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FDI, Trade, and Finance: Catalysts for Green Growth in ASEAN-5

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Abstract

Assuring economic growth and development without neglecting the requirement for environmental sustainability has become the most debatable topic in recent international forums. As a result, researchers and decision-makers are now focusing on green growth instead of traditional economic growth. Several factors that influence green growth have been studied in the literature to date, however, the impact of foreign direct investment, trade openness and financial development is relatively unexplored. Therefore, this study employs a fully modified ordinary least squares (FMOLS) estimator to investigate the impact of foreign direct investment, trade openness, and financial development on green economic growth for ASEAN-5 countries from 2010 to 2021. The empirical results show that foreign direct investment and financial development have a positive impact on green growth, whereas trade openness has a negative impact on green growth. Considering the results, this study recommends that policymakers to encourage environmentally responsible foreign investment to invest in the home nation and enhance financial market competitiveness through domestic and international liberalization and privatization in order to promote green growth. We also suggest that policymakers to strengthen and enforce environmental regulations to prevent environmental degradation brought on by increased trade to support green economic growth.

Keywords: FDI; Trade openness; Financial development; Green growth

1. Introduction

The idea of "green growth" has acquired a lot of popularity worldwide, particularly in the ASEAN 5 nations. Green growth prioritizes generating economic growth while reducing environmental damage (Hille et al., 2019). Studying green growth is essential for the ASEAN 5 countries as it balances economic development with environmental sustainability. Moreover, we can progress to achieve the United Nations Sustainable Development Goals (SDGs), such as Affordable and Clean Energy (Goal 7), Sustainable Cities and Communities (Goal 11), Responsible Consumption and Production (Goal 12), and Climate Action (Goal 13). There have been coordinated initiatives to support green growth across the ASEAN area. Sustainable development is a major objective in the ASEAN Vision 2020 and the ASEAN Economic Community Blueprint 2025. The member nations are collaborating to address local environmental problems, advance renewable energy, and improve sustainability across various industries.

Although ASEAN countries are famous for their biodiversity and natural beauty, they face environmental challenges like deforestation, habitat loss, and pollution (Omran and Schwarz-Herion, 2020). Hence, taking steps to transition towards green growth is urgent. Despite its potential advantages for sustainable development, foreign direct investment

(FDI) in the ASEAN region's green sector faces several obstacles. The level of commitment to green growth varies across ASEAN nations, and the lack of harmonized regulations can create uncertainty for foreign investors (Efrat, 2016). Many ASEAN nations lack the infrastructure required for green initiatives (Ng et al., 2023) such as recycling centers and networks for renewable energy. Additionally, some local financial institutions could be unwilling to offer loans or investment capital because they lack knowledge about green technologies. Investors may be hesitant to make long-term commitments in the green sector.

Moreover, major trading partners of ASEAN use unilateral environmental trade measures and environmental provisions in trade agreements. Each country may have its own requirements for green products, which would raise the cost of compliance (Lyon and Maxwell, 2019). The country may apply import limitations or levies on goods not adhering to specific environmental requirements which cannot ensure sustainable growth (Hermous, 2016). Besides, there might be a disconnect between the local workforce's skills and those required in the green sector (Song et al., 2021). As the green economy evolves and adopts new technologies, there might be a shortage of workers with the necessary training and expertise.

Environmental deterioration has emerged as a global problem during the past 50 years, posing threats to both developed and developing nations (Qamri et al., 2022). The ASEAN region's heavy reliance on non-renewable energy sources is undoubtedly a significant factor in the area's high levels of greenhouse gas emissions (Suki et al., 2022). Several researchers estimate the effect of FDI inflows (Choong et al., 2011; Tan and Tang, 2016), trade openness (Vogiatzoglou and Nguyen, 2016), financial development (Malarvizhi et al., 2019) and population growth (Ridzuan et al., 2018) on economic growth in ASEAN countries, the environmental consequences of the above-mentioned variables have not been analyzed thoroughly in the context of ASEAN 5. Therefore, the paper aims to investigate the impact of foreign direct investment, trade openness, and financial development on green economic growth by employing a panel sample of ASEAN 5 countries from 2010-2021.

The paper has the following structure. The literature review is presented in the next section. The methodology is then presented. After that, the empirical findings are presented. The conclusion and policy recommendations are in the final section.

2. Literature Review

In recent years, a substantial interest in the connection between FDI and green growth reflects the growing need to balance economic expansion with environmental sustainability (Wang et al., 2023). Given the two alternative outcomes linked to FDI inflows, economic theory is unclear whether FDI contributes positively or negatively to the environment. The positive interaction between FDI inflows and economic green growth can bring in green foreign capital that may help adopt cleaner manufacturing techniques and develop renewable energy sources (Chen et al., 2023). FDI is considered a possible accelerator for green growth if there is an incentive given to firms to conduct R&D for cleaner production technologies and vice versa (Chen et al., 2023). However, if the investments are not implemented in a proper way, FDI inflows may potentially have detrimental effects on the environment (Banerjee, 2022). FDI can increase pollution levels in some countries with more

relaxed environmental rules, while it can also help the environment in other countries that accept FDI but have tougher environmental restrictions (Leitao et al., 2021).

Wider access to green products and services, such as renewable energy development or eco-friendly consumer goods, can help countries achieve better green economic growth. The exchange of environmentally friendly technologies and methods among nations can be facilitated by trade openness (Li et al., 2023). The adoption of technology would boost resource efficiency and lessen environmental impact (Tang et al., 2022). However, trade may result in greater resource production and extraction to fulfil global demand, which may worsen resource depletion and environmental degradation (Opuala et al., 2023). To cut costs, businesses may move to nations with loose environmental standards, which can raise pollution and degrade the environment (Peng and Zhang, 2022). Increased shipping and transportation due to international trade may result in higher carbon emissions, which can reduce green growth (Andersson et al., 2016).

Financial development can have a significant impact on green economic growth. Effective and developed finance systems can support green technology research and development (Salahuddin et al., 2018). Financial institutions can help manage and reduce environmental risks (Park and Kim, 2020). Green investments can become more appealing by assisting businesses and investors in reducing their exposure to environmental hazards through mechanisms like green bonds and environmental insurance products (Sadiq et al., 2022). With relatively high levels of financial development, the relationship between financial development and green growth is complicated (Acheampong, 2019). The study shows that carbon emissions rise as financial development rises. However, carbon emissions fall after a certain level of these financial development indices. The study of Ozturk and Acaravci (2013) stated that there is no connection between financial development and carbon emissions in the long run.

The demand for limited natural resources like water, energy, and minerals increases as the global population grows. Due to construction, a compact city may lose its urban green areas (Wellmann et al., 2020). Green growth efforts strongly emphasize resource efficiency and conservation (OECD, 2011), which can help address resource scarcity and lessen the possibility of resource conflicts. By 2050, it is anticipated that metropolitan areas will account for 80% of the global population. A city's capacity to utilize and manage its natural resources impacts its citizens' quality of life. Rapid population expansion threatens the use of natural resources because it causes environmental deterioration. Natural resources are becoming less abundant and of lower quality due to overexploitation, intensive agriculture, and land fragmentation (Haider et al., 2021).

In short, green growth focuses on sustainable growth, productivity, and efficiency improvements that foster economic development while utilizing fewer natural resources and minimizing harmful externalities (Hao et al., 2021). To create a sustainable and carbon-neutral economy, green growth is necessary. Since then, numerous aspects of the earlier relationship have been examined in other studies (Bowen and Hepburn, 2014; D'Alessandro et al., 2020). This study aims to close a key research gap by investigating the impact of FDI, trade openness, and financial development on green growth in ASEAN 5 through the lens of FMOLS, which contrasts with OLS and GMM in previous studies.

3. Methodology and Data

Panel unit root test

The stationarity of panel data is examined using the panel unit-root test. Before performing panel cointegration tests, it is necessary to establish the stationarity of all study variables to avoid spurious regression that produces incorrect results. Several panel unit root tests are recommended to increase the power of the individual series unit root test by including the cross-sectional data analysis. These panel unit root tests comprised of Im, Pesaran and Shin (IPS) test proposed by Im et al. (2003), Levin, Lin and Chu (LLC) test suggested by Levin et al. (2002), and ADF and PP Fisher unit root tests suggested by Maddala and Wu (1999).

Panel cointegration tests

After examining the stationarity of all study variables, the cointegration tests is carried out. The panel cointegration tests are employed to ascertain whether the study variables are long-run related. This study applies Pedroni (1999) and Kao (1999) tests of cointegration to investigate the long-run relationship among the variables. The Pedroni cointegration test allows for acceptable short- and long-term heterogeneity. Pedroni (1999) proposed seven distinct panel statistics based on cointegrating residuals. The four of these statistics are within-dimension based statistics and are commonly referred as panel cointegration statistics. These four statistics are Panel ADF-statistics, Panel v-statistic, Panel PP-statistics and Panel rho-statistic. Another three statistics are between-dimension based statistics and are generally referred as group mean panel cointegration statistics. These three statistics are Group ADF-statistics, Group-rho and Group PP-statistics. In addition, the Kao (1999) panel cointegration test allows for homogeneity among panel members and is based on a two-step methodology. The Kao test under the ADF type is used in this study to test the null hypothesis that cointegration does not exist.

Panel fully modified OLS estimator

Following the confirmation of long-term cointegration, Fully Modified Ordinary Least Squares (FMOLS), which is proposed by Pedroni (2000), is used to determine the degree of coefficient of variables in the long run. This estimator applies the Phillips and Hansen (1990) semi-parametric correction to the ordinary least squares (OLS) estimator to remove the distortion results caused by the endogeneity of the regressors. Even in the face of heterogeneity and endogeneity, the FMOLS technique is helpful for generating consistent parameter estimates (Latif et al., 2018). The results of this method are free of endogeneity and heteroskedasticity since it uses heteroskedastic standard errors to fit a model with heteroskedastic residuals (Yang et al., 2017).

Data

The dataset comprises a panel of observations for ASEAN 5 countries, namely Indonesia, Malaysia, the Philippines, Singapore, and Thailand for the period 2010-2021. The dependent variable is defined as green economic growth. The independent variables are foreign direct investment, trade openness, financial development, and total population (control variable). All variables are generated from World Development Indicator (WDI) database except for green economic growth variable retrieved from Global Green Growth Institute (IGGG) database and financial development variable obtained from International Monetary Fund

(IMF) database. Measurement and source of the variables are illustration in Table 1. All the variables are transformed into natural logarithmic form except for foreign direct investment variable.

Table 2 reports descriptive statistics results for all the study variables in ASEAN 5 countries. The average green economic growth index is around 57.8020 and the gap index among them is considered small, which ranging from 53.7400 to 62.0400 for these ASEAN 5 countries. In respect to foreign direct investment, the net inflows (% of GDP) of foreign direct investment in Singapore is highest (32.6911) and the lowest ones is in Thailand (-0.9885). In term of trade openness, Singapore also recorded the highest (379.0986) while Indonesia received the lowest ones (32.9721). Besides, there have a highest financial development in Singapore (0.7616) whereas Indonesia has the lowest financial development (0.2902). Moreover, Indonesia has a highest total population while Singapore has a lowest total population among the ASEAN 5 countries.

Table 1: Variables description

Variable	Measurement	Source
Green economic growth (GG)	Index	Global Green Growth Institute
Foreign direct investment (FDI)	Net inflows (% of GDP)	World Bank Indicator
Trade openness (TO)	Imports + exports (% of GDP)	World Bank Indicator
Financial development (FD)	Index	International Monetary Fund
Total population (TP)	Number	World Bank Indicator

Table 2: Descriptive statistics

	GG	FDI	TO	FD	TP
Mean	57.8020	6.5328	141.4503	0.5597	94196096
Median	57.3550	2.6556	120.8666	0.6549	70450717
Maximum	62.0400	32.6911	379.0986	0.7616	2.74E+08
Minimum	53.7400	-0.9885	32.9721	0.2902	5076732
Std. Dev.	2.4910	8.7497	108.1821	0.1762	90297273
Skewness	0.2396	1.6447	1.1306	-0.3428	1.011895
Kurtosis	1.9422	4.1841	2.8793	1.2469	2.633021

4. Estimation Results

Panel Unit Root Test Results

This study starts by performing several types of panel unit root tests to check the stationarity of all the study variables at the level and first difference for constant effect and trend. We adopt the LLC, IPS, ADF and PP Fisher methods. Nonstationary series are the null hypothesis for the tests. Based on the panel unit root test results in Table 3, all the variables are nonstationary at the level except for FDI and FD variables. However, all the study variables become stationary at the first difference at 10 per cent, 5 per cent and 1 per cent level of significance. Hence, we can conclude that panel variables are integrated into order one, I (1).

Table 3: Panel unit root tests

Variable	GG	FDI	TO	FD	TP
		Level			
Levine, Lin, Chu	-2.7175***	-2.7971***	-1.6264*	-6.7039***	5.5619
Im, Pesaran and Shin	-0.5309	-1.6845**	0.1267	-2.2626**	6.5973
ADF - Fisher	12.5329	20.1017**	6.8604	21.8290**	0.2662
PP - Fisher	10.1503	24.5297***	10.3177	25.6432**	0.3458
		First Difference			
Levine, Lin, Chu	-5.1203***	-9.3732***	-3.3213***	-5.8512***	-3.3808***
Im, Pesaran and Shin	-4.2091***	-7.0114***	-2.7091***	-4.2728***	-2.1586**
ADF - Fisher	33.7704***	51.8331***	25.7118***	34.0793***	24.1828***
PP - Fisher	45.0200***	71.3254***	19.4258***	36.8746***	16.6850*

*Notes: The 10%, 5% and 1% of significance level is denoted as *, **, ***. The sample periods are obtained from year 2010 until year 2021. GG = green economic growth, FDI = foreign direct investment, TO = trade openness, FD = financial development, TP = total population.*

Panel cointegration tests

This study continues to investigate whether there is a long-run link among green economic growth, foreign direct investment, trade openness, financial development and total population variables in light of the integration of all study variables at I(1). This study utilizes two standard and different panel cointegration procedures to prevent inconsistent findings when conducting cointegration testing, namely Pedroni (2004) and Kao (1999). For instance, all seven statistics in the Pedroni test are left-tailed, aside from the Panel v-Statistic, a right-tailed test whereas a static panel's regression residuals serve as the foundation for the Kao test. One benefit of the Pedroni test is that it can fully account for regional or national heterogeneity as compared to other cointegration tests. These two-panel cointegration tests are applied with the null hypothesis that there is no cointegration and the alternative hypothesis that there is cointegration between the research variables. Table 4 presents the results of the Pedroni and Kao panel cointegration tests. The results showed that three out of seven statistics reject the null hypothesis of no cointegration for the model without trend. Moreover, four out of seven statistics reject the null hypothesis of no cointegration for the model with trend. Hence, we have sufficient evidence to conclude that these panel tests are likely to confirm the existence of a cointegrating relationship amongst green economic growth, foreign direct investment, trade openness, financial development and total population variables in the sample of ASEAN 5 countries. In other words, there is a long run relationship among the study variables.

Table 4: The results of Pedroni and Kao panel cointegration tests

Tests Statistics	No Trend	Trend
Pedroni	Weighted statistic (within-dimension)	
Panel v-Statistic	-1.5514	-2.4219
Panel rho-Statistic	1.9472	2.3716
Panel PP-Statistic	-1.6624**	-4.1405***
Panel ADF-Statistic	-2.0919**	-2.1709**
	Statistic (between-dimension)	
Group rho-Statistic	2.8895	2.8917
Group PP-Statistic	-0.9098	-3.0269***
Group ADF-Statistic	-1.9733**	-1.7105**
Kao: ADF	-3.5765***	

*Notes: The 5% and 1% of significance level is denoted as **, ***.*

Panel fully modified OLS estimator

The results of panel cointegration tests support the existence of a long-term relationship among the research variables. Subsequently, the coefficients of the explanatory and control variables are estimated in the long run. This study adopted panel fully modified OLS estimator method to estimate the coefficient. Table 5 represents the long-term estimations of coefficients regarding the dependent variable of green economic growth for the case of ASEAN 5 countries. Based on the results in Table 5, foreign direct investment (FDI) has a positive and significant effect on green economic growth (LGG) in the long run. Their green economies will rise by 0.14% with an increase of 1% in foreign direct investment in these nations. This indicates that foreign direct investment has a favorable impact on green economic growth for these countries in the long run. This result is in line with the findings of Birdsall and Wheeler (1993); Mihci et al., (2005), in which foreign direct investment enhances the host nation's environmental quality. They argue that technology and acceptable practices are transferred between nations, especially from developed to developing nations, through foreign direct investment. Fauzel (2017) found that foreign investment inflows are advantageous for environmental quality. He stated that the influx of foreign investment offers the means to invest in environmentally favorable sources such as cleaner technologies and greener energy. This encourages the sustainability of the environment by making a less considerable impact on greenhouse gas emissions. Moreover, Mukhtarov et al. (2021) conclude that a portion of foreign direct investment's contribution to reducing greenhouse gas emissions and ultimately promoting environmental sustainability is in the form of transferring cutting-edge technology, skills, and knowledge based on innovation.

Besides, the effect of trade openness (LTO) on green economic growth demonstrates a negative and significant relationship in the long run. With an increase of 1% in trade openness, these countries' green economies will experience a reduction of 0.0287%. This implies that green economic growth is not benefited by the increase in trade openness in these countries. This result is consistent with the finding of Tawiah et al. (2021a). They argue that trade openness increases carbon emissions and harms the environment in developing countries. Furthermore, Alola et al. (2019) demonstrate a negative and significant connection between trade openness and green growth. In addition, Tawiah et al. (2021b) suggest that nations with greater trade openness are more likely to encounter an overall decrease in green growth. The outcome supports the pollution haven hypothesis, according to which the flow of international trade degrades the host country's environmental quality because operations that produce large amounts of pollution are transferred from one nation to another.

In addition, financial development (LFD) has a long-run positive and significant relationship with green economic growth. For this purpose, with a 1% increase in financial development, these countries' green economic growth will grow by 0.0493%. This result suggests that financial development plays a vital role in the green economic growth of these countries in the long run. This result is supported by Shang et al. (2023). They reveal that in Asian nations with high-income levels, financial development promotes the growth of the green economy favorably. By means of this, these nations are better able to lessen their reliance on fossil fuels because of their greater financial development. In this context, the creation of green projects backed by green bonds may be a practical way to raise the proportion of clean energy in these nations' overall energy consumption. Rasoulinezhad and Mostaghimi (2022) suggest that income levels are a crucial consideration when assessing

how financial development affects sustainable development. It is obvious that a nation with a greater economic level has the financial capacity to achieve sustainable development goals, and it is anticipated that in these nations, the transition from dirty energy to clean energy will occur more quickly. On the other hand, the total population (LTP) has a positive but insignificant relationship with green economic growth in the long run. In other words, the total population does not significantly influence the green growth in these countries.

Table 5: The results of Panel FMOLS (Dependent variable: LGG)

Independent variables	
FDI	0.0014***
	(3.471345)
LTO	-0.0287***
	(-2.826166)
LFD	0.0493*
	(1.795392)
LTP	0.0502
	(1.670001)
R-squared	0.9618
Adjusted R-squared	0.9552
S.E. of regression	0.0091
Sum squared residual	0.0038

*Notes: The 10% and 1% of significance level is denoted as *, ***. The value of t-statistics is represented in the parentheses. LGG = natural logarithm of green economic growth, FDI = foreign direct investment, LTO = natural logarithm of trade openness, LFD = natural logarithm of financial development, LTP = natural logarithm of total population.*

5. Conclusion

This study investigates the impact of foreign direct investment, trade openness, and financial development on green economic growth by employing a panel sample of ASEAN 5 countries from 2010-2021. Two distinct panel cointegration tests are used in this investigation. The results of each two panel cointegration tests demonstrate that the study variables have a long run relationship among them. Subsequently, panel FMOLS estimator is used to compute the long run coefficients. The results of panel FMOLS estimator show positive impact of foreign direct investment on green economic growth in the long run. The fundamental reason is because foreign direct investment has positive spillover effects on the development of cutting-edge machinery and the expansion of employment. Additionally, it enables the transfer of technology, primarily in the form of new capital diversifications, which enables a nation to invest in various research and development projects that ultimately support environmental sustainability. On the other hand, the results of this study reveal that trade openness has negative and significant relationship with green economic growth in the long run. This indicates that greater international activity, such as trade, may hinder or drag out countries' efforts to achieve environmental goals. Therefore, it's critical to enforce timely limitations and monitor movement to make sure that trade has a positive impact on the environment. To promote green growth, the government and regulatory bodies should be thoughtful in their sustainability aims. Meanwhile, the financial development has a positive and significant effect on green economic growth in the run long. The rationale for this connection is that a nation's financial sector development is likely to consider higher quality financial services for environmentally friendly programs at a lower cost and thereby decreases energy contaminants, which is favorable to environmental

quality. Additionally, financial development encourages investments in cleaner technology and research and development activities, both of which are beneficial for the sustainability of the environment. Finally, the result shows the positive but insignificant link between total population and green economic growth in the long run.

The following policy recommendations are made according to the results. First, we advise that the government should only permit environmentally responsible foreign investment to invest in the home nation. Second, the government could launch renewable energy projects to draw in foreign investors to invest in environmentally favorable sources, such as cleaner technologies or cleaner energy while boost the amount of foreign money flowing into the country of origin, which will be advantageous for the green economic growth. Third, government could implement a carbon tax on the usage and manufacture of carbon-emitting technologies in order to encourage investments in the manufacture of low carbon technology. Fourth, government is suggested to strengthen and enforce environmental regulations to prevent environmental degradation brought on by increased trade. The government should keep track of how both domestic and foreign businesses operating in host country that are adhering to environmental regulations. Punishment for non-compliance companies should be implemented to deter environmental offenses. Fifth, government should introduce carbon pricing strategies, such as carbon taxes or cap-and-trade programs, to external and internalize costs of pollution and motivate companies to minimize their carbon emissions. Lastly, government should liberalize financial markets domestically and abroad in order to increase competitiveness in those markets. This causes a nation's financial sector to grow, which subsequently improves the green economic growth.

This study provides basic understanding into how foreign direct investment, trade openness, and financial development contribute to its green economic growth. However, this study reveals several limitations that can be addressed by future researchers. This study is being carried out in ASEAN 5 countries. However, the impact of these factors differs across bloc. Hence, this study advises future researchers to do similar studies for other blocs such as BRICS or European Union. On the other hand, future researchers are suggested to employ other factors that contribute to green economic growth, namely economic factor or energy-related factor.

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