

# The Effect of ASEAN's Digital Economy Growth on China's Export Trade

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## ABSTRACT

Currently, the digital economy is emerging as a powerful catalyst for nations globally to enhance the caliber of their economies and to foster international trade. As one of China's key trading partners, ASEAN holds immense potential in the growth of its digital economy, which is contributing positively to the trade interactions between China and ASEAN. Utilizing an expanded gravity model, this study investigates the influence of the digital economic progress in ASEAN countries on China's export trade, drawing on panel data from China's export activities with ASEAN member states between 2010 and 2022. The study shows that the degree of digital economic advancement among ASEAN member countries is diverse, with a general tendency towards improvement. The growth of the digital economy in these countries has a considerable impact on increasing the volume of China's export trade to ASEAN. And the GDP, population, and trade and transport infrastructure of ASEAN member countries significantly contribute to the enhancement of China's export trade.

## KEYWORDS

Digital Economy; Entropy Weight Method; Trade Gravity Model.

## 1. INTRODUCTION

Relying on interactive digital platforms and advanced digital information technology, the digital economy effectively breaks through the time and space barriers in the traditional trade model and reduces the problem of information asymmetry, thus enhancing the quality of export goods and fostering the growth of export trade. In recent years, China and ASEAN have continued to deepen cooperation in many fields. As of 2023, ASEAN has remained China's largest trading partner for four consecutive years, while China has consistently been ASEAN's primary trading partner for many years. The total value of China's export trade with ASEAN reached 3.68 trillion yuan, representing 15.49% of China's overall exports. Therefore, taking ten ASEAN member countries as a sample, studying the development degree of ASEAN's digital economy, exploring and analyzing the influence of ASEAN's digital economy on the volume of China's export trade is of practical value in helping China's export trade with ASEAN to be carried out efficiently, fostering the high-quality growth of China's foreign trade, and formulating appropriate relevant trade policies.

In the study of export trade, scholars have mainly utilized the trade gravity model. There are many related studies, such as Lateef, Tong and Riaz (2018), Christiana (2020), Pandey and Choubey (2021), and Chu (2022), which have been conducted on trade issues using the extended gravity model approach. In addition, a number of scholars have explored the mechanism by which the growth of the digital economy affects export trade and achieved rich results. Meijers (2013) argued that internet usage exerts a beneficial and considerable impact on the openness of international trade. Abeliasky

and Hilbert (2017) noted that there is a positive association between exports and both the quantity and quality of ICT infrastructure, and that the quality of data speeds is more important than the number of ICT users for developing countries. Koshkarev (2019) found that information digitization and communication technologies significantly reduce the negative impact of geographical barriers. Fan (2020) based on a heterogeneous stochastic frontier gravity model, empirical analysis shows that the digital economy growth in importing countries enhances the effectiveness of China's foreign trade and brings more uncertainty to export trade. Li, Wang and Liu (2023) pointed out that digital economy affects export trade by reducing information cost.

Existing literature provides an important reference for the study of this paper, but there are still the following shortcomings: firstly, the existing research focuses on the implications of the digital economy of the home country on its own export trade, and there are fewer relevant literatures studying how the digital economy of the importing country affects China's exportation; secondly, there are fewer studies in the previous literature on the progression of the digital economy of ASEAN member countries. Therefore, this paper develops an indicator framework to quantify the extent of ASEAN's digital economic advancement as the primary explanatory variable, and empirically examines its influence on China's export trade, aiming to enhance the current body of research.

## 2. MEASURING THE LEVEL OF DIGITAL ECONOMIC GROWTH IN ASEAN NATIONS

### 2.1. Selection of Indicators

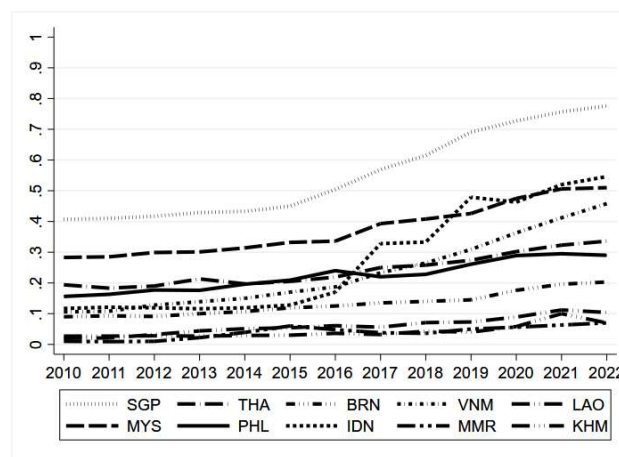
A consensus on the measurement of the digital economy's advancement level has not been established among scholars, both domestically and internationally. After reviewing a large amount of literature, this paper adopts the G20's definition of digital economy as the basis, synthesizes the research results of Zhang and Shen (2018), and selects three first-level indicators of digital infrastructure construction, digital innovation environment and international competitiveness of digital industry, as well as 10 second-level indicators, and ultimately presents the indicator system as shown in Table 1, in order to study the advancement level of digital economy in ASEAN partner countries from 2010 to 2022.

**Table 1.** Evaluation indicator system for measuring the level of development of the digital economy

Level 1 indicators	Level 2 indicators	Data sources
Digital infrastructure development	Fixed broadband Internet subscribers (per 100 population)	ITU
	Number of fixed-line telephone subscribers (per 100 population)	ITU
	Mobile phone subscriptions (per 100 population)	ITU
	Internet users as a proportion of the total population	ITU
	Secure Internet servers	ITU
Digital Innovation Environment	Number of scientific and technical journal publications	World Bank
	Number of patent applications	World Bank
	Enrolment in tertiary institutions	World Bank
Digital industry competitiveness	ICT products as a share of exports	World Bank
	ICT services as a share of exported services	World Bank

## 2.2. Assessment of the Composite Index of the ASEAN Digital Economy Growth Level and Analysis of the Results

Entropy weight method was first applied in information theory, it is a method to measure the uncertainty of information, the larger the amount of information covered, the smaller the uncertainty, through the entropy value to determine the randomness of the event and the degree of disorder; in economics, entropy weight method is usually used to determine the degree of dispersion of a certain indicator, the larger the entropy value, it means that the greater the degree of dispersion, the greater the impact of the indicator on the evaluation, and the degree of its variance to determine the weight of the indicator. The entropy weight method is chosen to assign weights to the digital economy development indicators, and the total score of the indicators is obtained through the assignment to make a comprehensive evaluation of the digital economy growth level of the ten ASEAN member countries. The data were analyzed by Stata software, and the comprehensive score of the digital economy growth index of the ten ASEAN member countries in 2010-2022 was calculated, as shown in Figure 1:



**Figure 1.** Level of digital economy growth in ten ASEAN member countries, 2010-2022

Figure 1 Digital Economy Development Level Score does not have economic significance, but the data in this table shows an overall upward trend in the state of digital economy development in the ten ASEAN member countries. As can be seen from Figure 1, there is a large gap in the level of digital development between ASEAN member countries, but overall there is a positive correlation with the level of national economic development. Singapore's level of development is the top of the ten ASEAN member countries, and its score for digital economy development as a whole has remained consistently high. Malaysia follows, with an overall increase in the level of digital economy development over the 13-year period, and the second highest average level of development among the 10 ASEAN member countries. On the other hand, Laos, Myanmar and Cambodia have the lowest level of digital economy development, with poor digital infrastructure development, low competitiveness of digital industry, and imperfect digital innovation environment.

## 3. EMPIRICAL STUDY OF THE EFFECT OF ASEAN'S DIGITAL ECONOMY ON CHINA'S EXPORT TRADE

### 3.1. Modelling

This paper introduces the level of digital economic growth to the original gravity model  $DIG_{jt}$ , population size  $POP_{jt}$ , level of trade and transport infrastructure  $FRAST_{ijt}$  tariff level  $TAR_{ijt}$ , and

constructed the extended trade gravity model. As shown in equation (1), where  $i$  denotes China,  $j$  represents importing countries, and  $t$  means year:

$$\ln EX_{ijt} = \beta_0 + \beta_1 \ln DIG_{jt} - \beta_2 \ln DIS_{ij} + \beta_3 \ln POP_{jt} + \beta_4 \ln GDP_{jt} + \beta_5 \ln FRAST_{ijt} - \beta_6 \ln TAR_{ijt} + \varepsilon_{ijt} \quad (1)$$

### 3.2. Selection of Variables and Description of Data

The explanatory variables in this paper are  $EX_{ijt}$ , denotes China's export trade volume with ASEAN member countries in year  $t$ , in USD million, and the data are from the China Statistical Yearbook.

The core explanatory variable of this paper is  $DIG_{jt}$  denotes the level of digital economy growth of ASEAN member countries in year  $t$ , as measured in the previous section. A higher level of digital economy development in a country means a better digital infrastructure development and a higher level of information technology development, which is more conducive to the development of export trade, and thus the sign of the regression coefficient is expected to be positive.

$GDP_{jt}$  is the GDP of importing country  $j$  in year  $t$ , and  $POP_{jt}$  is the total population of importing country  $j$  in year  $t$ , the  $FRAST_{ijt}$  is the level of trade and transport infrastructure in importing country  $j$  in year  $t$ , and  $TAR_{ijt}$  is the weighted average tariff of importing country  $j$  in year  $t$ , selected from the World Bank database.  $DIS_{ij}$  is the distance between the capital city of importing country  $j$  and Beijing multiplied by the WTI crude oil price in year  $t$ . The panel model requires variables that are time-series variables. The panel model requires variables to be time-series variables, and this paper draws on Zhang (2011) to express the distance in the gravity model as the distance between the capitals of the two countries multiplied by the price of WTI crude oil, with the data on the price of WTI crude oil obtained from the U.S. Energy Information Administration, and the data on the geographic distances obtained from the CEPII BACI database.

### 3.3. Empirical Analysis and Testing of Results

#### 3.3.1. Model Testing

Panel data generally have three forms: mixed estimation model, fixed effects model and random effects model, this paper through the Hausmann test to decide which method to use to deal with the data. The test results are shown in Table 2,  $P < 0.01$ , passing the 1% significance level test, indicating that the individual effect is significant and the fixed effect model should be selected.

**Table 2.** Hausmann test results

Chi-sq. Statistic	Prob.
66.44	0.000***

#### 3.3.2. Regression Results and Analyses

The model as a whole passed the significance test and the final regression results of the extended gravity model are shown in equation (2):

$$\ln EX_{ijt} = -74.82 + 0.14 \ln DIG_{jt} + 0.2 \ln DIS_{ij} + 3.49 \ln POP_{jt} + 1.07 \ln GDP_{jt} + 0.46 \ln FRAST_{ijt} - 0.03 \ln TAR_{ijt} + \varepsilon_{ijt} \quad (2)$$

**Table 3.** Benchmark model regression results

explanatory variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Indig	0.72***	0.77***	0.30***	0.13*	0.15**	0.14*
	(10.53)	(10.51)	(3.25)	(1.71)	(1.98)	(1.78)
Indistp		0.17*	0.31***	0.20***	0.20***	0.20***
		(1.83)	(3.75)	(2.96)	(3.03)	(2.98)
lnpop			6.51***	3.00***	3.45***	3.49***
			(6.91)	(3.46)	(3.91)	(3.93)
lngdp				1.23***	1.08***	1.07***
				(8.20)	(6.55)	(6.37)
lnfrast					0.45**	0.46**
					(2.05)	(2.08)
Intar						-0.03
						(-0.51)
_cons	15.53***	13.49***	-99.81***	-70.48***	-74.75***	-75.03***
	(114.93)	(12.06)	(-6.08)	(-5.18)	(-5.50)	(-5.50)
N	130	130	130	130	130	130
R <sup>2</sup>	0.96	0.96	0.97	0.98	0.98	0.98

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

From the regression results, it can be concluded: firstly, the regression coefficients are positive and significant whether only the single variable of the level of digital economy growth or other control variables are added sequentially. It indicates that the growth of digital economy in ASEAN member countries is conducive to the growth of China's export trade to ASEAN. Secondly, the impact of the geographical distance between ASEAN member countries and China on China's foreign trade exports is positive and significant, and the direction of its impact and the previous international trade theory is the opposite, relying on modern logistics and information technology, the new trade mode to a certain extent impacted the geographic factors on the restrictions on international trade, and the ASEAN ten countries with the farthest distance from China in the three countries are Indonesia, Singapore and Malaysia, these The three countries have been trading with China for a long time, and the trade scale is large, which in turn affects the regression results. Third, the GDP and population size factors of ASEAN countries have a significant and positive effect on the volume of China's foreign trade exports. Fourth, the development of trade and transport infrastructure in ASEAN countries has a positive promotion effect on China's foreign trade exports, while the weighted tariff rate of ASEAN countries has a non-significant effect on China's foreign trade exports, but with negative coefficients; the higher the tariff level of the importing country, the higher the corresponding price of the imported product, and the lower the volume of China's foreign trade exports.

#### 4. CONCLUSION AND RECOMMENDATIONS

This paper assesses the level of digital economy growth in ASEAN member countries using panel data from 2010 to 2022. Then the trade gravity model is used to estimate the impact of the digital economy growth level of ASEAN member countries on China's foreign trade exports. The specific conclusions are as follows: firstly, the level of digital economy development of ASEAN member

countries generally shows an upward trend, and the digital economy growth of Singapore has been kept in the first place of ASEAN member countries, Indonesia has the highest growth rate, and Myanmar and Cambodia have the lowest level of digital economy growth. Secondly, the level of digital economy growth of the ten ASEAN member countries can positively affect China's export trade to ASEAN, and the improvement of the level of digital economy growth can increase the volume of exports by reducing transaction costs, promoting trade facilitation, and improving industrial structure. Thirdly, among the three level 1 indicators for measuring the level of digital economy growth, ASEAN digital infrastructure construction has the greatest impact on China's exports, accounting for 48.81% of the weight of the indicators for measuring the level of digital economy development.

Drawing from the above conclusions, this paper proposes the following policy recommendations: firstly, pay attention to the growth of the digital economy in ASEAN member countries. China can participate in the construction of digital infrastructure in ASEAN member countries, which can not only deepen the cooperation between the two sides in the digital economy, but also promote a new round of development of China's exportation to ASEAN. Secondly, focus on ASEAN member countries that are lagging behind in digital economy development. The focus should be on digital technology and financial assistance to these countries to strengthen their connectivity.

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