A NEW PERSPECTIVE ON GLOBAL CARBON EMISSION INEQUALITY: INSIGHTS FROM GLOBAL INTERPERSONAL CARBON GINI-INDEX

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Overview

The issue of global inequality in carbon emission is one of the main debate focuses across countries related to the abatement responsibility. This paper contributes to existing studies by developing a global interpersonal carbon gini index to illustrate the global carbon inequality at personal level. Due to the great flexibility and availability of data, this study adopts the carbon Lorenz curve and carbon Gini-index to measure the interpersonal carbon inequality level among 190 Countries. The carbon Lorenz curves for various countries are generated according to the income distribution data and the assumption of the relationship between household income and carbon emission of each country in line with studies from peer reviewed literatures. Furthermore, This study also examines the the difference of global interpersonal carbon inequality level respectively estimated under the production based emission data and consumption based emission data of all these countries. The result gives a clear indication that the Gini-index has an obvious decreasing tendency during the study period, , and it's caused mainly by the increase of per capital emission in developing countries, which is demonstrated by the decomposition analysis. In parallel, the global interpersonal carbon Gini-index calculated under consumption based emission is higher than production based emission, especially true for recent years, which is corresponsive to the fact that the development of internationa trade has significantly strengthened the transferred emission across developed and developing countries.

Methods

1. Stimulate the income distribution curve of different countries. This study respectively choose two Gamma function and lognorm function to describe income distribution to verify with each other.
2. Construct the relationship between household income and emission of a given country i by assuming $C_i = A_i * I_i^{\beta i}$, where C_{it} means the emission value when income value is I_i, and β_i is the income elasticity of emissions. It is impossible to get the β_i of all the countries in the world, this study reviewed some existing literatures and select some typical country's β_i to represent the β_i of a group of countries.
3. For a given country, we also need the emission data to stimulate this country's emission distribution curve. This study mainly gets the emission data from EDGER database, we also use the input-output model and GTAP database to calculate the consumption based emission data of various countries. So we can both get the production based emission distribution curve and consumption based emission distribution curve by combining income distribution curve and functional form of income and emission.
4. By aggregating emission distribution curves of all the countries, we can finally get the global carbon Lorenz curve and calculate the global carbon Gini-index.

Results

First, both the global carbon Gini-index at interpersonalal level based on production emission data and consumption data have a decreaing tendency during year 1980 and 2014. As a whole, the global interpersonalal carbon Gini-index decrease from 0.7 in 1980 to less than 0.6 in year 2014.

Second, the Golal interpersonal carbon Gini-index under consumption based emission data is higher than the figure under production based emission data, especially in recent years.

Third, the decomposition analysis shows that the growth of emission per capital in developing countries mainly account for the decrease of global carbon Gini-index. However, part of the decrease of inequality is due to the transferred emission from developed countries to developing countries, which become more obvious in recent years.

Conclusions

With the rapaid growth of carbon emission in developing countries, the gap of emission level per capital between developing countries and developed countries become narrow, which leads to more equality of global interpersonal carbon emission. However, the global carbon inequality status is still very severe with Gini-index around 0.6. what's more, quite a part of the emission in developing countries is transferred emission from

developed countries, when this part is considered, the global Gini-index become higher. This study depicts a general view of the global interpersonal carbon emission inequality situation in recent decades, which also provides a theoretical basis for the abatement responsibility assignment on interperonal level rather than on national level across countries.

References

Chakravarty S, Chikkatur A, de Coninck H, Pacala S, Socolow R and Tavoni M (2009). “Sharing global CO2 emission reductions among one billion high emitters”. Proc Natl Acad Sci USA 106: 11884-8

Salaimartin, Xavier, and M. Pinkovskiy (2009). "Parametric Estimation of the World Distribution of Income." Nber Working Papers 15433:11-12.

Groot L (2010). “Carbon Lorenz curves”. Resource and Energy Economics 32: 45-64

Zhang C and Zhao W (2014). “Panel estimation for income inequality and CO2 emissions: A regional analysis in China”. Applied Energy 136: 382-92

Xu X, Han L and Lv X (2016). “Household carbon inequality in urban China, its sources and determinants”. Ecological Economics 128: 77-86

Grunewald N, Jakob M and Mouratiadou I (2014). “Decomposing inequality in CO2 emissions: The role of primary energy carriers and economic sectors”. Ecological Economics 100: 183-94