



By Robert N. Stavins

Repairing the R&D Market Failure

It has long been recognized that although carbon-pricing — whether carbon taxes or cap-and-trade — will be a necessary part of a meaningful national climate policy, it will not be sufficient on its own. Policies intended to foster climate-friendly technology research and development will also be necessary, but likewise will not be sufficient on their own.

Some recent press accounts have identified these two approaches to addressing CO₂ emissions as substitutes, rather than complements. That is fundamentally inconsistent with decades of research, and so my purpose is to set the record straight.

Why is there so much talk among policy analysts and policymakers about carbon pricing as the core of a meaningful strategy to reduce CO₂ emissions? The answer is simple and surprisingly pragmatic.

First, there is no other feasible approach that can provide meaningful emissions reductions, such as the 80 percent cut in national CO₂ emissions by 2050 that was part of the legislation passed by the House of Representatives and became part of the Obama administration's conditional pledge under the Copenhagen Accord. Because of the ubiquity and diversity of energy use in a modern economy, conventional regulatory approaches — standards of various kinds — simply cannot do the job. Only carbon pricing can significantly

tilt in a climate-friendly direction the millions of decentralized decisions that are made in our economy every day.

Second, carbon-pricing is the least costly approach in the short term, because abatement costs are exceptionally heterogeneous across sources. Only carbon-pricing provides strong incentives that push all sources to control at the same marginal abatement cost, thereby achieving a given aggregate target at the lowest possible cost.

Third, it is the least costly approach in the long term, because it provides incentives for carbon-friendly technological change, which brings down costs over time.

For these reasons, carbon-pricing is a necessary component of a truly meaningful national climate policy. However, although it is a necessary policy component, carbon-pricing is not sufficient on its own. This is because there are other market failures that dilute the impacts of price signals on decision makers.

The most important of these “other” market failures is the public good nature of information. Companies carrying out R&D incur the full costs of their efforts, but they do not capture the full benefits. This is because even with a perfectly enforced system of intellectual property rights (such as patents), there are tremendous spillover benefits to other firms. Decades of economic research — much of it by my former colleague and co-author, Professor Adam Jaffe, now Dean of Arts and Sciences at Brandeis University — has analyzed with empirical analysis the remarkable degree to which inventions and innovations by one firm provide valuable information that leads to new inventions and innovations by other firms.

So, firms pay the costs of their R&D, but do not reap all the benefits. The existence of this positive externality of firms' R&D — or put differently, the public-good nature of the information generated by R&D — means that the private sector will carry out less

than the “efficient” amount of R&D of new climate-friendly technologies in response to given carbon prices. Hence, other public policies are needed to address this “R&D market failure.”

New path-breaking technologies will be needed to address climate change, and public support for private-sector or public-sector R&D will be crucial to meet this need. But, at the same time, to address the climate-change market failure itself (that is, the externality associated with greenhouse gas emissions), carbon-pricing will be necessary, for all of the reasons I gave above. This is an application of an important and fundamental principle in economics: two market failures require the use of two policy instruments.

Empirical analyses have repeatedly verified the crucial point that combining carbon-pricing with R&D support is more cost-effective than adopting either approach alone.

Included have been studies by Carolyn Fischer (Resources for the Future) and Richard Newell (U.S. Energy Information Administration, on leave from

Although it is necessary, carbon pricing is not sufficient alone

Duke University); Stephen Schneider (late of Stanford University) and Lawrence Goulder (Stanford University); Daren Acemoglu (MIT), Philippe Aghion, Leonardo Burszty, and David Hemous (Harvard University); Terry Dinan (U.S. Congressional Budget Office); and David Hart and Kadri Kallas (MIT).

Carbon-pricing will be an essential part of any truly meaningful national climate policy. Likewise, to address the R&D market failure, direct technology innovation policies will also be required. Both are necessary. Neither is sufficient.

Robert N. Stavins is the Albert Pratt Professor of Business and Government at the John F. Kennedy School of Government, Harvard University, and Director of the Harvard Environmental Economics Program. He can be reached at robert_stavins@harvard.edu.