



Climate Action Under the Paris Agreement: How Do Economic Globalization and Financial Development Make Asia's Environmental Quality Better?

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Abstract.

Climate change is a pressing issue at high-level conferences, with COP26 being regarded as a significant milestone with historic agreements on climate change, marking a pivotal moment in global efforts to address the issue. This study was conducted in 43 Asian countries between 2009 and 2022 to examine the impact of economic growth, financial development, and economic globalization and the moderating role of the Paris Agreement on environmental issues. Using S-GMM estimation, the authors discover an inverted U-shaped impact of economic growth on environmental degradation, which is consistent with the EKC hypothesis. Besides, both economic globalization, financial development and the Paris Climate Agreement have negative impacts on environmental degradation. The findings also show that the Paris Climate Agreement negatively moderates the Financial Development - Environment Degradation nexus and has a positive moderating effect on Economic Globalization - Environment Degradation nexus. Based on the research results, the study has provided policy implications and recommendations to improve environmental quality in Asia.

Keywords: EKC; Financial development; Economic globalization; Environment degradation; Paris Climate Agreement.

1 Introduction

Climate change is the foremost challenge of humanity in the 21st century, resulting in a warming planet, directly impacting ecosystems, natural resources, and human existence. NASA data (2023) shows a significant increase in global surface air temperatures, attributed to emissions, with a rise of approximately 2.45 degrees Fahrenheit compared to the late 19th-century average (1850-1900). By early 2023, melting snow is projected to cause a sea level rise of nearly 98.5 mm from 1993 levels, while atmospheric CO₂ levels have risen to 420.67 parts per million, the highest in 650,000 years. Greenhouse gas emissions, particularly CO₂, are deemed the primary cause of climate change and environmental degradation over the past two decades.

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To address this crisis, COP21 convened in Paris, aiming to prevent global temperature from rising to about 2°C above pre-industrial levels, with efforts to restrict it to just 1.5°C. This goal, shared by COP26 in 2021, requires stringent emission reduction measures from all countries, along with the development of policies to minimize the ongoing impacts of climate change on individuals.

Economic activities, especially in developing countries, are considered significant contributors to climate change and pollution (Phuc et al., 2020). In the current context, common approaches with significant impacts on economic activities in each country can be observed, including economic growth targets, decisions on globalization, and the development of a robust financial system. The Pollution Halo Hypothesis implies that globalization fosters environmental improvement by promoting knowledge and technology exchange (Zarsky, 1999). Financial development is crucial, attracting foreign direct investment (FDI) and boosting research and development (R&D), contributing to economic growth, industrial activity, but with adverse effects on the environment (Tamzian et al., 2010).

In conclusion, environmental pollution and climate change have reached alarming levels, demanding immediate attention. However, debates persist regarding the interplay between economic and environmental factors. These factors include environmental issues, economic growth, financial development, and global economic integration. Moreover, there is a need to reassess the implementation of commitments in the Paris Climate Agreement in different countries and regions, laying the groundwork for future policy frameworks.

2 Literature Review

An examination of the Environmental Kuznets Curve (EKC) theory reveals conflicting research findings, with some studies supporting an inverted U-shaped relationship between economic growth and pollution, while others contest this correlation (Grossman & Krueger, 1991). Studies supporting the EKC hypothesis, such as those by Al Mamun et al. (2014) and Phuc et al. (2020), find an inverted U-shaped relationship between economic growth and pollution, with pollution increasing initially and then decreasing as development progresses. Challenging the EKC hypothesis, recent studies by Ulucak et al. (2020) and others find linear or non-monotonic relationships between economic growth and pollution, suggesting no automatic environmental improvement with development. While some research like Arouri et al. (2012) finds evidence for the EKC with varying thresholds across countries, others yield inconclusive results, highlighting the complexity of the relationship between economic growth and environmental pollution. In general, the EKC theory has faced criticism and concerns in experiments.

Research on globalization's impact on CO₂ emissions remains inconclusive, with arguments for both positive (Halos Hypothesis) and negative (Pollution Haven Hypothesis) effects lacking definitive evidence. While recent studies Bilgili et al. (2019), and Gaies et al. (2022) suggest economic globalization can improve environmental

quality in developing nations through access to clean technologies and financial markets. Comprehensive economic globalization can support sustainable development in developing nations by facilitating climate finance (Leal et al., 2023). Despite arguments for environmental benefits, globalization is linked to increased carbon emissions through transportation, industrial activity, and potential relocation of polluting industries (Wang et al., 2020; Rahman, 2020).

Recent research explores the link between financial development and the environment within the EKC framework. While some studies suggest a negative correlation between financial progress and CO₂ emissions, with financial resources facilitating green energy transitions (Dogan et al., 2022; Ding et al., 2023), others find a positive correlation, with financial development leading to increased energy consumption and pollution (Zhao and Feng, 2022). This ongoing debate highlights the complexity of the relationship between financial development and environmental pollution.

The Paris Agreement signifies a shift from environmental discussion to action. It sets global carbon standards and could impact international trade through mechanisms like the EU's carbon border tax. The agreement also encourages collaboration between developed and developing countries, with technology transfer identified as a key strategy to reduce global CO₂ emissions (Li et al., 2024). The Paris Agreement's focus on climate change has influenced financial markets. As fossil fuel investments decline, green finance is gaining traction (Qin et al., 2023). This shift towards green finance offers advantages at the micro and macro levels, promoting innovation, resource efficiency, and emission reduction.

This research identifies limitations in prior studies on the environment in Asia. These limitations include: (1) a lack of consensus on the impact of economic factors, (2) a focus on large economies, (3) limited research on the Paris Agreement, and (4) the use of traditional methods. To address these gaps, the authors employ a novel econometric method to examine the effects of economic growth, financial development, globalization on environmental degradation in Asia (2009-2022), while also considering the regulatory influence of the Paris Agreement.

3 Data, Model, and Methodology

3.1 Data

The country data for the year 2009 to 2022 is collect from World Development Indicators (WDI), International Monetary Fund (IMF), Our World In Data (OWID), Swiss Economic Institute (KOF), and Global Footprint Network (GFN). The countries in the research were selected by the authors from 48 countries in Asia according to the United Nation classification. However, due to objective issues with the availability of some countries, the authors clean the data to protect regression results from bias. Therefore, there are 43 countries used to investigate the impact of factors on environmental degradation.

3.2 Model and Methodology

In the discourse of scholarly research regarding the correlation between economic growth and environmental pollution, it is often observed that the effect is represented in a simplified form, as put forth by the EKC theory, as follows:

$$\ln CO2_{it} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{it}^2 + \varepsilon_{it} \quad (a)$$

With the inheritance of empirical models used in a number of recent studies related to financial development and globalization such as those of Patel and Mehta (2023), Wang et al. (2023), Phuc et al. (2020), the authors develop the model as follows:

$$\ln CO2_{it} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{it}^2 + \beta_3 \ln EG_{it} + \beta_4 \ln FD_{it} + \beta_5 \ln EPFF_{it} + \beta_6 \ln URB_{it} + \beta_7 \ln IND_{it} + \beta_8 \ln TNR_{it} + \varepsilon_{it} \quad (1)$$

$$\ln CO2_{it} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{it}^2 + \beta_3 \ln EG_{it} + \beta_4 \ln FD_{it} + \beta_5 PA + \beta_6 \ln EG * PA + \beta_7 \ln FD * PA + \beta_8 \ln EPFF_{it} + \beta_9 \ln URB_{it} + \beta_{10} \ln IND_{it} + \beta_{11} \ln TNR_{it} + \varepsilon_{it} \quad (2)$$

In which:

- Dependent variable: The pollution level variable (lnCO2) is calculated by taking the logarithm of the average CO2 emissions from industrial activities and fossil fuel use in countries. Data for this variable is collected from OWID (2024).
- Independent variables:
 - lnGDP - Economic Growth: Measured by the logarithm of the total real gross domestic product per capita.
 - lnGDP2: The squared forms of economic growth to test the EKC hypothesis. The EKC is confirmed if the coefficient of lnGDP is positive and the coefficient of lnGDP2 is negative.
 - lnEG - Economic Globalization: used to describe the integration of world economies, calculated as the logarithm of the KOF Index in country i.
 - lnFD - Financial Development: a representation of the expansion and progress of a country's financial systems, measured by the logarithm of FD index from IMF (2024).
- Control Variable:
 - lnEPFF - Energy from Fossil Fuel Variable: calculated as the logarithm of the percentage ratio of electricity generated from gas, oil, and coal to the total electricity output.
 - lnIND - Industrial Activity: represented as the logarithm of the percentage ratio of the value added by the industrial sector (including construction) to GDP.
 - lnURB - Urbanization Level: calculated as the logarithm of the percentage ratio of the urban population to the total population.
 - lnTNR - Total natural resources rent: measured as the logarithm of the percentage ratio of total natural resources rent to GDP.

- Moderating variable: The dummy variable Paris Agreement on Climate Change (PA) signifies the commitment of countries in the United Nations to participate in a global covenant on environmental protection and climate change mitigation at COP21, which entered into force on November 4, 2016.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
CO2	602	7.5274	8.6711	0.1528	48.9702
GDP	600	12599.83	15577.27	696.1428	73493.27
EG	560	58.0128	16.3469	24.6931	94.5818
FD	547	0.3646	0.2027	0.0737	0.9333
IND	587	34.2226	14.3515	2.7586	74.8122
TNR	557	9.8422	12.6852	0.0002	59.0697
EPFF	538	78.9267	26.9416	0.1844	100
URB	602	59.9177	24.1181	16.434	100
PA	602	0.5	0.5004	0	1

Source: Author's group synthesized

Table 1 shows the descriptive statistics for the model's non-logarithmically transformed data of variables. The average annual per capita CO₂ emissions in countries is 7,5274 tons per person, with the highest value being 48,9702 tons per person and the lowest being 0.1528 tons per person. The real GDP per capita (base year 2015) has an average value of 12599,83 USD.

As for the Economic Globalization Index, the average, maximum, and minimum values are 58,0128 points, 94,5818 points, and 24,6931 points, respectively. Regarding the Financial Development Index, the IMF assigns an average score of 0,3646 points. It can be observed that many countries have robust financial systems and actively participate in the globalization trend. However, there are still many countries that are slow to join this trend. In terms of control variables, the variable representing the value added of the industrial sector has an average value of 34,2226% and the mean value of the natural resources rent to GDP is 9,8422%.

4 Results

Table 2 displays the experimental results by S-GMM method that demonstrate the impacts of economic growth, financial development and globalization with the moderating role of Paris Agreement on environment degradation in Asia countries.

Table 2. Estimation results on CO₂ emissions – System GMM method

Variable	(1)	(2)
	lnCO ₂	lnCO ₂
lnGDP	0.5137*** (5.96)	1.7146*** (3.65)

lnGDP2	-0.0174*** (-3.63)	-0.0732*** (-3.03)
lnEG	-0.0861*** (-2.73)	-0.2697*** (-3.79)
lnFD	-0.0676*** (-3.90)	-0.1108** (-2.44)
PA		-0.6567*** (-2.94)
lnEG*PA		0.1403*** (2.79)
lnFD*PA		-0.0991*** (-3.78)
lnEPFF	-0.0174 (-1.59)	-0.0285 (-1.32)
lnURB	0.0096 (0.34)	0.0858* (1.84)
lnIND	0.0735*** (4.70)	0.0038 (0.07)
lnTNR	0.0145*** (25.70)	0.0415*** (5.44)
L.lnCO2	0.7930*** (76.28)	0.6204*** (14.49)
_cons	-2.7745*** (-5.63)	-8.0553*** (-3.56)
N	418	418
AR(1)	0.044	0.045
AR(2)	0.331	0.179
Sargan-test	0.115	0.328
Hansen- test	0.320	0.793

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively

Source: Author's group synthesized

Impact of Economic Growth on Environment Degradation: The positive coefficient on the lnGDP variable and the negative sign in the lnGDP2 coefficient with 1% significant level provide the most clear evidence of the inverted U-shaped effect of economic growth on environmental degradation, which confirms the existence of the EKC theory in Asia. In other words, economic growth initially has a negative impact on the environment, and the environment will recover during later stages of development. This aligns well with the findings of Phuc et al. (2020) regarding the validity of the EKC in 33 emerging economies, many of which are in Asia. The estimated results imply a positive signal for the environment: As growth approaches a threshold, instead of solely focusing on economic development goals, Asian countries are likely to tighten environmental controls, improve green technologies and to improve and recover the quality of the environment.

Impact of Economic Globalization on Environment Degradation: At 1% significance level, there is a negative effect of economic globalization on environmental degradation. This suggests that countries, when integrating into the global economic system, tend to maintain lower levels of CO2 emissions. This could be explained by the fact that when countries participate in globalization, they must adhere to environ-

mental standards and commitments to minimize negative impacts on the environment. The global economy has emerged as a crucial policy framework for growth and development in both developed and developing countries (Zhang et al., 2022). Globalization can lead to more efficient resource use and enhance awareness of environmental issues (Copeland, 2021).

Impact of Financial Development on Environment Degradation: Financial development has a negative impact on environmental degradation, and this effect is significant at the 1% level. This implies that countries with developed financial systems tend to reduce the impact of carbon emissions on the environment. Emerging economies enhance environmental sustainability by promoting human resources and efficient use of financial resources (Guohua Liu et al., 2022). Besides, this result is in line with the assessment of Ding et al. (2023) that financial development is the main key for countries to succeed in the renewable energy transition and elevate the industry towards an environmentally friendly direction.

Effect of Paris Agreement on Environment Degradation: The negative direct impact of the Paris Agreement on environmental pollution has 1% statistically significant level. The result implies that the environmental protection efforts committed by Asian countries are practically effective. In particular, in the region of Asia where many developing countries are located, there will be support from developed nations for environmental issues.

The results also show that the Paris Agreement positively moderates the Economic Globalization - Environment Degradation nexus with 1% significant level, which means after the signing of the Paris Agreement, the adverse impact of financial globalization is diminished in the Asian region. This result casts doubt on the theory that polluted havens existed more pronouncedly in Asia after the Paris Agreement. The result can be explained that environmental policies in countries, especially developed countries, become stricter, which makes dirty industries have to move to places where environmental gaps are wide, which are often the developing countries and low income economies (Wang et al., 2020). Therefore, Asia, especially developing countries, must be more careful with FDI inflows that accompany shifting pollution sources in the post-Paris Agreement period.

Beside, the Paris Agreement negatively moderates the Financial Development - Environment Degradation nexus, with 1% significant level. This shows that the financial development under the Paris Climate Agreement becomes more effective in environmental protection purposes. The legal framework established by the Paris Agreement has created pressure, encouraging the transition to environmentally sustainable industries and green technologies in line with the goals of sustainable development (Lee et al., 2022). Besides, the Paris Agreement encourages countries to integrate green finance elements into their financial markets and develop green industries (Li et al., 2024).

Additionally, both urbanization variable and total natural resources rent variable also show a positive impact on CO₂ emissions at a significant level of 1%. This is entirely consistent because they are among the primary factors contributing to envi-

ronmental pollution in the economic development process in countries, especially developing ones.

5 Conclusion

In this research, the authors examined the impacts of economic growth, financial development, economic globalization, and the regulatory impact of the Paris Climate Agreement on the environment in 43 countries in Asia between 2009 and 2022. Through the results of estimation from the S-GMM method, the authors found that the paper also demonstrates the existence of the EKC theory in Asia with the view of the inverted U-shaped impact of economic growth and environmental degradation. Besides, financial development, economic globalization and the Paris Agreement have a positive impact on environmental quality through cutting CO₂ emissions. At the same time, the Paris Agreement negatively moderates the Financial Development - Environment Degradation nexus but has the positive moderating impact on Economic Globalization - Environment Degradation nexus.

Based on the preceding conclusion, this paper implies policies for improving environmental quality across Asia. This entails the development of resilient financial systems and the promotion of green finance mechanisms to secure ample resources for eco-friendly and groundbreaking initiatives aimed at reshaping the national industrial landscape. Expediting the integration process and optimizing the utilization of technological assets and capital inflows from global markets are equally imperative. Moreover, Asian nations must enact more stringent environmental regulations and policies, while steadfastly upholding international pledges for environmental preservation, such as those outlined in the Paris Climate Agreement.

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