# THE IMPACT OF ECONOMIC GROWTH, GLOBALIZATION, AND FINANCIAL DEVELOPMENT ON $CO_2$ EMISSIONS IN ASEAN COUNTRIES

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## ABSTRACT

*The purpose of the paper is to investigate the impact of economic growth (EG), globalization (GL), and financial development (FD) on $CO_2$ emissions in ASEAN countries. For the purpose of analysis, the data were collected form "World Development Indicator (WDI), KOF Swiss economic institute and World Bank" from 2004 to 2018. The panel "fixed effect model" has been used to run the regression analysis with "Discroll-Kraay Standard Error" to control the heteroscedasticity and serial correlation effects on the results. The findings discovered that EG, GL, and FD have positive relation with $CO_2$ emissions in the ASEAN countries. This study recommended to the officials that they should develop policies regarding to control the $CO_2$ emissions. Due to EG, GL, and FD, the energy consumption increases that need to develop the policies regarding efficient use of energy resources that it will not become the cause of $CO_2$ emissions in the country.*

**Keywords:** $CO_2$ Emissions, Economic Growth, Globalization, Financial Development, ASEAN Countries.

## INTRODUCTION

Globalization affects the life of humans being in respect to politically, socially, and economically throughout the world. It enhanced the link between the economics of different nature by increasing the flow of investment and trade of goods and services that enhance the economic growth (EG) of the world. The globalization process is rising between different countries that promote competition among developed and developing countries of the world. Thus, the economies of the countries engaged in competition and globalization that is the reason the different countries are now closely linked, politically, socially and economically. The priority of developing countries is to enhance the EG by improving economic activities, and poverty elimination are also included in prime priority of the developing countries (Abidin, Haseeb, Azam, & Islam, 2015). They also adopt the differentiation strategy to improve the competitive advantage among other countries of the world. In addition, the method of urbanization, industrialization, and enhance the ability to produce goods are ways to reduce the poverty issues in the country. It also decreases the efforts of government by retaining the development and EG of the country. It helps the government in a way that the government put very fewer efforts to enhance sustainable development and EG. Thus, if these steps cannot be followed by any economy then it cannot reduce the poverty locally as well as globally. So, for the improvement in EG of the country, the country must increase trading, investments, both domestic and foreign, economic activities, industrialization, and production level. Moreover, energy is an essential pre-requisite for the economy because it is a critical input in the business and households, and

extensive use of energy leads the economy towards $CO_2$ emissions. The globalization has affected severely the quality of environments such as global warming minerals reduction and natural resources (Abosedra et al., 2015).

In globalization, the developed countries are able to afford the labor force at a very low rate of wages from developing countries to increase their production. Moreover, the developing economies can also obtain the benefits of environment form globalization through getting access to technology of energy-saving from developed countries (Hussain et al., 2020; Godil et al., 2020). The environment can be affected by globalization in three ways, composition effects, technique effects and income effects (Alam et al., 2016). The economic activities are encouraged by globalization and this can damages the quality of the environment, such as $CO_2$ emissions globally and this phenomenon is said to be income effect. Moreover, globalization can also provide access to international market that introduces the technologies of energy-efficient. These technologies improved the production of the country by using the minimal energy sources that decrease the level of $CO_2$ emissions and enhance the quality level of environment, and this phenomenon is said to be technique effect. The effect of composition happens when capital-labor ratio and production structure changes with the globalization that ultimately affects the quality of the environment (Amri, 2018). Thus, the $CO_2$ emissions and economic activities have direct link with composition effect due to service sector, agriculture sector and industrial sector intensity of pollution. When the economy of the nation converted from agriculture sector to industrial sector, the carbon emissions increases while when the industrial sector converted to the services sector, then the carbon emissions decline.

Globalization is one of the foremost factors of EG and FD via institutional reforms. If the government of the country needs to enhance the investment, it should promote the FD by accepting the foreign capital by the financial market of the country (Suzuki & Nijkamp, 2016). Resultantly, the increase the investment and reduce the cost of the country. The financial sector is playing a significant role in the development of the economy both developed and developing countries. The efficient management characteristics of the financial system permit the countries to utilize efficient financial resources (Bekhet et al., 2017). The progress of stimulates and innovation development of economy influenced by the socioeconomic environment favorably. The attraction of the investors, stock market boosts, and the improvement of the efficiency in the economic activities depends upon the managed and well-developed financial system of the world. FD is the essential element of the economy that promotes the banking activities and stock market in financial sector by attracting foreign investment that aids the financial system by improving the efficiency of the economy. Moreover, strong relationship among the economic activities and financial system of the economy has been observed by previous studies (Hussain et al., 2012). The financial network can be intensified by the FD of the country and also low the financing cost that enables the economy to purchase the large quantity of industrial equipment at low prices that have increasing effect on the usage of energy and $CO_2$ emissions. Thus, EG, globalization, FD may have prominent impact on the $CO_2$ emissions of the world.

ASEAN countries is the group of ten emerging countries such as Malaysia, Indonesia, Thailand, Singapore, Philippines, Vietnam, Brunei, Laos, Cambodia, and Myanmar that have progressively been popular in academia and public media because they are having unique profile between developing countries and the reason behind this uniqueness are low-cost labor, technological and abundance of minerals. Theses ASEAN countries have a high influence on the world because these countries represent more than 30 percent of the total population of the world and also contribute almost more than 40 percent of the EG of the globe (Hussain et al., 2019).

ASEAN countries grew an extensive development in various features of the economies. The importance of financial sector of the ASEAN countries is growing for two decades. The creation of development banks among these countries builds an extensive financial links between the countries. This development bank becomes a vast resource of finance for the investment in the projects of development and also infrastructure for the development of the economy of the countries. In addition, mutual trades and financial ties are increasing between the ASEAN countries that are the reason for their economy leader of the world (Hussain et al., 2018). The capitalization of the market of ASEAN countries grew from USD 1.2 trillion to USD 6.4 trillion from 2001 to 2010. The global FDI shares of ASEAN countries are also followed the growing trend in this period. The inflow of FDI has also increased and reached more than 10 percent of their capital formation. Moreover, the annual FDI inflows of all the countries tripled in 2010 then the annual inflows of FDI in 2000. According to the report of UNCTAD, ASEAN countries attracted more than USD 1.5 trillion that is approximately 12 percent of total inflows of the FDI of the world during 2000 to 2010 (Hussain et al., 2018). The unique factors of the economy of ASEAN countries make them different from the other countries of the world. A nation is said to be sustainable if EG is compatible with the quality of the environment.

The carbon emissions of ASEAN countries increased more than 40 percent of the world in 2013, while the consumption of energy increased more than 35 percent of the consumption of total world. Now ASEAN countries have a plan to reduce global carbon emissions and global warming through energy consumption control programs. In addition, other countries have also plan to reduce $CO_2$ emissions, such as South Africa and Brazil have plan to mitigate the emissions 34 percent and 39 percent, respectively. Moreover, India and China have planned to mitigate the emissions 20 to 25 percent and 40 to 45 percent respectively. Furthermore, Russia also has planned to mitigate the emissions 10 to 25 percent by the end of 2020. Thus, ASEAN countries are the major countries that damaged the quality of the environment. Therefore, it is a significant challenge for polices and policymakers to sustain the EG by balance the quality of the environment. There is dynamic association has been found by the previous study among the globalization, FD, EG and carbon emissions in ASEAN countries (Hussain et al., 2017).

The carbon emissions were increasing in some countries and also decreasing in some countries ASEAN countries since 1990 with respect to EG of the countries. Table 1 mentioned that carbon emission shows a decreasing trend in Singapore from 1990 to 2018. In 1990, the carbon emission was 18.79 percent, but in 2018 it was only 10.54 percent. In addition, the carbon emission shows increasing trend in Malaysia from 1990 to 2018. In 1990, the carbon emission was 10.9 percent, but in 2018 it was only 9.55 percent. Moreover, the carbon emission shows increasing trend in Cambodia from 1990 to 2018; in 1990, the carbon emission was 2.16 percent, but in 2018 it was only 8.57 percent. Furthermore, the carbon emission shows increasing trend in Thailand from 1990 to 2018; in 1990, the carbon emission was 3.68 percent, but in 2018 it was only 6.59 percent. Additionally, the carbon emission shows increasing trend in Vietnam from 1990 to 2018; in 1990, the carbon emission was 1.44 percent, but in 2018 it was only 3.42 percent. Similarly, the carbon emission shows decreasing trend in Indonesia from 1990 to 2018; in 1990, the carbon emission was 6.52 percent, but in 2018 it was only 3.16 percent. Likewise, the carbon emission shows increasing trend in Philippians from 1990 to 2018; in 1990, the carbon emission was 1.56 percent, but in 2018 it was only 1.71 percent. In addition, the carbon emission shows decreasing trend in Brunei from 1990 to 2018; in 1990, the carbon emission was 7.1 percent, but in 2018 it was only 1.55 percent. Finally, the carbon emission shows increasing trend in Myanmar from 1990 to 2018; in 1990, the carbon emission was 1.18 percent, but in

2018 it was only 1.48 percent. The carbon emissions in ASEAN countries with reference to EG from 1990 to 2018 are given below in Table 1.

**Table 1**
**CO2 EMISSIONS IN ASRAN COUNTRIES WITH REFERENCE TO EG FROM 1990 TO 2018**

| Countries | 1990 | 1995 | 2000 | 2005 | 2010 | 2014 | 2018 | EG since 1990 | EG since 2005 |
|---|---|---|---|---|---|---|---|---|---|
| Singapore | 18.79 | 12.78 | 12.28 | 10.59 | 10.38 | 10.68 | 10.54 | -7.30% | -14.20% |
| Malaysia | 10.9 | 12.17 | 7.32 | 9.54 | 9.33 | 9.45 | 9.55 | -12.80% | 30.50% |
| Cambodia | 2.16 | 1.93 | 3.45 | 7.56 | 8.79 | 8.68 | 8.57 | 296.80% | 168.40% |
| Thailand | 3.68 | 4.77 | 4.55 | 5.56 | 6.34 | 6.68 | 6.59 | 79.30% | 44.80% |
| Vietnam | 1.44 | 1.59 | 1.93 | 2.74 | 3.13 | 3.17 | 3.42 | 137.50% | 77.20% |
| Indonesia | 6.52 | 6.78 | 2.98 | 5.22 | 3.09 | 3.13 | 3.16 | -51.50% | 6.00% |
| Philippians | 1.56 | 1.8 | 1.93 | 1.71 | 1.71 | 1.72 | 1.71 | 10.90% | 10.44% |
| Brunei | 7.1 | 7.51 | 1.54 | 1.55 | 1.56 | 1.53 | 1.55 | -78.20% | 0.60% |
| Myanmar | 1.18 | 1.14 | 1.03 | 1.06 | 1.17 | 1.38 | 1.48 | 0.00% | 14.60% |

The carbon emissions are not only comes from the industrial sector of the ASEAN countries, but they also come from the transportation sector of the countries. The figures mentioned that Brunei produces 20 percent of its total carbon emissions from the transportation sector from 2000 to 2010. In addition, Cambodia provides 05 percent of its total carbon emissions from the transportation sector from 2000 to 2010. Moreover, Indonesia produces 260 percent of its total carbon emissions from the transportation sector from 2000 to 2010. Furthermore, Malaysia provides 105 percent of its total carbon emissions from the transportation sector from 2000 to 2010. Additionally, Myanmar provides 07 percent of its total carbon emissions from the transportation sector from 2000 to 2010. Similarly, Philippians produce 60 percent of its total carbon emissions from the transportation sector from 2000 to 2010. Likewise, Singapore produces 25 percent of its total carbon emissions from the transportation sector from 2000 to 2010. In addition, Thailand produces 150 percent of its total carbon emissions from the transportation sector from 2000 to 2010. Finally, Vietnam produces 65 percent of its total carbon emissions from the transportation sector from 2000 to 2010. The carbon emissions from transportation in ASEAN countries from 2000 to 2010 are given below in Figure 1.

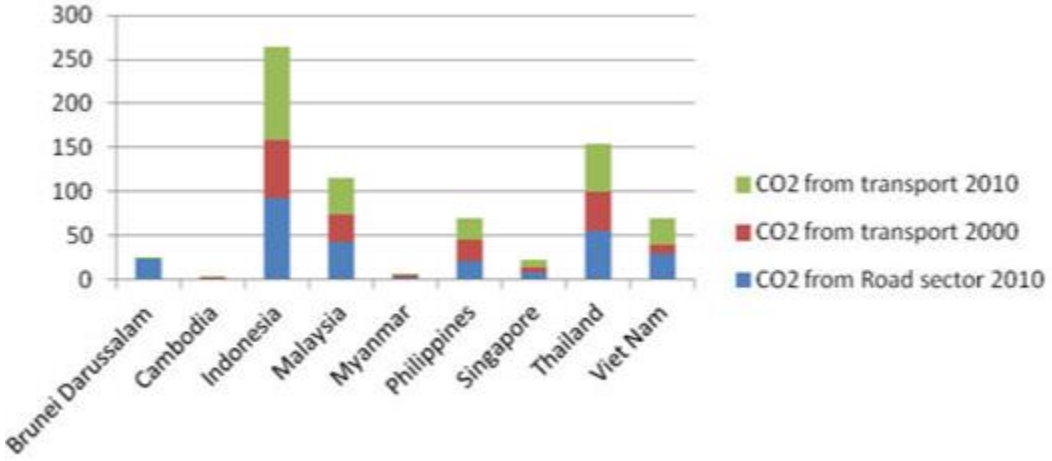


**FIGURE 1**
**THE $CO_2$ EMISSION FROM TRANSPORT IN ASEAN COUNTRIES FROM 2000 TO 2010**

Thus, carbon emissions are a serious issue regarding quality of environment in the ASEAN countries of the world. This problem can be a significant issue in the future for the environment of the ASEAN countries and need be fixing as soon as possible. Therefore, current study takes this area under discussion and finds out the significant issues of carbon emissions in ASEAN countries.

## LITERATURE REVIEW

The previous studies about the variables and their link with each other are mentioned in this section in the following sub-sections.

### Carbon Emissions

Carbon emissions mean is releasing carbon in the environment of the countries. It is releasing form the industrial and transportation sector of the nation that changes the environment of the climate (Dietz & Stern, 2015). In addition, it also means the discharge of carbon from the industry in the atmosphere of the country. *"To talk about carbon emissions is to talk about greenhouse gas emissions, the main contributors to climate change. Since greenhouse gas emissions are often calculated as carbon dioxide equivalents, they are often referred to as carbon emissions when discussing global warming or the greenhouse effect. Since the industrial revolution the burning of fossil fuels has increased, which directly correlates to the increase of carbon dioxide levels in our atmosphere and thus the rapid increase of global warming"* (Schandl et al., 2016). Moreover, it is also known as the leakage of greenhouse gas that affected the atmosphere of the country. The industrial, transportation and corporations are the major reasons for the carbon emissions in the country (Mossler et al., 2017). Furthermore, $CO_2$ is a non-poisonous, odorless and colorless gas that is formed from the consumption of the carbon that are harmful for the human life and it also refer to the greenhouse gas that is release from the industrial sector due to the high EG and FD in the country (Chau et al., 2015). Similarly, the carbon emissions also refer to the leakage of gas from the industrial sector that is the outcome of EG and damaged the quality of the environment badly (Inglesi-Lotz & Dogan, 2018). Likewise, carbon emission is also defined as the greenhouse gas that is discharge from the industry and transportation of the country and damage the environment (Dogan & Seker, 2016). Thus, carbon emissions are a serious issue regarding quality of environment in the ASEAN countries of the world. This problem can be a major issue in the future for the environment of the ASEAN countries and need be fixing as soon as possible. Therefore, current study takes this area under discussion and finds out the major issues of carbon emissions in ASEAN countries.

### Economic Growth

It means the growth in the output level of the nation that is due to the economic development in the country. In addition, EG means the improvement and increase in the output and production level of the country to increase in the development and GDP is the measurement of EG I the country (Zhu et al., 2016). Furthermore, the improvement in the production and output level of the country that is also measured with the help of GNP (Bende-Nabende, 2018; Shittu et al., 2018). Additionally, *"economic growth is an increase in the production of goods and services over a specific period. To be most accurate, the measurement must remove the effects of inflation (Liu et al.,, 2017). Economic growth creates more profit for businesses. As a result, stock prices rise. That gives company's capital to invest and hire more employees"* (Tan & Tang, 2016). Similarly, the enhancement in the production level by implementation of technology in the country is known as economic growth. Likewise, *"economic growth is the*

*increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product, or real GDP"* (Thanh, 2015). Thus, EG is a serious issue regarding quality of environment in the ASEAN countries of the world. This problem can be a major issue in the future for the environment of the ASEAN countries and need be fixing as soon as possible. Therefore, current study take this area under discussion and find out the EG effects on carbon emissions in ASEAN countries.

**Globalization**

It means the interaction of the peoples, institutions, companies, cooperatives, and industries across the border to enhance international relations among different countries of the world. In addition, it also means the process of integration and interaction with the people, government and companies of country with the people, government and companies of other countries. It also means the extension in the sense of capitalization that attract the global economy and investment in the products of other countries or the other countries investment in countries own products (Crane et al., 2016). In globalization, the developed countries are able to afford the labor force at a very low rate of wages from developing countries to increase their production. Moreover, the developing economies can also obtain the benefits of environment form globalization through getting access to technology of energy-saving from developed countries. The environment can be affected by globalization in three ways, composition effects, technique effects and income effects. Moreover, it also defined as the relationship of peoples, institutions, companies, cooperatives, and industries of different countries to promote international trade and relations with each other. Furthermore, *"globalization refers to the international interaction among people, companies, and governments of different countries through the exchanging of ideas, products, and cultural practices. Globalization is enhanced by the trading partnerships between different countries, as well as the use of the internet and mobile phones"* (Boyden, 2015). Additionally, the exchange of goods, ideas, cultural practices and services among two or more countries that enhance the relationship among the countries of the world. (Hitt et al., 2016). Likewise, globalization means the interchange of business ideas, culture, goods, and services across the border that improves the link among the interaction countries of the world (Donner, 2016). In addition, the beginning of the local market trade to the international market that enhance the global trade or the opening the door for one country for the trade to the other countries (Fernandez, 2016). Thus, globalization is a serious issue regarding quality of environment in the ASEAN countries of the world. This problem can be a major issue in the future for the environment of the ASEAN countries and need be fixing as soon as possible. Therefore, current study takes this area under discussion and finds out the globalization effects on carbon emissions in ASEAN countries.

**Financial Development**

It refers to the increase in the investment with respect to improvement in the financial system of the country that is a vital element for the economic growth of the country (Ozatac et al., 2017; Haseeb et al., 2019). Moreover, *"financial development means some improvements in producing information about possible investments and allocating capital, monitoring firms and exerting corporate governance, trading, diversification, and management of risk, mobilization, and pooling of savings, easing the exchange of goods and services"* (Abidin et al., 2015). In addition, the improvement in the system of finance in the country is said to be FD in the country (Al-Mulali et al., 2015). Furthermore, the improvement in the services of the financial sector

such as funds pooling, risk management, markets, institutions and regulations is said as FD (Dogan & Seker, 2016). Similarly, the improvement in the risk management, investment and trading services provided by the financial institutions are also known as FD in the country (Ziaei, 2015). Likewise, *"financial development means the production and of exchange, the conditions under which feudal society produced and exchanged, the feudal organization of agriculture and manufacturing industry, in one word, the feudal relations of property became no longer compatible with the already developed productive forces; they became so many fetters"* (Phong, 2019). Thus, FD is the serious issue regarding quality of environment in the ASEAN countries of the world. This problem can be a significant issue in the future for the environment of the ASEAN countries and need be fixing as soon as possible. Therefore, current study takes this area under discussion and finds out the FD effects on carbon emissions in ASEAN countries.

## Economic Growth and $CO_2$ Emissions

There are different opinions of different researchers on the link between the EG and carbon emissions. One school of thought is with the conclusion of a positive relationship among the EG and carbon emissions. In addition, the increase in carbon emissions depends on the rise in EG of the country (Paramati et al., 2017). Moreover, positive link is concluded among the EG and carbon emissions of the nation. Furthermore, one of the significant reasons for rise in carbon emissions is the rise in EG of society. Similarly, EG is the most prominent factor of the high and severely affected carbon emissions of the world. Likewise, the verse quality of the environment and carbon emissions are the outcomes of high EG in the country. Additionally, as far as the EG increases the carbon emissions are also increase and vice versa. In addition, when the EG rises the industry and transportation increase in the country that becomes a major reason for carbon emissions in the country (Haseeb et al., 2017).

However, another school of thought is with the conclusion of negative link among the EG and carbon emissions. In addition, the decrease in carbon emissions depends on the increase in EG of the country because high EG motivates the efficient use of energy resources. Moreover, negative link is concluded among the EG and carbon emissions of the nation. Furthermore, one of the significant reasons for the reduction in carbon emissions is the rise in EG of society. Similarly, EG is the most prominent factor of controlled carbon emissions of the world (Shahbaz et al., 2016). Likewise, the quality of the environment and reduction in carbon emissions are the outcomes of high EG in the country. Additionally, as far as the EG increases the carbon emissions are also decrease and vice versa (Ma et al., 2016). In addition, when the EG rises the industry and transportation increases in the country, but on the other hand efficient use of energy resources also increases that become a major reason for controlled carbon emissions in the country (Işik et al., 2017). Thus, EG is a severe issue regarding quality of environment in the ASEAN countries of the world. This problem can be a major issue in the future for the environment of the ASEAN countries and need be fixing as soon as possible. Therefore, current study takes this area under discussion and finds out the EG effects on carbon emissions in ASEAN countries.

*$H_1$ There is positive link among the EG and $CO_2$ emissions in the ASEAN countries.*

## Globalization and $CO_2$ Emissions

There are different opinions of different researchers on the link between globalization and carbon emissions. One school of thought is with the conclusion of positive link among globalization and carbon emissions. In addition, the increase in carbon emissions depends on the

rise in globalization of the country (Van & Bao, 2018). Moreover, positive link is concluded among the globalization and carbon emissions of the nation. Furthermore, one of the significant reasons for rise in carbon emissions is the rise in globalization of society. Similarly, globalization is the most prominent factor of the high and severely affected carbon emissions of the world. Likewise, the verse quality of the environment and carbon emissions are the outcomes of high globalization in the country. Additionally, as far as globalization an increase the carbon emissions is also increase and vice versa (Wood et al., 2019). In addition, when globalization rises, the industry and transportation increase in the country that becomes a major reason for carbon emissions in the country.

However, another school of thought is with the conclusion of negative link among globalization and carbon emissions. In addition, the decrease in carbon emissions depends on the increase in globalization of the country because high globalization motivates the efficient use of energy resources (Zaidi et al., 2019). Moreover, negative link is concluded among the globalization and carbon emissions of the nation. Furthermore, one of the significant reasons for reduction in carbon emissions is the rise in globalization of society. Similarly, globalization is the most prominent factor in controlled carbon emissions in the world. Likewise, the quality of the environment and reduction in carbon emissions are the outcomes of high globalization in the country (Shahbaz et al., 2018). Additionally, as far as globalization an increase the carbon emissions is also decrease and vice versa. In addition, when globalization rises, the industry and transportation increased in the country, but on the other hand efficient use of energy resources also increases that become a major reason for controlled carbon emissions in the country (Turcea & Mihai, 2019). Thus, globalization is a severe issue regarding quality of environment in the ASEAN countries of the world. This problem can be a major issue in the future for the environment of the ASEAN countries and need be fixing as soon as possible. Therefore, current study takes this area under discussion and finds out the globalization effects on carbon emissions in ASEAN countries.

*$H_2$ There is positive link among globalization and $CO_2$ emissions in the ASEAN countries.*

## Financial Development and $CO_2$ Emissions

There are also different opinions of different researchers on the link between the FD and carbon emissions. One school of thought is with the conclusion of positive link among the FD and carbon emissions. In addition, the increase in carbon emissions depends on the rise in the FD of the country. Moreover, positive link is concluded among the FD and carbon emissions of the nation (Pata, 2018). Furthermore, one of the significant reasons for rise in carbon emissions is the rise in FD of society. Similarly, FD is the most prominent factor of the high and severely affected carbon emissions of the world. Likewise, the verse quality of the environment and carbon emissions are the outcomes of high FD in the country. Additionally, as far as the FD increases the carbon emissions is also increase and vice versa (Dogan & Turkekul, 2016). In addition, when the FD raises the industry and transportation increase in the country that becomes a major reason for carbon emissions in the country.

However, another school of thought is with the conclusion of negative link among the FD and carbon emissions. In addition, the decrease in carbon emissions depends on the increase in FD of the country because high FD motivates the efficient use of energy resources. Moreover, negative link is concluded among the FD and carbon emissions of the nation. Furthermore, one of the significant reasons for reduction in carbon emissions is the rise in FD of society. Similarly, FD is the most prominent factor of controlled carbon emissions of the world (Charfeddine,

2017). Likewise, the quality of the environment and reduction in carbon emissions are the outcomes of high FD in the country. Additionally, as far as the FD increases the carbon emissions is also decrease and vice versa (Bekhet & Othman, 2018). In addition, when the FD raises the industry and transportation increases in the country, but on the other hand efficient use of energy resources also increases that become a major reason for controlled carbon emissions in the country (Asumadu-Sarkodie & Owusu, 2016). Thus, FD is a severe issue regarding the quality of the environment in the ASEAN countries of the world. This problem can be a major issue in the future for the environment of the ASEAN countries and need be fixing as soon as possible. Therefore, current study takes this area under discussion and finds out the FD effects on carbon emissions in ASEAN countries.

*$H_3$ There is positive link among the FD and $CO_2$ emissions in the ASEAN countries.*

## Research Methods

The purpose of the paper is to investigate the impact of economic growth (EG), globalization (GL), and financial development (FD) on $CO_2$ emissions in ASEAN countries. For the purpose of analysis, the data were collected form *"World Development Indicator (WDI), KOF Swiss economic institute and World Bank"* from 2004 to 2018. The panel *"fixed effect model"* has been used to run the regression analysis with *"discroll-kraay standard error"* to control the heteroscedasticity and serial correlation effects on the results.

## Data

The data were gathered from *"World Development Indicator (WDI), KOF Swiss economic institute and World Bank"*. The carbon emissions are measured by the $CO_2$ tons per capita, while the EG is measured with the GDP per capita. In addition, the energy consumption is measured with the *"tons of oil equivalent per capita"* while FD is measured through *"domestic credit to private sector (percentage of GDP)"*. Finally, globalization is measured by the *"KOF index from 0 to 100"*.

## RESEARCH RESULTS

The findings have shown the OLS regression and its assumptions. The first assumption of the regression is the multicollinearity that is checked by the following equation:

$$R^2_{EG}\, EG_{it} = \alpha_0 + \beta_2 FD_{it} + \beta_3 GL_{it} + \beta_3 EC_{it} + e_{it} \quad (1)$$

$$R^2_{FD}\, FD_{it} = \alpha_0 + \beta_2 EG_{it} + \beta_3 GL_{it} + \beta_3 EC_{it} + e_{it} \quad (2)$$

$$R^2_{GL}\, GL_{it} = \alpha_0 + \beta_2 FD_{it} + \beta_3 EG_{it} + \beta_3 EC_{it} + e_{it} \quad (3)$$

$$R^2_{EC}\, EC_{it} = \alpha_0 + \beta_2 FD_{it} + \beta_3 EG_{it} + \beta_3 GL_{it} + e_{it} \quad (4)$$

$$j = R^2_{EG}, R^2_{FD}, R^2_{GL}, R^2_{EC} \quad (5)$$

$$Tolrance = 1 - R^2_j \; VIF = \frac{1}{Tolerance} \quad (6)$$

The outcomes have shown that no issue with the assumption of multicollinearity because tolerance is higher than 0.10, and VIF is less than 5. Table 2 shown the results of multicollinearity test given below:

| Table 2<br>MULTICOLLINEARITY TEST | | | |
|---|---|---|---|
| | | **VIF** | **1/VIF** |
| EG | | 1.671 | 0.598 |
| FD | | 1.539 | 0.65 |
| GL | | 1.113 | 0.898 |
| EC | | 1.441 | 0.785 |
| Mean VIF | | 1.541 | . |

The alternative way of checking the multicollinearity is the correlation matrix and this also shown no issue with multicollinearity assumption because the values are less than 0.80. Table 3 shown the correlation matrix give below:

| Table 3<br>CORRELATION MATRIX | | | | | | |
|---|---|---|---|---|---|---|
| **Variables** | **EG** | **FD** | **$CO_2$** | **GL** | **EC** | |
| EG | 1 | | | | | |
| FD | 0.591 | 1 | | | | |
| $CO_2$ | -0.745 | -0.558 | 1 | | | |
| GL | 0.315 | 0.149 | -0.005 | 1 | | |
| EC | 0.245 | 0.214 | 0.055 | 0.415 | 1 | |

The second assumption of regression is the normality of the data. The normality assumption is checked by Skewness and Kurtosis test, and outcomes showed no issue with normality in case of $CO_2$ and EG, but FG, GL, and EC have issue with normality. However, normality problems cannot be affected the results in case of large data (more than 100 observations). The outcomes of Skewness and Kurtosis test are given below (Table 4):

The third assumption of regression is the homoscedasticity, and this is checked by *"Breusch-Pagan/Cook-Weisberg test"*. The outcomes of the test shown that variance in error term are not constant because the value is less than 0.05. The effects of heteroscedasticity can be handled by *"discroll-kraay standard error"*. In addition, the fourth assumption of the regression is autocorrelation that is checked through *"Wooldridge test"*. The outcomes of the test shown that no correlation between the values of different years because the value is higher than 0.05.

The links among the variables are evaluated by following equation:

| Table 4<br>NORMALITY TEST | | | | | |
|---|---|---|---|---|---|
| **Variable** | **Obs** | **Pr(Skewness)** | **Pr(Kurtosis)** | **adj_chi2(2)** | **Prob>chi2** |
| $CO_2$ | 150 | 0.218 | 0.492 | 2.02 | 0.363 |
| EG | 150 | 0.917 | 0.606 | 0.28 | 0.871 |
| FD | 150 | 0.414 | 0.013 | 6.51 | 0.039 |
| GL | 150 | 0 | 0 | 35.51 | 0 |
| EC | 150 | 0 | 0 | 33.125 | 0 |

$$CO_{2it} = \alpha_0 + \beta_2 FD_{it} + \beta_2 EG_{it} + \beta_3 GL_{it} + \beta_3 EC_{it} + e_{it} \quad (7)$$

The results of *"fixed and random effect models"* are given below that shown positive link among all the predictors such as FD, EG, EC, and GL with carbon emissions of ASEAN countries because finding show positive sign with all beta values, all the t-values are higher than 1.64 and p-values are lower than 0.05. The outcome of *"fixed and random effect models"* are given below in Table 5 and Table 6.

| Table 5<br>FIXED EFFECT MODEL | | | | | | | |
|---|---|---|---|---|---|---|---|
| **$CO_2$** | **Beta** | **S.E** | **t-value** | **p-value** | **L.L.** | **U.L.** | **Sig** |
| FD | 0.041 | 0.016 | 2.6 | 0.01 | 0.01 | 0.072 | *** |
| EG | 1.041 | 0.012 | 85.36 | 0 | 1.065 | 1.017 | *** |
| GL | 1.09 | 0.037 | 29.57 | 0 | 1.017 | 1.163 | *** |
| EC | 0.051 | 0.0381 | 28.88 | 0 | 1.258 | 1.245 | *** |
| Constant | -0.123 | 0.045 | -2.74 | 0.007 | -0.212 | -0.034 | *** |

| Table 6<br>RANDOM EFFECT MODEL | | | | | | | |
|---|---|---|---|---|---|---|---|
| **$CO_2$** | **Beta** | **S.E** | **t-value** | **p-value** | **L.L.** | **U.L.** | **Sig** |
| FD | 0.04 | 0.016 | 2.5 | 0.012 | 0.009 | 0.071 | ** |
| EG | 1.05 | 0.012 | 88.69 | 0 | 1.07 | 1.027 | *** |
| GL | 1.038 | 0.033 | 31.38 | 0 | 0.973 | 1.103 | *** |
| EC | 1.031 | 0.0332 | 30.457 | 0 | 0.872 | 1.125 | *** |
| Constant | -0.066 | 0.042 | -1.55 | 0.121 | -0.149 | 0.017 | |

The outcomes of the Hausman test shown that the *"fixed effect model"* is appropriate because the outcome is less than 0.05, and null hypothesis is that the *"random effect model"* is appropriate. The outcome of Hausman test is given below in Table 7.

| Table 7<br>HAUSMAN TEST | |
|---|---|
| | **Coef.** |
| Chi-square test value | 2.427 |
| P-value | 0.012 |

The outcome of the *"fixed effect model with discroll-kraay standard error"* shown that positive and significant link among the FD, EG, GL, EC with $CO_2$ emissions because finding show positive sign with all beta values, all the t-values are higher than 1.64 and p-values are lower than 0.05. The outcomes of the path analysis are given below in Table 8.

| Table 8<br>PATH ANALYSIS | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Coef.** | | **S.E.** | **t-values** | **P>t** | **L.L.** | **U.L.** |
| | 0.041 | | 0.012 | 3.38 | 0.006 | 0.014 | 0.068 |
| EG | 1.041 | | 0.008 | 125.06 | 0 | 1.06 | 1.023 |
| GL | 1.09 | | 0.062 | 17.67 | 0 | 0.954 | 1.226 |
| | 1.087 | | 0.059 | 18.424 | 0 | 0.876 | 1.592 |
| _cons | -0.123 | | 0.069 | -1.77 | 0.104 | -0.276 | 0.03 |
| R-squared = 0.9884 Prob > F = 0.0000 | | | | | | | |

## DISCUSSION AND CONCLUSIONS

The purpose of the paper is to investigate the impact of economic growth (EG), globalization (GL), and financial development (FD) on $CO_2$ emissions in ASEAN countries. The outcomes have shown that the EG, FD, globalization and energy consumption have positive link with carbon emissions of the ASEAN countries. In ASEAN countries, the inefficient energy consumption methods have been followed by organizations that are the reason that increases in EG, FD, globalization, and energy consumption affected the quality of the environment and high carbon emissions in the country. Thus, the present study concluded that the EG and FD increase the industry level in the ASEAN countries that need more consumption of energy resources that

is the major cause of high carbon emissions in the ASEAN countries. This study suggested to the regulators that they must develop policies regarding the carbon emission and efficient usage of energy resources of the country. ASEAN countries must use the energy sources efficiently along with the improvement in EG and FD that also improve the quality of the environment and reduction in carbon emissions in the country.

The current study has several limitations that are the future gaps for the upcoming studies. Firstly, this study focused only on the four factors such EG, FD, globalization, and energy consumption to predict the carbon emission and ignore the other factors that upcoming studies may add in their investigation. Secondly, the present study investigated the ASEAN countries and ignored other countries under examination, and future studies may include other countries in their examination. Thirdly, this stud investigated ASEAN countries for only fifteen years, and prospective study may expand the period of investigation. Finally, the environmental quality is measured only through carbon emission in this study, and there are many other measures are existing to evaluate the quality of environment, and upcoming studies may include these measures in their examination.

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