Zahir Šabotić

Climate Change Action: A Rich Country's Game?

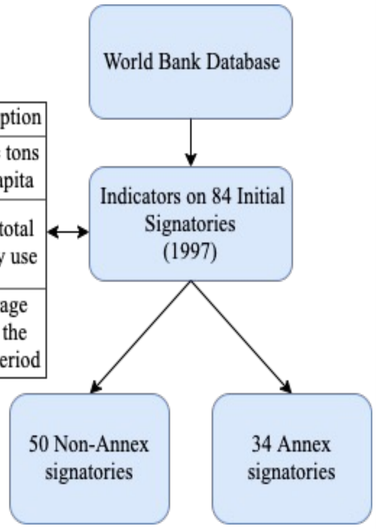
Introduction

Access to capital has been a central issue to climate change action ever since the UN recognized it as a pressing problem in 1992 [1]. Though the 1997 Kyoto Protocol, an international framework for CO2 emission reduction, was relatively a success story as Kim et al. [2] revealed in the paper on the economic and environmental impact, the question of access to monetary wealth still persist; Is Climate Change Action a "Rich" Country's Game? We will compare the CO2 emission rates amongst other indicators of two distinct signatories of the Kyoto Protocol: Annex (developed) and non-Annex (in development).

Methodology

Indicators

Field Name	Datatype	Timeframe	Description
CO2 emissions	Float	1990 and 2012	metric tons per capita
Renewable energy consumption	Float (%)	1990 and 2012	% of total energy use
GDP Growth	Float	1990 to 2012	Average over the time period



The year 1990 was used as the baseline emission rate, hence why it was chosen, whereas 2012 was chosen as a reference year. The figure above demonstrates the method behind data collection. ANOVA test was preformed to compare the two groups of countries, while Logistic Regression was used to estimate the probability of a country being an Annex signatory (True or False) given the parameters found to be significant in the figure above. The significance level for our tests will be: $\alpha = \mathbf{0.05}$.

Question

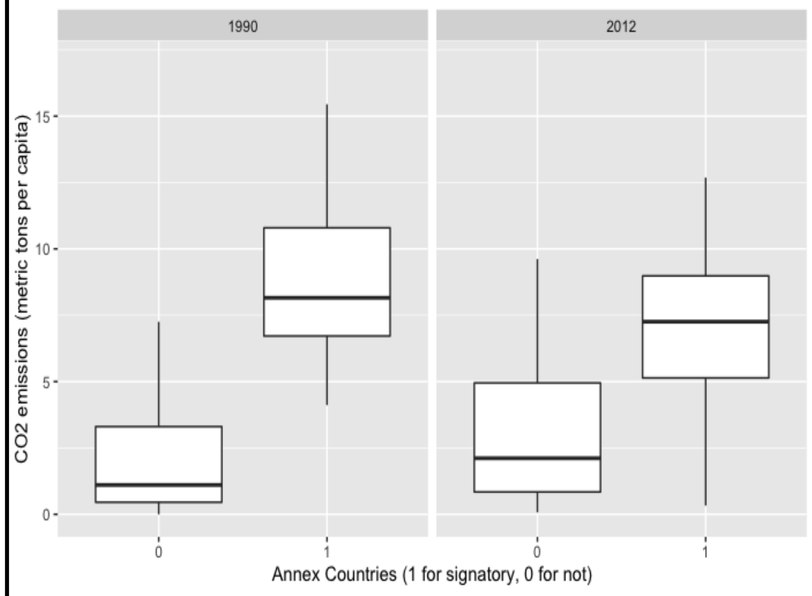
To what extent have more industrialized (Annex signatories) countries preformed better in reaching the reduction of CO2 emissions as opposed to non-industrialized countries amongst the 1997 Kyoto Protocol signatories?

References

[1] UN Climate Talks – Website
[2] Kim Y, Tanaka K, Matsuoka S (2020) Environmental and economic effectiveness of the Kyoto Protocol. https://doi.org/10.1371/journal.pone.0236299

Results

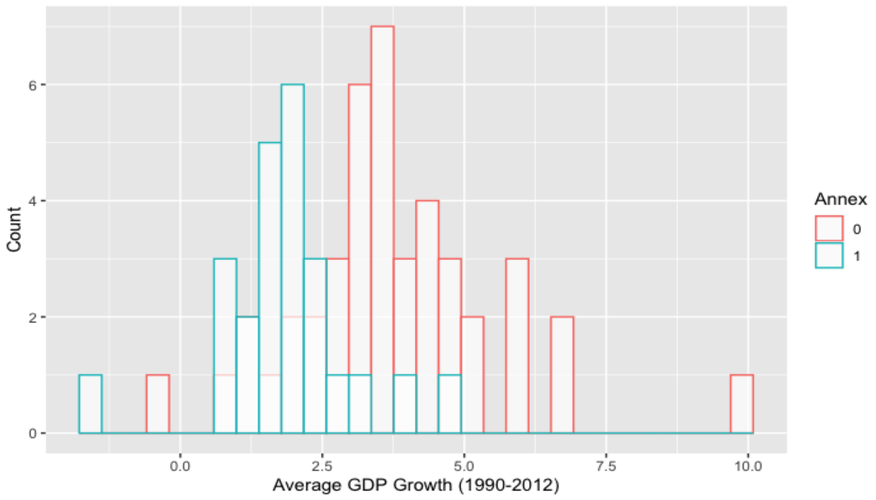
(Figure 1.)



In **Figure 1**., we see:

- Annex countries were successful in reducing CO2 emissions compared to non-Annex emissions who increased emissions
- In Table 1. we see that the difference in means was lowered.

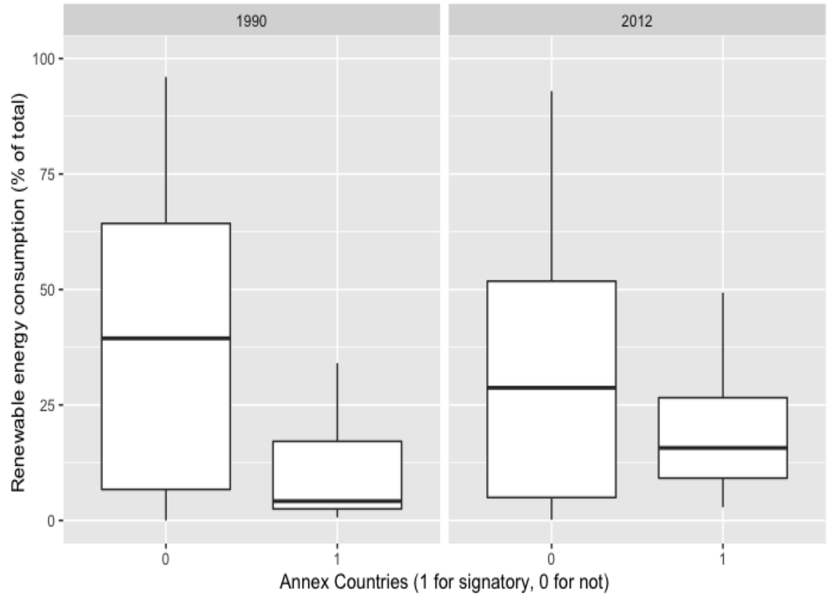
(Figure 3.)



Statistical Results and Discussion

In Table 1., the ANOVA results indicate a significant difference in means; p-values are substantially lower than our significance level of 0.05 for both years, but we do see a large drop in the difference in means. Annex countries did indeed preform better at lowering their CO2 emissions and increasing renewable energy consumption, though this came at a cost of GDP growth. The odds ratio's that we extrapolated from the Logistic Regression model reveal that higher the Avg. GDP growth, the less likely it is we are observing an Annex country. Conversely, increasing the CO2 emissions predictor variable increases the likelihood of us observing an Annex (a developed) country, as they do on average have higher CO2 emission rates (as seen in Figure 1.)

(Figure 2.)



This phenomenon can be attributed to the results demonstrated on **Figure 2**.:

- Non-Annex countries have lowered their renewable energy consumption rate as opposed to Annex countries which increased their renewable energy consumption rate

In **Figure 3**., we see:

- The distribution of average GDP growth of our two categories can, following the pattern, be attributed to Fig 2.; increased expenditure towards renewable energy technologies would indeed impede GDP growth.

Table 1. ANOVA Results for CO2 Emissions

	Annex (mean)	Non-Annex (mean)	Difference	p-value
1990	9.19	2.58	6.61	9.78e-12
2012	7.36	3.44	3.92	4.57e-06

Table 2. Logistic Regression Results (for 2012)

	Estimate	p-value	Odds ratio
(Intercept)	-0.50	0.59	1.40
Avg. GDP Growth	-0.92	0.000126	0.43
CO2 emissions	0.42	0.000164	1.39

Conclusion

Taking into account all the figures and statistical results provided, it does seem that offsetting CO2 emissions is indeed a "rich" countries game. What is promising is that this seems to be an issue stemming from unequal levels of economic strength, and that non-Annex countries have, in this time period, prioritized economic growth, which will hopefully be used later as a tool of CO2 emission offsetting.