization method of variables. Section 5 shows the regression results. Section 6 concludes with discussion and conclusions.

2. Literature Review

The previous literature has demonstrated the benefits of digital service trade from the perspectives of service supply, global value chain embedding, and manufacturing sector transformation. Digital service trade has revolutionized service supply, enhanced global service efficiency, and attained global reach while enabling micro-, small-, and medium-sized enterprises and individual content creators to access quality intermediate inputs at low costs [5,6]. Moreover, data and technologies carried by digital service imports have improved communication and collaboration efficiency among industry chain participants, thus enabling a more efficient industry transition with the flow of production factors from low-quality, low-efficiency industries to high-quality, high-efficiency industries. Consequently, digital service imports have helped increase enterprise productivity and advance the manufacturing sector's digital, service, and intelligent transformation [7,8]. Additionally, digital service trade has reshaped and enhanced global value chain integration and interaction methods, particularly for small- and medium-sized enterprises (SMEs) and developing countries [9,10].

However, service digitization has also posed challenges to global trade regulations. The international governance norms of digital service trade lag behind its development of digital service trade. International digital service trade norms contain treaties and informal agreements with varying legal strengths; thus, a universally accepted governance model remains to be developed [11]. The complexity and fragmentization of digital service trade norms lead to significant disparities in national regulatory strategies and capabilities. These disparities hinder the alignment of domestic sectors with international digital service sectors, reduce the efficiency of businesses accessing digital technologies and digital services, and increase the costs of digital service imports [12,13].

Research on the regulation of digital service trade has so far focused on trade regulation and data regulation. Trade regulation evaluates restrictive measures imposed on the transaction process of digital service trade. The Digital Service Trade Restrictiveness Index (DSTRI), derived from OECD's Service Trade Restrictiveness Index, identifies and quantifies barriers to digital service trade across five major policy domains [14]. Existing and emerging obstacles increase trade expenses for multinational corporations and possibly hinder the liberalization of digital service trade [15]. Additionally, Constraints on digital platforms might inversely correlate with activities in intangible economic sectors; countries with greater platform restrictions often receive limited contributions from the information and communication technology (ICT) sector toward productivity growth. Since 2015, digital service taxation or similar taxes have emerged as an international fiscal trend; however, a lack of a coordinated system of digital service tax may lead to trade friction among trading partners, which is detrimental to digital service trade [16]. Data regulation primarily focuses on restrictive measures imposed on the commercialization of electronic

data. Policy restrictions on "domestic data use" might indirectly escalate the costs of online digital service transactions, whereas those restrictions on "cross-border data flows" can directly increase transaction expenses [17]. Stone et al. were the first to quantify data localization measures [18], finding that such measures increase data utilization costs and diminish digital trade benefits [19]. Data restrictions can influence productivity in data-intensive sectors [20]. For data-intensive SMEs, complying with the General Data Protection Regulation (GDPR) might incur substantial costs and impact commercial activities [21]. In countries with advanced digital networks, policy restrictions on data have a stronger inhibitory effect on the import of digital services [22]. There is an urgent need to find a balance between the development of digital service trade and international governance and adaptation to globalization and digitization to ensure equitable benefits for all stakeholders.

Including digital trade provisions in free trade agreements has recently emerged as a significant trend in digital service trade regulation [23]. However, the complexity of these provisions varies significantly across agreements. Digital trade provisions in agreements led by the U.S., such as the TPP, CPTPP, and USMCA, differ notably from those in agreements led by the European Union, revealing disparities in digital service trade governance [24]. Enhancing the operability and trustworthiness of the digital service regulatory framework can stimulate growth in digital service trade via participation in international data agreements [25]. Trade clauses related to market access have similar implications to tariffs; they may reduce barriers to digital service imports among member nations but may increase barriers between member and non-member countries, resulting in trade diversion [26]. Countries actively engaging in World Trade Organization discussions on the digital economy are more likely to integrate digital service trade strategies into preferential trade agreements (PTAs) [27].

Nevertheless, existing research on digital service trade can be improved. First, restrictive regulatory policies on digital service trade have a significant and negative impact on digital service trade. However, the contradiction between regulations and trade on digital services should be investigated in depth as to how this contradiction affects economic growth. Second, digital service trade regulation quantification often relies heavily on DSTRI or specific data policies; however, a comprehensive evaluation of trade regulation in digital service is necessary to identify overall regulatory effects. This study addresses the abovementioned issues comprehensively by establishing a new economic growth model, refining methods for measuring digital service trade, systematically assessing trade regulatory barriers in digital services, and uncovering the effects of cross-border digital service inputs and digital service trade barriers on importing countries' economic growth. The findings of this study are expected to offer a more holistic understanding of digital service trade.

3. Research Hypotheses

Cross-border flow of data elements refers to the exchange and reconfiguration of data elements between countries, aiming to break the constraints of local factor markets, leverage comparative advantages, and maximize profits. In contrast to other types of service trade, digital service trade connects businesses, digital infrastructures, other infrastructures, and individuals through digital technologies, serving as the medium for the cross-border flow of data elements, a critical production factor in the era of digitalization. The inflow of data elements resulting from cross-border digital service inputs exerts dual-dimensional driving effects on the economic growth of the importing countries.

On the one hand, the inflow of data elements directly increases the factor stock of data in the importing country, thereby breaking the spatial limitations of the agglomeration effect, mapping more foreign entities into the virtual space network, expanding the driving source of economic growth in virtual space [28,29]. With the inflow of data elements, the number of users and the scale of data in the digital network increases more constantly, and digital products and services are copied more frequently, accelerating the value creation process and achieving economies of scale for value co-creation.

On the other hand, data elements are highly fluid, making it possible to integrate other elements that are less liquid. Specifically, the inflow of data elements is accompanied by the dissemination of new knowledge, new technologies, and new management models [30]. It promotes the communication, coordination, and cooperation of human capital among nations, guiding the transformation from underutilized, ordinary labor into knowledge-intensive and skilled labor. It expedites the conversion of human capital in the host country and facilitates technological advancements. Subsequently, the inflow of data elements enhances the upgrading of human capital and promotes the technological progress of the importing countries. Thus, this study proposes the following hypothesis.

Hypothesis 1: *Cross-border digital service inputs have a positive impact on economic growth in the importing country.*

The detrimental impact of trade regulation and data regulation on the liberalization of digital service trade has been confirmed. Regulatory policies concerning data flows and digital connectivity aim to safeguard domestic personal information and data security. However, policymaking should also consider the developmental needs of the digital service trade [31]. Excessive regulatory intensity hampers digital products and services inflow, impeding the interaction between domestic and foreign data elements. Conversely, if regulations are moderate, the dual-dimensional driving effects of data element inflows on the economic growth of the importing country can be realized [32]. Therefore, we derive the following hypothesis.

Hypothesis 2: *Barriers to digital service trade inhibit the positive influence of cross-border digital service inputs on the economic growth of the importing country.*

4. Model Setting and Variable Description

First, to determine the role of digital capital inputs within the economic growth model, we incorporate data elements into the production function in our study. Second, this study investigates methods for measuring digital service import trade, digitized capital, and digital service trade barriers. Finally, we elucidate our sample selection and data sources.

4.1. Model

Based on the ICT service function [33], this study devises a novel production model suitable for the digital economy era.

$$Y_t = F\left(A_t, D_t, K_t^{IT}, K_t^{NT,\beta}, L_t\right) = A_t\left(K_t^{IT} D_t\right)^{\alpha} K_t^{NT,\beta} {L_t}^{1-\alpha-\beta} \quad (1)$$

The coefficients α, β, and $1-\alpha-\beta$ represent, respectively, the shares of digitized capital, traditional material capital (K_t^{NT}), and labor (L_t) in the production output. ICT capital embodies the tangible infrastructure for creating, storing, and transmitting information and data. In contrast, traditional material capital refers to assets like factories and raw materials, excluding ICT capital. Notably, digital capital, stored in modern information network infrastructure and diverse databases, represents entirely digitized and factored information and data stemming from ICT. Its production relies on the inputs of ICT capital (K_t^{NT}) and data factor D_t. By dividing both sides of Equation (1) by labor (L_t) it can be expressed as follows:

$$Y_t = A_t\left(K_t^{IT} D_t\right)^{\alpha} K_t^{NT,\beta} \quad (2)$$

The study examines how digital service imports affect the economic growth of the importing country through a baseline regression model as follows:

$$ln\ y_{it} = \alpha_0 + \alpha_1 ln\ digtrade_{ist} + \sum_{k=1}^{6} \beta_k X_{it} + \theta_i + \delta_t + \upsilon_s + \varepsilon_{ist} \quad (3)$$

The explained variable ($ln\ y_{it}$) represents the logarithm of the per capita real GDP of country i in year t. The explanatory variable ($ln\ digtrade_{ist}$) denotes the logarithm of the value of per capita digital service imports in category s of country i in year t. Additionally, X_{it} indicates a set of control variables: digitalized capital (d) is denoted by the logarithmic value of the product of per capita ICT capital stock ${k_t}^{IT}$ and data factor stock D_t; traditional material capital (k) is expressed as the stock of per capita traditional material capital; innovation input ($inno$) is indicated by the proportion of R&D expenditure to GDP; external openness (op) is denoted by the ratio of export value to GDP; urbanization (urb) is the proportion of the urban population to the total population; and institution the Worldwide Governance Indicators indicate institutional quality, $(wgi)\theta_i$, δ_t, and v_s correspond to regional, annual, and industry-fixed effects, respectively, and ε_{ist} is the random disturbance term.

To determine the relationship between cross-border digital service inputs, digital service trade barriers, and the economic growth of importing countries and to understand and measure how the intensity of the impact of digital service imports on economic growth varies with the trade barriers, let $barrier_{it}$ represent the degree of trade barriers to digital service in country i in year t. The extended baseline regression model is constructed as follows:

$$ln\ y_{it} = \alpha_0 + \alpha_1 ln\ digtrade_{ist} + \alpha_2 barrier_{it} + \alpha_3 ln\ digtrade_{ist} \times barrier_{it} + \sum_{k=1}^{6} \beta_k X_{it} + \theta_i + \delta_t + v_s + \varepsilon_{ist} \quad (4)$$

4.2. Key Indicator Measures

This study elaborates on the methods for measuring digital service imports, digitalized capital, and digital service trade barriers.

4.2.1. Digital Service Import Trade

Digital service import trade essentially is a vessel for data element inflows, with data elements being key production factors and strategic resources in the new era. Based on the Extended Balance of Payments Services Classification (EBOPS 2010), this study determines the accounting scope for digital service inputs, encompassing six primary service categories (Table 1).

Table 1. Measurement of import trade in digital services.

Denomination of Digital Service	ISIC Rev.4	Data Intensity	Whether Stripping
Insurance and pension services	64–66	High	No
Financial services			
Charges for the use of intellectual property	72	High	
Telecommunications, computer, and information services	61–63	High	
Other business services	69–75	High	
	77–82	High	
Personal, cultural, and recreational services	58–60	Medium-high	Yes
	85–88, 90–93	Medium-low	
	94–96	High	

Assessing the trade volume of digital service industries entirely as digital service trade is common practice, but this proxy variable does not accurately capture the content of digital services. Therefore, a "stripping" coefficient is established to optimize the measurement of digital service inputs (Table 2).

Table 2. Stripping coefficient of digital service import trade.

Sector Denomination	ISIC Rev.4	2005	2006	2007	2008	2009	2010	2011
Personal, cultural, and recreational services	58–60	0.008	0.007	0.007	0.007	0.007	0.007	0.007
	85–88, 90–93							
	94–96							
Sector denomination	Code	2012	2013	2014	2015	2016	2017	2018
Personal, cultural, and recreational services	58–60	0.007	0.007	0.007	0.007	0.007	0.006	0.006

Step 1: we match digital service categories with the International Standard Industrial Classification (ISIC Rev.4) and classify the data intensity of each digital service category based on the industry's digital intensity [34]. Step 2: we consider the digital service categories with high data intensity wholly digital services, whereas others are considered partial digital services; thus, only the non-digitalized portion of the latter trade data needs to be stripped. Step 3: for the digital service categories that require stripping, we assume that the proportion of digital services in all services aligns with the ratio of digital economic output in that sector's total output. The U.S. industry-level ratio of digital economic output to total industry output is used as the stripping coefficient. The stripped import data then represent that category's digital service import value. Step 4: we use the stripped import trade of the six digital service categories as the proxy variable for cross-border digital service inputs.

4.2.2. Digitalized Capital

As digitalized capital is the product of per capita ICT capital stock and data element stock, we employ the OECD's Inter-Country Input–Output (ICIO) Tables' data to quantify these indicators. Step 1: based on the accounting framework for the scale of the digital economy [35] and the ISIC Rev.4, we identify the Data Element Production Sector and ICT Investment Sector (Table 3).

Step 2: We determine the data intensity of the Data Element Production Sector and the ICT Investment Sector [34].

Step 3: We regard the output of the Data Element Production Sector with high data intensity as a wholly digital input. For the Data Element Production Sector with medium-high, medium-low, and low data intensity, we assume that the proportion of digital output in total output aligns with the ratio of digital economic output in that sector's total output. Subsequently, we apply the same stripping method to remove the non-digital components from the total output, and the stripped output is considered as the input of the Data Element. The stripping coefficients are shown in Table 4.

Step 4: We use the perpetual inventory method to calculate the ICT capital and data element stocks. The depreciation rate for ICT Investment is set at 10%, whereas that for data elements is set at 5%, considering the timeliness of the data, although there is no "depreciation" problem with the data.

Table 3. Digitalized capital measurement.

Type Denomination	Industry Denomination	ICIO Industry Code	Data Intensity	Whether Stripping
Data Element Production	Wholesale	D45T47	Medium-high	Yes
	Retail			
	Publishing activities	D58T60	Medium-high	Yes
	Motion picture, video, and television program production, recording, and music publishing activities			
	Programming and broadcasting activities			
	Telecommunications	D61	High	No
	Computer programming, consultancy, and related activities	D62T63	High	No
	Information service activities			
	Financial service activities	D64T66	High	No
	Insurance, reinsurance, and pension funding			
	Activities auxiliary to financial services and insurance activities			
	Legal and accounting activities	D69T75	High	No
	Management consultancy activities			
	Technical testing and analysis; architectural and engineering activities			
	Scientific research and development			
	Advertising and market research			
	Other professional, scientific, and technical activities			
	Administrative and support service activities	D77T82	High	No
	Public administration and defense	D84	Medium-high	Yes
	Education	D85	Medium-low	Yes
	Human health and social work activities	D86T88	Medium-low	Yes
	Arts, entertainment, and recreation	D90T93	Medium-high	Yes
ICT Investment	Telecommunication	D61	High	No
	Computer programming, consultancy, and related activities Information service activities	D62T63	High	
	Manufacture of computers, electronic equipment, and optical products	D26	Medium-high	
	Manufacture of electrical equipment	D27	Medium-high	No
	Repair of computers and communication equipment	D94T96	High	

4.2.3. Digital Service Trade Barriers

The restrictive measures impeding cross-border digital service investments were systematically categorized into three primary classes to quantify the regulatory intensity or the degree of policy constraints on digital service trade across countries (Table 5). These include (1) direct restrictive policies, which directly impact digital service trade and are sourced from the OECD's DSTRI regulatory database, where each measure is assigned a specific weight based on its significance; (2) data restrictive policies, which directly affect the flow of data elements and primarily increase the operational costs of cross-border business; and (3) indirect restrictive policies, which indirectly affect digital service trade. The data for the second and third categories are derived from the ECIPE-DTE database, with each measure assigned a specific weight based on its influence on digital trade.

Table 4. Stripping coefficients of the data element production sector.

Industry Denomination	ICIO Industry Code	2005	2006	2007	2008	2009	2010	2011
Wholesale Retail	D45T47	0.141	0.148	0.155	0.163	0.176	0.193	0.201
Publishing activities Motion picture, video, and television program production, recording, and music publishing activities Programming and broadcasting activities	D58T60	0.241	0.247	0.250	0.266	0.280	0.279	0.294
Public administration and defense	D84	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Education	D85	0.012	0.012	0.012	0.012	0.011	0.012	0.012
Human health and social work activities	D86T88	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Arts, entertainment, and recreation	D90T93	0.001	0.002	0.002	0.002	0.002	0.002	0.002
Industry denomination	ICIO Industry Code	2012	2013	2014	2015	2016	2017	2018
Wholesale Retail	D45T47	0.211	0.214	0.219	0.231	0.233	0.237	0.240
Publishing activities Motion picture, video, and television program production, recording, and music publishing activities Programming and broadcasting activities	D58T60	0.295	0.302	0.307	0.310	0.336	0.355	0.357
Public administration and defense	D84	0.004	0.005	0.004	0.004	0.004	0.004	0.004
Education	D85	0.011	0.011	0.012	0.011	0.012	0.011	0.011
Human health and social work activities	D86T88	0.001	0.002	0.002	0.002	0.002	0.002	0.002
Arts, entertainment, and recreation	D90T93	0.001	0.002	0.002	0.002	0.002	0.002	0.002

Then, we evaluated, weighted, and aggregated the restrictive measures of digital service trade of various countries, which can be summarized into a comprehensive policy restrictive index and three subindexes, i.e., direct index, data index, and indirect index.

Subsequently, we develop two weighted policy restrictive indexes of digital trade services to set up the digital service trade barriers variable with two different weights, namely ξ_{ist} and ς_{it}, respectively, avoiding the bias arising from a singular metric. ξ_{ist} denotes the consumption intensity of data elements in the importing country, which equals the complete consuming coefficient of six categories of digital services. Hence, the country-specific policy restriction index we develop is multiplied by the term. This is how the digital service trade barriers variable is set up, which corresponds to a comprehensive barrier index (*barrier*1) and three subindexes, i.e., *barrier*1_*direct*, *barrier*1_*data*, and *barrier*1_*indirect*. ς_{it} denotes the stock of data element in the importing country. The second trade barrier index, the policy restriction weighted by ς_{it}, corresponds to a comprehensive barrier index (*barrier*2) and three subindexes, i.e., *barrier*2_*direct*, *barrier*2_*data* and *barrier*2_*indirec*.

Table 5. Measurement framework of policy restriction on digital service trade.

Policy Types	Weighting	Measure Types	Weighting	Measures Covered
Direct Restrictive Measures	0.33	Electronic Transactions	0.43	Discriminatory conditions for licenses to engage in e-commerce; Online tax registration and declaration is available to non-resident foreign providers; National contract rules for cross-border transactions deviate from internationally standardized rules; Laws or regulations explicitly protect confidential information, Laws or regulations provide electronic signatures with the equivalent legal validity of hand-written signatures; Dispute settlement mechanisms exist to resolve disputes arising from cross-border digital trade.
		Payment Systems	0.17	Discriminatory access to payment settlement methods; National payment security standards deviate from international standards; Restrictions on internet banking or insurance.
		Other Direct Restrictions	0.4	Performance requirements affecting cross-border digital trade; Limitations on downloading and streaming affecting cross-border digital trade; Restrictions on online advertising; Commercial presence is required in order to provide cross-border services; Local presence is required in order to provide cross-border services; Firms have redress when business practices restrict competition in a given market.
Data Restrictive Measures	0.33	Cross-Border Flow Restrictions	0.5	Ban to transfer or local processing requirement; Local storage requirement; Conditional flow regime.
		Domestic Regulatory Restrictions	0.5	Limitations on data retention; Subject rights on data privacy; Administrative requirements for data privacy; Sanctions for non-compliance.
Indirect Restrictive Measures	0.33	Fiscal Restrictions	0.25	Tariffs and trade defense; Limitations on taxation and subsidies; Limitations on public procurement.
		Establishment Restrictions	0.25	Limitations on foreign investment; Intellectual property rights; Competition policy; Business mobility.
		Intermediaries Restrictions	0.25	Limitations on intermediary liability; Limitations on content access.
		Trading Restrictions	0.25	Quantitative trade restrictions; Limitations on technical standards; Restriction to the efficient flow of online sales and transactions.

This strategy relies on the assumption that the more data-intensive sectors are more impacted by changes in data policies, and the sectors more dependent on digital services are more influenced by trade policies in digital services [36]. This is a more reasonable way to quantify the intensity of trade barriers in digital services than unweighted policy-restrictive indexes of digital trade services.

4.3. Descriptive Statistics

This study excluded countries with severe data omissions and employed sample data from 48 countries spanning 2005–2021, with a base period of 2005 for all variables. Descriptive statistics are illustrated in Table 6. The OECD-ICIO table was updated to 2018, and data for data elements spanning 2019–2021 were supplemented using linear interpolation.

Table 6. Descriptive statistics.

Variable	Symbol	Mean	Standard Deviation	Min.	Max.	Data Source
Economic Growth Level	*ln y*	9.592	1.221	5.168	11.553	World Bank
Digital Service Import Trade	*ln digtrade*	3.548	2.302	0.000	10.899	UNCTAD
Digitized Capital	*ln d*	2.333	0.386	−2.422	2.790	OECD
Traditional Material Capital	*ln k*	10.489	1.151	6.189	12.255	World Bank
Innovation Input	*inno*	1.518	0.994	0.066	5.002	World Bank
External Openness	*op*	0.472	0.304	0.085	2.121	World Bank
Urbanization	*urb*	0.727	0.157	0.192	0.981	World Bank
Institutional Quality	*wgi*	4.720	4.714	−5.386	11.363	World Bank
Digital Service Trade Barriers (1)	*barrier*1	−0.217	0.675	−4.379	1.034	OECD ECIPE-DTE
Digital Service Trade Barriers (2)	*barrier*2	3.950	7.913	0.008	54.372	OECD ECIPE-DTE

5. Results

Table 7 presents the results of the baseline regression model, i.e., Equation (3). Column (1) of Table 7 exclusively encompasses the explanatory variable ($ln\ digtrade_{ist}$) whereas Columns (2)–(7) progressively introduce control variables. The analysis reveals that the coefficient of digital service imports is significantly positive at the 1% level without adding control variables and adding control variables gradually, signifying that cross-border digital service inputs can considerably stimulate economic growth in the importing country. Cross-border digital service inputs underscore their pivotal economic importance, which supports Hypothesis 1.

Due to the low-cost replicable, non-competitive, and non-excludable data element characteristics, valuable data information within digital products and services can synergize with other factors across different industrial chain links, generating economies of scale, scope, and multiplier effects. This ultimately engenders a "comedy-of-the-commons" scenario that fosters macroeconomic growth.

5.1. Robustness Analysis

To ensure the consistency and robustness of the conclusions, we provided robustness checks for four perspectives to reexamine the economic growth effects of digital service imports.

- Substitution of explanatory variable: When the explanatory variable ($ln\ digtrade_{ist}$) was replaced with the total import value of the entire digital services industry, the results continued to yield a significantly positive coefficient, showing the enduring and robust economic impact of cross-border data service inputs for the importing nation. The absolute value of the coefficient for the explanatory variable ($ln\ digtrade_{ist}$) was slightly larger than that of the baseline regression, indicating the necessity of excluding the "nondigital" portion of import value to avoid overestimating the positive effect of cross-border digital service input.
- Winsorizing: We winsorize the data at the 1% and 99% levels on the sample data to reduce the influence of outliers.
- Adjustment of sample period: As the digital service trade concept was first introduced in 2012, we adjusted the sample period to 2012–2021.
- Adjustment of fixed effects: We incorporate interactive fixed effects of "year-industry" and "region-year" into the baseline model to mitigate the macro-level systemic environmental changes that could arise from the development of digital service trade.

Table 7. Baseline regression results.

$ln\ y_{it}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$ln\ digtrade_{ist}$	0.045 ***	0.046 ***	0.045 ***	0.043 ***	0.042 ***	0.042 ***	0.040 ***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ln d	—	0.256 ***	0.098 ***	0.134 ***	0.125 ***	0.137 ***	0.134 ***
		(0.030)	(0.016)	(0.018)	(0.017)	(0.016)	(0.017)
ln k	—	—	0.280 ***	0.260 ***	0.303 ***	0.250 ***	0.172 ***
			(0.024)	(0.022)	(0.023)	(0.024)	(0.025)
inno	—	—	—	0.200 ***	0.200 ***	0.203 ***	0.204 ***
				(0.015)	(0.015)	(0.015)	(0.015)
op	—	—	—	—	0.250 ***	0.290 ***	0.326 ***
					(0.049)	(0.050)	(0.050)
urb	—	—	—	—	—	1.645 ***	1.877 ***
						(0.286)	(0.275)
wgi	—	—	—	—	—	—	0.054 ***
							(0.007)
constant	9.431 ***	8.833 ***	6.265 ***	6.093 ***	5.554 ***	4.866 ***	5.251 ***
	(0.023)	(0.071)	(0.229)	(0.206)	(0.228)	(0.238)	(0.256)
Observations	4896	4896	4896	4896	4896	4896	4896
R^2	0.966	0.967	0.968	0.970	0.970	0.970	0.970
FE year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F.E. country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F.E. industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Values in parentheses indicate standard errors; *** indicate significance at the 1% levels.

Table 8 presents the results of the robustness checks. The positive coefficient for digital service imports remained strong, thus supporting the conclusion that cross-border digital service inputs contribute to the economic growth of importing countries.

Table 8. Results of robustness checks.

$ln\ y_{it}$	(1) Substitution of Explanatory Variable	(2) Winsorize	(3) Adjustment of Sample Period	(4) Adjustment of Fixed Effects
$ln\ digtrade_{ist}$	0.063 ***	0.041 ***	0.028 ***	0.295 ***
	(0.006)	(0.006)	(0.007)	(0.024)
Control variable	Yes	Yes	Yes	Yes
Observations	4896	4896	2880	4896
R^2	0.971	0.970	0.978	0.975
FE year	Yes	Yes	Yes	Yes
F.E. country	Yes	Yes	Yes	Yes
F.E. industry	Yes	Yes	Yes	Yes

Note: Values in parentheses indicate standard errors; *** indicate significance at the 1% levels.

5.2. Endogeneity Analysis

Considering that regions with higher economic growth might lean toward more inputs in digital service, a bidirectional causal relationship was determined, potentially causing

endogeneity issues. The model was reestimated using the two-stage least squares method to address this issue. We selected the digital service imports of matching countries as the first instrumental variable ($ln\ digtrade_{ist}{}^{IV}$), with the matching criterion being the minimum heterogeneity index of digital service trade restrictions (DSTRI_HI) between the two countries. Additionally, we selected the lagged one period of digital service imports as the second instrumental variable ($L.ln\ digtrade_{ist}$).

The results shown in Table 9 indicate that the *p*-value of the underidentification test is <0.05, and the weak identification test result is >16.380, substantiating the efficacy and rationality of the instrumental variables.

Table 9. Results of endogeneity analysis.

$ln\ y_{it}$	(1)	(2)	(3)	(4)
$ln\ digtrade_{ist}{}^{IV}$	0.072 *** (0.017)	0.083 *** (0.015)	—	—
$L.ln\ digtrade_{ist}$	—	—	0.042 *** (0.021)	0.038 * (0.020)
Control variable	No	Yes	No	Yes
Kleibergen–Paap rk LM	16.460 *** [0.000]	16.541 *** [0.000]	26.375 *** [0.000]	26.431 *** [0.000]
Cragg–Donald Wald F	186.777	185.043	85,933.020	85,729.610
Kleibergen–Paap rk Wald F	1567.117	1867.191	28,266.160	28,197.560
Observations	4896	4896	4608	4608
F.E. year	Yes	Yes	Yes	Yes
F.E. country	Yes	Yes	Yes	Yes
F.E. industry	Yes	Yes	Yes	Yes

Note: 1. Values in brackets indicate the *p*-value of the test for the instrumental variable; ***, and * indicate significance at the 1%, and 10% levels, respectively; 2. Stock–Yogo test threshold for the 10% level is 16.380.

The estimated coefficient of digital service imports remains consistent with the baseline regression outcomes, indicating that increasing input in cross-border digital services can significantly promote economic growth in importing countries, excluding potential endogeneity concerns.

5.3. Mechanisms Analysis Underlying Digital Service Trade Barriers

Table 10 presents the results of our comprehensive analysis of general digital service trade barriers (Column 1) and results disaggregated by specific barriers (Columns 2–4). The coefficient of digital service imports is significantly positive at the 1% level, aligning with the data presented in Table 5. The estimated coefficients of the interaction terms are consistently negative, implying that the digital service trade barriers of the importing country weaken the positive effect of cross-border digital service input and data element inflow on economic growth. As the importing country imposes stronger barriers to digital service trade, the categories and quality of digital service intermediates become more constrained, intensifying this inhibitory effect. The contradiction between digital service trade barriers and cross-border digital service input impedes the process of yielding the digital dividend and driving economic growth.

Table 10. Extended baseline regression results with *barrier*1.

$ln\ y_{it}$	(1) General Barriers *barrier*1	(2) Direct Barriers *barrier*1_*direct*	(3) Data Barriers *barrier*1_*data*	(4) Indirect Barriers *barrier*1_*indirect*
$ln\ digtrade_{ist}$	0.059 ***	0.062 ***	0.063 ***	0.059 ***
	(0.008)	(0.008)	(0.008)	(0.007)
*barrier*1	−0.034 **	0.434 *	−0.207 ***	−0.081 *
	(0.014)	(0.251)	(0.070)	(0.044)
$ln\ digtrade_{ist} \times barrier1$	−0.031 ***	−0.786 ***	−0.131 ***	−0.124 ***
	(0.004)	(0.100)	(0.016)	(0.014)
Control variable	Yes	Yes	Yes	Yes
Observations	4692 [1]	4896	4692 [1]	4692 [1]
R^2	0.968	0.971	0.968	0.968
FE year	Yes	Yes	Yes	Yes
F.E. country	Yes	Yes	Yes	Yes
F.E. industry	Yes	Yes	Yes	Yes

Note: [1] The ECIPE-DTE database has no information on the regulatory policies of Cambodia and Kazakhstan, and the sample size of the digital service trade barriers indexes is 4692. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Among the disaggregated digital service trade barriers, direct barriers have the highest inhibitory effect, followed by data barriers, while indirect barriers exhibit the weakest inhibitory effect. Direct restrictive measures directly hinder digital service trade transactions, representing pivotal institutional variables influencing digital service trade. Data restrictive measures directly affect the cross-border movement of data elements. In contrast, indirect restrictive measures influence digital infrastructure to support digital service trade and the competitive environment, consequently only indirectly affecting the trade costs of digital service.

We provide a robustness check for the extended baseline regression model with the second digital service trade barrier variable; the estimated results are listed in Table 11. The coefficient of interaction term remains significantly negative at the 1% level. Among the disaggregated digital service trade barriers, the inhibitory effect of direct barriers is the strongest, followed by data barriers, with indirect barriers exhibiting the weakest inhibitory effect, which is consistent with the results in Table 10. This further validates the contention that digital service trade barriers weaken the promoting effect of cross-border digital service inputs on economic growth.

Table 11. Extended baseline regression results with *barrier*2.

$ln\ y_{it}$	(1) General Barriers *barrier*2	(2) Direct Barriers *barrier*2_*direct*	(3) Data Barriers *barrier*2_*data*	(4) Indirect Barriers *barrier*2_*indirect*
$ln\ digtrade_{ist}$	0.040 ***	0.041 ***	0.040 ***	0.040 ***
	(0.006)	(0.006)	(0.006)	(0.008)
*barrier*2	0.219 ***	0.628 ***	0.422 ***	0.466 ***
	(0.014)	(0.044)	(0.026)	(0.053)
$ln\ digtrade_{ist} \times barrier2$	−0.002 **	−0.009 *	−0.005 ***	−0.003 **
	(0.001)	(0.005)	(0.002)	(0.001)

Table 11. *Cont.*

$ln\ y_{it}$	(1) General Barriers *barrier2*	(2) Direct Barriers *barrier2_direct*	(3) Data Barriers *barrier2_data*	(4) Indirect Barriers *barrier2_indirect*
Control variable	Yes	Yes	Yes	Yes
Observations	4692	4896	4692	4692
R^2	0.968	0.971	0.968	0.968
FE year	Yes	Yes	Yes	Yes
F.E. country	Yes	Yes	Yes	Yes
F.E. industry	Yes	Yes	Yes	Yes

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Furthermore, we investigated the differential impact of specific restrictive regulatory measures on the economic effects of cross-border digital service inputs in further detail. Table 12 presents the results of our analysis of nine weighted restrictive regulatory measures based on ξ_{ist}.

Table 12. Extended baseline regression results for specific measures with *barrier*1.

$ln\ y_{it}$	(1) Electronic Transactions	(2) Payment Systems	(3) Other Direct Restriction	(4) Cross-Border Flow Restrictions	(5) Domestic Regulatory Restrictions
$ln\ digtrade_{ist}$	0.057 ***	0.047 ***	0.055 ***	0.054 ***	0.054 ***
	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)
*barrier*1	−0.408	0.808 ***	0.035 **	−0.054	−0.055
	(0.307)	(0.278)	(0.014)	(0.042)	(0.045)
$ln\ digtrade_{ist} \times barrier1$	−0.574 ***	−1.015 ***	−0.052 ***	−0.085 ***	−0.059 ***
	(0.091)	(0.169)	(0.007)	(0.013)	(0.010)
Control variable	Yes	Yes	Yes	Yes	Yes
Observations	4896	4896	4896	4692	4692
R^2	0.971	0.971	0.971	0.968	0.967
FE year	Yes	Yes	Yes	Yes	Yes
F.E. country	Yes	Yes	Yes	Yes	Yes
F.E. industry	Yes	Yes	Yes	Yes	Yes
$ln\ y_{it}$	(6) Fiscal Restrictions	(7) Establishment Restrictions	(8) Intermediaries Restrictions	(9) Trading Restrictions	
$ln\ digtrade_{ist}$	0.063 ***	0.051 ***	0.056 ***	0.057 ***	
	(0.007)	(0.007)	(0.007)	(0.006)	
*barrier*1	−0.007 *	−0.038 *	−0.027	−0.007	
	(0.004)	(0.023)	(0.030)	(0.049)	
$ln\ digtrade_{ist} \times barrier1$	−0.010 ***	−0.054 ***	−0.063 ***	−0.139 ***	
	(0.001)	(0.007)	(0.009)	(0.015)	
Control variable	Yes	Yes	Yes	Yes	
Observations	4692	4692	4692	4692	
R^2	0.968	0.968	0.967	0.968	
FE year	Yes	Yes	Yes	Yes	
F.E. country	Yes	Yes	Yes	Yes	
F.E. industry	Yes	Yes	Yes	Yes	

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

The estimated coefficients of all the interaction terms are negative, implying that a greater number of restrictive regulatory measures are associated with a reduced potential for achieving the digital dividend effect using cross-border digital service inputs. Notably, the absolute values of the interaction term coefficients differ significantly, with payment systems, electronic transactions, trading restrictions, and cross-border flow restrictions exhibiting stronger inhibitory effects.

Table 13 presents the results for the nine weighted restrictive regulatory measures based on ς_{it}. The absolute values of the interaction term coefficients are more significant for electronic transactions, trading restrictions, cross-border flow restrictions, and domestic regulatory restrictions. These measures exhibit a stronger inhibitory effect on cross-border digital services' positive economic growth impact. Interestingly, only the interaction term coefficient of payment systems has a different result than the corresponding result in Table 12, showing uncertain effects on cross-border digital services' positive economic growth impact.

Table 13. Extended baseline regression results for specific measures with *barrier*2.

$ln\ y_{it}$	(1) Electronic Transactions	(2) Payment Systems	(3) Other Direct Restriction	(4) Cross-Border Flow Restrictions	(5) Domestic Regulatory Restrictions
$ln\ digtrade_{ist}$	0.042 ***	0.040 ***	0.041 ***	0.040 ***	0.040 ***
	(0.006)	(0.006)	(0.008)	(0.006)	(0.006)
*barrier*2	0.781 ***	0.715 ***	0.417 ***	0.868 ***	0.699 ***
	(0.100)	(0.055)	(0.044)	(0.064)	(0.045)
$ln\ digtrade_{ist} \times barrier2$	−0.013 ***	0.023 **	−0.003 **	−0.010 **	−0.008 ***
	(0.005)	(0.009)	(0.001)	(0.005)	(0.003)
Control variable	Yes	Yes	Yes	Yes	Yes
Observations	4896	4896	4896	4692	4692
R^2	0.971	0.971	0.971	0.968	0.968
FE year	Yes	Yes	Yes	Yes	Yes
F.E. country	Yes	Yes	Yes	Yes	Yes
F.E. industry	Yes	Yes	Yes	Yes	Yes
$ln\ y_{it}$	(6) Fiscal Restrictions	(7) Establishment Restrictions	(8) Intermediaries Restrictions	(9) Trading Restrictions	
$ln\ digtrade_{ist}$	0.040 ***	0.040 ***	0.040 *	0.017 ***	
	(0.006)	(0.006)	(0.017)	(0.005)	
*barrier*2	0.354 ***	0.370 ***	0.429 ***	−1.436 ***	
	(0.026)	(0.023)	(0.007)	(0.170)	
$ln\ digtrade_{ist} \times barrier2$	−0.003 *	−0.003 **	−0.004 *	0.011 ***	
	(0.002)	(0.002)	(0.002)	(0.001)	
Control variable	Yes	Yes	Yes	Yes	
Observations	4692	4692	4692	4692	
R^2	0.968	0.968	0.968	0.971	
FE year	Yes	Yes	Yes	Yes	
F.E. country	Yes	Yes	Yes	Yes	
F.E. industry	Yes	Yes	Yes	Yes	

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Electronic transaction restrictions can adversely affect digital service interoperability, thereby directly increasing the contractual costs of digital service inputs. Within measures on trading restrictions, trade quantity restrictions can negatively affect the import and export of digital products such as information and telecommunications equipment, hampering domestic digital infrastructure development. Technical standard limitations that surpass international norms can escalate the security certification costs of digital products, thus slowing down the market entry of international digital services into the domestic market. Restrictions on online transactions can decrease the number of digital service trade participants.

Cross-border flow restrictions and domestic regulatory restrictions may establish more stringent or even onerous provisions for online users and businesses reliant on data for their operations, thereby directly or indirectly constraining the inflow of data-intensive services and hindering countries from enhancing efficiency through digital service inputs.

5.4. Heterogeneity Analysis

This research further analyzes the heterogeneity according to categories of digital service inputs, types of importing countries, and personal data regulation models, and the results are shown in Table 14.

(1) Heterogeneity in Digital Service Categories

We used "personal, cultural, and recreational services" as the reference group within diverse digital service categories. Dummy variables ind_1, ind_2, ind_3, ind_4, and ind_5 were introduced to represent insurance and pension services, financial services, charges for the use of intellectual property, telecommunication, computer and information services, and other business services, respectively. We included the interaction terms ind_i and $ln\ digtrade_{ist} \times barrier1$ in the extended baseline regression model for estimation. Results shown in Column (1) of Table 14 indicate that digital service trade barriers weaken the positive impact of these segmented cross-border digital service inputs on economic growth. Notably, the inhibitory effect is stronger for personal, cultural, and recreational services and financial services.

(2) Heterogeneity in Countries

For various importing countries, we selected developing economies as the reference group and introduced interaction terms $ln\ digtrade_{ist} \times barrier1 \times dc$ for estimation, with dummy variables dc representing developed economies. Results in Column (2) of Table 14 demonstrate that regardless of whether the country is developing or not, digital service trade barriers weaken the positive impact of cross-border digital service investments on economic growth. However, the comparative advantages of developed economies allow them to set lower digital service trade barriers, resulting in lower negative moderating effects of such barriers.

We select Non-belt and Road economies as the reference group and include the interaction terms $ln\ digtrade_{ist} \times barrier1 \times br$ in the extended baseline regression model for estimation, with dummy variables br representing Belt and Road economies. Results in Column (3) of Table 14 show that higher trade barriers to digital service in Belt and Road economies lead to stronger negative moderating effects, thereby hindering the realization of the "digital dividends" brought by cross-border digital service inputs.

(3) Heterogeneity in Personal Data Regulation Modes

Various countries exhibit substantial differences in their regulatory framework for personal data transmission and processing, categorized as the open model in the United States, the conditional model in the European Union, and the limited model in China [37]. We select the open model economies as the reference group and include the corresponding interaction terms ($ln\ digtrade_{ist} \times barrier1 \times con$) of conditional model economies and the corresponding interaction terms ($ln\ digtrade_{ist} \times barrier1 \times ltd$) of limited model economies in the extended baseline regression model for estimation. Results in Column (4) of Table 14

reveal that digital service trade barriers of the limited model economies show the largest inhibitory effect on the relationship between cross-border digital service inputs and economic growth in importing countries, followed by conditional and open model economies. The combination of a strict personal data protection system and digital service trade barriers will hinder cross-border digital service inputs from releasing the digital dividend to a greater extent.

Table 14. Results of heterogeneity analysis.

$ln\ y_{it}$	(1) Type of Digital Services	(2) Level of Development	(3) Whether Belt and Road	(4) Personal Data Regulatory Model
$ln\ digtrade_{ist}$	0.061 ***	0.059 ***	0.059 ***	0.059 ***
	(0.011)	(0.008)	(0.011)	(0.008)
$barrier1$	−0.030 ***	−0.037 ***	−0.034 ***	−0.039 ***
	(0.007)	(0.014)	(0.007)	(0.014)
$ln\ digtrade_{ist} \times barrier1$	−0.066 ***	−0.111 ***	−0.031 ***	−0.015 **
	(0.016)	(0.010)	(0.005)	(0.007)
$ln\ digtrade_{ist} \times barrier1 \times ind_1$	0.033 **	—	—	—
	(0.012)			
$ln\ digtrade_{ist} \times barrier1 \times ind_2$	0.023 **	—	—	—
	(0.010)			
$ln\ digtrade_{ist} \times barrier1 \times ind_3$	0.037 ***	—	—	—
	(0.012)			
$ln\ digtrade_{ist} \times barrier1 \times ind_4$	0.034 **	—	—	—
	(0.013)			
$ln\ digtrade_{ist} \times barrier1 \times ind_5$	0.039 ***	—	—	—
	(0.013)			
$ln\ digtrade_{ist} \times barrier1 \times dc$	—	0.083 ***	—	—
		(0.009)		
$ln\ digtrade_{ist} \times barrier1 \times br$	—	—	−0.007 ***	—
			(0.001)	
$ln\ digtrade_{ist} \times barrier1 \times con$	—	—	—	−0.015 **
				(0.006)
$ln\ digtrade_{ist} \times barrier1 \times ltd$	—	—	—	−0.077 ***
				(0.013)
Control variable	Yes	Yes	Yes	Yes
Observations	4692	4692	4692	4692
R^2	0.968	0.968	0.968	0.968
FE year	Yes	Yes	Yes	Yes
F.E. country	Yes	Yes	Yes	Yes
F.E. industry	Yes	Yes	Yes	Yes

*** and ** indicate significance at the 1% and 5% levels, respectively.

6. Discussion and Conclusions

6.1. Discussion

Compared with previous studies, this paper aims to make three contributions to understanding the impact of cross-border digital service inputs on the economic growth

of importing countries. Firstly, the import trade in digital services serves as a conduit for the inflow of the data element. It is more direct and thorough to understand the impact of cross-border digital service input on the economic growth of importing countries from the perspective of data factor inflow than to analyze the benefits brought by digital service trade from the perspective of trade [5,10]. Secondly, it constructs a general index and three indexes to measure the intensity of digital service trade barriers. Previous research looked at type-specific regulatory policy, whereas the indexes constructed in this study include all barriers targeted at trade in digital services. Finally, restrictive regulatory policies on digital service trade have a significant and negative impact on digital service trade [15,17,20]. We estimate the impact of digital service trade barriers on the relationship between cross-border digital service inputs and the economic growth of importing countries and further answer the question of the impact of digital service trade barriers on economic growth in different importing countries.

6.2. Conclusions

Based on the panel data of 48 countries from 2005 to 2021, a three-dimensional fixed effects panel regression model was established to analyze the impact of digital service trade barriers and cross-border digital service inputs on economic growth in importing countries, and six main conclusions were drawn.

(1) Increasing cross-border digital service inputs can drive economic growth in the importing country, highlighting the significant economic value of such digital services.
(2) Digital service trade barriers constrain the inflow of the data factor and limit the options for digital services. This hinders the realization of the "digital dividends" from cross-border digital service inputs and subsequently affects economic growth in the importing country.
(3) Among the disaggregated digital service trade barriers, direct barriers have the strongest inhibitory effect on the relationship between cross-border digital service inputs and economic growth in the importing country, followed by data barriers. In contrast, indirect barriers exhibit the weakest inhibitory effect.
(4) Among the nine restrictive regulatory measures to digital service trade, electronic transactions, trading restrictions, cross-border flow restrictions, and domestic regulatory restrictions are the primary obstacles to unlocking the "digital dividends" from cross-border digital service inputs.
(5) Digital service trade barriers have a stronger negative moderating effect on the relationship between cross-border digital service inputs and economic growth in the importing country with a limited model for personal data transfers and processing.
(6) Digital service trade barriers have a weaker negative moderating effect on the relationship between cross-border digital service inputs and economic growth in developed countries due to their comparative advantage in the digital economy industry and lower trade barriers to digital services.

These conclusions have important policy implications for a need to (1) strengthen fiscal support and streamline the declaration process for digital service projects to enhance the competitive advantage of the industries related to the digital economy; (2) increase investment in digital services and encourage digital transformation of whole industries to stimulate economic growth; (3) actively engage in digital trade negotiations conducted by the World Trade Organization (WTO) while optimizing the management system for digital service trade within the existing legal framework; (4) leverage digital platforms to bolster data connectivity among the Belt and Road economies, promoting the exchange of information and knowledge; and (5) prioritize follow-up research and application of digital service investments and support talent cultivation necessary for the development of digital economy to fuel technological innovation and knowledge disseminate in the digital realm.

This research only focuses on the impact of the quantity of cross-border digital service inputs without considering the quality or technological content of such investments. These questions are left for future research.

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