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RESEARCH BRIEF

Abatement Strategies and the Cost of Environmental Regulation: Emission Standards on the European Car Market

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Emission standards are one of the primary policy tools used to reduce CO_2 emissions in the passenger vehicle market. Emission standards set mandatory limits on average emission rates (or fuel economy) across the fleet. The US implemented the Corporate Average Fuel Economy Standard (CAFE) in 1975, and today emission standards are in place from China to Mexico. This paper studies the 2015 introduction of an EU-wide emission standard to understand the effects of emission standards for consumers, firms, and the environment.

The EU emission standard aimed to reduce CO_2 emissions from passenger cars by 18%. The emission standard is very demanding: each firm has to reduce its average emission across yearly sales to 130 g CO_2/km. For comparison, the US CAFE standard required only 152 g CO_2/km in 2016. The EU standard is an attribute-based regulation; the policy target not only depends on CO_2 emission but also vehicle weight. The attribute basing makes the policy target less stringent for firms producing heavier vehicles. The EU announced the standard in 2007, and it became binding in 2015.

Evaluating the impact of emission standards is not an easy task. Firms can choose between different strategies to reduce emissions. The first strategy is to change pricing to shift the sales mix to vehicles with CO_2 emissions below the target. The second strategy is downsizing. Firms can sell smaller and less powerful vehicles that are more fuel-efficient. The third strategy is technology adoption. Firms can improve the fuel-efficiency of their vehicle fleet by adopting technologies that improve the combustion process. A fourth strategy is gaming. To establish emission ratings, the regulator requires that vehicles go through a test procedure. Firms reduce emissions during the test procedure but not necessarily on the road. Enforcement of the emission standard plays a role in limiting gaming.

In a first step, this paper explains the trend in sales-weighted official CO_2 emissions between 1998

and 2011 in the EU market. I find that official emissions, as measured during the test, reduce by 14% after the policy announcement. Price changes or the introduction of smaller vehicles do not explain the decrease in emissions. Instead, the results reveal that technological progress is twice as fast after the regulatory announcement. Firms respond to emission standards by increasing the speed of technology adoption, at least when we look at the official emission ratings. When we study the performance of vehicles on the road, the picture changes drastically. I find that only 30% of the increased technology adoption is measurable on the road so that 70% is attributable to gaming.

Next, the paper sets up an economic model of demand and supply to study the impact of the regulation on consumers, firms, and the environment. Firms' costs increase because of technology adoption. The increase in costs reduces profits and lowers consumer surplus. Because of the gaming, the reductions in actual CO_2 emissions are a mere 5% instead of the 18% target. The sum of the value of emission savings and consumer and profit losses is negative so that the regulation reduces welfare. However, when I consider two additional non-targeted welfare effects, I find the emission standard to have a small positive impact. The emission standard also reduces other externalities, such as local pollution, congestion, and accident risk. And, there is a correction of consumer undervaluation of fuel economy.

The economic model also allows studying how the market outcomes differ if the EU designed the regulation differently. I focus on two aspects: the attribute base of the standard and the lack of enforcement.

First, I study the attribute basing, which makes the emission target dependent on vehicle weight. Firms selling more lightweight vehicles face a more stringent attribute-based target. I find that attribute basing makes it much costlier to lower emission by changing prices. Firms have to distort prices more to reach the target because there are fewer vehicles to which firms can shift sales. If the regulation has a flat target without attribute basing, firms opt for changing prices together with some technology adoption. The flat target reaches actual CO_2 emission reductions of 11%, much closer to the 18% target. Why, then, was the attribute basing introduced? The attribute basing redistributes the incidence of the regulation between French, Italian, and German producers. The simulations show that the positions of the national governments are in line with the interests of their domestic firms. The French and Italian governments were in favor of regulation without attribute basing, while Germany lobbied for a steep attribute design.

Gaming is also a product of the political environment. A recent evaluation by the European Parliament has placed responsibility for enforcement failures with the car producing member states. The economic model in this paper allows computing the effects of better enforcement. A better test procedure would mean that official and actual emissions are more similar. With more enforcement, the reductions in consumer surplus and profits are higher. Firms have to adopt costlier technology, and this increases prices further. But enforcement would have led to much higher CO_2 and other externality savings, and the policy would have been welfare improving. Overall, this shows that the political and practical implementation of emission standards is crucial to understand the welfare consequences of these types of policies.

References

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Mathias Reynaert is an assistant professor of economics at the Toulouse School of Economics, France. He was a visiting scholar at MIT CEEPR in the spring and summer of 2019. His fields of interest are empirical industrial organization and environmental economics.