Press Release
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New research shows carbon emissions no longer support human development after a point

Once countries reach a certain level of human development, more carbon emissions no longer improve well-being, new study finds. The authors propose a new classification of countries to make climate policy more equitable.

A new study led by Professors François Gemenne of HEC Paris Business School, Thomas Porcher and Raphaël-Homayoun Boroumanda (Paris School of Business), Antoine Giraldi (School of Engineering and Architecture, University of Applied Sciences Western Switzerland) and Simon Porcher (Paris Dauphine University) highlights a pattern in the global relationship between carbon emissions and human development, identified as the "**Champagne Curve**".

Drawing on data from 119 countries and published last month in *Applied Economics Letters*, the research reveals **how CO_2 emissions per capita tend to increase as countries develop, but only up to a point. Once a country reaches a high level of development, further emissions no longer translate into gains in well-being (life expectancy, education, income).**

The researchers used the Human Development Index (HDI) to explore this relationship, finding that countries with low HDI scores (below 0.6) emit similar levels of carbon per person. In contrast, those with HDI scores above 0.8 exhibit wide disparities in emissions without a corresponding improvement in quality of life.

"*The 'Champagne Curve' challenges the assumption that development must come at the cost of the environment,*" said Professor Gemenne. "*Our findings show that beyond a certain threshold, more carbon consumption no longer translates into better lives. This means that developed countries can reduce emissions without compromising quality of life, a crucial insight for climate policy.*"

To help design more tailored climate strategies, the authors propose grouping countries into three categories based on their transformation capacity- that is, their ability to cut emissions

without undermining human development. Countries with advanced capacity (HDI above 0.8) have the financial, technological, and institutional means to decouple emissions from well-being. Those with moderate capacity (HDI between 0.6 and 0.8) are often navigating a trade-off between economic growth and sustainability. Limited-capacity countries (HDI below 0.6) still rely heavily on industrial expansion to improve basic living conditions, making emission cuts more difficult without international support.

To illustrate this, the study highlights three representative cases. Switzerland, with an HDI above 0.9, demonstrates an advanced transformation capacity: despite high living standards, it has significantly reduced its consumption-based CO2 emissions in recent years. Costa Rica, categorized as having moderate transformation capacity, balances rising human development with targeted investments in renewable energy, yet still faces trade-offs due to industrial reliance. Meanwhile, Nigeria, classified as having limited transformation capacity, shows relatively uniform per capita emissions tied to basic infrastructure and industrialization, making emission cuts more difficult without external support. These contrasting paths underline the importance of differentiated climate strategies adapted to each country's stage of development and potential for transition.

This framework, they argue, could support more equitable approaches to emissions reduction and ease tensions in international negotiations.

While many studies have examined the link between pollution and economic growth, fewer have explored how pollution affects human development. The authors suggest their classification could guide sustainable development strategies aligned with the Paris Agreement, while helping ensure that lower-income countries are not held back in the transition.

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