## **Digital Trade and Economic Growth from the Perspective of Digital Services**

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**Abstract:** This paper examines the relationship between digital trade and economic development from the perspective of digital service trade. Using a newly compiled panel of 47 countries over a 13-year period from 2005 to 2017, the paper reports estimate as follows: 1. The increase of digital service trade can significantly promote the degree of economic development. 2. The promotion effect of digital service trade import on economic development is greater than that of export. 3. Digital service trade plays an important role in promoting economic development in high-income and middle-income countries, but it is not significant in low-income countries. Based on the analysis, it is proposed that countries should attach importance to digital trade and improve the infrastructure investment of digital and ICT industries, and that low-income countries should first guarantee and improve the livelihood of the people through the deepening of reform so as to reap benefits from digital trade.

#### 1. Introduction

The revolution of informatization and digitization has changed the traditional form of international trade. One of the most obvious manifestations is, the proportion of digital products trade, digital service trade and e-commerce trade has increased significantly, all of this can be included in the socalled digital trade. With the promotion of information technology, the development and changes of digital trade occur increasingly faster. The Internet and global data flow make international trade in the development process from goods trade into service trade. Large enterprises continuously advance production and operation efficiency; small and medium-sized enterprises and companies from developing countries can participate in global trade in different ways; both parties of international trade shift from inter-industry trade to intra-industry trade of more technical goods and services. Digital trade, a new form of international trade, is changing the pattern of global trade and global economic. The existing literature research mainly focuses on the relationship between international trade and economic development and economic growth, but the research on digital trade, this new mode of trade, and its relationship with economic growth is still absent in current literature, especially in the qualitative research. This paper, based on the panel data of 47 countries from 2006 to 2017, studies the promoting effect of digital service trade on economic growth from the perspective of digitally delivered services trade (digital services). The paper also examines the heterogeneity of the effects in countries with different income levels, so as to put forward some suggestions on the development of digital trade from the national level.

## 2. Literature review

## 2.1 Dital trade and digitally delivered services trade

Through the in-depth analysis of existing literature complied, there is no authoritative definition of the concept and connotation of digital trade. Scholars [1] defined digital trade as data driven transformation of international trade, which is physical goods and digital goods traded through e-commerce platform. Ma [2] believes that digital trade includes physical goods, digital goods products

and services, and digital knowledge and information traded through e-commerce platforms. In an OECD document (OECD Trade Policy Papers No. 205) on digital trade, digital trade includes trade transactions of goods and services participated in by digital means, which can be digital transactions or actual delivery, involving consumers, companies and governments. It can be seen that there is no broad and authoritative consensus on the definition of digital trade. Its statistical caliber is also faced with challenges due to the intangibility of data flow, the difficulty of measuring digital products and services [1] and regional and national differences in the regulation of digital trade rules [3]. From the existing research, most scholars have not done much in-depth study on the concept or connotation of digital trade, but focused on the construction of governance system on digital trade [1-3] and policy countermeasures of cross-border data transfer, intellectual property rights and taxation issues [4]. From the existing research, academia has not reached a broad consensus on the precise definition and connotation of digital trade, but cross-border data flow, service attributes and low-cost are the widely accepted characteristics of digital trade. In 2020, the concept of "international trade in digital delivery services" has been added in the latest update of the statistical database of UNCTAD, which is defined as digitally delivered services, refers to an aggregation of insurance and pension services, financial services, charges for the use of intellectual property, telecommunications, computer and information services, other business. Although digital delivery service can not completely replace the whole picture of digital trade, the concept of digital delivery has alleviated the difficulties in the definition and statistics of digital trade to a certain extent, thus providing a new angle for quantitative research on digital trade. This paper, from the perspective of digital services (digitally delivered services), examines its role in promoting economic development.

#### 2.1 Digital trade and economic growth

There is a consistent conclusion that international trade promotes economic growth [5-8]. Contemporary macroeconomics regards net export as an important variable affecting economic growth, that is, the contribution of international trade to economic growth is more reflected in export than in import [9]. However, in the context of economic digitalization of the fourth industrial revolution [10], informatization, intelligence and digitization have magnified this effect on the economy. Information capital promotes productivity [11] and directly promotes economic growth. Furthermore, the use of the Internet can not only promote the development of international trade by reducing search costs and communication costs [12], improve the competitiveness of export products in the value chain [13], but also indirectly affect economic growth through trade. Therefore, the impact of digitization on trade and economic growth is both significant, while the impact of digital service trade on economic growth through superposition effect should be amplified to some extent. Based on the above analysis, this paper puts forward the following hypotheses: (1) digital service trade has a significant role in promoting economic growth. (2) Digital service export and import might have different effect on economic growth. (3) The impact of digital service trade on economic growth at different economic development stages.

The contents of this paper are organized in the following way. Section I and II illustrates the origin, the core concept, background literature and research actuality of digital trade. Section III provides the data used, model setting and research method based on research hypothesis. Section IV describes the evaluation results analyzed, including baseline, grouped test and robustness test. Finally, the section V presents policy recommendations based on the research results of the empirical analysis.

#### 3. Measurement Model and Data Description

#### **3.1 Empirical Model**

The following regression model is given in order to study the impact of digital service trade on economic growth, where the core independent variable is  $t_dt_value_{it}$  and the core dependent variable is  $gdpgr_percapita_{it}$ , if the variables have processed with natural logarithm, they are indicated by the symbol of Ln the same below), The model is expressed as Equation (1):

$$gdpgr_percapita_{it} = \alpha_0 + \beta_0 t_dt_value_{it} + \gamma Z_{it} + \nu_t + u_i + e_{it}$$
(1)

In the Equation (1),  $gdpgr_percapita_{it}$  is the growth rate of per capita GDP of country *i* in the *t* year, which measures the degree of economic development, the larger the index is, the higher the level of economic development is.  $t_dt_value_{it}$  measures "international trade in digital delivery services" (trade in digital services or digital service trade) by summing up the absolute value of  $dt_value_exp_{it}$  and  $dt_value_imp_{it}$ .

 $dt\_value\_exp_{it}$  and  $dt\_value\_imp_{it}$  represent respectively import and export volume of digital service trade of country *i* in the *t* year.  $Z_{it}$  includes a series of the control variables, including variables:

ln\_to ln\_poptotal ln\_to ln\_urban\_pop fdiin growthrate ict\_share\_import ict\_share\_export

In the Equation (1),  $\alpha_0$  is a constant term,  $u_i$  is the country individual effect which does not change with time,  $v_t$  is the time effect,  $e_{it}$  is the residual of this equation.  $\beta_0$  is the coefficient of digital service trade and economic growth, when  $\beta_0$  is positive, digital service trade promotes the economic growth and vice versa.

In order to explore the relationship between economic growth and digital service trade, we also set the second model expressed by Equation (2), where the  $\beta_1$  is what we need to verify, representing a nonlinear relationship.

$$gdpgr_percapita_{it} = \alpha_0 + \beta_0 t_dt_value_{it} + \beta_1 (t_dt_value_{it})^{-2} + \gamma Z_{it} + \nu_t + u_i + e_{it}(2)$$

#### **3.2 Data**

Matching variables for mediations of country code is from United Nations Statistical office, others variables' data is from UNCTAD (United Nations Conference on Trade and Development). They are all listed and explained as following in detail in Table 1.

Variable	Meaning	Index Construction			
gdp_percapita	Economic growth	annual average growth rates of gross domestic			
		product (GDP), per capita			
t_dt_value	Digital service trade	The amount of international trade in digitally-			
		deliverable services (millions)			
t_dt_value2	The trends of digital	the square of t_dt_value (millions)			
	service trade				
d_imp_value	Digital service	International trade in digitally-deliverable			
	import	services (millions)			
d_exp_value	Digital service	International export in digitally-deliverable			
	export	services (millions)			
ln_to	Trade openness	the natural logarithm of sum of exports and			
		imports as percentage of nominal gross domestic			
		product (GDP)(%)			
ln_poptotal	total population	the natural logarithm of total			
		population(thousands)			
ln_urban_pop	urban population	the natural logarithm of a percentage of total			
		population (%)			
fdiin	Foreign direct	Inward flows of foreign direct investment			
	investment	annually (millions)			
growthrate	gross domestic	annual average growth rates of gross domestic			
	product	product (GDP) (%)			

Table 1 Data Description

ictg_share_import	Share of ICT goods	the shares of information and communication		
	as percentage of total	technology (ICT) goods in total merchandise		
	trade	imports(%)		
ictg_share_export	Share of ICT goods	the shares of information and communication		
	as percentage of total	technology (ICT) goods in total merchandise		
	trade	exports(%)		

## 4. Empirical Results

Table 2 is the results of baseline, which is expressed by the Equation (1). From the Table 2, we can see that the value of  $\beta_0$  is from 0.046 to 0.053, which is significant at 1% level, representing the digital service trade's positive influence on the economic growth rate per capita. The samepositive result is also proved in Table 3 which presenting the digital service export and import's impact on the economic growth rate per capita, their coefficients are 0.13882 and 0.09672 respectively (significant at 1% level). So, the empirical study proves that the digital trade service has a vital catalytic role in improving GDP per capita.

(1)(2)(3)(4)(5)(6)gdpgr\_p gdpgr\_p gdpgr\_p gdpgr\_p gdpgr\_p gdpgr\_p ercapita ercapita ercapita ercapita ercapita ercapita  $0.0477\overline{0}$ t\_dt\_valu 0.05324 0.04606 0.04688 0.04690 0.04714 \*\*\* \*\*\* \*\*\* \*\*\* \*\*\* \*\*\* e (0.0072)(0.0072)(0.0071)(0.0071)(0.0071)(0.0071)4285.08 5011.10 4672.90 4703.24 4641.13 ln to 553\*\*\* 235\*\*\* 275\*\*\* 495\*\*\* 897\*\*\* (654.94 (679.14 (683.36 (687.45 (694.31 47) 87) 49) 15) 29) ln\_poptot 1676.71 1939.54 1856.60 2238.98 949 561 790 741 al (2.5e+0)(2.5e+0)(2.6e+0)(2.6e+0)3) 3) 3) 3) ln\_urban\_ 1.781e+04\* 1.861e+04\* 1.860e+04\* 1.840e+04\* pop \*\* \*\* \*\* \*\* (3.7e+0 (3.7e+0 (3.7e+0 (3.7e+0 3) 3) 3) 3) fdiin 0.02749 0.02778 0.02752 \*\*\* \*\*\* \*\*\* (0.0085)(0.0085)(0.0085)growthrat 9.78025 8.42664 e (23.099 (23.135 9) 6) 62.5443 ictg\_shar 2 e\_import

Table 2 Digital serviece trade and economic growth

						(54.734
						1)
ictg_shar						-
e_export						8.94465
						(49.483
						0)
_cons	1.098e+	-	1.377e+	1.781e+	1.825e+	1.411e+
	04***	3.347e+04*	04	04	04	04
		**				
	(312.18	(6.8e+0	(2.3e+0	(2.3e+0	(2.3e+0	(2.3e+0
	72)	3)	4)	4)	4)	4)
N	949	949	949	949	949	949
R2	0.224	0.262	0.283	0.292	0.292	0.293
r2_a	0.11025	0.15306	0.17513	0.18446	0.18365	0.18312
r2_w	0.22381	0.26206	0.28302	0.29199	0.29215	0.29341
Time	control	control	control	control	control	control
effect						
Country	control	control	control	control	control	control
individual						
effect						

Standard errors in parentheses

\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01

The same below

# Table 3 Digital service export/import and economic growth

	(1)	(2)	(3)
	gdpgr_percapita	gdpgr_percapita	gdpgr_percapita
d_imp_value	0.13882***		
	(0.0181)		
ln_to	2886.80060***	2976.59034***	2669.43953***
	(721.1846)	(733.2885)	(715.4651)
ln_poptotal	4885.65614	4385.29839	4682.98311
	(3.0e+03)	(3.0e+03)	(3.0e+03)
ln_urban_pop	-2.776e+04***	-2.799e+04***	-2.810e+04***
	(4.2e+03)	(4.3e+03)	(4.1e+03)
fdiin	0.01201	0.01605	-0.00314
	(0.0100)	(0.0102)	(0.0105)
growthrate	35.17756	37.20540*	37.51383 <sup>*</sup>
	(21.9890)	(22.3471)	(21.7534)
ictg_share_import	58.22871	75.31208	81.78843
	(52.8248)	(53.8539)	(52.3865)

ictg_share_export	5.60498	-12.14922	8.99916
	(48.1101)	(48.7734)	(47.5944)
d_exp_value		$0.09672^{***}$	
		(0.0159)	
t_dt_value			0.16212***
			(0.0225)
t_dt_value2			$-0.00000^{***}$
			(0.0000)
_cons	4.266e+04*	4.746e+04*	4.707e+04*
	(2.6e+04)	(2.6e+04)	(2.5e+04)
N	744	744	744
$R^2$	0.366	0.345	0.381
r2_a	0.24155	0.21646	0.25771
r2_w	0.36609	0.34512	0.38059
Time effect	control	control	control
Country indiviual effect	control	control	control

National heterogeneity test was carried out in Table 4, we classified the countries into four groups, including low-income countries, which are defined as those with a GNI per capita, calculated using the of \$1,035 or less in 2019; lower middle-income countries, referring to those with a GNI per capita between \$1,036 and \$4,045; upper middle-income countries, which are those with a GNI per capita between \$4,046 and \$12,535; high-income countries; which are those with a GNI per capita of \$12,536 or more. The results present that the digital service trade promotion on high-income and middle-income countries is relatively significant, but not noticeable in low-income countries, and it was most obvious that effect of high-income and lower middle-income countries.

	(1)	(2)	(3)	(4)
	high-income	upper middle-	lower middle-	low-income
	countries	income countries	income countries	countries
t_dt_value	0.04621***	0.01260*	0.04714***	-0.00832
	(0.0121)	(0.0066)	(0.0071)	(0.0386)
ln_to	1.624e+04**	3065.91244**	4641.13897**	286.98531**
	*	*	*	*
	(1.8e+03)	(477.0459)	(694.3129)	(71.5381)
ln_poptotal	1.443e+04**	4442.97441**	2238.98741	2.93595
	(6.0e+03)	(1.9e+03)	(2.6e+03)	(1.1e+03)
ln_urban_pop	-2.836e+04	-4.999e+03**	-	1073.37617*
			1.840e+04***	*
	(1.9e+04)	(2.0e+03)	(3.7e+03)	(449.3434)
fdiin	0.02508*	0.02801***	0.02752***	-0.00124
	(0.0128)	(0.0098)	(0.0085)	(0.0121)
growthrate	-29.85046	-12.49657	-8.42664	1.77903

 Table 4 Digital service trade with national heterogeneity

	(70.5368)	(17.0649)	(23.1359)	(2.1260)
ictg_share_impo	-15.89535	10.55258	62.54432	-1.72677
rt				
	(255.5219)	(29.3856)	(54.7341)	(7.1893)
ictg_share_expor	66.90316	-48.90170	-8.94465	2.51261
t				
	(148.8668)	(43.0050)	(49.4830)	(10.7968)
_cons	-1.692e+05*	-4.857e+04**	1.411e+04	-5.294e+03
	(9.9e+04)	(2.1e+04)	(2.3e+04)	(1.1e+04)
Ν	351	309	949	87
R2	0.517	0.702	0.293	0.738
r2_a	0.42332	0.64443	0.18312	0.59796
r2_w	0.51723	0.70215	0.29341	0.73821
Time effect	control	control	control	control
Country	control	control	control	control
indiviual effect				

In the Table 5, we use "the share of ICT service as percentage of total trade" and "Internet penetration rate" as the Instrumental variables to overcome endogeneity, the results are still significant and positive, which are presenting as follows. Then the robust test showed that the results are robustness in Table 6 with pooled OLS method.

	(1)	(2)	(3)	(4)
	Fixed Effect	(-)	(0)	(.)
t dt value	0.70224***	0.36409***	0.37090***	0.35512***
	(0.1142)	(0.0660)	(0.0655)	(0.0677)
			, , , , , , , , , , , , , , , , , , ,	
ln_to	-	3022.93128**	4171.31148***	5363.37375***
	5.103e+03***			
	(1.5e+03)	(1.4e+03)	(1.1e+03)	(1.2e+03)
ln_poptotal		-	-6.280e+03***	-6.956e+03***
		6.240e+03***		
		(691.7443)	(657.3463)	(721.1522)
ln_urban_pop		2807.16651	2023.96891	-365.85668
		(2.0e+03)	(1.7e+03)	(1.9e+03)
fdiin			-0.21895***	-0.19090**
			(0.0782)	(0.0745)
growthrate			-1.44206	21.66514
			(68.7097)	(67.1119)
ictg_share_import				453.40760***
				(152.7722)
ictg_share_export				-635.89232***

Table 5 Two-stage instrumental variables regression

				(136.8779)
_cons	5.292e+04***	1.997e+04***	1.302e+04***	1.539e+04***
	(1.4e+04)	(5.0e+03)	(4.4e+03)	(4.4e+03)
N	744	744	744	744
$R^2$	•	0.403	0.421	0.467
r2_a	•	0.39953	0.41633	0.46088
Time effect	control	control	control	control
Country indiviual	control	control	control	control
effect				

Table 6 Robustness check

	(1)	(2)	(3)	(4)	(5)	(6)
	Pooled C	•	•			
t_dt_value	0.07277	0.04248	0.04457	0.04391	0.04384	0.04418
	***	***	***	***	***	***
	(0.0072	(0.0069)	(0.0068)	(0.0068)	(0.0068)	(0.0068)
	)	× ,			· · · · ·	· · · · ·
ln_to		4691.86	6999.81	6861.14	6864.91	6962.92
		698***	073***	950***	099***	093***
		(352.579	(445.614	(447.539	(447.546	(453.725
		1)	7)	2)	9)	3)
ln_poptot			-	-	-	-
al			6.626e+03*	6.579e+03*	6.602e+03*	6.683e+03*
			**	**	**	**
			(650.636	(651.268	(653.569	(638.761
			0)	1)	0)	8)
ln_urban_			-	-	-	-
рор			5.906e+03*	5.880e+03*	6.103e+03*	5.864e+03*
			**	**	**	**
			(2.1e+03	(2.1e+03	(2.1e+03	(2.1e+03
			)	)	)	)
fdiin				0.02177	0.02279	0.02239
				**	***	**
				(0.0087)	(0.0087)	(0.0087)
growthrat					-	-
e					24.10806	24.52319
					(21.8123	(21.9458
					)	)
ictg_share						48.9590
_import						1
						(53.8713
						)
ictg_share						-3.55012

_export						
						(49.7260
						)
_cons	1.231e+	-	2.257e+	2.333e+	2.447e+	2.292e+
	04***	3.639e+04*	04***	04***	04***	04***
		**				
	(1.6e+0	(4.0e+03	(8.7e+03	(8.7e+03	(8.8e+03	(8.7e+03
	3)	)	)	)	)	)
N	949	949	949	949	949	949
r2_w	0.08336	0.22357	0.24249	0.24859	0.24992	0.24934

#### 5. Conclusions and suggestions

Form the empirical result, we find that the digital service trade has a significant role in promoting economic growth, and digital service import's effect is stronger than export on improving the economic growth. The impact of digital service trade on economic growth is not the same in various countries at different economic development stages. Digital service trade promotion on high-income and middle-income countries (upper middle-income and lower middle-income countries) is relatively significant, but not significant in low-income countries, which defined as those with a GNI per capita less than \$1,035 in 2019. Therefore, countries around the world should strengthen the research of digital service trade and attach great importance to the development of digital service trade and digital trade. Low-income countries should firstly guarantee and improve the livelihood of the people with the necessary reform deepening, because there are certain standards of development stage for the benefits of digital trade.

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