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INTERNATIONAL TRADE AND THE IMPACT OF INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) ACCESS AND USE: A STUDY OF SOUTHEAST ASIAN NATIONS

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ABSTRACT

Continuous evolution of technologies and globalization have enabled international trade to be done via borderless selling and buying activities. This research underlines the relevance of ICT in impacting international trade in early member countries of ASEAN (Malaysia, Thailand, Philippines, Singapore and Thailand), in line with the Industry 4.0 Revolution. This study employs the examination of panel data to investigate the access to and use of ICT towards international trade. In accordance to that, the export and import of products and services are used to measure international trade. Mobile cellular subscriptions, Internet users, fixed broadband subscriptions, and fixed telephone subscriptions are all used to quantify ICT access and usage. In addition, control variables include foreign direct investment (FDI), research and development (R&D), real exchange rate, and also inflation. Government policy as the moderating variable on ICT against international trade is also discovered. As a result, this study takes a 10-year period to collect numerical data and analyse it using statistics and mathematical methodologies. Findings from the study are expected to show whether ICT has significant influence in promoting trade activities among the selected ASEAN member countries. Additionally, the study is also expected to bring some clarity on the potential role of government policy in moderating the impacts of ICT towards international trade. Overall, findings from the study would provide some insights to governments and policy makers on the crucial need to adopt ICT in daily operations to sustain trade activities. Future research direction may include

expanding the scope of the countries and investigating the impacts of other types of ICT such as ICT skills and adoption.

Keywords: Line efficiency, finishing department, fishbone diagram, ECRS

INTRODUCTION

Since the 1990s, information and communication technology (ICT) has figured prominently in business growth and expansion. For occurrence, ICT has been used by US businesses for a variety of business operations, including efficiency, effectiveness, electronic commerce (e-commerce), networking, and collaboration. (Colecchia and Schreyer, 2002; Ueki and Tsuji, 2019). The International Telecommunication Union (ITU) not only recognizes the impact and potential of ICT, but also encourages international organizations and financial institutions to develop policies that promote the use of ICT to promote sustainable development and achieve the Millennium Declaration's goals (International Telecommunication Union (ITU), 2021). Meanwhile, the United Nations Conference on Trade and Development (UNCTAD) works with poor countries to help them implement national ICT policies that encourage e-commerce, exports, and competitiveness, and it collaborates with a worldwide e-policy resource network (ePol-NET) (Annex, 2004).

In the context of developing countries, the Association of Southeast Asian Nations (ASEAN) has been developing ICT policies and courses in collaboration with various member countries to assist businesses, particularly small and medium enterprises (SMEs), in becoming more familiar with the shifting corporate landscape (Solinthone, Rumyantseva, and Syryamkin, 2016). In response to the rise of global e-commerce value chains, the growth of ICT and the quality of ICT infrastructure has boosted trade growth by encouraging companies, manufacturers, and exporters, particularly from emerging and least-developed nations, to increase trade (Nath & Liu, 2017).

Overall, this research of ICT access and usage against international trade will benefit Southeast Asia countries. In order to overcome the massive drawback following the COVID-19 pandemic outbreak, all countries worldwide have to adapt the new norm of doing things, which is to shift to online mode that requires extensive access and usage of ICT. ASEAN nations also have the responsibility to support the role of the business sectors and other stakeholders, not only in ensuring supply chains connectivity, but also in boosting confidence in the market, promoting new business models and opportunities, and facilitating the post-pandemic recovery which is much needed by ASEAN countries at the moment (Chandra, Mujahid, & Mahyassari, 2020).

Meantime, by generating global standard products and services, the use of ICT in production activities can help the firm reduce expenses, improve efficiency, gained wide attention, and boost market position. ICT is the driving force behind every business in today's era of globalization, and day-to-day operations would be practically impossible to carry out without it. In addition to other significant issues such as bureaucracy, long delays in starting a business, and corruption, most developing-country businesses have failed to recognize the importance of ICT, as a lack of ability to or knowledge of how to use ICT is becoming a prominent aspect of economic exclusion for developing-country businesses (Osterwalder, 2004).

While considering the above issues and situations, this study is highly motivated to concentrate towards the role of ICT in international trade of Southeast Asia nations as there are some main significances can be derived from this particular study which are yet to be explored by past researchers. First and foremost, the current condition of global economy in the midst of the pandemic causes much focus on ICT. All the businesses across the world regardless of the sectors was forced to shut down and that's where the role of ICT started to outreach and domain other classic modes. Therefore, this study adopts ICT access and usage variables to support ICT as whole. Along with that, it is also a call for ASEAN and developing nations to grab the advantage of ICT to further embrace international trade to achieve global standards in line with Industrial Revolution 4.0. As

developed countries had successfully incorporated and proved the importance of ICT in all sectors including businesses. Thus, this study covers the initial five member countries of ASEAN namely Malaysia, Thailand, Philippines, Singapore and Indonesia to represent other developing and ASEAN member countries. Meanwhile, government act as a bridge in between international trade and ICT, as the authority where the responsibility lies under each and every nations' government with only some insights and guidance from ASEAN. Hence, the role of government policy as a moderator is investigated in order to expose the significance of governance and structure of the country.

LITERARATUR REVIEW

Though the Hekscher-Ohlin (HO) model has been the most well-known trade theory for centuries, economists have continued to look for other acceptable international trade ideas due to a lack of empirical data. In the early 1980s, here is where the concept of growth theory was initially established. The technological distinctions between countries are the major differences between the theories. Beginning with Smith and Ricardo, technological differences were thought to be a major factor in commerce. Meanwhile, the HO model, along with growth theory, is considerably more interested in economies of scale with imperfect competition, assuming that all countries have identical technology (Berkum & Meijl, 2000).

However, in order to obtain the intended result, this study uses growth theory to further evaluate the factors. Growth theory emphasizes original generations of technical change as a crucial ingredient for commerce. In general, neoclassical growth theory is well known as economic theory. It mainly includes labor, capital and technology as the motivating forces for the fixed economic growth. In relation to that, Solow (1956) and Swan (1956) are known as the developers of the growth theory back in 1956. Initially, the theory incorporated exogenous population that rises to establish the growth rate. However, in 1957 Solow included technology change into the model. Based on growth theory, even with limited resources of capital and labor in an economy, the impact from technology tend to impose limitless growth as well as economic growth is impossible to continue without technological advances.

Despite the fact that neoclassical growth theory focuses on labor, capital, and technology, it also explains the distinctions between temporary and long-term equilibrium, as long-term equilibrium does not require any of those three factors. As a result, in long-term equilibrium, growth theory recommends that the accumulation of wealth inside an economy, as well as the most significant determinant in income progress is how individuals spend their money. In addition, an economy's output is determined by the interaction between capital and labor. Meanwhile, technology is thought to boost labor productivity by increasing labor's production potential. By means of the result, the production function of neoclassical growth theory is employed to quantify growth and equilibrium, with the function as follows:

$$AF = Y (K, L) \qquad (1)$$

When and where :

Y is an economy's gross domestic product (GDP); K is its share of capital; L is the amount of unskilled labor in the economy; A is its decisive degree of technology. Any changes in the inputs, will affect GDP and thus the equilibrium of an economy. Because any growth in these two inputs have rapid declining returns, as the returns of both untrained labor and capital on any market will be reduced if the three elements are not equivalent. Technology, on the other hand, has an unrestricted impact on growth and output.

Furthermore, because of the essence of growth theory concept, it is utilized in this study which emphasizes the influence of advancements in ICT and suggests whether policies on trade can influence a nation's long-term growth. Expansion theory also underpins the infinite needs and wants that drive profitability and income development when it comes to trading. In contrast to other

monetary philosophies that emphasize the importance of exterior and unpredictable sources, growth theory emphasizes the importance of entrepreneurship, knowledge, innovation, and technology (Schneider & Ziesemer, 1994). To put it another way, growth theory urges governments to always explore better methods to do things or manufacture new goods in order to maximize production efficiency and cost effectiveness. International trade is also known as the foundation of economic growth, where an increase in international trade causes an increase in the economic growth (Smith & Kulkarni, 2010). Therefore, the impact of ICT on international trade will be investigated further by utilizing growth theory, which emphasizes internal elements in order to foster innovation and maximize profitability.

In terms of empirical findings, international trade simply refers to the exchange of goods and services across international borders or territories, which extends the benefits of innovation beyond national borders by transferring goods and services, including capital goods, from one country to another. It is a natural extension of production, exchange, and consumption, which are all fundamental aspects of life (Hassan, Aboki, & Audu, 2014; Jankulovski & Bojkovska, 2018). Numerous experts have researched international commerce from diverse angles over the years. Likewise, ICT refers to communication devices like radios, cell phones, computers, and satellite systems, as well as the services and applications that go with them. (Rouse, 2005; Stech, 2017). According to previous studies, industrialized countries are particularly eager to construct a strong foundation of ICT access and usage since their understanding of ICT is considerably larger (Niebel, 2018). Due to that, because ICT is such a large topic, it is frequently described in the context of a specific field of interest. In this study, ICT access refers to the availability of ICTs within a place and ICT usage refers to the use by one or more individuals of a particular place.

Almost all the research findings outline that ICT benefits international trade in terms of export with positive and significant relationship with one another. For example, the findings of some of the literatures as follow regarding internet use and trade showed positive impact as it is firmly confirmed with the presence of control variables. In low-income countries, Internet use has a higher effect on trade than in high-income countries, as higher internet penetration rates provide non-high-income countries a competitive advantage (Meijers, 2014). In this regards, Rodriguez-crespo, Macro, & Billon (2018), stated that ICT has a considerable positive influence on the global economy, according to the findings, with export having a bigger impact than import because ICTs are only used when importing from wealthy countries. There are also study that determines the impact of ICT towards export performance alone as the result showed a strong support to the roles of ICT in promoting goods exports. This is because ICT known as the crucial component for exporters, manufacturers, and businesses to overcome traditional hurdles such as limited access to information about possible markets for their products (Soeng, 2020).

Whilst research on trade in products have gotten a lot of attention recently, papers on trade in services have gotten a lot of attention as well. The influence of ICT on service trade, for example, has been investigated. The findings show that ICT development possesses considerable favorable effects on the expansion as of international trade in the majority of service products because it helps to lower fixed entry costs into a market, hence spurring exports.(Freund & Weinhold, 2002; Luong & Nguyen, 2020; Nath & Liu, 2017; Wardani, Nahar, & Hairunnas, 2020). These findings were also mirrored according to an investigation conducted by Tee et al., (2020), which investigates the effects of ICT on ASEAN-5 service exports, that suggested a significant relationship between the variables because export of services is aided by the strength of business networks and the expansion of ICT networks. In the instance of Malaysia, a previous study looked into the effectiveness of ICT infrastructure on commerce. The findings prove that ICT infrastructure development is a critical enabler in increased rate of exports in Malaysia (Ahmad, Ismail, & Hook, 2011). Similarly, Bankole, Osei-Bryson and Brown (2013) also agreed that ICT infrastructure has major impact on trade. ICT effect on trade of fruits and vegetables worldwide in general was explored. Nevertheless, the analysis indicated just a slight positive effect, as neither of the ICT factors has a large positive influence on the chosen items' exports and imports. The findings do, however, support the idea that recent advancements in the

internet and mobile phones have had a major impact on the trend of commerce for specific products, even if only in minor ways (Thiemann et al., 2012).

Furthermore, ICT and international trade may have a proclivity to reveal a causal relationship that has not been thoroughly investigated. Export to ICT, for example, has a unidirectional causation because it shows that worldwide interaction has expanded as a result of exports, which has driven to innovations (Sener & Delican, 2019). Also, Ozcan and Nath (2016) explored the role of ICT on international trade and discovered that causation may run in the opposite direction, i.e., export or import may increase ICT use. Aside from that, previous research has found unidirectional causality between exports and Internet use in East Asia, as well as unidirectional causality between Internet use and exports in South Asia, but no influence in Western Asia (Yin & Choi, 2021). Freund and Weinhold (2002), identified a causal link between the Internet and international service commerce while looking at the association between Internet adoption and international service trade. A previous study found that there may be an inverted causation between Internet use and international trade, with enterprises that currently participate in trade finding it beneficial to invest in ICT (Maurseth & Medin, 2019).

Not only that, past studies have raised concern towards the importance of government policy as determinant of ICT. Laws and policies according to Jorgenson and Vu (2016), can assist a country gain immense value from the Integration of ICT since ICT policy is not a one-dimensional approach, but instead requires structural alignment, synchronization within government divisions, and partnership with economic and social development. In line with legislation, Harindranath, Dyerson and Barnes (2008), discovered that SMEs are mostly uninformed of established regulatory mechanisms somewhere at regional, national, and European levels aimed at assisting them in their adoption, which includes the usage of ICT. The effectiveness of government has a favorable short- and long-term impact on telephone penetration, which would be an obvious indication of ICT adoption (Asongu & Biekpe, 2017). As economic governance is the most significant generator of innovation, the positive effect of government effectiveness is broadly constant (Oluwatobi, Olurinola, & Alege, 2014).

Based on the reviews of past studies on ICT and international trade, it clearly stated the importance of ICT and thus, this study investigates the relationship between ICT and international trade in order to generate new facts on ICT's significance, notably in the instance of the ASEAN countries chosen. ICT in this study, is measured based on two dimensions (ICT access and ICT usage) which can help to further enrich the existing body of literature. Many studies also had indirectly found (not reported in the studies) the existence of causality while studying ICT and international trade. There is also limited attention to the causal relationship between ICT and international trade. This motivates the study to further investigate the possible causal relationship between the two variables and its direction of causality (either unidirectional or bidirectional). In addition, the goal of this research is to see if government policies on ICT can have a moderating effect on world trade.

METHODOLOGY

The static regression technique is used in this work to estimate data empirically. The approach relies on longitudinal or panel data from a sample of five ASEAN nations (Malaysia, Thailand, Philippines, Singapore, and Indonesia) over a 10-year period from 2009 till 2019. The World Development Indicator directory of the World Bank was used to gather every one of the data.

The dependent variable in this research is international trade, which is measured by the export and import of products and services. Whereas, the independent variables include: ICT variables such as fixed telephone subscriptions, mobile cellular subscriptions, fixed broadband subscriptions, and Internet users; and control variables such as foreign direct investment (FDI), research and development (R&D), real exchange rate, and inflation. Finally, the government policy moderator variable employs a proxy for government effectiveness. The following static regression models are

used to evaluate the impact of all independent variables in explaining international trade in the countries in the sample:

MODEL 1 :

$$\text{In } TRADE_{it} = \alpha_i + \beta_{i1} \text{ In } ICT_{it} + \beta_{i2} \text{ In } FDI_{it} + \beta_{i3} \text{ In } R\&D_{it} + \beta_{i4} \text{ In } RER_{it} + \beta_{i5} \text{ In } INF_{it} + \varepsilon_{it} \qquad (2)$$

MODEL 2 :

$$\text{In } TRADE_{it} = \alpha_i + \beta_{i1} \text{ In } ICT_{it} + \beta_{i2} \text{ In } FDI_{it} + \beta_{i3} \text{ In } R\&D_{it} + \beta_{i4} \text{ In } RER_{it} + \beta_{i5} \text{ In } INF_{it} \qquad (3)$$
$$+ \beta_{i16} \text{ In } ICT_{it} * GP_{it} + \varepsilon_{it}$$

Where TRADE is a measure of the country i's international trade (goods and services exported, goods and services imported) in year t.
ICT is an independent variable indicating ICT usage and access in the country i in year t (mobile cellular subscriptions, Internet users, fixed broadband subscriptions, fixed telephone subscribers).
FDI is a control parameter that indicates foreign direct investment as a percentage of GDP in the year t.
R&D = control variable expressing research and development as a proportion of GDP in year t for the country i.
RER is a control variable that represents the real exchange rate as a proportion of the country's GDP in year t.
INF = control variable expressing inflation as a percentage of GDP in year t for country i.
GP = moderating variable serving the country i's government policy (effectiveness) in year t.
ε = residuals (errors)

Analyses are carried by using two alternative models that involves one model without the moderator, and another model with the moderator. Moderator is tested by creating an interaction variable which multiplies with ICT. Thus, the moderation effect will be tested by the regression coefficient of interaction in the regression with moderator and not in the normal regression. The coefficient of government policy is used to test the interaction which is equivalent to a model comparison between normal regression and regression with moderator.

The collection of variables taken from the World Bank dataset undergoes several tests in order to examine the results of this study. Preliminary testing will be done on the annual dataset of each indicator based on Southeast Asian countries from 2009 through 2019. The test begins with the Levin Lin Chu (LLC) panel unit root test, the Fisher-typed Augmented Dickey Fuller (ADF) test, and the Fisher-typed Philips Perron (PP) test. The null hypothesis of a unit root for each individual series in a panel is tested using panel unit root tests. Whereas, the alternative hypothesis assumes the nature of the homogeneity and heterogeneity. Not only that, LLC (2002) is also acknowledged as the extension of ADF test in the perspective of panel data with the assumption individual process are cross-sectionally independent. Fisher-typed test helps to determine if there are nonrandom associations among two categorical variables. Overall, ADF test displays whether data have a unit root, while PP rejects the null hypothesis of unit root.

The Poolability of Data Test (Breusch Pagan LM Test) contributes to a considerably larger database since it aids in the estimation of parameters and the testing of heteroskedasticity in a linear regression analysis. Moreover, the Hausman test helps to select between fixed effects model or a random effects model. The dataset will also be subjected to a multicollinearity test (Variance Inflation Factor). In regression model, multicollinearity occurs only if there is an interaction between the variables that causes the regression analysis to fail. Parameters with a VIF value exceeding 10 will be discarded from the study since they are regarded highly collinear. Variables with value of less than 10 will be kept because they are still valid for the analysis. Then, if the estimates for certain independent variable are zero, the test of heteroscedasticity (Modified Wald test) will be performed to fix the error terms

to be robust, and also add variables to the model that are not zero. The autocorrelation test (Wooldridge test), which is a basic test for autocorrelation, heteroscedasticity, and multicollinearity in simulations panel data regression, will be performed next.

The dataset will next be subjected to a static panel estimator's main model, which includes the test of the Panel Feasible Generalized Least Squares (PFGLS). To finish, in the presence of heteroscedasticity and auto-correlation in the analysis, robust stand errors will be taken. The fact that the type of heteroscedasticity and autocorrelation does not need to be stated is one of the most important features of resilient standard errors. Simultaneously time, because they are derived upon this OLS estimator, these error terms will not be robust against outliers. The challenge of trustworthy estimate of standard errors is also explored in the robustness literature, but most typically in the context of their robustness over outliers. Besides that, the heteroscedasticity and autocorrelation consistency (HAC) standard error estimator does not necessitate any functional heteroscedasticity definition or any modelling of the correlation structure in the error terms (Croux, Leuven, Hoorelbeke, and Leuven, n.d.). Because the study involves nations with varying levels of income, the distribution of the overall dataset may be influenced. As a result, the robustness test will cover nations from both income classes, namely upper income and upper middle-income countries. Aside from that, the Granger causality test is used to see if one-time series may be used to predict others. If indeed the coefficient of determination value is less than a certain threshold, the hypothesis is rejected at this same threshold.

CONCLUSION AND RECOMMENDATIONS

The purpose of this research is to look into the interaction between ICT and international trade in Southeast Asia, as well as whether there is a causal link between the variables. Moreover, this study also explores the moderating effect of government policy on ICT and international trade of the Southeast Asia countries Using the static panel data regression method, this study is expected to extend growth theory in order to explain ICT in Southeast Asia countries by testing the role of government policy as moderator as government of each nations have the responsibility and the authority to govern and organize ICT as well as trade related matters. The findings of the regression will prove on whether indeed the role of ICT improves trade or otherwise in ASEAN context. Moreover, there also will be new evidence on the possible causal relationship between ICT and international trade as both the variables tend to affect one another. There are some limitations in this study. Only five Southeast Asian countries are selected as sample in this study, therefore future researchers can consider expanding the scope of countries as well as the years of study in order to get more comprehensive empirical evidence. Additionally, upcoming studies can widen the selection of ICT indicators as there are other indicators of ICT rather than ICT access and usage that impacts international trade. In summary, the projected results from this research highlight the significance of well-designed policies and enhancements in context of digital infrastructures in ASEAN members to reduce ICT connection and accessibility difficulties. Effective government initiatives may assist third world countries in excelling and capturing the benefits of increased digital connection, and that they should start providing both material and soft infrastructure in construct a powerful online economy (Ingram, 2020). The advancement of ICT has had a considerable effect on trade processes, particularly during the epidemic. As a result, ICT policies must serve as a crucial plan for ICT implementation methods and the introduction of modern innovation to secure long-term imports and exports.

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