FOREIGN DIRECT INVESTMENT AND CO_2 EMISSION: AN EMPIRICAL ANALYSIS – THE CASE OF MYANMAR

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Abstract

There are two main patterns of the liberalization process in Myanmar. The first one, acted in September 1988, concerns with the marketization and removal of restrictions in the agriculture sector. The second one is the Foreign Investment Law. This allows foreign capitals in a company from joint venture participation with a minimum of 35% of foreign holdings to a full detention with 100% of foreign equity. This study will assess the effect of foreign direct investment (FDI) on CO_2 emissions of Myanmar in the short-run and long-run impact by using an auto-regression distributed lag (ARDL) model. The data set for this study is from the time series data set of Myanmar (1990-2020). The sources of secondary data are World Bank, DICA, and Konema. This study makes a significant contribution by examining the impact of FDI and trade liberalization on Myanmar's CO_2 emissions. The results of this study provide evidence of the possibility to keep and rehabilitate the environment along with Myanmar's industrialization and urbanization through trade liberalization. As the developing and emerging Myanmar economies are on a transition path towards development, guaranteeing environmental sustainability. Myanmar government should be encouraging the types of FDI which ensure tech know-how and building a clean environment.

Keyword: Foreign Direct Investment, CO_2 emission, ARDL model, Pollution Heaven Hypothesis (PHH), Myanma

Introduction

Together with trade liberalization, this foreign investment aided nations in achieving respectable economic growth and actively taking part in globalization. As a result, foreign investment that generates employment opportunities and has a ripple effect on developing social-economic systems would assist nations in improving their living standards and becoming more globally competitive. Environmental quality was impacted when trade, economic growth, investment flows, and urbanization experienced significant increases in emerging and developing economies (EDEs). Environmental concerns have caught economists' attention, and scholars' focus on global trade and environmental challenges has expanded (Weidman and Lenzen, 2018; Khan et al., 2020).

When the economic structure transitions from rural to urban in industrial countries, environmental degradation increases, but it is reversed when the structural shift occurs from energy-intensive industries to technologically and knowledge-based services. The old paradigm of international commerce is clearly challenged by the advent of environmental issues. Sub-regional trade is a significant economic activity that closely relates to the environment (Bilgen, 2014). The EKC hypothesis, which asserts inverted U-shaped connections between income and environmental pollution, is widely accepted. In order to build its economy, a developing nation may decide to sacrifice the environment (i.e., increase carbon emissions).

With a geographic area of 676,578 square kilometers, Myanmar is the second-largest country in Southeast Asia. With a population of 53 million as of 2019, it will likely reach 54.7 million by 2024, making it the fifth-largest country in the region. With the progressive easing of restrictions on foreign investment in Myanmar, there has been an increase in foreign companies and robust manufacturing-led economic growth, which is predominantly supported by foreign direct investment (FDI). As one of the remaining accessible frontier markets in the world, Myanmar is developing at a faster rate than its Asian counterparts, such as Thailand and Vietnam, which are also going through rapid economic changes.

The government has been reforming and liberalizing various fields such as agriculture, the SEEs, finance and trade based on the objectives of development of agriculture as the base and

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all round development of other sectors of the economy as well, proper evolution of the market oriented economic system, development of the economy inviting participation in terms of technical know-how and investments from sources inside the country and abroad and the initiative to shape the national economy must be kept in the hands of the State and national peoples. Myanmar military government has approved $3.8 billion in foreign investment since a coup a year ago. The projects approved included $ 2.5 billion in liquefied natural gas power plant. That figure accounted for two-thirds of overall amount cited. In the 2019-2020 and 2020-2021fiscal years, Myanmar's foreign investment fell from $4.9 billion to $3.8 billion (DICA).

The number of enterprises permitted in 2019, was 282 enterprise and highest in manufacturing (79%) of total investment in terms of monetary as $ 4158.47 million. Within the first two years of their investment, foreign investors are required to hire at least 25% of their skilled workers from the local labor pool. For the third and fourth years, the local job ratio rises to 50%, and for the fifth and sixth years, it rises to 75% for the fifth and sixth years

Foreign investors are not compelled to purchase products or technology with domestic content. Information technology (IT) and data protection laws, rules, and regulations are currently being developed in Myanmar, however there are no current obligations for international IT providers to turn over source code or grant access to surveillance. Data localization rules do not exist in Burma.

To investigate the impact of foreign direct investment on CO_2 emission, the author uses the ARDL model to analyze the relationship between environmental attributes, foreign direct investment, gross domestic product, and urbanization. And then evaluates the effectiveness of current policy initiatives in addressing the causes of environmental degradation and offers policy suggestions.

Literature Review

The main goal of FDI syndicates is to make it easier for highly skilled workers, cutting-edge technologies, and financial resources to relocate from their home nations to other countries where they are going (Lasbrey et al., 2018). Industrialization and trade are fueled by direct foreign investment. FDI and economic development are positively correlated, according to an analysis of a heterogeneous panel covering the years 1983 to 2008 (Gaur et al., 2018). Most governments have been more selective in the source and type of FDI entering into their country as a result of being aware of the possible environmental harm that FDI may cause (Demena and Afesorgbor, 2020).

Large-scale FDI has the potential to hasten environmental deterioration in host nations, but it also has the potential to help safeguard the environment, particularly if it is accompanied with more eco-friendly technologies and sustainable management techniques (Demena and Afesorgbor, 2020). Research on the factors influencing business environmental performance has looked at the motivations for Previous research concerned with the FDI–environment relationship has mostly focused on the impacts of domestic regulation on aggregate FDI flows and the effects of FDI on the local environment, mainly relating it to the environmental Kuznets curve and the pollution haven hypothesis (Aung et al., 2017; Bruvoll and Fæhn, 2006; Rezza, 2013).

Some studies look at how well domestic companies function environmentally (Liu and Ye, 2012). The motivations for businesses to adopt environmentally responsible activities have been addressed in research on the factors influencing corporate environmental performance (Nikolaou et al., 2018).

Research Question And Objective

In order to protect the environment throughout Myanmar's economic expansion after 1988, this study aims to access the environmental effects of trade liberalization. The finding of the study helps to answer the following research question

- What and how of the long run and short run relationships between FDI and CO_2 emissions of Myanmar?

The objective of the study is

- To investigate the impact of foreign direct investment on CO_2 emission.

Theoretical Analysis And Methodology

Pollution Haven Hypothesis

According to the pollution haven hypothesis (PHH), under free trade, multinational corporations will move the manufacturing of their products that produce a lot of pollution to poorer nations, where there is less environmental oversight. In less developed countries, foreign investment is expected to close the internal resource and savings gap, improve managerial capabilities, lessen the currency shortage, and improve the country's overall balance of payments. The free movement of finance and trade has also grown in importance as environmental issues. Some contend that environmental quality is an ordinary benefit and that economic progress brought about by free trade will result in a cleaner environment.

There are three main explanations for why underdeveloped nations set lower standards. First off, developing nations generally have higher costs associated with monitoring and enforcing pollution standards. Second, wealthy developed nations create a greater demand for clean water and air. Third, economic development in emerging nations means a switch from agricultural to manufacturing, which prompts a quick urbanization process and significant investments in urban infrastructure, increasing pollution levels. Yet, growth in wealthy nations indicates a move from production to services, which results in a reduction of pollution sensitivity.

Environmental Kuznets curve

In the early stages of economic growth, pollution emissions increase and environmental quality declines, but beyond some level of per capita income (which will vary for different indicators) the trend reverses, so that at high income levels, economic growth leads to environmental improvement. This implies that environmental impacts or emissions per capita are an inverted U-shaped function of per capita income. The EKC is named after Simon Kuznets who proposed that income inequality first rises and then falls as economic development proceeds. The EKC is mostly an empirical phenomenon, yet the majority of EKC model estimates are not statistically reliable. The impact of growth outweighs these other factors in middle-income nations that are experiencing rapid growth. In developed nations, development is slower and the growth effect can be offset by measures to reduce pollution. Evidence that developing economies are actually addressing environmental issues lends support to these econometric findings. (Stern, 2020).

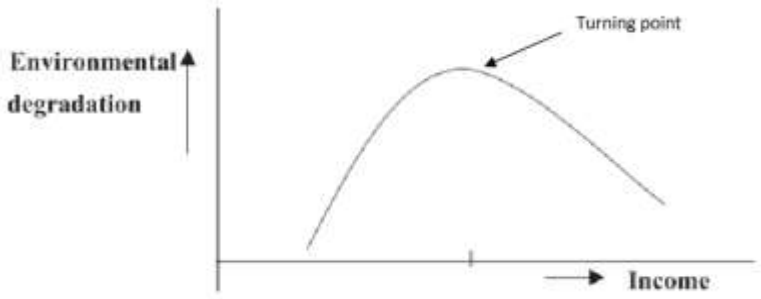


Figure 1- Environmental Kuznets Curve Source: Dinda ,2004

Methodology: Data collection and analysis methods

An ARDL model is used to analyze the environmental effects of trade liberalization. This study access the quantitative analysis of the impact of foreign direct investment on environmental quality of Myanmar. The autoregressive distributed lag model is used in this study to determine whether there is a long-term link between the time series variables. The ARDL technique's ability to be used regardless of whether the variable is I(0), I(1), or fractionally co-integrated is one of its key benefits (Pesaran & Pesaran, 1997). The ARDL model has enough lags to account for the dynamical implications of all dependent and independent variables, as well as those of the error term. Moreover, the error correction model (ECM) is created by deriving ARDL from a straightforward linear transformation. Without sacrificing long-run data, ECM combines short-run changes with long-run equilibrium.

This study uses current data that was gathered from publications or surveys produced by the government, including those from the Central Statistics Organization (CSO), the Directorate of Investment and Business Association (DICA), the World Bank Dataset, and Konema. The data set for this study is from the time series data set of Myanmar (1990-2020). The following table 1 - summarizes the detailed specifications on the variables.

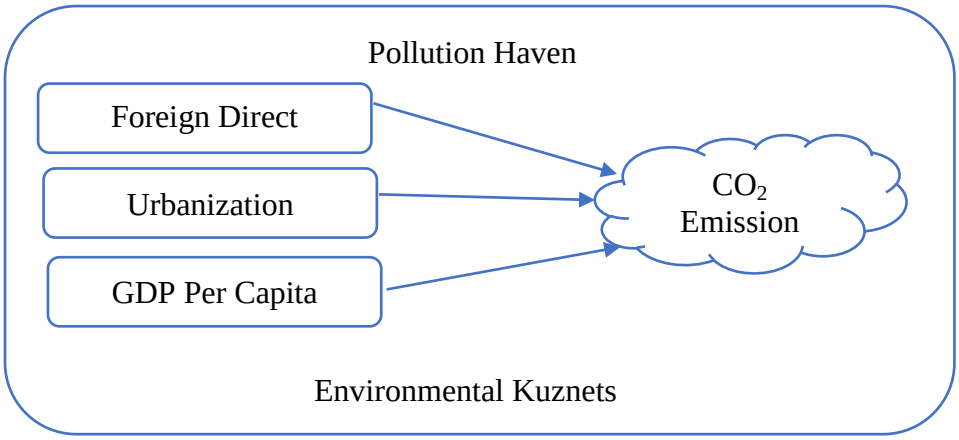
Table 1- The description of the Data

Types	Code	Meaning	Measurement	Expected Sign
Dependent variables	C	CO_2 emissions	Per capita CO_2 emissions(tons)	
Explanatory variables	FDI	Foreign Direct Investment	% of total GDP	+
	GDP	GDP per capita	current $	+
	Ur	Urbanization	% of total Population	+

Source: Author's own consideration

Conceptual Framework

In recent years, many researchers have focused on the impacts of FDI inflows on carbon emissions, but they have not concluded a consistent insight. Moreover, little research has investigated the influence channels of the impacts of FDI inflows on carbon emissions. Therefore, this study will examine the moderating effects of FDI, urbanization and GDP per capita in carbon emissions, which may provide a new explanation for the differential impact of FDI inflows on carbon emissions. Figure 2 presents the conceptual framework of this study.



Source: Author's own consideration

Discussion

Empirical Result

Empirically, the relationship between economic development and CO_2 emissions has been widely studied. It is plausible to establish the long-run relationship between CO_2 emissions, energy use, economic growth, and per capita income in a linear quadratic form (Stern, 2003). FDI inflows have also been considered as an additional determinant of environmental quality because of their potential effects on pollution. This study specified a log linear quadratic equation to test the long-run relationship among CO_2 emissions, economic growth, foreign direct investment and urbanization of Myanmar. The regression model is given as follows:

$$LnC_t = \alpha_0 + \alpha_1 LnFDI_t + \alpha_2 LnGDP_t + \alpha_3 LnUR_t + \varepsilon \quad (1)$$

Where,

LnC_t = Natural logarithm of CO_2 emission

$LnFDI_t$ = Natural logarithm of foreign direct investment

$LnGDP_t$ = Natural logarithm of GDP per capita

$LnUR_t$ = Natural logarithm of urbanization

GDP_t = Gross Domestic Per Capita

$\boldsymbol{\varepsilon}$ = The regression error terms**.**

All variables in equation (1) are in their natural logarithmic form.

Hypothesis

Researchers have studied how FDI affects the climate. Kaya et al. (2017) used a spatial agglomeration model to analyze the relationship between FDI and pollutant effects. They hypothesized that FDI inflows influenced a variety of environmental pollution and concluded that location has no bearing on the concentration of pollutants.

H_0 : A positive relationship exists between FDI and CO_2 emissions for Myanmar.

Unit Root test

A unit root test determines whether a time series variable is non-stationary.). This study used three different unit root test specifically i) Augment Dickey- Fuller test ii) ADF- GLS test iii) Phillip-Perron test for the equation (1).

Table 2- The results of the unit root test

t- statistics		LnC_t	$LnFDI_t$	$LnUr_t$	$LnGDP_t$
ADF	level	-1.89	-3.301	-1.013	-0.870
	1st Difference	-8.154***	-4.0.58***	-5.32***	-2.90***
Dickey Fuller GLS	level	0.153	2.915***	0.188	-0.591
	1st Difference	-8.326***	na	-6.069***	-2.997***
PPS	level	1.612	-3.128***	-1.053	-0.79
	1st Difference	-12.345***	na	-9.749***	-9.749***

Source: Eview -12 output

Note: *** denotes the significant at all 5%, 10% and 1%.

No one of the variables is I(2) which is qualified for the ARDL estimation technique and the Bounds Integration .According to the table 2, the results of the ADF, for unit root and stationary all variables are stationary at the first difference.

Table 3 - The Correlation Matrix for ARDL (3,4,4,4)

Correlation Probability	*LnC*	*LnFDI*	*LnUr*	*LnGDP*
LnC	*1.000*			
LnFDI	*-0.129*	*1.000*		
LnUr	*0.767*	*-0.232*	*1.000*	
LnGDP	*0.738*	*-0.15*	*0.925*	*1.000*

Source: Eview -12 output

According to the table 3 – LnGDP and LnUr has correlation (0.925), there exists no correlation among other independent variables. This means that there has no multi-collineary in the regression model. If variables have multi-collinear each other's, their coefficients may become unstable and difficult to interpret.

Selection of Lags Optimal and Test of Johansen Co-integration

The variables (Ur_t , GDP_t , FDI_t and C_t) are integrated at I(1) and I (0) have a long-run relationship, thus the study can progress to develop the ARDL model. The software Eview 12 is used in this study to estimate the chosen ARDL model. With the use of this software, a user can choose a specific lag level or have it automatically chosen one between the maximum lags of dependent and independent variables.

Table 4 - Lag Optimal Selection

Lag	*Log L*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	*5.3*	*NA*	*1.05*	*-0.113*	*0.083*	*-0.064*
1	*71.645*	*103.83*	*1.36*	*-4.49*	*-3.5*	*-4.242*
2	*79.723*	*9.833*	*3.13*	*-3.802*	*-2.024*	*-3.355*
3	*120.81*	*35.73*	*5.41**	*-5.983*	*-3.416*	*-5.33*
4	*207.59*	*45.275**	*3.36*	*-12.138**	*-8.878**	*-11.294**

Source: Eview -12 output

*Indicates la g order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

For the sample period of 1995–2021, attention has been paid to five VAR (p), p= 0, 1, 2, 3, and 4 models. The order is inferred by at least four criteria.

Table 5: Johansen Cointegration test results

H_0	H_1	*Trace Statistic*	*5% Critical Value*	*Prob*	H_0	H_1	*Max-Eigen Statistics*	*5% Critical Value*	*Prob*
*r=0**	*r>1*	*66.320*	*63.876*	*0.030*	*r=0**	*r>1*	*34.439*	*32.118*	*0.025*
*r<1**	*r=1*	*31.881*	*42.915*	*0.394*	*r<1**	*r=1*	*19.233*	*25.823*	*0.289*
r<2	*r=2*	*12.647*	*25.872*	*0.765*	*r<2*	*r=2*	*10.114*	*19.387*	*0.606*
r<3	*r=3*	*2.532*	*12.517*	*0.926*	*r<3*	*r=3*	*2.517*	*12.517*	*0.926*

Source: Eview -12 output

Trace statistic and Max-Eigen statistic are both significant at the 5% level for the null hypothesis r=0 (see Table 5). Both trace statistic and max-eigen statistics show that the p-value of the null hypothesis that the number of co integration equations is, r=0 which is lower than 0.05. This indicates that the null hypothesis r=0 is not rejected at the 5% significance level. Therefore, we can conclude that there is co-integration all variables in the long-run.

The Bounds Tests for Co-integration of ARDL Models

The long-term association between the variables was examined in conjunction with the F-test. The empirical formulation of the ARDL framework for bound testing can be written as follows:

$$\Delta LnC_t = \beta_o + \sum_{i=1}^{p} \delta_i \Delta LnC_{t-i} + \sum_{i=1}^{p} \emptyset_i \Delta LnFDI_{t-i} + \sum_{i=1}^{p} \omega_i \Delta LnGDP_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta LnUR_{t-i} + \sigma_1 LnC_{t-1} + \sigma_2 LnFDI_{t-1} + \sigma_3 LnGDP_{t-1} + \sigma_4 LnUR_{t-1} + U_t \quad (2)$$

Table 6 : The Bounds Tests for Co-integration

F –Bound Test	*Value*	*Signif*	*I (0) Lower Bound*	*I(1) Upper Bound*
F – statistic	*6.366*	*10%*	*2.72*	*3.77*
		5%	*3.23*	*4.35*
		1%	*4.29*	*5.61*

Source: Eview -12 output
Note: H_0: No level relationship

The computed F-statistics for order of lag four turned out to be 6.366 when the dependent variable is Ct. Pesaren et. al. (2001) provided the critical value , upper bound I(1) (3.77, 4.35, 5.61) and I (0) lower bound (3.72,3.23,4,29) at 10%, 5 % and 1% level of significant respectively. Thus the study rejects the null of no level relationship among variables. So it provides enough sign that there is a strong long-run relationship among the variables of the model.

Error Correction Estimation and ARDL long-run Estimate

After ARDL cointegration methodology Eq. (2) has been predictable to get the long run estimates. The estimation results are shown in table 7.

Table 7: Estimation Results for ARDL (3,4,4,4,)

ARDL Error Correction Regression			*ARDL Long-run*		
Regressor	*Cofficient*	*P- value*	*Regressor*	*Cofficient*	*P- value*
Coint Eq(-1)	*-2.676*	*0.0026****	$LnFDI_t$	*-1.367*	*0.0005****
C	*-73.59*	*0.0027****	$LnGDP_t$	*0.257*	*0.057*
$\boldsymbol{LnFDI_t}$	*-0.966*	*0.034****	$LnUr_t$	*9.173*	*0.008****
$\boldsymbol{LnGDP_t}$	*0.868*	*0.139*	*C*	*-73.590*	*0.031****
$\boldsymbol{LnUr_t}$	*-14.679*	*0.0079****			
R-Square =0.99 , P(F- statistics) =0.00001, Durbin Watson test= 2.125					

Source: Eview -12 output
Note: *** represent 5% level of significance.
The Error Correction Model

EC=Ln C- (- 1.3678*LnFDI +0.2574*LnGDP + 9.1735*LnUr) (3)

According to the equation 3, foreign direct investment impact on the carbon emission (CO_2) is negative relationship but statistically significant. This means that the flow of FDI rise 1% leads to reduce 1.367% decrease in CO_2 emission of Myanmar. This is an interesting finding, as previous scholars have commented on the possible environmental benefits of FDI. Even some recent discoveries in Latin America suggest that FDI could benefit the environment, as demonstrated by Polloni-Silva et al. and Xu et al. Part of the literature defends the idea that FDI brings innovation, green technologies, and higher productivity levels to emerging economies (Bakhsh et al, Zafar et al and Ferraz et al).

From the co-integrated equation in Table 3 can be explained that, in the long-term, when urbanization increases by one percent, then it will increase degration of environmental quality by 9.17%. However, statistically LnGDP are not significant or accept the null hypothesis, no significant effect on LnC in the long term or rejects the null hypothesis.

The R-squared is 0.99, meaning that approximately 99% of the variability of the carbon emissions (CO_2) from Gas Fuels considering the change of urbanization, foreign direct investment and GDP per capita is accounted for by the variables in the model.

According to the empirical results show that the FDI and CO_2 emission are inversely related if FDI increase 1% lead to 0.96% reduce CO_2 emission in short-run and 1.357% reduce in the long-run.

The Granger Causality Test

Under the null hypothesis of no causation, the F-statistic and Granger causality probability (see table 8) are used to establish the direction of the link. Granger causality is not present between variables, according to the null hypothesis. Reject the null hypothesis if p 0.05 and use the Granger Causality test instead.

Table 8: **Pair Wise Granger Causality Test.**

	F- Statistics	*P value*
LnGDP does not Granger Cause Lnc	*3.553*	*0.033*
LnC does not Granger Cause LnUr	*3.963*	*0 .023*

Source: Eview -12 output

The results of Granger Causality test presented in Table-8. The results proved that there is the one-way causal relationship between GDP and CO_2 emission and GDP does Granger cause U_r through one-way causality runs.

Tests for Heteroscedasticity

Therefore, we further checked for the existence of heteroscedasticity using the Breusch-pagan-Godfrey test. The Breusch-Pagan Godfrey test regresses the squared residuals, which are obtained from equation (3), on the independent variables $ln\, C_{t-3}$, $Ln\, Ur_{t-4}$, $Ln\, FDI_{t-4}$ and $Ln\, FDP_{t-4}$ and the intercept. The result of the test is presented in Table 9.

Table 9 : Breuch-Pagan –Godfrey Hetroscedasticity Test

F-statistic	***0.606***	***Prob.F (3,23)***	***0.617***
Obs* R -squared	***1.979***	***Prob. Chi- Square (3)***	***0.576***
Scaled explained SS	***5.007***	***Prob. Chi- Square (3)***	***0.171***

Note: Ho: There is no heteroscedasticity.

The author does not reject the homoscedasticity null since the Breusch-Pagan -Godfrey test demonstrates that the p-value of the F-statistic test is unimportant. As a result, our model is not heteroscedastic.

Conclusion

For the goal of this study, CO_2 emissions in Myanmar and foreign direct investment (FDI) are inversely connected. The degree of permission granted by Myanmar's government legislation and regulations is a major factor in this circumstance. The market-oriented reforms improve the climate for FDI influx by making it more hospitable and favorable. The telecommunications industry and labor-intensive manufacturing sectors are where most of the foreign investment is looking to invest. Agriculture is Myanmar's main export, so modernizing the packaging method and enhancing technology are required to increase the value of exports. Due to political unrest, foreign direct investment has drastically decreased in Myanmar now. Majority of foreign investing in Myanmar are manufacturing such as garment and food wearing, second is construction.

Urbanization and CO_2 emissions had a favorable relationship in this study. According to Cohen's (2006) prediction, the majority of population growth in the developing countries will

occur in cities over the course of the next 30 years. Due to the economic shift that fundamentally altered how their economies, communities, and environments functioned, developing nations with transitional economies in Southeast Asia, including Myanmar, have seen increasing urbanization over the past few decades.

The FIL restriction has reduced FDI's involvement in Myanmar's heavy sectors, which are major contributors to CO_2 emissions. Then, according to government statistics, foreign investment in Myanmar has decreased to an eight-year low, first hurt by the COVID-19 outbreak and then by the political turmoil that escalated following the military takeover in February. The empirical findings imply that Myanmar is not a "pollution Heaven Hypothesis" and "Environmental Kuznets Curve" contrary to popular belief.

Policy Implication

In Myanmar, a negative significant association between FDI and CO_2 had been discovered. The findings imply that primary commodities like agricultural, wood, marine, and mining items, including natural gas, make up most Myanmar's exports, while the majority of foreign investment is concentrated in the telecommunications and real estate sectors. The evidence thus showed that FDI had no negative effects on Myanmar's environmental quality. Nonetheless, the increased urbanization and energy consumption of Ur and Tr have a favorable effect on the environment. Regarding the Granger causality findings, GDP and CO_2, GDP and TR, and C to TR all have a unidirectional link. This demonstrates that if one of the variables increases, the other will also increase. To maintain sustainable economic growth without severe consequences for the ecosystem, the skillful, efficient, and all- inclusive natural resource and environmental governance is necessary in Myanmar. Myanmar government with the limited institutional capacities and flexible environmental management, it enforces to reduce investments in high emission industries with effective laws and regulations on the local and foreign investors. Moreover, there are adequate systematically measure and document regarding with the environmental health and social costs of natural resource extraction.

Myanmar government requires to target on "green FDI" which focus on the adverse environmental externalities and sustainable economic growth of Myanmar.

Acknowledgment

I would like to express my special thanks of gratitude to my supervisor Professor Yunfeng Yan for her valuable guidelines on this study. I would like to extend my gratitude to Dr. Tin Tin Htwe, Rector of Yangon University of Economics and Dr. Su Su Myat, Departmental Head of Applied Economics, who encouraged me to participate in the Research Conference held by MAAS in 2024.

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