Vehicle fuel economy standards as global climate policy: How much can they deliver and at what cost?

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Higher fuel economy standards may enable fewer trips to the gas pump, but they are not as cost-effective as carbon pricing in reducing carbon dioxide emissions. Credit: Upupa4me/Flickr

Over the past decade, many countries and regions seeking to reduce climate-warming carbon dioxide emissions have adopted more aggressive fuel economy standards designed to boost the efficiency of new, light-duty cars and trucks. Economists, however, generally argue that a more cost-effective way to reduce CO2 emissions is to price carbon through a system such as cap-and-trade, in which emitters across all sectors of the economy pay for each ton of CO2 they put into the atmosphere. Impacts of these two approaches have been previously compared on a national and regional level, but until now, have not been evaluated on a global scale.

To fill this gap, researchers at the MIT Joint Program on the Science and Policy of Global Change have compared the worldwide economic, environmental, and energy impacts of currently planned fuel economy standards (extended to the year 2050) with those of region-specific carbon prices designed to yield identical CO2 emissions reductions. Their study, which appears in the *Journal of Transport Economics and Policy*, shows that such stringent fuel economy standards would cost the economy 10 percent of global gross domestic product (GDP) in 2050, compared with only 6 percent under carbon pricing.

This finding reinforces economists' contention that improving the efficiency of motor vehicles through fuel economy standards will yield significantly less CO2 emissions reduction per dollar than an economy-wide instrument that encourages such cutbacks where they are cheapest—principally in the electric power and industrial sectors. But the fuel economy standards modeled in the study did prove beneficial in terms of fuel consumption: They reduced fuel used in passenger vehicles by 47 percent relative to a no-policy scenario in 2050, versus only 6 percent under carbon pricing.

"Many developed countries are choosing very expensive ways to reduce CO2 emissions, but if that's a top priority, they should go with a price on

carbon," says the study's lead author Valerie Karplus, assistant professor of global economics and management at the MIT Sloan School of Management. "If they're more focused on energy independence, fuel economy standards can deliver, but a tax on gasoline would be more cost-effective."

"The new paper by Professor Karplus and her colleagues provides important new insights into the role of efforts by nations around the world to reduce petroleum use and greenhouse gas emissions from the transportation sector," says Jonathan Rubin, a professor at the Margaret Chase Smith Policy Center and School of Economics at the University of Maine. "The research shows that the often-used policy of requiring fuel economy improvements, while capable of reducing petroleum use, is significantly more expensive than other, economy-wide options which are more cost-effective at reducing greenhouse gas emissions."

Capturing the interwoven responses of a global economy

To arrive at their findings, the researchers used the MIT Emissions Prediction and Policy Analysis (EPPA) model to simulate the impact of fuel economy and carbon pricing policies. The fuel economy scenario simulated the impacts of extending current fuel economy mandates past their expiration dates through 2050. The carbon pricing scenario consisted of a patchwork of national and regional cap-and-trade policies designed to achieve the same CO2 emissions reductions by 2050 as the fuel economy standards produced in each market.

An important feature of the study was its ability to capture, via the EPPA model, two major effects of national and regional fuel economy standards: rebound and leakage. Adoption of more fuel-efficient vehicles, by decreasing fuel demand, also reduces the per-mile price of fuel as supply and demand balance in the market. This price reduction can lead to more driving in the market covered by the policy—known as

the rebound effect—as well as in sectors and regions not covered by the policy—known as the leakage effect—because globally interlinked fuel markets cause prices to fall worldwide.

"What makes our study unique is that we used a global model that captures market linkages around the world, rather than within a single nation, region or sector," says Karplus.

Modeling new technologies and behaviors

The model simulates not only rebound and leakage effects, but also the gradual adoption of new, more expensive vehicles and retirement of old ones; how vehicle owners navigate the tradeoff between using more fuel and purchasing a more efficient vehicle; the relationship between changes in household income and vehicle usage behavior; and the adoption of off-the-shelf and advanced, low-carbon technologies that increase miles per gallon.

The study also determined that by 2050, currently planned fuel economy standards would reduce CO2 emissions by about 4 percent relative to a no-policy scenario. Extending these standards past their deadlines through 2050 would decrease emissions by an additional 6 percent. These relatively modest reductions would come at a high cost.

Although it may be politically easier to repurpose or replicate commonly applied fuel economy standards to reduce CO2 emissions, this analysis suggests that a coordinated approach that includes a price on CO2 will be far more effective at achieving this goal.

More information: The Global Energy, CO2 Emissions, and Economic Impact of Vehicle Fuel Economy Standards, *Journal of Transport Economics and Policy* (*JTEP*), Volume 49, Number 4, October 2015, pp. 517-538(22) www.ingentaconnect.com/content …

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