Foreign Direct Investment and Economic Growth: Does Gross Fiscal Formation and Trade Openness Matter?
Saira Ghulam Hassan

Abstract
The current study has examined the relationship between foreign direct investment and economic growth. In addition, the study has also examined the role of gross fixed capital formation in fostering economic growth. The study has used the data of 28 years from the period starting from 1991 to 2018. In the study, panel data estimates were used, and the most reliable results from the diagnostic test came from the fixed effect model. The technique of estimate based on panel data is the one that works well for this kind of inquiry. Panel data is desirable because it can account for and even minimize individual variation, providing lower collinearity across variables and more degrees of freedom, as well as uncover and quantify consequences. Panel data is also advantageous since it can discover and quantify causes. At the 95% confidence level, the panel unit root test reveals that all variables are stationary. This conclusion is based on the results of the test. A supplemental estimate may be obtained through the use of the fixed effects model. All of the variables that were put through their paces were found to be stable and significant at the 5% level of significance. If the Hausman test is carried out, it is generally agreed that the model with fixed effects is superior to the model with random effects, which is its counterpart. According to the results of the model with fixed effects, every variable has a significant and favorable association with GDP. A rise in foreign direct investment (FDI) is correlated with an increase in commercial activity and the formation of more stable forms of capital, both of which may drive GDP growth. GDP may be increased by a variety of means, including gross fixed capital creation, foreign direct investment, and openness; hence, each of these may also contribute to economic growth. It has been shown that there is a positive correlation between each model variable and GDP.

Keywords: Openness, capital formation, economic growth, ASEAN
Background

ECNG refers to a nation’s economic expansion, and several approaches are used to measure the ECNG. However, the most frequently used approach is the Gross Domestic Product (GDP). According to Moore and Diaz (2015), ECNG is the quantitative dimension of real total output, output per capita or national income, where national income can be measured at best using income per capita and GDP. Various ECNG definitions have been proposed by researchers. Such as, ECNG is the expansion of a nations’ goods and services producing capability (Samargandi, Fidrmuc, & Ghosh, 2015). It has been further explained that the term ECNG accounts for the increase in actual goods and services over time and increase in the nation’s goods and services producing capability. In another definition, ECNG is referred to an increase in an economy’s productive capacity, with respect to its RGDP growth (Huwaina, Harun, & Kasuma, 2017). It implies that the RGDP explains the economy’s performance with respect to the level of production. Putting differently, the ECNG refers to a country’s expansion of goods and services that may result in higher consumption, which consequently increase the demand for labor, leading to higher wages for the labor force. Thus, higher income subsequently signifies RGDP increase which ultimately results in ECNG.

FDI, or foreign direct investment, refers to investments made from a country outside of the host nation that demonstrate a commitment to the economic and commercial policies of the host nation. An investor in Malaysia is obliged to own at least 10 percent of the total shares of a firm before they may invest. Over the course of the last four decades, the government of Malaysia has implemented a variety of schemes with the hope of luring increased levels of investment from elsewhere. Malaysia attracts a significant amount of foreign direct investment (FDI) as a result of its highly qualified workforce, abundant natural resources, and stringent regulatory framework. Foreign direct investment is essential to the growth of local economies because it facilitates access to international markets as well as the sharing of knowledge and the acquisition of new resources. It is possible to conduct an analysis of foreign direct investment (FDI) flows to ASEAN member states by focusing on either the countries of origin or the sectors in which they are concentrated (Dike, 2018). When compared to the years 1990 through 2009, Malaysia saw the lowest amount of foreign direct investment (FDI) in the year 2000. Following the year 2004, there was a discernible decline in the volume of net FDI. After reaching a high of $7.2 billion in 2008, foreign direct investment (FDI) in Malaysia has since fallen to $1.38 billion. The ECNG is the gold standard when it comes to measuring national economic production. The importance of this study cannot be overstated since it will provide decision-makers with information that can be used in the fight against ECNG. Understanding the essential aspects, the relationship, and the causality between growth and the determinants is necessary for the government to be able to plan and implement effective policies to achieve future high growth rates. This ability is dependent on an appreciation of the relationship between growth and its determinants. This inquiry will concentrate on the following three subtopics: Trade openness (Opn), capital creation, and foreign direct investment (FDI) are the independent variables. The leaders of Thailand’s government are well aware that the country’s continued economic growth is very necessary if it is to realize its goal of becoming a high-income nation by the year 2020 and if it is to meet the target of Nation 2020. For this reason, it is of the utmost importance to examine how everything will impact the economy of Thailand. In a similar vein, gaining an understanding of the factors that have played a role in the progression of development in other nations may provide insight on how to foster growth in one’s own country. The findings of this study will provide critical insights to policymakers on how to sustain good growth. In just a moment, we will dive deeper into the factors that really make a difference for Thailand’s GDP growth rate. The previous study’s findings revealed significant points of contention on the developmental factors. Numerous articles on this subject may be found across the economics literature (Christensen & Miguel, 2018). It is very necessary to have a
good grasp on this subject in order to achieve quick growth. The new understandings that have resulted from this study ought to inspire more research into ECNG. These insights will also be helpful in assisting others in gaining a deeper understanding of the elements that play a role in determining the path that history takes. The primary purpose of this research is to get a deeper understanding of the factors that contribute to the development of ECNG in each of the four ASEAN nations. The analysis considers annual data from 1991 all the way up to 2018. The study provides data on real terms for RGDP per capita as well as statistics on ECNG components like FDI, trade OPN, and GCF. The problems that the researcher experienced made it more difficult to conduct the investigation. When it came to the collection of data, time was a concern due to the fact that estimations had to be translated into accurate values in order to account for inflation (Feldstein, 2017).

Figure 1. Real RGDP growth (ASEAN)
Source: Thomson Reuters DataStream

Literature review

Chirwa and Odhiambo (2017) investigate the differences in ECNG across China’s provinces. According to the findings of their research, the three factors of private sector participation, formal education, and public perception are as follows: According to their analysis, three policy implications are having a substantial impact on China’s ECNG industry. The first school of thought maintains that areas of China with a lower level of development have fewer available human resources. In order for China to successfully expand its human capital, the country has to create a labor structure that is capable of attracting and keeping the most intellectual individuals in these disciplines. The second perspective looks at the issue from the perspective of international business dealings. It is essential to the economic growth of an area that foreign commerce be both reliable and easy to access. The facilitation of international commerce helps to concentrate resources in areas where they may be utilized most effectively, which is one of its many benefits. In addition, roadblocks placed in the way of interstate commerce are harmful to ECNG. A third point of view contends that reducing mortality rates is absolutely necessary for the development of ECNG. Improving ECNG might be helped by lowering the number of deaths that have occurred. A nation’s economy is
opened up to foreign markets when trade liberalization occurs. Along with the unskilled and skilled workers that come with this, new ideas, technology, and resources are also brought in. Danquah (2018) suggests that there is some kind of link between OPN and other forms of technology. The ability to import cutting-edge technology from all over the world is made possible by an active economy, which is one factor that may significantly contribute to the technological development of a country. Because it enables the transfer of both technology and foreign finance, foreign direct investment (also known as FDI) is an option that should not be discounted. The second stage is to make an investment in machinery and tools that are compatible with this technology. Incentives for economic growth may also contribute to the creation of new products for the local market. The immediate result of investing in research and development is an increase in the quality of both the products and services being offered. The expectation of future growth in income will serve as motivation for the firm to increase output by expanding into more nations. Danquah believes that an efficient economic theory entails the following: (2018). Productivity rises in direct proportion to the degree to which economic liberties are expanded. Trade almost always has the impact of raising overall levels of productivity. The chance of reaping economies of scale grows with the number of customers served. However, this will push local firms to compete with their overseas counterparts as well as items imported from other countries as new markets are opened. The accumulation of components and the increase in productivity are the two avenues through which economic policy influences growth. In conclusion, the gathering of various kinds of resources is the core concept behind the concept of factor accumulation. Both direct investments made in other countries and investments made in stock markets contribute significantly to capital flows. Portfolio investing is practiced by foreign investors who buy stocks or bonds issued by the United States. When attempting to portray the capital mobility associated with expansion, the Solow model is a useful tool. For the purpose of this investigation, the ownership-location-internalization (OLI) paradigm will be used. Using this framework, one may comprehend the concept of foreign direct investment. This all-encompassing method will look at how foreign direct investment affects economies all across the world (Perri & Peruffo, 2016).

The significance of government involvement in the formulation of laws to entice firms based in other countries in a number of studies, it was shown that foreign direct investment (FDI) was significantly influenced by two additional variables. This research demonstrates the relationship between delay capacity and reversibility in foreign direct investment (FDI) by using data from the Malaysian Investment Development Authority (Huwaina et al., 2017). One of the factors that determines the degree of assurance one has is the chance of a delay. The purpose of this paper is to provide policymakers with some advice on how to encourage foreign direct investment (FDI) in Malaysia via the use of government-managed programs. Pan and Ngo (2016) investigate the variables that contributed to the rise of provinces in Indonesia during the years 1993 and 2003. During the course of this inquiry, both the Cobb-Douglas production function and the Solow-Swan model were used. The Cobb-Douglas function may be expressed using the following formula:

\[ Y = AK^{a}L^{1-a} \] (1)

Where \( Y \) represents output and \( K \) the quantity of physical capital. The symbol \( L \) represents labor, the letter \( A \) represents total factor output, and the equal sign represents the coefficient share. This is intended to demonstrate the link between inputs and outcomes. If the quantity is less than 1, output growth is being driven by an input bigger than 1. A signifies that an increase in the quantity of input will result in an increase in the amount of output. According to Greiner, Semmler, and Gong (2016) (who were mentioned by Pan and Ngo (2016), the growth indicators are located in the explanatory variables designated by the letter \( A \) and also known as TFP. Nevertheless, there are a few variables that cannot be
utilized in subnational research but are often used in international research. Included in these factors are the following: This approach is applicable for all sorts of economies. According to the results of their investigation, GCF is regarded as an investment. Earlier research, on the other hand, indicated that physical capital alone could not properly explain the variance in income growth predicted by the Solow-Swan model (George & Ogunyomi, 2018).

The authors Bacarreza, Jetter, and Robles (2018) studied the impact of a variable independent known as financial development. This research aimed to examine the relationship between the expansion of island economies’ financial sectors and ECNG. According to Dabla-Norris (2016), sectors that largely depend on foreign capital advance the growth of nations at a quicker rate than other industries, even in countries with well-established financial institutions (Bacarreza et al., 2018). The objective of Stoddard and Noy (2015) study is to achieve Opn. For this purpose, they examined a two-way causal relation among financial Opn and trade Opn in developing economies. In an abundant labor economy, benefits of cost advantage are received that arise from the labor-intensive production, by allowing the FDI to fragment the optimal productivity. Furthermore, Gradojevic and Lento (2015) test for causality was used and found that 1 percent increase in trade Opn will create a 9.5 percent increase in domestic country’s international financial flows. The results reported a bi-directional causality among financial Opn and trade Opn, where an increase in financial Opn would result in the expansion of trade Opn. Although, the current account restrictions may negatively influence the developing economies trade Opn.

In Portugal, a bi-directional causality exists between ECNG and inward FDI. This research finding was reported by Bhat (2019) research. They employed a three-staged technique on the data, for the years 1977-2004. Their study attempted to examine the causal relation among export, growth and FDI. In the short run, FDI is found to be significant, and Granger causes the total real exports. In addition, study also found that FDI is considered to be one of the significant indicating variable which affects the Portugal’s RGDP growth. Although, RGDP growth rates do not actually get influenced by the exports. However, FDI expansion influences the economy’s total capital formation process. Resultantly, improvement in external competitiveness and total production capacity will enhance the growth rates in the economy.

Brooks (2016) investigate international capital flows in seven East Asian countries. This paper intends to analyze net outflow indicators in East Asian economies. They also estimated the effects of financial markets Opn on the capital inflows, as well as the linkage between international and domestic capital flows. The results indicate domestic capital markets as the useful variable for indicating total capital flow changes in the 7-East Asian economies. Moreover, capital market Opn is critical to assess the impact on the economy’s total capital flows. In this regard, macroeconomic variables in the US play significant role in estimating RGDP growth.

Rafiq and Yun (2017) also investigated the causal association among real RGDP per capita and trade Opn in 8 Union Economique et Monetaire Ouest-Africaine (UEMOA) economies as well as the effects of Opn. Three measurement variables were used for trade Opn. Johansen cointegration test was employed and the findings suggest a long-run equilibrium exists between growth rate and trade Opn. In another study, workers’ real RGDP is employed as a proxy variable for the ECNG of a country (Azam, Khan, & Bakhtyar, 2017). The study used FDI and human capital as the independent variables having significant impact on the country’s growth. Result has reported a weak significance of Opn in certain growth model. This finding was also supported by Chu, Furukawa, and Ji (2016) and since economic Opn tends to improve the domestic country’s opportunity to absorb technologies of foreign country.
Xaypanya, Rangkakulnuwat, and Paweenawat (2015) examined four South Asian countries, the purpose of this research is to investigate the effect that foreign direct investment has had on these four nations. The years 1980 through 2009 are covered by these statistics. The results of the least squares approach suggest that foreign direct investment has a considerable bearing on the expansion of the economy. Since this is the case, the governments of these South Asian nations should work toward increasing the overall amount of foreign direct investment (FDI) that enters the country. FDI has the ability to significantly boost RGDP.

Furthermore, Nyoni and Bonga (2018) tried to examine the causality among financial development, trade Opn and ECNG in Nigeria. It further classified the financial variable into three sub-variables, i.e. money supply, direct credit, and private credit, using the time-series for the years 1970-2005. Primarily, the stationarity test was performed through Augmented Dicky Fuller (ADF) test, which shows stationarity of all variables at first difference. Although, no co-integration between all the independent variables is found in the long-run. The result of Granger causality test indicates no causal effects of two-independent variables on growth. Contrarily, growth is also found to influence trade Opn and financial development in Nigeria. In addition, money supply acts as the only variable of financial development which influence the country’s level of trade Opn.

Meanwhile, the FDI’s impact on Vietnam’s growth was examined by Sakyi, Commodore, and Opoku (2015) through employing a panel data for the years 1995-2006. Results indicate significant impact of FDI on the Vietnam’s growth rates, i.e. 1 percent increase in FDI would bring an expansion of ECNG by 0.012%. Moreover, they also analyzed if growth is significantly affected by human capital. It is mentioned that FDI exhibits positive impact only when a certain level of human capital stock is achieved. At this level, the technology gained through FDI can be utilized. Makoni (2017) examined the FDI determinants in Canada. The FDI determinants in Japan, EU-15 and Brazil were also examined using fixed effect estimators and GMM system estimator. The results have shown that market size and trade Opn are the significant FDI affecting factors in Canada. The study highlighted FTA and NAFTA act as the driving forces for the FDI inflows in Canada. In addition, wages and taxes also found to have significant influence on the total FDI estimation. Meanwhile, the stable macroeconomic policies also bring foreign investment into the country.

In order to investigate the empirical nature of the long-term and short-term connections between economic expansion and the finance-growth nexus, time series data will be used. In the wake of the financial crisis, the state of their connection is the primary focus of their research. Both the ARDL model and the Granger causality test are used in this investigation. Statistics make it quite clear that there is no connection at all between the country of Indonesia’s financial resources and the country’s overall economic development. Castro and Nevárez (2018)’s “independent theory” comes to mind here. Due to the unpredictability and volatility of stock prices, finance has a limited effect on growth. This leads to poor investment allocation, which in turn has a negative impact on growth. As a direct result of this, growth rates can go down over time. Arif and Khan (2019) conduct an empirical investigation of the relationship between FDI and ECNG. They study the ways in which developments in the financial sector might strengthen the link between foreign direct investment (FDI), financial growth, and ECNG. In their sample, they included countries from both Asia and Latin America. The findings of their study suggest that there is a positive correlation between foreign direct investment and economic and political stability in 37 of the 67 nations that were assessed. Nevertheless, the economic system has the potential to be of assistance to ECNG in two different ways. At first, this increases the total amount of money that is immediately available for investment by encouraging the use of savings. In addition, the efficiency of investment projects is improved as a result of this sort of oversight. The ability to oversee investment activity and the mobilization of money are both made
possible by a robust domestic financial system. As a consequence of this, ECNG may benefit from a robust local banking system. According to Lau (2015), there were two major factors that contributed to the development of ECNG in China from the 1980s to the 1990s. The initial difference and level form of each variable are analyzed using the ADF process in order to determine whether or not a unit root is present in the data. Fixed capital expenditures and product exports both play a significant role in the overall economy. Nevertheless, developments within the framework of the economic system are to blame for the increase of both international commerce and investments in fixed capital. Based on the findings of the empirical research, it seems that the ECNG business in China will have to amass significant quantities of physical capital stock. The research carried out by Arshad and Munir (2015) offers a rationalization for the rapid expansion of the Chinese economy. They explore the roles of capital and labor inputs in China’s ECNG with a primary focus on productivity by using a standard neoclassical growth paradigm in their analysis. Time series data are used if there is an analytical purpose involved. Throughout the course of the reform movement, it was established that the ECNG business in China was most reliant on physical investment (1979–1994). When China was under a system of central planning (between the years 1952 and 1978), 65.2% of the rise in output may be attributed to increases in capital investment. Using the two-stage least-squares (2SLS) approach, Lucky and Kingsley (2016) explored the link between capital creation, ECNG, and FDI in Nigeria. They conducted their research in the country (2016). According to the findings of the research, there is a connection between long-term capital creation, ECNG, and FDI. On the other hand, it has been shown that the connection between variables is a key error-correcting component in the equilibrium reached in the long term. According to research that was conducted by Manu, Sulaiman, and Babaulle, (2018) the level of domestic investment in Nigeria fell from 24.4% of the country’s GDP between 1973 and 1981 to 13.57 percent between 1982 and 1996. During the last two decades, the rate of private investment saw a 4.4% annualized fall. ECNG relies heavily on domestic investment since this factor significantly affects the pace of new capital creation (Lucky & Kingsley, 2016). Investigate, via the use of panel data, the factors that, together, determine the rate of GDP growth in COMESA nations. COMESA now has six members: Burundi, the Democratic Republic of the Congo, Egypt, Ethiopia, and Kenya. Madagascar is also a member. The importance that has been placed on it in the discussion of empirical frameworks suggests that foreign direct investment (also known as FDI) is an important factor in economic expansion. Research conducted by Bhat (2019) demonstrates that foreign direct investment is important in the short term and that a rise in FDI may have an influence on the overall capital formation of the economy, which may lead to an increase in ECNG if the level of FDI is increased. Research conducted by Sakai and colleagues shows that foreign direct investment (also known as FDI) has a significant impact on economic growth rates (2015). According to the findings of research carried out by Nyoni (2018), foreign direct investment (FDI) has an influence on economic development in South Asia that is even more significant than that of exports. According to the findings of the study, opsin is an important factor in determining the size of an adult. According to Stoddard and Noy (2015), there is a correlation between a rise in the volume of commerce with China and an increase in the volume of foreign direct investment. As a consequence of this, it is beneficial to development. In addition, as shown by Danquah (2018), OPN has the potential to enhance technology and pave the way for new technological developments in industry. The findings of comprehensive research that was carried out by Rafiq and Yun (2017) point to a connection between OPN and the expansion of the economy. Hussin and Saidin (2012) revealed that there was no substantial influence that trade had on economic growth in their study of the impact of U.S. exports on ECNG in North African states.
Arshad and Munir (2015) provide an explanation for China’s lightning-fast economic growth. They study the contributions of capital and labor inputs, and productivity in particular, to China’s ECNG using the standard neoclassical growth paradigm. The study makes use of data gathered over a period of time. During the period of time when China was undergoing reform, which lasted from 1979 through 1994, physical investment played a significant part in the growth of ECNG. During the time of central planning in China, the dominant factor that determined ECNG was capital formation. This component was responsible for 65.2% of total output growth between the years 1952 and 1978. The two-stage least squares (2SLS) method was used by Lucky and Kingsley in an attempt to investigate a potential connection between the development of new capital, the extraction of ECNG, and outside private investment in Nigeria (2016). According to the findings of the study, there is a connection that exists over the long term between capital formation, ECNG, and international private investment. But it has also been shown that the relationship between variables is important as a way to correct mistakes in the long-term equilibrium.

According to research conducted by Manu, Sulaiman, and Babawulle (2018), the level of domestic investment in Nigeria as a percentage of the country’s gross domestic product (GDP) fell from an average of 24.4% between 1973 and 1981 to 13.577% between 1982 and 1996. In addition, a decrease of 4.4% can be seen in the rate of private investment between the two time periods. Because investment has an effect on the rate at which new capital is created, investing inside one’s own country is an essential component of ECNG (Lucky & Kingsley, 2016). Analyze the variables that contribute to COMESA countries’ high rates of population increase using panel data. COMESA is made up of the countries of Burundi, the Democratic Republic of the Congo, Egypt, Ethiopia, Kenya, and Madagascar. The accumulation of capital, the attainment of knowledge, and the creation of opportunities are the aspects that have a significant impact on the rate of growth. As a consequence of these countries’ expansion, not only do their political systems become more stable and their economies make more progress, but their growth rates also accelerate. Several different theoretical frameworks have been discussed in this chapter. The formula for the production function has also been explained in some detail. On top of that, a great number of empirical frameworks have been presented. When empirical frameworks are taken into account, foreign direct investment (FDI) seems to be one of the most important growth rate indicators.

According to the findings of a study that was carried out by Bhat (2019), foreign direct investment (FDI) is significant in the short term, and its rise may have an influence on total capital formation, which may lead to an increase in ECNG.

Research conducted by Sakyi and colleagues (2015) found that foreign direct investment (FDI) has a significant impact on economic growth rates. The study by Nyoni (2018) that investigates the role that exports, and foreign direct investment have in the development of South Asia’s economy shows that FDI has a significant role in economic expansion. According to studies, opsins have an effect on the pace of growth. Stoddard and Noy (2015) illustrate that an increase in the local nation’s commerce with China will lead to an increase in the local nation’s exposure to international financial flows. As a direct result, this fosters the development of new things. Additionally, Danquah (2018) suggests that OPn may contribute to the development of modern technologies and aid in the innovation of manufacturing. According to the findings of Rafiq and Yun (2017), OPn and growth exhibit a correlation that is stable throughout time. In contrast, Hussin and Saidin (2012) came to the conclusion that trade did not have any impact on economic growth after doing research on the function of U.S. trade and its effect on ECNG in North African nations. According to the findings of a number of studies, the GCF contributes positively to economic expansion. In the study that Bacarreza and colleagues conducted in 2018 on the topic of financial development and ECNG, they discovered that financial development had a positive impact on ECNG. It was discovered via research conducted in China throughout the 1980s and 1990s on fixed capital investment, international trade, and ECNG that fixed
capital investment is a crucial element in ECNG. This was one of the findings of the research. After studying China's development history, Arshad and Munir (2015) conclude that capital generation is the single most important factor in driving economic expansion.

**Data and Estimation**

This is empirical research which used secondary data for the 4 ASEAN economies, namely Indonesia, Thailand, Malaysia, and Philippines during the period 1991-2018. The data for the FDI, total GDP, GCF, imports and exports are taken from World Development Indicators (WDI).

\[
\text{GDP}_it = \alpha_0 + \alpha_1 \text{FDI}_it + \alpha_2 \text{Open}_it + \alpha_3 \text{GRCF}_it + \epsilon_i…………(2)
\]

\[
\text{GDP}_it = \alpha_0 + \alpha_1 \text{FDI}_it + \alpha_2 \text{Open}_it + \alpha_3 \text{Open} \cdot \text{FDI}_it + \epsilon_i ....(3)
\]

\[
\text{GDP}_it = \alpha_0 + \alpha_1 \text{FDI}_it + \alpha_2 \text{GRCF}_it + \alpha_3 \text{GRCF} \cdot \text{FDI}_it + \epsilon_i ……. (4)
\]

Where, RGDP: Growth Domestic Product (GDP), FDI: Foreign Direct Investment (FDI) Open : Opn [ (export + import) / GDP ] , and GRCF: GCF. The panel unit root test is used for assessing the panel cointegration’s possibility. The panel unit root is generally applied for checking data stationarity. The Dicky-Fuller (DF) test used in panel study allows the occurrence of heterogeneous intercept terms (Im, Pesaran, & Shin, 2003). In a stationary series, if the limiting fraction is greater than zero i.e. N→∞, then the LM-bar test will turn out to be consistent. Furthermore, a general setting (IPS, 2003) was denoted in the form of a standardized t-bar statistic test, in which DF statistics consecutively converge in the standard normal variate probability, where N→∞ shows cross-section and T→∞ shows time series dimension. The panel unit root test is characterized into two, i.e. at level and at first difference. Thus, the data stationarity is ensured at first difference or at level through performing a panel unit root test. For testing it, the following equation is considered:

\[
\Delta yt = \beta_1 + \beta_2 t + \delta yt-1 + a_i \sum \Delta yt-1 + \epsilon_t…….(5)
\]

Here, yt represents variable of interest, t shows the time trend, \( \Delta \) represents differencing operators, \( \epsilon \) shows white noise error term with mean=0 and constant variance, whereas \( \beta_1, \beta_2, a_i, \) and \( \delta \) are the parameters to the model which needs to be estimated. Thus, following are the null and alternative hypotheses for applying unit root tests:

H0: \( \delta = 0 \) (with non-stationary yt)

H1: \( \delta \neq 0 \) (stationary yt)

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Table 1. Unit root test

Therefore, at first difference the unit root test is performed for the variables to assess whether the data is stationary and found that all variables exhibit stationarity at first difference. Therefore, we do not accept the null-hypothesis. This implies that all ASEAN-4 countries variables are non-stationary at first difference.
Maddala (1994) defined panel data as the data sets of same individuals for a particular time period. However, sometimes incomplete data sets also exist. Putting differently, there may exist some missing data for a particular time period. However, sometimes there is data availability only for a limited time i.e. for just two to seven years, which are referred as short panels. However, panel data is the combination of time series and cross-sectional set of data, which is generally used in empirical research. According to the different study, panel data has three advantages, firstly, for every micro-unit, there is a well-defined estimation technique for panel data heterogeneity; secondly, the time series and cross-sectional data combination provides extensive information, that implies less collinearity issues between variables and better-quality variable, and thirdly, it allows to assess complex model behavior. Furthermore, adjustment dynamics can also be analyzed through panel data (Nyarko, 2018). In addition, it is suitable to use panel data while studying the economic duration. Besides, panel data is simple and easy for analyzing and estimating the effects as compared to pure cross-sections and pure time-series data.

Bliese, Schepker, and Ployhart (2019) explains that in general, the Hausman test is a comparison of two estimators. The first estimator is consistent and typically efficient under the null hypothesis. The second estimator is consistent under both the null and alternative hypothesis. In other words, the Hausman test is used to vary the consistency and efficiency of the estimator between the fixed effects and random effects model. In addition, the Hausman test functions to compare the significance of the fixed effects model estimator to the random effects model estimator. It also tests whether the estimator of the random effects model produce consistent and efficient result.

Maddala (1994) has put forward several arguments regarding the use of random effects model instead of fixed effects models. When the cross-sectional units are large in number as compared to N of ai, then under random effects model only mean and variance can be estimated, thereby saving large degrees of freedom. The measure effects of µit are ignored for i-th unit of cross-section and t-th time period. Therefore, if µit is considered as a random variable, then ai should not be used otherwise. In addition, ai must be taken as fixed, if only the cross-sectional units are to be interpreted. Contrarily, if the aim is to interpret with respect to population, then ai must be taken as a random variable, such as, family background, and years of schooling are the time-variant variables used in wage studies (Guo, 2018).

Results

Correlation analysis is used to determine the direction and strength of the relationship between latent variables. As illustrated in Table 2, the results show that all variables, have a positive relationship with ECN.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>0.15</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.41)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td>0.20</td>
<td>0.13</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.27)</td>
<td>(0.48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRCF</td>
<td>0.26</td>
<td>-0.13</td>
<td>0.41</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(0.15)</td>
<td>(0.46)</td>
<td>(0.02)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Correlation Analysis
The association between three different factors and GDP was investigated in this research. Those are the figures for gross capital formation, foreign direct investment, and optionality, respectively. The function of the dependent variable is taken on by RGDP when it is used as an indicator of ECNG. A method known as the panel data estimate method is the one that should be used for such an investigation. Panel data is the preferred technique because of its capacity to account for individual variability, provide lower collinearity across variables, provide more degrees of freedom, and uncover and quantify impacts. According to the findings of the panel unit root test, all of the variables under consideration are both stationary and statistically significant at the level of 5 percent for the first difference. Following the estimate of the model with random effects comes the estimate of the model with fixed effects. We observed that all of the variables that were evaluated were consistent at the 5% level of statistical significance. Additionally, the model demonstrates that there is a positive correlation between each of the components and GDP.

Table 3. Regression results Fixed effect estimates (equation 1-3)

<table>
<thead>
<tr>
<th>Dependent Variable: GDP</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI</td>
<td>0.177***</td>
<td>0.2353**</td>
<td>0.213***</td>
</tr>
<tr>
<td>Open</td>
<td>0.198**</td>
<td>0.3544**</td>
<td>0.239**</td>
</tr>
<tr>
<td>GRCF</td>
<td>0.254**</td>
<td>0.4238**</td>
<td>0.321*</td>
</tr>
<tr>
<td>Open*FDI</td>
<td></td>
<td>0.3132*</td>
<td>0.244*</td>
</tr>
<tr>
<td>GRCF*FDI</td>
<td></td>
<td></td>
<td>0.293</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.740</td>
<td>0.518</td>
<td>0.821</td>
</tr>
</tbody>
</table>

The conclusion because we used the model with fixed effects, we discovered that all of the independent variables, including GDP, produced findings that were statistically significant. Under these circumstances, a growth in real gross domestic product would be produced as a consequence of an expansion of both foreign direct investment and gross capital creation. On the other hand, OPN has a negative correlation with GDP. Because of this, an increase in OPN will have a negative impact on GDP. This circumstance, which may in turn have an effect on OPN, may have been caused by a number of variables, some of which include changes in imports and exports as a direct result of factors such as political instability (Lawal, 2019). In conclusion, the scenario that is picked should be the one that portrays reality the most accurately. Due to the fact that the Hausman test makes it possible to reject the model with random effects, the model with fixed effects is the one that is recommended. According to the concept of fixed effects, there is a positive relationship between each component and GDP. The efforts that OPN and GCF are making to attract more foreign direct investment will lead to an increase in the country’s gross domestic product (GDP). That is to say, international direct investment, unrestricted market access, and the Global Climate Fund (GCF) are all potential factors in the development of ECNG.

References


