

Information and Communication Technology and International Trade: A Case of China-ASEAN Countries

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Abstract. In 2000, ASEAN countries initiated the e-ASEAN Framework Agreement in order to build the ASEAN information infrastructures and promote development of e-service and e-commerce in commerce, society and government. The purpose of this study is to examine the impact of information and communication technology on international trade between China and ASEAN countries using data for 2001 to 2017. The empirical findings of this study show that information and communication technology has significantly positive impact on international trade between China and ASEAN countries. Especially, internet as the most important information and communication instruments mostly contributes to international trade between China and ASEAN countries. According to the empirical results, this study suggests that ASEAN countries should speedily develop infrastructure of information and communication technology based on e-ASEAN Framework Agreement of 2000. Moreover, China should provide direct investment and technique-related for ASEAN countries to assist development of information and communication technology.

1. Introduction

Global and regional economic integration has increasingly formed, which led to profoundly closed economic and trade relationship among countries. Development of information and communication technology (ICT) playing an important role in development of global and regional economy has speedily facilitated cross-border transactions and, furthermore, employed data stored in the data banks telecommunication service companies to search for potential markets and trade opportunities[1]-[3]. The main features of ICT are time-saving and no compression geographical distance. These can lower the transaction costs and increase trade between countries[4]-[5]. On the other hand, it also has brought more competition in the world trade [4].

As an empirical report shown, 10% of internet penetration contributed on an increase in average 1.3% of GDP, while 10% of mobile phones penetration contributed on an increase in 0.7% of GDP[6]. However, previous studies provide ambiguous evidence that ICT may have positive or negative effects on economic growth in certain cases. Choi and Yi find internet has positive impact on economic growth by employing data for 207 countries from 1991 to 2000[7]. Following the study of Choi and Yi[7], Maurseth has opposite results that internet has negative impact on economic growth by using data for 171 countries from 1990 to 2015[8]. By applying data for 18 Arab countries over the period from 1995 to 2013, the study by Hodrab, Maitah and Lubos also show results that internet has significantly positive impact on economic growth in the Arab countries[9]. By using data for 42 Sub-Saharan African countries from 1998 to 2014, results of study by Tripathi and Inani reveal that internet has no effect on economic growth, while mobile phone has positive effect on economic growth[10].

As an empirical study found, internet penetration causes an increase in 1.7% of export growth and 1.1% of import growth in U.S.[1]. In 2000, ASEAN countries initiated the e-ASEAN Framework agreement in order to build the ASEAN information infrastructures and promote development of e-service and e-commerce in commerce, society and government [6]. The IT ministers of ASEAN countries proposed the ASEAN Information and Communication Technology Overall Plan to defined ICT as an engine for growth in ASEAN countries. Mobile phones and internet as main tools

of ICT have rapidly developed in ASEAN countries. This will surely be benefit for future of economic and trade development of ASEAN countries.

The previous studies have paid more attention on the issues concerning the relationship between China-ASEAN countries, which focuses on trade and economic effects[11], international trade[12]-[13], foreign direct investment[14] and economic growth[13]. Few researches are conducted about the issues of ICT. To fill research gap, this paper tries to investigate the impact of ICT on international trade between China and ASEAN countries for data over the period from 2001 to 2017 by using panel data approach. The rest of the study includes 5 sections. Section 2 provides a review of literature. Section 3 presents data and methodology. The empirical results are analyzed and explained in section 4. Conclusion is shown in the final section.

2. Review of Literature

Recently, All of ASEAN countries have aggressively implement plans of information and communication technology based on e-ASEAN Framework Agreement in 2000. Governments have invested large amount of spending in as information and communication technology. Even though, such as Myanmar, Lao, and Cambodia with poor-developed in information and communication technology also have down efforts on setting up ICT center in order to improve information and communication technology[6]. Myanmar ICT Development Corporation (MICTDC) established in 2001 is consortium of 50 private companies in order to promote ICT development in Myanmar. In 2007, Lao National Internet Committee (LANIC) constructed to establish internet network information center. National Information and Communication Technology Development Authority (NiDA) in Cambodia is responsible for managing the development of the information industry. Then, as ICT instruments, telephones, mobile phones and internet are commonly used to conduct international trade in ASEAN countries.

Previous studies empirically examine the effects of ICT on international trade. Freund and Weinhold find that internet increases in contribution on exports by 1%, while web only has 0.2% of contribution in export growth in 56 countries for the years 1995-1999[15]. Choi also confirm that internet has 4% increase in service trade, service export and service import between the United States and other 31 countries over period 1990-2006[5].

Some studies conclude internet using in developing countries effectively improve international trade. The study of Clark and Wallsten has empirical result that internet affects export from developing countries to developed countries for the year 1999-2002[4]. In case of 135 developing countries over the period 1999-2011, Salmani, Pourebrahim and Saremi use unbalance panel data approach and modified gravity model to test the effect of internet on service trade, and, also, find internet has significantly positive effect on bilateral service trade[16]. Chung, Fleming and Fleming conclude that there is positive effect of internet on international fruit and vegetables trade in APEC countries for the year 1997-2006[2]. Kurihara and Fukushima reveal that internet has positive effect on international trade comparison between Asian countries and OECD countries employing data of 2005 and 2010[17].

In addition, few researches explore the effect of telephone or mobile phones on trade. In case of local markets in Ghana, the study of Boateng shows that women traders as interviewees use mobile phones in order to improve information management for trading[18]. Chung, Fleming and Fleming conclude that telephone has positive effect on international trade, while mobile phone on international trade relating to fruit and vegetables trade in APEC countries for the year 1997-2006[2].

3. Data and Methodology

The aims of this empirical study are to investigate the impact of ICT on international trade between China and ASEAN countries by using annual data originally collected from World Data Indicators (WDI) in the World Bank for the years from 2001 to 2017.

By following the models of Freund and Weinhold and Boateng [1][18], the regression estimates of this study are constructed by the dependent variable in exports of ASEAN countries to China,

imports of ASEAN countries to China, and bilateral trade between China and ASEAN countries, and independent variables in number of telephone users per 100 people, number of mobile phone users per 100 people, and number of internet users per 100 people. In addition, the study also adds GDP, lag GDP, population, fixed capital formation and government spending as control variables into the estimation regression.

With reference to the empirical models of Freund and Weinhold and Boateng[1][18], the estimation equation of the study is constructed as follows:

$$EXP_{it} = \alpha_0 + \beta_1 TEL_{it} + \beta_2 MOBILE_{it} + \beta_3 INTERNET_{it} + \beta_4 GDP_{it} + \beta_5 GDPLAG_{it} + \beta_6 POP_{it} + \beta_7 CAPITAL_{it} + \beta_8 GOVSP_{it} + \varepsilon_{it} \quad (1)$$

$$IMP_{it} = \alpha_0 + \beta_1 TEL_{it} + \beta_2 MOBILE_{it} + \beta_3 INTERNET_{it} + \beta_4 GDP_{it} + \beta_5 GDPLAG_{it} + \beta_6 POP_{it} + \beta_7 CAPITAL_{it} + \beta_8 GOVSP_{it} + \varepsilon_{it} \quad (2)$$

$$TRADE_{it} = \alpha_0 + \beta_1 TEL_{it} + \beta_2 MOBILE_{it} + \beta_3 INTERNET_{it} + \beta_4 GDP_{it} + \beta_5 GDPLAG_{it} + \beta_6 POP_{it} + \beta_7 CAPITAL_{it} + \beta_8 GOVSP_{it} + \varepsilon_{it} \quad (3)$$

where,

- EXP_{it}: growth rate of exports from i country of ASEAN to China at time of t;
- IMP_{it}: growth rate of imports from China to i country of ASEAN at time of t;
- TRADE_{it}: growth rate of total trade between China and i country of ASEAN at time of t;
- TEL_{it}: logarithm of telephone users per 100 people in i country of ASEAN at time of t;
- MOBILE_{it}: logarithm of mobile phone users per 100 people in i country of ASEAN at time of t;
- INTERNET_{it}: logarithm of internet users per 100 people in i country of ASEAN at time of t;
- GDP_{it}: growth rate of real GDP in i country of ASEAN at time of t;
- GDPLAG_{it-1}: growth rate of real GDP in i country of ASEAN at time of t-1;
- POP_{it}: logarithm of population in i country of ASEAN at time of t;
- CAPITAL_{it}: ratio of fixed capital formation to GDP in i country of ASEAN at time of t;
- GOVSP_{it}: ratio of government spending to GDP in i country of ASEAN at time of t;
- α₀: a constant item;
- β₁...β₈: β coefficient;
- ε_t: an error item.

4. Empirical Results

As shown in Table 1, descriptive analysis presents the basic characteristics of all variables including maximum values, minimum values, means, median and standard deviations.

Table 1. Descriptive Analysis on all variables

Variables	Max.	Min.	Mean	Median	St. Dev.
EXP	4.461	-0.759	0.259	0.161	0.522
IMP	1.617	-0.636	0.225	0.215	0.256
TRADE	1.449	-0.514	0.215	0.192	0.275
TEL	3.880	-1.658	1.800	2.155	1.349
MOBILE	5.170	-3.023	3.673	4.391	1.718
INTERNET	13.655	0.299	10.001	10.693	2.580
GDP	0.813	-0.403	0.106	0.095	0.127
GDPLAG	1.174	-0.403	0.114	0.099	0.151
POP	19.391	12.737	16.913	17.463	1.798
CAPITAL	0.394	0.104	0.245	0.245	0.061
GOVSP	0.294	0.034	0.125	0.114	0.059

As listed in Table 2, there are correlations between any two variables in independent and control variables. The correlation coefficient between any two variables are not more than 0.7, which implies any one of independent and control variables can explain dependent variable.

Table 2. Correlation Matrix

Var.	TEL	MOBILE	INTERNET	GDP	GDPLAG	POP	CAPITAL	GOVSP
TEL	1.00							
MOBILE	0.59	1.00						
INTERNET	0.43	0.65	1.00					
GDP	-0.18	-0.32	-0.19	1.00				
GDPLAG	-0.15	-0.24	-0.17	0.31	1.00			
POP	-0.26	-0.12	0.58	0.09	0.01	1.00		
CAPITAL	0.22	0.29	0.33	-0.25	-0.15	0.08	1.00	
GOVSP	0.08	-0.13	-0.32	-0.05	-0.06	-0.43	-0.02	1.00

Note: MOB., INT., I.GDP, CAP. and GOV. are symbols of MOBILE, INTERNET, GDPLAG, CAPITAL and GOVSP respectively.

The study uses Hausman test for selecting random effect model or fixed effect model. If the study accepts H_0 according to results of Hausman test, it will employ random effect model. Otherwise, it will employ fixed effect model. As presented in Table 3, all estimation regression will employ random effect models.

Table 3. Hausman Test

Model	Chi-Sq Stat	Chi-Sq. d.f.	Prob.
Model 1	0.0000	8	1.0000
Model 2	0.0000	8	1.0000
Model 3	0.0000	8	1.0000

Table 4. Results of Estimation Regression

Variables	Model 1	Model 2	Model 3
C	215.085*** [34.118]	318.309*** [21.176]	286.495*** [21.893]
TEL	0.125* [0.073]	-0.612*** [0.045]	-0.414*** [0.046]
MOBILE	0.079** [0.033]	0.124*** [0.021]	0.115*** [0.021]
INTERNET	0.416*** [0.065]	0.624*** [0.040]	0.565*** [0.042]
GDP	-1.174*** [0.190]	-0.525*** [0.118]	-0.652*** [0.122]
GDPLAG	-1.341*** [0.169]	0.834*** [0.105]	0.225** [0.109]
POP	-12.230*** [1.912]	-17.878*** [0.187]	-16.150*** [1.227]
CAPITAL	-1.202** [0.571]	0.894** [0.355]	0.614* [0.367]
GOVSP	66.535*** [6.615]	34.618*** [4.106]	46.052*** [4.245]
R ²	0.690	0.805	0.684
Adi-R ²	0.674	0.796	0.668
F-stat	44.823***	83.429***	43.620***

Note: ***p<0.01, **p<0.05, *p<0.1. Standard errors in parentheses

5. Conclusion

From the perspective of information and communication technology, the purpose of this study is to examine the international trade between China and ASEAN countries by using data for 2001 to 2017. The empirical findings of this study show that information and communication technology has significantly positive impact on international trade between China and ASEAN countries. Similar to the studies of Salmani, Pourebrahim and Saremi and Chung, Fleming and Fleming [16][2], the study concludes that information and communication technology serve as a key determinant of international trade between CHINA and ASEAN countries.

The study further analyzes contribution of the different information and communication instruments on international trade between China and ASEAN countries. Related to export of ASEAN countries to China, internet has more impact on export than telephone and mobile. On the other hand, internet and mobile has positive impact on import and bilateral trade of ASEAN countries from China, while telephone has negative impact on import and bilateral trade of ASEAN countries from China. In general, internet as the most important information and communication instruments mostly contributes to international trade between China and ASEAN countries.

It is inevitable for ASEAN countries to upgrade information and communication technology in order to improve international trade between China and ASEAN countries. Among ASEAN countries, they have different level of development in information and communication technology. Such as Singapore, Thailand, and Malaysia have well-developed in information and communication technology, while Myanmar, Lao, and Cambodia have poor-developed in information and communication technology. According to the empirical results, this study suggests that ASEAN countries should speedily develop infrastructure of information and communication technology based on e-ASEAN Framework Agreement of 2000. Moreover, China should provide direct investment and technique-related for ASEAN countries to assist development of information and communication technology.

6. References

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