Is Cap-and-Trade or Carbon Tax Better for Business?

Emissions regulation is fraught with uncertainty owing to the complexity of the business environment.

Economists and business leaders are united in preferring carbon pricing schemes to more draconian emissions-reduction alternatives such as mandated use of "clean" technologies. Using price as a lever enables consumers and companies to absorb the financial burden in their own way. However, experts are divided on the question of which of the two main types of carbon pricing – carbon tax and cap-and-trade – works best.

A carbon tax system, as the name implies, forces companies to pay a fixed fee per ton of greenhouse gas emissions (GHG). Cap-and-trade involves setting an economy-wide emissions limit (for those sectors under regulation), and issuing (or auctioning off) emissions permits to companies that can then be sold on secondary markets, providing financial incentives for emitters to convert to sustainable technologies. Conventional wisdom holds that cap-and-trade is more costly for business in the long run, since fluctuation in permit demand results in high uncertainty in permit prices. The debate continues amid China's preparations to launch a **national carbon trading programme**, in line with the Obama administration's sweeping **Clean Power Plan** (currently caught in political limbo).

But cap-and-trade's prevailing uncertainty turns out to be a blessing in disguise for both business and the environment, as we show in the paper "**Technology Choice and Capacity Portfolios Under Emissions Regulation**" (co-written by the late Paul R. Kleindorfer), recently published in *Production and Operations Management*. Compared to outcomes under carbon taxation, cap-and-trade emerges as the clear best choice in our analysis.

Double uncertainty

After consulting with a number of executives from various sectors exposed to emissions regulation , we developed a two-stage, stochastic model incorporating two important facets of the problem – first, in choosing between "clean" and "dirty" technologies, firms are not limited to employing a single technology in their capacity "portfolio" but can incorporate some of each technology; second, firms make capacity investments under demand uncertainty that is resolved by the time of actual production (under cap-and-trade, as noted above, there is emissions price uncertainty as well).

Using figures gleaned from our field research, as well as publicly available sources, we constructed a test case of a cement manufacturer selecting between investing in standard kilns and kilns equipped with the more environmentally friendly CCS (carbon capture and storage) technology. (It is estimated that the cement industry is responsible for up to five percent of global carbon emissions.)

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Plugging the real-world data into our model produced surprising results, namely that total profits were greater under cap-and-trade. This occurred not despite the added uncertainty but actually because of it – with cap-and-trade, firms could make a strategic decision not to serve demand if emissions prices were too high, or to deploy its most profitable technologies given the current price environment. For example, a cement company could choose to shift production outside the emissions-regulated territory, or over-produce during low-price periods and hold the surplus in reserve in anticipation of future price hikes.

True, cap-and-trade proved only minimally more profitable, because the probability that the firm would leave demand unmet was small. Still, our findings fly in the face of the consensus view that carbon taxes are unequivocally better for business.

Emissions differences

Additionally, our experiment showed that emissions were 11.7 percent lower under the cap-and-trade scenario. This was partly due to lower production volume overall, but the bulk of the difference stemmed from the firm's technology choice, with greater adoption of the cleaner CCS technology under cap-and-trade than under the carbon tax setting. Here, we again break with consensus, which holds that the cost certainty of carbon taxes incentivizes greater investment in clean technology.

Mixed portfolios

There were more interesting findings related to the sometimes counter-intuitive second-order effects occurring within capacity portfolios as a whole. For instance, steps to reduce the environmental impact of "dirty" technologies can lead to more overall pollution, not less, as these well-intended improvements can lead to reduced adoption of truly green options within the portfolio.

Policy-makers should also be aware that in situations where clean technologies are more expensive than conventional methods, clean technology subsidies could actually lead to increased emissions potential. This finding applies to investment rather than production subsidies, because making clean technology a lower-risk investment results in increased capacity on the whole. If the increase in overall capacity exceeds the decrease in emissions intensity achieved by substituting dirty technologies with clean ones, the investment subsidy could backfire. The mechanism here can be likened to eating a super-sized portion of a low-calorie snack. Binging on clean technology can pollute the environment just as easily as using 20th-century technology.

When policy-makers consider the impact of clean technology subsidies on emissions, they mostly do not distinguish between production and investment subsidies. We conclude, however, that the two varieties differ in their impact. Production subsidies reduce operation costs; investment subsidies lessen risk – which can be more ambiguous, due to the complexities of managing mixed technology portfolios in an uncertain market environment.

The need for diverse feedback

Setting effective regulations within such an ambiguous environment requires a less atomised approach than most policy-makers are currently comfortable with. Regulators should start assimilating input from a more diverse group of stakeholders before committing to policy.

For the industries most affected by emissions regulation, the stakes could not be higher. Cement executives reported to us that they expect production costs to increase by 40 percent, once the EU's full auctioning scheme under cap-and-trade comes into effect by 2020. Our research backs up their predictions, with nearly 50 percent of the sector's profits expected to erode as a direct result of emissions regulation, according to our calculations. The EU seems to have made a good decision in choosing a cap-and-trade scheme over carbon taxation. However, institutional policies can have unforeseen and even irrational knock-on effects. If mishandled, regulation could adversely affect European competitiveness, while failing to meet its environmental targets.

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