THE IMPACT OF SINGLE WINDOW SYSTEM IN FACILITATING TRADE: EVIDENCE FROM ASEAN COUNTRIES

A Thesis

Submitted to the Master's Study Program of Economics at the Faculty of Economics and Business in partial fulfillment of the requirements for the degree of

Master of Arts (M.A.)

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ABSTRACT

Name	:	Andiyani Kurnia
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This study aims to assess the impact of the Single Window System on facilitating trade processes in ASEAN member countries using panel data analysis. The Single Window System is an integrated platform that streamlines and harmonizes trade procedures by allowing traders to submit all required documents and data through a single electronic gateway. This research utilizes panel data from multiple ASEAN member countries over a specific time period to examine the effects of implementing the Single Window System on trade facilitation. The study employs a Fixed Effect model, shows that Single Window has a positive and significant impact toward Trade as well as the other determinant such as Trade in service GDP, and Population. Besides, Frontier Technology Readiness has significant negative impact. The findings of this research contribute to the understanding of the effectiveness of the Single Window System in enhancing trade processes within ASEAN member countries. It provides insights into the extent to which the implementation of this system has reduced trade barriers, improved efficiency and increased transparency in trade procedures. The results also shed light on potential variations in the impact of the Single Window System across different ASEAN member countries. The analysis will help identify best practices and policy recommendations for optimizing the implementation and utilization of the Single Window System to further enhance trade facilitation.

Keywords: *Single Window System, Trade Facilitation, ASEAN, Panel Data Analysis.*

JEL Classifications: C23, F10, F13, O33, N70

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ABBREVIATION DIRECTORY

AI	: Artificial Intelligence
AMS	: ASEAN Member State
AFTA	: ASEAN Free Trade Area
ASEAN	: Association of Southeast Asian Nations
ASW	: ASEAN Single Window
ASYCUDA	: Automated System for Customs Data
CEM	: Common Effect Model
CEPT	: Common Effective Preferential Tariff
EDB	: Ease of Doing Business
ET	: Enabling Trading
FEM	: Fixed Effect Model
FTRI	: Frontier Technology Readiness Index
GDP	: Gross Domestic Product
IoT	: Internet of Things
ISWE	: International Single Window Environment
LPI	: Logistic Performance Index
NSW	: National Single Window
REM	: Random Effect Model
RS	: Regional Services
SW	: Single Window
PG	: Population Growth
PKI	: Public Key Infrastructure
TF	: Trade Facilitation
TFA	: Trade Facilitation Agreement
TIS	: Trade in Service
WCO	: World Custom Organization
WTO	: World Trade Organization

CHAPTER I
INTRODUCTION

1.1 Background

International trade is an essential element of the process of globalization. Open trade with various countries in the world provides benefits. It brings domestic economic growth, both directly in the form of an impact on the allocation of resources and efficiency, as well as indirectly in the form of increased levels of investment.

In general, international trade is a means of exchanging goods and services. Before Covid-19 attacked, international trade had grown and developed drastically and in large size. According to Rusyidiana (2008), This is due to the cooperation carried out by various countries to eliminate trade protection and the desire to promote trade in goods and services on an ongoing basis free

ASEAN is one region with great potential as a robust world economy. Aryani argues that this is because ASEAN has a population that reaches 8.5% of the world's population and can contribute 3.5% of the GDP world in 2017. From the trade side, on in 2017 trade in goods in ASEAN grew 15%, and trade in services grew 6.1% (Aryani *et al*,2020)

On the other hand, ASEAN member countries face a fascinating and challenging mix of trade requirements. Legal requirements, national and regional planning, social security and risk management, and requirements of a purely technical nature. According to Zivcovic and Pantastico, (2018), pressure to intensify cross-border initiatives is building from two aspects: the globalization of production and security initiatives. The business sector is already operating global supply chains, and the freight forwarding and transport industry operates worldwide logistics networks and chains. They exchange data and information across borders between our partners in our supply and logistics chains for further simplification at border crossings and customs points. Security initiatives initiated by governments worldwide are pushing unprecedented levels of cross-border data exchange for risk and compliance management**.**

ASEAN has agreed to strengthen economic cooperation by expanding the scope of trade liberalization. Hakim (2009), trade liberalization in the region was initially included in the 1992 AFTA Articles. AFTA 1992 then emphasized only efforts to reduce import tariffs to 0-5%, and tariff reduction plans were documented in the Common Effective Preferential Tariff (CEPT). The National Single Window (N.S.W.) is a trading system aimed at improving import and export procedures and reducing time. Before establishing the ASEAN Single Window (A.S.W.), all ASEAN Member States should establish the N.S.W., a unified system for customs-related collection, processing, and decision-making of cargo data and information under A.S.W. Therefore, an amalgamation of 10 N.S.W.s in ASEAN countries aimed at reducing transaction times and costs to increase efficiency and competitiveness. In addition, A.S.W. aims to improve the performance of the movement of goods between ASEAN Member States, aiming and facilitating expedited customs and cargo clearance processes. (Hapsari *et al*, 2015).

According to a survey from the United Nations, in 2021 several countries in ASEAN have implemented the electronic single windows system in the region, such as the Philippines and Vietnam; Myanmar is still in the partially implemented stage, while Laos is in the planning stage status and the rest namely Brunei, Indonesia, Cambodia, Malaysia, Singapore, and Thailand have been fully implemented. On the other hand, this survey reveals that the level of implementation of paperless Trade in Southeast Asian and East Asian countries is ranked second with 75.27% after economically developed countries with a total level of 81.68%. In research by Suvannaphakdy and Kevin, (2022) in ASEAN, member countries have developed the ASEAN Single Window (A.S.W.) since 2005. A.S.W. creates an interoperable environment to connect and integrate the N.S.W. of ASEAN member states at the regional level. Three regional agreements or protocols have supported the establishment and operation of A.S.W., namely the Agreement to Establish and Implement the ASEAN Single Window, signed on December 5, 2005, and the Protocol to Establish and Implement the ASEAN Single Window (Implementation Protocol) signed on December 20, 2006. The Protocol on the Legal Framework to Implement the ASEAN Single Window (Legal Framework

Protocol) was signed on September 4th, 2015 and continues to promote ASEAN's role as a single window worldwide**.**

Exciting insights from Duval *et al*, (2017), from trade facilitation (T.F.) counterfactual simulations regarding trade costs, many developing countries in the Asia-Pacific region can expect only limited trade cost reductions through the independent implementation of the World Trade Organization (W.T.O.) Trade Facilitation Agreements (TFA). The measures proposed in the Agreement are especially proper for ASEAN and East Asian economies, where some of the most progressive measures of the W.T.O T.F.A have been implemented. Single Window started long before the WTO TFA was completed. These countries have made significant progress in reducing transaction costs through T.F. It means focusing on cross-border paperless trade actions.

The A.S.W. rely on a common conceptual framework used as a reference model for linkage of the A.S.W. Architecture and ASEAN Member State (A.M.S.) National Single Windows addresses today's T.F needs and expected business and technological challenges of the foreseeable future. The favourable approach is a modular and flexible transformation through a pilot and phased implementation plan implemented/introduced incrementally. This means that it can be used for developing functional components based on a modern, flexible ASW/NSW IT Architecture and simultaneously offer the means for retaining some existing implementation systems by providing A.S.W. integration services.

Hakim (2004) illustrates the limitations of import tariff reduction tools in increasing regional Trade. Importers and exporters pay attention to the import and export formalities process. This process is expensive, and the long waiting process also impacts on the opportunity cost. For this reason, the ASEAN Secretariat has issued a Trade Facilitation Policy to ease the above restrictions.

The implications of implementing a single window system were made clear in a journal Weber and Rolf (2011), stating that multiple single window experiences were created. A prime example is TradeNet, which has dramatically improved and simplified the trading process, which is very important to Singapore's economy. There are many other benefits, such as using cutting-edge technology to enable

rapid response, improved collection of accurate and rapid trade statistics, cost efficiency, and integration with trading partners and regulators to facilitate vigorous enforcement and enforcement of rules and regulations Such as easy integration and connectivity.

CTI (2019) underlined that after the entry into force of the World Trade Organization Agreement (TFA) on Trade Facilitation, the international trade single window is now globally recognized for processing import, export, and transit-related data and procedures. The international interoperability of single windows could help ensure harmonized and compatible implementation of the TFA commitments to reduce costs and lost productivity for stakeholders and governments.

Some of the literature, Martínez *et al*, (2020) state that the literature found that a single window operation was able to reduce the number of documents required for export and import to study Latin America. Another side, Tsen (2011) presents a descriptive review of S.W. Although the literature is unclear and quantitative analysis is lacking, the study claims that business processes have been simplified and automated, increasing collaboration between government agencies and the private sector. The authors do not provide concrete data to support this claim but say that S.W has improved trade facilitation and logistics performance indicators in many countries. Another article Choi (2011) looked at 177 countries and found an average of 15 institutions involved in cross-border transactions. With the introduction of S.W., South Korea has reduced the time foreign traders spend completing customs declarations by 30% to 40%. Additionally, the time spent in customs clearance has decreased from just over a day to just two minutes for exports and increased from two days to less than two hours for imports.

The single window system cannot be separated from the technological infrastructure that supports the system. The trend of massive technological developments has led to the fourth industrial revolution, which emphasizes the use of information and communication technology as a basis in various fields. An article from Freire (2021) encouraged the developing countries to mitigate the risk of being left behind, needs to diversify their economies while adopting frontier

technologies while diversifying their economies. Meanwhile, UNCTAD's Technology and Innovation Report 2021 introduces a readiness index to assess national capabilities to use, adopt and adapt these technologies equitably. The index comprises five building blocks: (i) Information and Communication Technology deployment, (ii) skills, (iii) Research and Development activity, (iv) industry activity and (v) access to finance. On 15th Conference of the ASEAN in March 2021 adopted the Framework for Developing Digital Readiness Among ASEAN Citizens To achieve digital readiness, this Framework has identified three inter-related elements, namely (i) digital access; (ii) digital literacy; and (iii) digital participation.

Along with these, service is also necessary to improve the trade processes. According to OECD.org, Trade in services captures the value of services exchanged between residents and non-residents of the economy, such as services provided through foreign subsidiaries based abroad. The value of exports, imports, net trade and percentage of GDP measures this indicator. Services include transportation (both freight and passenger), travel, and communication services (postal, telephone, satellite, etc).

This trade includes not only the export and import of goods but also the export and import of services and trade in capital. According to Rinaldi, *et al* (2017), one of the advantages of international trade is that it allows a country to specialize in producing relatively inexpensive goods and services. In addition, the tangible benefits of international trade can be increased state income, foreign exchange reserves, capital transactions and broad employment opportunities for the population.

Developed countries have become more specialized due to the expansion of international trade Production of industrial goods for intensive use by skilled workers. The resulting increase in demand for skilled labour will lead to gradual investment in population quality, accelerating demographic change, stimulating technological progress, and comparing these developed countries in producing skilled labour-intensive commodities. In contrast, international trade has incentivised non-industrial economies to specialize in producing unskilled and

intensive non-industrial goods. The lack of significant demand for human capital has limited incentives to invest in population quality, and profits from trade have been primarily used for further population growth rather than income for the existing population (Galor & Mountford, 2008)

Moreover, the calculation of Gross Domestic Product (GDP), one of which uses the expenditure approach, involves exports and imports in the calculation. Therefore, mathematically, of course, these exports and imports can affect the value of GDP. Exports can add to GDP, while imports can reduce GDP. This GDP can later be compared to see a country's high and low economic growth.

Based on the background explanation above, this research will conduct an empirical study to quantitatively verify the implementation of a single window system toward global trade. There are also several control variables, namely the Frontier Technology Readiness Index (FTRI), which represents the readiness to use technology and innovation in a country so that it is assumed to be able to support SW infrastructure in accelerating international trade. Furthermore, Trade in Service represents the value of service in the trade, Population is the proxy for the human capital, and GDP represents Economic growth in a country. All of those independent variables will be used to examine the total trade. Using a combination of cross-sectional data, namely ASEAN member countries and time series with the annual period from 2015 to 2021, the data will be tested with panel data regression using Stata 17 software.

This research's novelty is integrating single windows technology readiness, GDP, Population, and trade in service in examining 10 ASEAN countries in the particular econometric model. This research can be used to improve and analyze the success rate of single-window system implementation. The findings of this study contribute to several aspects, namely practical and academic implications, by providing more insights that correlate with single window systems and management as structural.

1.2 Research Objective

Based on the background stated earlier, this study aims to examine the implementation of the Single Window system expressed in Rates of Paperless Trade and several other determinants such as Frontier Technology Readiness Index (FTRI), Trade in service, population and GDP. can influence the acceleration of Trade among ASEAN member countries.

1.3 Problem Statement

The single window system is a system that supports paperless movement on trade facilitation. The index that was raised by the survey on Sustainable Trade Facilitation is a representation of the implementation of the system in the 10 ASEAN countries tested and is believed to be able to accelerate the implementation of the international trade process supported by several control determinants tested in this study, namely FTRI, TIS, PG, and GDP

1.4 Research Question

Based on the Problem stated above, the following research questions arise:

1. What is the effect of implementing the single window in the 10 ASEAN countries on international trade tested in this research?
2. How come the single windows system helps accelerate trading?
3. Can other control determinants such as FTRI, TIS, PG, and GDP significantly affect global trade in ASEAN countries?
4. What is the comparison of implementing the single window system in regions outside ASEAN?

1.5 Research Hypothesis

The hypothesis that appears in this study is as follows:

1) H0: Single window has a significant and positive impact towards trade
   H1: Single window has not significant and positive impact on trade
2) H0: FTRI has a significant and positive impact towards trade
   H1: FTRI has not significant and positive impact towards trade
3) H0: TIS has a significant and positive impact towards trade
   H1: TIS has not significant and positive impact towards trade
4) H0: PG has a significant and positive impact towards trade

H1: PG has not significant and positive impact towards trade

5) H0: GDP has a significant and positive impact towards trade

H1: GDP has not significant and positive impact towards trade

1.6 Research Significant

Every research is expected to be helpful for all parties who read it or are directly involved. The uses of this research are:

1. As a form of illustration to the governments of ASEAN countries, especially to the managers of the National Single Window portal in developing the N.S.W. system in the future.
2. As a consideration and reference for the parties concerned in managing the National Single Window system integration.
3. As consideration and reference material for future researchers who discuss the N.S.W. system to be studied and developed further.
4. As a consideration and reference for new policies in carrying out the paperless movement in the bureaucratic order of the Government sector and the private sector.

1.7 Thesis Outline

To provide a clearer picture of the discussion in this study, the authors divide this writing into three chapters, with the following systematics:

Chapter I: Introduction

It contains background, problem formulation, problem limitation, research objectives, research significancy, hypothesis, limitation and writing systematics.

Chapter II: Literature Review

Describes the theoretical studies related to the basic theoretical research carried out in this study and previous studies conducted.

Chapter III: Research Methodology

Explains the sample used in the research, the type of data, and the data analysis method used.

Chapter IV: Result and Discussion

This chapter contains data analysis obtained from research. The data analysis includes statistical analysis used to test the research hypothesis.

Chapter V: Closing

This chapter contains conclusions, policy recommendation, and limitations of the research conducted.

References and Appendices

CHAPTER II

LITERATURE REVIEW

2.1 International Trade

International Trade is a crucial element of the globalization process. Opening Trade with various countries in the world will provide benefits and bring domestic economic growth, both directly in the form of influences on resource allocation and efficiency as well as indirectly in the form of increased investment levels (Rusyidiana, 2008).

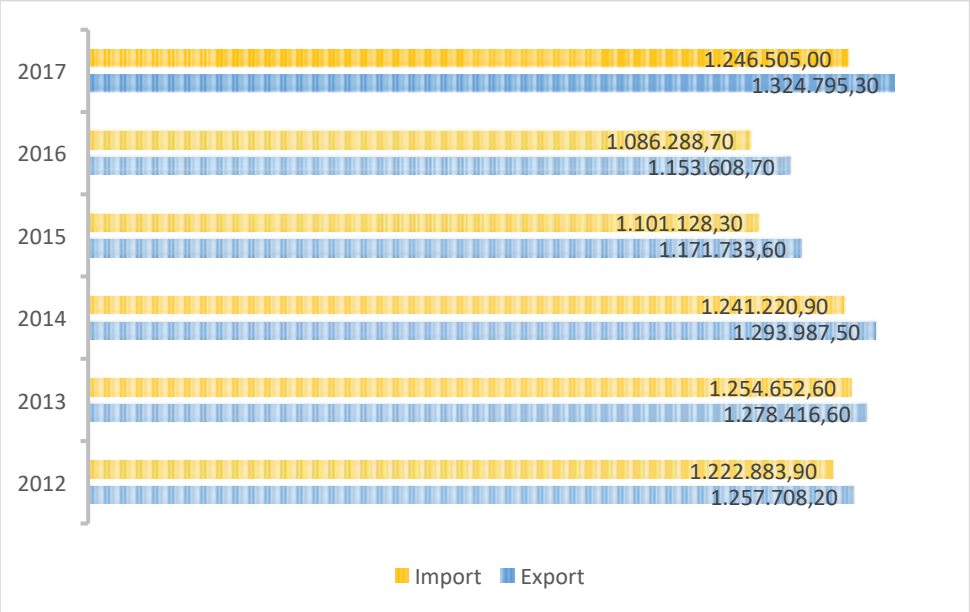
International Trade is Trade among countries based on agreements between individuals, individuals and governments, or between the government of one country and another. International Trade also drives industrialization, transport progress, globalization, and the existence of multinational corporations. International Trade is one of the critical aspects supporting a country's economic growth, so countries engage in international Trade even when they have perfect resources. International Trade is the commercial exchange of goods and services between countries through cross-border imports and exports (Binus.ac.id).

International Trade is essential in improving prosperity because it can help countries. Trade is an engine of growth Salvatore (2004) in Hasoloan (2013). These components may drive growth when international trade activities include imports and exports. A study from Tambunan (2005) noted that Indonesia established policies for export promotion in the early 1980s.

There is an opportunity to move production areas when there is international Trade in imports and exports. A growing market characterized by increased imports of certain goods into a country increases the likelihood of producing those goods in the importing country. This likelihood is based on comparing the cost of manufacturing in exporting country plus transportation to the cost that would have occurred if the goods had been manufactured in the importing country. If the production and transportation costs in the exporting country are higher than the importing country's production cost, the investor will transfer the production site to the importing country (Appleyard *et al*, 2006).

Globalization has significantly blurred national trade boundaries. As part of its integration efforts, ASEAN was formed to promote the economic sustainability of each member. ASEAN statistical yearbook 2022 has captured that the total export-import has growth significantly.

Figure 1. Total Export-Import of ASEAN Country in 2012-2016



Source: ASEAN Statistical Yearbook 2022

From the figure above, the growth amount of the total trade in ASEAN moves dynamically. In the year 2012-2014, in case the average export is USD 3,8 Billion. Besides, three years after (2015-2017), the average export amount is 3,6 Billion USD, which tends to decrease. The same trend comes from the import sector. From the first three years, the average export is 3,7 Billion USD and the three years after went down to 3,4 Billion USD. The global economic landscape is dynamic, and shifts in economic conditions can impact trade patterns, Menon & Mendelez (2017). Global economic conditions have changed, with factors such as slower global growth, geopolitical uncertainties, or changes in trade policies affecting export-import demand and leading to a decline in ASEAN trade.

Nevertheless, trade facilitation, consisting of hard and soft equipment, plays a big role here. Wardhani, *et al* (2018) Overall, trade facilitation is an essential factor in enhancing the quality and quantity of a country's exports, especially for

developing countries, as it determines trade costs that also affect the effectiveness and efficiency of Trade is play an important role.

2.2 Trade Facilitation

Trade facilitation, according to the World Trade Organization (W.T.O.) and the World Customs Organization (W.C.O.) is the simplification of trade transactions, transparency and professionalism of customs and regulatory environments such as harmonization and standardization, so from this definition, it is used as the central pillar in Trade Facilitation. These pillars are Simplification, Transparency, Harmonization, and Standardization. The four pillars are used as a reference in measuring trade facilitation carried out by W.T.O. and W.C.O. member countries. The Trade Facilitation Agreement aims to enhance global Trade through increased transparency and simplifying export and import procedures to accelerate the movement, release and clearance of goods, including goods in transit.

The World Trade Organization in Trade Facilitation Agreement was adopted at the W.T.O.'s Ninth Ministerial Conference in Bali, Indonesia, in December 2013 as part of the Doha Development Agenda and, after a lengthy development period, was launched in 2017. It went into effect on February 22. There is a wide range of trade facilitation agreements under W.T.O. The table below summarizes their purpose.

Table 1: General Purpose of W.T.O. on TFA

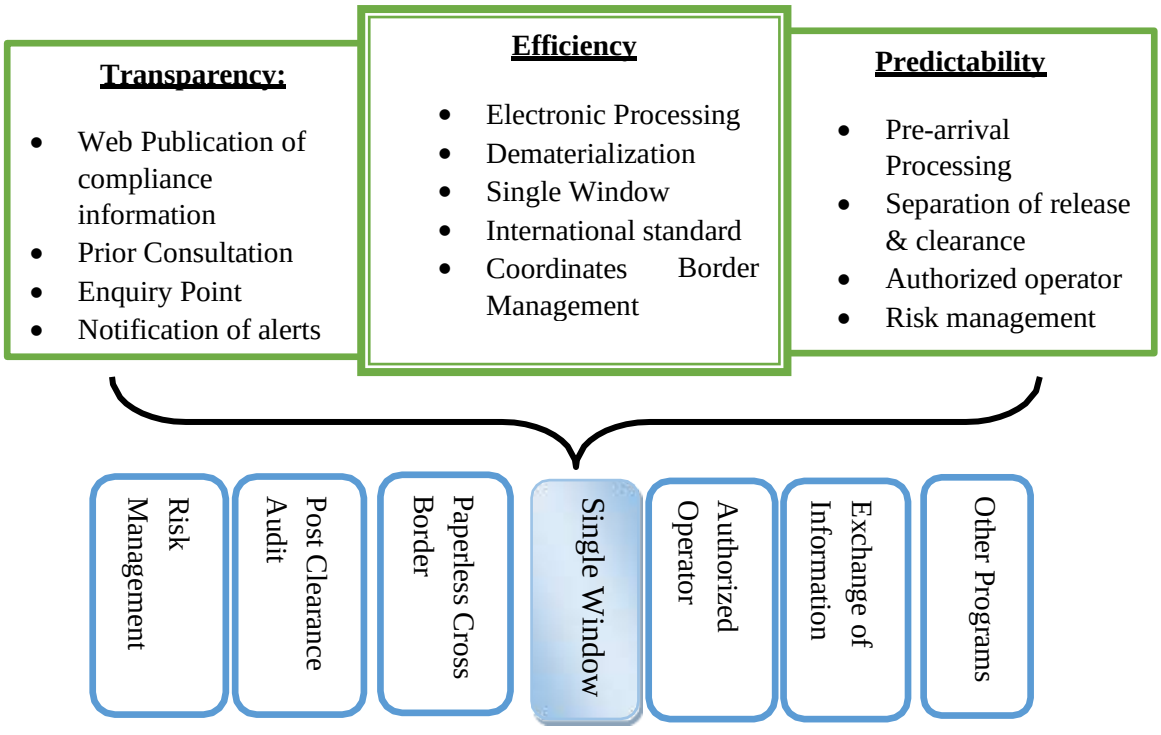
Objective	Characteristics
Speedy release and clearance of goods	➢ Transparency in regulations ➢ Predictability in decision-making ➢ Rational, transparent fees and charges ➢ Customs cooperation ➢ Border agency cooperation ➢ Simplifying documentation ➢ Freedom of transit ➢ Advance rulings ➢ Appeal procedures ➢ Transparent penalties
Expedited movement of export, import, and transit cargo	
Lower costs of international Trade by reducing procedural barriers	
Cooperation and coordination among border agencies within the government and between governments	
Provision of technical assistance in building capabilities	
Speedy release and clearance of goods	➢ Transparency in regulations ➢ Predictability in decision-making ➢ Rational,transparent charges
Expedited movement of export, import, and transit cargo	

Lower costs of international Trade by reducing procedural barriers	➢ Customs cooperation ➢ Border agency cooperation ➢ Simplifying documentation ➢ Freedom of transit ➢ Advance rulings ➢ Appeal procedures ➢ Transparent penalties
Cooperation and coordination among border agencies within the government and between governments	
Provision of technical assistance in building capabilities	

Resource: World Custom Organization (W.C.O.)

Analysing the TFA articles in isolation could miss the opportunities that countries offer to strategically orient information and communications technology, human resources, and capacity building. Nevertheless, the Agreement offers members the opportunity to achieve new levels of trade facilitation in terms of transparency, efficiency and predictability. An overall strategy usually involves a program that introduces a single window, as shown in the diagram below**:**

Figure 2. Measures under the WTO TFA



Sources: WTO TFA

Trade facilitation measures, especially the Single Window, are vital to streamlining border bureaucracy and customs clearance times Das (2017). According to a report published by the United Nation in 2021 regarding the trade

facilitation score, there are five categories of indicators to measure Trade Facilitation, which will be described in the following table:

Table 2. Trade Facilitation Indicators

Indicator	Measures
Transparency	1. Publication of existing import-export regulations on the Internet 2. Stakeholders' consultation on new draft regulations (prior to their finalization) 3. Advance publication/notification of new trade-related regulations before their implementation (e.g., 30 days prior) 4. Advance ruling on tariff classification and origin of imported goods 5. Independent appeal mechanism (for traders to appeal customs rulings and the rulings of other relevant trade control agencies)
Formalities	1. Risk management (as a basis for deciding whether a shipment will be physically inspected or not) 2. Pre-arrival processing 3. Post-clearance audits 4. Separation of release from final determination of customs duties, taxes, fees and charges 5. Establishment and publication of average release times 6. Trade facilitation measures for authorized operators 7. Expedited shipments 8. Acceptance of copies of original supporting documents required for import, export or transit formalities
Institutional Arrangement and Cooperation	1. Establishment of a National Trade Facilitation Committee (NTFC) 23 or similar body 2. National legislative framework and/or institutional arrangements for 8 border agencies cooperation 3. Government agencies delegating border controls to Customs authorities 4. Alignment of working days and hours with neighboring countries at border crossings
Transit Facilitation	1. Transit facilitation agreement(s) with neighboring country(ies)

	2. Customs authorities limit the physical inspections of transit goods and 10.5 use risk assessment 3. Supporting pre-arrival processing for transit facilitation 4. Cooperation between agencies of countries involved in transit
Paperless Trade	1. Automated Customs System 2. Internet connection available to Customs and other trade control agencies at border-crossings 3. Electronic Single Window System 4. Electronic submission of Customs declarations 5. Electronic application and issuance of import and export permits 6. Electronic submission of Sea Cargo manifests 7. Electronic submission of Air Cargo manifests 8. Electronic application and issuance of Preferential Certificate of Origin 9. E-payment of Customs duties and fees 10. Electronic application for Customs refunds
Cross-Border Paperless Trade	1. Laws and regulations for electronic transactions are in place (e.g., e-commerce law, e-transaction law) 2. Recognized certification authority issuing digital certificates to traders to conduct electronic transactions 3. Electronic exchange of Customs declaration 4. Electronic exchange of Certificate of Origin 5. Electronic exchange of Sanitary and Phyto Sanitary Certificate 6. Paperless collection of payment from a documentary letter of credit

Source: United Nations Global Survey on Digital and Sustainable Trade Facilitation (2021). Data Processed.

The Trade Facilitation Indicator's description explicitly mentions that the Electronic Single Window System is used to measure paperless trading rates and is measured by other automated systems. Therefore, In this paper focused on the paperless indicator in the measurement of the single window system**.**

To create an International Single Window Environment (ISWE) that complements a deeply connected and universal exchange landscape, border offices work together to ensure that goods, including the entire supply chain, are matched

before they reach a physical border. It needs to be able to check the authenticity and customs clearance. Measures of coordination and cooperation range from arrangements to narrative and physical controls between households and international border organizations. In any event, cooperation and coordination among global border organizations is grounded in the political order and can be demonstrated through the endorsement of international agreements and related treaties. is a political commitment on the part of the W.T.O. and thus helps achieve the desired outcome. An individual due to its multilateral nature. Article 12 TFA may be a component in this context as it emphasizes the importance of customs cooperation. Participation is achieved because each Member State has eligibility requirements and regulatory frameworks that need to be harmonized as a first step and then to establish belief-based relationships with other Member States. It must recognize that it is not easy. Article 12 of the TFA specifies the manner and manner of Trade and interaction between border authorities in different locations and, therefore can be addressed from a current perspective regarding ISWE (Bal, *et al*, 2017).

Implementing a Single Window involves analysing the need and determining its potential scope, level and nature of demand, data and other information requirements, legal issues, implementation options, possibilities and types. A feasibility study needs to be prepared. Pilot implementations, implementation costs for different scenarios, other resources required (human, technical, etc.), potential benefits and risks, timeframes, implementation and management strategies. From a legal perspective, the framework should include implementing data protection laws and regulations that ensure confidentiality and security in information exchange. (Luddy, 2008).

2.3 Trade Facilitation in ASEAN

The member countries of the Association of Southeast Asian Nations (ASEAN) have made a series of commitments to facilitate trade among themselves and with their main trading partners. These efforts are crucial for establishing a functional economic and trading system, especially considering the growing trade

fragmentation, manufacturing specialization, and the fact that goods are no longer exclusively associated with a single origin for their identification or designation.

In 1992, five ASEAN member states (Brunei, Indonesia, Thailand, Philippines, Malaysia, and Singapore) agreed to establish the ASEAN Free Trade Area (AFTA). The primary objective of this commitment was to reduce intra-regional tariffs by implementing the Common Effective Preferential Tariff (CEPT) scheme. Under the CEPT, it was agreed that all goods produced and traded among the member countries would have tariffs ranging from 0% to 5% by the year 2015.

Subsequently, additional ASEAN countries (Myanmar, Vietnam, Cambodia, and Lao PDR) joined the AFTA, agreeing to the same conditions but with a longer-term implementation timeline, also set for the year 2015. These countries committed to gradually reducing tariffs on traded goods to promote greater regional economic integration.

In addition to the commitments related to tariffs, the ASEAN working group also recognized the importance of trade facilitation initiatives within the framework of AFTA. During the discussions in the early 1990s, the focus was primarily on harmonizing Customs procedures, reducing tariffs, implementing WTO valuation standards, and achieving tariff harmonization. The aim was to establish a common ground for trade in the region, ensuring that traders and government officials clearly understood how to engage with each other and facilitate smooth trade interactions. At that time, automation of trade processes was not a primary consideration, and the focus was more on establishing standardized procedures and regulations.

Over time, it has become evident that efforts focused solely on reducing tariffs and duties are not sufficient to address the challenges faced in intra-ASEAN trade. The core obstacles lie in the activities required to facilitate the movement of goods across countries. The World Bank's Doing Business benchmark study examines the cost and time associated with the entry and exit of a standard cargo container in a country. Non-tariff barriers, such as licensing requirements, excessive cargo handling, bureaucratic procedures, and red tape, can significantly increase the cost of trading goods, adding up to 60% of the cargo's origin cost. While this may

not pose a significant issue for high-value goods like electronics or luxury items, it can harm the competitiveness of low-value goods such as agricultural products or basic textiles and apparel. The increased costs caused by these external factors can hinder trade and potentially lead to a decline in competitiveness or even the cessation of trade in specific sectors. The table below provides a comparative overview of the ASEAN member states, highlighting the time and cost burdens imposed by these "soft" issues on the efficiency of their trade transactions.

Based on indicators such as Ease of Doing Business (E.D.B.), Logistics Performance Index (LPI), and Enabling Trade (E.T.), it can quickly estimate the current time and cost of customs clearance in ASEAN countries

Table 3. Current State of Custom Clearance index for ASEAN that indicate E.D.B., LPI, and E.T

Country	Ease of doing Business Index (Score) in 2015	Logistic Performance Index (Score) in 2014	Border Administration Index (Score) in 2014
Brunei	46 (80,8)	n.a	n.a
Cambodia	124 (65,9)	71 (2.6)	108 (3.4)
Indonesia	62 (77.4)	55 (2.8)	69 (4.4)
Laos	156 (52.9)	100 (2.4)	114 (3.4)
Malaysia	11 (89.9)	27 (3.3)	33 (5.2)
Myanmar	103 (70.0)	150 (1.9)	117 (3.3)
Philippines	65 (77.2)	47 (3.0)	71 (4.3)
Singapore	1 (96.4)	3 (4.0)	1 (6.3)
Thailand	36 (83.5)	36 (3.2)	56 (4.7)
Vietnam	75 (75.6)	61 (2.8)	86 (4.0)

Sources: World Bank Doing Business Database; World Bank (2014), Logistics Performance Index and its Indicators; World Economic Forum (2014); The Global Enabling Trade Report

The indicators that measure ease of doing Business are export documentation, time and cost, and the same conditions apply to imports. Das (2017) Doing Business shows that the estimated cost per shipment of ASEAN member countries (excluding Laos) is lower than the average of OECD countries. However, most ASEAN member states (except for Singapore and Malaysia) have room for improvement in the number and time required for imports and exports.

Logistics performance can be measured by release time, physical inspection of import shipments, multiple inspections, and the number of agents and forms. The table above shows that the top 50% of 160 countries ranked in 2014 included 8 of the 9 ASEAN countries (excluding Brunei due to unavailability of information). According to (Das, 2017), most ASEAN member states are required to complete 4-5 forms and imports and exports from the country involve 3-4 agencies**.**

The Philippines is the exception, with the highest number of agencies and documents required for export. This will increase the number of days required for customs clearance. Laos and Myanmar (75%) have the highest incidence of physical screening, followed by Vietnam (53%), but Cambodia and the Philippines also suffer from this problem but much less.

The trade-ability indicators in the table above compare the quality of service, predictability, and transparency in border controls. Except for Singapore and Malaysia, most ASEAN countries perform poorly and are in the bottom 50% of the total number of countries surveyed. An important point to note here is that there are gaps among ASEAN member states on all three indicators. While Singapore and Malaysia perform best in customs clearance, Cambodia, Laos, Myanmar, and Vietnam perform relatively poorly in most cases in all cases. A key challenge for ASEAN is reducing performance disparities among member states, thereby improving the efficiency of the cross-border movement of goods and services. In this scenario, requiring each of the 10 A.S.W. members to establish a National Single Window (N.S.W.) simultaneously removes many barriers discussed under the index (Das, 2017)

2.4 Single Window System

In order to improve the competitiveness of the supply chain, shippers, logistics companies, governments, and related agencies exchange information and documents with other port operators and managers to keep them informed of events and events happening elsewhere. Must be able to recognize accidents/delays and gain visibility. Get the traffic flow 'end-to-end' encryption.

After W.T.O., the Trade Facilitation Agreement, International Trade Single Window, is recognized globally for processing import, export, and transit-related data and procedures. International interoperability of individual windows could help ensure harmonized and compatible implementation of TFA obligations to reduce costs and productivity losses for stakeholders and governments. (CTI, 2019).

A single window system is a regional integrated national system that allows for the single submission of data and information, single and synchronous processing of data and information, and single decision-making for customs release and clearance of cargoes (Kemenkeu.go.id) UN/CEFACT Recommendation No. 33 aims to facilitate cooperation between Customs and other governmental authorities concerning the flow of information between parties involved in Trade and transport on the one hand and regulatory authorities on the other. I am using the Buy Ship Pay Model 4. This is the first attempt to rigorously collect data and documentation on the design and implementation of a single window for international Trade. This Recommendation is the basis for our current understanding of this topic. All over the world, the application of the Single Window Concept is judged by meeting the criteria required by the typologies set out in the Single Window Concept Definition and Recommendation Annex. The definition of a single window according to UN/CEFACT Recommendation No. 33 is:

In the context of this Recommendation, a single window point of contact is a way for parties involved in Trade and transportation to store standardized information and documents in a central location to meet all import, export, and transportation-related regulatory requirements. It is defined as a facility that allows If the information is electronic, each data element should be sent only once

2.4.1 Single window significancy

The benefits of the Single Window concept based on Weber (2011) it says below

1. S.W. implements better risk management, increases security levels, Improves revenue through improved merchant compliance, transparent and predictable interpretation and enforcement of rules, and better use of human and financial resources to increase productivity and competitiveness.
2. A single Window point of contact can significantly simplify and expedite providing and sharing of the information necessary to meet trade-related regulatory requirements for traders and regulators. Such a system could increase the efficiency and effectiveness of public administration and make better use of resources, thus reducing costs for traders and governments.
3. A Single Window can also lead to a better combination of existing governmental systems and processes while at the same time promoting a more open and facilitative approach to how governments operate and communicate with businesses. Efficient systems with accurate validation schemes will also result in better coordination and cooperation between the governmental authorities involved in trade-related activities. Furthermore, the implementation of a payment system within the Single Window ensures rapid and accurate payment to governmental authorities and agencies for required duties and any other charges
4. Provides up-to-date information on tariff rates and other legal and procedural requirements in a single window, reducing unintentional errors and improving merchant compliance. A single window will reduce human and financial resources, allowing governments to reallocate previously devoted to administrative tasks to more essential and critical areas.
5. For the trading community, Single Window can provide traders with a one-stop-shop for submitting all necessary information and documents at once to government agencies involved in export, import or transit procedures. Merchants will benefit from faster release and clearance times, speeding up their supply chain. In addition, greater transparency and predictability may further reduce the potential for corruption by the public and private sectors.

The National Trade Single Window is now a concept firmly entrenched in the minds of policymakers and trade facilitation implementers. At the same

time, it is essential to note that a sufficient number of documents and transactions must be exchanged to generate actual revenue. (Ponten, 2011).

2.5 ASEAN Single Window

On September 15, 2015, all ASEAN Member States signed the Protocol on the Legal Framework for Implementing the ASEAN Single Window. Indonesia, Malaysia, Thailand, Vietnam and Singapore. The remaining ASEAN members are completing their countries' Single Window infrastructure. (Deinla, 2018)

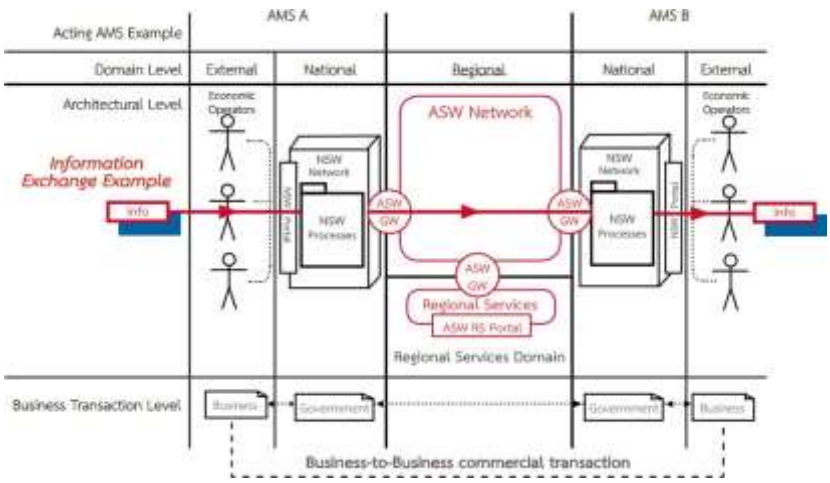
Establishing the National Single Window (N.S.W.) is based on the Agreement on establishing the ASEAN Single Window (A.S.W.). The ultimate goal is to realize a National Single Window. This has implications for strengthening competitiveness in international Trade. N.S.W. Services' scope varies by ASEAN member country, but N.S.W. can be implemented in developed and developing countries.

To facilitate the Trade and movement of goods by linking information between its A.S.W. government departments and all relevant users such as importers, exporters, shipping companies, freight forwarders, transportation, and logistics services was established. They are committed to A.S.W. A development hopes to create interoperability and interconnectivity. A.S.W. progress is as follows; Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, and Thailand launched National Single Windows in 2013, with other countries under development. Cambodia, Laos, Myanmar, and Vietnam are planning to develop this N.S.W (Pengman & Kettapan, 2018).

In 2010, the project's initial phase involved developing a technical architecture design that enabled the direct exchange of data between NSWs (National Single Windows) while preserving the functionality of a Regional Services (RS) component. The RS function managed regional and national Reference Data, handled Public Key Infrastructure (PKI) certificates, and monitored transaction statistics. Member States agreed that the RS server would not store the actual content of trade data and information exchanged. Figure 1 illustrates the overall business and architectural framework of the coexistence between NSWs and ASW:

Figure 3: Business and Architectural Environment of NSW and

ASW coexistence



Source: United Nation ESCAP

The ASW architecture is comprised of three domains, each serving a specific purpose UN ESCAP (2012):

1) The Regional Domain: This domain includes the ASW Network and Regional Services.
   - The ASW Network enables communication between Member States and the Regional Services. All Member States must have access to the ASW Network.
   - The ASW Gateway acts as the single access point to the ASW Network for each Member State. It facilitates the exchange of information through the ASW Network.
   - The Regional Services encompass a set of applications accessible to Member States via the secure ASEAN network. These services do not actively participate in the data exchange.
   - The Reference Data Services (RDS) application is responsible for overseeing the central repository of regionally agreed reference data, ensuring that any changes are communicated to all ASW Gateways. This data includes both national reference data, which Member States are responsible for maintaining and updating (such as Customs office codes or Authorized Economic Operator codes), and common reference data (like

the ASEAN Harmonized Tariff Code, country names and codes, currency codes), which is managed by a regional team

- The Management Information System (MIS) application serves as the primary system for managing trusted PKI certificates. It ensures that any certificate changes are disseminated to all ASW Gateways in the network. The MIS application also facilitates the collection, consolidation, and availability of relevant statistics, providing Member States access to this information. Additionally, it manages the master copy of unavailability data and ensures that updates are shared across the ASW network.
- The Portal provides an online platform that allows authorized personnel to make real-time changes to Reference Data, PKI Trusted Certificates, and Management Information. It offers a user-friendly interface for managing and updating these critical components of the ASW architecture.

2) The National Domain refers to the network infrastructure hosted by each Member State, including their existing national customs systems. Each Member State is responsible for managing and securing its own national domain network.
3) The External Domain refers to the network that economic operators and the trading community utilise. Unlike the Regional Domain, the External Domain does not have direct access to the Regional Domain. This restriction is in place to ensure the integrity and confidentiality of the data exchanged through the Regional Domain.

The ASEAN Single Window is a critical component of the Association of Southeast Asian Nations (ASEAN) plan to realize an ASEAN Economic Community and improve trade facilitation. Once A.S.W. goes into operation, it will improve trade facilitation and facilitate the movement of goods within the region by providing an architecture related to the electronic exchange of cargo-handling documents between ASEAN Member States. Bureau, 2012a). Traders use the Practical National Single Window (N.S.W.) to exchange trade-related documents through a secure federal network where member country authorities can process and transmit trade-facilitating decisions (ASEAN Secretariat, 2012a). A.M.S. is in various stages of development of N.S.W. In some A.M.S., business and industry

leaders use existing N.S.W. to file and process customs declarations and meet regulatory requirements. This exchange is implemented in conjunction with the implementation of A.S.W. (ASEAN Secretariat, 2012a)

The following table is a list of National Single Windows that are implemented in the ASEAN Region:

Table 4. National Single Window in ASEAN

AMS	**NSW Status**	**Key NSW Application**
Brunei Darussalam	https://bdnsw.mofe.gov.bn/Pages/Home.aspx Brunei Darussalam has made significant progress in implementing its National Single Window (NSW) through the e-Customs system. The e-Customs system, which was launched in stages since 2008, serves as the primary platform for Brunei Darussalam's NSW, offering online services for the submission and processing of customs declarations and approval permits.. Additionally, i-Banking has been introduced in collaboration with local banks, allowing traders and importers to make online payments for duties and taxes. The project's vision is to establish a common online platform, known as the electronic single window, for the electronic exchange and submission of trade information and documents by businesses and the public to the relevant controlling agencies. This platform will consolidate multiple trade declarations into a single electronic submission, which will be automatically forwarded to multiple agencies for approval and decision-making purposes The launch of the first stage of her NSW is scheduled early 2013 and it involves: • Newly developed online Certificate of Origin system	e-Declaration e-Manifest e-Permit i-Banking e-CO

	• Newly developed Brunei Darussalam NSW Portal • Integration with ASEAN Single Window The second stage includes: • Involvement of Other Government Agencies (OGA) • Centralize processing of trade documents	
Cambodia	https://nsw.gov.kh/ As part of the strategic plan to implement the Risk Management System, the Ministry of Economy and Finance, specifically the General Department of Customs and Excise (GDCE), has entered into Service Level Arrangements (SLAs) with three government entities: the Ministry of Industry, Mine, and Energy; the Ministry of Health; and the Ministry of Commerce. These SLAs were signed last year, indicating a commitment to cooperation and coordination in implementing the Risk Management System. Cambodia is placing significant emphasis on the implementation of its Customs automation system, known as ASYCUDA World. Extensive efforts are currently underway to ensure the system is fully deployed throughout the country. Once this implementation is completed, the ASYCUDA system will serve as the foundation for the development and implementation of Cambodia's National Single Window (NSW).	ASYCUDA World: -Geographic expansion to 20 operational Customs offices (covered 95% of import & export operation) -Manifest pilot implementation -Customs bonded warehouse -Direct Trader Input is testing -Customs Transit is developing
Indonesia	https://www.insw.go.id/ As of September 2010, the mandatory Export-INSW (Integrated National Single Window) procedure has been implemented in five major ports in Indonesia. This procedure has since been extended to five additional ports in 2012. Furthermore, export and import procedures have already been successfully	

	implemented in a total of 10 major ports nationwide. Additionally, the INSW (Integrated National Single Window) has expanded its range of trade facilitation assistance tools and features. These include trade simulation, a duty rate calculator, the Indonesia National Trade Repository (NTR) for online tariff information, a control goods regulation information system, and more. The INSW facilitates a significant volume of daily message exchanges, with approximately 140 million messages being transmitted each day. It is important to note that there is no fee charged for the usage of the INSW, as all associated costs are fully covered by the government	
Lao PDR	https://www.laonsw.net/ In 2011, Lao PDR conducted a comprehensive analysis of legal gaps and organized workshops involving relevant government agencies and the private sector in Vientiane. Currently, Lao PDR is actively engaged in developing the Lao National Single Window Road Map and making revisions to the existing NSW Committee. Furthermore, the Customs Automation System has undergone upgrades, and testing will be carried out at a major Customs border checkpoint. Once the testing phase is successfully completed, the system will be implemented at other checkpoints throughout the country. The Customs Automation System (ASYCUDA World) will serve as the foundation for the future development of the Lao National Single Window. During its second meeting in 2012, the Lao NSW Committee reached a decision to engage an international consulting company to carry out a feasibility study for the	ASYCUDA World modules

	establishment of the Lao NSW. The study commenced in September 2012 and is anticipated to be finalized by early 2013. Recognizing the importance of expediting the development of the NSW, the Lao Government has urged the Lao NSW Committee to adopt a Public-Private Partnership (PPP) approach in the process. This approach involves collaboration between the public and private sectors to accelerate the implementation of the NSW.	
Malaysia	Malaysia's NSW has been fully operational since September 2009, and continuous efforts are underway to implement it nationwide. The NSW provides six core services, namely e-Declare (Electronic Customs Declaration), e-Manifest (Electronic Manifest), e-Permit (Electronic Permit), e-PermitSTA (Electronic Permit for Strategic Trade Act 2010), e-PCO (Electronic Preferential Certificate of Origin), and e-Payment (Electronic Customs Duty Payment). The future expansion plan of the NSW focuses on completing the implementation of its services, including the inclusion of more Permit Issuance Agencies and coverage of all existing ports throughout the country. Additionally, there will be a concerted effort to promote the utilization of online services such as e-Payment and e-PCO through awareness programs. The NSW portal, which encompasses all six core services, can be accessed through the website http://www.mytradelink.gov.my. As part of the ongoing development, efforts are being made to establish a National Trade Repository (NTR). The NSW is actively engaging with all stakeholders to gather and incorporate relevant information into the NTR, ensuring that it serves as a comprehensive source of trade-related data and resources	ePermit ePCO eManifest ePayment ePermitSTA

Myanmar	As part of the initial implementation of the NSW, the e-Customs action plan included the introduction of electronic export clearance system on 29th August 2011. Subsequently, on 2nd January 2012, the import clearance system was also implemented. Additionally, the Advance Cargo Declaration Document (ACDD) has been implemented in electronic format since 1st November 2011, further enhancing the efficiency and automation of customs processes Myanmar is currently in the process of selecting a system for its National Single Window (NSW) among the options of ASYCUDA, UNIPASS, and two local systems. The launch of the e-Customs system took place in January 2012, involving the participation of four government agencies. For accessing information related to the Myanmar Customs Department, their website can be visited at https://onlineco.myanmartradenet.com	Ongoing Development
Philippine	The Philippine Bureau of Customs (BOC) is anticipating the commencement of the second phase of the Philippine National Single Window (NSW) in the first half of 2013. Currently, 30 out of the 40 government agencies have already been connected to the NSW, with plans to connect the remaining 10 agencies in the near future. The NSW streamlines trade procedures by enabling traders to electronically submit forms for export, import, and transit processes only once. These forms are then processed and cleared by multiple government agencies through an integrated and coordinated approach. In the second phase of the NSW, there will be a government-wide effort to rationalize, standardize, and harmonize trade data, as well as enhance trade portals. Additionally, the NSW will be linked to the	e-Payment, e-Forms including e-Permits, e-Licenses, e-Clearances

	ASEAN Single Window (ASW) for further integration and connectivity. The NSW website could be accessed through: http://www.nsw.gov.ph	
Singapore	Singapore Network Trade Platform https://www.ntp.gov.sg/ Singapore has implemented her National Single Window, TradeNet (TN) since 1989. Since then, TN has gone through several version upgrades. The latest Version 4.1 was implemented on 1 January 2012 to align the system to international standards and to incorporate the revised set of tariff codes under the ASEAN Harmonised Tariff Nomenclature 2012/1	All types for import, export, transshipment
Thailand	The Thai Customs Department has made significant progress in implementing the Thai National Single Window (NSW). They have signed a Memorandum of Understanding (MOU) with 36 relevant agencies to collaborate on the NSW implementation. The NSW has been operational since 2008 and has facilitated live data exchange among 12 government agencies and 9,400 agents, catering to approximately 100,000 traders. Furthermore, the NSW serves a wide range of entities including 660 Customs stations, business communities such as Customs Houses, Ports, Container Yards, Inland Container Depots, Warehouses, Industrial Estates, Export Processing Zones, and Free zones. Currently, 14 government agencies are involved in conducting the pilot test to further enhance the effectiveness of the NSW. This demonstrates Thailand's commitment to streamlining trade processes and improving efficiency through the NSW platform. The NSW website could be accessed through http://www.thainsw.net	e-Import, e-Export, e-Payment, e-Licensing, e-Express, e-Tracking, e-Manifest, RFID (e-Seal) e-Certificate, (e-Service available for sea, land and air modes)
Vietnam	Vietnam has made significant strides in the implementation of its National Single	Electronic Customs

	Window (NSW). The country has established a Master Plan for the NSW and has activated working groups dedicated to its development. The electronic clearance system of Vietnam Customs has been expanded and is now available in thirteen Customs Departments across the country. The NSW Steering Committee has approved the initial version of Vietnam's Data Model, which outlines the data requirements and business processes of six ministries involved in trade activities. To support the NSW implementation, Vietnam has conducted several legal gap analysis activities, which serve as the basis for developing the necessary legal framework for the NSW. Additionally, Vietnam is working towards introducing an integrated IT system for the pilot phase of the NSW in the near future. These efforts demonstrate Vietnam's commitment to streamlining trade processes, enhancing efficiency, and promoting a more integrated approach to managing trade-related data and procedures through the NSW platform. The Customs website can be accessed through http://www.customs.gov.vn	Declaration (E-Declare), Customs Assessment and Customs Release

Sources: https://asw.asean.org/ and UN UNESCAP

The ASEAN Single Window (ASW) connects and integrates the National Single Windows (NSW) of ASEAN Member States (AMS) to exchange electronic trade-related documents. The system enables a single submission of data, a single synchronous processing of information and a single decision-making for Customs release and clearance among AMS and participating countries. ASW is the environment that provides the secure information technology (IT) architecture and legal framework that will allow trade, transport, and commercial data to be exchanged electronically among government agencies and private sectors. ASW aims to expedite the cargo clearance, reduce business costs and time, and enhance trade efficiency and competitiveness.

2.5.1 Benefits from ASW

ASW (ASEAN Single Window) symbolizes the commitment of Member States to establish National Single Windows (NSWs) and connect and integrate them to facilitate efficient cargo clearance. ASW is primarily a continuous effort by Member States to establish and enhance their NSWs. Through working group meetings and regional capacity-building activities, Member States can develop the technical and legal frameworks of ASW. These platforms also enable sharing NSW information, developing NSW progress indicators, and bilateral discussions on data sharing among Member States. ASW focuses on fostering collaboration and cooperation among ASEAN Member States in streamlining trade processes and facilitating the exchange of trade-related information. By establishing NSWs and integrating them through ASW, the aim is to reduce trade barriers, enhance transparency, and expedite cargo clearance within the ASEAN region. The continuous improvement and harmonization of NSWs within the ASW framework contribute to the overall goal of promoting seamless trade facilitation and enhancing regional economic integration (Benjelloun *et al*, 2012):

a) The regional SW architecture of ASW encourages the adoption of international technical and legal standards within ASEAN, while facilitating discussions among Member States to agree on the exchanged data, promoting economic cooperation and integration. ASW offers more advantages than bilateral data exchange mechanisms, including harmonized standards, improved efficiency, cost-effectiveness, transparency, and accountability. It supports ASEAN's regional integration goals by streamlining trade processes and facilitating the seamless movement of goods, services, and regional investments.
b) The technical infrastructure of ASW enables seamless and secure communication and data exchange among Member States' ASW Gateways. It is built on international open industry standards, allowing Member States to exchange various types of data with each other and trading partners using international open communication standards. This compatibility ensures that participating Member States can communicate reliably with any trading partner using international standards, regardless of their current commercial solutions. Each Member State's NSW is internally integrated with their ASW Gateway,

which facilitates data exchange with other ASW Gateways integrated with different Member State NSWs. This integration supports the exchange of information such as certificates of origin and advance cargo details with non-ASEAN trading partners. Furthermore, the ASW Gateway software is designed to interface with NSWs using different methods to ensure that NSWs can access data from the ASW Gateway and distribute it to relevant parties.

c) Member States are actively engaging in discussions to establish a legal framework that supports the implementation of single-window systems. This framework governs the exchange of data within each Member State and facilitates cross-border data exchange. While the resulting Legal Framework will be binding within ASEAN, its implementation will also have implications at the national level. This includes considerations such as adopting information security and data protection principles to enhance Member States' ability to exchange data with non-ASEAN trading partners. The aim is to create a legal environment that enables seamless and secure data exchange, both regionally and globally.

d) ASW facilitates real-time control and validation of data by enabling NSWs to use common data sets agreed upon by Member States. For example, when executing Mutual Recognition Agreements (MRAs) for Authorized Economic Operator (AEO) programs, only the AEO code and name need to be uploaded to the ASW Regional Services. This information is then replicated across other Member States' NSWs, ensuring synchronization and efficiency. Other data elements provided by traders during the accreditation process are retained at the national level. This setup simplifies the process of updating, adding, or suspending actors within the ASW, as only one reference point needs to be managed instead of multiple iterations between independent NSWs. The same concept applies to managing Public Key Infrastructure (PKI), digital certificates, information security tools, trade repositories, and information or business rules changes. Eventually, the ASW's Regional Services feature could be utilized to synchronize information about NGOs providing disaster assistance or intellectual property rights enforcement in ASEAN, streamlining operations and promoting collaboration among Member States.

e) Data validation "plus": There is a growing trend to shift the responsibility of entering customs information from importers to exporters, recognizing that importers may not always have complete knowledge of the goods' origin and handling. This expands the scope of performing risk profiling from the importing country upon the goods' arrival to the point of origin or exporting country. ASW Regional Services enable import-side Member States to validate or access information about authorized cargo clearance actors on the export side in real-time. This supports their risk profiling and targeting efforts. Conducting such validation on a bilateral basis without an ASW would be challenging, as countries typically do not grant trading partners access to their systems to check economic operator data, such as newly added exporters/importers, suspended brokers, or cancelled logistics providers.

f) Standardization and harmonization of forms, data, and processes: The ASW architecture facilitates the seamless, reliable, and secure data exchange between ASEAN Member States, promoting regional economic integration. While the standardization of forms is a separate and complex process, the ASW enables the exchange of standardized and harmonized data elements. For example, the ASW can facilitate the exchange of data related to MRAs for conformity assessment procedures and discussions on equivalence for sanitary and phytosanitary measures. The focus is on standardizing and harmonizing individual data elements to align with international standards rather than standardizing the forms.

g) The platform for any business application: The ASW is a versatile platform that facilitates data exchange across borders for various business applications. As ASEAN moves towards economic integration, there is an increasing need for trade facilitation, enforcement, and compliance data. The ASW can provide the framework for any business application to exchange data securely. For instance, developing the ASEAN Customs Transit System (ACTS) is an example of utilizing the ASW architecture. Other applications can be developed as long as there is a viable business case for exchanging different data types. Since Member States have agreed to adhere to the World Customs Organization (WCO) Data Model and the ASW utilizes international open communication standards,

developing business applications for intra-ASEAN use or interactions between Member States and non-ASEAN trading partners becomes relatively straightforward.

h) The ASW Regional Services Portal provides a comprehensive overview of the data exchanged for cargo clearance among ASEAN Member States. This allows both Member States and the ASEAN Secretariat to access and analyse information on the flow of cargo clearance data, including the countries involved and the timeframes of exchange. Such analysis is valuable for policymakers and researchers who study the progress of economic integration within ASEAN and advocate for paperless clearance procedures. The ASW enables government officials to conduct pattern recognition by examining the patterns and trends in the cross-border message exchange. It also facilitates timely information retrieval and enables cross-referencing of cross-border security credentials. Furthermore, the ASW supports data visualization, providing a clear and visual representation of the data exchanged, enhancing understanding and decision-making processes.

i) In the event of a regional dispute concerning the exchange of electronic cross-border messages, the ASW architecture plays a crucial role in providing electronic time stamping for record-keeping purposes. This feature enables the ability to conduct audits and facilitates back-tracing to establish the chronological sequence of cross-border transactions. By having electronic stamps on the exchanged messages, it becomes easier to determine the order in which the messages were sent and received, helping to resolve disputes and clarify the transaction history. This enhances transparency, accountability, and reliability in cross-border trade within the region.

j) General support for regional policies: Besides the benefits as mentioned earlier, a regional platform like ASW provides valuable support for Member States in implementing various regional policies. It enables the implementation of regional guarantee charges for a transit regime, ensuring the smooth movement of goods across borders. ASW also facilitates monitoring balances of permits and quotas, such as those related to certificates of origin, contributing to effective trade management within the region.

2.6 The Other Control Determinants

Additional control determinants are needed to improve the accuracy and precision of the regression model. Control variables can capture essential factors contributing to the dependent variable and help explain additional variation in the outcome. By accounting for these factors, the model becomes more robust and provides a better understanding of the relationship between the independent variable and the dependent variable. Here is the following determinants in this research:

2.6.1 Frontier Technology Readiness

Technology Readiness (TR) refers to an individual perception of the new technology, either accepting or rejecting it, (Saberi *et al,* 2019). It relates to individual certainty in choosing the new technology (Reyna *et al,* 2018). The concept is usually used to measure user satisfaction while dealing with new technology, especially in information and communication, and to measure user reactions (Fosso, *et al,* 2020). TR also measures customer perception (Morkunas, *et al,* 2019). Many researchers have declared that TR is utilized to measure users' reactions to up-to-date technologies, providing information about their perceptions, either positive or negative. The positive perception shows the variables of optimism and innovation, while the negative perception reflects discomfort and insecurity.

Frontier technology readiness refers to the preparedness of an economy, industry, or organization to adopt and leverage emerging or cutting-edge technologies. These technologies are often at the forefront of innovation and have the potential to impact various sectors and processes significantly. Examples of frontier technologies include artificial intelligence (AI), blockchain, Internet of Things (IoT), advanced robotics, 3D printing, and renewable energy technologies (Friere, 2021). The impact of frontier technology readiness on global trade can be substantial and far-reaching through enhanced productivity and Efficiency. Frontier technologies enable automation, digitization, and optimization of production processes, supply chains, and logistics. By adopting these technologies, businesses can achieve higher productivity, reduce costs, improve quality control, and enhance operational efficiency. This increased efficiency translates into a competitive advantage, making trade more viable and profitable (Chen *et al,* 2019).

According to Nken, *et al* (*2019)* FT can lead to disruptive innovations that can reshape industries and create new trade opportunities. For example, the rise of e-commerce, online platforms, and sharing economy models has transformed the retail and service sectors. Such innovations create new trade channels, alter traditional business models, and drive global trade expansion in emerging sectors. Another Study from Bekkers, *et al* (2020) Frontier technologies have the potential to boost productivity across various sectors. Businesses can optimize production processes, improve quality control, and enhance supply chain management by leveraging technologies like artificial intelligence, robotics, and data analytics. Increased productivity translates into higher output and competitiveness, which can drive more excellent trade activity.

Frontier technology readiness is unlikely to reduce the amount of trade. On the contrary, frontier technology readiness has the potential to enhance trade by increasing efficiency, reducing costs, and expanding market access. While there may be some concerns about the disruptive effects of frontier technologies on specific industries and job markets, overall, their impact on trade is expected to be positive. By improving efficiency, reducing trade barriers, and expanding market access, frontier technology readiness is more likely to foster trade growth rather than reduce the amount of trade.

2.6.2 Trade in Service

International trade in services encompasses a range of activities such as investment income derived from foreign assets, business services, and various government transactions. The relatively small proportion of services in the overall trade in services can be attributed to several factors. Firstly, a strong interconnection exists between services and tangible products, leading to challenges in accurately categorizing and measuring services. Additionally, statistical data collection and classification issues contribute to the complexity of capturing service trade. Lastly, service transactions' personal and interactive nature presents inherent difficulties in facilitating trade. It is common for services and goods to be closely intertwined, further complicating the assessment of their respective trade volumes, (Landefeld, 1987).

The theoretical literature on services trade focuses on the distinction between trade in services and goods and its implications for existing theoretical frameworks. Several authors have highlighted a key characteristic of services, namely the requirement for simultaneous production and consumption. Hill (1977) emphasizes this joint production aspect and argues that it challenges the applicability of the law of comparative advantage to services trade. Deardorff (1985) and Melvin (1989) also discuss how this feature necessitates a reinterpretation of traditional trade theories. Mirza and Nicoletti (2004) note that joint production in services trade often requires inputs from exporting and importing countries.

Additionally, the rapid advancement of technology in the telecommunications sector has a twofold impact on the economics of trade in services. Firstly, as previously mentioned, international telephony is a prominent example of a service delivered across borders, and ongoing technological progress is expected to facilitate its rapid expansion further. Secondly, these advancements contribute to the increased traceability of services by enabling the separation of production and consumption in information-intensive service activities. For instance, activities such as research and development, software development, data entry, inventory management, quality control, accounting, personnel management, secretarial tasks, marketing, advertising, distribution, and legal services can be more easily unbundled due to technological innovations, (Bernard and Braga, 1997).

On the other hand, some authors stress the similarities between goods and services trade. Hindley and Smith (1984) argue that the differences do not alter the normative implications of existing theoretical approaches. Bhagwati, *et al* (2004) suggest that theoretical frameworks developed for goods trade can be applied to understand the gains from trade in producer services. Markusen (1989) and van Marrewijk, *et al* (1997) highlight that many producers' services exhibit differentiation and scale economies, characteristics commonly found in trade in goods models. Markusen (2002) employs a monopolistic-competition model to analyse both producer services and intermediate goods trade, while Markusen and Strand (2009) demonstrate that incorporating foreign direct investment into services

trade requires only minor adjustments to Markusen (2002) knowledge-capital model.

Trade in services differs from trade in goods as it involves the exchange of intangible and non-physical products. The movement of people, knowledge, and information across borders characterizes it. Trade in services has gained increasing importance in the global economy, driven by technological advancements, digitalization, and the growing demand for specialized services. Countries trade services to access foreign expertise, meet domestic demand, generate employment opportunities, and enhance economic growth and competitiveness. Here in this study that examines trade in service impact on trade, argue that Trade in services significantly impacts overall trade dynamics. However, it is important to note that the impact of services trade on trade varies across countries and sectors, depending on their comparative advantages, regulatory frameworks, and market conditions.

2.6.3 Population Growth

Population growth refers to the rise in the number of individuals within a population over a specific timeframe. It is an important factor to consider concerning economic growth and improving living standards worldwide. The connection between population growth and living standards is a significant policy concern, as it impacts the overall economic landscape, Peterson (2017). Various factors influence population growth, including mortality, fertility, and migration patterns. In the long term, an increase in fertility rates can contribute to the expansion of the workforce, potentially leading to higher economic growth rates. However, it is crucial to complement this population growth with appropriate measures such as skills training and quality education, Kharis (2011). A growing population can enhance productivity and contribute positively to economic progress by investing in human capital development.

Several studies have examined the impact of population growth in closed economies. Becker, *et al* (1990) argued that investing in the quality of children reduces their number by increasing the rewards of human capital. Azariadis and Drazen (1990) explored that population growth may decrease as parents have fewer expectations of old-age support from their children. Lucas (2002) analysed

population growth from ancient hunter-gatherers to the present day and found that sustained reductions in population growth are primarily driven by the need to invest in child quality. Galor and Weil (2000) and Galor (2005) developed a unified model that explains the initial rise and subsequent decline in population growth as economies transition from a Malthusian to a post-Malthusian regime and eventually to a regime of modern growth. In this model, population growth initially promotes technology and income due to the positive effect on learning and productivity. However, as technical progress accelerates, formal education becomes more important, decreasing population growth as parents opt to have fewer but better-educated children. Ultimately, population growth tends to decline as societies progress.

A limited number of papers explore population growth in the context of an open economy with endogenous population dynamics. Becker and Barro (1988) proposed that long-term interest rates influence the fertility decisions of altruistic parents worldwide. Haaparanta (2004) suggested that international trade can contribute to population growth by attracting families to rural areas in developing countries where the opportunity costs of having children are lower, particularly in the agricultural sector. Galor and Mountford (2006) argued that non-industrial countries, which possess abundant unskilled labour, specialize in unskilled labour-intensive goods and have less incentive to invest in education. In contrast, industrial countries specialize in skilled labour-intensive goods and prioritize education. Therefore, international trade can hinder technical progress and promote population growth in non-industrial countries, while the opposite effect occurs in industrial countries. These trends can exacerbate income inequality. Galor and Mountford further posited that trade expansion following the Napoleonic wars led to a long-lasting asymmetrical development worldwide.

The impact of population growth on trade is influenced by various factors such as economic development, government policies, infrastructure, education, and technological advancements. Additionally, population growth alone does not guarantee positive trade outcomes, as other factors like institutional frameworks, market access, and trade policies also play crucial roles. However, this research argues that population growth impacts global trade as a labour supply production

and can fuel the demand for various services, such as healthcare, education, tourism, and financial services. This can lead to increased cross-border trade in services, with people traveling for medical treatments, education, tourism, or utilizing financial services offered by institutions from different countries.

2.6.4 Gross Domestic Product

Gross Domestic Product (G.D.P.) serves as a standard metric to gauge the value added by a country in terms of producing goods and services within a specific timeframe. It encompasses the income generated from production and the total expenditure on final goods or services, excluding imports. While G.D.P. is a crucial indicator for capturing economic growth, it falls short in adequately measuring people's material well-being, where alternative indicators may be more suitable (OEDC.org).

The concept of absorptive capacity and the introduction of new technologies argue that the impact of international trade on economic growth becomes more significant as economies progress, accumulating capital and enhancing productivity, which is often observed in advanced economies. The proponents of the new growth theory, Romer (1986, 1990); Lucas (1988); Grossman and Helpman (1991); Rebelo, (1991); Dollar (1992) in Ramzan (2019) also support a long-term association between trade liberalization and economic growth, which the neoclassical model failed to explain. I will elucidate this relationship in a theoretical manner. Accordingly, the new growth theory suggests that trade openness can facilitate economic growth by fostering technological advancements and specialization through "learning by doing" activities.

On the one hand, increasing national income (GDP) enhances a community's purchasing power regarding imports. Conversely, a rise in national income also boosts a community's capacity to engage in production processes, thus enabling the exportation of goods to other countries. However, for developing nations, a surge in imports tends to have a more detrimental effect on domestic economies than an increase in exports (Adi, 2017).

According to Chen (1999), the relationship between trade openness and the growth countries. Those are investigated the relationship between trade openness and output growth in Asian and Latin American countries from 1970 to 1992. His

findings revealed a positive correlation between trade openness and economic growth in the countries examined. However, previous empirical studies have yielded mixed results on this matter**.** According to Tavares and Wacziarg (2001); Wacziarg and Welch (2008), and several other scholars, a positive association exists between trade openness and economic growth. However, Yanikkaya (2003) discovered a combination of positive relationships and instances where no significant relationship was observed**.**

Contrary to the positive link between trade openness and economic growth, certain theoretical studies argue that trade openness can adversely affect growth. In particular, trade openness may decrease long-term growth if an economy focuses on sectors with a dynamic comparative disadvantage. Baliamoune-Lutz and Ndikumana (2007) suggest that increased trade openness has had detrimental effects on African countries. Rodriguez and Rodrik (2000) highlight the vagueness in the literature and the significant gap between theoretical predictions and empirical findings due to variations in estimation methods.

Kim (2011) conducted a study on the impact of trade liberalization on economic growth using data from 61 countries spanning the period 1960 to 2000. The findings indicate that trade liberalization positively affects economic growth in developed countries while it significantly negatively impacts growth in low-income countries. However, these conclusions remain consistent across alternative measures of trade liberalization. Additionally, the connection between trade and GDP growth appears to operate through human capital accumulation.

In this study, our primary focus is to examine the significance of GDP growth in explaining the relationship between trade and economic growth. It aims to contribute to the ongoing debate regarding the growth effects of global trade by challenging the notion that the indirect relationship between trade and growth can be summarized by a few conditional or intervening factors, such as financial development and the initial income level of a particular country. Building upon recent advancements in trade-growth theories, propose a more comprehensive approach to measure the indirect impact of international trade on GDP growth, explicitly considering the ASEAN countries.

2.7 Previous Research

To construct the idea of this study, had took previous research followed by a table below:

Table 5. Previous Research

No	Researcher	Year	Tittle	Findings
1	**Abhinayan Basu Bal, Trisha Rajput, and Parviz Alizada**	**2017**	International Single Window Environment: Prospects and Challenges	This paper considered only a sampling of the work on single windows and associated issues. Several initiatives focus on single Window, paperless Trade and e-commerce issues in various parts of the world. What may be found in all such initiatives are some interwoven commercial and Trade law issues that may need to be addressed
2	**Weber, Rolf. H**	**2011**	Legal framework for the single window concept in ASEAN: A successful movement towards trade facilitation in East Asian countries	By implementing Single Window, the increased re-use of data along the supply chain and the combination with assistance in the fields of logistics, trade insurance, and finance as well as purchasing and warehouse solutions to the trading community as a bundle together with permit preparation module will increase efficiency shortly.

3	**Hasamon Pengman and Komonmanee Kettapan**	**2018**	The Development of a Single Window Integrated with Transportation Management in ASEAN	ASEAN Member States are now working to expand the A.S.W. to support the exchange of export declaration information through the ASEAN Customs Declaration Document (ACDD) data to support Member States' Risk Management System and exchange of electronic Phyto-sanitary certificates. In the future, the A.S.W. may also be used to exchange many other things related to Trade activities.
4	**Sithanonxay Suvannaphakdy and Neo Guo Wei Kevin**	**2022**	Benefits of The ASEAN+6 Single Window for Asean Members	Establishing the ASEAN+6 Single Window, which will enable the cross-border electronic exchange of trade-related documents, has significant potential to reduce trade times and boost Trade in ASEAN and its six F.T.A. partners. Implementation of cross-border paperless Trade, the export gain for ASEAN would be US$199 billion annually. The time required to export would fall by 19 to 98 per cent,

				depending on the reform scenario considered.
5	**Sanchita Basu Das**	**2017**	ASEAN Single Window: Advancing Trade Facilitation for Regional Integration	ASEAN Member Country (A.M.C.) must raise awareness about the initiatives among businesses, including the S.M.E.s, as benefits from ASW/NSW may not be obvious enough to them at the moment the development of a globally networked Single Window. A.M.C. will need to ensure good coordination among its national agencies for the smooth implementation of the systems.
6	**Martínez-Zarzoso, Inmaculada; Chelala, Santiago**	**2020**	The impact of single windows on Trade	implementing S.W.s can increase Trade between countries by around 37 percent when both the importer and the exporter have operational S.W.s and can bring about increases of 23 percent in exports and 14 percent in imports when only one of the two partners has an S.W. system.
7	**Edvard Tijan, Marija Jović, Mladen Jardas, Marko Gulić**	**2019**	The Single Window Concept in International Trade,	Single Window is not only limited to the national level, it can be established on a multinational level. One example

			Transport and Seaports	is a development of multilateral interoperability projects in certain countries such as ASEAN group or the Pacific Alliance regional free trade arrangement (consisting of Chile, Columbia, Peru, and Mexico).
8	**M. H. Abeywickrama and W. A. D. N. Wickramaarachchi**	**2015**	Study on the Challenges of Implementing Single Window Concept to Facilitate Trade in Sri Lanka: A Freight Forwarder Perspective	As revealed by this study, Sri Lanka has not fully implemented the single window system. The current system is lagging in aspects such as connectivity and integration. Actions should be taken to connect all the other regulatory agencies to the customs automated system.
9	**Andrea Schwaiger Calvo and Cristian Campos**	**2016**	Mexico: Single Window for Foreign Trade	The Mexican Single Window for Trade (VUCEM for its acronym in Spanish). has been very effective in the reducing time, cost and documents needed for trade transactions. With respect to its implementation, the analysis of obstacles and drivers provides evidence that a combination of elements made VUCEM successful.

10	**Tatyana Sakulyeva and Zalikhina Kseniia**	**2019**	The Single Window Mechanism In The Field Of External Sector Of The Economy	The development mechanism of the “single window” on the territory of the Russian Federation is analysed in this article. Considered the signs and stages of building a "single window". Analysed the state of development of "single window». Problems were defined and suggested ways to solve them

Primary Data Processed

CHAPTER III

METHODOLOGY

3.1 Research Design

This research uses a quantitative approach. According to Sugiono (2016), a quantitative method is a scientific approach that views a reality that can be classified as concrete, observable, and measurable; variable relationships are causal, where the research data is in the form of numbers. The data used is secondary data obtained from several official websites such as Unctad.org; untfsurvey.org, aseanstats.org, and several related official websites. Then the data obtained is tabulated with Microsoft excel tools and panel data regression methods. Panel data refers to collecting observational data on many subjects over several periods, (Baltagi, 2005) This study explains the relationship between A.S.W. determinant variables expressed in the Trade facilitation category, namely paperless Trade. This refers to research conducted by Martinez, *et al* (2020) that measured trade facilitation as data that can represent S.W. statistics, although in the research, it is recognized that the proposed methodology cannot fully measure how S.W. can affect trade performance. Tsen (2011) stated that since S.W. is a relatively new tool, its available impact studies are also fairly recent by presenting a descriptive assessment for S.W.s. However, the references are vague and lack a quantitative analysis. In this study, S.W. is more specifically stated in the category of paperless Trade in T.F. because Single Window is explicitly measured in that category based on the explanation in the literature.

3.2 Data Collection Method

Data collection techniques are ways of collecting data needed to answer the formulation of the research problem. These data collection techniques include: Library Research is a data collection method with how to do excavations from various sources from books theory, scientific papers (from google scholar, JSTOR, Emerald, Elsevier, so on and so forth), and internet information;

Research design with data collection by observing the secondary data by browsing to the related official website. As for some of the data sources that collected through related websites.

Total trade, Population growth and GDP information was obtained from Aseanstat.org in ASEAN Statistical Yearbook 2022. The ASEAN Statistical Yearbook 2022 offers a comprehensive and detailed overview of various statistical areas within the ASEAN region. It covers many topics, including population, education, health, employment, macroeconomic indicators, trade in goods and services, foreign direct investment, transportation, tourism, agriculture, manufacturing, and other social indicators. The yearbook serves as a valuable resource for obtaining statistical data and insights on the ASEAN countries.

Single window variable obtained from the index of Paperless Trade category Trade Facilitation that measured single window electronic among others measurement. Therefore, around the 5 categories in trade facilitation mentioned in literature above, Paperless trade category is the proxy of Single windows variable. From untfsurvey.org this website is a website related to the United Nations Trade Facilitation and Single Window Survey, it is likely to provide information and resources related to trade facilitation, single window systems, and related topics. In the context of Paperless Trade on TFA (Trade Facilitation Agreement), "index" refers to the "Trade Facilitation Index'. This index is an indicator to measure the extent to which a country has implemented and improved efforts to facilitate trade. The higher the Trade Facilitation Index, the better and more efficient a country's trading system will be. This index reflects readiness, ease and speed in carrying out cross-border transactions, import and export processes, and other administrative procedures related to international trade activities.

The information about Frontier Technology Readiness index and Trade in Service Ratio was obtained from unctad.org. The United Nations Conference on Trade and Development (UNCTAD) is an intergovernmental organization operating within the United Nations Secretariat. Its main purpose is to advocate for the interests of developing countries in global trade. UNCTAD's primary objective is to develop policies encompassing various aspects of development, including trade, aid, transport, finance, and technology. It was established in response to concerns raised by developing countries regarding the perceived inadequacy of existing international institutions such as the General Agreement on Tariffs and Trade (GATT, now replaced by the World Trade Organization), the International

Monetary Fund (IMF), and the World Bank in effectively addressing the specific challenges faced by developing nations. UNCTAD serves as a platform where developing countries can engage in discussions and address issues about their economic development. This advanced technology readiness index helps assess and compare the extent to which a country has prepared itself to adopt advanced technology in various aspects of life and the economy. This index covers several dimensions, including technology infrastructure, innovation and research, availability of skilled human resources, policies and regulations, and technology adoption in the industrial sector. The higher the Frontier Technology Readiness Index of a country, the more prepared and capable the country is to face and exploit the potential of advanced technology. This index provides an overview of the extent to which a country can adapt to rapid technological change and take advantage of it to increase economic competitiveness, enhance innovation, and improve people's quality of life.

Secondary data collected through the website above is data from ASEAN countries (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam) starting from the 2015-2021 period by adjusting the data conditions available in each of these websites

3.3 Software Utilization

In terms of analysing the data, it needs some tools to cultivate the data so be serve as an information for this research interpretation. The tools follow:

1) *Microsoft Excel 2019*. It provides a structured la t for entering and organizing research data, allowing to create tables, input data, and customize column headers and formats. Therefore, it can be utilized to organize the Data.

2) *Stata 17 Version*. It is a statistical software package used in academic and research settings for data analysis, management, and statistical modeling. Similar to Excel, Stata offers a variety of functions and features that are specifically designed for advanced statistical analysis. Stata offers a wide range of statistical procedures and tests, including descriptive statistics, hypothesis testing, regression analysis (linear, logistic, and multilevel), time series analysis, survival analysis, panel data analysis, and many more. Therefore, it can be utilized to analyse the Data.

3) *Microsoft Word 2019*. It is a word processing software that is commonly used for creating and formatting documents. MS Word allows to create structured documents to organize and present research findings. It serves as a valuable tool for creating, formatting, and organizing research documents, including research reports, manuscripts, and other written materials.

3.4 Data Analysis

In analyzing the data required several steps in describing the interpretation quantitatively. The analysis steps taken in this study are:

3.4.1 Panel Data Regression Analysis

Panel data Regression could be a combination of time-series data and cross-section data. Panel data regression is a regression technique that combines cross-sectional data and time-series data therefore after all it will have additional observations than cross-section data and time-series data solely, Gujarati (2004).

In general, the use of panel data can provide a lot advantages statistically and in economic theory, among others, Rahma (2014): (1) Panel data is able to account for individual heterogeneity explicitly by allowing for individual-specific variables;(2) The ability to control this individual heterogeneity, in turn make Panel data can be used to test and build behaviour models more complex. For example: the phenomenon of economies of scale or technological change are better researched using panel data than pure data cross-section or time-series. If the specific effect is significantly correlated with other explanatory variables, then the use of panel data will reduce the omitted-variables problem significantly substantial; (3) Because it is based on repeated cross-sectional observations, then panel data is very well used for the study of dynamic adjustments such as labour mobility, rate of entry and exit of work, and others; (4)With the increasing number of observations, it will have implications for the data the more informative, the more varied, the more collinearity between variables decreases, and the degree of freedom increases so that more efficient estimation results can be obtained.

The final model of panel data regression is expressed within the sort of the following equation, Baltagi (2005):

$$\boldsymbol{Y_{it}} = \mathrm{Q_0} + \mathrm{Q_k}\boldsymbol{X_{it}} \ \ldots\ldots + \mathrm{Q_k}\boldsymbol{X_{it}} + \mathrm{s_{it}} \qquad \textbf{(3.1)}$$

Description:

Y_{it} = Unit cross section (i) time period (t).

β_0 = Intercepts.

β_k = Slope coefficient for all units.

X_{it} = Matrix of predictor variables for cross section unit (i); for the time period (t).

e = Error term i = Unit cross section (1,2…..N).

t = Unit time series (1,2…..T).

Where Y represents the dependent variable as total Trade of ASEAN, β0 represents the coefficient, $_{it}$ represents an independent variable, i represents individual i, namely, in this study β1 states Single Window (S.W.); β2 frontier Technology Readiness Index (FTRI); β3 represents the Economic Growth Rates (FDI); β4 represent Trade in Service (TIS); β5 represents Population Rates (PR); while $_{it}$ represents the t-th period and $_{it}$ represents i-th cross-section error and t-time. The estimation or estimation of the panel data regression model can be done using several approaches, two of which are the common effect model and the random effect model. of Panel Data Regression. Therefore, the equation for this model become:

$$\boldsymbol{Trade}_{it} = \mathrm{Q}_0 + \mathrm{Q}_1\boldsymbol{SW}_{it} + \mathrm{Q}_2\boldsymbol{FTRI}_{it} + \mathrm{Q}_3\boldsymbol{EGR}_{it} + \mathrm{Q}_4\boldsymbol{TIS}_{it} + \mathrm{Q}_5\boldsymbol{PR}_{it} + \mathrm{s}_{it} \quad (\mathbf{3.2})$$

Description:

Trade = Total Export-Import in ASEAN Country (in million USD)

SW = Single Window Index (%)

FTRI = Frontier Technology Readiness Index (%)

EGR = Economic Growth Rates (%)

TIS = Trade in Service Ratio to GDP (%)

PR = Population Rates (%)

3.4.2 Panel Data Models

3.4.2.1 Common Effect Model

The Common Effect Model combines data from both cross-sectional and time-series sources, disregarding the specific time and location of the research. It assumes that the intercept value for each variable is constant across all units of analysis, as well as the slope coefficient for both cross-sectional units and time-series observations (Apriliawan et al., 2013).

The equation of the Common Effect Model can be expressed as follows:

$$\boldsymbol{Y_{it}} = \mathrm{Q_0} + \mathrm{Q}_{\boldsymbol{k}} * \boldsymbol{X_{it}} \ \ldots\ldots a_i \ + \mathrm{s}_{\boldsymbol{it}} \qquad \textbf{(3.3)}$$

Where:

- $\boldsymbol{Y_{it}}$ represents the dependent variable for unit i at time t.
- $\boldsymbol{X_{it}}$ represents the independent variable for unit i at time t.
- $\mathrm{Q_0}$ is the intercept term, which is assumed to be the same across all units.
- **β1** is the slope coefficient, which represents the relationship between the independent and dependent variables.
- $\mathrm{s}_{\boldsymbol{it}}$ represents the individual-specific effects, which are assumed to be constant for each unit.
- **it** represents the error term, capturing unobserved factors or random variations.

In the Common Effect Model, the individual-specific effects **(αi)** are typically estimated using fixed effects or random effects estimation methods to account for the heterogeneity across different units. This model allows for the examination of the common effect of the independent variable (Xit) on the dependent variable (Yit), while controlling for unit-specific characteristics.

3.4.2.2 Fixed Effect Model

The Fixed Effect Model is a statistical approach used in panel data analysis to account for individual-specific heterogeneity. It allows for controlling individual-specific characteristics that are constant over time but may vary across different units or entities. The Fixed Effect Model assumes that the individual-specific effects are correlated with the independent variables but remain constant over time. Fixed effect model is a regression method that estimates panel data by adding variables dummy (Gujarati, 2004).

The equation of the Fixed Effect Model can be expressed as follows:

$$\boldsymbol{Y_{it}} = \mathrm{Q_0} + \mathrm{Q}_{\boldsymbol{k}} * \boldsymbol{X_{it}} \ + a_i \ + \mathrm{s}_{\boldsymbol{it}} \qquad \textbf{(3.4)}$$

Where:

- $\boldsymbol{Y_{it}}$represents the dependent variable for unit i at time t.
- $\boldsymbol{X_{it}}$ represents the independent variable for unit i at time t.
- Q_0 the intercept term, which represents the average value of the dependent variable across all units and time periods.
- $Q_k$is the slope coefficient, indicating the relationship between the independent and dependent variables.
- α_i represents the individual-specific fixed effects, capturing the heterogeneity across different units. These effects are assumed to be constant over time and uncorrelated with the independent variables.
- s_{it} represents the error term, accounting for unobserved factors or random variations.

In the Fixed Effect Model, the individual-specific fixed effects (αi) are included as dummy variables or fixed effects indicators in the model. These fixed effects capture the differences in intercepts across different units and help control for the unobserved heterogeneity. By including these fixed effects, the model focuses on the within-unit variation over time and estimates the relationship between the independent and dependent variables within each unit while controlling for unit-specific characteristics.

The Fixed Effect Model is useful for panel data analysis when there is concern about unobserved heterogeneity and the desire to control for individual-specific effects. It allows for the examination of the relationship between variables while accounting for unit-specific characteristics that may influence the outcome of interest.

3.4.2.3 Random Effect Model

The Random Effects Model is a statistical approach used in panel data analysis to account for unobserved heterogeneity across individual units. Unlike the Fixed Effect Model, the Random Effects Model assumes that the individual-specific effects are uncorrelated with the independent variables and are treated as random variables**.**

The equation of the Random Effects Model can be expressed as follows:

$$\boldsymbol{Y_{it}} = Q_0 + Q_k * \boldsymbol{X_{it}} + \alpha_i + s_{it} \qquad \textbf{(3.5)}$$

Where:

- Y_{it} represents the dependent variable for unit i at time t.
- X_{it} represents the independent variable for unit i at time t.
- Q_0 is the intercept term, which represents the average value of the dependent variable across all units and time periods.
- Q_k is the slope coefficient, indicating the relationship between the independent and dependent variables.
- a_i represents the individual-specific random effects, capturing the unobserved heterogeneity across different units. These effects are assumed to be uncorrelated with the independent variables.
- s_{it} represents the error term, accounting for unobserved factors or random variations.

In the Random Effects Model, the individual-specific random effects (αi) are assumed to follow a specific distribution, typically a normal distribution. These random effects are estimated alongside the other parameters of the model. The inclusion of random effects allows for capturing the unobserved unit-specific characteristics that may influence the dependent variable.

The Random Effects Model is suitable when the unobserved heterogeneity across units is assumed to be random and uncorrelated with the independent variables. It provides estimates of the average effects of the independent variables on the dependent variable, taking into account the variability across different units. However, it does not allow for the estimation of unit-specific effects or the examination of within-unit variation over time.

3.4.3 Selection of Panel Data Regression Model

To determine which model is suitable for use in regression interpretation, it is necessary to carry out several tests to compare existing models, namely the Chow test, Hausman test and Lagrange test. Here's the explanation:

3.4.3.1 Chow Test

The Chow Test, also known as the Likelihood Ratio Test, is a statistical test used to determine whether there are significant differences between two regression

models estimated on different subsets of data. It is commonly used to test for structural breaks or coefficient differences across different time periods or groups.

The basic idea behind the Chow Test is to compare the sum of squared residuals from two models: one model estimated on the combined data of the two subsets and another model estimated separately on each subset. The test assesses whether the separate models fit significantly better than the combined model.

The Chow test is used to determine whether F.E.M. model is better than P.L.S. model with see the significance of the F.E.M. model that can be done with the test statistics F. The steps that need to be done in the chow test are as follows:

1) Hypothesis formulation

   H0: Polled Least Square selected model

   H1: The selected model Fixed Effect

2) Determine the level of significance (α)

3) Determine the test criteria:

   H0 is accepted if p-value > alpha

   H0 is rejected if p-value < alpha

4) Conclusion

If the p-value > 0.05, then H0 is accepted so that the model selected polled least square. While the p-value < 0.05 then H0 is rejected so that the selected model is Fixed Effect.

The Chow Test can be applied to various regression models, including linear and logistic regression. It helps to assess whether there are significant differences in the relationship between independent variables and the dependent variable across different subsets of data, providing insights into structural changes or heterogeneity within the data.

3.4.3.2 Hausman Test

The Hausman Test is a statistical test used to assess the appropriateness of choosing between fixed and random effects models in panel data analysis. It helps determine whether the individual-specific effects in a panel data model are correlated with the

independent variables, which is a crucial consideration in selecting the appropriate model specification.

The basic idea behind the Hausman Test is to compare the estimated coefficients of the fixed effects model (which assumes the individual-specific effects are correlated with the independent variables) with the estimated coefficients of the random effects model (which assumes the individual-specific effects are uncorrelated with the independent variables). The test evaluates whether the random effects assumptions are valid or if the fixed effects model should be preferred.

The purpose of the Hausman Test itself is to find out whether Fixed Effect model is better than random effect model, then Hausman test was used. Hausman test statistics follow the distribution chi-square statistic with as many degrees of freedom as the number of variables free (p). Steps that need to be done in the test Hausman are as follows:

1) Hypothesis formulation

   H0: the selected model Random Effect Method/R.E.M.

   H1: the selected model Fixed Effect Method/F.E.M.

2) Determine the level of significance (α)
3) Determine the test criteria

   H0 is accepted if p-value > α

   H1 is accepted if p-value < α

4) Conclusion

If the p-value > 0.05, then H0 is accepted so that the model selected Random Effect Method, while p-value < 0.05, then H0 is rejected so that the model selected is Fixed Effect Method. After the two tests are carried out, the model that is most suitable is selected appropriate to estimate the panel data regression parameters, then it is necessary to do a goodness of fit test to see the estimated.

3.4.3.3 Lagrange Test

The Lagrange Multiplier Test, also known as the Lagrange Multiplier (LM) Test, is a statistical test used to assess the presence of omitted variables or functional form misspecification in a regression model. It is commonly employed in econometrics

to test the validity of the model assumptions and to ensure the reliability of the estimated coefficients.

The Lagrange Test is based on the concept of adding additional variables or transformations to the existing regression model and examining whether the model's fit significantly improves. It is a general test that can be applied to various types of regression models, including linear regression, nonlinear regression, and simultaneous equations models.

Lagrange Multiplier Test is a test to determine whether the model used common effect or random effect. This test was carried out with the following:

1) Hypothesis formulation
   H0: the selected model Common Effect Model/C.E.M.
   H1: the selected model Random Effect Method/R.E.M.
2) Determine the level of significance (α)
3) Determine the test criteria:
   H0 is accepted if p-value > α
   H1 is rejected if p-value < α
4) Conclusion

This L.M. test is based on the Breusch-Pagan probability, if the value of Breusch-Pagan probability is less than the alpha value, then Ho is rejected which means that the correct estimate for panel data regression is a random effect model. In case H0 is accepted, then the suitable model for panel data regression is Common effect Model.

The Lagrange Test helps researchers detect potential problems in their regression models by examining whether the inclusion of additional variables or transformations significantly improves the model's fit. It provides insights into the adequacy of the specified model and guides the necessary adjustments to ensure reliable and accurate regression analysis.

CHAPTER IV

RESULT AND DISCUSSION

4.1 Data Description

Data obtained from related official websites, presented in an annual period (2015-2021) with a total of 10 ASEAN countries (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam).

The data set obtained has different units of account. Where total trade (export-import) is in units of millions of USD, Population Rates Economic Growth Rates are in Percentage (%), while other variables (Single Window and Frontier Technology Readiness Index, and Trade in Service) are in percent (%) as well. It seems that the data has a Skewed. Therefore. The data with the non-percentage in the unit need to transform in Logarithm (ln). When the data is heavily skewed or has a long tail, applying the natural logarithm transformation can help reduce the skewness and make the data more symmetric, Wooldridge (2019). Using the natural logarithm transformation allows the coefficients in the regression model to be interpreted as elasticities, representing the percentage change in the dependent variable associated with a one percent change in the independent variable, Gujarati and Porter (2009).

The summary description of the dataset obtained from this study before and after generating Logarithm is as follows (Appendix 1):

Table 6. Summary Dataset before Log

Variable	Mean	Std.Dev	Min	Max	Obs
Trade	59965.6	57943.08	2644.9	214011.6	70
Single Window	68.0895	23.39293	11.11	100	40
Frontier Technology Readiness Index	.470552	.2292347	.1004	.9678	50
Economic Growth Rates	3.644286	3.808101	-0.96	9	70
Trade in Service	29.33746	23.32921	1.415464	77.81284	69
Population Rates	64061.32	73328.11	407.9083	272248.4	70

Primary Data Processed

From the data presented above it can be seen that the Trade, variables have long tail values with variables in percent units. This thing recognized as a Skewed Data. Skewed data can affect the estimation and interpretation of regression coefficients. If the dependent variable or predictor variables are highly skewed, the coefficients may be biased or have inefficient estimates. In such cases, transforming the skewed variables, such as taking their logarithm or applying other appropriate transformations, can help mitigate the skewness and improve the validity of the regression results. Consequently, variables Trade has to generate into logarithm as presented below (Appendix 2):

Table7. Summary Dataset after Log

Variable	Mean	Std.Dev	Min	Max	Obs
Log (Trade)	59965.6	57943.08	2644.9	214011.6	70
Single Window	68.0895	23.39293	11.11	100	40
Frontier Technology Readiness Index	.470552	.2292347	.1004	.9678	50
Economic Growth Rates	3.644286	3.808101	-0.96	9	70
Trade in Service	29.33746	23.32921	1.415464	77.81284	69
Population Rates	64061.32	73328.11	407.9083	272248.4	70

Primary Data Processed

From the data presented above, it can be seen that the average value generated after generating Trade has changed in value which can be interpreted as a unit of percent. Thus, the data above has not experienced a very large gap and has the same units. Hence, the equation formed becomes:

$$\boldsymbol{Ltrade} = Q_0 + Q_1\boldsymbol{SW}_{it} + Q_2\boldsymbol{FTRI}_{it} + Q_3\boldsymbol{EGR}_{it} + Q_4\boldsymbol{TIS}_{it} + Q_5\boldsymbol{PR}_{it} + s_{it}$$

4.2 Analysis Steps

The stages of analysis that will be carried out in analysing this case study are as follows:

a) Analysing characteristics for dependent variables and independent variables. In this case, the Dependent variable is *Ltrade* and the control variables is *SW*, *FTRI*, *EGR*, *TIS*, *PR*

b) Determine the standard error (α) of estimation which in this study is 0.05.

c) Run the Stata 17 Software to perform panel data regression. Then Load the data: Start by loading r panel dataset into Stata.

d) Declare the panel structure of the dataset using the '**xtset**' command. This command specifies the variables that identify the panel units (e.g., country or firm) and the time variable.

e) Use the '**summarize'** command to get an overview of the variables in the dataset and check for missing values or outliers.

f) Run the Ordinary Least Square model to recognize the regression for the classical assumption tests.

g) Verify the model against the selected model by testing the classical assumptions, as follows: (1) Normality test; (2) Multicollinearity Test; (3) Heteroscedasticity Test; (4) Autocorrelation Test.

h) Choose the appropriate regression model: Decide on the appropriate panel regression model for the analysis based on the nature of the dependent and independent variables. Determine parameter estimates in multiple regression for panel data using **Common Effect Model**, **Fixed Effect Model**, and **Random Effect Model**

i) Determining the selection of the best model by:

- Perform Chow Test to determine the best model between Common Effect Model and Fixed Effect Model, if the best model is the Common Effect Model, then the next step perform the Lagrange Multiplier test, whereas if the best model is the Fixed Effect Model
- Perform Hausman Test to determine the best model between Fixed Effect Model and Random Effect Model.
- Perform Lagrange test to determine the best model between Common Effect Model and Random Effect Model

j) Testing the suitable of the multiple regression model for panel data is by looking at the coefficient of determination.

k) Interpretation of the result.

4.3 Classical Assumption Test

The classical assumption tests in regression are conducted to assess the validity of the underlying assumptions of the linear regression model. These assumptions are important because violations of these assumptions can lead to biased or inefficient parameter estimates, incorrect standard errors, and misleading inference. The classical assumption tests help ensure that the regression results are reliable and meaningful. The key classical assumptions in linear regression include normality, multicollinearity, heteroscedasticity, and autocorrelation. The following explanations are here:

4.3.1 Normality Test

A normality test is used to assess whether the residuals or errors in a regression model follow a normal distribution. It is important to check the normality assumption because many statistical tests and estimators rely on this assumption**.** Woolridge (2019)**.**

As the result of the Normality test run by Kernel density for normality test followed by table below (Appendix 3):

Table 8. Normality Test

Variable	Bandwidth	Value	Result
LTRADE	**0.6176**	> α	Normally Distributed
SW	**0.0674**	> α	Normally Distributed
FTRI	**0.0930**	> α	Normally Distributed
TIS	**9.0027**	> α	Normally Distributed
EGR	**1.0954**	> α	Normally Distributed
PR	**0.2567**	> α	Normally Distributed

Primary Data Processed

The table above provide a normal distribution curve with central value (the mean) at the point in question and with an average spread (standard deviation, or *bandwidth*) that measured above 0.05. Means, the data has Distributed Normally (Statref.com)

4.3.2 Multicollinearity

In regression analysis, multicollinearity refers to the presence of high correlation among predictor variables. It can pose challenges in interpreting the individual effects of predictors and can affect the stability and reliability of the regression model. One commonly used measure to assess multicollinearity is the Variance Inflation Factor (VIF), Kennedy (2008).

As the result of the Multicollinearity test run by VIF followed by table below (Appendix 4):

Table 9. Multicollinearity test

Variables	VIF
SW	1.57
FTRI	1.47
TIS	1.74
EGR	1.52
PR	1.11
Mean	**3.29**

Primary Data Processed

The VIF measures the extent to which the variance of the estimated regression coefficient is increased due to multicollinearity. A VIF value of 1 indicates no multicollinearity, while values greater than 1 suggest increasing levels of multicollinearity. Specifically, a rule of thumb is that VIF values above 5 or 10 indicate the presence of multicollinearity (Kennedy, 2008). Hence, from the results above the VIF value < 5 or 10, the data assumed has no multicollinearity

4.3.3 Heteroscedasticity

Heteroscedasticity refers to the situation where the variability of errors or residuals in a regression model is not constant across all levels of the independent variables. In other words, the spread or dispersion of the residuals is different for different values of the predictors. Heteroscedasticity violates one of the assumptions of classical linear regression, which assumes constant variance of errors, also known as homoscedasticity. It is important to detect and address heteroscedasticity to ensure the validity and reliability of the regression analysis results (Woolridge, 2019).

Based on the result of heteroscedasticity (Appendix 5) shows that Chi2(1) = 2.74 and the Prob > Chi2 = 0,0978. It assumed that this data is free from heteroscedasticity, due to the value of Prob>Chi2 is bigger than standard error as well it says this data has homoscedasticity.

4.3.4 Autocorrelation

Autocorrelation, also known as serial correlation, refers to the correlation between the error terms or residuals of a regression model at different time points or

observations. It occurs when the errors in a time series or panel data exhibit a systematic pattern of correlation, Kennedy (2008).

Autocorrelation violates one of the assumptions of classical linear regression, which assumes that the error terms are not correlated with each other. In the presence of autocorrelation, the estimated coefficients may still be unbiased, but the standard errors and hypothesis tests can be invalid. This can lead to incorrect inferences about the significance of the coefficients and misleading conclusions about the relationships between variables, Kennedy (2008). Addressing autocorrelation is crucial to ensure the validity and reliability of the regression analysis results, particularly in time series or panel data settings where observations are likely to be correlated over time.

Autocorrelation assumption problems can be detected using various types of analysis by Durbin-Watson analysis. The Breusch-Godfrey LM test has an advantage over the classical Durbin-Watson D test. The Durbin-Watson test relies upon the assumption that the distribution of residuals is normal whereas the Breusch-Godfrey LM test is less sensitive to this assumption. Another advantage of this test is that it allows researchers to test for serial correlation through a number of lags besides one lag which is a correlation between the residuals between time t and t-k (where k is the number of lags). This is unlike the Durbin-Watson test which allows testing for only correlation between t and t-1. Therefore, if k is 1, then the results of the Breusch-Godfrey test and Durbin-Watson test will be the same. The hypothesis in this case is:

- **Null hypothesis:** There is no serial correlation.
- **Alternative Hypothesis:** There is a serial correlation.

Since from the Appendix 6 table, chi2 is 1.0 which is bigger than 0.05 or 5%, the null hypothesis can be Accepted.

4.4 Empirical Result of Regression Model

There are 3 types of models performed in Panel Data testing Regression, namely the Common Effect Model (CEM), Fixed Effect Model (FEM) and Random Effect Model (REM). The following results is an explanation of each of these models:

4.4.1 Common Effect Model (CEM)

The CEM model is the simplest approach to estimating panels, where all data are combined. Regardless of individual and times based on appendix 7 CEM model is obtained as follow:

Table 10. Common Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob
Constanta	8.218688	0.0089235	11.47	0.000
SW	0.021527	1.247308	2.41	0.024**
FTRI	0.9084468	0.0486721	0.73	0.473
EGR	-0.951013	0.0111944	-1.95	0.062*
TIS	0.0287006	0.1525875	2.56	0.017**
PR	-0.115005	0.7165508	-0.75	0.458

Primary Data Processed

The equation that arises from the CEM regression results above is:

$$Ltrade_{it} = 8.218688\ C + 0.021527\ SW + 0.9084468\ FTRI - 0.951013\ EGR + 0.0287006TIS - 0.115005\ PR$$

The CEM model has a coefficient of determination of 0.6091. Where the model is able to explain variations in Ltrade of 60% with all the variables are significant due to the Probability value is 0.002. This technique is the simplest technique for estimating model parameter data panel, namely by combining cross section and time series data into one entity regardless of differences in time and entities (individuals). Where is the approach which is often used is the Ordinary Least Square (OLS) method. Common Model Effects ignoring differences in individual dimensions and time or in other words behaviour data between individuals is the same in various time periods (Baltagi 2005)

4.4.2 Fixed Effect Model (FEM)

FEM is a panel data regression estimation method with the assumption that the unobserved heterogeneity is correlated with error term but with a constant slope coefficient. The following is a model of FEM based on Appendix 8:

Table 11. Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob
Constanta	10.31102	0.2523111	40.87	0.000
SW	0.0070099	0.0022643	3.10	0.007***
FTRI	0.3106417	0.1742131	1.78	0.095*
EGR	-0.0013989	0.0077814	-0.18	0.860
TIS	-0.0276428	0.0087714	-3.15	0.007***
PR	0.0299981	0.0211518	1.42	0.177

Primary Data Processed

The equation that arises from the FEM regression results above is:

$$Ltrade_{it} = 10.31102\ C + 0.0070099\ SW + 0.3106417\ FTRI - 0.0013989\ EGR - 0.0276428\ TIS + 0.0299981PR.$$

The FEM model has a coefficient of determination (R-Square Overall) of 0.6737. Where the model is able to explain variations in Ltrade of 67% with only SW, FTRI and TIS are significant the variables are significant because the standard error is higher than the value of Probability, and the rest of the variable such as EGR and PR are not significant. The Fixed Effect model approach assumes that the intercept of each individual is different while the slope between individuals is the same. This technique uses variables dummy to capture differences in intercept between individuals (Baltagi 2005).

4.4.3 Random Effect Model

The REM model is a model where the intercept of observations is assumed to be a random variable, based on Appendix 9 at the REM model:

Table 12. Random Effect Model

Variable	Coefficient	Std. Error	z-Statistic	Prob
Constanta	9.945742	0.4968842	20.02	0.000
SW	0.007982	0.0027298	2.92	0.003***
FTRI	0.284741	0.2120796	1.34	0.179
EGR	-0.0013464	0.0094292	-0.14	0.886
TIS	-0.142629	0.0094669	-1.51	0.132
PR	0.276626	0.4968842	1.07	0.283

Primary Data Processed

The equation that arises from the REM regression results above is:

$Ltrade_{it}$ = 9.945742 C + 0.007982 SW + 0.284741 FTRI -
0.0013464 EGR - 0.142629 TIS + 0.1306347 PR

The REM model has a coefficient of determination (R-Square Overall) of 0.6188. Where the model is able to explain variations in Ltrade by 61% With only SW has significant of the variables, because the Prob < α and the rest of the variables are not. The approach used in Random Effects assumes each country has a different intercept, which is the intercept is a random variable or stochastic. This model is highly valuable if the entities taken as a sample are chosen randomly and is representative of the population. This technique also takes that into account error may be correlated throughout the cross section and time series (Baltagi,2015).

4.5 Best Selection of Regression Model

After carrying out the regression model, the next step is to determine which model is chosen to be interpreted in this study based on the probability values from the results of the Chow Test, Hausman Test, or Lagrange Test. Here is the following explanation:

4.5.1 Chow Test

To find out which model is better in testing panel data, it can be done with the addition of a dummy variable so that it can be seen that the intercept is different can be tested with the F statistic test. This test is used to determine whether the data regression technique panel with Fixed Effect method is better than panel data model regression without variables dummy or Common Effect method.

The null hypothesis for this test is that the intercept is the same, or in other words the model is correct for panel data regression is Common Effect, and the alternative hypothesis is the intercept not the same or the right model for panel data regression is a Fixed Effect. The calculated F statistic value will follow the F statistical distribution with degrees of freedom (degrees of freedom) as many as m for the numerator and as many as "n – k" for the de-numerator. "M" is the number of restrictions or restrictions in the model without a dummy variable. Amount The restriction is the number of individuals minus one. n is the number of observations

and k is the number of parameters in the Fixed Effect model. The number of observations (n) is the number of individuals multiplied with the number of periods, while the number of parameters in the Fixed Effect model (k) is the number of variables plus the number of individuals. If the calculated F value is greater than the critical F then the null hypothesis is rejected which means the correct model for panel data regression is the Fixed model effects. And conversely, if the calculated F value is less than the critical F then the null hypothesis is accepted which means the right model for panel data regression is the Common Effect model (Iqbal, 2015)

To obtain the best model for Ltrade, it is necessary to carry out the several test, the first test is Chow Test to select the appropriate model between CEM and FEM by the Chow Test. Based on Appendix 10, the Chow Test is obtained the probability of F-Count is 0.000 which is less than 0.005 and it is indicate that h0 has to be rejected. Therefore, the appropriate model is the FEM.

4.5.2 Hausman Test

Hausman has developed a test to determine whether the Fixed Effect method and Random Effect method is better than the Common Effect method. The Hausman test is based on the idea that Least Squares Dummy Variables (LSDV) in the Fixed Effect method and Generalized Least Squares (GLS) in the Random Effect method is efficient meanwhile, Ordinary Least Squares (OLS) in the Common Effect method is not efficient. On the other hand, the alternative is efficient OLS and inefficient GLS methods. Therefore, test the null hypothesis is that the estimation results of the two do not differ so that the Hausman test can be carried out based on the difference in these estimates (Gujarati and Porter, 2009).

The Hausman test statistic follows the distribution of Chi-Square statistics with degrees of freedom (df) equal to the number of independent variables. The null hypothesis is that the model is correct for regression panel data is the Random Effect model and the alternative hypothesis is the right model for panel data regression is the Fixed Effect model. If the statistical value of Hausman is greater
from the critical value of Chi-Squares, the null hypothesis is rejected, which means that the model is right for panel data regression is a Fixed Effect model. And conversely, if the statistical value of Hausman smaller than the critical Chi-Squares

value, the null hypothesis is accepted, which means the model is correct. Appropriate for panel data regression is the Random Effect model.

In this Study, based on the result (Appendix 11) the value of Prob > Chi-Square is 0,0471 which smaller than 0,05, which has Rejected H0 decision, which means the appropriate model is Fixed Effect Model.

4.5.3 Lagrange Test

According to Widarjono (2007), to find out whether the Random Effect model is better than Common Effect model used Lagrange Multiplier (LM). Test the Significance of this Random Effect developed by Breusch-Pagan. The test is based on the residual value of the method Common Effects. This LM test is based on the Chi-Squares distribution with degrees of freedom (df) of number of independent variables. The null hypothesis is that the model is correct for regression panel data is Common Effect, and the alternative hypothesis is the right model for panel data regression is Random Effect. If the calculated LM value is greater than the critical Chi-Squares value then the null hypothesis is rejected, which means the right model for panel data regression is the Random Effect model. And conversely, if the calculated LM value is less than the critical value Chi-Squares then the null hypothesis is accepted which means the right model for data regression panels are the Common Effect model.

In this case, since it obvious that CEM and REM has rejected on the Hausman Test and Chow test, However, this test is not that necessary to explain more in this model because the FEM is already fit in.

4.6 THE DISCUSSION

4.6.1 The Effect of ASEAN Single Window on Trade

Single Window as a regional initiative that connects and integrates National Single Window (NSW) of ASEAN Member States that helps to integrated the export and import processes into one electronic system. The SW regression coefficient of 0.0070099, indicates that if SW index increases by 1 percentage point in the index, associated with an increase in Total Trade by 0.70%, assuming that the other variables are constant. Obtained a probability value of probability is 0.007 which is

smaller than alpha value, means that SW has a significant and positive impact toward total trade in ASEAN.

The Percentage is relatively small due to the explanation on the literature that the indicator to for the trade facilitation has 5 categories (Transparency, Formalities, Institutional Arrangement and Cooperation, Transit Facilitation, Paperless Trade, and Cross-Border Paperless Trade). The indicator of paperless trade has 10 measurements. One of that, mentioned single window. Therefore, Paperless Trade in Trade Facilitation category is the proxy of single window. Align with that, some perspective comes from the other study, according to Bal, *et al* (2017) several concerns regarding the implementation of the ASW system and its potential impact on exports between Malaysia and Singapore, ASW system has the potential to affect exports negatively in the short term due to exporters delaying sales, potential processing delays, limited utilization by some exporters, and uncertainties surrounding the system's implementation. However, it is important to note that these concerns are temporary and the long-term benefits of the ASW system, such as streamlined trade processes and improved efficiency are expected to outweigh any initial challenges. Indira and Kusumasari (2020) stated that the implementation of Single Window systems has shown promising trends, indicating that this innovation has the potential to be a comprehensive solution for trade facilitation. The efficient design of administrative procedures within a Single Window system is effective in reducing trade costs. This, in turn, helps countries maximize their potential to improve their rankings in the Logistics Performance Index (LPI) and Ease of Doing Business (EDB), particularly in the area of Trading Across Borders. By streamlining trade processes and reducing complexities, Single Window systems contribute to enhancing competitiveness in international trade. Other side from Jonathan KOH and Mowerman (2013) said that the ASW is not just a short-term benefit for both the public and private sectors; it represents the first step in a series of automation initiatives that ASEAN countries are undertaking to enhance their connectivity and engagement with the global business environment. It signifies a long-term commitment to improving trade processes, fostering greater efficiency, and embracing digital transformation. By implementing the ASW, ASEAN countries are laying the foundation for future automation efforts that will

further enhance their competitiveness and integration into the global marketplace. The ASW serves as a catalyst for continuous progress and signifies ASEAN's dedication to staying at the forefront of technological advancements in trade facilitation.

Another interesting finding from Martinez, *et al* (2020) Empirical evidence clearly demonstrates that operational Single Windows (SW) have a significant positive impact on trade performance. The implementation of SWs leads to a reduction in the number of documents required for exports and imports, as well as a decrease in the time needed to complete foreign trade operations. This, in turn, results in increased trade between countries. When both the importer and exporter have operational SWs, trade between them can increase by approximately 37 percent. Even when only one of the trading partners has an SW, there are still notable benefits, with exports increasing by 23 percent and imports by 14 percent. These effects remain statistically significant and positive across various model specifications, including cases where zero trade flows are considered. The positive impact of SWs stems from several factors. Firstly, SWs lower costs and enhance competitiveness, making trade more efficient. Secondly, SWs enable the emergence of new market players and facilitate increased trade volumes. Lastly, SWs contribute to the optimization of trade operations and allow for more transactions to be conducted within the same time period. Overall, the empirical evidence highlights the tangible benefits of operational SWs, emphasizing their role in promoting trade, reducing barriers, and facilitating economic growth.

4.6.1.1 Single Window Implementation in ASEAN State Member

As mentioned earlier, implementing a single window system has several advantages. Below are examples of ASEAN Member States that have introduced this system.

In Indonesia, before the introduction of the Indonesian National Single Window System (INSW), both customs officers, importers and exporters, and authorities issuing import and export licenses went through a lengthy process to process import and export documents. The importer must download the Goods

Export Notification Module *(PIB)* as a first step. The function of this module is to help the user create the *PIB* document. The importer then prepares the documents that must be submitted to customs as paper copies. The documents must be presented directly to the customs officer who precisely delivers the import documents. The importer must obtain from the competent authority (in this case, the G.A.) an import license issued by the competent authority. The importer submits proof of approval to customs. Only then can the import document be processed Hapsari, *et al* (2015)

Furthermore, on Hapsari, *et al* (2015), after the introduction of the INSW system, importers no longer need to present import licenses from the relevant General Administration (G.A.) authorities and no longer need to present them directly to customs officials. This is because the license issued to a particular importer by the Import Licensing Authority has been entered into his INSW system. Therefore, the person in charge does not have to wait for the license from the importer and can check directly in the INSW system whether the licensing agency has issued the import license. Prepare the import documents for immediate processing so they can be completed more quickly.

The establishment of AFTA is known for facilitating Business in International Trade, especially with connections to more than 600 ports in 120 countries, exporting countries such as Singapore, which was the world's 14th largest exporter in terms of global Trade. The stressed ASEAN's important capacity for imports. Thailand was worth US$410 billion in 2014, making the 15th largest importer worth US$366 billion, Koty (2016).

On the other hand, Handley (2016) stated Vietnam is developing and modernizing by globalizing its import and export sector using systems such as e-Customs, VNACCS/VCIS Vietnam is developing and modernizing by globalizing its import and export sector using systems such as e-Customs The Department of Finance (D.O.F.) of the Philippines announced that about 20 government agencies are expected to come online under the ASEAN Single Window (A.S.W.) platform during the first and second quarters of 2018.

From the perspective above, in this research argue that Single Window System that already implemented in ASEAN county will be help the International

Trade to be accelerated due to rapid access on export-import documents and payment in custom clearances.

4.6.1.2 Single Windows Implementation in the Other Region

Single Window system is not only applied by ASEAN Country but already encouraged to implemented by all over the world. Here some example cases that study about SW outside the ASEAN. The implementation of Single Window systems in seaports is underway in many countries, spanning a wide range of economic development levels. Examples include countries like Australia, Singapore, Sweden, the United States, Benin, Colombia, Indonesia, and Vietnam, among others. The extent to which Single Windows replace traditional paper-based systems varies across countries. In some cases, Single Window systems are used to process all customs documentation, including documents related to other government certifications such as sanitary and phytosanitary standards. However, in other countries, Single Windows coexist alongside paper-based systems, which reduces the time and cost savings that the former can provide, Peterson (2017).

According to WTO (2018), Colombia has made significant strides in strengthening its main trade facilitation mechanism, the Single Window for Foreign Trade (VUCE). VUCE is a digital platform that enables the electronic processing of authorizations, permits, certifications, and other necessary approvals from relevant national government entities for import and export activities. By streamlining these processes, VUCE benefits all foreign trade operators, including importers, exporters, and customs agents, by reducing transaction costs associated with delays in physical paperwork for export or import operations. The implementation of VUCE in Colombia has led to increased efficiency and reduced administrative burdens in foreign trade transactions, ultimately fostering a more conducive business environment.

Another study about Mexican Single window by Schwaiger and Campos, (2016) VUCEM (in Spanish), the Mexican Single Window for Trade, exemplifies Mexico's efforts towards modernizing its public administration. Similar initiatives have been implemented in 71 economies worldwide, each with varying levels of complexity. Established in 2012, VUCEM is an online platform that streamlines the exchange of information between the trading community and government entities.

It serves as a single-entry point for submitting standardized information and documents to fulfill trade-related regulatory requirements. VUCEM stands out due to the involvement of 12 government agencies, the technical sophistication of its electronic platform, and significant investments totaling USD$62 million. Presently, traders in over half of the OECD high-income economies, including Mexico, can electronically submit all trade documents without the need for hard copies. This is in contrast to regions like Sub-Saharan Africa and Eastern Europe and Central Asia, where most economies have electronic systems but still require traders to provide hard copies alongside the electronic submission. The implementation of VUCEM and similar Single Window systems represents a crucial step towards enhancing efficiency and transparency in international trade. By facilitating streamlined processes and eliminating the need for physical documentation, these systems contribute to trade facilitation and promote economic growth.

The European Parliament's Committee on Transport and Tourism has released a draft report on the Commission's proposal for a Regulation establishing a European Maritime Single Window environment. This proposal aims to simplify and streamline reporting formalities within the maritime transport sector. Unlike other single window initiatives, the European Maritime Single Window focuses primarily on ship-related data rather than cargo and trading information. The key stakeholders involved in this initiative are the European Maritime Safety Agency (EMSA) and national maritime administrations. The implementation of a paperless and standardized communication system is crucial not only for enhancing the efficiency of maritime transport operations involving multiple stakeholders but also for improving supply chain integration, coordination, and overall performance, Niculescu and Minea (2016).

Challenging finding to implement Single Window in Sri Lanka in research by Abeywickrama and Wickramaarachchi (2015) The implementation of a fully functional single window system in Sri Lanka has not been achieved. The existing system faces deficiencies in terms of connectivity and integration. It does not align with the comprehensive definition of a single window, particularly in terms of having a single-entry point, single data submission, single authority, and single

system. However, it does exhibit some similarities to a single window system in terms of automation. Yet, these automated systems are not integrated into a unified system, and there are several agencies that are not connected to these systems. As a result, the system lacks the necessary connectivity, integration, and centralization required for an ideal single window. It has been identified that the most critical challenges, with mean scores above average, include a lack of government support, inadequate coordination between Sri Lanka Customs, other regulatory institutions, and the trade community, as well as organizational and human resistance to change. Single Window systems can extend beyond national boundaries and be implemented on a multinational scale. Multilateral interoperability projects have been undertaken in certain countries, although they can be intricate and constantly evolving. However, once the challenges are resolved, both stakeholders and governments stand to gain various advantages from Single Window implementation. These benefits include cost reduction, shorter processing times, enhanced service predictability, and increased efficiency in cross-border trade operations, Tijan, *et al* (2019)

4.6.1.3 Challenge to Implementing the Single Window.

The quantifiable benefits of the Integrated Single Window Environment discussed in this paper are yet to be fully determined, pending the availability of more data. However, the anticipated advantages of the Automated Single Window implementation are expected to be beneficial for both governments and businesses. One significant benefit is the ability to receive pre-arrival information, which facilitates the smooth and efficient movement of goods, benefiting traders. Additionally, border authorities can effectively apply risk management procedures with the information obtained through the ASW. Perhaps most importantly, the ASW has the potential to harmonize and streamline national procedures, leading to increased efficiency and effectiveness for businesses.

At present, the implementation of the Automated Single Window faces several challenges from both participation and functional perspectives. Bal *et al* (2017) One key challenge is the varying levels of economic development among ASEAN Member States. Some Member States have not yet established a single

window system that can be integrated into the ASW environment. The implementation of a single window at the national level requires sufficient resources, expertise, and a prioritization of national needs and political will.

The second challenge in implementing the ASW is related to the existence of different customs regimes and laws among ASEAN Member States, which can hinder interoperability and legal certainty. Legal certainty has always been a crucial aspect of commercial transactions, as it ensures predictability and stability in business dealings. The concept of "ubi commercium, ibicius" emphasizes the need for legal certainty in order to facilitate efficient markets and trade. In the context of the ASW, legal certainty refers to businesses' ability to understand and comply with the legal framework governing cross-border trade. The aim is to establish a predictable and rule-based ASW framework that reduces risks associated with international trade for businesses, Petersmann (2006) To achieve this, the legal regimes of ASEAN Member States need to interoperate effectively, particularly in supporting cross-border transactions. Certain legal issues, such as the functional equivalence of paper and electronic documents and mutual recognition of digital signatures, need to be addressed to provide a robust legal framework for the ASW. Resolving these legal challenges will enhance legal certainty and promote smoother cross-border trade processes within the ASW.

For the future of the ASW, several interesting suggestions have been proposed. One important suggestion is to expand the scope of regional transactions, allowing for the cross-border exchange of data within ASEAN and between ASEAN and its dialogue partners. This would promote greater integration and collaboration in trade facilitation efforts. Another suggestion is the implementation of the ASEAN Customs Transit System, which would enable the exchange of data through a single transit declaration. This system aims to facilitate the smooth movement of goods within the region by streamlining customs procedures and reducing administrative burdens. Additionally, launching a central trade repository for trade-related information that traders can access is recommended. This repository would serve as a centralized platform where traders can access relevant trade information, documents, and regulations, enhancing transparency and simplifying trade processes. These suggestions aim further to enhance the

effectiveness and efficiency of the ASW, promoting seamless cross-border trade and fostering greater regional integration within ASEAN and its dialogue partners (UNNExt, 2015)

Identifying key stakeholders is crucial for the successful implementation and operation of the ASW. Identifying the relevant stakeholders makes it possible to develop a comprehensive business model that supports the architecture's operation and maintenance (UN/CEFACT, 2015). The identification of stakeholders and their requirements for interoperability is a crucial aspect of the ASW. It allows for the assessment of feasibility and ensures that the needs of those involved drive the system. By understanding the roles and benefits of stakeholders, an appropriate business process can be developed to effectively operate and maintain the ASW. (UN/CEFACT rec.36)

4.6.2 The Effect of Frontier Technology Readiness on Trade

The Frontier Technology Readiness Index (FTRI) is a measure used to assess a country's preparedness and capability to adopt and utilize frontier technologies. The FTRI regression coefficient of 0.3106417, indicates that if FTRI index increases by 1 point in the index, it is associated with an increase by 31%, assuming that the other variables are constant. Obtained a probability value of probability is 0.095 which is smaller than alpha value, means that FTRI has a significant and positive impact toward total trade in ASEAN.

This finding also supports the argument by several studies from Vemuri and Siddiqi (2009) conduct an analysis using panel data spanning sixty-four countries from 1985 to 2005. They find that the presence of Technology infrastructure and access to the Internet for commercial transactions have a significant and favourable influence on the volume of international trade. Freund and Weinhold (2002) conducted a study examining the impact of the Internet on international trade in services. Their research focused on U.S. trade, both exports and imports, of fourteen specific service categories involving thirty-one countries from 1995 to 1999. The results of their analysis reveal a noteworthy positive correlation between the level of Internet development in those nations and their bilateral trade with the United States. Subsequently, they expanded their investigation to encompass merchandise trade and included fifty-six countries in a

follow-up study (Freund and Weinhold 2004). Clarke and Wallsten (2006) additionally demonstrate that Internet access has a positive impact on export performance in developing countries, leading to increased exports to developed nations.

4.6.3 The Effect of Economic Growth on Trade

Economic growth refers to an increase in the production and consumption of goods and services in an economy over a specific period of time. It is commonly measured by the growth rate of the Gross Domestic Product (GDP), which is the total value of all goods and services produced within a country's borders. The EGR regression coefficient of -0,0013989, indicates that if GDP rates increases by 1 percent, it will affect to Total Trade decreases by 0,13%, assuming that the other variables are constant. Obtained a probability value of probability is 0.860 which is higher than alpha value, means that EGR has a not significant and negative impact toward total trade in ASEAN.

The insignificant significance of the trade coefficient indicates that in the analysis performed, the relationship between international trade and GDP cannot be considered as a statistically consistent or strong relationship. This can be caused by large data variations, small sample sizes, or other factors not included in the analysis model.

This result has a various perspective that argues by Yanikkaya (2003) discovered compelling evidence supporting the positive correlation between trade and economic growth, attributed to mechanisms like technology transfers, economies of scale, and comparative advantage. Interestingly, trade barriers, encompassing import duties, export taxes, and taxes on international trade, were unexpectedly found to have a positive association with growth, particularly in the case of developing nations, as evidenced by some specifications. Kim (2011) identified robust positive impacts of trade openness on growth and real income for developed countries; however, this effect was surprisingly negative for developing countries. Frankel and Romer (1996) said that there is a positive correlation between trade openness and economic growth. Countries that are more open to international trade tend to experience higher rates of economic growth. However, the study also acknowledges that the relationship between trade and growth is

complex and can be influenced by various factors, such as the quality of institutions, human capital development, and macroeconomic stability. While the positive correlation between trade openness and growth is observed on average, individual country experiences may vary based on specific circumstances.

These results can depend on a variety of factors as well, such as the economic characteristics of the country being analyzed, the types of goods or services traded, trade policies, and the time period of the analysis. The absence of statistical significance may also indicate that other factors influence the relationship and are not included in the model.

4.6.4 The Effect of Trade in Service on Trade

Trade in services refers to the exchange of services between countries. It involves international buying and selling services such as banking, insurance, transportation, tourism, telecommunications, consulting, and other professional services. The TIS regression coefficient of -0,0276428, indicates that if TIS ratio increases by 1 percent, it will affect to Total Trade decreases by -0,27%, assuming that the other variables are constant. Obtaining a probability value of 0.007 which is bigger than alpha value, meaning that TIS has significant but negative impact toward total trade in ASEAN.

Trade in goods and trade in Services is a complimentary of each other. Some studies argue that lowering the cost of transportation services yields comparable outcomes to reducing tariff protection. One of these outcomes is an increase in the quantity of traded goods (Deardorff, 2001). The process of international goods trade relies on inputs from various service industries like transportation, insurance, and finance to facilitate and finalize transactions. Barriers that impede national service providers from offering these services across borders or within foreign nations result in costs that constrain the global movement of goods trade. Consequently, the removal of these barriers offers a significant enhancement to the international trade of goods (Blyde and Sinyafskaya, 2007). Lennon (2008) and Ariu (2016) have examined the distinctions between these two concepts from different angles.

Lennon (2008) focuses on the differences in terms of the influence of language and physical geography on the international trade of goods and services. On the other hand, Ariu (2016) emphasizes variations in the volume of exports and

imports among firms engaged in international trade of goods and services, as well as disparities in the entry and exit rates of these firms. Lennon (2008) identifies that while the impact of physical geography on trade in services is relatively weaker, the influence of language is more pronounced compared to trade in goods. Building on Lennon's findings, Ariu (2016) concludes that the export and import volume of service traders is lower than that of goods traders. Furthermore, he notes that service traders tend to have higher entry and exit rates and a lower probability of survival.

Due to the distinct nature of international trade in goods and international trade in services, there has been a growing trend in researching the factors that influence each type separately (Bilgiç, 2021). This approach stems from the recognition that identical elements may impact these two forms of trade differently, leading to the hypothesis that certain factors may affect one while having no effect on the other. The goal is to uncover the nuanced relationships between these elements and the distinct impacts they have on the respective categories of international trade, thus shedding light on the complexities and unique dynamics of each trade type.

4.6.5 The Effect of Population Rates on Trade

Population Rates can expand the labour force, providing a larger pool of workers for various industries. The Population Rates regression coefficient of 0.0299981, indicates that if Population rates increases by 1 percent, it will affect to Total Trade increases by 0.29%, assuming that the other variables are constant. Obtained a probability value of probability is 0.177 which is bigger than alpha value, means that Population has positive but insignificant impact toward total trade in ASEAN. Along with the result above various arguments appear. Matyas (1997) observes that population tends to enhance trade and specialization, leading to gains from specialization. In contrast, Dell'Ariccia (1999) identifies a negative coefficient associated with population. Furthermore, Bergstrand (1989) presents a positive coefficient for GDP per capita, implying a negative correlation between population and trade flows. This suggests that imports and exports are more reliant on capital-intensive production. Bergstrand interprets a negative GDP per capita coefficient as an indication that the product group under consideration is not capital-intensive but rather labour-intensive. A growing population can lead to more labour force and

potentially greater productivity. This might not be immediately captured in trade volumes, as it takes time for the labour force to be trained and integrated into various economic activities.

Furthermore, the influence of population on trade can also vary based on the duration of the estimation period, whether short-term or long-term. In the short run, population can positively impact trade flows by expanding the labour force, fostering specialization, and increasing the array of exportable products. However, over the long term, a larger population may lead to a decrease in per capita income, resulting in reduced individual prosperity and potentially causing a decline in production and exports. Moreover, lower per capita income tends to diminish the demand for imports.

4.6.6 Robustness Test

Robustness tests are conducted in regression analysis of panel data to assess the stability and reliability of the estimated model and its results. It helps to address potential concerns about the validity and robustness of the findings. Specification model is need to make choices about which variables to include, how to transform variables, and which functional forms to use. Robustness tests involving different model specifications help confirm that the results are not dependent on these specific choices. Moreover, it can enhance the credibility and validity of the findings, demonstrate the robustness of the estimated relationships, and provide a more comprehensive analysis of the data. It helps ensure that the conclusions drawn from the regression analysis are reliable and not solely dependent on specific model specifications or assumptions (Wisberg,2006). In summary, robustness tests provide a comprehensive assessment of the validity and generalizability of research findings.

In the robustness test, I run the model in which trade are dropped from the model. The purpose of this exercise is to observe the extent to which the coefficient on the variable of interest, Single Window, change. The model is then estimated with the fixed effect model and the result is provided below

Table 13. Robustness Test

Variables	Coefficient	Robust. Std.Err	t-Statistic	Prob.
SW	0.0073916	0.0033889	2.18	0.057
FTRI	0.2965313	0.1065279	2.78	0.021
TIS	-0.274777	0.0042365	-6.49	0.000
Cons	10.31151	0.2625148	39.28	0.000

Primary Data Processed

The result above shows that the variables has not changes the coefficient symbols but the probability value since the robust of the standard error has changed. This may occur according to Wisberg (2006) because:

1) Robustness tests often involve testing alternative model specifications, such as including or excluding certain variables, using different functional forms, or employing alternative estimation techniques. These changes in the model specification can impact the estimated coefficients and their significance. Different variables or functional forms may capture different aspects of the relationship between the dependent and independent variables, leading to changes in the estimated effects.
2) Robustness tests that address endogeneity issues, such as instrumental variable approaches or alternative control variables, can lead to changes in the estimated coefficients.
3) Robustness tests that handle heteroscedasticity, such as using heteroscedasticity-consistent standard errors or clustered standard errors, can result in changes to the estimated standard errors.
4) Robustness tests that examine the impact of outliers or influential observations can result in changes to the estimated coefficients.
5) Robustness tests that address multicollinearity, such as using different variable combinations or addressing collinearity issues through variable transformations, can affect the estimated coefficients.

CHAPTER V

CONCLUSION

5.1 Conclusion

International trade involves the movement of capital, goods, and services across national borders, requiring various stakeholders to submit substantial amounts of information and documentation to government authorities and other parties involved in the trade process. Therefore, trade facilitation plays a crucial role in international trade. The primary objective of trade facilitation is to promote faster, more cost-effective, and predictable trade by ensuring the security of the trade operations. One important tool for trade facilitation is the Single Window, which allows stakeholders to submit standardized data through a single-entry point. The level of paper document replacement by a Single Window can vary across countries. Some countries use Single Window systems to process both customs documents and other government certifications like sanitary and phytosanitary standards. In contrast, other countries may use Single Window alongside traditional paper-based document exchange, resulting in a lesser reduction in the cost and time of business processes.

To provide the novel insight on how Single Window System is determined and to pinpoint specific measure for the International Trade, this research empirically investigated how firm this system can accelerate the rapid of total trade in ASEAN member country. This study found that 1) Index of Single Window is the proxy of Paperless Trade in Trade facilitation has been proven that it has a significant positive toward ASEAN export-import (in 0,05 significant level). This result implies that ASEAN's Policy Implementation for Paperless Trade Movement should encourage and focus more on reducing paper when conducting the export-import processes.2) The other determinants such as Frontier technology Readiness index has also positive and significant (in 10% significant level) impact on trade. The argument is solid with the implementation of the Single Windows system that also supports by the readiness of technology in the county has spotted; Economic Growth Rates has negative and insignificant effect on Trade; Trade in service shows the significant but negative impact on Trade; and Population Rates has insignificant

positive impact on Trade. This result may debatable since some reasons are follow, like the data limitation because the quality and availability of data can affect the results, different in sample selection, endogeneity, omitted variable bias or reverse causation can lead to different regression outcomes.

Eventually, the implementation of a single window system in ASEAN countries faces several challenges, which can explain why some countries have not fully implemented it. The reason is diverse because the numerous aspect that can affected on, such as the state of their technological infrastructure, legal and regulatory frameworks, institutional capacity, and coordination among government agencies can vary; coordinating and aligning the efforts of multiple government agencies and stakeholders across different levels of governance can be challenging. Lack of effective interagency coordination and harmonization of processes and systems can delay the implementation. Implementing a comprehensive single-window system requires significant financial resources, including investments in technology infrastructure, system development, training, and ongoing maintenance. Implementing a single window system requires building the capacity and awareness of government officials, stakeholders, and end-users. Training programs, workshops, and awareness campaigns must familiarize them with the system's functionalities, data requirements, security protocols, and benefits. A lack of adequate capacity-building initiatives and awareness campaigns can impede the adoption and effective utilization of the single window system.

Addressing these challenges requires strong political will, commitment, and collaboration among ASEAN member countries. Efforts to enhance regional cooperation, knowledge sharing, and technical assistance can support countries in overcoming these challenges and advancing the implementation of the single window system in ASEAN.

5.2 Policy Recommendation

Implementing ASW in the short-term process challenges due to technological disparities and diverse trading patterns among ASEAN member countries. While Singapore, with its limited exporting sector, Singapore may not require protectionist measures, countries like Cambodia and the Philippines have more

robust policies that can impede trade within the region. The main goal of ASW is to reduce trade time, documentation, and costs while considering all member countries' local and security interests.

There are significant disparities among ASEAN countries in their implementation of NSW Countries such as Singapore, Malaysia, Indonesia, Philippines, and Thailand have already established functional NSW platforms, enabling effective communication between government agencies and the business community. However, each of these countries has its own priorities and areas of focus their efforts in designing and testing quality standards and characteristics to expand the platform's usage to B2B activities, as well as invest their efforts in the reduction of documentation needed to trade. Brunei and Vietnam have successfully established their Customs Single Window platforms. These platforms serve as centralized systems where all customs-related activities take place. Traders, customs brokers, freight forwarders, and other relevant parties can use the platform to submit various support documents for import and export declaration processing.

Lao PDR has implemented trade point portals to facilitate trade transactions at various entry and exit points, including land, sea, and airports. The objective is to reduce trade processing time and alleviate congestion in warehousing facilities. On the other hand, Cambodia and Myanmar have started establishing their customs systems and digitizing trade documents. However, these systems currently do not include business-to-government (B2G) or government-to-government (G2G) functionalities.

Based on the consideration above, the following list below is the recommendation for successful Single Window Implementation in ASEAN Member States:

1) **Harmonization and Standardization**: ASEAN countries should work towards harmonizing and standardizing their trade procedures, documents, and data formats to ensure interoperability within the Single Window system. This will facilitate seamless exchange of information and enhance efficiency in cross-border trade.
2) **Stakeholder Engagement and Capacity Building**: Engage all relevant stakeholders, including government agencies, private sector entities, and trade associations, in the planning and implementation process. Provide necessary

training and capacity building programs to ensure smooth adoption and effective utilization of the Single Window system

3) **Legal and Regulatory Framework**: Develop a comprehensive legal and regulatory framework that supports the implementation of the Single Window system. This should include provisions for data protection, electronic signatures, digital authentication, and legal recognition of electronic documents to foster trust and facilitate electronic transactions.
4) **Infrastructure and Connectivity**: Invest in robust and reliable ICT infrastructure to support the implementation of the Single Window system. Ensure seamless connectivity among government agencies, trade partners, and other stakeholders to enable secure and real-time exchange of trade-related information
5) **Interoperability and Integration**: Foster interoperability among different national Single Window systems within ASEAN and promote integration with international trade facilitation platforms. This will enable seamless exchange of information and data sharing among countries, reducing duplication of efforts and enhancing cross-border trade facilitation.
6) **Public-Private Partnership**: Foster collaboration between the public and private sectors to drive the implementation and sustainability of the Single Window system. Encourage private sector involvement in system design, development, and operation, as well as in providing value-added services to traders.
7) **Monitoring and Evaluation**: Establish mechanisms for continuous monitoring and evaluation of the Single Window implementation to assess its effectiveness, identify areas for improvement, and address any challenges or bottlenecks. Regularly engage stakeholders to gather feedback and make necessary adjustments to enhance the system's performance.
8) **Regional Cooperation and Collaboration**: Encourage collaboration and knowledge sharing among ASEAN member countries in the implementation of Single Window systems. Exchange best practices, experiences, and lessons learned to accelerate progress and avoid duplication of efforts.

5.3 Research Limitation

Given the many developments that can be found in this issue, it is necessary to have clear problem boundaries regarding what is made and resolved in carrying out this research. The limitations of the problem in carrying out this research are as follows:

1. This research focuses on testing the independent variables (SW, FTRI, Trade in service, Population and Economic Growth.) that affect the Trade that focus only on Total Export-Import of ASEAN as the dependent variable.
2. The data used uses secondary data that very limited. Obtained from several official websites managed by the government.
3. The data obtained is panel data. They are limited from 2015 to 2021 in annual period that has only 30 observations.
4. The obtained data was managed manually and then regressed using Stata 17 software.
5. The model used in the regression is panel data regression

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APPENDICES

Appendix 1. Summary Dataset Before Log

Variable		Mean	Std. dev.	Min	Max	Observations	
trade	overall	59965.6	57943.08	2644.9	214011.6	N =	70
	between		59981.63	3830.871	184700	n =	10
	within		8512.15	37373.7	89277.2	T =	7
sw	overall	68.0895	23.39293	11.11	100	N =	40
	between		21.3772	39.815	100	n =	10
	within		11.1981	39.3845	94.9445	T =	4
ftri	overall	.4708471	.2269405	.1004	.9678	N =	51
	between		.0685352	.39256	.55472	n =	10
	within		.2172939	.1786871	1.046087	T =	5.1
egr	overall	3.644286	3.808101	-9.6	9	N =	70
	between		2.503707	-1.7	6.171429	n =	10
	within		2.962799	-4.827143	10.10143	T =	7
tis	overall	29.33746	23.32921	1.415464	77.81284	N =	69
	between		21.20496	2.592775	68.22685	n =	10
	within		11.6435	15.00969	77.2874	T =	6.9
pr	overall	.8371429	1.413514	-5.2	5	N =	70
	between		.5690506	-.2428571	1.514286	n =	10
	within		1.304745	-5.034286	5.165714	T =	7

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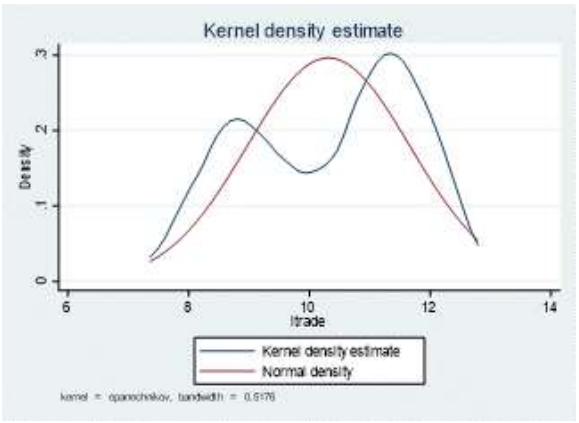
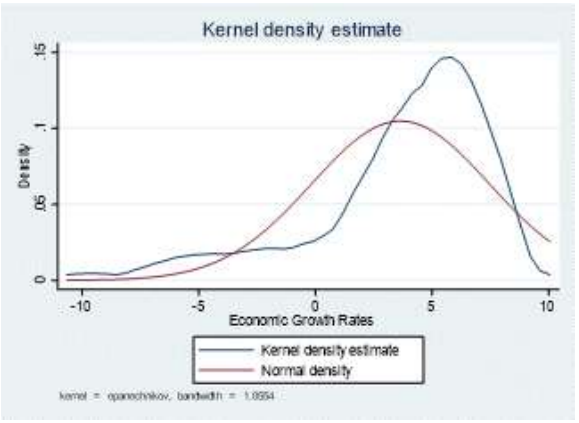
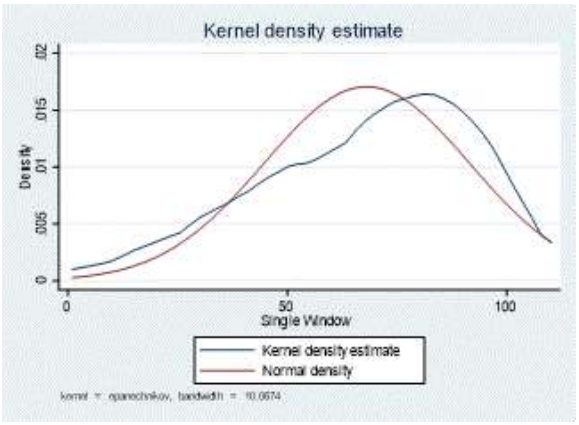
Appendix 2. Summary Dataset After Log

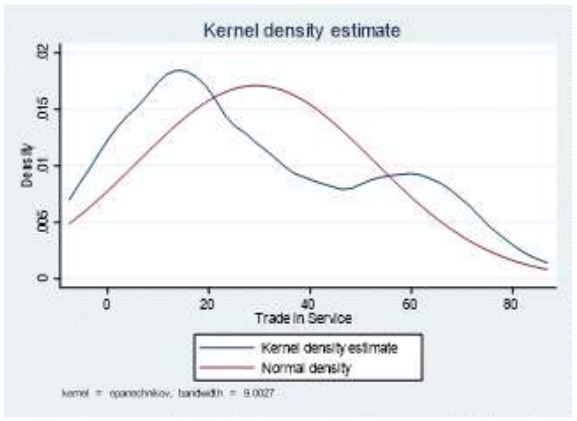
Variable		Mean	Std. dev.	Min	Max	Observations	
ltrade	overall	10.31545	1.345072	7.880389	12.27379	N =	70
	between		1.395232	8.206544	12.12251	n =	10
	within		.1783835	9.931701	10.85344	T =	7
sw	overall	68.0895	23.39293	11.11	100	N =	40
	between		21.3772	39.815	100	n =	10
	within		11.1981	39.3845	94.9445	T =	4
ftri	overall	.4708471	.2269405	.1004	.9678	N =	51
	between		.0685352	.39256	.55472	n =	10
	within		.2172939	.1786871	1.046087	T =	5.1
egr	overall	3.644286	3.808101	-9.6	9	N =	70
	between		2.503707	-1.7	6.171429	n =	10
	within		2.962799	-4.827143	10.10143	T =	7
tis	overall	29.33746	23.32921	1.415464	77.81284	N =	69
	between		21.20496	2.592775	68.22685	n =	10
	within		11.6435	15.00969	77.2874	T =	6.9
pr	overall	.8371429	1.413514	-5.2	5	N =	70
	between		.5690506	-.2428571	1.514286	n =	10
	within		1.304745	-5.034286	5.165714	T =	7

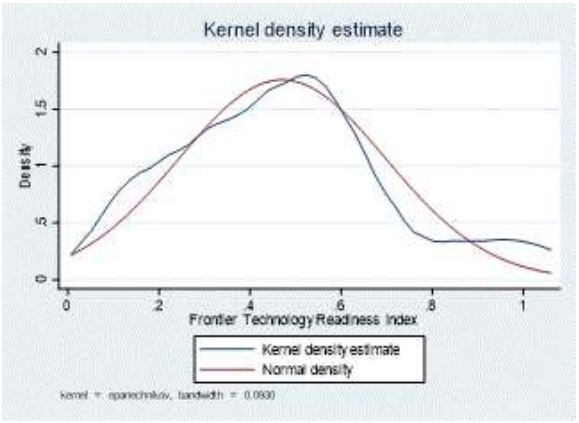
Appendix 3. Normality Graph

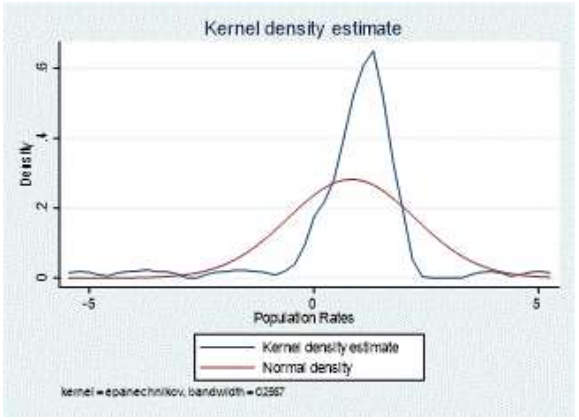












Appendix 4. Multicollinearity

Variable	VIF	1/VIF
tis	1.74	0.574343
sw	1.57	0.638679
egr	1.52	0.659072
ftri	1.47	0.681738
pr	1.11	0.900760
Mean VIF	1.48	

Appendix 5. Heteroscedasticity

```
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variable: Fitted values of ltrade

H0: Constant variance

    chi2(1) =   2.74
Prob > chi2 = 0.0978
```

Appendix 6. Autocorrelation

Number of gaps in sample = 29

Breusch-Godfrey LM test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	0.000	1	1.0000

H0: no serial correlation

Appendix 7. Common Effect Model

Source	SS	df	MS	Number of obs	=	30
				F(5, 24)	=	7.48
Model	33.9242964	5	6.78485928	Prob > F	=	0.0002
Residual	21.7751613	24	.90729839	R-squared	=	0.6091
				Adj R-squared	=	0.5276
Total	55.6994578	29	1.92067096	Root MSE	=	.95252

ltrade	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
sw	.021527	.0089235	2.41	0.024	.0031097	.0399442
ftri	.9084468	1.247308	0.73	0.473	-1.665871	3.482765
egr	-.0951013	.0486721	-1.95	0.062	-.1955556	.005353
tis	.0287006	.0111944	2.56	0.017	.0055964	.0518048
pr	-.115005	.1525875	-0.75	0.458	-.42993	.1999201
_cons	8.218688	.7165508	11.47	0.000	6.7398	9.697576

Appendix 8. Fixed Effect Model

Fixed-effects (within) regression — Number of obs = 30
Group variable: country — Number of groups = 10

R-squared:
Within = 0.6737
Between = 0.2148
Overall = 0.1866

Obs per group:
min = 3
avg = 3.0
max = 3

F(5,15) = 6.19
corr(u_i, Xb) = -0.6699 — Prob > F = 0.0026

ltrade	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
sw	.0070099	.0022643	3.10	0.007	.0021836	.0118361
ftri	.3106417	.1742131	1.78	0.095	-.0606848	.6819681
egr	-.0013989	.0077814	-0.18	0.860	-.0179845	.0151868
tis	-.0276428	.0087714	-3.15	0.007	-.0463386	-.008947
pr	.0299981	.0211518	1.42	0.177	-.0150858	.0750821
_cons	10.31102	.2523111	40.87	0.000	9.773231	10.84881
sigma_u	1.7411093					
sigma_e	.1110442					
rho	.99594887	(fraction of variance due to u_i)				

F test that all u_i=0: F(9, 15) = 194.55 — Prob > F = 0.0000

Appendix 9. Random Effect Model

```
Random-effects GLS regression                   Number of obs     =         30
Group variable: country                         Number of groups  =         10

R-squared:                                      Obs per group:
     Within  = 0.6188                                         min =          3
     Between = 0.0544                                         avg =        3.0
     Overall = 0.0340                                         max =          3

                                                Wald chi2(5)      =      17.78
corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0032
```

ltrade	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
sw	.007982	.0027298	2.92	0.003	.0026317	.0133323
ftri	.284741	.2120796	1.34	0.179	-.1309274	.7004094
egr	-.0013464	.0094292	-0.14	0.886	-.0198272	.0171344
tis	-.0142629	.0094669	-1.51	0.132	-.0328176	.0042918
pr	.0276626	.0257506	1.07	0.283	-.0228077	.0781329
_cons	9.945742	.4968842	20.02	0.000	8.971867	10.91962
sigma_u	1.0642191					
sigma_e	.1110442					
rho	.98922972	(fraction of variance due to u_i)				

Appendix 10. Chow Test (Likelihood Test)

Source	SS	df	MS		
				Number of obs	= 30
				F(14, 15)	= 321.58
Model	55.5144956	14	3.96532111	Prob > F	= 0.0000
Residual	.184962208	15	.012330814	R-squared	= 0.9967
				Adj R-squared	= 0.9936
Total	55.6994578	29	1.92067096	Root MSE	= .11104

ltrade	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
sw	.0070099	.0022643	3.10	0.007	.0021836	.0118361
ftri	.3106417	.1742131	1.78	0.095	-.0606848	.6819681
egr	-.0013989	.0077814	-0.18	0.860	-.0179845	.0151868
tis	-.0276428	.0087714	-3.15	0.007	-.0463386	-.008947
pr	.0299981	.0211518	1.42	0.177	-.0150858	.0750821
country						
2	.9125094	.1073523	8.50	0.000	.6836933	1.141325
3	3.69647	.2522859	14.65	0.000	3.158736	4.234205
4	.7657747	.1137578	6.73	0.000	.5233058	1.008244
5	4.055725	.2392705	16.95	0.000	3.545732	4.565718
6	2.115865	.2312191	9.15	0.000	1.623033	2.608697
7	4.05755	.5629236	7.21	0.000	2.857706	5.257393
8	5.286461	.4824444	10.96	0.000	4.258155	6.314767
9	3.807912	.1884019	20.21	0.000	3.406342	4.209481
10	3.14158	.1250046	25.13	0.000	2.875139	3.40802
_cons	7.527035	.1543868	48.75	0.000	7.197967	7.856103

Appendix 11. Hausman Test

	Coefficients			
	(b) fem	(B) rem	(b-B) Difference	sqrt(diag(V_b Std.
sw	.0070099	.007982	-.0009722	
ftri	.3106417	.284741	.025900	
egr	-.0013989	-.0013464	-.0	
tis	-.0276428	-.0142629		
pr	.0299981	.0276626		

b = Co
B = Inconsistent

Test of H0: Differe

chi2(5)

Pr

Appendix 12. Lagrange Test

Breusch and Pagan Lagrangian multiplier test for random effects

ltrade[country,t] = Xb + u[country] + e[country,t]

Estimated results:

	Var	SD = sqrt(Var)
ltrade	1.920671	1.385883
e	.0123308	.1110442
u	1.132562	1.064219

Test: Var(u) = 0

chibar2(01) = 17.68
Prob > chibar2 = 0.0000

Appendix 13. Robust Test

Fixed-effects (within) regression — Number of obs = 30
Group variable: country — Number of groups = 10

R-squared:
Within = 0.6282
Between = 0.1933
Overall = 0.1685

Obs per group:
min = 3
avg = 3.0
max = 3

F(3,9) = 24.46
corr(u_i, Xb) = -0.6545 — Prob > F = 0.0001

(Std. err. adjusted for 10 clusters in country)

ltrade	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sw	.0073916	.0033889	2.18	0.057	-.0002745	.0150578
ftri	.2965313	.1065279	2.78	0.021	.0555484	.5375141
tis	-.0274777	.0042365	-6.49	0.000	-.0370614	-.017894
_cons	10.31151	.2625148	39.28	0.000	9.717657	10.90536
sigma_u	1.7282227					
sigma_e	.11135301					
rho	.99586567	(fraction of variance due to u_i)				