

# Carbon pricing works, major meta-study finds

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Between 5 and 21% emission reductions: this is the empirically measured effect of carbon pricing systems in their first few years of operation. A research team now identifies these findings for 17 real-

world climate policies around the globe, condensing the state of knowledge more comprehensively than ever. The team uses artificial intelligence to collate existing surveys, making them comparable using a novel calculation concept.

The major meta-study was led by the Berlin-based climate research institute MCC (Mercator Research Institute on Global Commons and Climate Change) and [published](#) in the journal *Nature Communications*.

"This research can help set to rights the debate on the fundamental orientation of climate policy," says Ottmar Edenhofer, Director of MCC and a co-author of the study.

"Politicians have repeatedly questioned the efficiency of curbing greenhouse gas emissions through pricing, and often focus excessively on bans and regulation instead. A policy mix is certainly needed as a rule, but the conflict of beliefs over the optimal core instrument of climate policy can be resolved with facts."

The starting point of the meta-study is a laboratory experiment-type question: how did emissions change after the start of [carbon pricing](#), relative to a simulated business-as-usual scenario?

Using a keyword search in literature databases, the research team identified almost 17,000 potentially useful studies and then painstakingly—and with support of machine learning methods—narrowed them down to 80 that were genuinely relevant to this question.

These included 35 studies on pilot systems in China alone, 13 on EU [emissions trading](#), 7 and 5 on the larger pilot systems in British Columbia in Canada and the "Regional Greenhouse Gas Initiative" in the U.S., respectively, as well as studies on other systems in Australia,

Canada, Finland, Japan, Sweden, Switzerland, South Korea, the UK and the U.S.. Prior to this, the largest meta-study comprised just under half as many studies.

In a second step, key data was extracted from the surveys including statistical indicators on the effect of the carbon pricing launch, the type of implementation (tax or emissions trading), the scope and timing of the introduction, and the observation period, which varied by survey. In the meta-study, these measurements are standardized and thus made comparable.

In addition, the results are corrected for weaknesses in the primary surveys, such as a design that deviates from the standard setting of a laboratory experiment or the tendency to only publish statistically significant effects and ignore mini-effects. The research team is making the specially developed calculation concept publicly available, emphasizing that it is also suitable as a framework for future use, so that the effect on emissions can be continuously updated in the context of more comprehensive and higher carbon pricing.

To date, the [empirical data](#) shows, among other things, that the introduction of carbon pricing in some Chinese provinces has had an above-average effect on the emissions balance. In general, the effect tends to be particularly increased by an offensive policy design ("announcement effect") and a favorable environment (low CO<sub>2</sub> avoidance costs).

By contrast, the issue of whether carbon pricing is realized via emissions trading or a tax is less significant in the findings than it is in the [political debate](#), according to the research team.

The meta-study also highlights the need for further empirical research on this topic. "The emissions impacts of more than 50 further carbon

pricing systems have not yet been scientifically evaluated," reports Niklas Döbbeling-Hildebrandt, Ph.D. student in the MCC working group Applied Sustainability Science and lead author.

"Also, the recent significant rise in carbon prices has not yet been taken into account. Our systematic literature review furthermore highlights the potential for methodological improvement for precise and bias-free surveys.

"New standards and further fieldwork in this area are therefore important. Comprehensive and meaningful research syntheses are needed, including on the effectiveness of other policy instruments, so that climate policymakers know what works."

**More information:** Niklas Döbbeling-Hildebrandt et al, Systematic review and meta-analysis of ex-post evaluations on the effectiveness of carbon pricing, *Nature Communications* (2024). [DOI: 10.1038/s41467-024-48512-w](https://doi.org/10.1038/s41467-024-48512-w)

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