YANGON UNIVERSITY OF ECONOMICS
DEPARTMENT OF STATISTICS

COINTEGRATION AND CAUSAL RELATIONSHIP BETWEEN EXPORT AND IMPORT: CASE STUDY IN ASEAN (1970-2021)

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M.Econ (Statistics)
Roll No. 4

OCTOBER, 2023

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This is to certify that the thesis entitled "**COINTEGRATION AND CAUSAL RELATIONSHIP BETWEEN EXPORT AND IMPORT: CASE STUDY IN ASEAN (1970-2021)**" submitted as a partial fulfillment towards the requirements of Master of Economics (Statistics) has been accepted by the Board of Examiners.

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ABSTRACT

Export and import are key determinants of economic growth and a healthy economy. They are essential for planning and managerial improvement, as well as policy making. This thesis aims to analyze cointegration and causality between export and import series of ASEAN countries, using the annual data from the United Nations Database from 1970 to 2021. Augmented Dicky Fuller test, Engle-Granger and Johansson Cointegration Test, Vector Error Correction Model, and Vector Autoregressive Model were applied in this study. According to the Augmented Dicky-Fuller test, it was found that the export and import series have a unit root in level (not stationarity) but they are stationary at the first difference. Furthermore, the results of the Engle-Granger two-step procedure, as well as Johansen's trace and maximum eigenvalue test, simultaneously showed that cointegration had been found for Singapore and Thailand among the ten ASEAN countries. The cointegration test study revealed that because of the cointegration relationship, Singapore and Thailand used the VECM and both exports and imports made adjustments to their long-run equilibrium values. This study confirmed that the estimation results from the Vector Autoregressive (VAR) analysis of export to import had shown unidirectional causality for Indonesia and Myanmar and bi-directional causality for Cambodia and Vietnam. Based on the findings, it is recommended that Singapore and Thailand should not be worried about their trade balance in the presence of cointegration. For Indonesia and Myanmar, as export causes import, the latter is dependent on the former. Thus, it is indicated that these two countries should promote export so that they can meet their import demand. For Cambodia and Vietnam, as causality flows in both directions. In Brunei, Lao, Malaysia and Philippines, their trade balance as export and import are not cointegrated and have no causality.

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LIST OF ABBREVATIONS

ADF	Augmented Dicky Fuller
AIC	Akaike's Information Criteria
ARCH	Autoregressive Heteroskedasticity
ARDL	Autoregressive Distributed Lags
ASEAN	Association of South East Asia
BIC	Bayesian Information Criterion
BIMSTEC	Bay of Bengal Initiative for Multi-Sectorial Technical and Economic Cooperation
DW	Durbin-Watson
DICA	Directorate of Investment and Company Administration
EU	European Union
FTA	FREE TRADE TREA
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
ILO	International Labor Organization
IMF	International Monetary Fund
LM	Lagrange Multiplier
LR	Likelihood Ratio test Statistics
SBC	Schwartz Bayesian Criterion
UN	United Nations
VAR	Vector Autoregressive
VECM	Vector Error Correlation Model
WBG	World Bank Group
WTO	World Trade Organization

CHAPTER I
INTRODUCTION

Export and import play an important role in determining the overall health of an economy. An economy is considered healthy when both export and import show growth. This typically signifies economic vitality and a sustainable trade surplus or deficit. If export is increasing while import is decreasing, it might encourage that foreign economies are performing better than the domestic one. Conversely, if export experiences a sharp decline but import surges, it could suggest that the domestic economy is outperforming overseas markets. Possessing a comprehensive understanding of export and import movements plays a crucial role in determining their impact on an economy.

1.1 Rationale of the Study

In today's globalized economy, nearly all countries participate in international trade, and export and import activities profoundly impact a country's economy in various ways. Engaging in international trade provide substantial growth opportunities. Exchange rates, inflation, and interest rates experience an impact due to the equilibrium between a country's import and export. While a high import indicates robust domestic demand and an expanding economy, a high export triggers employments and funds into the country, resulting in increased consumer spending. Sustaining a favorable balance between import and export ensures an economically stable.

According to David Ricardo's Comparative Trade Theory, international trade arises from differences in technology, resource endowments, demand, economies of scale, and government policies. Technology refers to the techniques used to transform resources (labor, capital, land) into outputs (goods and services). If there is a difference in the technical ability to produce goods and services between countries, a trade advantage can arise from a high-producing country to a low-producing country. Differences in resource endowments are the skills and abilities of a country's workforce, the natural resources available within its borders (minerals and farmland) and the capital stock (machinery, infrastructure, and communication systems).

Advantageous trade can occur between countries if the countries differ in their endowments of resources. Trade occurs because individuals in different countries have different preferences or demand for different products. Economics of scale refers to a production process in which the cost of production decreases as the scale of production increases. Differences in production lead to trade between the two countries.

The expansion of international trade offers businesses the chance to achieve growth, higher profits, and greater economics visibility. Due to differences in technology, resource endowment, demand, economic scale and government policies between countries, export and import also differ between countries. In countries with low industrial development, exported commodities primarily consist of raw materials from the plantation and mining sectors, which are associated with various weaknesses. In contrast, the imported goods are technologically advanced industrial products with high value-added and selling prices. Therefore, the export values are also low, which can lead to deficits. In terms of export and import, exports are considered income, while imports are seen as expenditure. This means that an increase in export value can support import finances. Many countries have given priority support public health and export promotion. Most of the fundamental factors to development, such as capital goods, raw materials and technical know-how, are imported due to insufficient domestic supply. Therefore, the relationship between the values of export and import plays an important role in the development of a country.

The connection between trade, employment, and development is crucial, especially in developing countries and transitioning economies. Trade plays a significant role in generating and enhancing employment opportunities. Trade has the potential to create jobs by increasing income through expanded demand, higher returns, and efficient production.

Enhancing global trade is crucial for development and poverty reduction. To effectively combat poverty, it is necessary to continue working on increasing economic integration and reducing trade barriers. Sustained growth in developing countries is vital for poverty reduction, and trade plays a significant role in creating better job opportunities. Effective poverty reduction through trade policies requires collaboration between government agencies and stakeholders in various policy areas. According to the World Bank Group (2021), trade liberalization leads to an average increase in economic growth of 1.0 to 1.5 percentage points, resulting in 10 to 20 percent higher income over a decade. Improved trade practices have lifted over 1 billion people out of poverty since 1990. Furthermore, promoting cooperation through trade and commerce is essential for preventing conflicts between countries (World Bank Group, 2022).

Trade is crucial for ASEAN nations, as it directly contributes to employment generation, poverty reduction and developed nation through the interrelationship between exports and imports. The investigation of economic growth was carried out using cointegration analysis, with a focus on direct and indirect long-term relationships and impulse-response functions between exports, imports, and economic growth, as conducted by Taghavi in 2012. The findings revealed a positive connection between exports and long-term economic growth, while imports were negatively linked to economic growth, indicating a detrimental effect. Furthermore, an improvement in the export variable positively influenced economic growth, whereas an increase in the import error term had minimal impact, suggesting that import shocks did not significantly contribute to positive economic growth.

Studying the enduring correlation between a country's exports and imports within the context of the United States, Husted's 1992 research indicated that a stable, long-term relationship between these two economic factors signified the nation's adherence to its international budget constraint. Husted's examination of U.S. trade, utilizing quarterly data, unveiled a lasting association between exports and imports, showcasing a persistent trend of convergence between U.S. exports and imports over time. In Syaparuddin's 2017 study, which utilized yearly data spanning from 1980 to 2015, it was evident that Indonesia's export and import patterns displayed striking similarities. These similarities strongly implied a causal relationship between the two variables, underscoring the mutual dependence of exports and imports in Indonesia. Based on these factors, the study analyzed the cointegration and causal relationship between exports and imports, which were crucial for enhancing employment opportunities, reducing poverty, and bolstering the economies of all developing and developed countries in the ASEAN region.

1.2 Objectives of the Study

The objectives of the study are

1) To describe the situations of the export and import of ASEAN countries.
2) To investigate the causal relationship between export and import in ASEAN countries.

1.3 Method of Study

Firstly, descriptive analysis was employed to examine the export and import situation of ASEAN countries. Secondly, unit root tests were applied to determine the stationary and non-stationary nature of export and import series of ASEAN countries. Subsequently, the Johansen Cointegration test was utilized to establish the presence or absence of cointegration. Finally, the Vector Error Correction Model (VECM) and Vector Autoregressive (VAR) Model were used to investigate whether a causal relationship existed between the export and import of ASEAN countries.

1.4 Scope and Limitations of the Study

This study utilized secondary data for the export and import series of ASEAN countries. The secondary data were obtained from the United Nation Data Base spanning the years 1970 to 2021. Each country used annual data on export and import (in US$).

1.5 Organization of the Study

This thesis consists of six chapters. Chapter I presents introduction, rationale of the study, objectives of the study, method of study, scope, and limitations of the study. Chapter II reports the trade performance of ASEAN countries. Chapter III presents the literature review on the theoretical background and previous studies on import and export. Chapter IV explains the research methodology. Chapter V focuses on presenting the results and findings, while Chapter VI covers conclusion, findings and discussions, suggestions and recommendations, and the needs for further studies.

CHAPTER II
TRADE PERFORMANCE OF ASEAN COUNTRIES

2.1 International Trade

The exchange of goods or services through barter has been a practice throughout human history, but international trade specifically involves trade between individuals from different nations. The formal accounts and explanations of international trade largely emerged with the rise of the modern nation-state, which happened at the end of the European Middle Ages. As political thinkers and philosophers delved into understanding the concept and role of the nation, trade with foreign countries became a significant subject of their examination. One of the earliest endeavors to define the function of international trade can be found within the framework of mercantilism, a highly nationalistic school of thought. Mercantilism focused on the idea that a nation's wealth and power could be increased through policies that encouraged the accumulation of precious metals, exportation of goods, and importation of as little as possible. This perspective played a pivotal role in shaping early theories and practices of international trade (Britannica, 2023).

Importation and exportation are crucial financial transactions in international trade, involving the movement of goods between countries. These activities are regulated by import quotas and customs mandates. Importing and exporting nations may impose tariffs on goods, and trade agreements between them further influence these processes.

Importation involves buying or obtaining products or services from foreign markets, providing access to goods that are lacking, scarce, expensive, or of low quality in the home country. This plays a vital role in a nation's economy by diversifying its product offerings. Additionally, tourist spending in foreign countries and direct purchases made by residents abroad are considered as import of services.

Customs declarations are the primary means of reporting international trade in goods, and goods stored in customs warehouses may not be included in trade statistics unless they enter the domestic market. Among the items commonly traded are consumer goods such as television sets and clothing; capital goods such as machinery; and raw materials and food. Other transactions involve services, such as travel services and payments for foreign patents. International trade transactions are facilitated by international financial payments, in which the private banking system and the central banks of the trading nations play important roles. International trade and the accompanying financial transactions are generally conducted for the purpose of providing a nation with commodities it lacks in exchange for those that it produces in abundance. Such transactions, functioning with other economic policies, tend to improve a nation’s standard of living. Much of the modern history of international relations concerns efforts to promote freer trade between nations (Britannica, 2023).

2.2 Role of Export and Import

In an open economy, the role of export and import is crucial for countries, especially for many developing countries in Asia. Challenges in increasing export values often stem from the dominance of primary commodities in the export sector, with weaknesses associated with plantation and mining. Conversely, imported industrial products, processed with advanced technology and higher value, create a disparity. Exports are seen as income, while imports are viewed as expenditure, where an increase in export value can support import financing.

Export contributes to a country's income flow and is essential for broadening market opportunities. Export processes involve addressing financial matters, adapting products to meet local demand, researching foreign markets, and overcoming trade barriers. On the other hand, import helps access goods that cannot be produced domestically and cost-effectively. Free trade agreements and reliance on import from countries with lower labor costs can lead to a decline in manufacturing jobs domestically, which has been notable in recent years, exacerbated by economic crises.

In international trade, an export refers to a product or service produced in one country and sold to another, with the seller as the exporter and the foreign buyer as the importer. International trade covers various services and goods, including financial, professional, tourism, education, and intellectual property services. Exporting goods typically involve navigating customs authorities.

Import can be classified into two primary categories: industrial and consumer goods, and intermediate goods and services. Companies engage in importing for reasons of cost-efficiency, improved quality, and access to products not available locally. Importers can be broadly grouped into three categories: those who import for global resale, those seeking cost-effective foreign sourcing, and those integrating foreign sourcing into their global supply chain.

Direct import is a business model where major retailers purchase products directly from foreign manufacturers, bypassing local suppliers. Statistical data on import, including product details and quantities, are typically available from international, supranational, and national statistical agencies.

The responsibilities for importation and customs duties fall on the importer of record, who can be the goods' owner, the buyer, or a licensed customs broker. In macroeconomic theory, the value of import is influenced by two key factors: domestic spending on all goods and services and the real exchange rate. Both of these factors contribute positively to import. In simpler terms, an increased domestic spending and a favorable exchange rate result in higher levels of import.

A country demands import when the global market price of goods or services is lower than the domestic market price. The balance of trade reflects the difference between a country's export and import, leading to a trade deficit when import surpasses export. The level of import is primarily influenced by a country's income and its productive capacity. In the context of the US importing oil from Canada, the trade occurs because US consumers are willing to pay more for oil due to higher demand than what Canada can produce domestically. This highlights the importance of demand in international trade. Trade barriers encompass laws, regulations, policies, or practices that protect domestically produced items from foreign competition. The most common forms of trade barriers are government-imposed measures and policies that limit or obstruct the international exchange of goods and services, with the aim of safeguarding domestic industries.

2.3 Trade Performance of ASEAN Countries

This section discusses the performance of export and import of each ASEAN countries.

Trade plays a pivotal role in the Association of Southeast Asian Nations (ASEAN), which is a regional intergovernmental organization comprising ten member countries in Southeast Asia. The role of trade in ASEAN encompasses several key aspects such as economic growth and development, intra-ASEAN trade, trade agreements, export opportunities, Foreign Direct Investment (FDI), integration into global supply chains, diversity of industries, challenges, and opportunities.

Overall, trade is a fundamental driver of economic development, regional integration, and global engagement for ASEAN. The organization continues to work on initiatives that promote trade, reduce trade barriers, and strengthen economic ties among its member states and with the broader global community.

2.3.1 Brunei

Brunei is situated on the island of Borneo, bordered by the South China Sea to the north and Sarawak, Malaysia, to the east, west, and south. It has a well-developed and high-income economy, primarily due to its abundant reserves of oil and natural gas. The energy sector dominates the economy, accounting for a significant portion of the country's GDP and government revenue. Therefore, Trade in Brunei is mainly based on the export of oil and gas, which account for most of its economy and income. However, Brunei also imports various products, such as crude petroleum, cars, packaged medicaments, and coal briquettes. Brunei also participates in several trade agreements with its regional and external partners, such as ASEAN, China, Japan, Korea, India, Australia, New Zealand, and Hong Kong.

The Brunei government's trade policy aims to create a favorable environment for trade and investment, discover market opportunities for Brunei’s businesses, boost economic activities, reduce dependence on oil and gas, and maximize the benefits of participating in international and regional forums. Free Trade Agreements (FTAs) with key trading partners can help to facilitate trade liberalization and strengthen trade links. Brunei Darussalam's foreign trade policy centers around the following key principles: the pursuit of open trade within the framework of multilateral trade regulations, advocating for an open, rule-based, and fair multilateral trading system, and acknowledging the importance of "open regionalism" as a stepping stone toward broader multilateral trade liberalization.

in 2021, Brunei ranked as the 91st largest economy globally in terms of total exports and the 119th largest in total imports. during that year, Singapore emerged as Brunei Darussalam’s most significant trading partner, accounting for 21.4% of its exports and 8.7% of its imports. China was the second most important trade partner, with 20.1% of Brunei Darussalam’s exports and 6.7% of its imports by value. Brunei’s primary exports included refined petroleum, petroleum gas, crude petroleum, cyclic hydrocarbons, and acyclic alcohols. these were primarily directed toward countries such as Singapore, China, Japan, Australia, and Malaysia. on the import side, Brunei's key imports encompassed crude petroleum, refined petroleum, cars, coal briquettes, and packaged medicaments. these imports were primarily sourced from Malaysia, Russia, Singapore, Saudi Arabia, and China (Ministry of Foreign Affair Brunei Darussalam).

2.3.2 Cambodia

Cambodia, officially the Kingdom of Cambodia, is a Southeast Asian nation with a rich history and a blend of ancient traditions and modern developments Cambodia's economy is heavily reliant on exports of clothing, footwear, agricultural goods, and tourism services. These sectors play a pivotal role in the country's income. In contrast, Cambodia imports various products, such as petroleum, machinery, automobiles, electrical equipment, and pharmaceuticals. The nation actively participates in multiple trade agreements with regional and international partners, including ASEAN, China, Japan, South Korea, India, Australia, New Zealand, and Hong Kong.

In 2021, Cambodia experienced a negative trade balance, indicating higher imports than exports. However, this deficit was primarily influenced by the substantial value of gold imports, mainly serving as reserve assets for the central bank rather than reflecting the domestic gold market demand. In response, Cambodia has been focusing on enhancing its export competitiveness and broadening its export markets. To achieve this, the country is prioritizing the development of various sectors, including manufacturing, construction, agriculture, forestry, fishing, and services.

In 2021, Cambodia's economic statistics were as follows: It ranked as the 101st largest economy worldwide in terms of GDP (current US$), the 69th in total exports, the 61st in total imports, the 149th in GDP per capita (current US$), and the 92nd most complex economy according to the Economic Complexity Index (ECI). Cambodia's primary exports included knit sweaters, trunks and cases, knit women's suits, non-knit women's suits, and leather footwear. The key export destinations were the United States, China, Germany, Vietnam, and Japan.

On the import side, Cambodia's main imports comprised gold, refined petroleum, light rubberized knitted fabric, bi-wheel vehicle parts, and cars. These imports were primarily sourced from China, Singapore, Thailand, Vietnam, and Hong Kong (Britannica,2021).

2.3.3 Indonesia

Indonesia, the world's largest island country situated in Southeast Asia, boasts a diverse cultural heritage, abundant natural resources, and a rapidly growing economy. Trade in Indonesia is mainly based on the export of natural resources, agricultural products, manufactured goods, and services, which form the backbone of its economy and income. Simultaneously, the country imports a variety of products, including petroleum items, machinery, vehicles, electrical equipment, and pharmaceuticals. Indonesia actively engages in multiple trade agreements with regional and international partners, including ASEAN, China, Japan, Korea, India, Australia, New Zealand, and Hong Kong.

Indonesia's primary exports included coal briquettes, palm oil, petroleum gas ferro alloys, and large flat-rolled stainless steel. These were predominantly shipped to China, the United States, Japan, India, and Singapore. On the import side, Indonesia's key imports featured refined petroleum, crude petroleum, petroleum gas, vaccines, blood, antisera, toxins, and cultures, and motor vehicles; parts and accessories. These imports were primarily sourced from China, Singapore, Japan, the United States, and Malaysia (World’s Top Export).

In 2021, Indonesia recorded a positive trade balance, exporting more than it imported. However, this surplus was largely driven by high-value natural resource exports, which are susceptible to market fluctuations and price volatility. In response, Indonesia is working to diversify its economy and reduce reliance on a single commodity by promoting other sectors like manufacturing, construction, agriculture, forestry, fishing, and services. Indonesia's economic performance, as per the World Bank, ranked as follows: it was the 16th largest economy in the world by GDP (current US$), the 27th in total exports, the 30th in total imports, the 111st in terms of GDP per capita (current US$), and the 61st most complex economy based on the Economic Complexity Index (ECI).

2.3.4 Laos

Laos, officially the Laos People's Democratic Republic, is a landlocked nation in Southeast Asia, celebrated for its picturesque landscapes, cultural diversity, and rich history. As of 2021, Laos had a GDP of approximately $19.6 billion. Laos primarily engages in trade by exporting electricity, gold, copper, rubber, and various natural resources to neighboring countries, particularly China, Thailand, and

Vietnam. In return, Laos imports refined petroleum, gold, cars, broadcasting equipment, and other manufactured goods from these neighboring nations. Notably, Laos has been a member of the World Trade Organization (WTO) since 2013 and the ASEAN Economic Community (AEC) since 2015, leading to significant economic policy reforms and regulatory improvements, with the aim of enhancing the business and investment environment.

In 2021, Laos had a total trade volume of around $13 billion, with $7 billion in exports and $6 billion in imports. For the year, Laos maintained a trade surplus of $1 billion. In 2021, Laos ranked 112nd in global GDP (current US$), 101st in total exports, 121st in total imports, 132nd in GDP per capita (current US$), and 95th in economic complexity according to the Economic Complexity Index (ECI).

Laos' major import partners in 2021 included Thailand, China, Vietnam, the USA, Switzerland, Japan, Australia, Singapore, and Korea. The primary exports in 2021 consisted of Electricity, Gold, Other Uncoated Paper, Copper Ore, and Rubber, with Thailand, China, Vietnam, Australia, and Switzerland being the main export destinations. Laos' primary imports for the year included Refined Petroleum, Cars, Broadcasting Equipment, and Delivery Trucks, with Thailand, China, Vietnam, Switzerland, and Japan as the primary sources of these imports.

While the United States isn't a major trading partner for Laos, bilateral trade between the two nations has increased since the United States-Laos Bilateral Trade Agreement (BTA) took effect in 2005. In 2021, Laos imported goods worth $33.5 million from the United States and exported products valued at $218.4 million to the United States. The primary U.S. exports to Laos included civilian aircraft (engines, equipment, and parts), pulpwood, passenger cars, rice, plastic materials, gems and diamonds, industrial machinery and equipment, and measuring, testing, and controlling instruments.

2.3.5 Malaysia

Malaysia, located in the southeastern region of Asia, encompasses both the Malay Peninsula in mainland Southeast Asia and the island of Borneo. It shares land borders with Thailand, Indonesia, and Brunei, and has maritime boundaries with Vietnam and the Philippines. Malaysia's strategic location in the heart of Southeast Asia, rich cultural diversity, stunning natural landscapes, and notable landmarks contribute to its popularity as a tourist destination and its significance in the economic and cultural dynamics of the region.

During the 1970s, Malaysia implemented an export-focused strategy to stimulate economic growth, mainly relying on natural resource exports like rubber, palm oil, and tin while expanding the industrial sector with a focus on textiles, electronics, and manufacturing. In the 1980s, Malaysia broadened its export horizons by diversifying trade partners, particularly with the United States, Japan, and the European Union. The electronics sector gained prominence, setting the stage for Malaysia's future as a manufacturing and technology hub. In the 1990s, Malaysia continued its industrialization, with electronics and semiconductors becoming key exports, attracting foreign investment and multinational corporations due to pro-business policies.

The 2000s saw Malaysia actively engage in regional and bilateral trade agreements, including AFTA and ACFTA within the ASEAN region and strengthening economic cooperation with Japan through the Malaysia-Japan Economic Partnership Agreement. By the 2010s, Malaysia shifted its focus towards emerging markets in Asia and the Middle East, diversifying its exports, including petroleum and liquefied natural gas. Malaysia became an integral part of global supply chains, notably in electronics and technology, with numerous multinational corporations establishing operations in the country.

In 2021, Malaysia's primary export destinations were China, Singapore, the United States, Japan, Thailand, and South Korea, while its primary import partners were China, Singapore, Japan, the United States, Thailand, and South Korea. Malaysia's top export commodities for the same year consisted of electronics and electrical products, palm oil, petroleum and petroleum products, chemicals, rubber, and machinery and equipment. On the import side, Malaysia's key commodities included machinery and equipment, petroleum and petroleum products, electronics, chemicals, and plastics.

However, the COVID-19 pandemic in 2020 presented significant challenges, disrupting global supply chains and reducing trade, impacting various industries, including manufacturing and tourism. Despite these challenges, Malaysia actively promoted its digital economy and e-commerce, with substantial growth in cross-border trade of digital goods and technology-related products. Throughout this period, Malaysia remained actively engaged in trade negotiations and agreements, such as the CPTPP (Comprehensive and Progressive Agreement for Trans-Pacific Partnership), aligning itself with the global trading community. In summary, Malaysia's trade history has transitioned from a reliance on commodities to a diverse economy focused on manufacturing, services, and global supply chains, with a growing emphasis on the digital economy.

2.3.6 Myanmar

Myanmar is located at the main crossroad connecting China, India, and Southeast Asia, and is located on a major trade route that can lead to a successful market with large market potential that integrates the international. In the early 16th century, Burmese kings was traded with Southeast Asian countries and exported rice to European countries. In the early 1850s, after the British acquisition Lower Burma, Upper Burma controlled overseas trade and practiced an open trade policy. In 1869, the inland waterway Suez was opened, and Myanmar participated in international trade and the world's largest export of rice. The overall trade flow between Southeast Asian countries and Myanmar is comparable during this period. In 1886, the British seized over the country and established a balanced economy with unlimited trade. In 1962, the Burmese government started import substitution industry to attract foreign investment. The military government followed a policy of a socialist economic system from 1962 to 1988. In March 1989, the leaders boldly declared the government's intention to shift the economy from socialism to free market capitalism. After 1988, Myanmar Economic reforms were implemented by relaxing international trade rules and regulations.

Since 1988, India and Bangladesh are becoming more and more important for Myanmar's exports and China is increasingly important for Myanmar's imports. The sources of major import for Myanmar in its trade have been China and Thailand and it has developed continuous trade deficits with these countries. Even while exports from Myanmar to China are declining, imports from China to Myanmar are gradually increasing. Import export data refers to the information about the goods and services that are traded between different countries. In addition, in the 1990s, the US government-imposed trade barriers, strong sanctions were imposed on Myanmar through a variety of legislative and policy measures, including tariffs and financial restrictions. Myanmar joined the General Agreement on Tariffs and Trade in 1948 and January 1, 1995, it became World Trade Organization (WTO)’s member. Then, according to World Bank data, Myanmar was included in the 2000 list of world trade openness.

Myanmar has a history of established international relations and is a member of several prominent multilateral organizations. These include the World Trade Organization (formerly known as GATT) since 1995, the International Labor Organization (ILO) since its independence, ASEAN since 1997, and the Bay of Bengal Initiative for Multi-Sectorial Technical and Economic Cooperation (BIMSTEC) since the late 1990s. In addition, Myanmar has border trade agreement with China, India, Bangladesh, Thailand and Laos (Lin,2020). This participation reflects Myanmar's engagement in global and regional affairs and its commitment to cooperation on economic, labor, and geopolitical issues.

The Asian countries that trade the most with Myanmar are China, Singapore, Thailand, Japan, India, Indonesia, Malaysia, Vietnam, Hong Kong, Philippines, Bangladesh and South Korea. Oil and natural gas are main export of Myanmar. Other exports include vegetables, wood, fish, clothing, rubber and fruits. Myanmar's main export partners are China, India, Japan, South Korea, Germany, Indonesia and Hong Kong.

Myanmar mainly imports fuel, vegetable oil, vehicles, pharmaceutical products, construction equipment, polymers, tires and machinery. Myanmar's main import partners are China, Japan, India, Indonesia, Germany, France and Hong Kong. Priority will be given to other important products that support public health and export promotion. Most of the fundamental factors to development, such as capital goods, raw materials and technical know-how, are imported due to insufficient domestic supply.

Therefore, trade plays a big role for developing countries like Myanmar. Myanmar’s exported commodities are at low prices, while imported manufacturing and investment goods are at high prices. Myanmar's trade value is showing a deficit in some years.

2.3.7 Philippines

The Philippines is an archipelagic country in Southeast Asia known for its stunning natural beauty, rich cultural heritage, and diverse population. The Philippines has a diverse economy with sectors including agriculture, manufacturing, services, and a growing Information Technology and Business Process Outsourcing

(IT-BPO) industry. The remittances of Overseas Filipino Workers (OFWs) play a significant role in the country's economy.

In 1979 the government signed the General Agreement on Tariffs and Trade (GATT) rather than renewing a preferential trade agreement with the United States that had ultimately hindered Philippines economic development. The Philippines has been a member of the World Trade Organization (WTO) since 1995 and the ASEAN Economic Community (AEC) since 2015, which have facilitated trade liberalization and integration with regional and global markets. The Philippines' trade is mainly influenced by its strategic location, natural resources, and historical ties with other countries, especially the United States, Japan, China, and the ASEAN members.

The Philippines exports various products such as electronic products, machinery and transport equipment, coconut oil, fruits and nuts, copper, gold, and other minerals to its trading partners. The Philippines also imports petroleum products, electronic products, transport equipment, iron and steel, cereals, chemicals, and other manufactured goods from its trading partners. Although the United States and Japan have continued to be the Philippines' top trading partners, a number of new markets have been emerging, especially in China, Singapore, and other countries of East and Southeast Asia. The Philippines' principal exports include electronic equipment, garments and accessories, coconuts and coconut products, and minerals (copper, gold, and iron ore). The principal imports are machinery and transport equipment, fuels, chemicals and chemical products, and food (World Integrated Trade Solution,2021).

2.3.8 Singapore

Singapore is a small but highly developed city-state and island country located in Southeast Asia. Known for its modern skyline, vibrant economy, and efficient infrastructure, Singapore is often referred to as the "Lion City." Singapore boasts a highly developed and diverse economy. Situated at the crossroads of major shipping lanes, Singapore is a prominent trading hub in Asia. It is a major global financial hub and one of the world's busiest ports. The country's strategic location and business-friendly policies have made it a favored destination for multinational corporations.

Key economic sectors include finance, trade, manufacturing, and technology. Singapore's economic and strategic role in ASEAN and trading partnership with

China make it the top destination for Chinese businesses. As a major trading and financial hub, Singapore has the infrastructure and expertise that Chinese corporates need to effectively access other ASEAN markets. The country's stable tax, legal and regulatory systems and business-friendly environment make it easier to do business here. With top notch infrastructure and services, and a highly capable workforce, Singapore offers an excellent base to expand into the rest of ASEAN. It is Asia Pacific's largest foreign exchange center and manages two-thirds of all project financing in ASEAN. It plays a crucial role in connecting China with Southeast Asia, serving as a major offshore clearing center for the renminbi and facilitating global inflows from ASEAN markets. Its central role in ASEAN, combined with its economic partnership with China, makes it the central hub for commercial activity in the region, offering valuable opportunities for regional expansion. The two countries are working together to build trading routes across Asia and are cooperating in infrastructure, financial services, transportation and logistics among key areas.

Singapore's trade is mainly composed of two types: domestic exports and re-exports. Domestic exports refer to goods that are produced or have undergone substantial transformation in Singapore, while re-exports refer to goods that are transshipped through Singapore without undergoing any significant change. In 2021, domestic exports accounted for $199.2 billion or 43.5% of total exports, while re-exports accounted for $377 billion or 82.4% of total exports. The main domestic export products were electronic products, machinery and transport equipment, chemicals and chemical products, and miscellaneous manufactured articles. The main re-export products were electronic products, machinery and transport equipment, miscellaneous manufactured articles, and chemicals and chemical products. The 5 most valuable countries in terms of buying products exported by Singapore are mainland China, Hong Kong, Malaysia, United States of America, and Indonesia. Collectively, that powerful cohort that comprise Singapore's top 5 import customers accounted for almost half (49.7%) of overall Singaporean revenues from export sales. Singapore of major trading partners are mainland China, Hong Kong, Malaysia, United States, Indonesia, Taiwan, South Korea, Japan, Thailand and Vietnam (World Integrated Trade Solution, 2021).

2.3.9 Thailand

Thailand, officially known as the Kingdom of Thailand, is a country in Southeast Asia with a rich history, diverse culture, and abundant natural beauty. Thailand has a diverse and export-oriented economy. Key sectors include agriculture, manufacturing, tourism, and services. The country is one of the world's largest exporters of rice, textiles, and automobiles. Thailand's trade policy is based on free trade and multilateralism, as well as regional and bilateral agreements with its key trading partners. In the 1990s Thailand's trade deficit grew markedly until the last part of the decade, when a trade surplus was achieved largely as a result of a contraction in imports. Foreign debt declined until the last part of the decade, when it jumped substantially, peaking in 2000, before beginning a descent in the early 21st century.

The country's main trading partners are Japan, the United States, China, Singapore, and Malaysia. The most important import categories by value are machinery, chemicals and related products, petroleum, iron, steel, and other metals, and raw materials of various types. Machinery is also an important manufactured export, along with chemicals and chemical products, telecommunications equipment, road vehicles, and clothing and accessories. The United States is among Thailand's largest export markets, and Japan is among the country's biggest sources of import.

In 2021, Thailand was the number 24 economy in the world in terms of GDP (current US$), the number 25 in total export, the number 23 in total import, the number 84 economy in terms of GDP per capita (current US$) and the number 29 most complex economy according to the Economic Complexity Index (ECI). The top export of Thailand is Office Machine Parts, Integrated Circuits, Cars, Delivery Trucks, and Motor vehicles; parts and accessories, exporting mostly to United States, China, Japan, Vietnam, and Australia. The top import of Thailand is Crude Petroleum, Integrated Circuits, Gold, Petroleum Gas, and Motor vehicles; parts and accessories, importing mostly from China, Japan, Malaysia, United States, and United Arab Emirates (OEC, 2021).

2.3.10 Vietnam

Vietnam, officially known as the Socialist Republic of Vietnam, is a Southeast Asian country with a rich history, breathtaking natural landscapes, and a distinctive cultural heritage. After thousands of years of building and protecting the country, Vietnam has earned global recognition for its exquisite natural scenery, including several UNESCO World Heritage Sites. Its people are known for their friendliness and eagerness to learn, leading to remarkable socio-economic development achievements over the past three decades.

After the Vietnam War and reunification, both parts of Vietnam experienced trade deficits, which were exacerbated by a trade embargo, low export efficiency, and poor-quality control. During the first decade following reunification, the value of exports was only a third of imports, and the Soviet Union and Eastern European countries were significant trading partners. In the late 1980s and early 1990s, Vietnam shifted its focus to Asia and urgently expanded its trade relations.

Through many trade agreements with major regional and international trading partners, Vietnam is expected to continue to promote trade and GDP growth in the future. It became a member of ASEAN in 1995, and major trading partners included Singapore, Japan, China, South Korea, and Taiwan. A trade agreement in 2001 made the United States a primary export destination. Aggressive economic reforms boosted exports, but rapid industrialization, driven by foreign direct investment, led to a growing trade deficit. In 2001, Vietnam opened its state markets to foreign competition, and in 2007, it became a member of the World Trade Organization (WTO), which had a positive impact on its economy. Export revenues primarily come from crude petroleum, garments, footwear, seafood, and electronic products. Coffee regained importance as an export commodity in the late 20th century.

In the late 2000s, Vietnam's export-focused strategy was a major driver of its economic growth, significantly boosting the country's GDP. The government actively encouraged policies to promote exports and attract foreign investment, especially in labor-intensive sectors like textiles, electronics, and manufacturing. Key exports during this period included textiles, clothing, footwear, electronics, and agricultural products like rice, coffee, seafood, and crude oil, enabling Vietnam to access global markets, earn foreign currency, and support its economic development.

In terms of its sources for imports, Vietnam primarily relies on Asian countries, accounting for 82.1% of its total imports. Europe contributes 6.6%, while North America supplies 5%. Australia and New Zealand from Oceania contribute 2.63%, Latin American countries (excluding Mexico but including the Caribbean) make up 2.56%, and Africa provides 1.1% of Vietnam's imports. Vietnam’s imports consist of machinery, petroleum products, iron, steel, garments, and leather to support its industrial sector. The majority of Vietnam's imports countries are originated from the following countries: Vietnam's total imports are comprised of contributions from various countries, with Mainland China accounting for 33.2%, South Korea supplying 17%, Japan contributing 6.8%, Taiwan providing 6.3%, and the United States of America making up 4.6%. Additionally, Thailand contributes 3.8%, while Malaysia accounts for 2.5% (World Top Export,2022).

Vietnam also expanded its trade relations with emerging economies across Asia, the Middle East, and Africa, while China remained a significant trading partner. To strengthen its export capacity, Vietnam pursued trade agreements within ASEAN and with regional partners such as China. However, the global financial crisis of 2007-2008 had a notable impact, leading to reduced demand in Western markets and a trade deficit, particularly affecting the textile and electronics sectors. In response, Vietnam shifted its focus toward higher-tech exports to move up the value chain and reduce reliance on labor-intensive industries. The government introduced trade facilitation measures and trade policy liberalization, simplifying customs procedures and promoting foreign investment through export processing zones and industrial parks. Trade was supported through institutions like the Export-Import Bank (Exim bank), which provided financial assistance and trade credit insurance to mitigate international trade risks. Foreign Direct Investment (FDI) played a significant role, with foreign companies investing in Vietnam, often using it as a manufacturing base for exports, contributing to export growth and the transfer of technology and expertise to Vietnam. Vietnam became an integral part of the global supply chain, particularly in industries like electronics, where it supplied components and intermediate goods to major global manufacturers (Vietnam Trade Information Portal).

CHAPTER III
LITERATURE REVIEW

This chapter discusses the research works done by various scholars on the topic related to trade. It is divided into two sections, the first presents the review of theories and methodologies, and the second section deals empirical findings.

3.1 Theory of Export and Import

Export-base theory is a theory that argues that an economy is divided into two sectors; export or basic sector and the non-export or non-basic sector. The export or basic sector is the portion of the local economy that trades with firms outside the local region. The theory is grounded in the idea that a local economy must increase its monetary inflow if it is to grow and the only effective way to increase monetary inflow is to increase export (Kimbugwe et al. 2017*)*.

The import-export theory, also called the factor proportions theory, states that countries should ideally export materials and resources of which they have an excess, while proportionately importing those resources they need. Import-export theory is a branch of economics that studies the effects of international trade on countries and regions. There are different models and perspectives on how trade affects the production, consumption, and distribution of goods and services. The theory states that countries would produce and export goods that required resources or factors that were in great supply and, therefore, cheaper production factors. In contrast, countries would import goods that required resources that were in short supply, but higher demand.

Over the past two decades, the performance of economies that prioritize export has garnered considerable interest from both policymakers and researchers. This focus stems from the belief that fostering a robust export industry can serve as a viable means to stimulate growth in developing economies. Actively engaging in export activities involves the conversion of domestic resources into products that cater to the demands of both international and local markets. Furthermore, it exerts a direct influence on the overall macroeconomic landscape, contributing as a vital component of GDP. The entrance of firms into foreign markets not only enables these entities to harness economies of scale in production but also typically results in heightened levels of innovation, increased capital formation, and expanded employment opportunities.

3.2 Preceding Evidences for Methodology

When formulating models with time-series variables, one must be concerned with the stability properties of the variables. The presence of a unit root in a time series has significant implications for econometric analysis. If a unit root exists, it can lead to spurious regressions, where relationships between variables appear significant but are actually meaningless. Testing for unit roots is a crucial step in time series analysis. There are tests such as Augmented Dickey-Fuller (ADF), the Phillips-Perron (PP), and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) to identify unit roots.

Yule (1926) first introduced and examined the concept of spurious, or meaningless, regression. Prior to the 1980s, numerous economists applied linear regression to non-stationary time series data, a method that Nobel laureates Clive Granger and Paul Newbold revealed to be problematic, as it could generate spurious correlations. This issue persisted because common detrending techniques sometimes left the data still non-stationary. In 1987, Clive Granger, in collaboration with Robert Engle, formalized the cointegrating vector approach and coined the term. The Johansen test is employed to detect cointegration and can accommodate multiple cointegrating relationships, in contrast to the Engle-Granger method. However, it is important to note that the Johansen test relies on asymptotic properties, meaning it is most suitable for large samples. When dealing with smaller sample sizes, the results may lack reliability, and in such cases, it is advisable to opt for the Auto Regressive Distributed Lags (ARDL) method.

Error terms in a model arise when the model is not perfectly accurate, leading to variations in real-world outcomes. Serial correlation occurs when these error terms from different time periods are correlated, meaning that errors from one period affect future periods in time-series studies. The Breusch-Godfrey LM test is a tool used to assess autocorrelation in the residuals of a linear regression model. It offers an advantage over the classical Durbin-Watson D test because it is less sensitive to the assumption that the distribution of residuals follows a normal distribution, which the Durbin-Watson test relies on. Additionally, the LM test is valuable for detecting higher-order autocorrelation, a capability the Durbin-Watson test lack. Removing serial correlation is a crucial step in improving the accuracy and reliability of a statistical model.

The Vector Auto-Regressive (VAR) integrated model is a useful forecasting tool for multiple time series. VAR models require stationary data. To address this, it is required to test cointegration using Johansen's methods. This implies that only cointegrated variables can be used in a model that is expressed in levels of the variables. However, if the variables are not cointegrated, any model involving these variables should be stated in their first differences. If cointegration is present, that can use a Vector Error Correction Model (VECM) to capture both short-term dynamics and long-term relationships. If the two variables export, and import were found to be first-order integrated, I (1), and cointegrated, a VEC model was formulated and estimated. Causality tests are performed on the basis of the estimated VEC model. Deciding between VAR and VECM depends on the analysis specific data and objectives, and testing their performance is crucial for choosing the right approach (Maitra, 2019).

3.3 Previous Studies on Long-Run Relationship between Export and Import

This section provides analysis of specific studies done with regards to trade, based on the statistical methods backed with evidences and related findings.

Bahmani-Oskooee (1994) investigated the enduring relationship between export and import within the Australian economy. The data were obtained from 1960 to 1992 from various editions of the International Financial Statistics (IFS) published by the International Monetary Fund. This analysis used cointegration techniques to establish a long-term connection between these variables and further indicated the effectiveness of macroeconomic policies during the specified period. The application of cointegration techniques revealed that Australian import and export are indeed cointegrated, with cointegrating coefficients very close to unity, indicating that Australia's macroeconomic policies have been effective in the long run.

Zestos and Tao (2002) described the causal relations between trade and GDP growth in the United States and Canada. They created a dataset containing real variables, including export, import, and GDP for each country, comprising 49 observations spanning from 1948 to 1996. The analyzing used the vector error correction (VEC) model to investigate causal relations between the growth rates of export, import, and the GDP of both countries. Granger causality tests were conducted using annual time-series data from 1948 to 1996, as part of the VEC model framework. Bidirectional causality was found for Canada, indicating a causal relationship between the foreign sector and GDP, and vice versa. In the case of the United States, a weaker relationship between the foreign sector and GDP was statistically supported. These findings were further substantiated by comparing the total trade (export plus import) shares relative to the GDP of the two neighboring economies. The Granger causality tests implied that Canada has a higher degree of openness and trade dependency compared to the United States.

Michelis and Zestos (2004) studied causal relations of export, import, and GDP growth in six European Union countries, specifically Belgium, France, Germany, Greece, Italy, and the Netherlands. The study utilized annual time series data spanning from the 1950s to the 1990s, focusing on each country's real export, real import, and real GDP. The data set was obtained from the IFS CD-ROM of the IMF. In this analysis, it was found that the three variables exhibited first-order integration and were cointegrated. The research employed a Vector Error Correction Model (VECM) for estimation. Granger causality tests were then conducted within the context of the estimated VECM. In most countries, there was strong evidence of bidirectional causality between GDP and both export and import, with the exception of the Netherlands.

Irandoust and Ericsson (2004) examined the presence of a cointegrating relationship between export and import in several developed economies, including Germany, Sweden, the US, and the UK. The data were quarterly and covered the period data series (1971-1995), sourced from various issues of the IMF International Financial Statistics. The study discovered a cointegrating relationship between Germany, Sweden, and the US, indicating a lasting connection between their import and export that did not breach international budget limits. However, no such enduring association was found in the UK. The authors also raised policy questions about this absence of a long-term link between export and import in the UK, emphasizing potential productivity gap issues. They concluded that trade imbalances were mainly short-term occurrences and that the macroeconomic policies in these countries had successfully brought import and export into long-term balance.

Keong et al. (2004) explored the long-term relationship between export and import in Malaysia. Annual data were used for the 1959–2000 period, and the data were collected from the International Financial Statistics published by the

International Monetary Fund (IMF). The main finding of this study was that short-term fluctuations in Malaysia's import and export were not sustainable. Instead, it indicated that import and export would eventually move toward a long-term equilibrium, showing a cointegrating relationship between these economic variables in Malaysia.

Afzal (2008) used the Engle-Granger cointegration test to investigate and compare the long-term performance of import and export in five countries: Pakistan, India, Sri Lanka, Korea, and Thailand. The graphical analysis consistently showed that import and export moved together for extended periods. The cointegration and error correction analyses conducted further confirmed this observation, indicating that, on average, these countries did not deviate significantly from the international budget constraint over the long run.

Uddin (2009) analyzed the time series behavior of import and export in Bangladesh, providing evidence from cointegration analysis and an error correction model. The study used yearly time series data on nominal import and export values from 1972-1973 to 2007-2008, and the data were obtained from Bangladesh Bank and the Ministry of Finance. The Johansen cointegration test indicated a long-term equilibrium relationship between these two variables. Through error-correction mechanism analysis, the study identified bidirectional long-term causality and unidirectional short-term causality between Bangladesh's import and export.

Mukhtar and Rasheed (2010) identified the long-term convergence of export and import in Pakistan's economy using cointegration analysis. The analysis used data spanning the period from 1972 to 2004. The findings indicated that both export and import converged toward an equilibrium state in the long run, affirming the effectiveness of macroeconomic policies. This implies that macroeconomic policies have effectively brought import and export into long-term equilibrium, making trade imbalances a short-term phenomenon that can be sustained over time.

Hye and Siddiqui (2010) described whether import and export were cointegrated in Pakistan. Quarterly data spanning from 1985 to 2008 was utilized from the International Financial Statistics (IFS), with both export and import measured in millions of rupees at current prices. The findings indicated that import did not drive export. Instead, export had a significant influence on import. The cointegration analysis reveals that import impacts export starting from 2003, while export affects import between 1994 and 2004.

Sonje et al. (2010) studied a long-run relationship between export and import in Transition European Countries and utilized quarterly data spanning various years from the 1990s to 2006, sourced from the International Monetary Fund International Financial Statistics CD-ROM. The researchers employed the Johansen cointegration approach. The findings revealed that 10 out of the 16 countries under scrutiny, a sustained link between export and import existed. However, when considering specific criteria related to these long-term relationships, it became evident that only 5 of these nations could effectively maintain a current account deficit over an extended period.

Mukhtar and Rasheed (2010) found the relationship between import and export, utilizing cointegration analysis and vector error correction procedures. The authors worked with quarterly data for real export, real import, and the real exchange rate of Pakistan's economy, spanning from 1972 to 2006. This data was gathered from various sources, including the economic survey published by the government of Pakistan and the International Financial Statistics of the IMF. The study's results revealed that the export and import of Pakistan's economy were cointegrated, with no violation of the international budget constraint. The long-term relationship between the economy's export and import remained stable. Granger causality tests confirmed bidirectional causality between the variables.

Tiwari (2011) assessed whether India and China had cointegrated export and import from January 1992 to February 2010. The data were sourced from the OECD website. The results indicated that India could sustain its trade deficit, while China could not. This showed that India's macroeconomic policies successfully maintained a long-term balance between export and import. The study employed endogenous structural breaks in unit root and cointegration analysis to address potential issues with standard tests for stationarity and cointegration in the presence of structural breaks.

Ramakrishna and Sadeghi (2013) described the long-run relationship between export and import in the experience of India and Iran. The data for the study were collected from World Development Indicators (WDI) and Trade Map, IMF for the period 1970-2010. The data on export and import were in dollar terms and were transformed into their natural logarithms. The researchers investigated the long-term equilibrium and causal relationship between export and import in both countries using various empirical methods, finding that export and import were co-integrated and that short-term disequilibrium was annually corrected through export adjusting to import.

Ali (2013) investigated the long-term relationship between Pakistan's export and import. The data was obtained from the Economic Survey of Pakistan (2011-2012) released by the Ministry of Finance Pakistan, covering the period from 1972 to 2012. The author employed both the Engle and Granger (1987) and Johansen (1991, 1995) cointegration tests, which indicated the existence of a long-term relationship between export and import. The results obtained from the error correction model further illustrated that both variables tended to converge towards a long-term equilibrium. This finding underscored the effectiveness of macroeconomic policies in stabilizing Pakistan's international trade balance.

Mehta (2015) explored the relationship between India's GDP, export, and import by analyzing data from 1976 to 2014. The researcher employed statistical tools such as the ADF unit root test, Johansen cointegration analysis, and Vector Error Correction methods to explore long-term causality. The findings revealed stability in GDP, export, and import over time, which was supported by Augmented Dickey-Fuller unit root tests. Significantly, the research established a persistent cointegrating relationship among India's GDP, export, and import. Specifically, the study identified one-way causality, with GDP influencing export over time, while export did not reciprocally affect GDP. Conversely, no causality existed between GDP and import, indicating that GDP fluctuations did not significantly impact import levels, nor did import influence GDP. Additionally, the research uncovered one-way causality from export to import, showing that export played a significant role in shaping long-term import patterns. This research highlights the complex relationship among India's GDP, export, and import, stressing the importance of studying how these economic factors changed over time for a better understanding.

Saaed and Hussain (2015) investigated the impact of export and import on the economic growth of Tunisia for the period from 1977 to 2012. They employed the Johansen Cointegration approach and Granger causality test within the VECM framework. Their findings suggested a unidirectional causality between export and import, as well as between export and economic growth.

Alaoui (2015) analyzed the relationship between export, import, and economic growth using annual time series data for the Moroccan economy spanning from 1980 to 2013, by applying a cointegration approach and conducting a Granger causality test based on VECM. The cointegration results confirmed the existence of a long-term relationship among the variables studied. The Granger causality test revealed a long-term causality between export, import, and economic growth. Additionally, it demonstrated short-term causality between these variables.

Bakari and Mabrouki (2017) examined the impact of export and import on economic growth in Panama in Central America. They analyzed annual data obtained from World Development Indicator (WDI) for 1980-2015 and conducted the analysis using various statistical methods, including Johansen co-integration analysis, the Vector Auto Regression Model, and Granger-Causality tests. The analysis results suggested that there was no direct relationship between export, import, and economic growth in Panama. However, significant bidirectional causality was found, indicating that import contributed to economic growth, and export also played a crucial role in driving economic growth in the country. In essence, this study highlighted that both export and import were key contributors to Panama's economic growth.

Kalaitzi and Cleeve (2017) examined the causality between export and economic growth in the United Arab Emirates (UAE) over the period from 1981 to 2012. They employed the Johansen cointegration approach and Granger causality test under VECM. Their cointegration test revealed the existence of a long-term relationship between the variables studied. The results provided evidence supporting a bi-directional causality between export and economic growth in the short term, as well as economic growth causing export in the long term for the UAE.

Fannoun and Hassouneh (2019) explored the relationship between export, import, and economic growth in the Palestinian economy over the period 2000-2018, using quarterly data. The researcher applied cointegration tests using Johansen's approach and utilized the vector error correction technique. The findings confirmed the existence of a long-run equilibrium relationship between export, import, and output growth. The results also supported the presence of bidirectional long-run causality between export, import, and output growth. Concerning short-term causality, the findings provided support for both the export-led import and the import-led export hypotheses.

Turay (2020) investigated the relationship between export and economic growth in Sierra Leone. Data for this research was obtained from Sierra Leone's annual data from 1964 to 2017, as provided by World Bank Indicators. Over the years, it was observed that export and import made significant contributions to Sierra

Leone's economic growth. In the analysis, various statistical tools were employed, including the Augmented Dickey-Fuller Unit Root test, the Johansen Cointegration test, the Vector Autoregression model, and the Pairwise Granger Causality test. The Augmented Dickey-Fuller unit root test results indicated the existence of stationarity at the first difference. However, the cointegration test results revealed that there was no significant relationship between export, import, and economic growth. In contrast, the Vector Autoregressive (VAR) Model test revealed that export had a positive effect on economic growth, while import had a negative impact on the country's economic growth over the years. The Pairwise Granger Causality test showed that both export and import influenced Sierra Leone's GDP. However, it was found that GDP did not have any influence on the import and export of goods.

It is noteworthy that, despite previous attempts to investigate the causal relationship between export, import, and economic growth, no previous analysis has explored this relationship in each ASEAN country. This represents a unique contribution of this research to the existing literature.

CHAPTER IV
METHODOLOGY

In this chapter, the content is split into two main parts. The first part explains where the data comes from, and the second part describes Johansen cointegration and Granger causality to check if there's a connection and if one variable causes to the other.

4.1 Source of Data

This study utilized the export and import (in US$) data of 10 ASEAN countries for the period spanning from 1970 to 2021. All the datasets were sourced from the UN Data Base (UN). For econometric estimation, the natural logarithms of the variables were employed in the analysis.

4.2 Stationary and Non-Stationary Variables

Formally, a time series y, is stationary if its mean and variance are constant over time, and if the covariance between two values from the series depends only on the length of time separation the two values, and not on the actual times at which the variables are observed. That is, the time series y_t is stationary if for all values, and every time period. It is true that.

$$E(y_t) = \mu \text{ (Constant Mean)}$$

$$V(y_t) = \sigma^2 \text{ (Constant Variance)}$$

$$Cov(y_t, y_{t-1}) = \gamma_s$$

The first condition of a constant mean is the feature that has received the more attention. To appreciate this condition for stationary, look at the plots and see if their sample means are similar across different sample periods, whereas the sample means for the variables in the original levels. Nonstationary series with nonconstant means are often described as not having the property of mean reversion. That is, stationary series have the property of mean reversion. Looking at the sample means of time-series variables is a convenient indicator as to whether a series is stationary or nonstationary, but this does not constitute a hypothesis test.

4.3 Augmented Dickey Fuller Test

Before estimating the long-run relationship, both variables underwent unit root testing. Plotting the data and observing the graph is sometimes highly useful as it can clearly indicate the presence or absence of deterministic regressors, especially when the data-generating process is unknown.

There are many tests for determining whether a series is stationary or nonstationary. The most popular one, and the one that we discuss, is the Dickey-Fuller test. As noted in our discussion of the autoregressive and random walk models, stochastic processes can include or exclude a constant term and can include or exclude a time trend. There are three variations of the Dickey-Fuller test designed to take account of the role of the constant term and the trend. We begin by describing the test equations and hypotheses for these three cases and then outline the testing procedure.

Firstly, Dickey and Fuller devised a formal procedure to test for non-stationarity. The key insight of their test is that testing for non-stationarity is equivalent to testing for the existence of a unit root. Thus, the obvious test is the following, which is based on the simple AR (1) model of the form:

$$y_t = \rho y_{t-1} + v_t \quad (4.1)$$

where the v_t, are independent random errors with zero mean and constant variance. We can test for nonstationary by testing the null hypothesis that p = 1 against the alternative that $|\rho| < I$, or simply $|\rho| < 1$. This one-sided (lower tail) test is put into a more convenient form by subtracting y_{t-1} from both sides of (4.1) to obtain:

$$y_t - y_{t-1} = (\rho - 1)\, y_{t-1} + v_t \quad (4.2)$$

$$\Delta y_t = (\rho - 1)\, y_{t-1} + v_t \quad (4.3)$$

$$\Delta y_t = \gamma\, y_{t-1} + v_t \quad (4.4)$$

where $\gamma = \rho - 1$ and $\Delta y_t = y_t - y_{t-1}$. Then, the hypotheses can be written in terms of either ρ or γ as follow

H_0: ρ = 1 H_0: γ = 0

H_1: ρ < 1 H_1: γ < 0

Note that the null hypothesis is that the series is nonstationary. In other words, if we do not reject the null, we conclude that it is a nonstationary process: if we reject the null hypothesis that γ = 0, then we conclude that the series is stationary.

The second Dickey-Fuller test includes a constant term in the test equation:

$$\Delta y_t = \alpha + \gamma y_{t-1} + v_t \qquad (4.5)$$

The null and alternative hypotheses are the same as before.

The third Dickey-Fuller test includes a constant and a trend in the test equation:

$$\Delta y_t = \alpha + \gamma y_{t-1} + \lambda_t + v_t \qquad (4.6)$$

To test the hypothesis in all three cases, simply estimate the test equation by least squares and examine the t-statistic for the hypothesis that γ=0. Unfortunately, this -statistic no longer has the t-distribution that we have used previously to test zero null hypotheses for regression coefficients. A problem arises because, when the null hypothesis is true y_t, is nonstationary and has a variance that increases as the sample size increases. This increasing variance alters the distribution of the usual t-statistic when H_0 is true. To recognize this fact the statistic is often called a г (tau) statistic, and its value must be compared to specially generated critical values. Note that critical values are generated for the three different tests because the addition of the constant term and the time-trend term changes the behavior of the time series.

Originally these critical values were tabulated by the statisticians Professor David Dickey and Professor Wayne Fuller. The values have since been refined, but in deference to the seminal work, unit root tests using these critical values have become known as Dickey- Fuller tests. Table (4.1) contains the critical values for the tau (г) statistic for the three cases: they are valid in large samples for a one-tail test.

Note that the Dickey-Fuller critical values are more negative than the standard critical values (shown in the last row). This implies that the г -statistic must take larger (negative) values than usual for the null hypothesis of nonstationary y = 0 to be rejected in favor of the alternative of stationarity γ <0. Specifically, to carry out this one-tail test of significance, if $г_c$, is the critical value obtained from Table (4.1), we reject the null hypothesis of nonstationary. If $г \leq г_c$. If $г > г_l$, do not reject the null hypothesis that the series y_t, is nonstationary. Expressed in a casual way, but one that avoids the proliferation of "double negatives," $г \leq г_c$, suggests the series is stationary while $г > г_c$, suggests nonstationary.

Table (4.1) Critical Values for the Dickey–Fuller Test

Model	1%	5%	10%
$\Delta y_t = \gamma y_{t-1} + v_t$	−2.56	−1.94	−1.62
$\Delta y_t = \alpha + \gamma y_{t-1} + v_t$	−3.43	−2.86	−2.57
$\Delta y_t = \alpha + \gamma y_{t-1} + \lambda_t + v_t$	−3.96	−3.41	−3.13
Standard critical values	−2.33	−1.65	−1.28

Note: The critical values are taken from R. Davidson and J.G MacKinnon (1993). Estimation and inference in econometrics. New York: Oxford University Press, P.708.

An important extension of the Dickey-Fuller test allows for the possibility that the error term is autocorrelated. Such autocorrelation is likely to occur if our earlier models did not have sufficient lag terms to capture the full dynamic nature of the process. As the error term is unlikely to be white noise, Dickey and Fuller extended their test procedure by suggesting an augmented version of the test that includes extra lagged terms of the dependent variable in order to eliminate autocorrelation. The lag length on these extra terms is either determined by the Akaike information criterion (AIC) or the Schwartz Bayesian criterion (SBC), or more usefully by the lag length necessary to whiten the residuals (that is, for each case, it is required to check whether the residuals of the Augmented Dickey Fuller (ADF) regression are autocorrelated or not through a Lagrange multiplier (LM) test). The three possible forms of the ADF test are given by the following equations:

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + v_t \quad (4.7)$$

$$\Delta y_t = \alpha + \gamma y_{t-1} + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + v_t \quad (4.8)$$

$$\Delta y_t = \alpha + \lambda_t + \gamma y_{t-1} + \sum_{t=1}^{m} \beta_i \Delta y_{t-i} + v_t \quad (4.9)$$

where $\Delta y_{t-1} = (y_{t-1} - y_{t-2})$, $\Delta y_{t-2} = (y_{t-2} - y_{t-3})$, ... By adding as many lagged first difference terms as we need to ensure that the residuals are not autocorrelated and including lags of the dependent variable can be used to eliminate autocorrelation in the errors. The number of lagged terms can be determined by examining the autocorrelation function (ACF) of the residuals v_t or the significance of the estimated lag coefficients β_i. The unit root tests for Equations (4.7), (4.8) and (4.9) are referred to as Augmented Dickey-Fuller tests.

The hypotheses for stationarity and nonstationary are expressed in terms of γ in the same way and the test critical values are the same as those for the Dickey-

Fuller test shown in Table (4.1). When $\gamma = 0$, in addition to saying the series is nonstationary and the series has a unit root. In practice. The analysis always uses the augmented Dickey-Fuller test (rather than the nonaugmented version) to ensure the errors are uncorrelated (Hill et al. 2018).

4.4 Selection of Optimal Lag Length

In economics, the relationship between a predicted variable Y and a predictor variable or regressor X is seldom immediate. Instead, Y's response to X is delayed over time, a phenomenon known as a lag (Gujarati and Porter, 2009). Determining the appropriate lag length is a crucial consideration to ensure that error terms exhibit Gaussian characteristics, meaning they adhere to standard normal distribution and avoid issues like non-normality, autocorrelation, and heteroskedasticity (Asteiou and Hall, 2011).

The determination of the lag length is influenced by the possibility of omitting variables that specifically impact the short-term behavior of the model. This omission leads to those variables instantly becoming part of the error term. Therefore, it is essential to meticulously examine the data and the functional relationship before proceeding with estimation to decide whether additional variables should be included. It's also common practice to incorporate dummy variables to account for short-term disruptions to the system, such as political events that have significant effects on macroeconomic conditions.

The most commonly employed approach for selecting the optimal lag length is to estimate a Vector Autoregressive (VAR) Model that includes all the variables in their original levels, without differencing the data. This VAR model is initially estimated for a large number of lags and is then systematically reduced by re-estimating the model with one fewer lag until reaching zero lags. The process involves estimating the model for various lags, for example, starting with 12 lags, then 11, then 10, and so on until reaching zero lags. In each of these models, it is crucial to assess the values of criteria such as AIC and SBC, along with diagnostic tests for autocorrelation, heteroskedasticity, potential Autoregressive Conditional Heteroskedasticity (ARCH) effects, and the normality of the residuals. Typically, the model that minimizes both AIC and SBC and passes all diagnostic checks is chosen as the one with the optimal lag length (Asteiou and Hall, 2011).

4.5 Cointegration Test

As a general rule, it is advisable to avoid using nonstationary time series variables in regression models to prevent the issue of spurious regression. However, there is an exception to this rule. If both the dependent variable (y) and independent variable (x) are nonstationary, it is possible that their difference or any linear combination of them forms a stationary process, often referred to as an I(0) process. In this case y and x are cointegrated.

4.5.1 Engle Granger Cointegration Test

The Engle Granger test is a test for cointegration. It constructs residuals (errors) based on the static regression. The test uses the residuals to see if unit roots are present, using Augmented Dickey-Fuller test or another, similar test. The residuals will be practically stationary if the time series is cointegrated.

4.5.2 Johansen Cointegration Test

According to Johansen's work, specifically Johansen (1988) and Johansen and Juselius (1990), there are two methods for determining the number of cointegrating relations, each involving the estimation of a matrix denoted as Γ. This matrix has dimensions $k \times k$ and possesses a rank denoted as r. The procedures for determining cointegration are built upon propositions related to eigenvalues.

The Johansen cointegration test serves the purpose of assessing the presence of a long-run equilibrium relationship among the variables. This approach relies on two fundamental test statistics: the trace test statistic and the maximum eigenvalue test statistic.

(i) The Maximum Eigen Value Test

One method tests the null hypothesis, that Rank (Γ) = r against the hypothesis that the rank is r + 1. So, the null in this case is that there are cointegrating vectors and there are up to r cointegrating relationships, with the alternative suggesting that there are (r + 1) vectors. The test statistics are based on the characteristic roots (also called eigenvalues) obtained from the estimation procedure. The test consists of ordering the largest eigenvalues in descending order and considering whether they are significantly different from zero. To understand the test procedure, obtained n characteristic roots denoted by $\lambda_1 > \lambda_2 > \lambda_3 > \cdots > \lambda_n$. If the variables under examination are not cointegrated, the rank of Γ is zero and all the characteristic roots will equal zero. Therefore $(1 - \hat{\lambda}_1)$ will be equal to 1 and, since ln (1) = 0, each of the expressions will be equal to zero for no cointegration. On the other hand, if the rank of Γ is equal to 1, then $0 < \lambda_1 < 1$ so that the first expression is $(1 - \hat{\lambda}_1) < 0$, while all the rest will be equal to zero. To test how many of the numbers of the characteristic roots are significantly different from zero this test uses the following statistic:

$$\lambda max(r, r+1) = -T \ln (1 - \hat{\lambda}_{r+1}) \qquad (4.10)$$

As noted above, the test statistic is based on the maximum eigenvalue and is thus called the maximal eigenvalue statistic (denoted by λmax).

(ii) The Trace Test

The second method is based on a likelihood ratio test for the trace of the matrix (and because of that it is called the trace statistic). The trace statistic considers whether the trace is increased by adding more eigenvalues beyond the r^{th}. The null hypothesis in this case is that the number of cointegrating vectors is less than or equal to r. From the previous analysis it should be clear that when all $\hat{\lambda}_i = 0$, then the trace statistic is also equal to zero. On the other hand, the closer the characteristic roots are to unity, the more negative is the $\ln(1 - \hat{\lambda}_i)$ term and therefore the larger the trace statistic. This statistic is calculated by:

$$\lambda trace(r) = -T \sum_{i=r+1}^{n} \text{Ln}\,(1 - \hat{\lambda}_{r+1}) \qquad (4.11)$$

The usual procedure is to work downwards and stop at the value of r, which is associated with a test statistic that exceeds the displayed critical value. Critical values for both statistics are provided by Johansen and Juselius (1990) (Asteiou and Hall, 2011).

4.6 Lagrange Multiplier (LM) Test for Autocorrelation

Time series data or observations collected successively over a period of time present a particular difficulty when using the technique of regression. One of the assumptions traditionally used in regression is that the successive residuals are independent. This means that there is not a pattern to the residuals, the residuals are not highly correlated, and there are not long runs of positive or negative residuals. When time series data are used, the assumption of non-autocorrelation is frequently violated. Though the violation of the assumption of non-autocorrelation will not affect the unbiasedness or consistency of the least-squares estimators, it does affect their efficiency. To avoid some of the pitfalls of autocorrelation, statisticians Breusch and Godfrey have developed a test of autocorrelation. A General Test of Autocorrelation: The Breusch–Godfrey (BG) is also known as Lagrange Multiplier (LM) test proceeds as follows.

(i) Regress y on the restricted set of independent variables and save the residuals, $\hat{u}$

(ii) Regress $\hat{u}$ on all of the independent variables and obtain the R-squared, and $\hat{u}_{t-1}$, $\hat{u}_{t-1}$, $\hat{u}_{t-2}$, …, $\hat{u}_{t-p}$, where the latter are the lagged values of the estimated residuals in step 1. Thus, if p = 4, it introduces four lagged values of the residuals as additional regressors in the model. Note that to run this regression it has only (n − p) observations (why?). In short, run the following regression:

$$\hat{u}_t = \alpha_1 + \alpha_2 X_t + \hat{\rho}_1\hat{u}_{t-1} + \hat{\rho}_2\hat{u}_{t-2}, + \cdots + \hat{\rho}_p\hat{u}_{t-p}, + \varepsilon_t \quad (4.12)$$

and obtain R^2 from this (auxiliary) regression

(iii) If the sample size is large (technically, infinite), Breusch and Godfrey have shown that

$$(n - p)\, R^2 \sim \chi^2_p \quad (4.13)$$

That is, asymptotically, n-p times the R^2 obtained from the auxiliary regression follows the chi-square distribution with p degree of freedom. If in an application, (n-p) R^2 exceeds the critical chi-square value at the chosen level of significance the null hypothesis is rejected, in which case at least one ρ is statistically significantly different from zero.

Test hypothesis is

Null Hypothesis : There is no serial correlation.

Alternative Hypothesis : There is serial correlation.

4.7 Vector Error Correction Model (VECM) and Vector Autoregressive (VAR) Model

4.7.1 Estimating a Vector Error Correction Model

There are many econometric methods to estimate the error correction model. The most straightforward is to use a two-step least squares procedure. First, use least squares to estimate the cointegrating relationship $y_t = \beta_0 + \beta_1 x_t + e_t$ and generate the lagged residuals $\hat{e}_{t-1} = y_{t-1} - b_0 - b_1 x_{t-1}$.

Second use least square to estimate the equations:

$$\Delta y_t = \alpha_{10} + \alpha_{11}\hat{e}_{t-1} + v_t{}^{y} \quad (4.14)$$

$$\Delta x_t = \alpha_{20} + \alpha_{21}\hat{e}_{t-1} + v_t{}^{x} \quad (4.15)$$

Note that all the variables in equation ($\Delta y, \Delta x$ and $\hat{e}$) are stationary (recall that for y and x to be cointegrated, the residuals $\hat{e}$ must be stationary). Hence, the standard regression analysis studied in earlier chapters may be used to test the significance of the parameters. The usual residual diagnostic tests may be applied.

One's need to be careful here about how we combine stationary and nonstationary variables in a regression model. Cointegration is about the relationship between I (1) variables. The cointegrating equation does not contain I (0) variables. The corresponding VEC model, however relates the change in an I (1) variable (the I (0) variables ($\Delta y, \Delta x$) to other I (0) variables. namely the cointegration residuals $\hat{e}_{t-1}$, and, if required, other stationary variables may be added. In other words, we should not mix stationary and nonstationary variables: an I (0) dependent variable on the left-hand side of a regression equation should be "explained" by other I (0) variables on the right-hand side and an I (1) dependent variable on the left-hand side of a regression equation should be "explained" by other I (1) variables on the right-hand side (Hill et al. 2018).

4.7.2 Estimating a Vector Autoregressive (VAR) Model

It is quite common in economics to have models in which some variables are not only explanatory variables for a given dependent variable, but are also explained by the variables that they are used to determine. In this case, the models have simultaneous equations, in which it is necessary to identify clearly which are the endogenous and which are the exogenous or predetermined variables (Asteiou and Hall, 2011).

The decision regarding such a differentiation among variables was heavily criticized by Sims (1980). According to Sims, if there is simultaneity among a number of variables, then all these variables should be treated in the same way. In other words, there should be no distinction between endogenous and exogenous variables. Therefore, once this distinction is abandoned, all variables are treated as endogenous. This means that in its general reduced form each equation has the same set of regressors, which leads to the development of VAR models (Asteiou and Hall, 2011).

When there are not confident that a variable really is exogenous, each variable has to be treated symmetrically. The time series y_t that is affected by current and past values of x_t and, simultaneously, the time series x_t to be a series that is affected by current and past values of the y_t series. In this case the simple bivariate model is given by:

$$y_t = \beta_{10} - \beta_{12}x_t + \gamma_{11}y_{t-1} + \gamma_{12}x_{t-1} + u_{yt} \qquad (4.16)$$

$$x_t = \beta_{20} - \beta_{21}y_t + \gamma_{21}y_{t-1} + \gamma_{22}x_{t-1} + u_{xt} \qquad (4.17)$$

where it is assumed that both y_t and x_t are stationary, and u_{yt} and u_{xt} are uncorrelated white-noise error terms. Equations (3.13) and (3.14) constitute a first-order VAR model, because the longest lag length is unity. These equations are not reduced-form equations, since y_t has a contemporaneous impact on x_t (given by $-\beta_{21}$), and x_t has a contemporaneous impact on y_t (given by $-\beta_{12}$). Rewriting the system using matrix algebra, we get:

$$\begin{bmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{bmatrix} \begin{bmatrix} \gamma_t \\ X_t \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} \gamma_{t-1} \\ X_{2t-1} \end{bmatrix} + \begin{bmatrix} u_t \\ u_{Xt} \end{bmatrix} \qquad (4.18)$$

$$B_{Zt} = \Gamma_0 + \Gamma_1 Z_{t-1} + u_t \qquad (4.9)$$

$$B = \begin{bmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{bmatrix} \; Z_t = \begin{bmatrix} \gamma_t \\ X_t \end{bmatrix} \gamma_0 = \begin{bmatrix} \beta_{10} \\ \beta_{20} \end{bmatrix} \qquad (4.20)$$

$$\gamma_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \quad \text{and } u_t = \begin{bmatrix} u_t \\ u_{Xt} \end{bmatrix} \qquad (4.21)$$

Multiplying both sides by B^{-1} we obtain:

$$z_t = A_0 + A_1 z_{t-1} + e_t \qquad (4.22)$$

Where, $A_0 = B^{-1}\,\Gamma_0$, $A_1 = B^{-1}\,\Gamma_1$, and $e_t = B^{-1}u_t$. For purposes of notational simplification can denote as a_{i0}; the i^{th}element of the vector A_0; a_{ij} the element in row i and column j of the matrix A_1; and e_{it} as the i^{th}element of the vector e_t. Using this, we can rewrite the VAR model as:

$$y_t = a_{10} + a_{11}y_{t-1} + a_{12}x_{t-1} + e_{1t} \qquad (4.23)$$

$$x_t = a_{20} + a_{21}y_{t-1} + a_{22}x_{t-1} + e_{2t} \qquad (4.24)$$

To distinguish between the original VAR model and the system have just obtained, the first a structural or primitive VAR system and the second a VAR in standard (or reduced) form. It is important to note that the new error terms, e_{1t} and e_{2t}, are composites of the two shocks u_{yt} and u_{xt}. Since $e_t = B^{-1}u_t$ we can obtain e_{1t} and e_{2t} as:

$$e_{1t} = \left(u_{yt} + \beta_{12}u_{xt}\right)/(1 - \beta_{12}\beta_{21}) \qquad (4.25)$$

$$e_{1t} = (u_{xt} + \beta_{21} u_{yt})/(1 - \beta_{12}\beta_{21}) \quad (4.26)$$

Since, u_{yt} and u_{xt} are white-noise processes, it follows that both e_{1t} and e_{2t} are also white-noise processes. The VAR model approach has some very good characteristics. First, it is very simple. The econometrician does not have to worry about which variables are endogenous or exogenous. Second, estimation is also very simple, in the sense that each equation can be estimated separately with the usual OLS method. Third, forecasts obtained from VAR models are in most cases better than those obtained from the far more complex simultaneous equation models (Asteiou and Hall, 2001).

However, on the other hand, VAR models have faced severe criticism over various points. First, they are a theoretic, in that they are not based on any economic theory. Since initially there are no restrictions on any of the parameters under estimation, in effect 'everything causes everything'. However, statistical inference is often used in the estimated models so that some coefficients that appear to be insignificant can be dropped, in order to lead to models that might have an underlying consistent theory. Such inference is normally carried out using what are called causality tests.

4.8 Granger Causality Test

One of the good features of VAR models is that they allow us to test for the direction of causality. Causality in econometrics is somewhat different from the concept in everyday use. It refers more to the ability of one variable to predict (and therefore cause) the other.

Suppose two variables, say y_t and x_t, affect each other with distributed lags. The relationship between these variables can be captured by a VAR model. In this case it is possible to state that (a) y_t causes x_t; (b) x_t causes y_t; (c) there is a bi-directional feedback (causality among the variables); and (d) the two variables are independent. The problem is to find an appropriate procedure that allows us to test and statistically detect the cause-and-effect relationship among the variables.

Granger (1969) developed a relatively simple test that defined causality as follows: a variable y_t is said to Granger cause x_t if x_t can be predicted with greater accuracy by using past values of the y_t variable rather than not using such past values, all other terms remaining unchanged. The next section presents the Granger causality test, and this will be followed by an alternative causality test developed by Sims (1972).

The Granger causality test for the case of two stationary variables y_t and x_t involves as a first step the estimation of the following VAR model:

$$y_t = a_1 + \sum_{i=0}^{n} \beta_i x_{t-i} + \sum_{j=0}^{m} \gamma_j y_{t-j} + e_{yt} \quad (4.27)$$

$$x_t = a_2 + \sum_{i=0}^{n} \theta_i x_{t-i} + \sum_{j=0}^{m} \delta_j y_{t-j} + e_{xt} \quad (4.29)$$

Where, it is assumed that both e_{yt} and e_{xt} are uncorrelated white-noise error terms.

Granger causality test of hypotheses are as follows:

H_0: There is no cause and effect (Granger causality) between the two variables.

If p-value > 5 percent, the null hypothesis (H_0) is accepted.

H_1: There is a cause and effect (Granger causality) between the two variables.

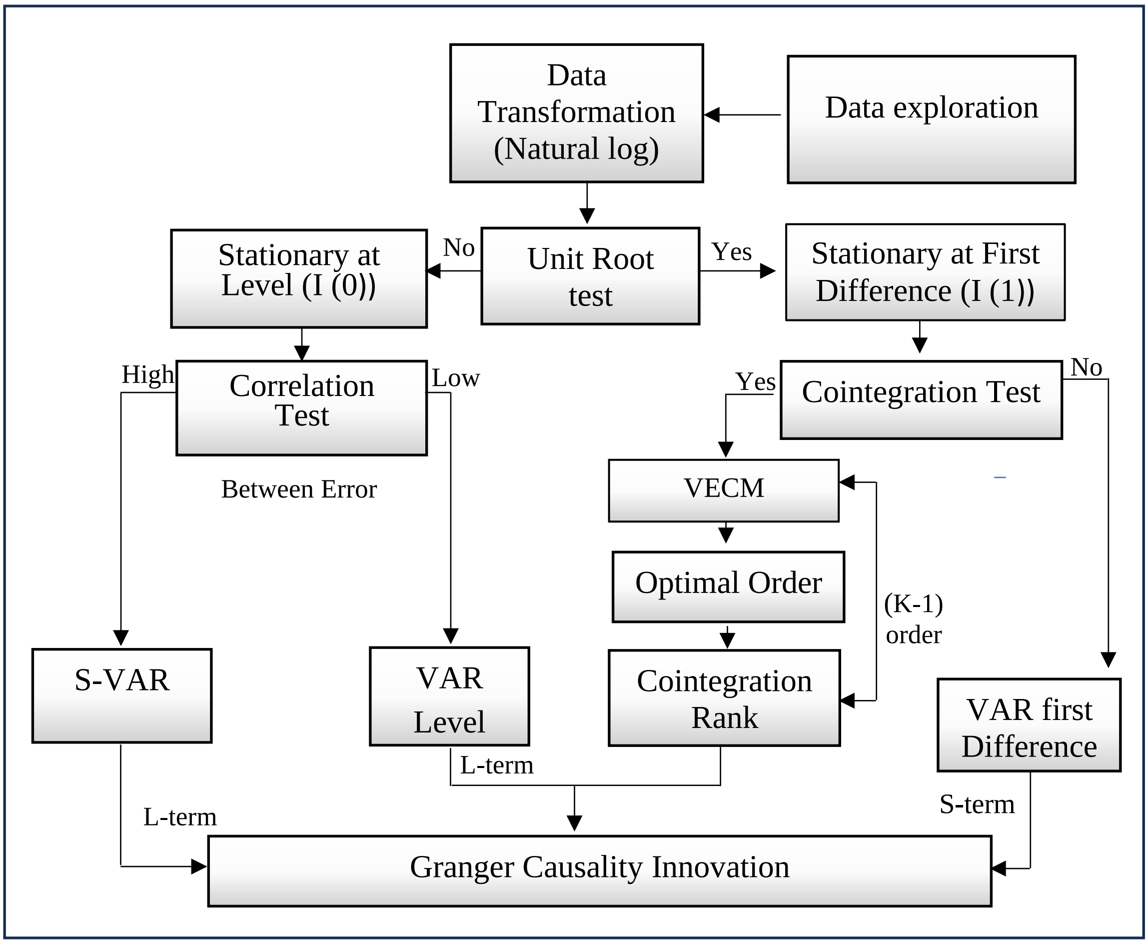
If p-value < 5 percent, null hypothesis (H_0) is rejected.

Since the probabilities of all different periods are more the 5 percent then there is no Granger causality between the two variables. To underline the causal direction between the variables, a pairwise Granger causality test has been conducted. In testing the pairwise Granger causality, at least two variables are usually analyzed together while testing for their interaction.

Following are the possible results of the analyses:

- Unidirectional Granger Causality from variable Y_t to variable X_t
- Unidirectional Granger Causality from variable X_t to variable Y_t
- Bi-directional Granger Causality and No Causality.

Figure (4.1) shows the procedure of causality testing that required for long-run and short-run relationship between export and import series.



Source: Own Completion

Figure (4.1) Procedure of Causality Testing

CHAPTER V

COINTEGRATION AND CAUSILITY BETWEEN EXPORT AND IMPORT OF ASEAN COUNTRIES

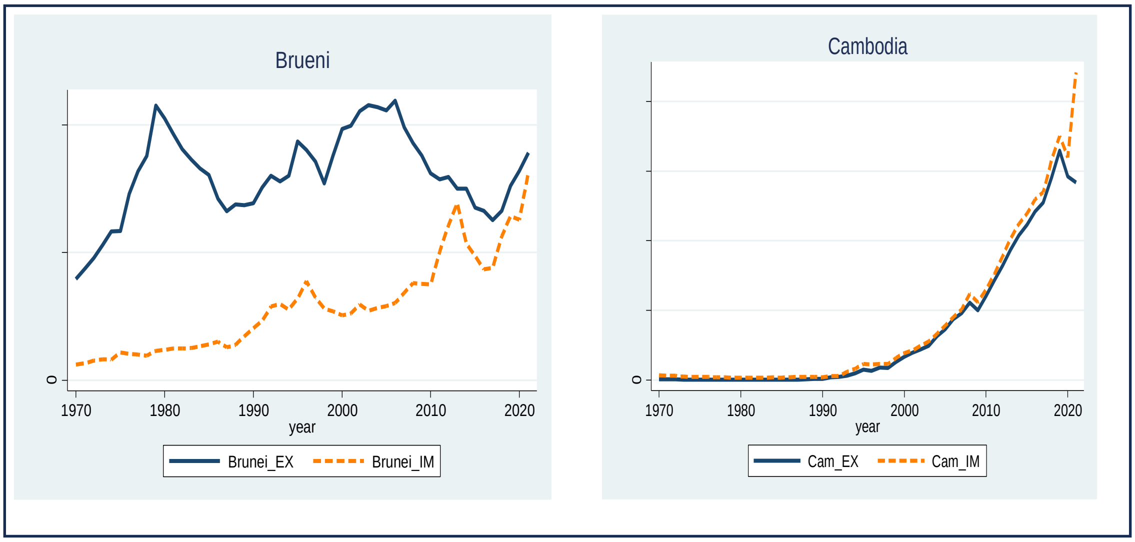
In this chapter, the study's outcomes were presented, organized into two key sections. The initial section provided descriptive statistics, while the subsequent section focused on the presentation of the econometric analysis. The econometric analysis primarily relied on the application of the unit root test, Johansen Cointegration analysis, and Granger causality test to examine the relationship between the export and import of ASEAN countries.

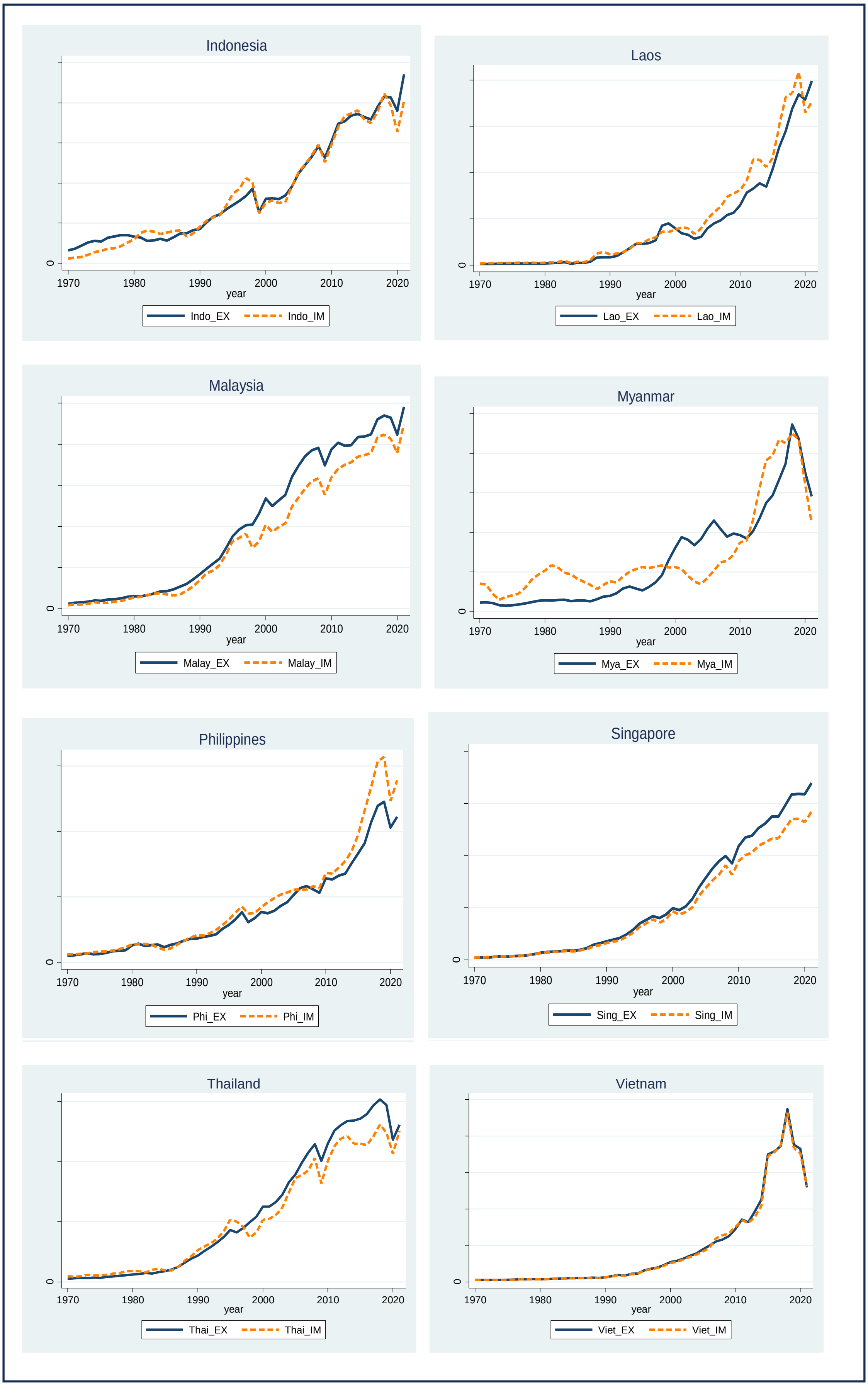
5.1 Descriptive Statistics

The data are used yearly observations of export and import in US$. The data has been obtained from United Nation Database. Time period of the analysis is from 1970 to 2021 for each country, consisting 52 observations (Appendix A (1– 5)).

5.1.1 Graphical Approach

This study analyzes by the graphical method of export and import (values) situation from 1970 to 2021 in ASEAN for each country. Figure (5.1) show the export and import series are increasing overtime and closely moving over time in general.





Source: Own calculation.

Figure (5.1) Line Graph of Export and Import (US$) of ASEAN Countries

In Brunei, the minimum export value was identified in 1970, and the maximum export value was discovered in 2006. After 2006, the export value gradually decreased, and then it increased in 2016. The minimum import value was recognized in 1970, and the maximum export value was observed in 2021. Following 1970, the export value exhibited a gradual increase until 2021. These figures suggested that the variables had a positive relationship and exhibited fluctuations. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

For Cambodia, the lowest export value was identified in 1986, while the highest export value was recorded in 2019. After 1986, there was a gradual increase in export values, which persisted until 2019, followed by a subsequent decrease. The minimum import value was pinpointed in 1982, and the maximum export value was observed in 2021. Following 1982, the export value displayed a gradual increase up to 2021. These figures suggested that the variables had a positive relationship. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

As for Indonesia, the lowest export value was identified in 1970, while the highest export value was recorded in 2021. The minimum import value was pinpointed in 1982, and the maximum export value was observed in 2018. Following 1982, the export value displayed a gradual increase up to 2021. These figures suggested that the variables had a positive relationship and exhibited fluctuations. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

Furthermore, for Laos, the lowest export value was identified in 1970, while the highest export value was recorded in 2021. The minimum import value was pinpointed in 1970, and the maximum export value was observed in 2019. Following 2019, the export value displayed a gradual increase up to 2021. These figures suggested that the variables had a positive relationship and exhibited fluctuations. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

In the case of Malaysia, the lowest export value was identified in 1970, while the highest export value was recorded in 2021. The minimum import value was pinpointed in 1970, and the maximum export value was observed in 2019. Following 2019, the export value displayed a gradual increase up to 2021. These figures investigated that the variables had a positive relationship and exhibited fluctuations. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

In Myanmar, the lowest export value was identified in 1974, while the highest export value was recorded in 2018. Starting from 1974, export values increased incrementally until 2018. The minimum import value was observed in 1973, and the maximum export value occurred in 2018. Following 1973, export values gradually increased until 1981, followed by a decline until 1988. Subsequently, there was a resurgence after 1988, which continued until 2004. Post 2004, there was a gradual increase leading up to 2018. These figures suggested that the variables had a positive relationship and exhibited fluctuations. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

For the Philippines, the lowest export value was established in 1970, and the peak export value was documented in 2019. The lowest import value was singled out in 1971, and the highest export value was witnessed in 2019. These figures suggested that the variables had a positive relationship and exhibited fluctuations. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

In Singapore, the lowest export value was pinpointed in 1970, and the highest export value was documented in 2021. In the same year, the minimum import value was also noted as the maximum export value was observed. These figures highlighted that the variables had a positive relationship and exhibited fluctuations. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

Similarly, in Thailand, the lowest export value was pinpointed in 1970, and the highest export value was documented in 2021. In the same year, the minimum import value was also noted as the maximum export value was observed. These figures pointed out that the variables had a positive relationship and exhibited fluctuations. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

In Vietnam, the lowest export value was pinpointed in 1970, and the highest export value was documented in 2018. In the same year, the minimum import value was also noted as the maximum export value was observed. These figures suggested that the variables had a positive relationship and exhibited fluctuations. They then transitioned to an upward trend in the long run, despite short-term fluctuations.

5.1.2 Mean Values of Export and Import

(Figure (5.1) describes as irregular ups and downs, or more like fluctuations. The values of import and export appear to fluctuate around an upward trend. Initially. this study inquiry focuses on distinguishing between stationary and nonstationary data series. The data analysis involves comparing sample means for various variables across different sample periods. Stationary time series maintain consistent mean and variance over time, with covariance based solely on time lags, not specific observation times. Conversely, nonstationary series exhibit varying means over time. This study observes that the sample means for original level variables vary across four periods.

Table (5.1) shows the variation in the mean export and import values of ASEAN countries. The mean export and import values for Brunei vary across different time periods and the situation of balance trade is surplus and exhibits a fluctuation ranging from 2,132.244(million $) to 6,704.009(million 5) in all period. The mean export and import values for Cambodia vary across different time periods and the situation of balance trade is deficit and exhibits a fluctuation ranging from -1364.653 (million $) to -186.75 (million $) in all period.

The mean export and import values for Indonesia vary across different time periods and the situation of balance trade is both deficit and surplus. That exhibits a fluctuation ranging from -4040.352(million S) to 8634.339(million 5) in all period. The mean export and import values for Laos vary across different time periods and the situation of balance trade is deficit. That exhibits a fluctuation ranging from -628.718(million $) to -32.322(million 5) in all period. The mean export and import values for Malaysia vary across different time periods and the situation of balance trade is surplus. That exhibits a fluctuation ranging from 2122.545(million $) to 30885.376(million $) in all period. The mean export and import values for Myanmar vary across different time periods and the situation of balance trade is both deficit and surplus. That exhibits a fluctuation ranging from -2359.469(million $) to 2788.494 (million S) in all period. The mean export and import values for Philippines vary across different time periods and the situation of balance trade is deficit. That exhibits a fluctuation ranging from -16990.871(million 5) to -683.864(million S) in all period. The mean export and import values for Singapore vary across different time periods and the situation of balance trade is both deficit and surplus. That exhibits a fluctuation ranging from -33.481(million 5) to 79654.938(million $) in all period. The mean export and import values for Thailand vary across different time periods and the situation of balance trade is both deficit and surplus. That exhibits a fluctuation ranging from -5697.610(million $) to 34132.218(million $) in all period. The mean export and import values for Philippines vary across different time periods and the situation of balance trade is surplus. That exhibits a fluctuation ranging from 76.657(million $) to 2162.857(million $) in all period.

Table (5.1) Mean Values of Export and Import in ASEAN Countries

Country	Variable	Million Dollar (USD)			
		1970-1982	1983-1995	1996-2008	2009-2021
Brunei	Export	7228.017	7690.699	9734.945	7591.634
	Import	966.205	2005.632	3030.936	5459.389
	Balance of Trade	6261.812	5685.067	6704.009	2132.245
Cambodia	Export	28.220	169.542	2569.536	10914.323
	Import	218.401	356.292	2862.327	12278.976
	Balance of Trade	-190.181	-186.75	-292.791	-1364.653
Indonesia	Export	27939.040	45016.02	96359.507	184655.61
	Import	19304.710	49056.37	98620.168	178442.47
	Balance of Trade	8634.339	-4040.352	-2260.661	6213.137
Laos	Export	65.355	385.237	1514.589	4811.871
	Import	97.677	457.109	1743.949	5440.589
	Balance of Trade	-32.322	-71.872	-229.360	-628.718
Malaysia	Export	10954.020	41819.810	142459.100	211673.340
	Import	8831.475	35467.300	111573.730	186362.720
	Balance of Trade	2122.545	6352.511	30885.376	25310.628
Myanmar	Export	1115.287	2021.369	7977.393	14774.521
	Import	3474.756	4236.3290	5188.899	15807.139
	Balance of Trade	-2359.469	-2214.960	2788.494	-1032.618
Philippines	Export	8356.160	17881.250	43181.751	86751.955
	Import	9246.401	18565.120	47791.630	103742.830
	Balance of Trade	-890.241	-683.864	-4609.879	-16990.871
Singapore	Export	16728.180	68403.510	246336.720	542603.630
	Import	16761.660	62279.02	219345.510	462948.690
	Balance of Trade	-33.481	6124.494	26991.211	79654.938
Thailand	Export	8831.705	41721.940	145523.780	262702.660
	Import	12959.050	47419.550	129094.670	228570.440
	Balance of Trade	-4127.341	-5697.610	16429.112	34132.218
Vietnam	Export	3096.252	6899.337	34197.940	137487.270
	Import	3019.595	6676.487	33723.765	135324.420
	Balance of Trade	76.657	222.850	474.175	2162.857

Source: Own calculation.

5.2 Augmented Dickey Fuller Test for Unit Root

Before investigating the causality test among the variables, it is necessary to determine whether the study's variables are stationary or non-stationary. Export and Import values were transformed by natural log form to minimize fluctuations in the series. In this study Augmented Dicky Fuller test was employed to test stationarity.

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-1} + u_t \quad (5.1)$$

$$\Delta lnexport_t = \alpha_0 + \gamma lnexporty_{t-1} + \sum_{i=1}^{p} \beta_i \Delta lnexporty_{t-1} + u_t \quad (5.2)$$

$$\Delta lnimport_t = \alpha_0 + \gamma lnimporty_{t-1} + \sum_{i=1}^{p} \beta_i \Delta lnimporty_{t-1} + u_t \quad (5.3)$$

Augmented Dickey Fuller test of hypotheses are as follows:

H_0: (γ =0). The export or import have unit root (non-stationary).

H_1: ($\gamma < 0$). The export or import does not have a unit root (Stationary).

The results of Augmented Dicky Fuller (ADF) test at level and first difference of export and import in ASEAN countries are presented in Table (5.2). At level, all series, except for the export of Brunei, has a unit root (not stationarity). However, at first difference, all series are stationary.

Table (5.2) ADF Unit Root Test Results

Country	Variable	Level		First Difference	
		ADF statistic	Number of lags	ADF statistic	Number of lags
Brunei	lnexport	-3.117**	2	-3.381***	1
	lnimport	-0.790	1	-5.153***	0
Cambodia	lnexport	-1.022	3	-1.686*	2
	lnimport	0.620	3	-2.403**	2
Indonesia	lnexport	-0.787	1	-6.192***	0
	lnimport	-2.506	1	-4.890***	0
Laos	lnexport	-0.282	1	-6.003***	0
	lnimport	-0.486	1	-6.801***	0
Malaysia	lnexport	-2.302	1	-4.045***	0
	lnimport	-1.712	1	-4.789***	0
Myanmar	lnexport	-1.264	3	-2.867***	2
	lnimport	-2.168	2	-3.727***	1
Philippines	lnexport	-0.955	1	-5.554***	0
	lnimport	-0.360	2	-3.343***	1
Singapore	lnexport	-2.291	1	-3.046***	0
	lnimport	-1.875	1	-3.675***	0
Thailand	lnexport	-2.124	1	-3.879***	0
	lnimport	-1.473	1	-5.071***	0
Vietnam	lnexport	-0.202	1	-4.387***	0
	lnimport	-0.182	1	-4.448***	0

Note: ***, **, and * indicate 1%, 5%, and 10% significance level, respectively. For level, unit root test model includes intercept term but no trend. The Augmented Dicky Fuller critical value for 1%, 5%, and 10% significance level are -3.580, -2.930, and -2.600, respectively. For first difference, unit root test model includes no intercept term and trend. The Augmented Dicky Fuller critical value for 1%, 5%, and 10% significance level are -2.620, -1.950, and -1.610, respectively.

Source: Own calculation.

5.3 Cointegration Test for Export and Import

In this section, cointegration tests for unit root series are performed. Augmented Engle-Granger two-step approach and Johansen's multivariate tests are performed.

5.3.1 Augmented Engle-Granger Two-Step Approach to Cointegration

The long-run relationship between import and export is specified as bellows:

$$\mathrm{lnimport}_t = \alpha_0 + \alpha_1 \mathrm{lnexporty}_t + u_t \quad (5.4)$$

The Augmented Engle-Granger's second step is

$$\Delta\hat{u}_{t-1} = \alpha_0 + \gamma\hat{u}_t + \sum_{i=1}^{p} \beta_i \Delta\hat{u}_{t-1} + \varepsilon_t \quad (5.5)$$

Table (5.3) presents the results from augmented Engle-Granger two-step procedure for cointegration of export and import. Except for Brunei and Cambodia, other countries have cointegrated relationship between export and import.

Table (5.3) Results of Augmented Engle-Granger Two-Step Approach

Country	Engle-Granger	
	Lags	Coef. of lags
Brunei	1	-0.284
Cambodia	2	-1.375
Indonesia	2	-2.859***
Laos	1	-2.954***
Malaysia	2	-3.200***
Myanmar	4	-3.087***
Philippines	1	-3.323***
Singapore	1	-3.425***
Thailand	1	-3.983***
Vietnam	2	-3.880***

Note: ***, ** and * indicate 1%, 5%, and 10% significance level, respectively. The model excludes constant and trend. The critical values for 1%,5%, and 10% significance level are -2.622, -1.950, and -1.610.

Source: Own Calculation.

5.3.2 Johansen's Multivariate Tests for Cointegration

Johansen's Multivariate hypotheses tests are as follow;

H_0: There is no cointegration relationship between the two series.

H_1: There is at most one cointegration relationship between the two series.

Table (5.4) presents the results from Johansen's cointegration tests. According to trade statistic, export and import of Cambodia, Singapore, and Thailand are cointegrated. According to maximum Eigen value statistic, export and import of Malaysia, Singapore, and Thailand are cointegrated.

Table (5.4) Results of Johansen Cointegration Test

Country	Trace Statistic	Eigen Value Statistic
Brunei	0.053	0.053
Cambodia	1.608***	1.608
Indonesia	0.091	0.091
Laos	0.202	0.201
Malaysia	5.201	5.200**
Myanmar	0.935	0.935
Philippines	0.731	0.731
Singapore	6.992***	6.992***
Thailand	4.552***	4.551**
Vietnam	0.070	0.070

Note: ***, ** and * indicate 1%, 5%, and 10% significance level, respectively.

Source: Own calculation

5.4 Vector Error Correction Model (VECM)

Since both augmented Engle-Granger two-step procedure and Johansen's trace statistic and maximum Eigen value statistic consistently confirm that there is a cointegration relationship between export and import of Singapore and Thailand. Therefore, vector error correction model (VECM) was applied to find the relationship between export and import. The equilibrium adjustment coefficient and its standard error in parenthesis are presented below.

Table (5.5) presents the results of VECM for Singapore and Thailand. The results of Singapore show that both error correction coefficients have negative signs. The error correction coefficient in the import equation is -0.950 and statistically significant. The error correction coefficient in the export equation is -0.852 and statistically significant. Since the sizes of both error correction coefficients are less than one, they are adjusting to their equilibrium value. The results of Thailand show that both error correction coefficients have negative signs. The error correction coefficient in the import equation is -0.616 and statistically significant. The error correction coefficient in the export equation is -0.134 and not statistically significant. Since the sizes of both error correction coefficients are less than one, they are adjusting to their equilibrium value.

Table (5.5) Results of VECM

Right-Hand Side Variables	Singapore		Thailand	
	$\Delta \text{Inexport}_t$	$\Delta \text{Inimport}_t$	$\Delta \text{Inexport}_t$	$\Delta \text{Inimport}_t$
$\hat{\varepsilon}_{t-1}$	-0.852*** (0.223)	-0.950*** (0.237)	-0.134 (0.102)	-0.616*** (0.131)
constant	0.008 (0.023)	-0.007*** (0.024)	0.061*** (0.018)	-0.013 (0.022)

Note: *** indicates 1% significance level.

Source: Own calculation.

5.5 Granger Causality Test for Export and Import

Since there is no cointegration relationship between export and import of Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, and Vietnam, the direction of causality between export and import can be estimated by Vector Autoregressive (VAR) Model.

Table (5.6) reports the results of VAR models for Brune. The optimum number of lags is two, and the first lag of import in the import equation and the first lag of export in the export equation are statistically significant. The LM test results indicate that there is no causality between export and import (Appendices (A-.10)).

Table (5.6) Results of VAR Model for Brunei

Variables	Brunei	
	$\Delta \text{Inexport}_t$	$\Delta \text{Inimport}_t$
$\Delta \text{Inimport}_{t-1}$	0.067 (0.085)	0.246* (0.146)
$\Delta \text{Inimport}_{t-2}$	-0.103 (0.084)	-0.083 (0.145)
$\Delta \text{Inexport}_{t-1}$	0.350** (0.140)	0.388 (0.240)
$\Delta \text{Inexport}_{t-2}$	0.126 (0.141)	-0.140 (0.242)
LM test	Accept H_0	Accept H_0

Note: ***, **, and * indicate 1%, 5%, and 10% significance level, respectively. For import equation, the null hypothesis (H_0) is that all lag export lags are simultaneously equal to zero. For export equation, the null hypothesis (H_0) is that all lag import lags are simultaneously equal to zero.
Source: Own calculation.

Table (5.7) reports the results of VAR models for Cambodia. The optimum number of lags is four. In the import equation, all lags are significant, except for the second and fourth lags of import and the third lag of export. In the export equation, all lags are significant, except for the first and second lags of import and the second lag of export. The LM test results indicate that there is bi-directional causality between export and import (Appendix (A-10)).

Table (5.7) Results of VAR Model for Cambodia

Variables	**Cambodia**	
	$\Delta \mathbf{lnexport_t}$	$\Delta \mathbf{lnimport_t}$
$\Delta \text{lnimport}_{t-1}$	0.205 (0.245)	0.413** (0.174)
$\Delta \text{lnimport}_{t-2}$	0.144 (0.257)	0.039 (0.183)
$\Delta \text{lnimport}_{t-3}$	-0.820*** (0.223)	-0.266* (0.158)
$\Delta \text{lnimport}_{t-4}$	0.672*** (0.225)	-0.117 (0.160)
$\Delta \text{lnexport}_{t-1}$	0.287* (0.158)	-0.319*** (0.113)
$\Delta \text{lnexport}_{t-2}$	0.214 (0.169)	0.393*** (0.120)
$\Delta \text{lnexport}_{t-3}$	0.502** (0.185)	0.121 (0.131)
$\Delta \text{lnexport}_{t-4}$	-0.309* (0.183)	0.304** (0.130)
LM test	Reject H_0	Reject H_0

Note: ***, **, and * indicate 1%, 5%, and 10% significance level, respectively. For import equation, the null hypothesis (H_0) is that all lag export lags are simultaneously equal to zero. For export equation, the null hypothesis (H_0) is that all lag import lags are simultaneously equal to zero.

Source: Own calculation.

Table (5.8) reports the results of VAR models for Indonesia. The optimum number of lags is three. In the import equation, all lags are significant, except for the third lags of export and import. In the export equation, no lags are statistically significant. The LM test results indicate export causes import (Appendix (A-10)).

Table (5.8) Results of VAR Model for Indonesia

Variables	**Indonesia**	
	$\Delta \text{lnexport}_t$	$\Delta \text{lnimport}_t$
$\Delta \text{lnimport}_{t-1}$	0.087 (0.158)	0.606*** (0.189)
$\Delta \text{lnimport}_{t-2}$	-0.192 (0.176)	-0.439** (0.209)
$\Delta \text{lnimport}_{t-3}$	0.056 (0.159)	0.145 (0.190)
$\Delta \text{lnexport}_{t-1}$	-0.148 (0.200)	-0.580** (0.239)
$\Delta \text{lnexport}_{t-2}$	0.325 (0.201)	0.536** (0.240)
$\Delta \text{lnexport}_{t-3}$	0.263 (0.200)	0.327 (0.238)
LM test	Accept H_0	Reject H_0

Note: ***, **, and * indicate 1%, 5%, and 10% significance level, respectively. For import equation, the null hypothesis (H_0) is that all lag export lags are simultaneously equal to zero. For export equation, the null hypothesis (H_0) is that all lag import lags are simultaneously equal to zero.

Source: Own calculation.

Table (5.9) reports the results of VAR models for Laos. The optimum number of lags is two. No lags in both export and import equations are statistically significant. The LM test results indicate that there is no causality between export and import (Appendix (A-10)).

Table (5.9) Results of VAR for Laos

Variables	Laos	
	$\Delta \text{lnexport}_t$	$\Delta \text{lnimport}_t$
$\Delta \text{lnimport}_{t-1}$	-0.432 (0.327)	-0.347 (0.328)
$\Delta \text{lnimport}_{t-2}$	-0.192 (0.349)	-0.333 (0.350)
$\Delta \text{lnexport}_{t-1}$	0.506 (0.334)	0.364 (0.335)
$\Delta \text{lnexport}_{t-2}$	0.364 (0.353)	0.550 (0.354)
LM test	Accept H_0	Accept H_0

Note: ***, **, and * indicate 1%, 5%, and 10% significance level, respectively. For import equation, the null hypothesis (H_0) is that all lag export lags are simultaneously equal to zero. For export equation, the null hypothesis (H_0) is that all lag import lags are simultaneously equal to zero.

Source: Own calculation.

Table (5.10) reports the results of VAR models for Malaysia. The optimal number of lags is five. Only the fourth lags of export and import are significant in the import equation and only the fourth lag of export is significant in the export equation. The LM test results indicate that there is no causality between export and import (Appendix (A-10)).

Table (5.10) Results of VAR for Malaysia

Variables	Malaysia	
	$\Delta \text{lnexport}_t$	$\Delta \text{lnimport}_t$
$\Delta \text{lnimport}_{t-1}$	-0.050 (0.154)	0.252 (0.223)
$\Delta \text{lnimport}_{t-2}$	0.104 (0.151)	0.031 (0.218)
$\Delta \text{lnimport}_{t-3}$	-0.072 (0.153)	0.007 (0.222)
$\Delta \text{lnimport}_{t-4}$	-0.194 (0.152)	-0.466** (0.220)
$\Delta \text{lnimport}_{t-5}$	0.113 (0.146)	-0.086 (0.211)
$\Delta \text{lnexport}_{t-1}$	0.167 (0.244)	-0.020 (0.353)
$\Delta \text{lnexport}_{t-2}$	-0.132 (0.250)	-0.132 (0.363)
$\Delta \text{lnexport}_{t-3}$	0.215 (0.244)	-0.070 (0.354)
$\Delta \text{lnexport}_{t-4}$	0.551** (0.246)	0.921** (0.356)
$\Delta \text{lnexport}_{t-5}$	0.193 (0.222)	0.514 (0.322)
LM test	Accept H_0	Accept H_0

Note: ***, **, and * indicate 1%, 5%, and 10% significance level, respectively. For import equation, the null hypothesis (H_0) is that all lag export lags are simultaneously equal to zero. For export equation, the null hypothesis (H_0) is that all lag import lags are simultaneously equal to zero.

Source: Own calculation.

Table (5.11) reports the results of VAR models for Myanmar. The optimal number of lags is two. All lags, except for the second lag of import, are significant in the import equation, and the first and second lags of export are significant in the export equation. The LM test results indicate export causes import (Appendix (A-10)).

Table (5.11) Results of VAR for Myanmar

Variable	Myanmar	
	$\Delta \text{lnexport}_t$	$\Delta \text{lnimport}_t$
$\Delta \text{lnimport}_{t-1}$	0.099 (0.111)	0.531*** (0.135)
$\Delta \text{lnimport}_{t-2}$	-0.040 (0.114)	-0.045 (0.138)
$\Delta \text{lnexport}_{t-1}$	0.757*** (0.146)	0.381** (0.177)
$\Delta \text{lnexport}_{t-2}$	-0.281* (0.146)	-0.408** (0.177)
LM test	Accept H_0	Reject H_0

Note: ***, **, and * indicate 1%, 5%, and 10% significance level, respectively. For import equation, the null hypothesis (H_0) is that all lag export lags are simultaneously equal to zero. For export equation, the null hypothesis (H_0) is that all lag import lags are simultaneously equal to zero.
Source: Own calculation.

Table (5.12) reports the results of VAR models for Philippines. The optimal number of lags is two. The LM test results indicate export causes import. The first lags of import in both export and import are significant. The LM test results indicate that there is no causality between export and import (Appendix (A-10)).

Table (5.12) Results of VAR for Philippines

Variables	Philippines	
	$\Delta \text{lnexport}_t$	$\Delta \text{lnimport}_t$
$\Delta \text{lnimport}_{t-1}$	0.489** (0.203)	.550*** (0.328)
$\Delta \text{lnimport}_{t-2}$	0.293 (0.217)	-.149 (0.350)
$\Delta \text{lnexport}_{t-1}$	-0.199 (0.182)	-.023 (0.335)
$\Delta \text{lnexport}_{t-2}$	-0.226 (0.182)	.182 (0.354)
LM test	Accept H_0	Accept H_0

Note: ***, **, and * indicate 1%, 5%, and 10% significance level, respectively. For import equation, the null hypothesis (H_0) is that all lag export lags are simultaneously equal to zero. For export equation, the null hypothesis (H_0) is that all lag import lags are simultaneously equal to zero.
Source: Own calculation.

Table (5.13) reports the results of VAR models for Vietnam. The optimal number of lags is eight. Only the eighth lags of export and import are significant in the import equation and the sixth and eighth lags of export and import are significant in the export equation. The LM test results indicate that there is bi-directional causality between export and import (Appendix (A-10)).

Table (5.13) Results of VAR for Vietnam

Variables	Vietnam	
	$\Delta \text{lnexport}_t$	$\Delta \text{lnimport}_t$
$\Delta \text{lnimport}_{t-1}$	-.256 (0.586)	-0.069 (0.584)
$\Delta \text{lnimport}_{t-2}$	.131 (0.588)	-0.334 (0.586)
$\Delta \text{lnimport}_{t-3}$	.778 (0.576)	0.672 (0.574)
$\Delta \text{lnimport}_{t-4}$	.581 (0.583)	0.039 (0.581)
$\Delta \text{lnimport}_{t-5}$	-.965 (0.586)	-0.864 (0.584)
$\Delta \text{lnimport}_{t-6}$	1.073* (0.617)	0.360 (0.615)
$\Delta \text{lnimport}_{t-7}$	.554 (0.709)	0.692 (0.706)
$\Delta \text{lnimport}_{t-8}$	3.493*** (0.717)	3.305*** (0.714)
$\Delta \text{lnexport}_{t-1}$	.209 (0.597)	0.007 (0.594)
$\Delta \text{lnexport}_{t-2}$	.312 (0.602)	0.695 (0.600)
$\Delta \text{lnexport}_{t-3}$	-.561 (0.598)	-0.484 (0.595)
$\Delta \text{lnexport}_{t-4}$	-.381 (0.599)	.133 (.596)
$\Delta \text{lnexport}_{t-5}$	.927 (0.615)	0.823 (0.612)
$\Delta \text{lnexport}_{t-6}$	-1.131* (0.644)	-0.378 (0.641)
$\Delta \text{lnexport}_{t-7}$	-.494 (0.723)	-0.558 (0.720)
$\Delta \text{lnexport}_{t-8}$	-3.405*** (0.728)	-3.150*** (0.726)
LM test	Reject H_0	Reject H_0

Note: ***, **, and * indicate 1%, 5%, and 10% significance level, respectively. For import equation, the null hypothesis (H_0) is that all lag export lags are simultaneously equal to zero. For export equation, the null hypothesis (H_0) is that all lag import lags are simultaneously equal to zero.
Source: own calculation.

CHAPTER VI
CONCLUSION

In this chapter, summary of findings, recommendation, and need for future research.

6.1 Findings

Using the annual data from the United Nations Database from 1970 to 2021, this thesis aims to analyze cointegration and causality between export and import series of ASEAN countries. The line graphs show the export and import series are increasing overtime in general and closely moving over time. This suggests the potential cointegration between the two series. The results of Augmented Dicky-Fuller (ADF) test for unit root show that all series are nonstationary in level while they are stationary in first difference. Therefore, all series need to be first-differenced to become stationary.

Classical time-series regression models assume that series in the model are stationary. Otherwise, the results would be spurious. However, if the linear combination of the first-order integration series is stationary, i.e., the series are cointegrated, the results are not spurious. Engle-Granger test and Johansen test are used to test the cointegration between export and import series. The results of Engle-Granger two-step procedure show that there is a cointegration relationship between export and import for all countries, except for Brunei and Cambodia. The results of Johansen's trace statistic show that there is a cointegration relationship between export and import for Cambodia, Singapore, and Thailand. The results of Johansen's maximum Eigen value statistic show that there is a cointegration relationship between export and import for Malaysia, Singapore, and Thailand.

Since the two cointegration tests consistently suggest that export and import of Singapore and Thailand are cointegrated, vector error correction model (VECM) is applied to these two countries. The results of VECM for Singapore show the coefficient of error correction term has expected negative signs and statistically significant in both export and import equations. This implies that both export and import series make adjustment to their long-run equilibrium value each year. Similarly, the results of VECM for Thailand show the coefficient of error correction term has expected negative signs and statistically significant in both export and import equations. This implies that both export and import series make adjustment to their long-run equilibrium value each year.

The direction of causality between export and import is estimated by Vector Autoregressive (VAR) Model for ASEAN countries excluding Singapore and Thailand. The estimation results from VAR models show that there is no causality between export and import for Brunei, Laos, Malaysia, and Philippines; causality from export to import for Indonesia and Myanmar; and a bi-directional causality for Cambodia and Vietnam.

6.2 Recommendations

Based on the findings, some recommendations could be made. Since there is a cointegration relationship between export and import, Singapore and Thailand should not be worried about trade balance. While trade balances could be deficit or surplus in the short-run, they will, however, be balanced in the long-run. For Indonesia and Myanmar, as export causes import, the latter is dependent on the former. Thus, it is suggested that these two countries should promote export so that they can meet their import demand. For Cambodia and Vietnam, as causality flows in both directions, they would experience a constant trade balance to GDP ratio over time. The other four countries should be worried about their trade balance as export and import are not cointegrated and have no causality. In the long-run, they could face trade balance explosion. Thus, they should impose strict trade policy.

6.3 Need for Future Research

As in other research, this thesis also has limitations such as variance decomposition analysis to analyze how economic variable response to an exogenous shock. Therefore, these limitations should be incorporated into future studies.

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APPENDICES

Appendix (A-1) The Values of Export, Import and Balance of Trade for Brunei and Cambodia

Year	Brunei		Cambodia	
	Export (US $)	Import (US $)	Export (US $)	Import (US $)
1970	3961453014.60	616153236.45	41698840.16	325267467.18
1971	4348797498.91	658054691.66	39659937.98	309054070.58
1972	4782928490.60	766257736.30	37627720.93	292224994.72
1973	5287265223.00	820034300.79	30506640.87	236792677.46
1974	5819821687.55	806415114.34	28782551.66	224543253.94
1975	5840583175.13	1092362205.47	28091589.27	221389013.66
1976	7298995790.69	1023968395.37	28577973.35	221590319.93
1977	8179731331.84	1000487728.94	24729587.22	188856287.07
1978	8771215457.67	960975441.63	24362871.05	188592427.74
1979	10754382883.95	1150126772.40	20650450.16	165276693.98
1980	10243963604.34	1189028226.32	18648236.18	154895528.52
1981	9632859050.88	1236743673.33	21766029.32	156242057.20
1982	9042220640.74	1240056606.45	21766029.32	154486528.47
1983	8628867922.91	1258378380.96	19355159.30	160888392.78
1984	8291605979.51	1317606739.40	18320348.99	175460548.47
1985	8036109816.37	1405928067.51	16627050.55	171931353.11
1986	7102137783.36	1508351190.12	16038934.22	179802550.70
1987	6608345923.17	1281654678.34	24385091.80	220662469.38
1988	6877815195.60	1384077801.67	45086237.08	213056790.33
1989	6846776850.25	1723439748.83	69867481.06	212655127.00
1990	6934248550.96	2032757579.64	78401723.03	195643837.85
1991	7542317956.18	2323639249.35	187913358.36	266676571.78
1992	7998017301.36	2884917962.53	215421552.53	282898573.91
1993	7775105547.27	2983926981.84	294809292.12	592631363.17
1994	7996606467.04	2764741498.61	489051787.17	809854660.10
1995	9341131161.19	3203795285.59	728766886.27	1149626642.37
1996	9019461035.07	3881836359.39	648942585.77	1095289146.95
1997	8562350855.58	3235205042.96	883242821.63	1158698749.03
1998	7710207188.58	2800248181.23	857093999.17	1139908025.58
1999	8786673443.34	2698507879.13	1282002369.93	1568151918.62
2000	9830690519.71	2530533957.56	1670391428.92	1940123124.51
2001	9959076402.78	2611106814.33	1949454109.19	2125498444.94
2002	10534696628.98	2959345431.78	2203303854.63	2449740026.61
2003	10773127555.41	2720358144.97	2447501988.99	2766904026.38
2004	10695819087.95	2822592045.20	3134869932.43	3315422200.53
2005	10561036180.57	2903008429.23	3648694484.21	3889681091.73
2006	10948585911.52	3021810563.82	4348698042.75	4510157284.26
2007	9893509309.29	3421130324.32	4789945144.29	5054125106.35
2008	9279054469.85	3796483756.86	5539824878.47	6196553447.03
2009	8789495111.33	3765756820.00	4993280984.37	5566976550.38
2010	8103970926.04	3755787636.02	6019978252.51	6503412237.72
2011	7860866627.77	5021646431.67	7156802877.92	7566700141.57
2012	7956228538.05	6055820141.60	8189163566.77	8842717004.26
2013	7504514978.79	6935769511.31	9337457808.91	10178825280.94
2014	7497183282.94	5349765715.18	10390711285.07	11210461471.19
2015	6751298119.78	4872547173.74	11140138897.42	11939253887.28
2016	6623617652.26	4346134275.16	12100136299.00	12967678064.32
2017	6270201064.22	4402032065.88	12736806738.26	13494170124.42
2018	6627902560.24	5637792028.31	14543036089.51	15775591917.28
2019	7614163501.58	6413890441.54	16476378485.53	17519725918.52
2020	8187171598.84	6282092757.82	14618128520.56	15969165964.66
2021	8904621591.53	8133024141.58	14184182034.16	22092002955.29

Appendix (A-2) The Values of Export, Import and Balance of Trade for Indonesia and Laos

Year	Indonesia		Laos	
	Export (US $)	Import (US $)	Export (US $)	Import (US $)
1970	15932837964.96	5889753787.47	50245231.75	75143998.55
1971	18015187291.32	6785681942.97	52643765.27	78728520.58
1972	21836011743.34	7736144855.76	54408407.19	81354493.82
1973	25905189784.75	10369394564.97	59711475.28	89281846.91
1974	27605456665.91	13703805439.36	61628747.65	92137262.67
1975	26936812386.80	15300894760.03	65379314.57	97854587.88
1976	31521801729.24	17864028352.73	66710150.81	99748108.36
1977	33317589221.69	18526236119.84	65675715.97	98122838.08
1978	34845919002.50	21027044275.62	70391152.41	105238653.92
1979	34807710757.98	25740405441.52	64281486.45	96042602.06
1980	32839986165.19	29627954568.43	69843639.71	105144499.01
1981	32056717152.52	37652354569.88	78395624.10	116610003.92
1982	27586352543.65	40737463696.64	90301793.74	134389802.75
1983	28453712656.36	39340326846.94	126418893.85	189467593.42
1984	30314594352.74	36383688606.89	62133255.14	92327813.24
1985	27949066772.60	38304000087.54	95355941.68	149384442.21
1986	32199848151.46	39901586987.42	89515902.23	123568129.38
1987	36909398515.55	40689355684.60	148763756.62	221790608.73
1988	37297918499.92	33082276280.54	326091023.46	494382877.66
1989	41180497004.01	36910071875.26	331438104.63	566249765.40
1990	42563181656.47	45457827453.87	330280565.68	463005553.78
1991	50555098947.64	52607301536.69	393881188.14	496885520.65
1992	57486497110.39	57176794272.66	546481800.95	563522852.63
1993	60997824785.30	59566031785.03	729321030.58	686035666.16
1994	67061588328.63	71655087238.84	914851434.06	944402010.30
1995	72239051009.74	86658495701.54	913542385.94	951387391.14
1996	77701346729.26	92608031479.00	954535508.18	1118369169.42
1997	83761653560.96	106235956513.78	1074183088.97	1201693333.00
1998	93128650739.00	100615472849.18	1704513673.23	1448030821.92
1999	63509471456.48	62077618928.28	1799480788.61	1435454025.52
2000	80329830253.57	75170549303.80	1597270324.94	1519949770.66
2001	80847941799.11	78312573811.70	1377821354.94	1632243659.73
2002	79864078569.10	74984717379.74	1314606911.22	1598048155.05
2003	84565181612.81	76157278642.00	1140239483.36	1340962714.48
2004	96005438870.20	96455702370.79	1219655907.13	1590954238.44
2005	111943603414.76	113594866368.82	1599030699.31	2012908594.71
2006	122472487779.65	123344336095.88	1807598159.94	2283652240.36
2007	132935287567.73	134524585382.60	1931963327.58	2532776985.31
2008	145608620963.93	147980497512.47	2168757433.30	2956298157.06
2009	131498944580.31	125816785895.77	2263398577.42	3099376088.95
2010	151573997426.82	147638855602.91	2588351554.94	3243262712.29
2011	173961354440.19	169827326051.73	3131788453.30	3637987544.71
2012	176759955554.77	183410813948.17	3302966727.98	4566191619.34
2013	184125467803.01	186825733771.38	3538648692.37	4560317289.69
2014	186104152989.04	190785883241.12	3396433386.94	4236035613.72
2015	182158298808.72	178863652312.47	4158982773.39	4630637708.85
2016	179133544567.18	174561779205.67	5096687660.27	6025714194.28
2017	195071579412.56	188645329723.23	5789481312.87	7266810905.58
2018	207778829594.91	211539357389.97	6770988252.22	7441934939.75
2019	206787676319.89	196463073217.43	7391869763.74	8363243112.57
2020	189956053773.29	163619520875.50	7152719246.35	6587494262.45
2021	235613061765.25	201754026439.16	7972012852.44	7068644478.81

Appendix (A-3) The Values of Export, Import and Balance of Trade for Malaysia and Laos

Year	Malaysia		Myanmar	
	Export (US $)	Import (US $)	Export (US $)	Import (US $)
1970	5638797355.23	4056810914.34	1124588349.69	3538504756.26
1971	7133104687.70	5115521630.64	1174348896.14	3395206777.47
1972	7277589107.36	4960665436.49	1072837381.39	2214431432.24
1973	8309806628.93	5787618582.95	802140008.72	1481701100.69
1974	9633596312.66	7918734781.25	739690522.93	1864306704.06
1975	9344627473.08	6565059885.09	814082539.86	2035308958.75
1976	10930051106.16	7168683009.97	903402720.74	2290857020.93
1977	11384330948.56	8300081327.83	1026311270.46	3027408631.91
1978	12248634144.22	9368273035.69	1207190856.79	4041480661.82
1979	14449236210.84	11282637016.61	1357965312.52	4686321566.37
1980	14907283062.08	13596703366.97	1415189940.94	5179744273.34
1981	14783379741.28	14356877005.95	1397524946.95	5850856474.01
1982	16361828962.59	16331509053.99	1463457670.99	5565693496.21
1983	18380530409.02	17801822464.63	1485849916.89	4916075992.37
1984	20913957885.56	18959992773.27	1339802713.07	4714025842.27
1985	21007544436.42	17095094092.82	1401754593.40	4162806283.86
1986	23483633674.09	15989231917.91	1384089599.41	3743420865.93
1987	26902179022.66	17344126294.72	1307955963.34	3359382282.77
1988	30037987538.13	21558911025.84	1564969185.74	2844464878.99
1989	35457439707.52	27314511435.03	1882441472.07	3371323781.01
1990	41775655145.52	34494273685.07	1981216156.77	3849939030.17
1991	48363819317.88	43189986753.77	2315358226.15	3666995277.24
1992	54455626139.72	45942898646.72	2888599721.22	4423130945.33
1993	60741186488.90	52850520328.22	3173976455.09	5033102675.04
1994	74047590937.25	66399102462.99	2890341340.34	5360777386.54
1995	88090367638.92	82134397992.16	2661442826.69	5626833967.17
1996	96219307752.83	86147101544.21	3086646696.07	5481147688.73
1997	101502356874.68	91164807431.35	3676060368.73	5702781895.92
1998	102000891230.81	74067895835.64	4623388602.28	5830109418.82
1999	115427575256.52	81891937183.50	6437469449.71	5575192083.12
2000	133972400205.24	101852260701.84	8017142510.25	5636051583.01
2001	124821867183.30	93464688156.24	9405430028.24	5410056496.42
2002	131596367749.46	99246360516.83	9076316620.10	4504835392.72
2003	138352357036.62	103745962940.20	8383825942.15	3778283345.71
2004	160569342938.37	124117892316.11	9151757227.81	3476956563.58
2005	173899659979.41	135177840642.81	10490708070.63	4260303023.88
2006	185518190126.38	146221677332.90	11483618971.68	5190803523.07
2007	192537140220.05	154864977144.34	10423918232.66	6217483729.32
2008	195550868266.73	158495037296.48	9449821370.47	6391675865.43
2009	174272851633.70	138310842020.08	9863965400.97	7209661373.99
2010	193649122846.99	159953184386.09	9664724018.66	8745905063.38
2011	201742480578.71	170046623885.55	9242358765.71	8960995456.17
2012	198228416462.28	174998469142.63	10146660242.54	11604658462.21
2013	198742319186.60	178015258639.37	11767734956.67	15652770237.64
2014	208759490071.56	185116312774.62	13735563768.11	19083700596.64
2015	209286952234.47	186603045427.79	14666236785.44	19750522408.08
2016	212048449398.38	189279208581.32	16644200384.73	21733252674.27
2017	230460615896.17	208570166723.92	18633266452.47	21248446147.02
2018	234915397570.29	211674243841.71	23634491498.13	22475335699.29
2019	232461128883.96	206619369006.12	21844145758.88	21729806736.56
2020	211774662475.33	189292011320.18	17667716822.80	16077205194.00
2021	245411582499.03	224236574323.28	14557703351.47	11220558418.55

Appendix (A-4) The Values of Export, Import and Balance of Trade for Philippines and Singapore

Year	Philippines		Singapore	
	Export (US $)	Import (US $)	Export (US $)	Import (US $)
1970	5110450118.34	6125256811.73	7757423672.10	8753768661.47
1971	5284879550.59	6090260136.81	8573891222.52	9831214881.89
1972	5944887297.56	6271495640.71	9056643572.82	10254032331.39
1973	6898933230.31	6610178059.03	11065553797.76	11805138835.85
1974	6111758121.08	7614178528.28	12682559598.49	13535831833.14
1975	6327718370.53	8076683604.69	12353863218.96	12724019420.65
1976	7139479723.54	8208283301.69	13831651301.07	13919371556.38
1977	8311313261.71	8741849164.67	15795392140.82	15242376302.44
1978	8814583704.57	9854651932.64	17619042423.58	17244740239.67
1979	9193095572.55	11441777826.30	21747567872.27	21087847544.23
1980	12853621800.72	13684309858.59	26529412834.36	25579546487.73
1981	14071554545.99	13576041278.23	29510301311.08	28107504591.49
1982	12567806716.75	13908242830.80	30943065481.06	29816231156.69
1983	13001222325.07	13483326775.59	32687214736.42	31277362573.42
1984	13592039730.58	11126807752.00	35505609804.88	33803284054.33
1985	11407767930.67	9546315215.02	34341970796.28	32443838306.69
1986	13337289697.85	10523477275.60	38757878275.42	35984361646.03
1987	14247645210.92	13536012401.69	44237121088.14	40770643536.45
1988	16318122571.70	16191261212.53	57377120724.46	51639735966.40
1989	17765886859.37	18648881741.47	63050788282.15	56598112487.04
1990	18096222979.40	20521318218.05	71296055861.66	64802138453.99
1991	19230014289.00	20291895571.35	77418362337.02	69454948811.67
1992	20053653455.75	22055758485.63	83025475969.67	74642809084.79
1993	21301239204.51	24592826803.82	97120433509.72	88487916643.94
1994	25516949397.03	28159361581.30	115080101103.78	103056752677.61
1995	28588236390.75	32669281672.10	139347480588.44	126665284672.60
1996	32743786377.70	37844683519.60	152371029040.06	139366755768.92
1997	38209595367.23	42681147841.86	167960140381.50	155018202316.66
1998	30600478394.66	37057293232.27	160540941574.38	141928027203.46
1999	33711641372.34	37686893605.54	173413270779.92	155286090957.03
2000	38338028059.25	42131935149.06	198260433146.04	186372883821.58
2001	37506797309.71	45760299088.24	191042350844.65	173656138053.93
2002	39324049462.30	49006145055.31	205142690887.93	183277217100.36
2003	42954929049.84	51607720972.84	233597439674.14	201401705671.63
2004	45764754835.80	53308182940.59	278913679922.90	246965395595.80
2005	51484483905.99	55295206287.09	314558434709.87	275546051315.62
2006	56662370892.11	55512427204.65	349015983852.49	303926608841.13
2007	58284134685.21	55375745653.94	378815340134.20	326611532376.85
2008	55777713923.67	58023589633.29	398745585801.83	362134962631.61
2009	53151522113.48	56661668369.61	370020329860.16	326118305966.21
2010	63945390278.58	68417300057.04	435838306693.58	379297510592.26
2011	63446064750.45	67776811966.27	469356390813.38	400870219846.16
2012	66305846961.10	72354925300.36	475914025421.42	411220337133.82
2013	67614464876.31	77424499245.97	505134398923.50	438001345625.81
2014	75820897027.37	85088166979.26	523420071645.48	450127470769.01
2015	83377968159.61	97858999262.88	549421999163.53	465345116651.21
2016	91054124530.37	116269382854.54	549616787591.15	466256650846.47
2017	106899164008.54	133878420438.23	590160420417.14	503892786354.63
2018	119530730383.81	153484336624.68	634778026294.26	540231665848.38
2019	122681581077.82	157065041118.10	636710635899.12	540549888167.59
2020	102876480721.40	123210580279.57	635134871710.95	528197115996.58
2021	111071173362.40	139166606445.14	678340952484.86	568224610404.96

Appendix (A-5) The Values of Export, Import and Balance of Trade for Thailand

Year	Thailand		Vietnam	
	Export (US $)	Import (US $)	Export (US $)	Import (US $)
1970	4819734569.99	9526679084.74	2439249403.22	2378848229.76
1971	5680922887.91	8261242674.39	2532064646.18	2469365935.14
1972	6643023324.83	9336134058.87	2581687643.04	2517758493.76
1973	6342648740.75	11526257441.47	2545038924.55	2482018273.93
1974	6833253404.54	10867074649.39	2608197779.08	2543616252.36
1975	6504322837.85	10687973769.25	2685967423.58	2619450801.32
1976	8071895988.92	11469895023.93	2981667612.30	2907838549.51
1977	8970228554.89	13744418981.02	3385860468.59	3302035222.49
1978	10083267757.08	14658806222.15	3445171724.77	3359817449.34
1979	11134256741.42	17718398573.98	3678497036.07	3587452350.73
1980	12000812725.21	17691218727.98	3548070941.85	3460267621.72
1981	13100200299.89	17790699583.57	3751758812.68	3658610600.00
1982	14627602170.47	15188802267.63	4068042557.94	3967655175.77
1983	13752394997.51	20165258681.93	4341047663.48	4233669467.52
1984	16125805880.69	21704374293.23	4702689171.32	4584784739.49
1985	17704350634.27	18954919144.26	5026441733.74	4904654608.57
1986	20433733194.55	18778919571.51	5081677689.79	4955075229.60
1987	24889433934.70	25080852382.61	5254856133.06	5117795547.98
1988	31652158161.83	35003953571.18	5798106089.11	5671605400.68
1989	38357162236.22	42532142856.87	5349516816.02	5204209179.36
1990	43643566005.94	52643311787.56	6228122720.76	6044540407.58
1991	51073009928.81	58581009822.47	7722530157.64	7393186253.52
1992	58046359063.38	64104839567.55	9429820740.92	8999334041.02
1993	65981022050.06	71531238983.40	8424332985.10	8138607393.34
1994	74627783481.77	84035067260.56	10858025501.51	10475879401.78
1995	86098403372.86	103338225361.13	11474213501.32	11070983484.04
1996	82238030582.38	99981120490.70	15625957303.69	15030248809.68
1997	89682170587.10	91296816716.35	17823619579.92	17085164865.68
1998	99360150291.27	73443286932.28	19614485853.22	18812959535.41
1999	107940862306.11	81813759128.39	22895815780.25	21839269101.77
2000	125029919477.57	103051503218.01	26929196176.94	25626216101.95
2001	125004422738.19	104564528631.78	28566120127.84	27183902930.41
2002	132363787975.89	111069481883.32	31808608900.86	30375621783.86
2003	144453668436.33	123393962642.70	35648903116.45	34126520946.28
2004	165588838740.07	148449140442.11	39008781126.32	37167780305.86
2005	178438060520.51	172482629190.91	44292097931.78	41446400336.90
2006	197687342176.52	177559535362.54	49254349609.15	46389784138.21
2007	215269159774.14	185017748489.25	55325405278.77	59642493547.74
2008	228752773719.99	206107223459.25	57779884249.27	63682584436.22
2009	200981604128.87	163294019049.15	62620140984.19	66138841021.45
2010	229561746675.11	200779032314.58	71982149542.20	75279736403.35
2011	251391797699.58	225676124898.26	85491568284.22	84413022727.04
2012	260596990684.41	238380598432.42	81910248574.76	80876884273.92
2013	267149274416.50	242386876821.56	96156430521.89	88513402157.60
2014	268072150461.08	229544410947.11	113025232282.23	103987024716.09
2015	271423496359.61	229553376551.14	174473995760.12	172245363449.15
2016	278741249708.11	227276892745.15	179000452459.18	177701397382.52
2017	293182391053.54	241429966917.87	185978194454.38	187179431074.51
2018	303006844607.71	261406750184.50	236988664406.40	231984827995.17
2019	294057337767.55	247900687863.11	188007134266.46	183295164410.06
2020	236179890679.12	212850349930.91	182351963344.15	176522970678.69
2021	260789767218.40	250936625661.11	129348387532.67	131079351379.03

Appendix (A-6) Augmented Engle-Granger Cointegratin Test For ASEAN

Augmented Engle-Granger Two-Step Appraoch for cointegrations test for LnBrunei_IM LnBrunei_EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-46.1726				.417971	1.96553	1.98026	2.00451
1	25.0554	142.46*	1	0.000	.022405*	-.96064*	-.931176*	-.882673*
2	25.2631	.4155	1	0.519	.02316	-.927629	-.883434	-.810679
3	25.3464	.16663	1	0.683	.024067	-.889434	-.830506	-.7335
4	25.6901	.68734	1	0.407	.024743	-.862087	-.788427	-.66717

. dfuller ehat, noconstant lags(1) /*NO COINTEGRATED*/

Augmented Dickey-Fuller test for unit root Number of obs = 50

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-0.284	-2.620	-1.950	-1.610

*Augmented Engle-Granger Two-Step Approach for cointegrations test for LnCam_IM LnCam_EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-14.6537				.112406	.652236	.666968	.69122
1	27.3722	84.052	1	0.000	.020343	-1.05717	-1.02771	-.979207
2	30.2799	5.8154*	1	0.016	.018791*	-1.13666*	-1.09246*	-1.01971*
3	30.2897	.0197	1	0.888	.019587	-1.0954	-1.03648	-.939471
4	30.8267	1.0741	1	0.300	.019976	-1.07611	-1.00245	-.881197

. dfuller ehat, noconstant lags(2) /*NO COINTEGRATED*/

Augmented Dickey-Fuller test for unit root Number of obs = 49

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.375	-2.622	-1.950	-1.610

*Augmented Engle-Granger Two-Step Approach for cointegrations test for LnIndo_IM LnIndo-EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-.810993				.063139	.075458	.09019	.114441
1	41.7812	85.184	1	0.000	.01116	-1.65755	-1.62809	-1.57959
2	46.3194	9.0763*	1	0.003	.009632*	-1.80497*	-1.76078*	-1.68802*
3	46.3522	.06552	1	0.798	.01003	-1.76467	-1.70575	-1.60874
4	46.3954	.08653	1	0.769	.010442	-1.72481	-1.65115	-1.52989

. dfuller ehat, noconstant lags(2)

Augmented Dickey-Fuller test for unit root Number of obs = 49

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.859	-2.622	-1.950	-1.610

*Augmented Engle-Granger Two-Step Approach for cointegrations test for LnLao_IM LnLao-EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	28.4549				.018652	-1.14396	-1.12922	-1.10497
1	46.8091	36.708*	1	0.000	.009051*	-1.86705*	-1.83758*	-1.78908*
2	47.7761	1.934	1	0.164	.009065	-1.86567	-1.82147	-1.74872
3	47.8043	.05636	1	0.812	.009441	-1.82518	-1.76625	-1.66924
4	49.0621	2.5157	1	0.113	.009344	-1.83592	-1.76226	-1.641

. dfuller ehat, noconstant lags(1)

Augmented Dickey-Fuller test for unit root Number of obs = 50

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.954	-2.620	-1.950	-1.610

*Augmented Engle-Granger Two-Step Approach for cointegrations test for LnMalay_IM LnMalay-EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	40.8673				.01112	-1.66114	-1.6464	-1.62215
1	62.1017	42.469	1	0.000	.004786	-2.50424	-2.47477	-2.42627
2	65.2589	6.3145	1	0.012	.004375	-2.59412	-2.54993*	-2.47717*
3	65.3159	.11402	1	0.736	.004551	-2.55483	-2.4959	-2.3989
4	67.8266	5.0215*	1	0.025	.004275*	-2.61778*	-2.54412	-2.42286

. dfuller ehat, noconstant lags(2)

Augmented Dickey-Fuller test for unit root Number of obs = 49

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.200	-2.622	-1.950	-1.610

*Augmented Engle-Granger Two-Step Approach for cointegrations test for LnMya_IM LnMya-EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-22.9853				.159059	.999388	1.01412	1.03837
1	28.1561	102.28	1	0.000	.01969	-1.08984	-1.06037	-1.01187
2	35.1645	14.017	1	0.000	.015331	-1.34019	-1.29599	-1.22324
3	35.6587	.98845	1	0.320	.015661	-1.31911	-1.26019	-1.16318
4	41.9424	12.567*	1	0.000	.012571*	-1.53927*	-1.46561*	-1.34435*

Augmented Dickey-Fuller test for unit root Number of obs = 47

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.087	-2.625	-1.950	-1.609

Augmented Engle-Granger Two-Step Approach for cointegrations test for LnPhilip_IM LnPhilip-EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	39.7204				.011664	-1.61335	-1.59862	-1.57437
1	53.5726	27.704*	1	0.000	.006828*	-2.14886*	-2.1194*	-2.07089*
2	53.7491	.35296	1	0.552	.007067	-2.11455	-2.07035	-1.9976
3	55.2806	3.0631	1	0.080	.006914	-2.13669	-2.07777	-1.98076
4	55.4509	.34043	1	0.560	.00716	-2.10212	-2.02846	-1.9072

. dfuller ehat, noconstant lags(1)

Augmented Dickey-Fuller test for unit root Number of obs = 50

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.323	-2.620	-1.950	-1.610

Augmented Engle-Granger Two-Step Approach for cointegrations test for LnSing_IM LnSing-EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	108.683				.000659	-4.48679	-4.47206	-4.44781
1	123.308	29.249*	1	0.000	.000374*	-5.05448*	-5.02502*	-4.97652*
2	123.799	.98264	1	0.322	.000382	-5.03329	-4.98909	-4.91634
3	123.804	.00955	1	0.922	.000398	-4.99182	-4.93289	-4.83589
4	124.136	.66544	1	0.415	.000409	-4.96402	-4.89036	-4.7691

. dfuller ehat, noconstant lags(1)

Augmented Dickey-Fuller test for unit root Number of obs = 50

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.425	-2.620	-1.950	-1.610

Augmented Engle-Granger Two-Step Approach for cointegrations test for LnThai_IM LnThai-EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	36.211				.013501	-1.46713	-1.45239	-1.42814
1	45.2853	18.149*	1	0.000	.009644*	-1.80356*	-1.77409*	-1.72559*
2	46.0518	1.533	1	0.216	.00974	-1.79383	-1.74963	-1.67688
3	46.1646	.22542	1	0.635	.010109	-1.75686	-1.69793	-1.60092
4	46.4357	.54227	1	0.461	.010424	-1.72649	-1.65283	-1.53157

Augmented Dickey-Fuller test for unit root Number of obs = 50

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.983	-2.620	-1.950	-1.610

Augmented Engle-Granger Two-Step Approach for cointegrations test for LnViet_IM LnViet-EX

Selection-order criteria
Sample: 1974 - 2021 Number of obs = 48

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	95.5299				.00114	-3.93875	-3.92402	-3.89976
1	107.953	24.846	1	0.000	.000708	-4.41471	-4.38525	-4.33674
2	110.823	5.7398*	1	0.017	.000655*	-4.49262*	-4.44843*	-4.37567*
3	111.144	.64244	1	0.423	.000674	-4.46434	-4.40541	-4.30841
4	111.462	.63622	1	0.425	.000694	-4.43593	-4.36227	-4.24101

. dfuller ehat, noconstant lags(2)

Augmented Dickey-Fuller test for unit root Number of obs = 49

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.880	-2.622	-1.950	-1.610

Appendix (A-7) Johansen's Cointegration for Multiple-Trace Test for ASEAN

Johansen's Cointegration for Multiple-Trace Test for Brunei

```
. vecrank LnBrunei_IM LnBrunei_EX, level99 trend(constant) /*NO COINTEGRATED*/

                       Johansen tests for cointegration
Trend: constant                                         Number of obs =      50
Sample:  1972 - 2021                                             Lags =       2
-------------------------------------------------------------------------------
                                                             1%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6      94.010673        .        9.4573*    20.04
    1       9      98.712689     0.17145     0.0533      6.65
    2      10      98.739333     0.00107
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Multiple-Trace Test for Cambod

```
. vecrank LnCam_IM LnCam_EX, level99 trend(constant)

                       Johansen tests for cointegration
Trend: constant                                         Number of obs =      50
Sample:  1972 - 2021                                             Lags =       2
-------------------------------------------------------------------------------
                                                             1%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6      44.687155        .       27.9214     20.04
    1       9      57.843816     0.40919     1.6081*     6.65
    2      10      58.647865     0.03165
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Multiple-Trace Test for Indonesia

```
. vecrank LnIndo_IM LnIndo_EX, level99 trend(constant) /*NO COINTEGRATED*/

                       Johansen tests for cointegration
Trend: constant                                         Number of obs =      50
Sample:  1972 - 2021                                             Lags =       2
-------------------------------------------------------------------------------
                                                             1%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6      90.719505        .       12.9078*    20.04
    1       9      97.127912     0.22612     0.0910      6.65
    2      10      97.173414     0.00182
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Multiple-Trace Test for Lao

```
. vecrank LnLao_IM LnLao_EX, level99 trend(constant) /*NO COINTEGRATED*/

                       Johansen tests for cointegration
Trend: constant                                         Number of obs =      50
Sample:  1972 - 2021                                             Lags =       2
-------------------------------------------------------------------------------
                                                             1%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6      55.915364        .        9.0331*    20.04
    1       9      60.331058     0.16191     0.2017      6.65
    2      10      60.431905     0.00403
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Multiple-Trace Test for Malaysia

```
. vecrank LnMalay_IM LnMalay_EX, level99 trend(constant) /*NO COINTEGRATED*/

                       Johansen tests for cointegration
Trend: constant                                         Number of obs =      50
Sample:  1972 - 2021                                             Lags =       2
-------------------------------------------------------------------------------
                                                             1%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6      126.47647        .       16.0717*    20.04
    1       9      131.91192     0.19541     5.2008      6.65
    2      10      134.51235     0.09879
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Multiple-Trace Test for Myanmar

```
. vecrank LnMya_IM LnMya_EX, level99 trend(constant) /*NO COINTEGRATED*/

                       Johansen tests for cointegration
Trend: constant                                         Number of obs =      50
Sample:  1972 - 2021                                             Lags =       2
-------------------------------------------------------------------------------
                                                             1%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6      71.642865        .        7.5763*    20.04
    1       9      74.963408     0.12438     0.9352      6.65
    2      10      75.431011     0.01853
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Multiple-Trace Test for Philippine

```
. vecrank LnPhi_IM LnPhi_EX, level99 trend(constant) /*NO COINTEGRATED*/

                       Johansen tests for cointegration
Trend: constant                                         Number of obs =      50
Sample:  1972 - 2021                                             Lags =       2
-------------------------------------------------------------------------------
                                                             1%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6      106.69129        .       13.6340*    20.04
    1       9      113.14281     0.22745     0.7310      6.65
    2      10      113.5083      0.01451
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Multiple-Trace Test for Singapore

```
-------------------------------------------------------------------------------
. vecrank LnSing_IM LnSing_EX, level99 trend(constant)

                       Johansen tests for cointegration
Trend: constant                                         Number of obs =      50
Sample:  1972 - 2021                                             Lags =       2
-------------------------------------------------------------------------------
                                                             1%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6      190.61841        .       22.4394     20.04
    1       9      198.34175     0.26577     6.9927      6.65
    2      10      201.83811     0.13052
```

Johansen's Cointegration for Multiple-Trace Test for Thailand

```
. vecrank LnThai_IM LnThai_EX, level99 trend(constant)

                     Johansen tests for cointegration
Trend: constant                                          Number of obs =      50
Sample:  1972 - 2021                                              Lags =       2
--------------------------------------------------------------------------------
                                                           1%
maximum                                        trace    critical
  rank    parms       LL        eigenvalue   statistic    value
    0       6      93.844114         .        23.8630     20.04
    1       9      103.49986     0.32039       4.5515*     6.65
    2      10      105.77561     0.08701
--------------------------------------------------------------------------------
```

Johansen's Cointegration for Multiple-Trace Test for Vietnam

```
. vecrank LnViet_IM LnViet_EX, level99 trend(constant) /*NO COINTEGRATED*/

                     Johansen tests for cointegration
Trend: constant                                          Number of obs =      50
Sample:  1972 - 2021                                              Lags =       2
--------------------------------------------------------------------------------
                                                           1%
maximum                                        trace    critical
  rank    parms       LL        eigenvalue   statistic    value
    0       6      143.77591         .        16.9474*    20.04
    1       9      152.21458     0.28648       0.0701      6.65
    2      10      152.24961     0.00140
--------------------------------------------------------------------------------
```

Appendix (A-8) Johansen's Cointegration for Maximum Eigen Value Test for ASEAN

Johansen's Cointegration for Maximum Eigen Value Test for Brunei

```
.
. *Johansen's maximum-eigenvalue test for cointegration
. vecrank LnBrunei_IM LnBrunei_EX, max levela notrace trend(constant) /*NO COINTEGRATED*/

                     Johansen tests for cointegration
Trend: constant                                          Number of obs =      50
Sample:  1972 - 2021                                              Lags =       2
--------------------------------------------------------------------------------
maximum                                          max    5% critical  1% critical
  rank    parms       LL        eigenvalue   statistic     value        value
    0       6      94.010673                   9.4040      14.07        18.63
    1       9      98.712689     0.17145       0.0533       3.76         6.65
    2      10      98.739333     0.00107
--------------------------------------------------------------------------------
```

Johansen's Cointegration for Maximum Eigen Value Test for Cambodia

```
. vecrank LnCam_IM LnCam_EX, max levela notrace trend(constant)

                     Johansen tests for cointegration
Trend: constant                                          Number of obs =      50
Sample:  1972 - 2021                                              Lags =       2
--------------------------------------------------------------------------------
maximum                                          max    5% critical  1% critical
  rank    parms       LL        eigenvalue   statistic     value        value
    0       6      44.687155                  26.3133      14.07        18.63
    1       9      57.843816     0.40919       1.6081       3.76         6.65
    2      10      58.647865     0.03165
--------------------------------------------------------------------------------
```

Johansen's Cointegration for Maximum Eigen Value Test for Indonesia

```
. vecrank LnIndo_IM LnIndo_EX, max levela notrace trend(constant) /*NO COINTEGRATED*/

                     Johansen tests for cointegration
Trend: constant                                          Number of obs =      50
Sample:  1972 - 2021                                              Lags =       2
--------------------------------------------------------------------------------
maximum                                          max    5% critical  1% critical
  rank    parms       LL        eigenvalue   statistic     value        value
    0       6      90.719505                  12.8168      14.07        18.63
    1       9      97.127912     0.22612       0.0910       3.76         6.65
    2      10      97.173414     0.00182
--------------------------------------------------------------------------------
```

Johansen's Cointegration for Maximum Eigen Value Test for Lao

```
. vecrank LnLao_IM LnLao_EX, max levela notrace trend(constant) /*NO COINTEGRATED*/

                     Johansen tests for cointegration
Trend: constant                                       Number of obs =      50
Sample:  1972 - 2021                                           Lags =       2
-------------------------------------------------------------------------------
maximum                                            max     5% critical  1% critical
  rank    parms       LL        eigenvalue  statistic     value         value
    0       6      55.915364                  8.8314      14.07         18.63
    1       9      60.331058     0.16191      0.2017       3.76          6.65
    2      10      60.431905     0.00403
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Maximum Eigen Value Test for Malaysia

```
. vecrank LnMalay_IM LnMalay_EX, max levela notrace trend(constant) /*NO COINTEG

                     Johansen tests for cointegration
Trend: constant                                       Number of obs =      50
Sample:  1972 - 2021                                           Lags =       2
-------------------------------------------------------------------------------
maximum                                            max     5% critical  1% critical
  rank    parms       LL        eigenvalue  statistic     value         value
    0       6      126.47647                  10.8709     14.07         18.63
    1       9      131.91192     0.19541      5.2008       3.76          6.65
    2      10      134.51235     0.09879
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Maximum Eigen Value Test for Myanmar

```
. vecrank LnMya_IM LnMya_EX, max levela notrace trend(constant) /*NO COINTEGRATED*/

                     Johansen tests for cointegration
Trend: constant                                       Number of obs =      50
Sample:  1972 - 2021                                           Lags =       2
-------------------------------------------------------------------------------
maximum                                            max     5% critical  1% critical
  rank    parms       LL        eigenvalue  statistic     value         value
    0       6      71.642865                  6.6411      14.07         18.63
    1       9      74.963408     0.12438      0.9352       3.76          6.65
    2      10      75.431011     0.01853
-------------------------------------------------------------------------------
```

Johansen's Cointegration for Maximum Eigen Value Test for Philippine

```
. vecrank LnPhi_IM LnPhi_EX, max levela notrace trend(constant) /*NO COINTEGRATED*/
```

Johansen tests for cointegration

Trend: constant Number of obs = 50

Sample: 1972 - 2021 Lags = 2

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value	1% critical value
0	6	106.69129		12.9030	14.07	18.63
1	9	113.14281	0.22745	0.7310	3.76	6.65
2	10	113.5083	0.01451			

Johansen's Cointegration for Maximum Eigen Value Test for Singapore

```
. vecrank LnSing_IM LnSing_EX, max levela notrace trend(constant)
```

Johansen tests for cointegration

Trend: constant Number of obs =

Sample: 1972 - 2021 Lags =

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value	1% cr va
0	6	190.61841		15.4467	14.07	18
1	9	198.34175	0.26577	6.9927	3.76	6
2	10	201.83811	0.13052			

Johansen's Cointegration for Maximum Eigen Value Test for Thailand

```
. vecrank LnThai_IM LnThai_EX, max levela notrace trend(constant)
```

Johansen tests for cointegration

Trend: constant Number of obs =

Sample: 1972 - 2021 Lags =

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value	1% cr va
0	6	93.844114		19.3115	14.07	18
1	9	103.49986	0.32039	4.5515	3.76	6
2	10	105.77561	0.08701			

Johansen's Cointegration for Maximum Eigen Value Test for Vietnam

```
. vecrank LnViet_IM LnViet_EX, max levela notrace trend(constant) /*NO COINTEGRATED*/

                        Johansen tests for cointegration
Trend: constant                                         Number of obs =      50
Sample:  1972 - 2021                                             Lags =       2
-------------------------------------------------------------------------------
maximum                                      max      5% critical  1% critical
  rank    parms       LL       eigenvalue  statistic     value        value
    0       6     143.77591                 16.8773      14.07        18.63
    1       9     152.21458     0.28648      0.0701       3.76         6.65
    2      10     152.24961     0.00140
-------------------------------------------------------------------------------
```

Appendix (A-9) VECM Model for Singapore and Thailand

```
Vector error-correction model

Sample:  1971 - 2021                            Number of obs     =         51
                                                AIC               =  -7.511841
Log likelihood =  195.5519                      HQIC              =  -7.453942
Det(Sigma_ml)  =  1.60e-06                      SBIC              =  -7.360325

Equation           Parms      RMSE     R-sq      chi2     P>chi2
----------------------------------------------------------------
D_LnSing_IM          1      .067737   0.6350   85.23383   0.0000
D_LnSing_EX          1      .061992   0.7004   114.5334   0.0000
----------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_LnSing_IM  |
        _ce1 |
         L1. |  -.4839117   .0524156    -9.23   0.000    -.5866443   -.3811791
-------------+----------------------------------------------------------------
D_LnSing_EX  |
        _ce1 |
         L1. |  -.5133718   .0479696   -10.70   0.000    -.6073904   -.4193532
```

For Singapore

Thailand

```
.
. vec LnThai_IM LnThai_EX, lags(1) trend(rconstant)

Vector error-correction model

Sample:  1971 - 2021                            Number of obs     =         51
                                                AIC               =  -3.608713
Log likelihood =  96.02218                      HQIC              =  -3.550814
Det(Sigma_ml)  =  .0000794                      SBIC              =  -3.457197

Equation           Parms      RMSE     R-sq      chi2     P>chi2
----------------------------------------------------------------
D_LnThai_IM          1     .117407   0.3476   26.10715   0.0000
D_LnThai_EX          1     .081152   0.5180   52.66675   0.0000
----------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_LnThai_IM  |
        _ce1 |
         L1. |  -.2440275   .0477594    -5.11   0.000    -.3376342   -.1504207
-------------+----------------------------------------------------------------
D_LnThai_EX  |
        _ce1 |
         L1. |  -.2395712   .0330116    -7.26   0.000    -.3042728   -.1748697
------------------------------------------------------------------------------
```

Appendix (A-10) VAR Model for Brunei, Cambodia, Indonesia, Lao, Malaysia, Myanmar, Philippine, and Vietnam

Brueni

```
. varlmar

   Lagrange-multiplier test

  +--------------------------------------+
  | lag |      chi2    df   Prob > chi2  |
  |-----+--------------------------------|
  |   1 |    2.0293     4     0.73037    |
  |   2 |    4.1053     4     0.39194    |
  +--------------------------------------+
   H0: no autocorrelation at lag order


. *Import equation
. test _b[D_LnBrunei_IM:LD.LnBrunei_IM]=_b[D_LnBrunei_IM:L2D.LnBrunei_IM]

 ( 1)  [D_LnBrunei_IM]LD.LnBrunei_IM - [D_LnBrunei_IM]L2D.LnBrunei_IM = 0

           chi2(  1) =    2.10
         Prob > chi2 =    0.1477

. test _b[D_LnBrunei_IM:LD.LnBrunei_EX]=_b[D_LnBrunei_IM:L2D.LnBrunei_EX]

 ( 1)  [D_LnBrunei_IM]LD.LnBrunei_EX - [D_LnBrunei_IM]L2D.LnBrunei_EX = 0

           chi2(  1) =    1.76
         Prob > chi2 =    0.1844

. *Export equation
. test _b[D_LnBrunei_EX:LD.LnBrunei_IM]=_b[D_LnBrunei_EX:L2D.LnBrunei_IM]

 ( 1)  [D_LnBrunei_EX]LD.LnBrunei_IM - [D_LnBrunei_EX]L2D.LnBrunei_IM = 0

           chi2(  1) =    1.64
         Prob > chi2 =    0.2007

. test _b[D_LnBrunei_EX:LD.LnBrunei_EX]= _b[D_LnBrunei_EX:L2D.LnBrunei_EX] /*No cointegration, No causality.*/

 ( 1)  [D_LnBrunei_EX]LD.LnBrunei_EX - [D_LnBrunei_EX]L2D.LnBrunei_EX = 0

           chi2(  1) =    0.93
         Prob > chi2 =    0.3349
```

Cambodia

```
. varlmar

   Lagrange-multiplier test
```

lag	chi2	df	Prob > chi2
1	6.8218	4	0.14561
2	0.9362	4	0.91931

```
   H0: no autocorrelation at lag order
```

```
. *Import equation
. test _b[D_LnCam_IM:LD.LnCam_IM]=_b[D_LnCam_IM:L2D.LnCam_IM]=_b[D_LnCam_IM:L3D.LnCam_IM]=_b[D_LnCam_IM:L4D.LnCam_IM]

 ( 1)  [D_LnCam_IM]LD.LnCam_IM - [D_LnCam_IM]L2D.LnCam_IM = 0
 ( 2)  [D_LnCam_IM]LD.LnCam_IM - [D_LnCam_IM]L3D.LnCam_IM = 0
 ( 3)  [D_LnCam_IM]LD.LnCam_IM - [D_LnCam_IM]L4D.LnCam_IM = 0

           chi2(  3) =   11.47
         Prob > chi2 =    0.0094

. test _b[D_LnCam_IM:LD.LnCam_EX]=_b[D_LnCam_IM:L2D.LnCam_EX]=_b[D_LnCam_IM:L3D.LnCam_EX]=_b[D_LnCam_IM:L4D.LnCam_EX]

 ( 1)  [D_LnCam_IM]LD.LnCam_EX - [D_LnCam_IM]L2D.LnCam_EX = 0
 ( 2)  [D_LnCam_IM]LD.LnCam_EX - [D_LnCam_IM]L3D.LnCam_EX = 0
 ( 3)  [D_LnCam_IM]LD.LnCam_EX - [D_LnCam_IM]L4D.LnCam_EX = 0

           chi2(  3) =   17.15
         Prob > chi2 =    0.0007

. *Export equation
. test _b[D_LnCam_EX:LD.LnCam_IM]=_b[D_LnCam_EX:L2D.LnCam_IM]=_b[D_LnCam_EX:L3D.LnCam_IM]=_b[D_LnCam_EX:L4D.LnCam_IM]

 ( 1)  [D_LnCam_EX]LD.LnCam_IM - [D_LnCam_EX]L2D.LnCam_IM = 0
 ( 2)  [D_LnCam_EX]LD.LnCam_IM - [D_LnCam_EX]L3D.LnCam_IM = 0
 ( 3)  [D_LnCam_EX]LD.LnCam_IM - [D_LnCam_EX]L4D.LnCam_IM = 0

           chi2(  3) =   16.90
         Prob > chi2 =    0.0007

. test _b[D_LnCam_EX:LD.LnCam_EX]=_b[D_LnCam_EX:L2D.LnCam_EX]=_b[D_LnCam_EX:L3D.LnCam_EX]=_b[D_LnCam_EX:L4D.LnCam_EX]/*bidirec
> tional causality*/

 ( 1)  [D_LnCam_EX]LD.LnCam_EX - [D_LnCam_EX]L2D.LnCam_EX = 0
 ( 2)  [D_LnCam_EX]LD.LnCam_EX - [D_LnCam_EX]L3D.LnCam_EX = 0
 ( 3)  [D_LnCam_EX]LD.LnCam_EX - [D_LnCam_EX]L4D.LnCam_EX = 0

           chi2(  3) =    8.94
         Prob > chi2 =    0.0302
```

Indonesia

```
. varlmar

   Lagrange-multiplier test
```

lag	chi2	df	Prob > chi2
1	5.1950	4	0.26787
2	2.7351	4	0.60309

```
   H0: no autocorrelation at lag order
```

```
. *Import equation
. test _b[D_LnIndo_IM:LD.LnIndo_IM]=_b[D_LnIndo_IM:L2D.LnIndo_IM]=_b[D_LnIndo_IM:L3D.LnIndo_IM]

 ( 1)  [D_LnIndo_IM]LD.LnIndo_IM - [D_LnIndo_IM]L2D.LnIndo_IM = 0
 ( 2)  [D_LnIndo_IM]LD.LnIndo_IM - [D_LnIndo_IM]L3D.LnIndo_IM = 0

           chi2(  2) =   10.18
         Prob > chi2 =    0.0062

. test _b[D_LnIndo_IM:LD.LnIndo_EX]=_b[D_LnIndo_IM:L2D.LnIndo_EX]=_b[D_LnIndo_IM:L3D.LnIndo_EX]

 ( 1)  [D_LnIndo_IM]LD.LnIndo_EX - [D_LnIndo_IM]L2D.LnIndo_EX = 0
 ( 2)  [D_LnIndo_IM]LD.LnIndo_EX - [D_LnIndo_IM]L3D.LnIndo_EX = 0

           chi2(  2) =   11.31
         Prob > chi2 =    0.0035

. *Export equation
. test _b[D_LnIndo_EX:LD.LnIndo_IM]=_b[D_LnIndo_EX:L2D.LnIndo_IM]=_b[D_LnIndo_EX:L3D.LnIndo_IM]

 ( 1)  [D_LnIndo_EX]LD.LnIndo_IM - [D_LnIndo_EX]L2D.LnIndo_IM = 0
 ( 2)  [D_LnIndo_EX]LD.LnIndo_IM - [D_LnIndo_EX]L3D.LnIndo_IM = 0

           chi2(  2) =    1.00
         Prob > chi2 =    0.6071

. test _b[D_LnIndo_EX:LD.LnIndo_EX]= _b[D_LnIndo_EX:L2D.LnIndo_EX]= _b[D_LnIndo_EX:L3D.LnIndo_EX]/*export cause import*/

 ( 1)  [D_LnIndo_EX]LD.LnIndo_EX - [D_LnIndo_EX]L2D.LnIndo_EX = 0
 ( 2)  [D_LnIndo_EX]LD.LnIndo_EX - [D_LnIndo_EX]L3D.LnIndo_EX = 0

           chi2(  2) =    3.05
         Prob > chi2 =    0.2172
```

Laos

```
. varlmar

   Lagrange-multiplier test

  +--------------------------------------+
  | lag |      chi2    df   Prob > chi2  |
  |-----+--------------------------------|
  |   1 |    6.9057     4     0.14096    |
  |   2 |    0.6435     4     0.95811    |
  +--------------------------------------+
   H0: no autocorrelation at lag order


. *Import equation
. test _b[D_LnLao_IM:LD.LnLao_IM]=_b[D_LnLao_IM:L2D.LnLao_IM]

 ( 1)  [D_LnLao_IM]LD.LnLao_IM - [D_LnLao_IM]L2D.LnLao_IM = 0

           chi2(  1) =    0.00
         Prob > chi2 =    0.9780

. test _b[D_LnLao_IM:LD.LnLao_EX]=_b[D_LnLao_IM:L2D.LnLao_EX]

 ( 1)  [D_LnLao_IM]LD.LnLao_EX - [D_LnLao_IM]L2D.LnLao_EX = 0

           chi2(  1) =    0.13
         Prob > chi2 =    0.7209

. *Export equation
. test _b[D_LnLao_EX:LD.LnLao_IM]=_b[D_LnLao_EX:L2D.LnLao_IM]

 ( 1)  [D_LnLao_EX]LD.LnLao_IM - [D_LnLao_EX]L2D.LnLao_IM = 0

           chi2(  1) =    0.25
         Prob > chi2 =    0.6206

. test _b[D_LnLao_EX:LD.LnLao_EX]= _b[D_LnLao_EX:L2D.LnLao_EX]/*No cointegration, No causality.*/

 ( 1)  [D_LnLao_EX]LD.LnLao_EX - [D_LnLao_EX]L2D.LnLao_EX = 0

           chi2(  1) =    0.07
         Prob > chi2 =    0.7847
```

Malaysia

```
. varlmar

   Lagrange-multiplier test

  +--------------------------------------+
  | lag |      chi2    df   Prob > chi2  |
  |-----+--------------------------------|
  |   1 |    2.3050     4     0.67986    |
  |   2 |    3.5390     4     0.47197    |
  +--------------------------------------+
   H0: no autocorrelation at lag order


. *Import equation
. test _b[D_LnMalay_IM:LD.LnMalay_IM]=_b[D_LnMalay_IM:L2D.LnMalay_IM]=_b[D_LnMalay_IM:L3D.LnMalay_IM]=_b[D_LnMalay_IM:L4D.LnMa
> lay_IM]=_b[D_LnMalay_IM:L5D.LnMalay_IM]

 ( 1)  [D_LnMalay_IM]LD.LnMalay_IM - [D_LnMalay_IM]L2D.LnMalay_IM = 0
 ( 2)  [D_LnMalay_IM]LD.LnMalay_IM - [D_LnMalay_IM]L3D.LnMalay_IM = 0
 ( 3)  [D_LnMalay_IM]LD.LnMalay_IM - [D_LnMalay_IM]L4D.LnMalay_IM = 0
 ( 4)  [D_LnMalay_IM]LD.LnMalay_IM - [D_LnMalay_IM]L5D.LnMalay_IM = 0

           chi2(  4) =    6.58
         Prob > chi2 =    0.1597

. test _b[D_LnMalay_IM:LD.LnMalay_EX]=_b[D_LnMalay_IM:L2D.LnMalay_EX]=_b[D_LnMalay_IM:L3D.LnMalay_EX]=_b[D_LnMalay_IM:L4D.LnMa
> lay_EX]=_b[D_LnMalay_IM:L5D.LnMalay_EX]

 ( 1)  [D_LnMalay_IM]LD.LnMalay_EX - [D_LnMalay_IM]L2D.LnMalay_EX = 0
 ( 2)  [D_LnMalay_IM]LD.LnMalay_EX - [D_LnMalay_IM]L3D.LnMalay_EX = 0
 ( 3)  [D_LnMalay_IM]LD.LnMalay_EX - [D_LnMalay_IM]L4D.LnMalay_EX = 0
 ( 4)  [D_LnMalay_IM]LD.LnMalay_EX - [D_LnMalay_IM]L5D.LnMalay_EX = 0

           chi2(  4) =    6.59
         Prob > chi2 =    0.1592

. *Export equation
. test _b[D_LnMalay_EX:LD.LnMalay_IM]=_b[D_LnMalay_EX:L2D.LnMalay_IM]=_b[D_LnMalay_EX:L3D.LnMalay_IM]=_b[D_LnMalay_EX:L4D.LnMa
> lay_IM]=_b[D_LnMalay_EX:L5D.LnMalay_IM]

 ( 1)  [D_LnMalay_EX]LD.LnMalay_IM - [D_LnMalay_EX]L2D.LnMalay_IM = 0
 ( 2)  [D_LnMalay_EX]LD.LnMalay_IM - [D_LnMalay_EX]L3D.LnMalay_IM = 0
 ( 3)  [D_LnMalay_EX]LD.LnMalay_IM - [D_LnMalay_EX]L4D.LnMalay_IM = 0
 ( 4)  [D_LnMalay_EX]LD.LnMalay_IM - [D_LnMalay_EX]L5D.LnMalay_IM = 0

           chi2(  4) =    3.14
         Prob > chi2 =    0.5351

. test _b[D_LnMalay_EX:LD.LnMalay_EX]= _b[D_LnMalay_EX:L2D.LnMalay_EX]= _b[D_LnMalay_EX:L3D.LnMalay_EX]= _b[D_LnMalay_EX:L4D.L
> nMalay_EX]= _b[D_LnMalay_EX:L5D.LnMalay_EX]/*No cointegration, No causality.*/

 ( 1)  [D_LnMalay_EX]LD.LnMalay_EX - [D_LnMalay_EX]L2D.LnMalay_EX = 0
 ( 2)  [D_LnMalay_EX]LD.LnMalay_EX - [D_LnMalay_EX]L3D.LnMalay_EX = 0
 ( 3)  [D_LnMalay_EX]LD.LnMalay_EX - [D_LnMalay_EX]L4D.LnMalay_EX = 0
 ( 4)  [D_LnMalay_EX]LD.LnMalay_EX - [D_LnMalay_EX]L5D.LnMalay_EX = 0

           chi2(  4) =    4.01
         Prob > chi2 =    0.4051
```

Myanmar

```
. varlmar

   Lagrange-multiplier test

  lag        chi2    df   Prob > chi2

    1      5.1007     4     0.27712
    2      3.4606     4     0.48390

   H0: no autocorrelation at lag order

. *Import equation
. test _b[D_LnMya_IM:LD.LnMya_IM]=_b[D_LnMya_IM:L2D.LnMya_IM]

 ( 1)  [D_LnMya_IM]LD.LnMya_IM - [D_LnMya_IM]L2D.LnMya_IM = 0

           chi2(  1) =    6.10
         Prob > chi2 =    0.0135

. test _b[D_LnMya_IM:LD.LnMya_EX]=_b[D_LnMya_IM:L2D.LnMya_EX]

 ( 1)  [D_LnMya_IM]LD.LnMya_EX - [D_LnMya_IM]L2D.LnMya_EX = 0

           chi2(  1) =    6.37
         Prob > chi2 =    0.0116

. *Export equation
. test _b[D_LnMya_EX:LD.LnMya_IM]=_b[D_LnMya_EX:L2D.LnMya_IM]

 ( 1)  [D_LnMya_EX]LD.LnMya_IM - [D_LnMya_EX]L2D.LnMya_IM = 0

           chi2(  1) =    0.53
         Prob > chi2 =    0.4673

. test _b[D_LnMya_EX:LD.LnMya_EX]= _b[D_LnMya_EX:L2D.LnMya_EX]/*export cause import*/

 ( 1)  [D_LnMya_EX]LD.LnMya_EX - [D_LnMya_EX]L2D.LnMya_EX = 0

           chi2(  1) =   16.20
         Prob > chi2 =    0.0001
```

Philippines

```
. varlmar

   Lagrange-multiplier test

  lag        chi2    df   Prob > chi2

    1      6.2158     4     0.18360
    2      1.3916     4     0.84565

   H0: no autocorrelation at lag order


. *Import equation
. test _b[D_LnPhi_IM:LD.LnPhi_IM]=_b[D_LnPhi_IM:L2D.LnPhi_IM]

 ( 1)  [D_LnPhi_IM]LD.LnPhi_IM - [D_LnPhi_IM]L2D.LnPhi_IM = 0

           chi2(  1) =    4.65
         Prob > chi2 =    0.0311

. test _b[D_LnPhi_IM:LD.LnPhi_EX]=_b[D_LnPhi_IM:L2D.LnPhi_EX]

 ( 1)  [D_LnPhi_IM]LD.LnPhi_EX - [D_LnPhi_IM]L2D.LnPhi_EX = 0

           chi2(  1) =    0.79
         Prob > chi2 =    0.3741

. *Export equation
. test _b[D_LnPhi_EX:LD.LnPhi_IM]=_b[D_LnPhi_EX:L2D.LnPhi_IM]

 ( 1)  [D_LnPhi_EX]LD.LnPhi_IM - [D_LnPhi_EX]L2D.LnPhi_IM = 0

           chi2(  1) =    0.34
         Prob > chi2 =    0.5622

. test _b[D_LnPhi_EX:LD.LnPhi_EX]= _b[D_LnPhi_EX:L2D.LnPhi_EX]/*No cointegration, No causality.*/

 ( 1)  [D_LnPhi_EX]LD.LnPhi_EX - [D_LnPhi_EX]L2D.LnPhi_EX = 0

           chi2(  1) =    0.01
         Prob > chi2 =    0.9108
```

Vietnam

```
. varlmar

   Lagrange-multiplier test

  lag        chi2    df   Prob > chi2

    1      1.1737     4     0.88240
    2      5.7670     4     0.21723

   H0: no autocorrelation at lag order
```

. *Import equation

.test_b[D_LnViet_IM:LD.LnViet_IM]=_b[D_LnViet_IM:L2D.LnViet_IM]=_b[D_LnViet_IM:L3D.LnViet_IM]=_b[D_LnViet_IM:L4D.LnViet_IM]=_b[D_LnViet_IM:L5D.LnViet_IM]=_b[D_LnViet_IM:L6D.LnViet_IM]=_b[D_LnViet_IM:L7D.LnViet_IM]=_b[D_LnViet_IM:L8D.LnViet_IM]

```
 ( 1)  [D_LnViet_IM]LD.LnViet_IM - [D_LnViet_IM]L2D.LnViet_IM = 0
 ( 2)  [D_LnViet_IM]LD.LnViet_IM - [D_LnViet_IM]L3D.LnViet_IM = 0
 ( 3)  [D_LnViet_IM]LD.LnViet_IM - [D_LnViet_IM]L4D.LnViet_IM = 0
 ( 4)  [D_LnViet_IM]LD.LnViet_IM - [D_LnViet_IM]L5D.LnViet_IM = 0
 ( 5)  [D_LnViet_IM]LD.LnViet_IM - [D_LnViet_IM]L6D.LnViet_IM = 0
 ( 6)  [D_LnViet_IM]LD.LnViet_IM - [D_LnViet_IM]L7D.LnViet_IM = 0
 ( 7)  [D_LnViet_IM]LD.LnViet_IM - [D_LnViet_IM]L8D.LnViet_IM = 0

           chi2(  7) =   56.30
         Prob > chi2 =    0.0000
```

.test_b[D_LnViet_IM:LD.LnViet_EX]=_b[D_LnViet_IM:L2D.LnViet_EX]=_b[D_LnViet_IM:L3D.LnViet_EX]=_b[D_LnViet_IM:L4D.LnViet_EX]=_b[D_LnViet_IM:L5D.LnViet_EX]=_b[D_LnViet_IM:L6D.LnViet_EX]=_b[D_LnViet_IM:L7D.LnViet_EX]=_b[D_LnViet_IM:L8D.LnViet_EX]

```
 ( 1)  [D_LnViet_IM]LD.LnViet_EX - [D_LnViet_IM]L2D.LnViet_EX = 0
 ( 2)  [D_LnViet_IM]LD.LnViet_EX - [D_LnViet_IM]L3D.LnViet_EX = 0
 ( 3)  [D_LnViet_IM]LD.LnViet_EX - [D_LnViet_IM]L4D.LnViet_EX = 0
 ( 4)  [D_LnViet_IM]LD.LnViet_EX - [D_LnViet_IM]L5D.LnViet_EX = 0
 ( 5)  [D_LnViet_IM]LD.LnViet_EX - [D_LnViet_IM]L6D.LnViet_EX = 0
 ( 6)  [D_LnViet_IM]LD.LnViet_EX - [D_LnViet_IM]L7D.LnViet_EX = 0
 ( 7)  [D_LnViet_IM]LD.LnViet_EX - [D_LnViet_IM]L8D.LnViet_EX = 0

           chi2(  7) =   50.21
         Prob > chi2 =    0.0000
```

. *Export equation

. test
_b[D_LnViet_EX:LD.LnViet_IM]=_b[D_LnViet_EX:L2D.LnViet_IM]=_b[D_LnViet_EX:L3D.LnViet_IM]=_b[D_LnViet_EX:L4D.LnViet_IM]=_b[D_LnViet_EX:L5D.LnViet_IM]=_b[D_LnViet_EX:L6D.LnViet_IM]=_b[D_LnViet_EX:L7D.LnViet_IM]=_b[D_LnViet_EX:L8D.LnViet_IM]

```
 ( 1)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L2D.LnViet_IM = 0
 ( 2)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L3D.LnViet_IM = 0
 ( 3)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L4D.LnViet_IM = 0
 ( 4)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L5D.LnViet_IM = 0
 ( 5)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L6D.LnViet_IM = 0
 ( 6)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L7D.LnViet_IM = 0
 ( 7)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L8D.LnViet_IM = 0

           chi2(  7) =   50.81
         Prob > chi2 =    0.0000
```

. *Export equation

.test_b[D_LnViet_EX:LD.LnViet_IM]=_b[D_LnViet_EX:L2D.LnViet_IM]=_b[D_LnViet_EX:L3D.LnViet_IM]=_b[D_LnViet_EX:L4D.LnViet_IM]=_b[D_LnViet_EX:L5D.LnViet_IM]=_b[D_LnViet_EX:L6D.LnViet_IM]=_b[D_LnViet_EX:L7D.LnViet_IM]=_b[D_LnViet_EX:L8D.LnViet_IM]

```
 ( 1)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L2D.LnViet_IM = 0
 ( 2)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L3D.LnViet_IM = 0
 ( 3)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L4D.LnViet_IM = 0
 ( 4)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L5D.LnViet_IM = 0
 ( 5)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L6D.LnViet_IM = 0
 ( 6)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L7D.LnViet_IM = 0
 ( 7)  [D_LnViet_EX]LD.LnViet_IM - [D_LnViet_EX]L8D.LnViet_IM = 0

           chi2(  7) =   50.81
         Prob > chi2 =    0.0000
```

. test_b[D_LnViet_EX:LD.LnViet_EX]= _b[D_LnViet_EX:L2D.LnViet_EX]= _b[D_LnViet_EX:L3D.LnViet_EX] = _b[D_LnViet_EX:L4D.LnViet_EX] = _b[D_LnViet_EX:L5D.LnViet_EX] = _b[D_LnViet_EX:L6D.LnViet_EX] = _b[D_LnViet_EX:L7D.LnViet_EX] = _b[D_LnViet_EX:L8D.LnV

> iet_EX]/*bidirectional causality*/

```
 ( 1)  [D_LnViet_EX]LD.LnViet_EX - [D_LnViet_EX]L2D.LnViet_EX = 0
 ( 2)  [D_LnViet_EX]LD.LnViet_EX - [D_LnViet_EX]L3D.LnViet_EX = 0
 ( 3)  [D_LnViet_EX]LD.LnViet_EX - [D_LnViet_EX]L4D.LnViet_EX = 0
 ( 4)  [D_LnViet_EX]LD.LnViet_EX - [D_LnViet_EX]L5D.LnViet_EX = 0
 ( 5)  [D_LnViet_EX]LD.LnViet_EX - [D_LnViet_EX]L6D.LnViet_EX = 0
 ( 6)  [D_LnViet_EX]LD.LnViet_EX - [D_LnViet_EX]L7D.LnViet_EX = 0
 ( 7)  [D_LnViet_EX]LD.LnViet_EX - [D_LnViet_EX]L8D.LnViet_EX = 0

           chi2(  7) =   48.50
         Prob > chi2 =    0.0000
```