Is institutional quality the missing piece between economic growth and CO_2 Emissions?

[Alanda Venter, Department of Economics, University of Pretoria, alandav@mweb.co.za]
[Roula Inglesi-Lotz, Department of Economics, University of Pretoria, roula.inglesi-lotz@up.ac.za]

Overview

On 12 December 2015, COP21 was implemented, where 196 parties came together with one goal in mind – to limit global warming. As COP21 states, one way to limit global warming is to reach a global peak of greenhouse gas emissions as soon as possible (Unfccc, 2015). A large contributor to greenhouse gas emissions is CO2 emissions. To reduce CO2 emissions, most countries focus on decreasing emissions in the energy sector – particularly in the electricity and heat sectors which contributed 43% of total CO2 emissions in 2019 (Data Explorer | Climate Watch, 2022; Ritchie & Roser, 2020). A challenge most of these counties experience is reducing CO2 emissions while sustaining economic growth, a possible solution to this challenge might be to account for the effect of institutional quality. This study examines potential pairwise relationships between economic growth and CO2 emissions while considering institutional quality.

Methods

The study uses a panel dataset consisting of 106 countries for the time period 2003 to 2018. As per the World Bank divisions, the 106 countries were divided into four income groups – low-income, lower-middle-income, upper-middle-income and high-income countries. A traditional panel VAR model is used, that will treat the variables within the system as endogenous (Antonakakis et al., 2017). Within this PVAR model, the Generalized Method of Moments (GMM) is used (Abrigo & Love, 2016). The PVAR model is specified in Equation 1.

$$Y_{it} = A_1 Y_{it-1} + A_2 Y_{it-2} + \cdots + A_n Y_{it-n} + BX_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

Where Y_{it} is a (1xk) vector of the dependent variables while X_{it} represents a vector of (1xl) vector of exogenous covariates. The dependent variable-specific panels' fixed-effects and idiosyncratic errors are represented by μ_I and ε_{it} respectively(Abrigo & Love, 2016). After estimating the PVAR models the Granger-causality is then estimated respectively to indicate if causal relationships between CO_2 emissions, GDP and institutional quality exist.

To test granger causality the following three equations will be used. For Equation 2 the study will test if GDP, the two institutional proxies and the institutional index Granger cause CO_2 emissions.

$$CO2emissions_{it} = \alpha_i + \sum_{k=1}^{p} \gamma_i^k CO2emissions_{i,t-k} + \sum_{k=0}^{p} \theta_i^k GDP_{i,t-k} + \sum_{k=0}^{p} \beta_i^k Institutions_{i,t-k} + \varepsilon_{i,t} \quad (2)$$

Likewise, to Equation 2, CO_2 emissions and two institutional proxies along with the institutional index will now be used to see if they Granger cause GDP respectively.

$$GDP_{it} = \alpha_i + \sum_{k=1}^{p} \gamma_i^k GDP_{i,t-k} + \sum_{k=0}^{p} \theta_i^k CO2emissions_{i,t-k} + \sum_{k=0}^{p} \beta_i^k Institutions_{i,t-k} + \varepsilon_{i,t} \quad (3)$$

For the last Granger causality test, we will test whether GDP and CO_2 emissions granger cause the two institutional proxies and the institutional index respectively.

$$Institutions_{it} = \alpha_i + \sum_{k=1}^{p} \gamma_i^k Institutions_{i,t-k} + \sum_{k=0}^{p} \theta_i^k GDP_{i,t-k} + \sum_{k=0}^{p} \beta_i^k CO2emissions_{i,t-k} + \varepsilon_{i,t} \quad (4)$$

Results

Rostow's (1959) framework of the five stages of economic growth assists in describing the study's results. Low-income countries can often be classified in one of the following two stages – the traditional societies and the preconditions for the take-off. These countries are generally agricultural-prone countries where the societies do not necessarily have a scientific and technological perspective or are starting to develope within the preconditions for take-off stage. These countries have also started to commercialize their agricultural sector and have just started their manufacturing sector (Rostow, 1959). For these countries, the results indicated no causal relationships were found

between economic growth, CO_2 emissions and institutions. Countries that are in the third stage -the take-off stage usually will experience some short-term significant growth while industrialisation starts to occur and institutions start to take effect. The study's results indicate that for the third stage lower middle-income countries experience bidirectional causation between CO_2 emissions and majority of institutional factors, further it was also found that economic growth granger cause institutional factors. Rostow's (1959) fourth stage of growth -The drive to mature stage can be linked to the study's upper middle-income country's group. While this stage is known to occur over a long time, it is also known as a period where social welfare increases, technological advancement occurs and industrialization advances. The results resemble the description of Rostow's (1959) fourth stage as causation was found between CO_2 emissions, institutional factors, and economic growth. The study found that high-income countries can be linked to Rostow's (1959) fifth stage – High mass consumption. These countries experience high levels of consumption and production but are also moving to service-orientated countries, therefore, the study's results are in line and imply economic growth granger causes CO_2 emissions.

Conclusions

With the rising threat of climate change, countries from all over the world came together during COP21 to take measures in combating climate change. One of their goals is to decrease greenhouse gas emissions. With the latter in mind, these countries look at their energy sectors, more specifically the electricity and heat sector as this sector contributes the largest portion of CO2 emissions which in turn contributes to greenhouse gas emissions. Institutions may be the solution for countries who struggle to decrease emissions while sustaining economic growth. This study examines if pairwise causal relationships exist between CO_2 emissions and economic growth while considering institutional quality.

The overall results indicate that as developmental changes in the economies start to occur, causal relationships start to form. While no causal relationship was found for the low-income countries it is explained due to the countries being agricultural-prone economies as well as lack of scientific and technological perspectives (Rostow, 1959). Causal relationships were found for the two middle-income and high-income country groups as these countries have started to develop their economies to more industrial-prone economies where institutions start to play a role and economic growth is occurring along with increased energy demands.

The difficulty most countries experience as mentioned by Stewart (2015), is that "the social, economic and environmental goals are not integrated" within countries policy frameworks which can be problematic. This study aims to assist policymakers on when to account for the integration of CO_2 emissions, economic growth, and institutional quality within their policy framework.

References

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