Measuring Fuel Economy and Emissions in the Wake of the VW Diesel Scandal

A Look at US and EU Approaches

Historically, US and EU approaches to regulation have diverged, a trend that continues as the two regions respond to Volkswagen's high-profile rigging of emissions tests.

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In September 2015, Volkswagen admitted to programming nearly 11 million vehicles —affecting the company's Volkswagen, Audi, and Porche diesel models—to cheat on tailpipe emissions tests. The fallout included a historic $15.3 billion settlement with consumers and regulators in the United States, affecting roughly 475,000 two-liter cars; a plunge in the company's market capitalization; and the threat of criminal charges. (The US regulator recently rejected VW's proposed fix for 85,000 three-liter engine cars sold in the United States.)

The scandal also affected the way regulators in the United States and the European Union approach fuel economy and vehicle emissions regulations, with different responses between the two regions. In the United States, the US Environmental Protection Agency (EPA) has responded by tightening emissions testing procedures, whereas EU regulators are providing manufacturers more time to adjust to tighter standards. More broadly, comparing the regulatory approaches and procedures between the two markets shows not only that regulatory requirements can differ across markets but also that they can influence the choice of vehicle engines and fuels—in turn affecting the outcomes of environmental policy.

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For example, the diesel engine is a distinctly European approach to reducing vehicle carbon dioxide (CO_2) emissions. Compared with gasoline, diesel provides greater fuel economy, resulting in lower greenhouse gas and CO_2 emissions. Yet, relative to gasoline engines, diesel engines also tend to emit more nitrogen oxides and particulate matter, which contribute to the formation of smog. When Volkswagen's "clean diesel" strategy meant that some of its engines couldn't meet the stringent US tailpipe emissions rules without sacrificing performance, the company installed a device to circumvent lab tests without affecting performance.

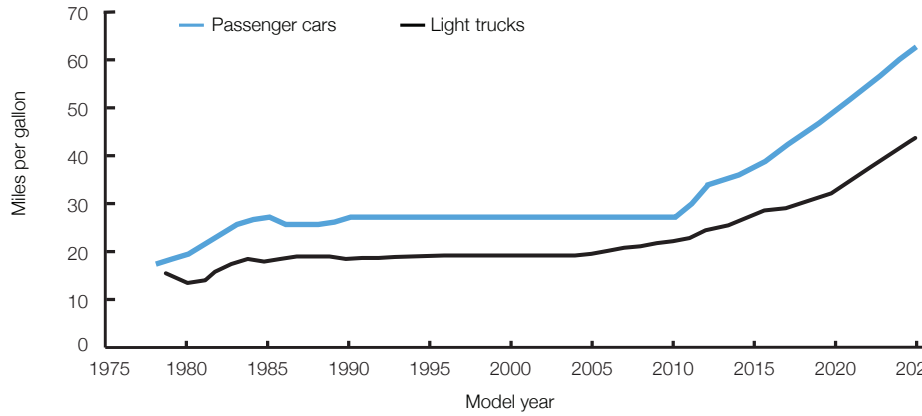
The scandal will likely have broader implications for the regulation of vehicle fuel economy, greenhouse gas emissions, and emissions of other pollutants. In particular, some have suggested giving more weight to real-world testing of vehicles—that is, measuring emissions and fuel consumption from vehicles while on the road, possibly over their lifetimes and not just at the time of certification.

Background on US Regulations

Well after particulate emissions were first addressed in the 1950s and 1960s, vehicle fuel economy became an important subject in the United States during the 1970s, when oil prices spiked multiple times. Congress enacted national corporate average fuel economy (CAFE) standards in 1975, requiring manufacturers to roughly double fuel economy by 1985, to 27.5 miles per gallon (mpg) for cars and to 19.5 mpg for light trucks. Fuel economy standards were tightened again in 2007, to an average of 35.5 mpg for cars and light trucks, to be achieved by 2016. In 2011, a new target of 54.5 mpg was set, to be met by 2025 (see Figure 1).

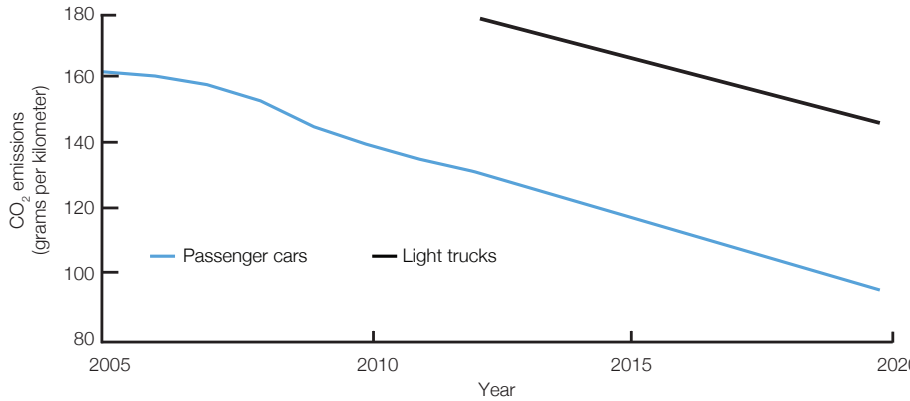
The rules for implementing fuel economy standards changed during the second CAFE regime, which began in 2007. The compliance mechanism has since been refined, and manufacturers now face standards that for both cars and light trucks are defined by the footprint of their vehicles (roughly the rectangle defined by the four wheels). Consequently, automakers that sell larger vehicles are subject to lower fuel economy requirements. According to research by RFF Fellow Benjamin Leard and colleagues, this relationship between a vehicle's footprint and its fuel economy requirement, along with the recent decline in gasoline prices (which caused consumers to shift toward larger vehicles), has slightly reduced the overall level of fuel economy required by the standards.

Figure 1. US Fuel Economy Standards



Source: McConville, Drew. 2012. What the New Fuel Economy Standards Mean for You. The White House Blog, *August 30.*

Figure 2. European Fuel Economy Standards



Source: International Council on Clean Transportation. 2014. EU CO_2 Emission Standards for Passenger Cars and Light-Commercial Vehicles. Policy update.

Background on EU Regulations

In the European Union, the regulatory goals of emissions and fuel economy were addressed in reverse order: fuel consumption came first. Numerous EU countries responded to the oil shocks of the 1970s by substantially raising fuel taxes to reduce fuel consumption. To this day, EU fuel taxes are much higher than those in the United States. Moreover, many EU countries decided to tax diesel at a lower rate than gasoline. Partly because of this favorable tax treatment, diesel's share among passenger cars in western Europe rose substantially, from 14 percent in 1990 to 52 percent in 2015, reducing fuel consumption.

In 1998, the European Commission reached an agreement with vehicle manufacturers to reduce CO_2 emissions by 25 percent by 2008, to 140 grams of CO_2 per kilometer (gCO_2/km, or about 40 mpg, which was more stringent than the US CAFE standards at the time). A mandatory requirement, backed by fines for noncompliance, was implemented in 2009; it set a level of 130 gCO_2/km to be met by 2015. Further tightening of regulations took place in 2012, including standards for light commercial vehicles. Passenger cars need to meet a CO_2 emissions target of 95 g/km (57.9 mpg) by 2021, and for light commercial vehicles it is 147 g/km (43.3 mpg) by 2020 (see Figure 2). Whereas the US standards depend on a vehicle's footprint, EU standards depend on its weight; heavier vehicles are subject to a higher CO_2 emissions (and lower fuel economy) requirement.

Compared with the United States, the European Union came late to regulating vehicle emissions of local air pollutants. It started with the Euro 1 requirements, which set nitrogen oxides emissions limits to 0.78 g/km in 1992. Catalytic converters were required in new cars in the European Union at the beginning of the 1990s, and the sale of leaded fuel was largely prohibited across the region by 2000.

The United States was ahead of the European Union by a decade on both counts. In the United States catalytic converters were ubiquitous in new cars by the early 1990s and leaded gasoline was nearly phased out entirely by 1990.

Currently the Euro 6 emissions rules are being implemented in Europe. These require emissions of nitrogen oxides in 2017 to be 90 percent below 1992 levels. Yet the new European emissions standards are less stringent than current US standards.

The Role of Compliance Tests

The large number of vehicles on the road makes direct measurement of emissions impractical. Instead, vehicle manufacturers play a key role in testing and reporting emissions. Each model year, new vehicles are tested in a laboratory where they are subjected to standardized protocols to be certified for sale. But the outcomes of those tests do not necessarily reflect real-life driving conditions.

In response, EPA adjusts the lab-based fuel economy ratings of vehicles so that the information communicated to US consumers better reflects actual driving conditions. Typically, the adjustment reduces the lab test results by about 20 percent, meaning that EPA estimates that the testing understates real-life fuel consumption. In addition, EPA conducts on-road testing of vehicles, both at low mileage (at least 10,000 miles) and at high mileage (more than 50,000 miles).

In the European Union, regulators pursue a similar testing approach, but EU tests tend to be less restrictive and currently do not include in-use testing. There is also evidence that the gap between the reported lab tests and real-world emissions has been growing. For example, the International Council on Clean Transportation (ICCT) reports a remarkable increase in the divergence between real-world and official CO_2 emissions values in the European Union from about 8 percent in 2001 to 40 percent in 2014. ICCT attributes the growing gap to manufacturers' more widespread exploitation of tolerances and flexibilities in test procedures to meet rising fuel economy requirements. Another study, also based on on-road testing, finds the average level of nitrogen oxides emissions from vehicles in the European Union to be seven times the certified Euro 6 emissions limit.

In the United States, several manufacturers recently have been fined for reporting incorrect testing data. For example, Hyundai and Kia were fined for overstating the fuel economy on the majority of their 2012 and 2013 model year vehicles sold in the United States, and Ford had to restate the fuel economy of one of its hybrid vehicles in 2013.

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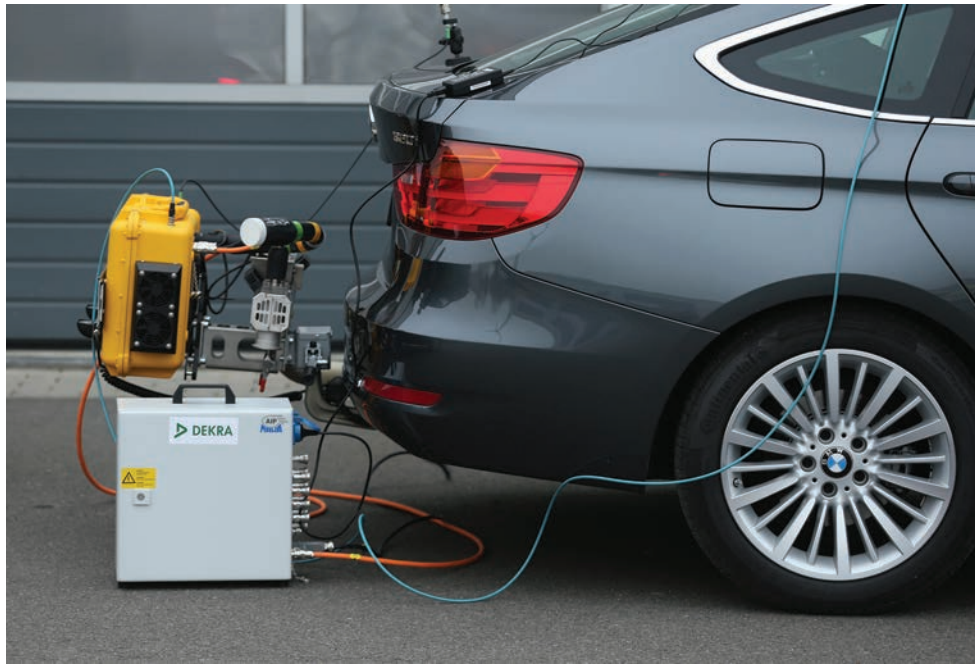
The recent Volkswagen scandal dwarfs these previous cases, both in terms of lost sales for the offending company and in potential fines. In the 12 months prior to September 2015, diesel vehicles represented more than 13 percent of Volkswagen's US sales. The company has since been prohibited from selling any diesel vehicles in the United States. In response to the VW diesel scandal, analysts have suggested giving more weight to the testing of vehicles under real-world driving conditions to make emissions testing more meaningful.

Longer-Term Implications of the Volkswagen Scandal

Following Volkswagen's admission of circumventing emissions requirements, discussions have taken place on both sides of the Atlantic regarding test improvements to address the gap between lab-based test values and real-world observations. The different responses by US and EU regulators to the Volkswagen case thus far have partly arisen because of the European Union's greater reliance on diesel technology. In the United States, EPA has changed its



emissions certification procedure, adding several tests and more time to the process. In contrast, EU officials weakened the testing framework in response to widespread noncompliance with emissions standards in order to provide more time for the auto industry to adjust to the Euro 6 standards before those are fully applied. Accordingly, manufacturers will be allowed to exceed the nitrogen oxides emissions standard under real-world driving conditions by 110 percent between September 2017 and the start of 2020, and by 50 percent afterward.

Looking ahead, decisions about how to address environmental challenges will depend on local conditions and public sensitivities. For example, recent occurrences of smog in London and Paris may well have shifted the policy discussion in the European Union regarding the future role of diesel. In the United States, prior to the VW scandal, diesel fuel vehicles accounted for a small but growing share of the overall market. Whether more reliable testing or reputational damage affects the prospects of diesel vehicles over the long term, in either region, is an open question. However, if diesel's market share were to fall, the auto industry's reliance on other technologies, such as hybrid and plug-in electric powertrains, would likely rise to meet the increasingly stringent greenhouse gas emissions and fuel economy standards. ●

FURTHER READING

Klier, Thomas, and Joshua Linn. 2016. Comparing US and EU Approaches to Regulating Automotive Emissions and Fuel Economy. Policy brief 16-03. Washington, DC: RFF.

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