Agricultural and Resource Economics

UPDATE

GIANNINI FOUNDATION OF AGRICULTURAL ECONOMICS • UNIVERSITY OF CALIFORNIA

V. 11 no. 3 • Jan/Feb 2008

What Hope for Climate Multilateralism?

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It is increasingly clear that significant global warming cannot be averted without a multilateral initiative to reduce greenhouse gas emissions. Unfortunately, global consensus is deadlocked between high-income countries, responsible for the majority of the stock of emissions, and low-income countries whose industrialization contributes significantly to current and expected future greenhouse gas flows. Because of the intrinsic linkage between carbon technologies and living standards, an underlying equity problem confounds the prospects for reconciling North and South.

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Global warming results from ambient concentrations of greenhouse gases (GHG) in the Earth's atmosphere. These concentrations have increased significantly since the Industrial Revolution, when carbon technologies were leveraged to achieve unprecedented improvements in living standards. Roughly three-quarters of the GHG stock change since 1750 was produced by OECD economies (OECD is an international organization of 30 industrialized countries). However, newly emergent economies are now important contributors. China, for example, became the largest single GHG emission source in 2007. While a majority of high-income countries have begun substantive multilateral climate action, emerging economies appear reluctant to be drawn into such agreements. Without their cooperation, however, it is unlikely that GHG concentrations can be stabilized.

At a fundamental level, the causes and effects of climate change represent an equity problem involving two global stakeholder groups:

Carbon Legacy Economies (CLE): Those countries responsible (mainly OECD) for the majority of atmospheric greenhouse gas stocks, who will continue to represent a significant share of future greenhouse gas flows, sometimes referred to as 'developed countries';

Carbon Emergent Economies (CEE): Those countries (e.g., China and India) who will be responsible for the majority of growth in greenhouse gas flows and an increasing share of future atmospheric greenhouse gas stocks, including those referred to as 'developing countries.'

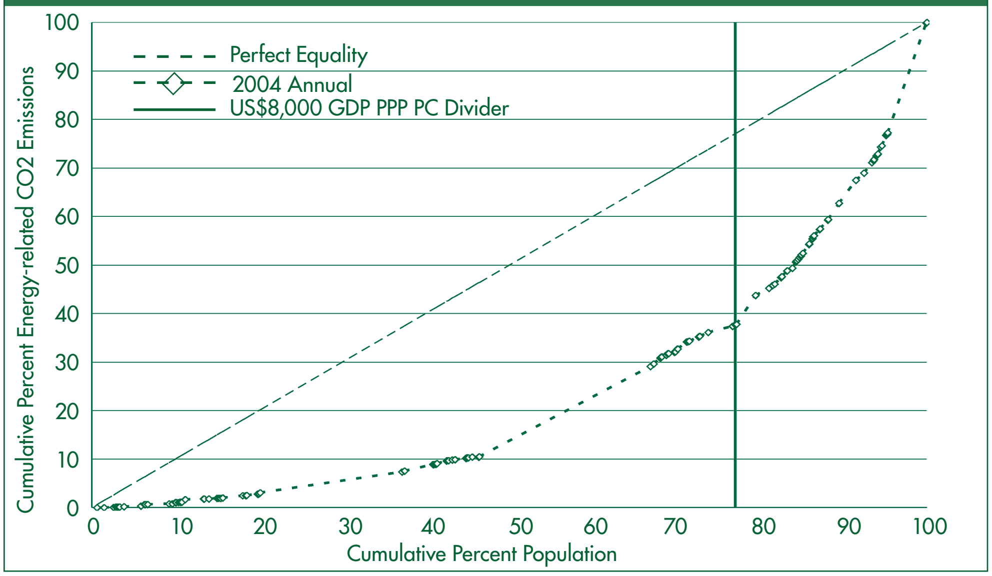
Despite mounting concern over rapid greenhouse gas emission growth in CEE countries, in this paper we argue that emissions growth will not fundamentally alter the carbon equity balance between CLE and CEE countries. Climate change is, and will continue to be, a problem caused predominantly by wealthy countries.

A useful device to visualize CLE-CEE carbon inequality is the Lorenz curve, a device used in economics to illustrate income distribution and other equity variables. In the present context, "CO2 emissions" or carbon Lorenz curves show the distribution of energy-related CO2 stocks and flows among countries on an implied per capita basis, with the cumulative percent of energy-related CO2 emissions on the y-axis and the cumulative percent of population on the x-axis, ranked by per capita income. All the Lorenz curves in this exposition use GDP per capita at purchasing power parity (PPP) to rank population along the x-axis.

Because of their per capita roots, Lorenz curves provide an important tool for considering equity in global climate negotiations. This paper elucidates the perspective of per capita emissions and incidence as logical and ethical bases for global climate policy dialogue between North and South.

Figure 1 provides an example of a CO2 emissions Lorenz curve for 2004. The 45 degree line represents the line of

Figure 1: Global Composition of Population and Energy-Related CO2 Emissions



perfect equality, where national CO2 emissions are equalized globally on a per capita basis. The area between the line of perfect equality and the actual distribution (Lorenz) curve is termed the ***Gini coefficient of inequality***, calculated using emissions levels in place of incomes.

A Gini coefficient of zero corresponds to perfect equality, while a theoretical Gini coefficient of one would indicate all emissions arise from one person.

The Gini coefficient in Figure 1 is 0.52. To put this in context, Brazil, a country with relatively high income inequality, had an income Gini coefficient of 0.54 in 2004. Another way to interpret Figure 1 is that the 77 percent of the world's population with per capita GDP PPP of less than US$8,000, accounted for 38 percent of global energy-related CO2 emissions in 2004, while the 23 percent with GDP per capita (corrected for Purchasing Power Parity) over US$8,000 accounted for 62 percent of global energy-related CO2 emissions. As a dividing line between lower and higher income countries, US$8,000 separates Romania and Costa Rica.

We use Lorenz curves to demonstrate two facts about global CO2 emissions—past, present, and future. First, from either a flow or stock perspective, carbon inequality is currently at levels that are unlikely to sustain multilateral cooperation in the absence of transfer mechanisms. Second, even with significant emissions growth in CEE countries over the next two decades, the fundamental imbalance in carbon stocks between CLE and CEE countries will not disappear.

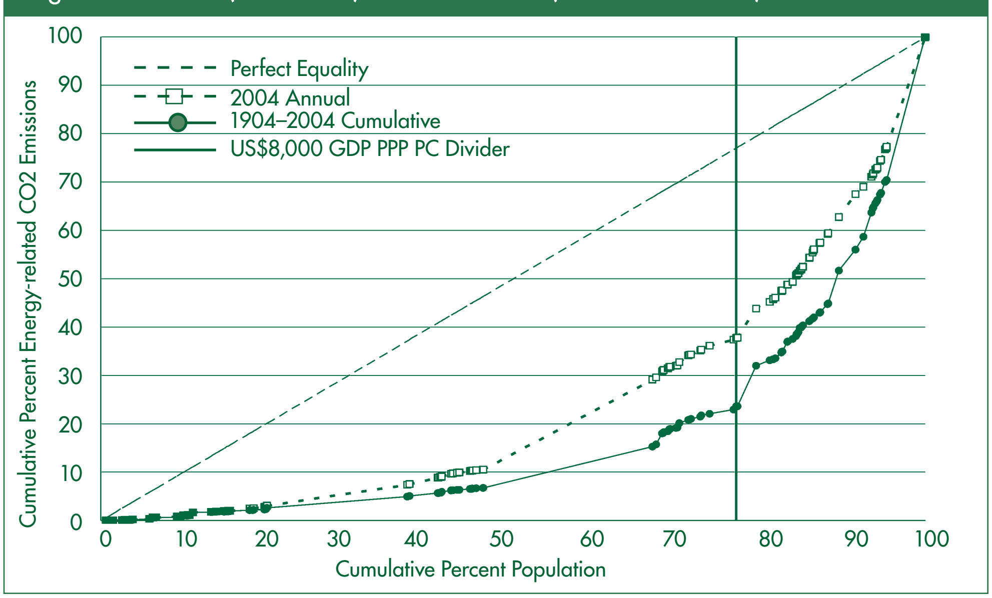
2004 CO2 Emissions and 1904–2004 Cumulative CO2 Emissions

Figure 2 shows the distribution of 2004 energy-related CO2 emissions (flows) and cumulative 1904–2004 energy-related CO2 emissions (stocks). By using a 100-year time frame for the latter, we implicitly assume a 100-year residence time for CO2 in the atmosphere. Extending emissions back this far in time likely overestimates the share of industrialized countries' emissions, given that better data on primary energy use exist in these countries. Similarly, we do not include emissions from land-use change in our Lorenz curves, which also biases them toward higher shares of emissions from industrialized countries. Nonetheless, given that climate change is driven in significant measure by the combustion of fossil fuels, Figures 2 and 3 provide a revealing perspective on the political economy of greenhouse gas emissions.

As noted previously, the 2004 annual curve has a Gini coefficient of 0.52. Note now that 1904–2004 stocks are significantly more unequal than 2004 flows, i.e., the 1904–2004 Cumulative curve has a Gini coefficient of 0.64, placing it on par with the world's most income-unequal societies. Put differently, the 77 percent of the world's population to the left of our US$8,000 dividing line contributed less than 24 percent to the world's atmospheric stock of fossil fuel CO2 emissions from 1904–2004, while 23 percent of the world's population to the right contributed more than 76 percent.

If conventional wisdom on the relationship between energy demand and economic growth is to prevail in the near

Figure 2: Current (2004 flow) and Cumulative (1904-2004 stock) CO2 Emissions



term, convergence of incomes between developing and developed countries will require significant growth in per capita energy consumption and, without changes in the world's dominant reliance on fossil fuels, significant growth of per capita CO2 emissions in developing countries.

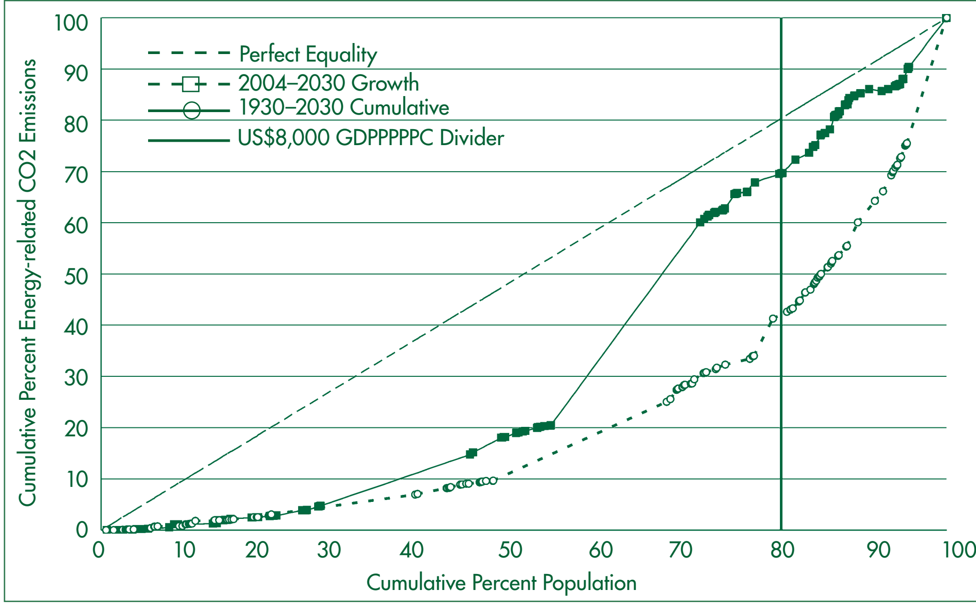
2004–2030 CO2 Emissions Growth and 1930–2030 Cumulative CO2 Emissions

Figure 3 shows the distribution of projected 2030 energy-related CO2 emissions and implied cumulative 1930–2030 energy-related CO2 emissions, using the International Energy Agency's reference scenario projections and updating cumulative emissions data to 2030. These projections are only available at an aggregate, regional level. To disaggregate regional totals by country, we assume that the national shares of 2004 regional emissions are the same as those in 2030. To calculate 2030 cumulative emissions, we assume an average, annualized growth rate in energy-related CO2 emissions from 2004–2030. For the x-axis in Figure 3, we use 2030 population projections from the United Nations, but rank these by 2004 GDP PPP per capita.

As Figure 3 illustrates, 80 percent of the world's population to the left of the US$8,000 divider accounts for nearly 70 percent of the growth in annual energy-related CO2 emissions from 2004–2030. Because much of this emissions growth occurs in the world's most populous countries—China (the nearly vertical line dominating the middle of the figure) alone is projected to account for almost 40 percent of growth in annual energy-related CO2 emissions from 2004–2030 — the Gini coefficient on the 2004–2030 Growth curve is 0.33, comparable to income inequality in northern European countries.

Despite their sizeable contribution to the growth of CO2 emission flows, rapid industrialization in developing countries will not significantly alter the balance in

Figure 3: Past and Future Cumulative Emissions



global carbon inequalities over the next two decades. The CO2 stock share of the world's upper-income quintile (countries representing the 20 percent of the world's population to the right of the US$8,000 divider) falls from roughly 76 over 1904–2004 to 66 percent over 1930–2030. Because of its shrinking share of global population and the persistence of atmospheric carbon stocks, the 1930–2030 Cumulative curve Gini coefficient falls by only four percentage points (0.60) vis-à-vis the 1904–2004 Cumulative curve coefficient (0.64). In other words, rapid growth in fossil fuel CO2 emissions in CEE countries will not alter the fundamental imbalances in carbon stocks that divide CLE and CEE countries.

Conclusion

International economic disparities are widely perceived as an obstacle to international conventions to reduce greenhouse gas emissions. Carbon Legacy Economies frequently exhort Carbon Emergent Economies to be more aggressive on climate action, while the latter defer on the grounds of growth opportunity cost. This paper presents new evidence regarding the equity problem that underlies this debate. When viewed on a per capita basis, global GHG emissions are distributed very unequally, a fact that undermines the moral authority of high-income economies to advocate mitigation in low-income countries without some transfer or other incentive mechanism. A second important finding is how limited is the capacity of Carbon Emergent Economies to alter the GHG stock imbalances represented by legacy emissions that are largely due to the high-income economies. This conjunction of environmental and economic evidence has profound implications for global climate negotiations.

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Sources for Figures 1–3: Population, GDP PPP, and 2004 energy-related CO2 emissions data are from the International Energy Agency and World Resources Institute.

For Further Reading

Agarwal, A. and Narain, S., 1991, Global Warming in an Unequal World: A Case of Environmental Colonialism. Center for Science and Environment, New Dehli.

International Energy Agency (IEA), 2006b, World Energy Outlook. IEA, Paris.