Environmental Policies for the Light Duty Vehicle Sector in the US: An Up to Date Modeling Approach

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Overview

In 2012, the US Environmental Protection Agency (EPA) and US Department of Transportation (DoT) released coordinated Corporate Average Fuel Economy (CAFE) and Greenhouse Gas (GHG) emissions standards for light-duty vehicles for the 2017-2025 period. At the same time, the California Air Resources Board (CARB) modified requirements relating to its Zero Emission Vehicle (ZEV) program for the same period. The requirements set by the DoT and CARB are notably more stringent that previous iterations. GHG standards for light-duty vehicles were introduced by the EPA for the first time as part of the 2012 rulemaking. The CAFE regulations require average fuel efficiency of the light duty fleet in the US to reach 54.5 miles per gallon by 2025. The ZEV regulations require 15.4% of all the new vehicles sold in California by 2025 be either plug-in electric (PEV) or fuel-cell powered (FCV) (CARB, 2012).

The Federal agencies along with CARB are currently conducting mid-term reviews of those regulations. Those reviews will reassess the fuel efficiency and zero emissions standards and any potential changes will affect the 2022 through 2025 implementation period (Carley et al. 2016). Since the publication of the 2017-2025 CAFE standards in 2012 a series of economic and technological parameters have changed. As an example, there has been a substantial decrease in gasoline prices. At the time the 2017-2025 fedral regulations were drafted, the Energy Information Administration (EIA) forecast for the price of gasoline in 2025 was $3.81 (EIA, 2012). The latest EIA report brings this estimate to $2.77 (EIA 2015)[2]. Considering that almost 80% of the benefits of the federal regulations are derived from fuel savings, this substantial decrease in gasoline prices has the potential to alter the benefit cost analysis results. Furthermore, recent research has examined the effects that decreasing fuel prices have on the rebound effect. The latter captures the behaviour in which drivers of fuel efficient vehicles increase their vehicle miles travelled since they face a lower fuel cost per mile of travel. Work by Hymel and Small (2015) suggests that the rebound effect is lower in years with low fuel prices.

There have also been important changes in technological parameters related to the federal regulations since the latter were published in 2012. One of them has been the gradual increase in the use of aluminium parts. This trend has resulted in both direct and indirect fuel economy benefits, since lighter vehicles can be fitted with reduced size powertrains, break systems and crash management structures (NRC, 2015).

Our work contributes to the mid-term review process of the federal regulations and the ZEV mandate by incorporating the most recent economic and technological parameters in evaluating the effects that the regulations will have on car sales, the overall profile of the light duty fleet as well as the effects on fuel savings.

Methods

Our main contribution lies in a modelling approach that considers both the federal standards and ZEV mandate, something that the fedral agencies did not do when designing the CAFE and GHG standards. We incorporate the electricity sector in our analysis and examine the impact that the demand for electric cars will have in the economy. We model the effects of the federal regulations and ZEV mandate using the MARKet ALlocation (MARKAL) model. The latter is an integrated energy system, linear programming cost minimization model that estimates the least cost path of meeting demand for energy services. In the context of our application, or primary interest lies in estimating the cost minimizing fleet of light duty vehicles that will meet the federal regulations. Our modeling of the

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[2] Both figures are expressed in constant 2009 dollars.

US energy system is based on EPA's US9r which is a holistic depiction of the US energy system that captures a series of sectors, from electricity generation to transportation. We update the US9r database with all the latest economic and technological parameters that are relevant to the light duty vehicle sector. In addition, we incorporate a series of energy related policies like the Regional Greenhouse Gas Initiative (RGGI), the California Cap and Trade program and the Clean Power Plan rule. We design a series of policy scenarios and focus on the impacts of scaling the ZEV mandates (currently applied to California and nine other US states) to the federal level. In addition, we conduct a series of simulations to examine how different fuel efficiency standards would impact the light duty market.

Results

Our work is currently under progress. While we cannot report on specific results, our modeling effort will include a sensitivity analysis on how different levels of CAFE standards will affect the cost of compliance on the part of automobile manufacturers. In addition, we plan to run a series of models that will vary the scope of the ZEV mandate. That is, we will simulate the impact of a ZEV mandate: a) adopted only by California, b) adopted by all 10 states that have currently signed on to it, or c) adopted by all 50 states. Finally, our results will provide estimates on fuel savings. The later represent by far the vast majority of benefits in the federal regulations. Our modeling work will examine the extent to which fuel savings will be affected by updated economic and technological parameters discussed in the overview section.

Conclusions

Our results will have significant policy implications not only for the US but also for other countries that are considering the adoption of similar fuel economy and electric vehicle policies. Our work will contribute to the literature by examining the ZEV mandate in conjunction with the CAFE and GHG standards. In addition, our simulations will provide insights into the effects of a scaling of the ZEV mandate to the federal level. Furthermore, by incorporating the latest information on economic and technological parameters our results will communicate the most up to date analysis.

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