

Assessing Economic Interaction and Institutional Effectiveness on the Economies of ASEAN Countries: A PLS-Structural Equation Modeling Analysis

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Abstract. In a multipolar world, a study of regional integration is highly relevant for understanding how economic interactions can foster economic growth, global competitiveness, and stability amid global uncertainty. The research highlights the significant impact of economic interactions and institutional performance on economic development in Southeast Asian. This study aims to investigate the impact of economic interactions and institutional performance on the economy. Trend visualization shows that Singapore gains the highest intra-investment and intra-trade, meanwhile Malaysia gets the highest intra-human mobility. Furthermore, a hypothesis can be developed that economic interactions and institutional performance have a significant impact on ASEAN's economy. The PLS-SEM analysis is employed to investigate the significance of the hypothesis. The model involves four latent variables such as economic interaction, economic growth, institutional performance, and economic determinants. The economic interaction variable is considered a manifestation of regional integration commitment, which is regulated in the cooperation policy of state institutions in this regional area. Economic interaction is represented by intra-export, intra-import, intra-FDI, and intra-human flow indicators. The results of the significance test indicate that institutional performance has a very strong direct impact on economic interactions. It supports the theory of Institutional Neoliberalism and New Institutional Economics. Moreover, Institutional performance and economic interaction do not have a direct impact on economic growth. However, the economic interactions supported by institutional performance have a significant impact on economic growth. It offers new insights, suggesting that economic interaction must be supported by institutional performance to have a significant impact on economic growth in ASEAN countries.

Key words: geopolitical regions; economic connectivity; regional integration; good government; multipolar world.

1. Introduction

In the modern era, regional interaction has become a necessity for every country because it can encourage economic growth, stability, and the resolution of common problems through cooperation, increase competitiveness, and strengthen the country's bargaining position on the global stage. Regional integration emerged significantly in the 1950s with the formation of the precursor to the European Union. The second wave of modern regional integration began in the late 1980s,

driven by the rise of regional trade arrangements. Economic integration necessitates the elimination of discriminatory measures, including trade barriers and other restrictions. Economic integration procedures encompass a wide range of integration, including free trade areas, customs unions, common markets, monetary unions, and full integration.

Preliminary research studies on contemporary regional integration were conducted in the 1960s to gain a deeper understanding of the issues involved in more integrative perspectives on Western European integration. Moreover, in post-Soviet Eurasia, several regional economic integrations have been established to foster regional economic collaboration and adjust to the global economy. Economic integration, largely centred on Russia as the former power bloc, emerged under different names and through different processes, such as the Commonwealth of Independent States and the Eurasian Economic Community [1]. Post-Soviet countries have initiated interstate integration trade associations, focusing on Eurasia, as a manifestation of their regional economic integration strategy [2].

In the current century, a network of nation-states tends to integrate their economies in pursuit of macroeconomic stability, economic development, efficiency, and active economic growth [3]. Regional integration agreements (RIAs) are the most effective medium for transferring knowledge and technology between member states of regional blocs, demonstrating the commitment of state institutions. Developed countries tend to provide technological facilities, while developing countries can reciprocally increase access to knowledge and technology through multilateral trade¹.

In Asia, the Association of Southeast Asian Nations (ASEAN) comprises the majority of its members as developing countries and has evolved into a regional organization of global significance. The ASEAN Economic Community (AEC) was established in 2015 as a framework for regional economic cooperation, aiming to promote regional growth through free trade and market integration [4]. ASEAN has established economic relations through crucial agreements, creating intra- and extra-regional flows, including economic openness, trade liberalization, regional production distribution, and foreign investment advancement, thereby confirming its position and role in the worldwide [5].

The formation of the AEC marked a commitment to achieving significant progress, going beyond mere political solidarity [6]. ASEAN member states have launched several initiatives to fulfil their commitment to economic integration, which can have a significant impact on economic growth [7]. This economic community aimed to facilitate the free movement of goods, services, capital, skilled labour, and investment. In short, ASEAN's economic integration represents the achievement of economic integration by developing countries [8].

¹ Schiff M., Winters W., Alan L. Regional Integration and Development. World Bank; Oxford University Press, 2003.

The success of regional economic integration requires government involvement. Government performance is crucial for ASEAN economic interaction, particularly in areas such as good governance, political stability, and supportive policies, including trade liberalization. However, its effectiveness varies across countries, depending on the implementation of policies and structural conditions. To encourage ideas related to economic interaction and institutional performance among ASEAN countries, this study investigates these ideas.

The researchers formulated *research questions* (RQ) as follows.

RQ1: Whether institutional performance has a direct impact on the economies in ASEAN countries?

RQ2: Whether economic interaction has a direct impact on the economies in ASEAN countries?

RQ3: Whether institutional performance has a direct impact on economic interaction in ASEAN countries?

RQ4: Whether economic interaction supported by institutional performance has an impact on the economies in ASEAN countries?

This research aims to provide and investigate a deeper understanding of how effectively the region's economic interactions and institutional performance contribute to economic growth in ASEAN.

The assessment of economic integration aims to evaluate the progress, benefits, and challenges of cooperation between countries in the Southeast Asian region. In this study, researchers focused on the economic interactions reflected in intra-trade, intra-investment, and intra-human mobility activities within the ASEAN region. This study utilizes six indicators from the World Government Indicator (WGI) to assess the quality of institutional performance in ASEAN countries. Data sourced from the World Bank¹. The institutional performance is measured by six indicators of the WGI, including political stability, government effectiveness, regulatory quality, rule of law, corruption control, and voice and accountability.

In previous research on economic interaction and development in ASEAN, researchers have employed four indicators of economic growth: GDP per capita, exports per capita, imports per capita, and population and economic determinant indicators, including the price deflator, Physicians per 1,000 people, unemployment rate, and life expectancy [9]. These indicators will also be used in this study as measures of the latent variable of economic growth and economic determinants.

Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis is employed to assess regional integration by examining the complex relationships between latent variables in a model. This method is applicable to a small sample. The latent variables in the study are economic growth, economic interaction, economic determinant, and institutional performance. Researchers employ this method to test hypothetical relationships, assess the predictive power of the model, and evaluate the significance of path coefficients to understand the driving factors of

¹ Retrieved from. <https://clck.ru/3RZiLs> (date of access: 08.11.2025)

economic development in ASEAN, which represents the success of regional integration through economic interaction in the Southeast Asian region. Institutional performance is considered a crucial factor that supports economic interactions, having a positive impact on the ASEAN economy.

The *hypotheses* of the study are represented below.

H1: Institutional performance has a direct impact on the economic growth of ASEAN countries.

H2: Economic interactions have a direct impact on the economic growth of ASEAN countries.

H3: Institutional performance has a direct impact on economic interactions in ASEAN countries.

H4: Economic interaction supported by institutional performance has an impact on the economies of ASEAN countries.

To test the hypotheses, a t-statistic and alpha values are used. The combination of economic interaction and institutional performance represents a moderate novelty and is expected to provide new insights useful for the knowledge related to regional economic interaction in ASEAN.

2. Literature review

2.1. Theoretical frameworks

Economist Bela Balassa¹ developed the theory of economic integration in 1961. The theory outlines the stages of integration and the economic impact of trade liberalization, which can stimulate growth, increase market size, and enhance competition. There are five stages of integration: free trade area, customs union, common market, economic union, and total economic integration. The process of economic integration involves actions such as eliminating discrimination within a region, but each country maintains its own tariffs against non-participating countries. This theory is closely tied to the field of international economics.

In addition, Howson [10] studied the economist James Meade, whose understanding of macroeconomic growth and fluctuations was grounded in Keynes's brilliant work and has provided a fundamental analytical framework. James Meade's significant contribution helped operationalize Keynes's framework by developing the first modern set of national accounts and extending it to include the international trade and capital flows that characterized the global economy.

Several studies have been conducted by researchers examining the theory related to the connection between institutional role and economic growth. For example, Rizki & Didenko [11] studied on impact of institutional involvement on the economic growth of nations. The study reviewed the distinct ideas of Adam Smith, Karl Marx, and John Maynard Keynes, who are referenced in global economic studies. Despite their differing ideas, these economists emphasized the important role of government involvement in a country's economy. Next, Bonefeld [12]

¹ *Balassa B.* The Theory of Economic Integration (1st ed.). George Allen and Unwin Ltd., 1962.

studied Adam Smith's thoughts and the ordoliberal concept of market liberty. Adam Smith believed that government policy was an important aspect of the market regulatory control systems, despite having distinct ideas about the institution's role in a nation's economy.

Additionally, Davies [13] examined the socialist government, demonstrating that Karl Marx predicted capitalism would ultimately give rise to internal struggles, ultimately leading to its eventual unravelling and replacement by an alternative system known as socialism.

Moreover, Ghisellini et al. [14] studied the circular economy based on the Keynesian concept, demonstrating that John Maynard Keynes has made significant contributions through his thoughts on the neoliberal paradigm and its impact on the sustainability of the global economy and society. Keynes's contribution to the global economy, in building a new paradigm of socio-economic development, underscores the importance of sustainable welfare fiscal policy and indicates the active role and responsibility of institutions.

2.2. Previous empirical studies

Scientists have conducted numerous empirical studies related to economic integration. Firstly, Butorina & Borko [15] studied regional integration in the global order. The study revealed that the integration is intended to respond dynamics shifting in the global order by helping member states enhance their global prominence and protect themselves from unintended external influences. Secondly, Solomon [16] studied the dramatic shift toward a market-based economy that occurred after 1980. His work revealed that increased economic interaction through key sectors, such as trade and finance, has the potential to generate both opportunities and widespread vulnerabilities.

Trade interactions and economic openness are manifestations of economic integration. Several studies have been conducted on these issues. For instance, Alesina et al. [17] studied the relationship between openness and equilibrium country size. The study disclosed that the economic benefits of country size are mediated by the level of openness to trade. The study found a significant relationship between trade liberalization and average country size. Then, Wooster et al. [18] studied the impact of trade on economic growth. The study revealed that intra-regional trade has a minor impact on output growth compared to extra-regional trade.

Also, Deme & Ndrianasy [19] studied the minimal impact of RTAs on the welfare of low-income developing countries. The research revealed that economic integration among relatively low-income countries benefits their members, as well as the majority of individual member countries, and suggests that RTAs among low-income countries have a significant trade-creating effect. Additionally, MacPhee & Sattayanuwat [20] studied the effect of the AFTA agreement on ASEAN countries. The study revealed that intra-regional trade has increased to 69 % for ASEAN developing countries that are Part of the AFTA regional agreement, compared to what they would be without AFTA.

Moreover, Tan [21] investigated the intra-increasing trade effect of trade agreements. The study indicated a slight increase in intra-ASEAN trade volume resulting from the ASEAN Preferential Trading Arrangements (PTAs). An examination of import and export data indicates a potential increase in intra-ASEAN imports for Indonesia, the Philippines, and Thailand.

Related to empirical studies investigating institutional performance, several works have been conducted. For example, Johnson & Koyama [22] and Salman et al. [23] studied the effect of institutional policies on the economy. The study revealed that the government decision provides positive support for a country’s economy. Appropriate government policies can have a significant positive impact on sustainable economic growth and public welfare.

Next, Oshota & Wahab [24] studied the impact of institutions on trade. The study disclosed that institutional performance has a significant and positive impact on trade flows. A reduction in corruption, an effective rule of law, and effective governance has a significant impact on trade increases between member states (Table 1).

Table 1. Research gap framework

Theoretical outlines	Research gap	Previous studies
<p><i>Economic integration</i> Economic integration and trade liberalization have the potential to stimulate economic growth, increase market size, and enhance competition³. James Meade’s significant contribution provided fundamental economic principles for understanding the benefits and challenges of countries cooperating in the context of European integration efforts [10].</p>	<p>Economic integration, facilitated by agreements among ASEAN countries, creates a free trade area aimed at eliminating tariffs and non-tariff barriers, thereby increasing the flow of goods and services across the region. Additionally, there are agreements on the rules of investment and people’s mobility within the region. These flows represent economic interactions among ASEAN countries and are expected to have a substantial impact on economic growth.</p>	<p>Economic interaction through trade and finance has the potential to generate both opportunities and widespread vulnerabilities between countries, especially in developing regions [16]. Regional integration is intended to respond to the dynamics of the global order by assisting member countries, particularly through RTA, to have a minimal impact on the welfare of developing countries and a significant impact on increasing their global influence [15–21]</p>
<p><i>Institutional performance</i> Adam Smith considered that government policy is a crucial factor in the market regulatory control systems of a country’s economy [12]. Karl Marx predicted that capitalism would face internal struggles and recommended its replacement with an alternative scheme of socialism [13]. John Maynard Keynes emphasized that institutions have an active role and responsibility in welfare fiscal policy [14].</p>	<p>Institutional performance has a direct positive impact on economic growth in ASEAN. Ever farther, institutional performance has a significant impact on supporting economic interactions, which in turn contribute substantially to economic growth in the ASEAN region.</p>	<p>Government policies, when implemented effectively, can have a profoundly positive impact on a country’s economy [22, 23]. National institutional quality has a significant and positive impact on bilateral trade flows [24].</p>

Source: compiled by the authors.

To build upon and expand the theoretical backgrounds and previous studies examining the direct and indirect effects of economic interactions and institutional performance on economic growth, researchers conducted a related study. This study was conducted to further investigate the significance of the direct and indirect relationships between economic interactions, institutional performance, and economic growth.

3. Materials and Methods

The research includes ASEAN member countries Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. The data used for each indicator is the average value of the data over a 10-year period, from 2013 to 2022. Intra-export is the average value of intra-export in millions of US\$. Intra-import is the average value of intra-import in millions of US\$. Intra-FDI is the average value of intra-FDI inflows in millions of US dollars. Intra-human flow is the average number of intra-human flows in thousands. Economic growth indicators data¹ come from the Asian Development Bank. GDP per capita is the average value of GDP per capita in US\$. Export per capita is the average value of exports per capita in US dollars. Import per capita is the average value of imports per capita in US dollars. The population is the average number of people in thousands.

The price deflator is the average of the price deflators in percentage terms. Physicians per 1000 people is the average of the Number of Physicians per 1000 people in a given population. The unemployment rate is the average percentage of the labor force that is unemployed. Life expectancy refers to the average number of years a person can expect to live. The Worldwide Governance Indicators (WGI) values range from approximately -2.5 to $+2.5$ using standard normal distribution units. The WGI data² including political stability, government effectiveness, regulatory quality, rule of law, corruption control, and voice and accountability.

Political stability is the average value of political stability scores. Government effectiveness is the average value of government effectiveness scores. Regulatory quality is the average value of regulatory quality scores. The rule of law is the average value of the rule of law scores. Corruption control is the average value of corruption control scores. Voice and accountability are the average value of voice and accountability scores.

The PLS-SEM is a statistical method widely used in the social sciences, including economics [25]. This method is highly reliable for analyzing complex causal relationships between latent variables and their indicators by combining measurement and structural models. It estimates the path through iterative calculation of latent variable scores and regression coefficients. A latent variable is an unobservable entity that is represented by several observed variables, also known

¹ Retrieved from <https://kidb.adb.org/> (date of access: 08.10.2025).

² Retrieved from <https://www.worldbank.org/en/publication/worldwide-governance-indicators/interactive-data-access> (date of access: 09.10.2025).

as indicators. The structural model represents the causal relationship between the latent variables. This model equation is commonly employed with the R Studio software for analysis [26]. The researchers employed four latent variables: economic growth, economic interaction, economic determinants, and institutional performance, as represented in Table 2.

Table 2. Latent variable and its indicators determination

Latent variables ¹	Indicators	Data Sources
Economic interaction (EI) (η_1)	Intra-export (<i>EI1</i>) ² (y_{11})	ASEAN Statistics
	Intra-import (<i>EI2</i>) (y_{12})	
	Intra-FDI (<i>EI3</i>) (y_{13})	
	Intra-human flows (<i>EI4</i>) ³ (y_{14})	
Economic growth (EG) (η_2)	GDP per capita (<i>EG1</i>) (y_{21})	Asian Development Bank
	Export per capita (<i>EG2</i>) (y_{22})	
	Imports per capita (<i>EG3</i>) (y_{23})	
	Population (<i>EG4</i>) (y_{24})	
Institutional performance (IP) (ξ_1)	Political stability (<i>IP1</i>) (x_{11})	World Bank
	Government effectiveness (<i>IP2</i>) (x_{12})	
	Regulatory quality (<i>IP3</i>) (x_{13})	
	Rule of law (<i>IP4</i>) (x_{14})	
	Corruption Control (<i>IP5</i>) (x_{15})	
	Voice and Accountability (<i>IP6</i>) (x_{16})	
Economic determinants (ED) (ξ_2)	Price Deflators (<i>ED1</i>) ⁴ (x_{21})	Asian Development Bank
	Physicians per 1000 people ⁵ (<i>ED2</i>) (x_{22})	World Bank
	Unemployment rate ⁶ (<i>ED3</i>) (x_{23})	Asian Development Bank
	Life expectancy ⁷ (<i>ED4</i>) (x_{24})	World Bank

Source: compiled by the authors.

¹ Retrieved from <https://www.aseanstats.org/wp-content/uploads/2023/12/ASYB-2023-v1.pdf> (date of access: 04.11.2025).

² Retrieved from <https://data.aseanstats.org/fdi-by-sources-and-sectors> (date of access: 10.11.2025).

³ Retrieved from <https://data.aseanstats.org/visitors> (date of access: 10.11.2025).

⁴ Retrieved from <https://kidb.adb.org/> (date of access: 08.10.2025).

⁵ <https://prosperitydata360.worldbank.org/en/indicator/UN+SDG+SH+MED+PHYS+ZS> (date of access: 08.01.2025).

⁶ Retrieved from <https://kidb.adb.org> (date of access: 08.10.2025).

⁷ <https://databank.worldbank.org/indicator/SP.DYN.LE00.IN/1ff4a498/Popular-Indicators#> (date of access: 08.01.2025).

Equation of Structural models:

$$\eta_1 = \beta_{\xi_1} \xi_1. \quad (1)$$

Where β_{ξ_1} presents the strength and direction of the relationship between institutional performance and economic interaction.

$$\eta_2 = \beta_{\eta_1} \eta_1 + \beta_{\xi_1} \xi_1 + \beta_{\xi_2} \xi_2. \quad (2)$$

Where β_{η_1} presents the strength and direction of the relationship between economic interaction and economic growth; β_{ξ_1} presents the strength and direction of the relationship between institutional performance and economic growth; β_{ξ_2} presents the strength and direction of the relationship between the economic determinant and economic growth.

Equation system of Measurement models:

$$\begin{cases} y_{1k} = \lambda_{\eta_{1k}} \eta_1 \\ y_{2l} = \lambda_{\eta_{2l}} \eta_2 \\ x_{1m} = \lambda_{\xi_{1m}} \xi_1 \\ x_{2n} = \lambda_{\xi_{2n}} \xi_2 \end{cases}. \quad (3)$$

Where $\lambda_{\eta_{1k}}$ presents the strength and direction of the relationship between economic interaction and its indicators; $k = 1, 2, 3, 4$; $\lambda_{\eta_{2l}}$ presents the strength and direction of the relationship between economic growth and its indicators; $l = 1, 2, 3, 4$; $\lambda_{\xi_{1m}}$ presents the strength and direction of the relationship between institutional performance and its indicators; $m = 1, 2, 3, 4, 5, 6$; $\lambda_{\xi_{2n}}$ presents the strength and direction of the relationship between the economic determinant and its indicators; $n = 1, 2, 3, 4$.

Reliability values measure the consistency and reliability of indicators, ensuring accuracy and precision. The values are represented by Cronbach's Alpha, Rho_A, Rho_C, and Average Variance Extracted (AVE). Cronbach's Alpha measures internal consistency using item variances and covariances. Rho_C is a more accurate measure than Cronbach's Alpha, utilizing estimated indicator loadings (λ) and error variance (δ):

$$\rho_C = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum \delta_i}. \quad (4)$$

Rho_A reflects a more realistic internal consistency and is typically situated between Alpha and Rho_C. The AVE value measures convergent validity by calculating the average percentage of variance that items within a construct account for:

$$AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum \delta_i} \tag{5}$$

The discriminant validity value ensures that the different constructs in the model are accurately conceptually and empirically distinct. An Heterotrait-Monotrait Ratio (HTMT) indicator less than 0.90 indicates that discriminant validity is satisfied. Furthermore, the Fornell-Larcker (F-L) value ensures that each latent variable is truly distinct and unique from other constructs. The accepted F-L criterion for discriminant validity is generally greater than 0.50.

Model evaluation using bootstrapping focuses on testing the significance of path coefficients using t-statistics from resampling results. It provides t-statistics to indicate whether the effect is significant, which in turn determines the alpha value. R-squared measures the proportion of the variance in the endogenous variable that is explained by the exogenous variables. Adjusted R-squared measures the contribution of exogenous variables to the variation in endogenous variables.

4. Results

4.1. Indicator trends

The researchers presented trend graphs to provide initial visual insights into the economic interaction situation in the ten ASEAN member countries. Singapore achieved the highest intra-trade values, while Cambodia, Lao PDR, and Myanmar had the smallest volume of intra-trade among the other member countries (Fig. 1–2).

Singapore receives the highest flow of FDI. Meanwhile, Brunei Darussalam, Cambodia, Indonesia, and Myanmar in certain years gained negative value (Fig. 3). Furthermore, Malaysia became a highly sought-after destination for other ASEAN citizens, surpassing other ASEAN countries (Fig. 4). In 2020 and 2021, there was an extreme decrease in visitors, presumably due to the COVID-19 pandemic, and it began to increase again in 2022.

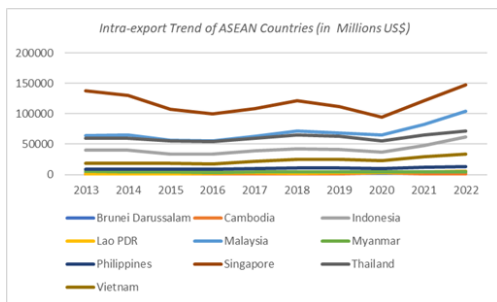


Figure 1. Trend of intra-export

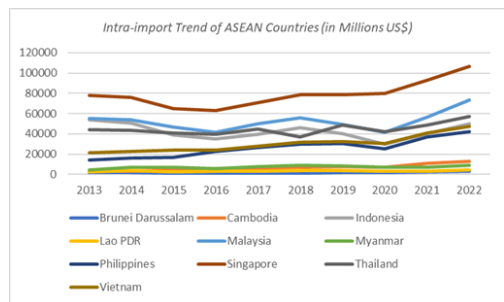


Figure 2. Trend of intra-import

Source: Fig. 1–6 compiled by the authors.

Singapore and Brunei Darussalam are Southeast Asian countries with small populations but very high GDP per capita, often leading the rankings in the region, and even globally (Fig. 5–6). This is a result of advanced economies and natural resources such as oil and gas in Brunei and financial services and trade in Singapore which are concentrated among a small population. Singapore consistently ranks at the top, followed by Brunei, whose economy is heavily dependent on natural resources.

4.2. Modeling variables

The PLS-SEM model employs four latent variables: economic growth, economic interaction, economic determinants, and institutional performance, along with their corresponding indicators (Fig. 7).

The path coefficient values indicate the strength and direction of the direct relationship between latent variables (Table 2). Path coefficient values range from -1 to +1.

The structural model equation, using path coefficients in Table 3, presents the relationship between the latent variables (Eq. 6–7):

$$\eta_{1i} = 0.777\xi_{1i} \tag{6}$$

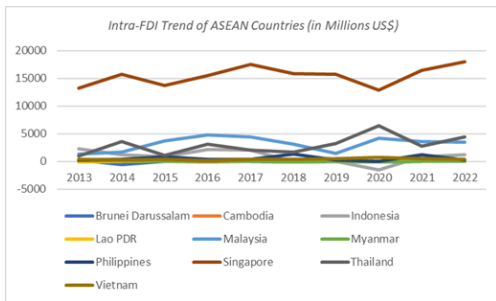


Figure 3. Trend of intra-FDI

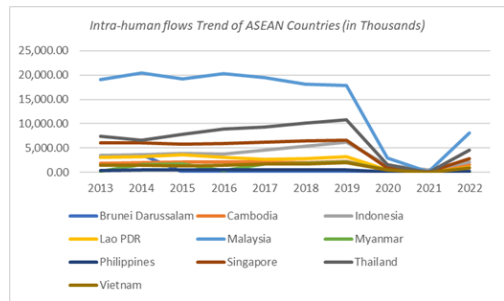


Figure 4. Trend of intra-human flows

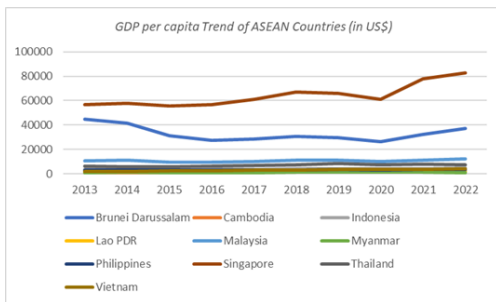


Figure 5. Trend of GDP per capita

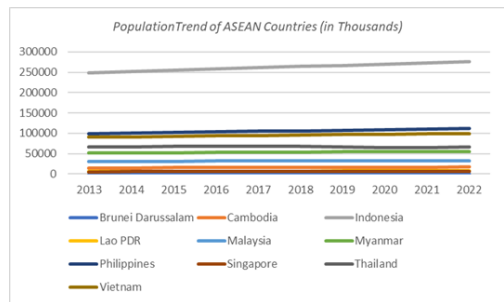


Figure 6. Trend of population

Table 3. Path coefficients PLS-SEM model

	Economic growth	Economic interaction
Economic interaction	0.178	—
Institutional performance	0.740	0.777
Economic determinant	0.001	—
R-squared	0.786	0.603
Adjusted R-squared	0.678	0.554

Source: calculated by the authors.

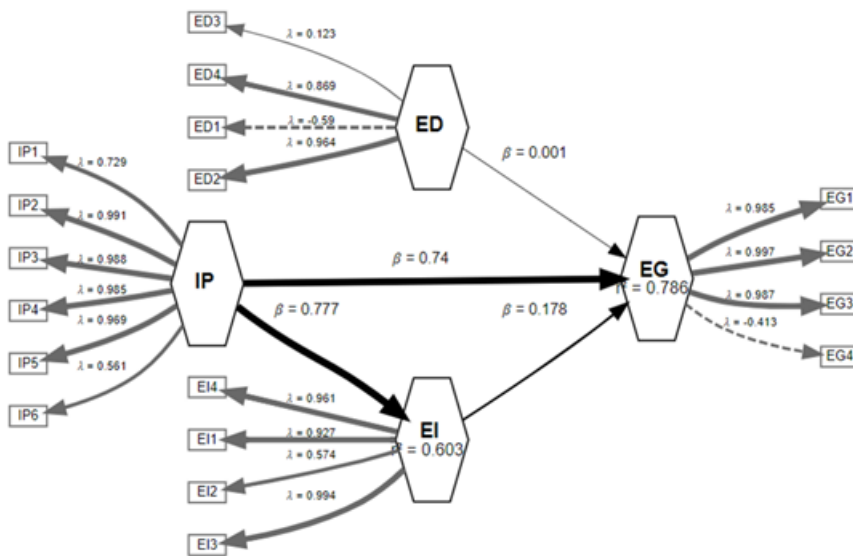


Figure 7. PLS-SEM model plot

The path coefficient value of 0.777 in the model indicates a strong and positive relationship between the institutional performance and economic interaction variables. Each one-unit increase in the institutional performance variable will increase the economic interaction variable by 0.777 units, assuming other variables are held constant.

The R-squared value of 0.603 in the PLS SEM model for economic interaction indicates that 60.3 % of the variation in the endogenous variable, represented by economic interaction, can be explained by the exogenous institutional performance variable in the model. The adjusted R-squared value of 0.554 for the economic interaction variable indicates that 55.4 percent of the variance in the economic interaction variable can be explained by the independent institutional performance variable, considering the number of predictors in the model:

$$\eta_2 = 0.178\eta_1 + 0.740\xi_1 + 0.001\xi_2. \tag{7}$$

A path coefficient of 0.178 in the model indicates a moderate positive direct relationship between economic interaction and economic growth. This value suggests that the impact of economic interaction on economic growth is positive, albeit not particularly strong. Each one-unit increase in economic interaction results in a 0.178-unit increase in economic growth, assuming other variables remain constant. The path coefficient value of 0.740 in the model indicates a strong and positive relationship between the institutional performance and economic growth variables. Each one-unit increase in the institutional performance variable will result in a 0.740-unit increase in the economic growth variable, assuming that other variables are held constant. A path coefficient of 0.001 in the model indicates a very weak relationship between the economic determinant and economic growth variables. Each one-unit increase in the economic determinant variable will result in a 0.001-unit increase in the economic growth variable, assuming all other variables are held constant.

The R-squared value of 0.786 in the PLS-SEM model for economic growth indicates that the proportion of variation in endogenous variables accounted for by economic growth, at 78.6 percent, can be explained by the exogenous variables of economic interaction, institutional performance, and economic determinants in the model. The adjusted R-squared value of 0.678 for the economic growth variable indicates that 67.8 percent of the variance in the economic growth variable can be explained by the independent variables of economic interaction, institutional performance, and economic determinants, considering the number of predictors in the model.

The outer loading value indicates the correlation between the latent variable and its indicator. It measures the absolute contribution of an indicator to the construct. A higher outer loading value indicates a better and more valid indicator in measuring the latent construct. A negative outer loading value indicates an inverse relationship with the latent construct being measured (Table 4).

Table 4. **Outer loading values**

Latent variable	Indicators	Value
Economic interaction	Intra-export	0.927
	Intra-import	0.574
	Intra-FDI	0.994
	Intra-human flows	0.961
Economic growth	GDP per capita	0.985
	Export per capita	0.997
	Imports per capita	0.987
	Population	-0.413

End of table 4

Latent variable	Indicators	Value
Institutional performance	Political stability	0.729
	Government effectiveness	0.991
	Regulatory quality	0.988
	Rule of law	0.985
	Corruption control	0.969
	Voice and Accountability	0.561
Economic determinants	Price deflator	-0.590
	Physicians per 1000 people	0.964
	Unemployment rate	0.123
	Life expectancy	0.869

Source: calculated by the authors.

Equations set present the relationship of economic interaction and its indicators:

$$\left. \begin{array}{l} y_{11} = 0.927\eta_1 \\ y_{12} = 0.574\eta_1 \\ y_{13} = 0.994\eta_1 \\ y_{14} = 0.961\eta_1 \end{array} \right\}. \quad (8)$$

The outer loading values of the economic interaction indicators, represented by intra-export, indrawn FDI, and human flows, show very strong values, with values of 0.927, 0.994, and 0.961, respectively. This suggests that these indicators are highly effective and valid in measuring and influencing economic interactions. Meanwhile, the value for the intra-import is around 0.574, indicating a moderate and significant impact on economic interaction, although not as pronounced.

Equations set present the relationship of economic growth and its indicators:

$$\left. \begin{array}{l} y_{21} = 0.985\eta_2 \\ y_{22} = 0.997\eta_2 \\ y_{23} = 0.987\eta_2 \\ y_{24} = -0.413\eta_2 \end{array} \right\}. \quad (9)$$

The outer loading values of the economic growth indicators, represented by GDP per capita, export per capita, and import per capita, show strong confidence values that approach 1. These values suggest that the contributions of these three indicators to economic growth are substantial and valid in measuring and influencing

economic growth. The value for the population indicator is below 0.50, indicating a moderate contribution to economic growth, which is inversely proportional.

Equations set present the relationship between institutional performance and its indicators:

$$\left. \begin{array}{l} x_{11} = 0.729\xi_1 \\ x_{12} = 0.991\xi_1 \\ x_{13} = 0.988\xi_1 \\ x_{14} = 0.985\xi_1 \\ x_{15} = 0.969\xi_1 \\ x_{16} = 0.561\xi_1 \end{array} \right\}. \quad (10)$$

The outer loading values of institutional performance indicators, represented by government effectiveness, regulatory quality, rule of law, and corruption control, exhibit very strong values, with scores above 0.95. These values suggest that the contributions of these four indicators are substantial and valid in measuring and influencing institutional performance. The value for the political stability and absence of violence indicator is around 0.729, indicating that this indicator has a strong influence on institutional performance. The value for the voice and accountability indicator is 0.561, indicating a significant influence on institutional performance.

Equations set present the relationship of economic determinants and their indicators:

$$\left. \begin{array}{l} x_{21} = -0.590\xi_2 \\ x_{22} = 0.964\xi_2 \\ x_{23} = 0.123\xi_2 \\ x_{24} = 0.869\xi_2 \end{array} \right\}. \quad (11)$$

The outer loading values of the economic determinant indicators, represented by physicians per 1,000 people and life expectancy, are very strong, at 0.964 and 0.869, respectively. These values indicate that the three indicators contribute significantly and are valid for economic determinants. The value for the price deflator indicator is -0.590 , indicating a moderate inverse effect on economic determinants. The value for the unemployment rate is 0.123, indicating no significant effect on economic determinants (Fig. 8).

Ideal values for Cronbach's Alpha, Rho_A, and Rho_C should be greater than 0.7, while AVE should be greater than 0.5. Referring to the result from Table 5, almost all of the alpha, RhoC, and RhoA values of the latent variables are greater than 0.7, indicating a high level of internal consistency. Only the Alpha value of economic growth and the Rho_C value of economic determinants are under 0.7.

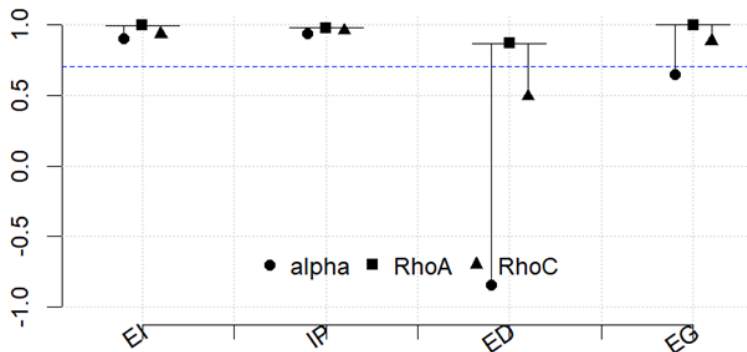


Figure 8. Reliability plot PLS SEM

Source: calculated by the authors.

The AVE values of all latent variables are greater than 0.5, indicating more than 50 % of the variance in those latent variable indicators is explained by the latent construct being measured (Table 5).

The HTMT determines whether two constructs in a model are distinct, with a common threshold for discriminant validity. The HTMT values of the latent variable construct of economic interaction — economic growth, economic determinants — economic growth, economic determinants — economic interaction, and institutional performance — economic interaction, with values below 0.90, indicate good discriminant validity (Table 6).

Table 5. Reliability values of the PLS-SEM model

	Alpha	Rho_C	Rho_A	AVE
Economic interaction	0.901	0.930	0.994	0.776
Economic growth	0.643	0.880	0.998	0.777
Institutional performance	0.937	0.955	0.976	0.786
Economic determinant	-0.841	0.489	0.866	0.512

Source: calculated by the authors.

Table 6. HTMT values

	EG	EI	ED	IP
EG	—			
EI	0.700	—		
ED	0.828	0.730	—	
IP	0.934	0.798	0.974	—

Source: calculated by the Authors

Table 7. The Fornell-Larcker (F-L) criterion values

	EG	EI	ED	IP
EG	0.882	—		
EI	0.754	0.881	—	
ED	0.823	0.713	0.716	—
IP	0.879	0.777	0.939	0.887

Source: calculated by the authors.

The results in Table 7 indicate that all latent variables are distinct and unique from one another. It is indicated by the F-L criterion values exceeding 0.5.

4.3. Evaluation of PLS-SEM significance using the Bootstrapping technique

The study utilized data spanning from 2013 to 2022. Several significance tests were used to evaluate the Structural Equation Modeling model with Partial Least Squares. To evaluate the model's significance, the researcher used the t-test, R-squared, and adjusted R-squared. Bootstrapping is necessary in PLS SEM models to test statistical significance by repeatedly resampling the sample data. The researchers use an alpha value of 0.1, which remains relevant for economic studies. The research subjects were in 10 ASEAN countries. Using a two-tailed test, for $n=10$ and $\alpha=0.1$, critical values are ± 1.833 . The t-value will be significant if it is greater than 1.833 or less than -1.833 .

Table 8 presents the results of the significance test for the path coefficients in the SEM-PLS model.

Table 8. Significance of direct and indirect effects using Bootstrap

Inner Model	t-statistics	5 % CI	95 % CI	Significant (Yes or No)
Institutional Performance → Economic interaction → Economic Growth	2.228	0.046	0.158	Yes
Institutional Performance → Economic Interaction	6.044	0.617	0.830	Yes
Economic interaction → Economic Growth	1.528	0.0577	0.258	No
Institutional Performance → Economic Growth	1.302	0.248	1.266	No
Economic Determinant → Economic growth	0.002	-0.433	0.527	No

Source: calculated by the Authors

On the path from Institutional Performance to Economic Interaction to Economic Growth, the t-value of 2.228 supports the hypothesis. It indicates institutional performance has a significant indirect impact on economic growth through economic interactions. On the Institutional Performance → Economic Interaction path, the t-value of 6.044 supports the hypothesis. This suggests that Institutional Performance has a significant direct impact on economic growth. Meanwhile, on the paths of Economic Interaction → Economic Growth, Institutional Performance → Economic Growth, and Economic Determinant → Economic Growth, the t-values obtained are 1.528, 1.302, and 0.002, respectively. It suggests there is no significant direct impact on those paths.

Table 9 presents the significance evaluation of the relationship between latent variables and their indicators.

Table 9. **Significance of Bootstrap's outer loading evaluation**

	Path of the indicators and their latent variable	t-statistics	5 % CI	95 % CI	Significant (Yes or No)
Economic Interaction	Intra-export	68.049	0.923	0.947	Yes
	Intra-import	3.503	0.430	0.740	Yes
	Intra-FDI	5658.664	0.994	0.995	Yes
	Intra-human Flows	92.349	0.944	0.964	Yes
Economic Growth	GDP per capita	161.665	0.977	0.988	Yes
	Export per capita	318.234	0.990	0.996	Yes
	Imports per capita	100.999	0.970	0.987	Yes
	Population	-6.357	-0.566	-0.444	Yes
Institutional Performance	Political stability	7.246	0.680	0.856	Yes
	Government effectiveness	674.922	0.992	0.994	Yes
	Regulatory quality	258.139	0.982	0.989	Yes
	Rule of Law	273.075	0.986	0.992	Yes
	Corruption Control	72.537	0.973	0.997	Yes
	Voice and Accountability	5.585	0.335	0.524	Yes
Economic Determinant	Price deflator	-3.241	-0.673	-0.338	Yes
	Physicians per 1000 people	63.036	0.952	0.980	Yes
	Unemployment rate	0.251	-0.637	0.267	No
	Life expectancy	12.902	0.850	0.975	Yes

Source: calculated by the Authors

Table 10. Value of R-squared and Adj. R-Squared

	Economic Growth	Economic Interaction
R-Squared	0.786	0.603
Adjusted R-Squared	0.678	0.554

Source: calculated by the authors.

The t-values of the path of economic interaction and its indicators are greater than 1.833. It indicates that intra-export, intra-import, intra-FDI, and intra-human flows have a significant direct influence on measuring economic interactions. Then, the t-values of the path of economic growth and its indicators lead to a significant decision. It indicates that the GDP per capita, export per capita, import per capita, and population have a significant direct influence on measuring economic growth.

Next, the t-values of the path of institutional performance and its indicators lead to a significant conclusion. It indicates that the political stability, government effectiveness, regulatory quality, rule of law, corruption control, and voice and accountability have a significant direct influence on measuring institutional performance.

Lastly, the t-values of the path of economic determinants and their indicators, price deflator, physicians per 1,000 people, and Life expectancy lead to a significant conclusion. It indicates that those indicators have a significant direct influence on measuring economic determinants. On the other hand, unemployment does not have a significant direct impact on economic determinants, as indicated by its t-value.

The R-squared value for the model, with economic growth as the endogenous variable, is 0.786, indicating that 78.6 % of the variation in the endogenous variable can be explained by the exogenous variables. This suggests that the model adequately explains the relationship between the variables. The adjusted R-squared value of 0.678 indicates that the model can explain approximately 67.8 % of the variation in the endogenous variable, while the remaining 32.2 % is attributed to factors not included in the model.

The R-squared value for the model, with economic interaction as the endogenous variable, is 0.603, indicating that 60.3 % of the variation in the endogenous variable can be explained by the exogenous variables. This indicates that the model adequately explains the relationship between the variables. The adjusted R-squared value of 0.554 indicates that the model can explain approximately 55.4 % of the variation in the endogenous variable, while the remaining 44.6 % is attributed to factors not included in the model.

5. Discussion

Trend visualization illustrates a short highlight. Singapore serves as a major hub, with the largest sources coming from the United States, the United Kingdom, Japan, and China, driven by the financial, manufacturing, technology,

and infrastructure sectors. According to Lam's research results [27], it is evident that Singapore's strategic location makes it one of the world's busiest ports, offering high standards of service and productivity. It attracts investors because its economic growth is driven by the services sector, high-tech manufacturing, finance, and world-class infrastructure. It creates a competitive, efficient, and corruption-free investment climate. It makes a global business hub. In addition, Malaysia became the country with the most visitors. Malaysia places a high priority on promoting strong tourism. Tourists came from Singapore and Indonesia, being the main contributors, especially within the intra-ASEAN market. Refer to research conducted by Kadir [28] discloses that Tourism is a key industry that contributes significantly to Malaysia's accelerated economic growth.

The significance evaluation reveals that the economic interaction indicators: intra-export, intra-import, intra-FDI, and human flows are significant, as shown by a t-value greater than the critical value. This indicates that these indicators are significant in measuring and influencing economic interaction. Moreover, the significance evaluation reveals that economic growth indicators, including GDP per capita, export per capita, import per capita, and population, are statistically significant. This indicates that whole indicators are significant in measuring and influencing economic interaction. However, the path coefficient between economic growth and population is negative, as shown in (Eq. 9), indicating an inverse relationship between economic growth and population in ASEAN countries. This is confirmed by the economic conditions of Singapore and Brunei Darussalam. These two countries have the smallest populations, far below those of other ASEAN member states. Yet their GDP per capita is significantly higher than the average GDP per capita of other ASEAN countries (see Fig. 5–6).

The significance evaluation reveals that institutional performance indicators, including political stability, government effectiveness, regulatory quality, rule of law, corruption control, and voice and accountability, are statistically significant. This indicates that whole indicators are significant in measuring and influencing institutional performance. The significance evaluation reveals that economic determinants indicators, including Physicians per 1,000 people and Life expectancy, are statistically significant. This indicates that those indicators are significant in measuring and influencing economic determinants. However, the unemployment rate indicator is not a significant measure of influencing economic determinants.

The model evaluation results presented in Table 8 indicate that institutional performance has no direct impact on economic growth, as evidenced by the t-value of 1.302, which suggests that Hypothesis *H1* is rejected.

Additionally, it indicates that economic interactions did not have a significant direct effect on economic growth, as evidenced by a t-value of 1.528, and Hypothesis *H2* is rejected. The results of two significant tests indicate that institutional performance and economic interaction have no direct impact on economic growth in ASEAN countries. This finding contradicts existing theory, and previous

research stated that institutional performance and economic integration have a significant impact on economic growth. It may be due to data limitations and some situations that occurred during the years when the research data was collected.

Data covering the years 2013–2022, during which ASEAN was facing a pandemic that slowed economic interaction and growth. This pandemic has led to a drastic decrease in human mobility between countries, which will impact on the intra-human flow data (Fig. 4). Despite the challenges posed by the COVID-19 pandemic, which temporarily suppressed economic growth, this economic interaction serves as a crucial foundation for the region's long-term economic recovery and growth. However, the t-value of economic interaction is 1.528, which is approaching 1.833, suggesting that economic interaction may have a potential impact on economic growth.

Additionally, the impact of economic interactions can be linked to Solow's ideas. Referring to the Neoclassical Growth Theory by Solow, it emphasizes that economic growth is influenced by the level of technological mastery of growing workers, savings, population growth, and exogenous technological changes as key factors [29]. Excepting technological factors that tend to require interaction with other countries, Solow emphasized that long-term economic growth is primarily driven by the accumulation of labor and capital, which are resources that originate from within the country and not from interaction activities with other countries.

Moreover, on the direct path of institutional performance and economic interaction, the t-value is 6.044. This means that Hypothesis *H3* is accepted, indicating that institutional performance has a direct impact on economic interaction. The significance of this hypothesis supports the Institutional Neoliberalism theory. Keohane [30] is considered one of the key founders, focusing on the role of international regimes and how institutions facilitate cooperation among countries to address global problems. A study conducted by Keohane [31] reveals that trends since the 1990s, linked to geopolitics, indicate that institution-building by the United States and its allies has a significant security justification: to create economic prosperity and patterns of cooperation that will strengthen the West's position. In addition, new institutional economics (NIE) is extending neoclassical theory by focusing on institutions related to economic interaction. Akansel [32] explored NIE, and the study reveals that NIE appears similar to neoliberal and neoclassical economics, but it offers a different perspective. Neoliberalism aims to eliminate all barriers to international trade, grounded in the logic of free markets. However, NIE adds significant distinctions such as bounded rationality, transaction costs, and property rights [33].

Furthermore, North¹ argues that strong and stable institutions stimulate a predictable environment, encouraging investment and innovation, while weak institutions give rise to inefficiency and risk; therefore, an understanding of

¹ North D. C. The Role of Institutions in Economic Development // UNECE Discussion Paper Series. 2003. https://unece.org/fileadmin/DAM/oes/disc_papers/ECE_DP_2003-2.pdf

institutional evolution is crucial to economic history. In the 1970s, ASEAN sought to align its organizational identity with the emerging Asia-Pacific identity by introducing the concept of the Pacific Basin. The momentum of the 1993 Seattle and 1994 Bogor APEC (Asia-Pacific Economic Cooperation) meetings provided sufficient political will to establish an Asia-Pacific identity, potentially undermining Southeast Asia's geographic autonomy. The theoretical proposition of neoliberal institutionalism, that the loss of bipolarity would benefit the international structure, has not been proven in Southeast Asia [34].

The analysis results on the indirect path, between institutional performance, economic interaction, and economic growth, indicate that the t-value attains 2.228. This means that Hypothesis *H4* is accepted, indicating that economic interactions supported by institutional performance have a significant impact on ASEAN countries. Institutional performance plays a crucial role in supporting economic growth and regional integration in the ASEAN region. The acceptance of Hypothesis *H4* implies a new perspective on economic integration, particularly in the ASEAN region. The findings of this study are expected to enrich and complement previous research, providing a foundation for further insights into more complex investigations of institutional performance, economic integration, and regional economics.

The study's limitation employs an alpha value of 10 % and is based on a small sample. The researchers implement an alpha value of 0.1, which is still acceptable to economic studies but is considered less strict because it allows for a ten percent probability that the outcomes are caused by a Type I error [35]. This consideration is based on the context of this study, which remains within the social sciences category, allowing for an acceptable tolerance level of error. PLS-SEM is suitable for research with small sample sizes [36]. It provides sufficient initial insights for future studies of economic interaction.

6. Conclusion

ASEAN intra-regional investment remains concentrated in Singapore, accounting for over 50 % of the total regional investment in the region. Singapore also maintains the highest intra-regional trade volume. Malaysia is the most popular destination for ASEAN residents from 2013 to 2022. This is supported by Malaysia's commitment to promoting tourism. The significance evaluation shows that the latent variables of economic interaction, economic growth, and institutional performance are significant in measuring and influencing their respective latent variables. However, the unemployment rate indicator is not a significant measure in influencing economic determinants.

Model evaluation using t-statistics rejects the significance of Hypothesis *H1* and Hypothesis *H2*. This suggests that institutional performance and economic interaction do not have a direct impact on economic growth, which contradicts previous theories and research that has stated institutional performance and economic integration have a significant impact on economic growth. This is strongly

believed to be due to several circumstances that occurred between 2013 and 2022, during which the COVID-19 pandemic slowed economic interactions and growth. Further investigation is needed to prove this hypothesis in further research.

The theoretical significance of this research lies in the methodology developed, which utilizes four groups of latent variables: institutional performance, economic interaction, economic determinants, and economic growth. The authors assess the institutional effectiveness and economic interactions of ASEAN countries in a multipolar world, within the conceptual framework of the impact of economic integration on sustainable economic growth. This study proposes PLS-structural equation modelling to analyse the relationship between institutional performance, macroeconomic factors, economic interactions, and economic growth. This approach provides a new perspective that can support or validate existing theories, as indicated by the acceptance of Hypothesis *H3* and Hypothesis *H4*.

The significance test provides a decision that Hypothesis *H3* is accepted. This indicates that institutional performance has a direct impact on economic interactions. The significance of Hypothesis *H3* supports the theory of ‘Institutional Neoliberalism’, and ‘New Institutional Economic Theory’ extends neoclassical theory by focusing on institutions related to economic interactions. Furthermore, Hypothesis *H4* is accepted. It reveals new insights indicating that the economic interaction supported by the effectiveness of institutions makes a significant contribution to economic growth.

The practical significance of this study lies in the fact that the developed models and methods can be used to demonstrate the direct and indirect relationships between institutional performance, economic integration, and economic growth. The findings of this study can be utilized by government agencies, international organizations, and the scientific community to develop strategies for regional and international economic integration, enhance institutional performance, increase bilateral and regional trade volumes, and facilitate human mobility in areas such as labour mobility and tourism. Ultimately, this study provides recommendations for implementing strategic policies that foster long-term regional economic growth.

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Оценка экономического взаимодействия и институциональной эффективности в экономиках стран АСЕАН: анализ с использованием PLS-моделирования структурных уравнений

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Аннотация. В многополярном мире изучение региональной интеграции имеет большое значение для понимания того, как экономические взаимодействия могут способствовать экономическому росту, глобальной конкурентоспособности и стабильности в условиях глобальной неопределенности. Исследование подчеркивает значительное влияние экономических взаимодействий и эффективности институтов на экономическое развитие Юго-Восточной Азии. Цель данного исследования — изучить влияние экономических взаимодействий и эффективности институтов на экономику. Визуализация трендов показывает, что Сингапур получает наибольший объем внутриотраслевых инвестиций и внутриторговли, в то время как Малайзия получает наибольший объем внутрирыночной мобильности. Кроме того, можно выдвинуть гипотезу о том, что экономические взаимодействия и эффективность институтов оказывают значительное влияние на экономику АСЕАН. Для проверки значимости гипотезы используется анализ PLS-SEM. Модель включает четыре латентные переменные: экономическое взаимодействие, экономический рост, эффективность институтов и экономические детерминанты. Переменная экономического взаимодействия рассматривается как проявление приверженности региональной интеграции, которая регулируется политикой сотрудничества государственных институтов в этом регионе. Экономическое взаимодействие представлено показателями внутриэкспорта, внутриимпорта, внутрирыночных прямых иностранных инвестиций и внутрирыночных потоков. Результаты теста на значимость показывают, что эффективность работы институтов оказывает очень сильное прямое влияние на экономические взаимодействия. Это подтверждает теорию институционального неолиберализма и новой институциональной экономики. Более того, эффективность работы институтов и экономические взаимодействия не оказывают прямого влияния на экономический рост. Однако экономические взаимодействия, поддерживаемые эффективностью работы институтов, оказывают значительное влияние на экономический рост. Исследование дает новые представления, аргументируя, что для того чтобы экономическое взаимодействие оказывало значительное влияние на экономический рост в странах АСЕАН, оно должно поддерживаться эффективностью работы институтов.

Ключевые слова: геополитические регионы; экономическая взаимосвязь; региональная интеграция; эффективное управление; многополярный мир.

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