

The impact of green finance and Covid-19 on economic development: capital formation and educational expenditure of ASEAN economies

The impact of
green finance

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Abstract

Purpose – The purpose of this study is to examine the impact of green finance (i.e. green investment, green security and green credit) along with capital formation and government educational expenditures on the economic development of (ASEAN) countries.

Design/methodology/approach – The data were gathered from the central banks of all ASEAN countries and the World Bank Indicators between 2008 and 2019. The fixed-effect model and generalized method of moments were used to check the nexus between the constructs.

Findings – The results revealed that green finance along with capital formation and government educational expenditures have a positive association with the economic development of ASEAN countries.

Research limitations/implications – The study carries some limitations, even though it addresses the underlying variables comprehensively. These limitations provide opportunities to future researchers and authors to expand the scope and accuracy of their study. This research investigation has been supported by the data collected from a single source. Though data collection is maintained correctly, it is still recommended to the upcoming scholars to acquire data to reconfirm the same findings using multiple data sources. The data collected from using some specific data source may be limited in scope and may hinder the comprehensive elaboration of the underlying variables and their mutual relationship. Therefore, the utilization of multiple sources of data collection gives data sufficient to meet the requirement of an okay quality research study. The study is about the economies of ASEAN countries. It checks the influences of green finance development on economic activities and the country's economic growth in ASEAN countries' economies. Thus, its results are valid only in the economies of these countries, and this research investigation lacks generalizability. For generalizability, the authors must consider the underlying variables in the world's vast economies. They must adopt a standard scale to judge the impacts of green financial development on economic development. Besides, the study analyzes the economic factors, economic conditions and their effects on the country's position in the world economy in the face of a severe epidemic like COVID-19. Thus, the results may be different in the case of the normal situation. So, a general standardized study is recommended to be conducted in the upcoming days.

Originality/value – Green finance has significant capability to improve the global economy, especially amidst the COVID-19 pandemic. This study is beneficial for policymakers to develop policies related to economic development with reference to green finance and also helps future research on a similar topic.

Keywords Green finance, Green investment, Green security, Capital formation, Economic development

Paper type Research paper



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1. Introduction

Green finance refers to the ways of providing funds to different projects that aim toward bringing improvement in the quality of natural resources, atmosphere and the health of living beings by overcoming the negative environmental impacts of human activities (Zhang *et al.*, 2019). Aside from improving the environmental quality and encouraging social activities, green financing also provides a healthy workforce to the economy, ensures the availability of good quality natural resources and stimulates economic activities. Thus, the act of banks or other financial institutions to grant green finance to social or commercial sectors can accelerate and sustain the high economic growth rate (Dalia and Vitaliy, 2021). Green financing includes several financial factors like green bonds, green loans, green securities, as well as green investments that can improve the environmental quality and enhance the economic development of the affiliated countries.

The COVID-19 outbreak has adversely impacted the world's economy as the highly contagious pandemic affects the public's health and distorts the fluency in social and economic activities (Caldecott, 2020). It imposes serious threats to the global economic growth regardless of the geographical boundary (Kemfert *et al.*, 2020). Such adverse situation thus prompts the attention and effort of governments and economic entities to overcome the economical and societal impact of the pandemic by restoring sustainability in the economic development. This can be achieved through appropriate capital formation and enhancing the government's educational expenditures to support and sustain the economic development of the affected countries (Yu and Rehman Khan, 2021). Furthermore, green financing, including all of its influential elements, is believed to have the capability of increasing capital formation and appropriate government expenditures on the educational sectors in the form of education-related science, technology and resources, subsequently benefitting and accelerating the economic growth (Chien *et al.*, 2021a). On such account, researchers and academicians have been interested to investigate the role of green financing, enhanced capital formation and government expenditures on public education in dealing with the negative impacts of the COVID-19 and sustaining economic development. Therefore, the present study investigates the impact of green financing, including green credit, green investment and green security on the economic growth during COVID-19. The aim is to examine the role of capital formation and government education expenditures in overcoming the COVID-19 effects and creating sustainability in economic growth (Baloch *et al.*, 2021; Sadiq *et al.*, 2021; Chien *et al.*, 2021b).

This study analyzes the impact of green credit, green investment and green security as well as capital formation and government educational expenditures on economic growth during the period of the COVID-19 pandemic. The different reforms that take place in the world economy have also posed prominent impact on the economies of the Association of Southeast Asian Nations (ASEAN) countries. In this regard, various countries across the globe have achieved significant financial development and economic growth through the highlighted reforms established globally (Fauzi and Paiman, 2020). Different degrees are also established among the performance of reforms to dominate the safety norms in providing significant calculated measures to secure the economies (Yoshino *et al.*, 2020). ASEAN countries' economies are always bounded with several restrictive elements, which are prominently enforced by the international economy through various loans. The role of democratic movements is also highlighted globally through the eminence of providing various opportunities to establish sustainable environments and economic development (Chien *et al.*, 2021c; Mukanjari and Sterner, 2020). Therefore, green finance has been performed eminently among the factors related to local and international economies. However, many factors prevail in economic development, which requires extensive consideration of green finance and climate funds. The green finance factors include various influential elements like green investment, green security or green credit that are

directly related to the global economy, thus helping countries to achieve the simple attainment of environmental improvement (Chien *et al.*, 2021d).

Currently, the world economy along with the majority of economic sectors and entities are rooting for green finance mainly due to its prime benefit of climate change. ASEAN countries are also paying special attention to such concept, particularly in producing and employing energy resources (Taghizadeh-Hesary *et al.*, 2021). The opportunities for green finance in ASEAN are given in Table 1.

A country's economy commonly comprises two sectors, namely, the government and private sectors. Both sectors are important for the country's economy. However, the private sector often offers higher economic contribution than the government sector. The green finance opportunities from the private sector in ASEAN are given in Figure 1.

This study mainly focuses on the impact of green finance like green credit, green investment and green security on the economic growth of countries throughout the period of the COVID-19 pandemic. It also measures the role of capital formation and government educational expenditures in accelerating the economic growth during a contagious disease outbreak. The role of green finance in achieving economic development has been addressed in the past literature, but most of the studies have discussed this issue as one whole. For instance, Chien *et al.* (2021a) have addressed the impact of green finance on economic development. However, this study deals with three categories of green finance, namely, green credit, green investment and green security, while analyzing the economic growth rate of the respective countries. This serves as a prominent contribution to the literature. In addition, a discussion on the role of green finance, capital formation and government education in achieving higher economic growth during the prevalence of a pandemic like

Sr.	Sector	Sub-sector	Green finance opportunity in the USA (\$)	Percentage
1	Renewable energy	Solar	140	5%
2		Hydropower	90	3%
3		Wind	35	1%
4		Bioenergy and others	135	5%
5	Energy efficiency	Building	152	5%
6		Industry	57	2%
7		Transport	191	6%

Table 1. Opportunities for green finance in ASEAN

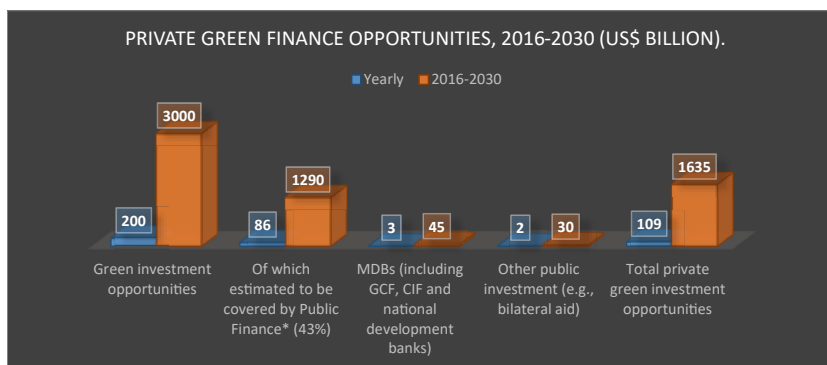


Figure 1. Private green finance opportunities in ASEAN countries

COVID-19 further contributes to the pool of knowledge pertaining to economic development. Moreover, a discussion on the interrelationship between the underlying factors and economic growth from the context of the ASEAN economies also serves as a great contribution to the literature. Aside from the theoretical contribution, the current study also offers practical significance to the ASEAN economies. This is because ASEAN mainly comprises industrialized and highly populated countries, and as the COVID-19 pandemic has adversely affected most human activities, it has subsequently impacted the economic growth of the ASEAN countries. This prompts an urgent need in finding ways to remove the negative impacts of business operations from the environment so that the economic growth of ASEAN countries can be accelerated. The present study, thus, hopes to provide a guideline for ASEAN economists, governments and policymakers to improve the economic growth rate by properly dealing with green finance, capital formation and government educational expenditures.

Section 2 of this paper looks on the views of different researchers or academicians about the relationship between green credit, green investment and green security, as well as capital formation and government educational expenditures toward economic growth. Meanwhile, Section 3 describes the methods used to collect data on the impact of green credit, green investment and green security, along with capital formation and government educational expenditures on the economic growth of ASEAN economies during the COVID-19 pandemic outbreak. This is followed by Section 4 that discusses the findings of the study. These findings are further validated through comparison with other studies.

2. Literature review

The positive link between economic development and green finance has been confirmed along with its positive depiction in ASEAN economies. Aside from the financial indicators that are widely seen in the relationship between these elements, the dominance of financial development also prevails with COVID-19. In this regard, economic growth is prominently highlighted with improvements across the emerging countries, along with the relevance of international policies of loans and investments (Nawaz *et al.*, 2021a; Redmond and Nasir, 2020). Although financial markets face various indicators with internal and external influences, financial movements' maturity provides deeper exercise of green finance factors. A number of scholars have propounded on green finance and its impacts toward economic development during the prevalence of the COVID-19 pandemic. Meanwhile, several researchers have considered financial factors other than green finance like capital formation and government educational expenditures while measuring economic growth in case a country is exposed to environmental pollution or infectious disease. This study takes the views of these researchers in describing the relationship between green finance (i.e. green credit, green investment and green security), capital formation and government educational expenditures with the economic growth rate of emerging countries as they face issues resulting from the COVID-19 outbreak.

A country's wealth is often elaborated by the positive aspects of economic development retrieved through green finance elements like green credit, green investment and green security that bring remarkable improvement in the economic development, the people's standard of living and the country's wealth (Nawaz *et al.*, 2021b; Pan *et al.*, 2020). In this regard, economic development requires financial as well as various other measures and uplifts the prominent impact of financial contribution. Nevertheless, certain drawbacks resulting from the COVID-19 pandemic have been asserted with the prevalence of global shocks, which refrain the efforts of achieving economic development. By contrast, the eminence of green finance elements provide safe measures to economic development with

the initiation of various financial projects (Mukanjari and Sterner, 2020). This is because product innovations and the introduction of various new products help countries to sustain their economic development. A number of research has enumerated the influence of COVID-19 along with other financial constraints that affect the global economy in recent years. Past literature also suggested numerous strategies to secure the premises of economic development through various financial means, which have the potential to develop the economy and provide more opportunities (Asongu and Odhiambo, 2020). This is because countries that begin to develop significant products with strong measures to enhance the overall wealth and economic growth often require financial sustainability. Therefore, green finance plays a vital role in the effectiveness of the targeted activities, which help countries to improve the quality of life and well-being of its citizens (Shair *et al.*, 2021).

Furthermore, existing literature specifies that the transmission of financial elements under green finance is believed to have positive enumeration to the development of the economy. This is further evident by economies that pay particular attention to green finance (i.e. green credit, green investment and green security) and manage to produce rapid progress even during the period of a global pandemic (Sun *et al.*, 2020; Li *et al.*, 2021). Although a country's circumstances and environmental quality can affect the performance of its economy, sustainable economic development is still possible through the application of green finance via green credit, green investment and green security. In addition, the influence of regulatory policies has been widely described in the literature, while the impact of COVID-19 has also been eminently highlighted from the context of the ASEAN economies. Although both developed and developing economies are affected by the unpredicted elements of the pandemic, the positive aspects of green finance also support certain scenarios. These economic pillars are prominent in different countries and adopted in emerging economies with improved structures (Zhu, 2020).

Related literature has also depicted numerous paths that can help economies to stand on a strong base, including the elements of green finance and financial innovations. Several control variables of green finance, like capital formation and government educational expenditures, have a significant impact on economic development. Following the shocking outbreak of the COVID-19 pandemic, green finance has provided positive measures that enable the safety measures to sustain the economic development. The formation of per capita gross domestic product (GDP) has been proposed as a controlling factor for green finance that influences economic development (Song *et al.*, 2020; Zhuang *et al.*, 2021). In this regard, the reflection of per capita GDP denotes the signs of establishing proper economic development as seen in the previous decades. World economies also promote the positive aspects of per capita GDP, which directly impacts the general economy as well as ASEAN economies that primarily emphasize on the importance of per capita GDP. It has been reported that the empowerment of per capita GDP directly initiates important measures that cultivate the sustainable means of economic development (Gómez-Zaldívar *et al.*, 2020). A similar situation is also depicted in the after-impacts of COVID-19 where world-leading economies strive to establish a sustainable environment (Pacana and Ulewicz, 2020).

Usually, industries are perceived as the major contributor to economic development. However, effective policies established to maintain the per capita GDP involve various reforms that can uplift as well as sustain economic development. It is propounded that appropriate amendments in the policies related to capital formation can support the economy (Bassino and van Der Eng, 2020). Strong variation of GDP per capita has also been depicted in the literature to have a dominating impact toward economic bars with the certainty of green finance, which in turn can motivate the economic development grounds. During COVID-19, the impact of green finance positively enumerates economic development, but the pandemic's aftershocks have significantly disrupted the economic conditions (Bilan *et al.*, 2020). Certain

leveled circumstances also denote the prevalence of green finance elements that is dominated by a wide distribution of per capita structure among the economic development. This is evident by the per capita GDP charts initiated from green finance and dominated with significant influence upon economic development (Deme and Mahmoud, 2020). The influence of economic performance with the dominance of green finance is commonly depicted by a certain variation of GDP per capita, including the significance of a particular population (Moldabekova *et al.*, 2021). This is because economic well-being and living standard interlink with one another following the significance of financial contributions and economic performances (Wang *et al.*, 2021).

Likewise, financial development also promotes economic growth and green finance. As the widespread of COVID-19 has affected the world societies and economies, green finance, along with green credit, green investment and green security, serve as powerful tools to cope with the issue. This is because such tools ensure environmental protection and provide a healthy workforce as well as a sound market, thus sustaining economic growth even during the pandemic (Grabara *et al.*, 2020). As the economies of most ASEAN countries have greatly suffered during COVID-19, implementing the green finance elements may support viable economic growth (Olopade *et al.*, 2020). The effects of green finance may also develop short-term relationships with the adverting factors, but the dominating influence of these factors is widely depicted over economic development (Jabarullah *et al.*, 2020).

The formation of capital usually denotes the prominence of import and export elements where employees are indulged with various conquering outputs (Nurmahmudah and Putra, 2020). Capital stocks that assert the significance of green finance will positively impact economic development when the flaws among employees' capital formation prevail (Lee and Brahasrene, 2020). Therefore, certain set-asides are often required in the capital goods stock, elaborate the financial bonds including capital formation and positively influence economic development (Anggraini and Lo, 2020). In this accord, capitals raised from different sources usually denote the establishment of green finance, which attains various measures to support the economic grounds. It provides safety measures to handle unstable economies and perceived as helpful in the economic development with a certain increase in investment and increasing demands (Safavi and Bouzari, 2020). The scientific approach of expenditures applied to the education sector acts as a significant measure to determine the economic growth during COVID-19. Furthermore, the implementation of green finance through various technological reforms is believed to have a significant contribution to the development of the post-COVID-19 economy. Although the extent of responsibilities related to government structures is reported to have positive impacts, economic development is believed to be directly related with improvements in government expenditures (Liu *et al.*, 2020a). It is also reported that economic development and financial development are interrelated over the green finance factors. Over the past decades, numerous financial crises have imposed a significant influence over the economies of developed and developing countries. Nevertheless, the positive aspects of green finance such as green credit, green investment and green security may assure the formation of positive strategies by the government in bringing ecological friendly improvements in the education or other sectors, which leads to an increase in the economic growth (Steffen *et al.*, 2020).

A number of countries have established reasonable managing elements in striving for education-related technological and scientific expenditures for the benefit of economic development (Chugunov *et al.*, 2020). Budgets allocated by governments may induce a dominant impact on the economy; however, implementing appropriate strategies to avoid the misuse of the public's budget can uplift the economy. Moreover, the rise in expenditures often denotes potential negative implications for economic development, while proper utilization of budgets can drive profitable means in a short span for the betterment of the public's interests. Previous literature has exhibited a number of variables associated with green finance that

promote a dominant impact toward economic development by enhancing and uplifting the economy (Dotti *et al.*, 2020). Many countries also use public debt expenditure for scientific and technological expenditures related to education where many of them are utilized in the positive scenario and prompted positive implications. It depends on the respective governments to induce positive prospects to the revenues generated from the usage of public debts as well as utilizing them properly. Past studies reported that numerous projects were initiated in a short period that induced similar expenditure clauses, which uplifted the standard of living and endorsed positive results. This posits the relationship between expenditures with the current and capital from the business, higher education, government and other sectors (Blanco *et al.*, 2020).

This study, therefore, aims to analyze the impact of green finance (i.e. green credit, green investment, green security), capital formation and government educational expenditures on the economic growth during COVID-19. Many authors have propounded different views related to the association between green finance, green credit, green investment and green security, as well as capital formation and government educational expenditures toward economic growth. To extract existing findings pertaining to such relationship, the current study had reviewed the arguments by a number of authors or researchers about the research subject under investigation. First, the study examined the positive arguments reported by past studies about the impact of green finance, green security, green credit and green investment. It was followed by a review of past research about capital formation and its impact on the economic growth of a country, which posits a positive association between capital formation and economic development. Moreover, these past studies were sorted to confirm the positive association between governments' educational expenditures and the economic growth of a country.

3. Research methods

The purpose of this study is to examine the impact of green investment, green security and green credit along with capital formation and governments' educational expenditures on the economic development of ASEAN countries. The data were extracted from the central banks of all ASEAN countries and World Bank Indicators (WDIs) from 2008 to 2019. This study has developed the following estimation based on the reviewed literature:

$$ED_{it} = \alpha_0 + \beta_1 GC_{it} + \beta_2 GINV_{it} + \beta_3 GS_{it} + \beta_4 CF_{it} + \beta_5 GEE_{it} + e_{it} \quad (1)$$

where

ED = Economic development

i = Country

t = Time period

GC = Green credit

$GINV$ = Green investment

GS = Green security

CF = Capital formation

GEE = Government educational expenditures

The predictive variable of this study is economic development that was measured by the annual GDP growth (%). Meanwhile, a number of predictors were utilized in this study, namely (1) green credit measured by the total green credit or total loans of the banks, (2) green

investment measured by the fiscal expenditures and total market value of environmental protection industries or companies, (3) green security measured by the total market value of all shares, (4) capital formation measured by the gross capital formation (% of GDP) and (5) government educational expenditures measured by the current education expenditures (% of total expenditures). Table 2 shows the measurements of the variables.

This study had used a panel dataset with both a cross-sectional and a time-series dimension where all cross-section units were observed during the entire time period. The multicollinearity assumption was examined via the variance inflation factor (VIF). Multicollinearity issue often occurs when there is a high correlation between two or more independent variables that creates a redundancy of information, subsequently skewing the results in a regression model. Whereas, the VIF values of lower than 5 indicate no issue with the assumption of multicollinearity. The estimation equations for VIF are as follows:

$$R^2 Y \rightarrow Y_{it} = \alpha_0 + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + \epsilon_{it} \quad (2)$$

$$j = R^2_Y, R^2_{X1}, R^2_{X2}, R^2_{X3}, R^2_{X4}, R^2_{X5} \quad (3)$$

$$\text{Tolerance} = 1 - R^2_j \text{VIF} = \frac{1}{\text{Tolerance}} \quad (4)$$

In addition, the panel data (the combination of time series and cross-sections) were deemed fit for this study to examine the 2008–2019 post-financial crises data of ASEAN countries. This involved several panel data analysis techniques such as the fixed-effect model (FEM), random-effect model (REM), robust standard error and generalized method of moments (GMM). The results of the Hausman test have shown less than 0.05 probability value, indicating to adopt FEM. Thus, the estimation equation for FEM formulated by the researcher is as follows:

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + u_{it} \quad (5)$$

In the equation above, individual country is represented by (1), and each country is differentiated by its specific characteristics. In FEM, the unobserved constructs are allowed to have any relationships with the observed constructs. FEM also has the ability to control or partial out the effects of time-invariant constructs with time-invariant effects. According to the variables taken by the study, the estimation equation for FEM is given below:

$$ED_{it} = \beta_{1i} + \beta_2 GC_{it} + \beta_3 GINV_{it} + \beta_4 GS_{it} + \beta_5 CG_{it} + \beta_6 GEE_{it} + u_{it} \quad (6)$$

Moreover, GMM was used in this study as an estimation procedure that allowed models in the panel data to be specified while avoiding unnecessary assumptions such as specifying a particular distribution for the errors. GMM was also executed to check the nexus among the

Table 2.
Measurements of
variables

S#	Variables	Measurements
01	Economic development	GDP growth (annual %)
02	Green credit	Total green credit of the banks/total loans of the banks
03	Green investment	Fiscal expenditure of environmental protection industries/total fiscal expenditure
04	Green security	The total market value of environmental protection companies/total market value of all shares
05	Capital formation	Gross capital formation (% of GDP)
06	Government educational expenditures	Current education expenditures (% of total expenditures)

constructs. It addressed the issue of endogeneity as “it allows the use of previous GI index values without compromising the consistency and efficiency of the estimators.” The GMM estimator has been found to be more efficient than the “common method of moments estimators” such as two-stage least squares and ordinary least squares when assumptions such as homoscedasticity fail. The GMM estimator is shown below:

$$Y_{it} = \delta Y_{i,t-1} + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + u_{it} + \varepsilon_{it} \quad (7)$$

where $\delta Y_{i,t-1}$ represents the lag value of the predictive construct. Furthermore, the present study has formulated the following equation by using the variables under investigation.

$$ED_{it} = \delta ED_{i,t-1} + \beta_1 GC_{it} + \beta_2 GINV_{it} + \beta_3 GS_{it} + \beta_4 CF_{it} + \beta_5 GEE_{it} + u_{it} + \varepsilon_{it} \quad (8)$$

4. Results and discussion

The data analysis of this study was conducted via descriptive statistics involving means and standard deviations along with the maximum and minimum values. The results showed an average GDP growth of 1.8%, with the minimum value of 1.028 and the maximum value of 2.733. Meanwhile, the green credit ratio recorded an average of 0.149, with the minimum value of 0.005 and the maximum value of 0.593. In addition, the average ratio of green investment is 0.568, where the minimum value is 0.099 and the maximum value is 0.699. Whereas, the green security ratio is 0.478, with the minimum value of 0.33 and the maximum value of 0.606. Finally, capital formation recorded an average of 8.658%, while the average ratio of government education expenditures is 20.553. Such results, thus, indicate that ASEAN countries are extensively investing in green finance and had a high capital formation that can improve the economic development in the respective countries. These descriptive statistics results are illustrated in Table 3 and Figure 2, which include the minimum and maximum values along with the means and standard deviations of all variables used in this study.

Variable	Obs	Mean	Std. dev.	Min.	Max.
ED	120	1.800	0.405	1.028	2.733
GC	120	0.149	0.126	0.005	0.593
CF	118	8.658	0.346	7.767	9.128
GS	120	0.478	0.095	0.330	0.606
GINV	120	0.568	0.410	0.099	0.699
GEE	120	20.553	12.374	31.94	65.89

Table 3.
Descriptive statistics

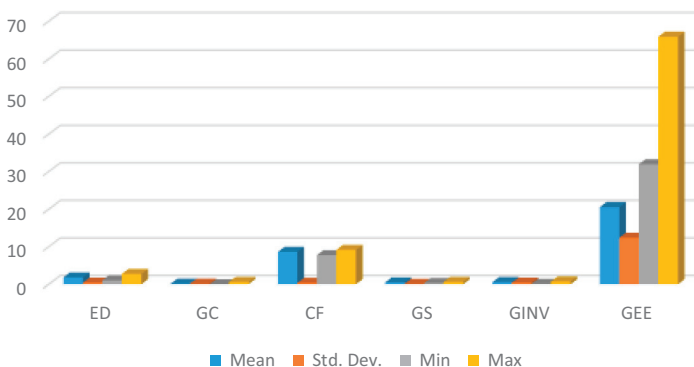


Figure 2.
Descriptive statistics

Table 4 further shows the correlation matrix that exposed the links between the constructs, and the figures indicate a positive association between economic development, green finance, capital formation and education expenditures. It suggests that ASEAN countries are effectively investing in green finance and capital formation that promote high economic development in these countries.

Meanwhile, the multicollinearity assumption reported no issue of multicollinearity because the VIF values are less than 5 (Table 5). It indicates that the predictors are not highly correlated with each other and do not affect the results.

Figure 3 presents the line plots of VIF results pertaining to the ASEAN countries by referring to the respective country's code, such as Indonesia (111), Malaysia (222) and Thailand (333).

The data of all ASEAN countries are also presented in the form of scatterplots as shown in Figure 4:

The Hausman test results (Table 6) further revealed that FEM is appropriate as the probability values of the Hausman test were less than 0.05.

Such findings, thus, indicate that green finance, along with capital formation and government educational expenditures, have a positive association with the economic development of ASEAN countries. The beta values have shown a positive sign, while the *t*-values were larger than 1.64 and the *p*-values were less than 0.05, hence positing positive and significant links between green credit, capital formation, green investment, education expenditure and economic development. Such results revealed that ASEAN countries are effectively investing in green finance and effective capital formation that serve as the reasons for high economic development in the countries. However, insignificant link was found between green security and economic development because the *p*-value was greater than 0.05 and the *t*-value was less than 1.64. In addition, the *R*-square value of FEM was recorded at 0.612, hence positing that 61.2% variation in economic development is prompted by the predictors used in this study. These values are presented in Table 7.

Furthermore, green finance, capital formation and educational expenditure were found to have a positive significant association with the economic development of ASEAN

Table 4.
Correlation matrix

Variables	ED	GC	CF	GS	GINV	GEE
ED	1.000					
GC	0.224	1.000				
CF	0.092	0.236	1.000			
GS	0.145	0.029	-0.030	1.000		
GINV	0.087	-0.052	0.076	0.384	1.000	
GEE	0.246	-0.121	-0.030	0.854	0.228	1.000

Table 5.
VIF

	VIF	1/VIF
GS	4.765	0.21
GEE	4.301	0.232
GINV	1.272	0.786
GC	1.188	0.842
CF	1.084	0.922
Mean VIF	2.522	

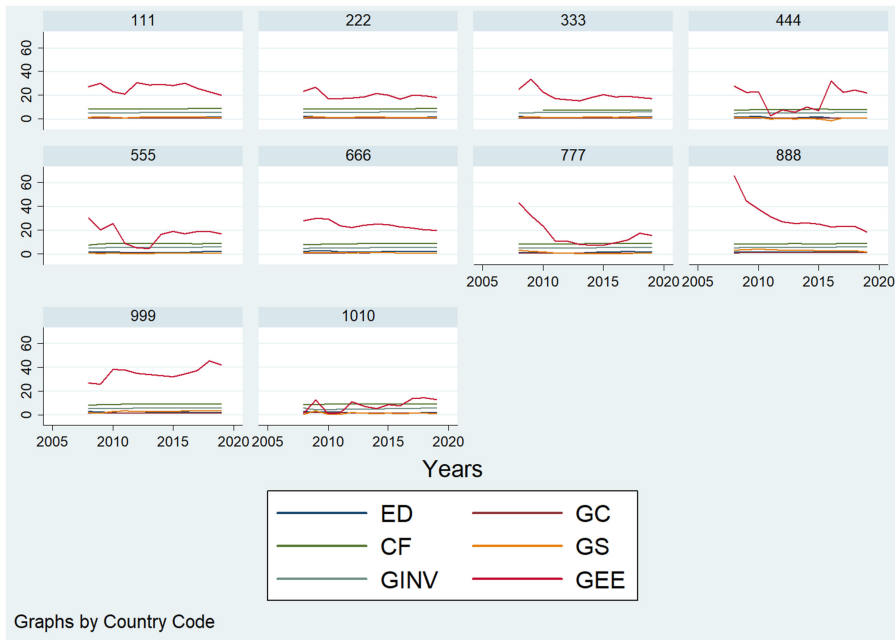


Figure 3.
Line plots for all ASEAN countries

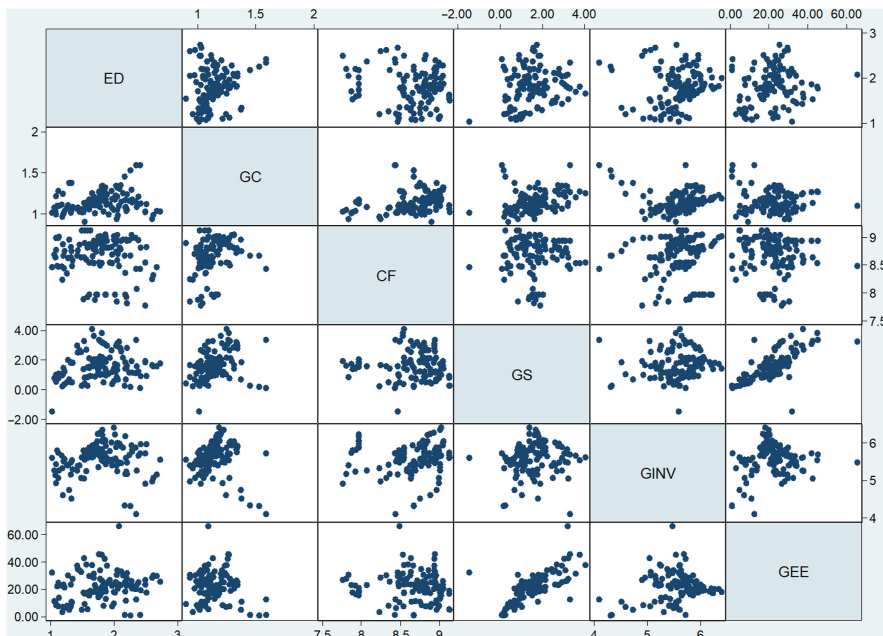


Figure 4.
Scatterplot of the variables

countries. This is evident by the positive sign shown by the beta values, while the *t*-values were larger than 1.64 and the *p*-values were less than 0.05. However, an insignificant link was reported between green security and economic development as the *p*-value was greater than 0.05, while the *t*-value was less than 1.64. These values are presented in Table 8.

4.1 Robustness analysis

The results from the robustness analysis revealed that green credit, green investment and capital formation are positively associated with the economic development of ASEAN countries. This is because the beta values of these variables had shown a positive sign, while the *t*-values were larger than 1.64, and the *p*-values were less than 0.05. However, an insignificant link was found between green security and economic development because the *p*-value was greater than 0.05, and the *t*-value was less than 1.64. Moreover, the *R*-square value was 0.503, which posits that 50.3% variation in economic development is due to all predictors used in the study. These values are presented in Table 9.

Table 6.
Hausman test

	Coefficient
Chi-square test value	11.158
<i>p</i> -value	0.048

Table 7.
FEM

ED	Coefficient	St. err.	<i>t</i> -value	<i>p</i> -value	LL	UL	Sig.
GC	1.661	0.334	4.98	0.000	0.999	2.323	***
CF	0.808	0.170	4.75	0.000	1.145	2.470	***
GS	0.038	0.076	0.50	0.617	0.188	-0.512	
GINV	0.343	0.147	2.33	0.022	0.052	0.635	**
GEE	0.106	0.046	2.30	0.026	0.005	0.418	**
Constant	4.890	1.157	4.23	0.000	2.595	7.185	***
<i>R</i> -squared	0.612		Number of obs.		118.000		
<i>F</i> -test	9.331		Prob > <i>F</i>		0.000		

Note(s): ****p* < 0.01, ***p* < 0.05

Table 8.
GMM

ED	Coefficient	St. err.	<i>t</i> -value	<i>p</i> -value	LL	UL	Sig.
GC	2.531	0.406	6.23	0.000	1.725	3.337	***
CF	2.036	0.488	4.17	0.000	0.003	1.068	***
GS	0.071	0.111	0.64	0.523	0.149	-0.429	
GINV	1.104	0.289	3.82	0.000	0.531	1.677	***
GEE	0.034	0.01	3.34	0.021	0.023	0.416	**
Mean dependent var	1.765		SD dependent var.		0.386		
Number of obs.	108.000		<i>F</i> -test		10.134		

Note(s): ****p* < 0.01, ***p* < 0.05

4.2 Discussions

This study found that green credit is positively associated with economic growth amidst the COVID-19 pandemic. The result is in line with Biduri and Proyogi (2021) who reported that the issuance of credits for the fulfillment of projects may overcome the polluting factors that sustain the quality of the atmosphere, natural resources and health of living beings to be employed in the economic activities. Amidst the COVID-19 pandemic, product- or service-oriented business organizations are presented with the facility of credit acquisition on easy conditions, which can be utilized to strengthen their financial resources and overcome issues resulting from the pandemic. This is further supported by Liu et al. (2020b) who analyzed the implication of green concept in financing to achieve high economic growth rate. The finding suggests that inscription in the fiscal policy to provide credits for ecological programs like the acquisition of environmental friendly resources, application of green production techniques and eco-friendly logistics are proven beneficial to overcome the prevalence of infectious diseases. As a result, economic activities continue to run smoothly, subsequently promoting sustainable economic growth.

The findings reported in this study also indicate that green investment has a significant positive association with economic growth during the COVID-19 outbreak. This is aligned with Lahcen et al. (2020) where economies that encourage ecological-friendly investment programs to minimize the negative impacts of social and economic activities upon the natural environment and the health of human beings often provide business organizations with excellent resources and are likely to promote high economic growth rate. The result is further supported by Chien et al. (2021b) who posit on the benefits of conducting investments via eco-friendly resources and technology amidst the COVID-19 pandemic as such green production techniques help to develop an eco-friendly working environment and minimize the risk of infection and health threats from the pandemic. This will eliminate any potential gaps in economic activities that may occur due to the pandemic and assist the respective countries in making sustainable economic growth.

Furthermore, green security was also found to have a positive relationship with economic growth. Such result is in line with Chien et al. (2021a) that looked on the economic development after the integration of the green aspect in finance by examining the impact of green security toward environmental quality, public health and the economic position of the country. The authors conclude that the issuance of green security protects the atmosphere from polluting factors, minimizes the chances of COVID-19 infection among people and thus ensures sustainable GDP growth. These results are further supported by Pons et al. (2020) who reported that financial institutions' policies affect the performance of other economic sectors due to their reliance on financial institutions for fund raising. In an economy where financial institutions or banks provide green security, the respective organizations can reduce the negative impact of their business activities toward the environment and protect the health of their workers, customers and the general public. This motivates these

ED	Beta	SD	t-value	p-value	LL	UL	Sig.
GC	1.575	0.337	4.67	0.000	0.907	2.244	***
CF	0.854	0.166	5.14	0.000	0.184	1.524	***
GS	0.034	0.055	0.61	0.542	-0.075	0.142	
GINV	0.371	0.149	2.48	0.015	0.074	0.667	**
Constant	5.258	1.111	4.73	0.000	3.055	7.460	***
R-squared	0.503		Number of obs.		118.000		
F-test	11.280		Prob > F		0.000		

Note(s): *** $p < 0.01$, ** $p < 0.05$

Table 9. Robustness analysis

organizations to continue undertaking the economic activities and sustain their economic development even during a serious pandemic.

This study also reported a positive association between capital formation with economic growth during COVID-19. The result is supported by [Asiedu *et al.* \(2020\)](#) where the addition of capital goods through enhanced investment, increased productivity or import of goods to cope with future needs enables business organizations to overcome environmental or economic problems and promotes sustainable economic development. It is also in line with the findings by [Nath \(2020\)](#) who reported that capital formation allows businesses to prepare for future crises, thus promoting sustainable economic performance. The addition of quality capital goods also enables firms to make proper planning to deal with a pandemic like COVID-19 and execute it instantly as it assists in the implementation of eco-friendly projects. This advocates the prominence of capital formation in sustaining economic development.

Moreover, it was found that government educational expenditures have a positive relationship with economic growth within the prevalence of the COVID-19 situation. The result is supported by [Cardwell and Ghazalian \(2020\)](#) and [Djurovic *et al.* \(2020\)](#) who stated that COVID-19 has adversely affected all economic sectors, particularly educational institutions. Therefore, government budgets that are favorable toward meeting the educational expenditures of a nation can serve as a remedy to successfully cope with the negative impact imposed by the pandemic toward educational institutions, subsequently supporting the economic growth of the respective nation. This is in line with the study by [Song and Zhou \(2020\)](#) that explored the contribution of government educational expenditures in sustaining economic development even during the prevalence of infectious diseases like the COVID-19. It was reported that allocating a substantial amount of government budget to maintain the performance of the educational sector and protect the educational interest of the general public significantly facilitates the educational management to make sustainable contribution in the economic growth of a country.

5. Conclusion and policy implications

The present study investigated the impact of green economic growth on the natural environment, the health of the general public and the economy of countries amidst the prolonged threat of the COVID-19 pandemic. It also looked on the role of capital formation and government educational expenditures in controlling the COVID-19 impact and accelerating economic growth. For these purposes, the study had analyzed the change in economic growth (GDP %) with the measurement of green finance like green credit, green investment, green security, capital formation and government educational expenditures in ASEAN countries. The results indicated that the provision of credits on easy conditions by banks or financial institutions for ecological friendly projects facilitate business firms to overcome the environmental issues and adverse impacts resulting from the COVID-19 pandemic. This in return contributes to a large share of the country's GDP. Similarly, the organizations' intention to invest in the acquisition of green resources or technology and adopt green techniques helps to create and promote sustainability in economic development. The findings also reported that the issuance of green security encourages investment in green economic projects, which minimizes the chances of COVID-19 prevalence, ensures healthy human resources, and thus sustains economic growth. This study also concurs that improvement in capital goods helps to control the circumstances within a country and sustain economic development amidst COVID-19. Furthermore, increased government expenditures in resources used for the education sector potentially act as a powerful tool to deal with issues prompted by the COVID-19 pandemic and maintains the educational sector's share in economic growth.

The findings reported in this study serve great significance for policymakers in both business organizations and government departments. It guides stakeholders such as economists, firms or the government on how to accelerate the economic growth rate through relevant amendments in the existing policies. This study hopes to guide policymakers on how to enhance the economic growth rate via green aspects' attachment in the fiscal policies. The findings reported in this study have found clear indication that placing significant consideration on environmental issues and environmental protection requirements in the formation of financial policies will greatly promote environmental protection, enable the economic sectors to overcome COVID-19 issues, maintain the productivity of the labor force and subsequently enhances the economic growth of the country. This study can further advise policymakers on how to enhance higher per capita GDP and enhance the economic growth rates. Moreover, the findings of this study posit that business organizations should formulate their policies by paying particular attention to capital formation to cope with the sudden economic crisis while sustaining economic development. This study also guides the government regulators in emerging economies, particularly the ASEAN economies, on how to best formulate the fiscal policy to overcome issues pertaining to the COVID-19 pandemic and accelerate the economic growth rate of their respective countries. In addition, allotting a substantial amount of budget for the management of education sectors will assist governments to safeguard and sustain the economic growth of their countries even amidst the COVID-19 pandemic.

5.1 Limitations and future directions

Despite successfully achieving its intended objectives, this study is not without its limitations. However, it is worth to discuss and highlight these limitations as they provide opportunities further expand the scope and accuracy of future research. First, the findings reported in this study was based on data collected from a single source. Though the data collection was executed correctly, the single-source data might be limited in scope and hinder comprehensive elaboration on the underlying variables and its mutual relationship. Therefore, it is recommended for future research to gather data from multiple sources to have sufficient data that can further improve the findings. Second, this study investigated the influence of green finance development on economic activities and economic growth with particular focus on the ASEAN countries. Thus, the findings are only applicable and valid for the economies of these countries, and it lacks in generalizability. This can be improved by considering the variables related to the world's economy. Future research can also adopt a standard scale to judge the impact of green financial development on economic development. Finally, this study analyzed the economic factors, economic conditions and its effect on the ASEAN countries' position in the world economy as they face the adverse impact of the COVID-19 pandemic. Thus, the findings might be different in the case of a normal economic situation, thus requiring further investigation.

Highlights

- (1) Recently, green finance has become a globally accepted measure for economic development, especially for ASEAN countries.
- (2) Economic development has been intensely affected by the COVID-19 pandemic across the world.
- (3) Green finance has significantly improved economic development, especially amidst COVID-19 in ASEAN countries.
- (4) Regulators should enhance their focus on green finance to improve the global economic condition.

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