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Analysis of the Impact of Climate Change on Economic Growth, Financial Development, and Investment

— Evidence from the ASEAN Region

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Abstract: By using the ASEAN region as a case study, the research attempts to examine how climate change has an impact on financial development, foreign direct investment, and economic growth. ASEAN region is considered among the highest growing region across the world hence this study assesses the climate change consequences by taking into consideration the growth of region. This study conducted an empirical test using regression and focuses on the five nations with the greatest economies in the ASEAN region. These countries are Singapore, Malaysia, Thailand, the Philippines, and Indonesia, and they cover the years 2000–2022. The study collects data from the World Bank. This study used five independent variables while taking one climate change variable (CO2 emission) as independent variable. This study used the data in the panel format and after reviewing multiple literature the hypothesis could be tested. The result states that climate change has had a mixed impact on economic growth, performance, and investment.

Keywords: Climate Change, Economic Development, Foreign Direct Investment, Financial Development, Environment

1. Introduction

The UNFCCC COP21 conference took place in Paris in 2015, and the majority of member nations of the United Nations signed the Paris Agreement, which aims to limit the global temperature rise below 2*C. Additionally, the agreement requires commitment from nations to divert the pathway of financial flow towards low greenhouse gas emission projects and developments. Further, the United Nations (UN) also launched its Agenda, which provides multiple aims under sustainable development goals (SDGs) expected to be achieved by 2030 [1]. Moreover, Europe also launched the European Commission EU2030 goals, which aim to reduce European Union emissions by 40% by 2030. Investment decisions have a long-term influence on climate change, and there has been increasing awareness regarding the fact that to achieve global climate targets requires alignment of finance with sustainability [2]. The research aims to analyze the implication of foreign direct investment flows, economic growth, and financial development on environmental degradation in ASEAN (Association of Southeast Asian Nations) countries by drawing empirical data from 2001 to 2022. According to McKinsey & Company, the ASEAN countries are among the world's

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outperforming countries in terms of long-term growth, but it is important to consider the environmental consequences behind that development [3]. The study contributes by helping investors and financial policy decision-makers, as this study focuses on filling up the gap by analyzing climate risk in emerging nations.

2. Literature Review

The studies referring to economic development and climate degradation show mixed results, and the focus has been on the contrast between the investments' long-term and short-term consequences. For instance, studies by Lindmark, Atasoy, and Onafowora reported different results showing short-term economic development has mixed results on long-term climate change [4][5][6]. Parallel to economic development, the expansion of the financial industry is a major factor, and its role in either the degradation or improvement of the environment will be an interesting aspect to study [7][8]. However, according to the study by Y J Zhang, the financial development impact on climate change can be described through three pathways [9]. Firstly, the expansion of FDI in the country as a result of financial development eventually causes a rise in energy consumption. The second pathway is that due to the increase in financial intermediaries, credit creation increased, which encourage a rise in the use of energy-intensive projects investment. The third channel is strengthening the financial system, which encourage more investments, in turn, higher energy use, and hence leads to environmental degradation [9]. Whereas on the plus side, the strengthening of the financial system or financial development leads to more investments in the renewable energy sector, and funds used for innovation eventually lead to less dependence on non-renewable energy source [10].

Moving further, the investment role in climate degradation is also inconclusive, with many researchers having a contrasting opinion. The contrasting results support the fact that there are three dimensions of FDI and climate change that are pollution haven, scale effect and pollution halo hypothesis. Firstly, as per the pollution-haven hypothesis, the increased investments attract weak climate regulations in the host nation leading to environmental degradation [11]. Whereas, as per the pollution-halo hypothesis, the FDI coming to the host nation led to the transfer of green technology and increased the climate protection standards in the host nation. Nevertheless, as per the scale-effect hypothesis, FDI could lead to a significant rise in industrial output, which increases environmental degradation practices in the host nation [12]. Considering the ASEAN region, the countries in these nations have been drawing a significant flood of international investments along with growth in the economy. This prompted us to investigate the impact of this development on climate change. Considering the ASEAN region, with the economic development, these countries have attracted a lot of foreign investment.

3. The Implication of Climate Change on Financial Development, Economic Growth, and Investments

3.1. Climate Change and Economic Growth

Economic growth is one of the policymakers' most crucial macroeconomic goals after World War II, and the same remains true for ASEAN countries. In constant, the important aspect that gained importance during the effects of economic expansion on the environment. Hence, many researchers have studied the effect of economic expansion on climate change and also focused on the notation of the Environmental Kuznets Curve (EKC). The curve has a U-shaped form, indicating the link between economic development and climate change in short-term economic development leads to climate degradation. Whereas, as the income of the nation's increases, the relationship turns inverse and economic development begins to have a favorable effect on climate change. [13]. According to

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research by Fosten that focuses on the UK, there is strong evidence for EKC [14]. In addition, the study also found asymmetric adjustment on EKC due to the presence of strong climate regulations in the UK, leading to disequilibrium from long-run EKC. The same aspect could be interesting to study for the ASEAN region. Meanwhile, Ghosh conducted a study on the Indian economy and found that there was no relationship between economic growth and climate change [15]. While Narayan discovered evidence of EKC in the Middle East and South African countries in his study of 43 developing nations, the overall findings were mixed [16]. As a result, the clarity comes in the heterogeneities where one research did not fit the other's research, but the majority of studies indicate the presence of no significant EKC results and argue that nations focused on economic growth cannot lead to climate improvement. This research provides a base for this study in the context of ASEAN nations because these nations are projected to achieve remarkable growth in the near future.

3.2. Environmental Change and Financial Development

The stability of the financial system is important for economic stability and for better functioning. The effective financial sector is crucial to economic expansion. Researchers Soukhakian and Katircioglu show that financial development has climate change implications [17][18]. Although financial development also benefits the economy, it also indirectly increases energy consumption, which has effects on the environment [19][20]. Contradictory and conflicting findings emerge from the empirical investigation of the connection between financial development and climate change, with some researchers claiming that financial development improves climate quality while other studies claim the opposite. Piñeiro Chousa researched BRICS nations and found that financial development helps in the reduction of environmental degradation [21]. However, many studies have reported the negative impact of financial development — rising carbon emissions. The financial development system has a negative impact on climatic and environmental implications, according to research by J. Y. Zhang [9]. Other researchers even report no signs of this financial and climate relationship [22]. The literature review on this topic shows that it will be difficult, based on existing evidence, to generalize findings subject to ASEAN countries which are also going through the rapid development of the financial system. This motivates us to investigate how the financial prosperity of ASEAN nations has affected their environmental effects.

3.3. Changes in the Environment and Foreign Direct Investment

The relationship between FDI and environmental change is the third significant topic that this study seeks to investigate. According to the ASEAN Investment report by McKinsey & Company, there is an expected increase in the flow of FDI in the ASEAN region and during the historical period, and this region has witnessed a remarkable flow of FDI, so it becomes essential to study the environmental consequences of such a massive inflow of investment in this region [23]. Depending on the transmission channel through which the FDI is routed and the pollution-halo hypothesis, pollution-haven hypothesis, and scale effect hypothesis in the country, the investment may have either favorable or unfavorable effect on the environment [24]. The results from different studies show that the FDI in different regions has a different impact on climate change. However, Hitam and Tang conducted studies on different countries and found that FDI leads to the degradation of the environment [25][26]. While there are some studies that did not find any impact and state FDI impact is insignificant on the environmental change [27]. Some of these researchers have also concentrated on ASEAN countries, yielding mixed results that contradict each other. Meanwhile, these studies have ignored the economic and financial development aspects, which are required to be studied in parallel with FDI's impact on environmental change. Therefore, this research will also

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look at the influence of FDI on environmental consequences and the causes for this while taking economic and financial trends into account.

4. Methodology

Nowadays, the Environmental Social and Governance (ESG) rating providers provide risk ratings to the companies based on their ESG performance and provide ESG metrics as a proxy for sustainable performance [2]. This data has become the key reference provider for much research linked to the investment and financing [28]. This study took a different approach and did not consider such rating providers to conduct the analysis. The analysis covers the years 2000 to 2022 and focuses on Singapore, Malaysia, Thailand, the Philippines, and Indonesia, the five countries in the ASEAN area with the greatest economies [29]. The study collects data from the world bank website, and the availability of data for all five countries is the primary factor in the selection of the 22-year time frame, and the data will be in the form of time series set on a cross-sectional basis. The study uses six variables which are shown in Table1.

Table 1: Variable explanation, measurement and source [30].

Variables	Explanation	Measurement	Source
CO2	Showing CO2 emission per capita	It measures the carbon dioxide and computes as per the burning of fossil fuel	World Development Indicators
FDI	Foreign Direct Investment shows net inflow	Net investments computed after excluding disinvestment	World Development Indicators
GDP	GDP growth based on constant local currency	GDP represents the economy's overall gross value added after subtracting any subsidies that are not reflected in product value.	World Development Indicators
BCBD	Measured as Bank Credit to Bank Deposit (proportion)	Retrieved from private credit from bank report and bank deposits	The world Bank and IMF database
Listedco PC	No. of listed companies per 10.000 population	No. of listed companies scaled as per 10.000 population	World Development Indicators
Internatio nal Debt	International debt issued over the GDP	The sum of the outstanding international debt by GDP	Bank for International Settlements World Development Indicators

The Augmented Dickey-Fuller (ADF) test is used to determine cross-sectional dependence among the factors considered in this study, as cross-sectional data shares the common factors for the objective. Hence, the test will be conducted by referring to the existence of cross-sectional dependency among the factors, so the hypothesis is formed where H_0 /= 0 and H_A = 0. Further, the study conducted the stationary test using the unit root test by using ADF regression on the pooled panel data. Firstly, the study will conduct the FMOLS (fully Modified OLS) to find the long-run relationship with the variables. However, this Dynamic OLS approach will be used to control the errors from auto-correlation, and it will be conducted on CO2 as the dependent variable while others as independent variables. Finally, the study also analyzes the longer-term impact of economic growth on climate change by using the quadratic of GDP; in this approach, the GDP2

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variable will be added to the other variables, and both the FMOLS and DOLS approach will be used to estimate the environmental Kuznets curve. The study also conducts the robustness test considering the fact that there can be some contradicting results in both models, so it's important to test the robustness and validity of the model. The findings show that ASEAN countries' financial, foreign direct investment, and economic development have a significant long-term co-integration relationship with the impact of climate change. The CO2 emissions increased as development and investment increased in these countries. The results are evident: all 5 countries in the ASEAN region have a negative impact on the climate due to economic development, financial development, and investment. The results lead us to open an argument for implementing the carbon tax policy and promoting low-emission technologies to improve the overall impact on climate degradation.

5. Conclusion

The important part of this research is to study the policy implications after the global financial crisis. The study used the historic data from 2000-2022 to do the quantitative analysis on the panel data for five nations by using two methods the Fully Modified OLS (FMOLS) and Dynamic Ordinary Least Square (DOLS) approach. The results demonstrate a substantial long-term co-integration link between the impact of climate change and the financial, foreign direct investment, and economic development of ASEAN countries. As these countries' development and investment grew, so did their CO2 emissions. The conclusions are clear: due to economic development, financial development, and investment, all five ASEAN member countries have a detrimental influence on the environment. This study focused on studying the significance of CO2 emission, but for further studies, the research can be extended to study the ecological footprints which can be incorporated into this analysis. Further study can also use the research and development aspect in the ASEAN region to study the impact of R&D on ecological change. Finally, the study can be extended to other nations like Asian countries or a comparative study by taking developed and developing nations in different sets of panels and then comparing these findings. Finally, we can conclude that climate change has a mixed effect on economic growth, performance, and investment

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