



The trade openness puzzle: insights into economic growth dynamics in ASEAN+3 economies

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Abstract

This study aims to analyze the relationship between economic openness, as measured by trade index, import, export, gross capital formation, and economic growth, in the ASEAN+3 region during the period 2012-2022 using the Panel Vector Autoregression (PVAR) model. The results show that Gross Domestic Product (GDP) is significantly influenced by trade index, export, and import. In addition, exports are influenced by the trade and import index, while imports are influenced by the trade and export index. Gross capital formation is also found to have a significant effect on GDP, trade index, import, and export. However, this variable does not provide a causal effect on other variables in the model. These findings underline the strategic role of economic openness, especially international trade, in driving economic growth in the ASEAN+3 region. This study provides important insights into regional economic dynamics while emphasizing the importance of policies that support economic openness to strengthen regional economic integration and sustainable growth.

Keywords: trade index; gross domestic product; exports; imports; gross capital formation

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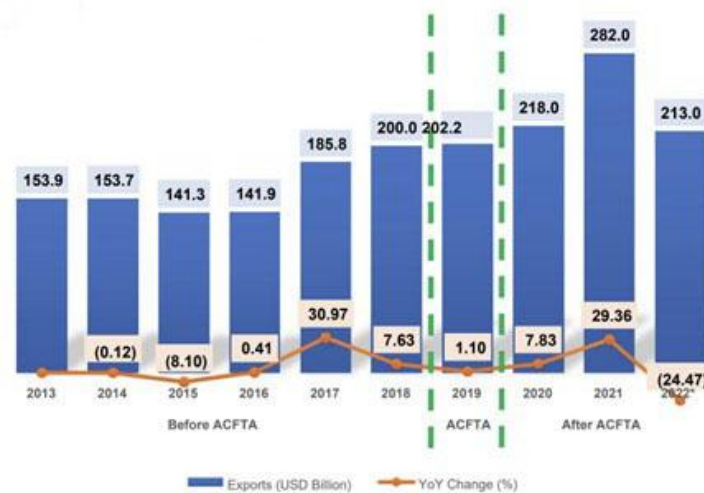
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Introduction

The global economy is moving towards deeper integration, marked by increasing openness to international trade. Ideally, openness to trade is believed to accelerate economic growth through greater access to global markets, technology flows, and investment. In classical and modern economic theory, as explained by Ricardo's theory of comparative advantage. According to Mizuta (2015) foreign trade can provide benefits to a country. Trade openness allows countries to allocate resources efficiently based on their respective strengths, thus encouraging increased productivity and economic growth. Likewise with the Heckscher-Ohlin theory according to Lu (2024) international trade patterns are influenced by comparative advantages that arise from differences in natural resources, labor, and capital between countries, thereby creating efficiency in the production and distribution of goods in the global market.

In the Asian region, trade openness has become the main catalyst that has made it the center of world economic growth. Data from the ASEAN Secretariat (2023) shows that since 2012, trade volume in the ASEAN+3 region, which includes the Association of Southeast Asian Nations together with Japan, South Korea, and China, has increased by more than 50%, thanks to various initiatives such as the ASEAN-China Free Trade Agreement (ACFTA). For example, implementing ACFTA has increased the value of ASEAN exports to China in recent years. Efforts to harmonize regulations and reduce tariff barriers under the ACFTA framework have expanded market access for ASEAN products. This trade growth is also supported by the strengthening of logistics networks and increased intra-regional investment, which further strengthen economic relations in the ASEAN+3 region.



Data unit: USD billion; observation years: 2013–2022

Figure 1. ASEAN Exports to China

Source: Ministry of Trade of the Republic of Indonesia (2023)

Figure 1 illustrates the significant impact of the implementation of the ACFTA Agreement on regional trade volume. In 2013–2018, before the ACFTA was implemented, the value of ASEAN exports to China was stable in the range of USD 140–185 billion with an average of around USD 162.8 billion. However, after reaching a peak of USD 282 billion in 2021, the export value experienced a moderate decline to USD 213 billion in 2022. Overall, the implementation of ACFTA drove average export growth of up to 53.6% compared to the previous period. The decline in 2022 may reflect the impact of external factors such as global economic instability or changes in market demand.

Amidst this optimism, there is a “trade openness puzzle,” namely the relationship between trade openness and economic growth that is not always linear or uniform. Some countries show significant positive results, such as Khalid (2016) where in the short term trade openness drives economic growth in Turkey. Likewise Sunde et al. (2023) stated that trade liberalization and export-driven growth are very important for the economic development of Namibia. However, these findings are not universally applicable. In many countries, high levels of trade openness do not always correlate with increased economic growth. For example, Ukwandu (2015) shows that even though international trade has been adopted concerning the theory of comparative advantage, the African continent is still trapped in poverty, unemployment, and underdevelopment. Likewise, Malefane & Odhiambo (2019) produced a study that trade openness had no significant effect on economic growth in Lesotho in both the short and long term. This difference reflects that the impact of trade openness on economic growth is highly dependent on the structural characteristics and specific contexts of each country, including the level of economic diversification, institutional capacity, and development strategies implemented. A deeper analysis is needed to understand the factors that cause these variations so that trade policies can be adjusted to optimize their benefits according to the conditions of each country.

This phenomenon is particularly relevant in the ASEAN+3 region, one of the regions with the highest levels of trade openness in the world. According to The Observatory of Economic Complexity (2025) ASEAN recorded a

significant contribution to global trade, with total exports reaching US\$1.98 trillion and imports reaching US\$1.86 trillion in 2022, representing 8.38% and 7.83% of total global exports and imports, respectively. However, economic growth in some member countries is not always in line with increasing trade openness. For example, although Indonesia and the Philippines experienced an increase in trade indices in 2021-2022, their GDP growth was not as high as countries such as Vietnam, which shows the success of integrating exports and investment in its economic growth strategy. Data shows that Vietnam became the largest exporter in ASEAN in 2022 with exports reaching US\$399 billion, while Indonesia and the Philippines recorded lower export values. According to [The Hong Kong Trade Development Council \(2025\)](#) this condition shows the complex dynamics in the relationship between trade openness, exports, imports, gross fixed capital formation, and gross domestic product (GDP). Although trade openness can drive economic growth, its effectiveness depends on how countries integrate trade with investment and other domestic policies. Vietnam, for example, has succeeded in attracting significant foreign direct investment, which has contributed to increasing its export capacity and economic growth.

In theory, the relationship between these variables has been widely discussed in the literature. According to [Khalid \(2016\)](#) trade openness has helped the transfer of resources from developing to developed countries and increased technological progress through exports and imports. Meanwhile, [Raghutla \(2020\)](#) exports can be the main driver of economic growth by increasing foreign exchange, absorbing labor, and increasing production capacity. On the other hand, [Yuliadi et al., \(2024\)](#) imports can affect changes in trade and investment fund flows so that they have an impact on a country's macroeconomic indicators. However, this correlation is not always strong because it is influenced by factors such as institutional quality, level of innovation, and market efficiency.

Several studies have shown that trade openness brings both benefits and challenges. [Khalid \(2016\)](#) calls this openness an opportunity to increase foreign direct investment, expand access to technology, and improve economic competitiveness. However, [Suci and Mulatsih \(2015\)](#) highlight the inequality in the distribution of economic benefits between countries, which often benefits developed countries compared to developing countries. In addition, dependence on international trade can also make countries vulnerable to global market fluctuations, as stated by [Furuoka and Munir \(2010\)](#). This challenge is caused by the imbalance in the economic structure of ASEAN+3 countries. Although free trade has increased trade volume, there is a risk that increased imports can threaten the domestic industrial sector, and dependence on foreign capital can damage economic sovereignty. According to [Yan et al. \(2008\)](#), foreign capital flows that are not managed properly have the potential to trigger excessive consumption and unproductive investment, thus inhibiting sustainable economic growth.

The methodological approaches used in trade openness research are diverse and reflect developments in economic analysis. [Suci and Mulatsih \(2015\)](#) analyzed the impact of globalization on ASEAN economic growth using the Panel Regression approach. This approach provides limited focus on the dynamic relationships and complex interactions between these variables, especially in the context of the highly integrated ASEAN+3 region. As an illustration, the impact of trade openness on economic growth can occur through other channels, such as gross capital formation and productivity gains, before its impact is felt as a whole. [Khalid \(2016\)](#) used the ARDL model to show the efficiency of trade openness in driving economic growth through increasing access to technology in Turkey. [Udeagha and Ngepah \(2021\)](#) used nonlinear ARDL, identifying that the relationship between trade openness and economic growth differs by period. Traditional approaches such as ARDL and DOLS are often limited in capturing simultaneous interactions between variables. In this context, Panel Vector Autoregression (PVAR) becomes relevant as an innovative methodology rarely applied in the region. According to [Yang et al. \(2023\)](#), PVAR allows the analysis of simultaneous relationships between variables by considering both short-run and long-run effects, as well as dynamic feedback patterns that cannot be captured by traditional approaches. By integrating these methodologies, this study seeks to fill the gap in the literature by providing more comprehensive insights into how trade openness impacts economic growth dynamics in ASEAN+3.

By using panel data and appropriate econometric methods, this study is expected to contribute theoretically by expanding the understanding of how trade openness affects economic growth in the context of developing and developed countries in ASEAN+3. The findings of this study will not only provide a deeper understanding of the dynamic relationship but also contribute directly to innovative policy design. For example, policies can pay more attention to the distribution of economic benefits to be more equitable among member countries, as well as strategies to mitigate risks associated with global market fluctuations. In addition, this study can be a basis for developing more inclusive regional economic integration strategies, such as strengthening strategic domestic sectors to reduce excessive dependence on international trade. Thus, this study not only adds to the academic literature but also makes a real contribution to more effective policy decision-making, which can ultimately support sustainable and inclusive economic growth in the ASEAN+3 region.

Literature Review

Trade Openness and Economic Growth

Trade openness is an important aspect of the analysis of economic growth. The trade index, which reflects the ratio of total trade to GDP, is often used to indicate trade openness (Khalid, 2016). In classical economic theory, as proposed by Ricardo, trade openness allows countries to take advantage of comparative advantages, increase the efficiency of resource allocation, and encourage economic growth. According to Siddiqui (2018), Ricardo's theory of comparative advantage does not compare production costs in the form of money in the domestic market and foreign markets, but rather between real costs (in the form of labor time and other resources) of various commodities domestically. If protection is removed, resources are expected to shift from high-cost products to low-cost products and productivity will increase. The Heckscher-Ohlin model and new trade theory emphasize the importance of trade in increasing economies of scale and technological innovation. According to Jeyarajah (2024) this theory explains international trade based on differences in the availability of production factors, such as labor, capital, and natural resources, between countries. This theory states that a country will export goods that utilize its abundant factors of production and import goods that require its scarce factors of production. By eliminating the labor theory of value in the Ricardian model, this theory replaces it with the price mechanism as the primary determinant of trade patterns. Although it does not fully consider other aspects such as technological innovation, consumer preferences, transportation costs, or government policies, this theory remains relevant as a basic framework for understanding global trade. This simplification makes the Heckscher-Ohlin theory a useful analytical tool for understanding the basic principles and benefits of international trade.

Empirical studies have revealed various benefits of trade openness on economic growth, making it an important instrument in development strategies. Jalil and Rauf (2021) argue that trade openness enables the adoption of new technologies, which creates opportunities for open economies to grow faster than closed economies. Khalid (2016) extends this view by showing that trade openness improves the efficiency of resource allocation, attracts foreign direct investment, and provides access to advanced technologies. In addition, Sghaier (2021) emphasizes that technology diffusion, increasing local innovation, and strengthening production efficiency through comparative advantage are the main outcomes of trade openness. In the context of the South and West Asian regions, Intisar et al. (2020), found a positive and significant relationship between trade openness and economic growth. This result is supported by Sunde et al. (2023), who showed a positive impact of trade openness on economic growth in Namibia. This study leverages these findings to understand how trade openness, particularly in the context of the ASEAN+3 region, can drive economic growth through innovation and efficiency channels. Raghutla (2020) also notes that trade openness helps developing countries to engage in global supply chains, which in turn increases domestic production capacity and drives economic growth. This approach broadens the view of trade openness in the context of the global economy and international integration.

The Role of Exports and Imports in Economic Growth

The carrying capacity of an open economy has a multi-player trade effect as an indicator of increasing state income to improve the economy through several variables, one of which is exports and imports (Yaqin & Sulistyono, 2024). Exports are the main driving force of economic growth, especially through increasing foreign exchange, technology transfer, and job creation. According to Yuliadi et al. (2024), export and import transactions in international trade will create global economic efficiency, namely the achievement of international economic balance. Simultaneously, imports and exports will have an impact on the allocation of economic resources and macroeconomic performance, if there is a change in input, it will have an impact on a greater change in output, namely the intensity in utilizing the input. Juliansyah et al. (2022) exports influence economic growth. If exports increase, the production of goods and services will also increase because an increase in exports indicates an increase in demand for domestic products abroad. This increase in the production of goods and services will lead to an increase in economic growth. Thus, export and import activities have a strategic role in driving a country's economic growth. Increased exports will expand the production base and create a multiplier effect on other economic sectors, while well-managed imports can meet domestic needs and increase production efficiency. The collaboration of both will strengthen the structure of the national economy and support sustainable economic growth amidst global dynamics.

Gross Capital Formation as the Foundation of Economic Growth

Gross fixed capital formation reflects investment in fixed assets such as infrastructure, machinery, and equipment. Kaur (2021) capital formation refers to the accumulation of a country's net capital during an accounting period. Countries need capital goods to replace old goods used in the production of products and services. When capital goods reach the end of their useful life and cannot be replaced, production will decline. According to Maune and Matanda (2022), an increase in GCF is expected to increase employment which in turn results in high economic growth. Job creation is the result of entrepreneurship and MSMEs because more capital is available through savings and increases the production capacity of large companies to meet the high demand for products due to high disposable income. Thus, gross fixed capital formation is a key factor in supporting long-term economic growth. Investment in capital goods not only increases production capacity but also creates job opportunities that encourage increased community income. The synergy between increasing GCF, entrepreneurship, and MSME performance is an important foundation for creating a more productive and sustainable economy.

Risks and Challenges of Trade Openness

The risks of trade openness cannot be ignored. [Udeagha and Ngepah \(2021\)](#) note that trade openness tends to boost economic growth in the short term but can be a significant drag in the long term. This implication is reinforced by the findings of [Omoke and Charles \(2021\)](#) who revealed that exports have a positive impact on economic growth, while imports have a significant negative impact. In Botswana, [Malefane and Odhiambo \(2019\)](#) found that trade openness had no significant impact on economic growth in the short or long term, regardless of the proxy used. This underscores the importance of domestic institutional and policy contexts in determining the benefits or drawbacks of trade openness. This study addresses these challenges by looking at the risks associated with trade openness, including over-reliance on imports and global market fluctuations, which can affect economic stability in ASEAN+3. [Raghutla \(2020\)](#) also notes that while trade openness can improve efficiency, it opens the door to external risks such as global commodity price volatility that can affect developing economies.

Research Contribution

This study offers theoretical and empirical contributions by examining the dynamic relationship between key variables in the ASEAN+3 context. Theoretically, this study broadens the understanding of how trade openness affects economic growth through complex interactions between variables. Empirically, this study provides relevant data and analysis to support the formulation of more effective trade and investment policies in the region. This study contributes by integrating gross capital formation as a key variable, which is rarely considered in previous studies. [Fatima et al. \(2020\)](#) highlighted that low levels of human capital accumulation can undermine the benefits of trade openness. By including gross capital formation, this study reveals a more holistic relationship between trade openness and economic growth. In addition, the use of the PVAR model offers an innovative approach to studying trade openness, going beyond existing methodological limitations. [Nguyen and Bui \(2021\)](#) who used a threshold approach for panel fixed effects in ASEAN-6, found that the impact of trade openness tends to decline when reaching a certain threshold. This study deepens this analysis by exploring the dynamics of the relationship in the ASEAN+3 context. By integrating the benefits and risks of trade openness, this study evaluates how innovative economic strategies can maximize the benefits while mitigating the risks. The PVAR methodological approach not only allows for simultaneous analysis but also enriches the literature with new insights relevant to the ASEAN+3 region. This review, with its theme-based structure, provides a comprehensive framework to support research focus in evaluating the impact of trade openness on economic growth in the ASEAN+3 region.

Research Method

This study uses the Panel Vector Autoregressive (PVAR) methodology approach to analyze the relationship between trade openness and economic growth in the ASEAN+3 region during the period 2012-2022. The Trade Index (TI) measures the level of openness of a country's economy to international trade. TI was chosen because trade openness is often considered a key factor in driving economic growth, innovation, and technology diffusion ([Rehman et al., 2021](#)). Exports and imports are important indicators in measuring the direct impact of trade openness on a country's economy. According to [Yaqin & Sulistyono \(2024\)](#), exports are often considered the main driver of economic growth, while imports, although they have a negative impact on the trade balance, are also important in providing goods and technology needed to support the domestic sector. Gross Capital Formation (GCF) measures the accumulation of investment in infrastructure and production that supports economic growth ([Maune and Matanda, 2022](#)). GCF was chosen because investment is one of the main keys in facilitating long-term economic growth, and the impact of trade openness on capital accumulation is often overlooked in previous studies.

According to [Mtar & Belazreg \(2020\)](#), the Panel Vector Autoregression (PVAR) model is estimated using the Generalized Method of Moments (GMM), which ensures consistent parameter estimation in dynamic panel settings. The estimation procedure follows Equation (1) as presented in [Us \(2020\)](#).

$$Y_{it} = A_1(L)Y_{it} + A_2(L)W_t + U_{it} \dots \quad (1)$$

Where Y_{it} is a vector of endogenous variables consisting of specific variables of trade openness and economic growth; W_t is a vector of predetermined or exogenous variables; $A_1(L)$ and $A_2(L)$ are lag operators; and U_{it} is a random disturbance vector. Next, i denotes the panel from each country and t represents the research period.

The data used in this study comes from various official sources such as the World Bank database, the International Monetary Fund (IMF), and statistical institutions of ASEAN+3 member countries. The data covers the period 2012 to 2022 and includes 10 ASEAN member countries (Indonesia, Malaysia, Singapore, Thailand, the Philippines, Vietnam, Brunei Darussalam, Myanmar, Cambodia, and Timor Leste) plus China, Japan, and South Korea. The use of panel data allows for the integration of information from various countries into the analysis, thereby strengthening the validity and generalizability of the findings. [Yang et al. \(2023\)](#) added that the PVAR model does not

have prediction test requirements like multivariate models, so the analysis is more flexible and PVAR also treats all variables as endogenous variables. This can reduce model uncertainty arising from subjective decisions. With this approach, PVAR can capture the reciprocal impact between trade openness and economic growth, which is more in line with the complex economic reality in the ASEAN+3 region, where these variables interact with each other in a dynamic system, which cannot be achieved by traditional methods. Traditional methods are often only able to analyze one-way relationships between variables, assuming that one variable linearly affects the other. For example, in traditional regression models, the relationship between trade openness and economic growth may only be viewed from one side, namely how trade openness affects economic growth, without considering the possibility that economic growth may also affect the level of trade openness.

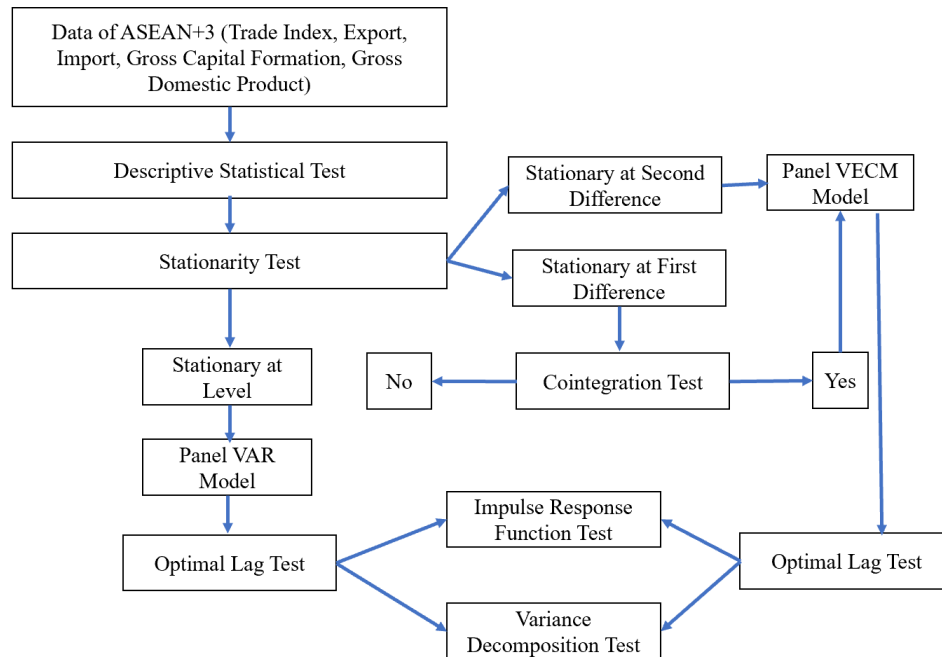


Figure 2. Data Analysis Process

One of the main strengths of PVAR is its ability to analyze the long-run and short-run impacts of changes in one variable on another, using techniques such as Impulse Response Function (IRF) and Variance Decomposition (VD). According to Časni et al. (2016), IRF is constructed from the estimated VAR coefficients and their standard errors. Meanwhile, VD states the magnitude of the overall impact of a shock, by providing the proportion of movement in one variable explained by the shock to another variable over time. This allows research to provide a more holistic picture of how shocks or changes in one variable—such as increased exports—can affect other variables—such as economic growth—over different periods. Thus, PVAR not only provides a more accurate picture of the relationship between trade openness and economic growth but also offers a more flexible and dynamic analysis, allowing the identification of interaction patterns that may have previously been missed by traditional methods. This becomes especially relevant in the ASEAN+3 context, where countries with varying degrees of economic openness interact in a complex and interdependent system.

The PVAR estimation steps involve stationarity testing, and cointegration, and are complemented by econometric techniques such as the IRF test and the VD test, which are illustrated in the diagram in Figure 2.

Result and Discussion

First, a statistical description test is carried out. This test aims to provide a comprehensive understanding of the observed data. Through various metrics such as mean, median, and mode, as well as measures of dispersion such as standard deviation and quartiles, descriptive tests help in summarizing data systematically. The results can be seen in the Table 1.

The data distribution used in this research tends to have large values, this can be seen from the variable average which is close to the maximum value. Likewise, the data variance tends to be large where the average value tends to exceed the standard deviation.

Table 1. Descriptive Statistical Test Results

	GDP	TI	EX	IM	GCF
Mean	2.877622	101.8673	54.04385	52.45091	28.78133
Median	3.120000	87.32000	47.83000	44.03000	28.13000
Maximum	29.98000	369.2100	196.7200	172.4900	57.60000
Minimum	-21.75000	-9.140000	2.390000	5.770000	10.03000
Std. Dev.	5.053060	81.94589	43.72156	35.96080	7.169655
Skewness	0.065882	1.615518	1.795229	1.653017	0.726268
Kurtosis	13.09396	5.761047	6.177334	5.650863	4.239343
Observations	143	143	143	143	143

The data distribution is symmetrical and skewed more to the right, because the skewness value is close to zero and positive. In addition, the kurtosis value shows the sharpness of the data distribution, where a higher value indicates a thicker tail of the distribution and a higher and sharper peak.

Based on descriptive statistical tests (see Table 1), the average, distribution, and variation of each variable were obtained, which can provide an initial overview of the relationship patterns between variables in the PVAR model. Therefore, a stationarity test is necessary to ensure the stability of the average and variation between variables over time. Next, a stationarity test was carried out using the PP Fisher Chi-Square test to see the unit root of each variable presented in the table 2 as follows.

Table 2. Unit Root Test Results

Variable	Statistic	Value Prob.	Information
GDP	144.742	0.0000	Stationary at 1 st Difference
Trade Index	63.0751	0.0001	Stationary at 1 st Difference
Export	64.4192	0.0000	Stationary at 1 st Difference
Import	60.3391	0.0002	Stationary at 1 st Difference
Gross Capital Formation	74.0238	0.0000	Stationary at 1 st Difference

The results of the stationarity test show that the data is not stationary at the level so the test continues with the first difference. As a result, the probability values of the five variables are below 5 percent significance or 0.05. So to continue testing, data on the first difference is used.

After ensuring that all variables are stationary (see Table 2), further testing is needed to see if there is a long-term relationship between variables in the PVAR model. The test uses the Pedroni Residual Cointegration test type which is shown in the Table 3.

Table 3. Co-integration Test Results

Cointegration Test	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	1.204663	0.1142	-1.960079	0.9750
Panel rho-Statistic	4.841920	1.0000	3.242494	0.9994
Panel ADF-Statistic	-2.844193	0.0022	0.838056	0.7990

The results of the cointegration test show a probability value above 5 percent significance or 0.05 so that there is no cointegration of the data for all the variables used. Based on the results of the unit root and cointegration tests, the next data analysis model can use PVAR. However, before carrying out the PVAR test, the researcher first determines the lag that will be used using the Lag Order Selection Criteria with the main consideration being the Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) values. The results are displayed in the Table 4.

Table 4. Lag Order Selection Criteria

Lag	LogL	SC	HQ
0	-1538.334	39.72373	39.63314
1	-1038.707	28.30918*	27.76561*
2	-1007.230	28.89846	27.90192
3	-970.5526	29.35438	27.90487
4	-936.6789	29.88221	27.97972
5	-895.1845	30.21463	27.85917

By using lag 1, the PVAR test results are obtained as follows.

$$GDP_t = 0.503630 + 0.351540 GDP(-1)_{t-1} + 0.011269 TI(-1)_{t-1} - 0.046628 EX(-1)_{t-1} + 0.030720 IM(-1)_{t-1} + 0.032653 GCF(-1)_{t-1}$$

The PVAR test results show that the TI variable has a significant positive effect on GDP, the EX variable has a significant negative effect on GDP, and the IM variable has a significant positive effect on GDP. A positive relationship shows that an increase in TI and IM results in an increase in GDP by 0.011269 points and 0.030720 points, whereas a negative relationship shows that an increase in EX can reduce GDP by 0.046628 points.

$$TI_t = 12.08500 + 0.003640 GDP(-1)_{t-1} + 1.005905 TI(-1)_{t-1} + 0.066884 EX(-1)_{t-1} - 0.143174 IM(-1)_{t-1} - 0.289861 GCF(-1)_{t-1}$$

In the PVAR model of this research, the TI variable is not affected by other variables. The basis for this decision is obtained from the probability value of the PVAR test results which shows significance above 5 percent or 0.05.

$$EX_t = 4.014178 + 0.209911 GDP(-1)_{t-1} - 0.027379 TI(-1)_{t-1} - 0.046628 EX(-1)_{t-1} + 0.030720 IM(-1)_{t-1} - 0.122977 GCF(-1)_{t-1}$$

The TI variable has a significant negative effect on EX, while IM has a significant positive effect. Each increase in TI will decrease EX by 0.027379 points and each increase in IM will increase EX by 0.030720 points.

$$IM_t = 9.534084 - 0.184510 GDP(-1)_{t-1} - 0.022509 TI(-1)_{t-1} + 0.151099 EX(-1)_{t-1} + 0.829322 IM(-1)_{t-1} - 0.204501 GCF(-1)_{t-1}$$

The TI variable has a significant negative effect on IM, while EX has a significant positive effect on IM. Increasing TI results in a decrease in IM of 0.022509 points while increasing EX results in an increase in IM of 0.151099 points.

$$GCF_t = 3.621066 - 0.018459 GDP(-1)_{t-1} - 0.009328 TI(-1)_{t-1} + 0.063791 EX(-1)_{t-1} - 0.066346 IM(-1)_{t-1} + 0.896443 GCF(-1)_{t-1}$$

The variables GDP, TI, and IM have a significant negative effect on GCF, while EX has a significant positive effect on GCF. Increases in GDP, TI, and IM reduce GCF by 0.018459 points, 0.009328 points, and 0.066346 points. Meanwhile, an increase in EX can increase GCF by 0.063791 points.

As indicated in Table 2, all variables are stationary at first difference, which validates the PVAR estimation in Equation (1). This finding is further confirmed by the impulse responses in Figure 3.

The IRF test uses 20 shock periods for each variable. First, is the GDP variable. Shocks to the TI variable responded positively in the short term by 0.05 points, then the response continued to decline in the medium term until the 20th period of the study reached -0.007. The same response also occurred due to shocks to the IM variable, in the short term the GDP response due to IM shocks was 0.1 points and decreased to -0.09 points at the end of the research period. Shocks to the EX variable responded negatively starting from the 2nd period at -0.24 points to -0.05 points in the 20th period. Meanwhile, shocks to the GCF variable were responded positively by GDP throughout the research period by 0.06 points in the 2nd period and 0.03 points at the end of the period.

Second, the TI variable. This variable responds positively and negatively to shocks from the other 4 variables in the study. TI responded to the GDP variable by 2.1 points in the 1st period and decreased to 1.04 points at the end of the period. Furthermore, shocks to the EX variable are responded to fluctuating in the short and long term. The response was 0.8 points in the 2nd period then increased to 2 points in the 8th period and fell again in the 9th period by 1.9 points to 0.5 points in the 20th period. Shocks to the IM variable responded negatively throughout the research period where the response was -0.5 in the 2nd period and reached -3.6 points in the 20th period. Likewise, the GCF variable, responded negatively by -0.5 points and continued to decline to -3.7 at the end of the period.

Third, the EX variable. This variable responded positively to GDP shocks of 1.4 points at the beginning of the period then increased by 2.4 points in the 2nd period to 2.07 points in the 7th period then decreased by 1.9 points in the 8th period and continued to fall to 0.7 points until the end of the period. Shocks to the TI variable responded positively by 4.06 points and decreased to 3.36 at the end of the period. Likewise, with the EX variable, the shock was responded to by EX by 3.16 points at the beginning of the period and fell to 2.11 points in the 20th period. Meanwhile, the shock from the GCF variable was the only one that responded negatively throughout the period, amounting to -0.2 points in the 2nd period and continuing to fall to -2.6 points at the end of the period.

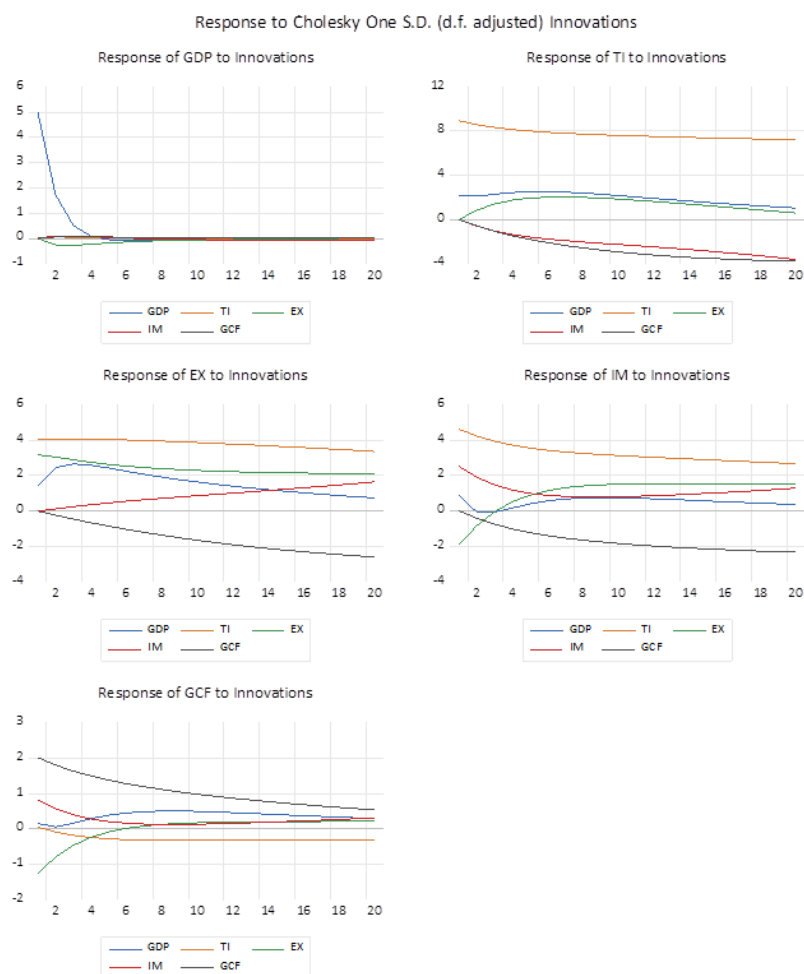


Figure 3. IRF Test Results

Fourth, is the IM variable. The GDP shock responded by 0.86 points in the 1st period, then decreased in the 2nd period by -0.06 points. The response increased again in the 4th period by 0.16 points to 0.36 points in the 20th period. Furthermore, shocks to the TI variable responded positively throughout the period by 4.6 points in the 1st period and fell to 2.66 points at the end of the period. Shocks to the EX variable were responded negatively in the 1st period by -1.89 points to the 3rd period by -0.04 points. Furthermore, the response changed positively by 0.5 points in the 4th period and reached 1.55 points in the 20th period. The shock to the IM variable responded by 2.5 points at the beginning of the period then decreased until the 15th period amounting to 0.99 points and then increased again reaching 1.28 points in the 20th period. Meanwhile, shocks to the GCF variable responded negatively by -0.41 points at the beginning of the period and continued to decline to -2.33 at the end of the period.

Lastly, the GCF variable. This variable responded positively to shocks to GDP by 0.15 points in the 1st period then increased to 0.29 at the end of the period. The TI shock responded positively in the 1st period at 0.05 and after that, the response was negative until the end of the period reaching -0.29 points. Furthermore, shocks to the EX variable responded negatively in periods 1 to 5, amounting to -1.25 points to -0.08 points, after which the response changed to positive until it reached 0.21 points at the end of the period. Shocks to the IM variable responded by 0.8 points in the 1st period and decreased to 0.3 at the end of the period. Likewise, with the GCF shock, it responded by 2 points in the 1st period then fell to 0.53 points in the 20th period.

The results of the IRF test (Figure 4) have provided an overview of the direction, strength, and duration of the influence between variables. Next, a variance decomposition (VD) test was performed. The VD test is also carried out as part of the PVAR test which aims to see the contribution of each variable in influencing the value of other variables. In this research, the VD test was carried out over 20 research periods to see the contribution between variables in the short and long term. The results are presented in the Figure 4.

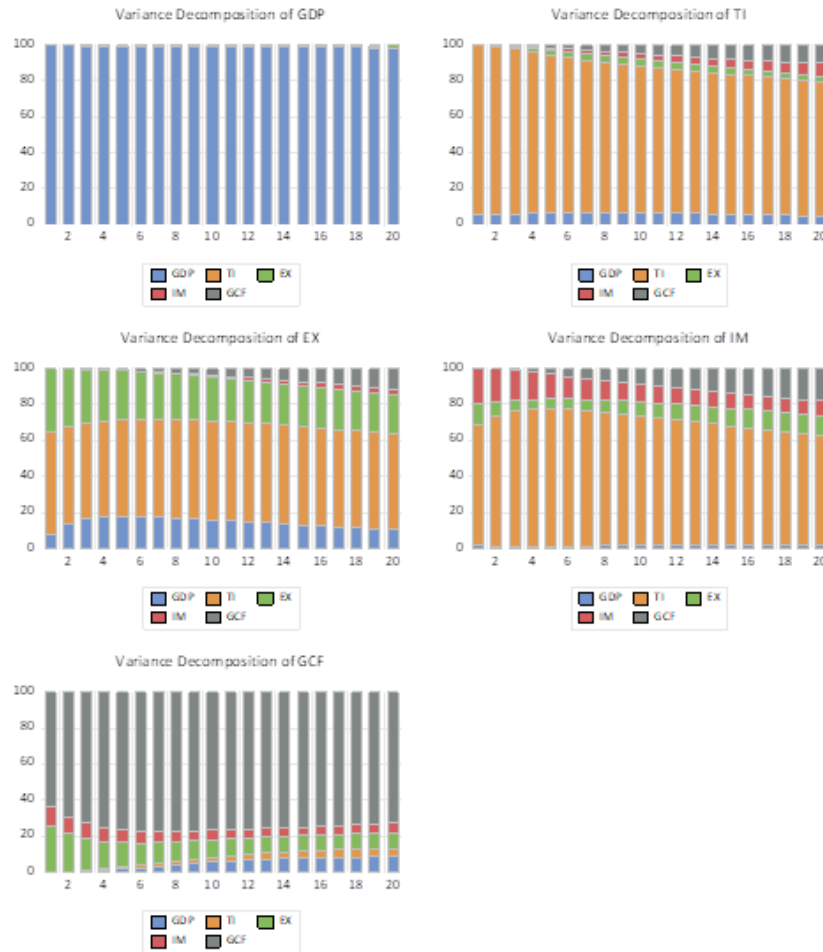


Figure 4. VD Test Results

Figure 5 shows that the GDP variable is more influenced by the variable itself in both the short and long term. The contribution of the other 4 variables is very small at 0.03 percent for the TI variable, 1 percent for the EX variable, 0.31 percent for the IM variable, and 0.12 percent for the GCF variable. Furthermore, the value of the TI variable in the 1st period was more influenced by the variable itself at 94.5 percent, the remaining 5.47 percent was influenced by GDP. In the long term, the largest contribution is made by the GCF variable at 10.1 percent, IM at 7.2 percent, GDP at 4.9 percent and EX at 2.7 percent.

Then, the value of the EX variable in period 1 was influenced by the variable itself by 35 percent and continued to fall to 21.4 percent at the end of the period. The biggest contribution was made by the TI variable at 57.6 percent in the 1st period and decreased to 52.8 percent in the 20th period. GDP contributed 7.3 percent at the beginning of the period then increased by 17.9 percent in the 5th period and continued to fall to 10.75 percent in the 20th period. The IM variable contributed a small amount of 0.019 percent in the 2nd period and increased to 3.6 percent in the 20th period. Likewise, with the GCF variable, its influence is quite small in the short term at 0.1 percent but increases to reach 11.2 percent at the end of the period.

Likewise, the IM variable, its value was more influenced by the TI variable throughout the research period by 66.7 percent and decreased to 61.2 percent at the end of the period. The EX variable contributed 11.2 percent in the 1st period then decreased to 5.5 percent in the 6th period then increased to 10.9 percent in the 20th period. Variable GDP contributed 2.34 percent at the beginning of the period then fluctuated throughout the period by 1.38 percent in the 2nd period, 0.88 percent in the 4th period, 2 percent in the 13th period, and fell again to 1.81 at the end of the period. Finally, the GCF contribution to IM was 0.3 percent in the 2nd period then increased significantly to 17.8 percent in the 20th period.

And finally, the value of the GCF variable. This variable was more influenced by the GCF variable itself throughout the period, amounting to 63.9 percent in the short term and increasing by 72.9 percent in the long term. The second contribution provided by the EX variable was 24.9 percent at the beginning of the period and decreased to 8.4 percent at the end of the period. Third, the contribution of the IM variable was 10.6 percent in the 1st period and decreased to 5.3 percent in the 20th period. GDP contributes little in the short term at 0.36 percent but increases to 8.4 percent in

the long term. Meanwhile, TI contributed to the value of the GCF variable by 0.04 percent in the 1st period and increased to 4.76 percent in the 20th period.

Based on the test results above, it can be explained that the main indicator in measuring a country's economic performance is GDP. According to [Setiartiti and Rahmadani \(2023\)](#), GDP can be interpreted as the added value generated by all production activities in the economy, where an increase in GDP can reflect an increase in rewards for production factors used in these activities. The results of this study indicate that international trade, as reflected in the Trade Index, exports, and imports, plays a significant role in driving GDP growth in ASEAN+3 countries. This finding confirms the importance of economic openness and global integration (as measured using the trade index) for the financial dynamics of the region. [Jalil and Rauf \(2021\)](#) also support this finding by asserting that the level of trade openness in different countries explains the differences in their economic growth. Trade restrictions are likely to hamper the economic growth of countries that have started to increase their economic growth. Therefore, trade policies should be set based on lower tariffs to attract trade opportunities, increase access to global markets, increase foreign direct investment (FDI) flows, and facilitate technology transfer. In line with that, [Fatima et al. \(2020\)](#) added that developing countries are currently trying to take advantage of the global market after opening their economies to trade. This implementation will support the integration of technological advantages obtained through trade with developed countries. This result is in line with [Khalid \(2016\)](#), Trade index has a significant impact on economic growth in Turkey. Research by [Raghutla \(2020\)](#), Trade openness has an impact on economic growth in emerging market countries, as well as research by [Udeagha and Ngepah \(2021\)](#) in South Africa with the same results. Trade drives short-term economic growth through several mechanisms, such as increasing economies of scale, efficient allocation of resources, more optimal utilization of domestic capacity, and increased productivity driven by spillover effects. These factors form the foundation for creating a competitive climate in the domestic industrial sector, which ultimately expands market share internationally.

Imports also have a positive impact on GDP, reflecting the importance of imported capital goods and raw materials in supporting productive sectors. However, a negative effect of exports on GDP can occur when over-reliance on external markets reduces domestic consumption or puts pressure on less competitive domestic sectors. This result can be explained by the dualistic role of trade in the economy. According to [Stojanović et al. \(2023\)](#) previously, imports were often considered to have a negative impact on economic development. However, this view has partly changed. An important thing to note is the structure of imports itself. If the imported products are goods for final consumption, of course, this can have a negative impact on economic development. On the other hand, if what is imported is raw materials that will be further processed and re-exported in the form of final products with higher added value, as well as services that provide benefits to the economy, then this negative impact does not always occur. The positive impact of imports on GDP reflects that imported capital goods and raw materials are very important in supporting the productive sector, especially in countries that still need technology and materials from abroad to increase their production capacity. These imports can be strategic inputs that enable the creation of added value in domestic economic sectors, thereby driving GDP growth. On the other hand, the negative impact of exports on GDP can occur when the economy is too dependent on external markets. According to [Furuoka and Munir \(2010\)](#) excessive dependence on exports can lead to serious economic decline in the region. This dependence can reduce domestic consumption power because most of the production is directed abroad, which ultimately suppresses domestic demand.

In addition, pressure on the less competitive domestic sector can arise when high exports are accompanied by a lack of development of local sectors to meet international market standards. This condition indicates the need for a balance between exports, and imports, and strengthening the domestic market to maintain sustainable economic growth. The results of this study are in line with [Omoke and Charles \(2021\)](#) in Nigeria with export and import results having a significant influence on economic growth. And research by [Yuliadi et al. \(2024\)](#) at the ASEAN level with similar results. Meanwhile, GDP only has a significant effect on the formation of GCF but not vice versa, this shows that the formation of physical capital has not been optimal in driving economic growth directly. Economic growth in this region has a greater impact on increasing physical investment than other variables. This significant relationship shows that ASEAN+3 countries tend to use their GDP growth to strengthen their economic base through infrastructure development and procurement of modern technology. This study is in line with [Kaur \(2021\)](#) where GDP and GCF have a significant relationship in Saudi Arabia. In addition, the response of GDP to other variables, both in the short and long term, tends to be small, with the contribution of other variables to GDP changes being limited throughout the study period. This indicates that although there is a dynamic relationship between variables, the strength of its influence is relatively weak so the stability of GDP growth in ASEAN+3 is more influenced by internal factors or domestic policies than external shocks.

In theory, the relationship between GDP and Trade Index, exports, and imports (see Figure 3) confirms the Ricardian perspective that trade openness enhances growth through the theory of comparative advantage ([Siddiqui, 2018](#); [Ukwandu, 2015](#)), the Heckscher-Ohlin model ([Jeyarajah, 2024](#); [Lu, 2024](#)) and the endogenous growth model ([Hrnjic and Brankovic, 2017](#)). Economic openness through trade allows ASEAN+3 countries to utilize resources more efficiently, adopt technology from abroad, and strengthen global competitiveness. Exports increase foreign exchange earnings, while imports provide capital goods and technology needed to support productivity. In general, this model emphasizes the

importance of trade and capital accumulation in driving economic growth. In contrast, the one-way relationship between GDP and GCF can be attributed to investment efficiency factors and economic structures in each country. High GDP reflects the economy's capacity to increase investment, but GCF does not always have a direct impact on GDP because it may be hampered by a lack of efficiency or a mismatch in investment allocation. If this theory is juxtaposed with the conditions in ASEAN+3 countries, it shows variations in economic openness and growth dynamics that are not always the same.

In Indonesia, export downstream continues to be encouraged to increase added value and strengthen the competitiveness of the national economy in facing the challenges of the current uncertain global economic conditions (Putri and Saufica, 2024). Although in Indonesia dependence on raw commodities is still a major challenge. Malaysia, as a trading-based country, relies heavily on electronics and palm oil exports, with active participation in free trade agreements such as the Regional Comprehensive Economic Partnership (RCEP). As a major sector in the Malaysian economy, determining the direction of development and optimization of the palm oil industry's export potential can open up more market access opportunities, expand Malaysian palm oil exports to RCEP member countries, and increase its competitiveness. The signing of RCEP plays a role in harmonizing trade regulations and standards between member countries, reducing barriers and uncertainties in trade while increasing competitive pressures for other member countries (Xiaoxi et al., 2024). Singapore, as a global trading hub, leverages its zero-tariff policy and advanced logistics infrastructure to drive economic growth (OECD, 2021). Thailand focuses on diversification through the Thailand 4.0 program, one of which is by leveraging its manufacturing capabilities to produce complex products, developing relationships, and at the same time upgrading its service model towards a global innovator service (Frias & Kumar, 2022). Meanwhile, Vietnam is leveraging international trade agreements such as the European Union-Vietnam Free Trade Agreement (EVFTA) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) to accelerate the growth of textile and electronics exports (Thanh et al., 2024).

Other countries also face challenges in economic diversification due to their high dependence on natural resources. The implications of this research suggest the importance of policies that support economic openness and investment efficiency. ASEAN+3 countries need to strengthen regional integration through trade cooperation such as RCEP and CPTPP to expand market access and enhance competitiveness. In addition, governments should encourage export diversification, improve investment efficiency, and ensure more productive capital allocation. Domestic policy reforms, including improving the quality of institutions and governance, are also needed to ensure that investment has an optimal impact on economic growth. Digitalization of trade and investment should also be prioritized to increase efficiency and reduce barriers. With the right policies, economic openness can continue to be a key driver of economic growth in ASEAN+3, while increasing GDP will support more effective investment in the region.

Conclusions, suggestions and limitations

This study highlights the complex relationship between economic openness and economic growth in the ASEAN+3 region, as measured by trade, import, export, gross capital formation, and Gross Domestic Product (GDP) indices. The analysis shows a positive correlation between economic openness and economic growth, although its impact on GDP tends to be small throughout the study period. The findings suggest that countries with higher levels of economic openness have more dynamic and sustainable economic growth, but this relationship is context-specific, such as domestic policies, infrastructure, and global market dynamics. Implicatively, this study highlights the importance of economic openness as a strategic element in driving trade policy innovation and regional economic integration. ASEAN+3 governments should leverage these findings to develop innovative policies that promote international trade by reducing tariff and non-tariff barriers, strengthening regional trade agreements, and developing trade infrastructure. In addition, increasing foreign direct investment (FDI) through attractive incentives can encourage technology transfer and strengthen the domestic economic base. In this regard, the study provides a foundation for more intensive regional collaboration through organizations such as ASEAN to create harmonized standards and policies, thereby enhancing the region's competitiveness in the global market. For business actors, this study provides strategic recommendations to innovate in production and services, improve competitiveness through technology adoption, and explore new, broader markets. These efforts not only support business sustainability but also contribute to the overall economic growth of the region. Meanwhile, regulatory bodies are encouraged to formulate balanced policies that protect domestic markets without hindering trade openness, through local industry protection, trade facilitation, and the elimination of excessive bureaucratic barriers.

However, this study has several limitations. The variables used are limited to trade index, GDP, exports, imports, and gross capital formation, thus not covering other important factors such as institutional quality, technological innovation, or education level. The use of Panel Vector Autoregressive (PVAR) methodology, although innovative, may not fully capture the dynamics of the relationship between variables in a longer time context. In addition, the focus on ASEAN+3 countries limits the generalizability of the study results to other regions with different economic structures. In the future, further research can expand the scope of variables, such as the role of institutional quality or technological innovation in influencing the relationship between economic openness and growth. A more comprehensive methodological approach, such as Dynamic Stochastic General Equilibrium (DSGE), can also be applied to explore the interactions between variables in the increasingly complex global economic system. With this focus, future research can

make a greater contribution to the development of innovative trade policies and sustainable regional economic integration. Practical recommendations that can be drawn from this study are that policymakers should prioritize reducing trade barriers and increasing market access through innovative and data-driven policies. Business actors need to focus on market diversification and increasing competitiveness through technology adoption and production efficiency. Meanwhile, regulatory bodies should develop balanced policies to encourage economic openness while protecting domestic interests. With this approach, trade openness can be optimized to achieve inclusive and sustainable economic growth in ASEAN+3.

Competing Interests

The author(s) declare that there are no competing interests relevant to the content of this article.

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