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# Investigating the Effects of Kyoto Protocol Mechanisms on the Environment and Economy

As production processes improve, the stimulation of economic growth has overlooked its externalities over time. In pursuit of sustainable development, nations were driven to combat climate change and increasing greenhouse gas emissions through the Kyoto Protocol. The policy brief is based on the investigation of the Kyoto Protocol Mechanisms (Clean Development and Emissions Trading Scheme) through difference-in-difference (DID) estimation, together with panel regression to evaluate the path towards viability using the metrics for externalities (total greenhouse gas emissions) and economic growth (GDP). For this reason, the DID takes into account the quantitative aspect in evaluating the effectiveness of the said mechanisms by investigating the pre- and post-treatment periods. The panel regression results then quantify the influence of the drivers of development towards the specified metrics. Results show that relying on the mechanisms aforementioned in promoting and reinforcing cleaner economic growth throughout the globe is inefficient. Such evidence will be fundamental in enhancing the said mechanisms for its continuity.

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## Policy Recommendations

1. **Integrate custom unions in promoting emission reduction approaches.** Upon recognizing the impact of the E.U. ETS on the ECA region, the researchers acknowledge that if enough resources are allocated to the emission reduction scheme, then it may be effective enough to reduce CO2 levels. Since the employment of an emissions trading scheme requires a large number of resources, developing countries may not have enough capital to allocate to the carbon reduction projects on their own. Given that trade and foreign direct investments (FDI) have provided avenues for production expansion and cater to the existence of distortion in consumption, custom unions among developing countries like the ASEAN Economic Community, the economic integration among regions, among others, should also work together in mitigating the emissions of their members as they approach economic development.

2. **Resume and ensure the continuity of CDM projects beyond their operating period.** Evident in our study is the implication of ensuring the continuity of the CDM projects established by the countries in certain regions, particularly SEA and LAC, in adhering to the Kyoto Protocol Mechanism. CDM projects that continued to operate beyond their intended operating periods have been shown to decrease emissions through the creation of local employment. Therefore, the respective national governments are encouraged to resume and enforce the effectiveness of the projects under CDM.

3. **Align the type of CDM projects by the material footprint.** Although there are several factors to consider in investigating the components of global emissions, the intensity of the varying material footprints and the prominence of certain industries within the economy of a specific country should also be considered before employing a particular type of CDM. Because the effect of existing CDM projects differs across regions, aside from the multi-faceted economic development, the types of CDM projects and their varying effects should also be investigated when analyzing the impact of the mechanism as a whole.

4. **Implement ETS according to their respective energy consumption.** ETS should not only be limited to the GHG emissions covered by the Kyoto Protocol itself. Duan and Yan (2019) showed that China's intensive emission of sulfur dioxide (SO2) allows it to avoid part of its responsibilities of partaking in the Kyoto Protocol. Thus, instead of putting a cap and levy taxes on carbon emissions, the ETS to be employed should also consider capping and taxing based on the intensity of the particular energy consumption and emission. The fiscal policy implemented should not only limit itself to one type of emission and instead encompass all applicable emissions and have tax rates vary on the intensity of its usage in the country accordingly. Because countries like China and India plan to establish production plants in other developing countries, it is also proposed that the taxing rates for foreign corporations should also be higher than domestic corporations to account for the marginal social cost.

5. **Provide patents for green innovations and technology transfers in developing countries.** Given the additional constraints that currently exist for developing countries, as the externalities of production are now considered, national governments of developing countries should provide patents for green innovations and technology transfers brought by CDM. By doing so, not only will it incentivize local researchers, but developing countries can also utilize the right of use for economic development, while developed countries could also gain credits from the respective technology transfers under CDM.

6. **Provide opportunities for the unemployed to work in the CDM projects.** Addressing the laid-off employees due to the rising labor force and the circumstances that transpired, national governments and custom unions should train and prioritize them to work in the CDM projects. Another project that should be considered in promoting CDM is building recycling facilities that could be managed by the unemployed. That way, the effect of the Kyoto Protocol Mechanism can trickle down to those in need while mitigating emissions and reducing the impact of pollution as the world aims to diminish the marginal social cost of economic development.

## Introduction

In mitigating the environmental effects of emissions caused by the processes employed in approaching economic development, several countries have created means to improve environmental conditions. The United Nations Framework Convention on Climate Change (UNFCCC) introduced the Kyoto Protocol in 1997 and then was implemented in 2005. Under the treaty are three different mechanisms: the clean development mechanism (CDM), emissions trading scheme (ETS), and joint implementation

(JI). The study evaluated the viability of the Kyoto Protocol mechanisms (CDM and ETS) adopted by the industrialized and developing countries. Additionally, the impact of emission reduction policies regulated by UNFCCC on a country's economic growth was determined, and the effectiveness of the emission reduction policies mandated by UNFCCC under the Kyoto Protocol between developed and developing countries was assessed. Ultimately, the effects of implementing the CDM were differentiated from implementing ETS among the developed and developing countries.

## Model Specification and Results

This study uses panel data regression analysis to investigate the effects of covariates on a country's GDP, measured in local currency units and its total greenhouse gas emissions over time while disregarding the effects of the Kyoto Protocol mechanisms. The study utilizes the difference-in-difference method to evaluate appropriately and account for the true causal effect of the Kyoto Protocol mechanisms on a longitudinal perspective to complement the panel data regression models. Additionally, the data used covers the periods 1995 to 2016 from developed and developing countries that have been categorized based on their respective regions, namely North America (NA), East Asia and the Pacific (EAP), South East Asia (SEA), East Central Asia (ECA), Middle East and North Africa (MENA), Latin America and the Caribbean (LAC), South Asia (SA), and Sub-Saharan Africa (SSA).

The panel regression model (Eq. 1) investigates how the demographic variables, democracy, net barter trade, labor force population, urban population, financial development, and public debt of each country affect the dependent variables, where $m$ is either GDPLCU (GDP measured in local currency unit) or TGHG (total greenhouse gases) for the dependent variable.

$$Y_{m_{it}} = \beta_{0_{it}} + \beta_1 dem_{it} + \beta_2 nbt_{it} + \beta_3 lfpop_{it} + \beta_4 upop_{it} + \beta_5 findev_{it} + \beta_6 pubd_{it} + v_{it} \quad (1)$$

Meanwhile, the DID model (Eq. 2) looks into the differences affecting either the TGHG emission levels or GDPLCU (denoted by $m$) of the treatment group among developed or developing countries, before the implementation of the Kyoto Protocol mechanism and after its implementation, where $k$ indicates the type of Kyoto Protocol mechanism (i.e., CDM, ETS, or both CDM and ETS). The equation is also subject to the country-specific economic variables.

$$Y_{m_{it}} = \beta_{0_{it}} + \beta_1 time_{it} + \beta_2 KPM_{it} + \beta_3 (time \cdot KPM_k)_{it} + \beta_4 dem_{it} + \beta_5 nbt_{it} + \beta_6 lfpop_{it} + \beta_7 upop_{it} + \beta_8 findev_{it} + \beta_9 pubd_{it} + v_{it} \quad (2)$$

The results from the panel regression model reveal that the covariates have varying effects on both GDP and TGHG across different regions. For the DID model, the results showed that among the countries that have ETS implemented, only developed countries that came from the ECA region experienced a negative effect on their TGHG and a positive effect on their GDP. The ECA region also proved that ETS crucially contributed to emission reduction and improved their economic growth by 2016. Meanwhile, CDM did not have any effect on the TGHG of developed countries; however, it was shown to have decreased GHG emissions in developing regions, like LAC and SEA. Despite the varying effects of CDM on the GDP of developing countries, it could still help increase GDP through job creation and government spending. The developed countries that have implemented both CDM and ETS had not experienced any significant impacts on their TGHG and GDP except for the ECA region. Furthermore, none of the regions' GDP and TGHG were affected significantly by implementing both mechanisms.

## Conclusion

Our findings suggest that the current employment of CDM or ETS towards sustainable development is inadequate due to varying drivers of development and emissions across the regions. In some instances, these effects may lead a country to experience GHG emission sink, wherein they yield a greater domestic footprint than their contribution to the global footprint, whereas some could experience GHG emission leakage wherein they tend to yield a greater contribution to the global footprint in the attempt of diminishing their domestic footprint (Malik & Lan, 2016). Furthermore, although developed countries

have employed a cleaner technology development to mitigate emissions while developing countries have been fostering energy efficiency as a way to reduce emissions, the impact of these attempts is still not enough to overcome the multi-faceted challenges that each country may or have encountered over the years, as energy consumption and GHG emissions only tend to shift from one form to another. Several authors like Hu et al. (2017), Liu et al. (2019), Malik and Lan (2016) have emphasized the effects of underlying factors in enhancing the essential aspects (societal, economic, and environmental) in pursuit of viability for the public. As indicated by Liu et al. (2019), such effects can be classified into either energy intensity effect, Leontief structure effect, final demand structure effect, consumption expansion effect, investment expansion effect, and export expansion and import substitution effect.

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