Testing Causality Models in the Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT)

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Abstract. Analyzing the reciprocal relationship between economic growth, foreign direct investment, exports, and imports in Indonesia, Malaysia, and Thailand aims to foster collective economic development, boost investments, and promote cross-border trade and tourism involving these three countries. The tool used is Granger causality, analyzing time series data from 1981 to 2022. The findings indicate that in Indonesia, there is a bidirectional relationship between FDI and GDP, as well as between imports and exports. In Malaysia, there exists a bidirectional relationship between imports and GDP. Meanwhile, Thailand has a unidirectional relationship in which exports affect GDP. The study's constraints arise from the restricted number of countries observed and the limited independence of the data. This research contributes to illustrating the long-term economic cooperation among IMT-GT countries.

Keywords: Granger, FDI, Economic Cooperation.

1 Introduction

Countries within the same geographical area have the privilege of being able to interact with each other and create mutually beneficial cooperation. As an example of trade cooperation in ASEAN (Association of Southeast Asian Countries), there is the IMT-GT (Indonesia, Malaysia, Thailand Growth Triangle) partnership. IMT-GT is a subregional initiative formed in 1993 by the governments of Indonesia, Malaysia, and Thailand to accelerate economic transformation in less developed regions. The role of the private sector will continue to be the key to promoting economic cooperation in IMT-GT. Since its inception, IMT-GT has grown geographically and involved more than 70 million residents. Currently, IMT-GT covers 14 provinces in southern Thailand, 8 states in Peninsular Malaysia, and 10 provinces in Sumatra, Indonesia. Apart from the role of the state, non-state actors or the private sector also play an important role in supporting the implementation of programs that have been agreed within the IMT-GT framework. The increasing number of investors, both foreign and domestic, will accelerate the process of economic transformation in the investment area [1].

The growth triangle is an economic concept driven by strong political commitment. It connects regions adjacent to each country involved, aiming to exploit production factors such as land, labor, and capital. One of its goals is to increase competitiveness to attract both domestic and

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foreign investors, as well as to promote mutually beneficial trade between cross-border integrated regions.

Since its establishment, the IMT-GT has made progress on programs that are showing positive implementation and development year after year. This partnership holds great promise for the three countries involved due to the region's significant economic potential, vast land, abundant labor, and natural resources. Additionally, the area also boasts a sizable market, comprising approximately 70 million people. With such potential, the IMT-GT has the opportunity to become a thriving hub for growth, particularly when combined with the financial strength and business expertise of a dynamic private sector. Economic opportunities in this region encompass various sectors, including agriculture and industry, such as rubber production, palm oil, horticulture, marine products, oil and gas, and natural wood.

Several research studies suggest that foreign direct investment contributes to economic growth. For instance, [2] indicate a positive impact on economic growth in Jordan, recommending that the government implement regulations to attract more investors. Similarly, [3] highlights the important role of FDI in the economic growth of the United States. In the Caribbean region and five African countries, FDI has been shown to have a positive effect on economic growth [4] & [5]. Additionally, a study covering 108 developed and developing countries from 1970 to 2007 concluded that economic growth was influenced by FDI [6]. However, some studies present differing results. For example, [7] found that Spanish economic growth was not influenced by FDI from 1984 to 2010. Similarly, [8] found no significant link between FDI and economic growth in Australia. On the other hand, [9] found that economic growth in G20 member countries is significantly strengthened by foreign direct investment.

2 Literature Review

Endogenous growth theory describes economic growth as the result of internal elements in the economic system. This view can be considered a critical response to the Neo-Classical view of growth, especially in terms of the idea of diminishing marginal productivity of capital and the income convergence between different countries [10]. Endogenous growth models suggest that sustainable development can be achieved through savings and investment, where capital (K) is considered to cover a broad of knowledge. The factors that influence the growth rate are explained by this model. According to Paul Romer, endogenous growth consists of three main elements: endogenous technological progress resulting from the accumulation of knowledge, firms generating new ideas through the dissemination of knowledge, and the production of consumer goods by knowledge production factors that have unlimited growth potential [11]. Depending on the availability of capital (K), the amount of labor (L), and the level of technology or productivity (A), the level of technological progress is not considered an exogenous factor but is assumed to be an endogenous factor that depends on the growth of capital (capital).

3 Methodology

This research uses secondary data from three countries, namely the Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT). Then the independent variables used are foreign direct investment, economic growth, and international trade. The research year taken was time series data from 1981 – 2022.

Table 1. Variables Description

Symbol	Definition
GDP	Gross Domestic Product (Current US$)
FDI	Foreign Direct Investment (Current US$)
Exp	Export (Current US$)
Imp	Import (Current US$)

Source: World Bank, 2024

The analytical tool used is the causality test using the Granger Causality method.

4 Result

The stationarity test results show that the variables used in this research are not stationary at the level. Therefore, root testing was carried out at the first difference level. Based on the test results at the first difference level, all variables have become stationary because the statistical value of the ADF (Augmented Dickey-Fuller) test for these variables is lower than the critical value determined by McKinnon. Detailed results of unit root testing at the first difference level can be found in the following table.

Table 2. The result of the Unit Roots Test Model Time Series of First Difference Level

Country	**Variable**	**ADF**	**Prob**	**Conclusion**
Indonesia	GDP	-4.298428	0.0015	Stationary
	FDI	-8.163734	0.0000	Stationary
	Export	-4.658717	0.0006	Stationary
	Import	-5.362371	0.0001	Stationary
Malaysia	GDP	-5.686227	0.0000	Stationary
	FDI	-7.259439	0.0000	Stationary
	Export	-5.688176	0.0000	Stationary
	Import	-5.660397	0.0000	Stationary
Thailand	GDP	-4.443832	0.0010	Stationary
	FDI	-6.877360	0.0000	Stationary
	Export	-5.986471	0.0000	Stationary
	Import	-5.326838	0.0001	Stationary

The results of the Panel model unit root test in Table 3 after the first differentiation show that all variables have become stationary. All variables that will be estimated in the research have a first difference level.

Table 3. The result of the Unit Roots Test Model Panel Data of First Difference Level

Variables	Methods	Statistic	Prob.
GDP	ADF – Fisher Chi-square	33.8251	0.0000
FDI	ADF – Fisher Chi-square	87.8692	0.0000
Export	ADF – Fisher Chi-square	56.1792	0.0000
Import	ADF – Fisher Chi-square	59.0374	0.0000

The next test is determining the optimum lag. Table 4 shows the optimal lag results based on the AIC criteria.

Table 4. The results of Length Criteria Test Time Series and Panel Data Model

Countries/Panel	AIC	Lag Position
Indonesia	196.0528*	3
Malaysia	191.4347*	2
Thailand	194.1961*	3
PANEL	196.1029*	4

The results of causality testing can be seen in Table 5.

Table 5. The Results of Granger Causality Model Time Series and Panel Data

Models	**Countries**	**Variable**	**Prob**	**Conclusion**
TIME SERIES	Indonesia	FDI → GDP GDP → FDI	0,0577 0,0000	Two-way relationship
		Exp →GDP GDP → Exp	0,8022 0,4525	x
		Imp → GDP GDP → Imp	0,1903 0,0005	One-way relationship **(GDP → Imp)**
		Exp → FDI FDI → Exp	0,0038 0,3327	One-way relationship **(Exp → FDI)**
		Imp → FDI FDI → Imp	0,0018 0,6097	One-way relationship **(Imp → FDI)**
		Imp → Exp Exp → Imp	0,0001 0,0000	Two-way relationship
	Malaysia	FDI → GDP GDP → FDI	0,5388 0,0002	One-way relationship **(GDP →FDI)**
		Exp →GDP GDP → Exp	0,2278 0,0446	One-way relationship **(GDP → Exp)**
		Imp → GDP GDP → Imp	0,0361 0,0050	Two-way relationship
		Exp → FDI FDI → Exp	0,0005 0,1397	One-way relationship **(Exp → FDI)**
		Imp → FDI FDI → Imp	0,0018 0,3377	One-way relationship **(Imp → FDI)**
		Imp → Exp Exp → Imp	0,2557 0,2463	x
	Thailand	FDI → GDP GDP → FDI	0,5302 0,1756	x
		Exp →GDP GDP → Exp	0,0948 0,6189	One-way relationship **(Exp → GDP)**

Models	Countries	Variable	Prob	Conclusion
		Imp → GDP	0,5094	x
		GDP → Imp	0,8970	
		Exp → FDI	0,3668	x
		FDI → Exp	0,5381	
		Imp → FDI	0,2389	x
		FDI → Imp	0,4787	
		Imp → Exp	0,9018	x
		Exp → Imp	0,4918	

The variables of Gross domestic product and Foreign direct investment in Indonesia have a two-way relationship. Strong economic growth creates a conducive environment for FDI inflow, while FDI can strengthen economic growth through technology and capital transfer [12]. The results of this research are in line with previous research such as [13]–[16] which states that gross domestic product and foreign direct investment have a two-way relationship and influence each other. However, it is important to remember that the relationship between GDP and FDI is not deterministic. Factors such as government policies, political stability, and global market conditions also play an important role in shaping a country's economic dynamics [5].

Things are different in Malaysia. Gross domestic product influences Foreign Direct Investment. The results of this research are in accordance with previous research such as [17]–[19] revealed that the relationship between GDP and FDI tends to show a one-way direction from GDP to FDI. This means that strong and stable GDP growth in a country encourages an increase in the amount and quality of foreign direct investment (FDI). Strong GDP growth not only strengthens the domestic economy but is also a major trigger for increased foreign investment that supports the country's long-term economic development [20].

There is no relationship between gross domestic product and foreign direct investment in Thailand. The results of this research are in accordance with research by [21]–[23] found that a country's GDP does not always have a relationship with FDI. Although GDP and FDI are often considered supporting factors to increase economic growth, some countries may succeed in increasing economic growth by attracting investors to undertake foreign direct investment. On the other hand, there are countries where strong economic growth is not always accompanied by a proportional increase in foreign direct investment because investors are more careful in allocating their capital [23].

In this research, GDP and Exports in Indonesia do not have a reciprocal relationship. Inconsistent policy changes and political uncertainty influence the relationship between GDP and exports in Indonesia [24]. This is in accordance with research by [25]–[27] who found similar results to this study. They state that the relationship between GDP and exports is not generally consistent.

Malaysia and Thailand have a one-way relationship between GDP and exports. In this context, strong GDP growth not only indicates the health of the domestic economy but also drives the export sector to consistently increase the volume and value of the country's exports during this period [28]. Despite challenges from fluctuating commodity prices and global demand, Thailand's success in maintaining this one-way relationship shows the importance of an effective export strategy in driving sustainable national economic growth [20]. This research is in line with [29]–[31] who reveals that there is a possible one-way relationship between GDP and exports in general.

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In Indonesia, this research shows that there is a 1-way relationship from GDP to imports, meaning that GDP affects imports. This is following research by [32]–[34] indicates that high domestic economic growth often increases imports of goods and services. In Malaysia, the results show that GDP and imports have a two-way relationship. Malaysia, with a focus on economic diversification and integration in global supply chains, leverages imports to strengthen key sectors such as manufacturing and high technology. In addition, progressive trade policies and active participation in regional trade agreements also strengthen the link between GDP growth and the country's import volume [35].

5 Conclusion

In this research, the variables gross domestic product, foreign direct investment, exports, and imports are used for the period 1981 to 2022. The countries used are Indonesia, Malaysia and Thailand which are part of the Growth Triangle economic cooperation. The stationary test used is the level of first difference in all countries.

This research concludes that in the time series model, Indonesia shows a two-way relationship between GDP and FDI, as well as between Exports and Imports. Apart from that, there is a one-way relationship between GDP and Imports, Exports and FDI, and Imports and FDI. On the other hand, Malaysia shows a two-way relationship between GDP and Imports, as well as a one-way relationship from GDP to FDI, GDP to Exports, Exports to FDI, and Imports to FDI. However, no reciprocal relationship was found between Export and Import in Malaysia. Meanwhile, Thailand only shows one relationship, namely a one-way relationship from exports to GDP. In addition, no reciprocal relationship was observed in Thailand based on the results of this study.

Limitations and further studies

The limitations of this research come from the lack of research variables and the analytical tools used to better understand the results of long-term collaboration. To get more comprehensive results, further research can increase the number of research variables from the IMT-GT collaboration. Further research would be interesting if we carried out comparisons between other Economic Cooperations.

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