



Safer or cheaper? Traffic safety, vehicle choices and the effect of new corporate average fuel economy standards



Yizao Liu

Department of Agricultural Economics, Sociology and Education, The Pennsylvania State University, 208A Armsby Building, State College, PA, 16802, United States

ARTICLE INFO

Article history:

Received 27 April 2016
Accepted 12 April 2017
Available online 23 April 2017

Keyword:

Fuel economy standards
MPG targets
Lightweighting
Traffic safety
Automobile demand

ABSTRACT

The new Corporate Average Fuel Economy (CAFE) Standards increase fuel economy to 54.5 MPG by model year 2025 and determine fuel economy targets based on vehicle sizes. This paper examines the effect of the new CAFE standards on consumer choices and composition of vehicle sales, accounting for the impact of traffic safety. We first formulate and estimate a mixed logit model of consumer demand using micro-level data. Two measures of traffic safety, consumers' safety concerns and traffic fatalities, are included and interacted with two vehicle characteristics that matter most for traffic safety: weight and size. Further, we conduct simulations of three extreme firm responses to assess the potential impact of the new CAFE standards: lightweighting, paying CAFE fines, and size increase. Simulation results suggest that the sales impact will fall almost entirely on the SUV and light truck segments and on US automakers that use lightweighting. Moreover, consumers in states with more traffic fatalities are the most responsive, shifting away from passenger cars. In addition, the new CAFE standards could result in an increase of 8.1 percent in the share of SUV and light trucks, which will cause as many as 347 more equivalent fatalities on roads each year.

© 2017 Elsevier B.V. All rights reserved.

1. Introduction

Growing concerns over the environmental externalities of greenhouse gas emissions have heightened the interest of environmental groups and government in demanding increases in vehicle fuel efficiency. In 2011, President Obama announced an agreement with 13 large automakers to increase fuel economy to 54.5 miles per gallon for cars and light-duty trucks by model year 2025, a jump from the previous standard for all vehicles of 35.5 MPG. Further, until the changes to the CAFE rules in 2012, all passenger cars were held to the same fuel economy standard¹ and all light-duty trucks were held to a lower standard.² Calls to increase fuel economy by the CAFE have been under fierce debate for several decades. The old CAFE standards forced people into lighter, smaller, and less safe vehicles and opponents of increasing fuel economy standards observe that heavier vehicles provide a greater protection to their occupants in a crash than do lighter vehicles. Further, it was clear that American manufacturers, because of the size of the vehicles they produced, had been the most affected by CAFE regulations in the past. In contrast, some Japanese manufacturers did not appear constrained by the standards, and were actually able to lower the average fuel economy of their fleets during the late 1980s and early 1990s (EPA, 2012).

E-mail address: yul459@psu.edu

¹ The standard for passenger cars was 27.5 mpg from 1990 to 2011.

² The standard for light-duty trucks was between 20 and 23 mpg during the same period.

The US Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) now base the new CAFE standards on a vehicle's footprint, which is measured by multiplying the vehicle's wheelbase³ by its average track width.⁴ The footprint, defined as the area between the four wheels, is used a proxy for vehicle sizes. The new standards also maintain the car–truck distinction. Vehicles with a smaller footprint must meet a tighter standard than those with a larger footprint, and light-duty trucks still have a less stringent overall footprint standard than cars.

The shift to tougher, vehicle footprint-based CAFE standards may have important implications on both manufacturers and consumers. On one hand, the new standards present major challenges to automakers. Even the smallest and most efficient cars struggle as the CAFE standard skyrockets about 10 mpg every five years (Berkowitz and Csere, 2011). Achieving these standards will require various changes in engine and transmission technologies, as well as improved aerodynamics, tires with lower rolling resistance, and materials that reduce weight (Csere, 2010). In fact, to meet the tougher rules that are being phased in, more than 50% of automakers will shift their focus to lightweighting and use of lightweight structural materials on their new products, as other technologies will soon be insufficient to enable the industry to progress toward meeting the tougher requirements (Wards Auto, 2014; P.E., 2014). For example, GM is using high-strength steel, aluminum and composites to reduce vehicle weight and also considering using carbon fiber in the future (O'Hara, 2015). Ford has taken the lead by converting the F-150 pickup, its best-selling model, into a full aluminum-body vehicle (Hawver, 2015).

On the other hand, although the effect of CAFE standards on traffic safety and fatalities is highly controversial, it is generally believed that the decrease in vehicle weight due to higher fuel economy standard is correlated with increases in vehicle fatalities (Crandall and Graham, 1989). Bigger and heavier vehicles are safer in single-vehicle accidents and are safer for their own occupants in multi-vehicle crashes. Automakers' decision to lightweight in response to the CAFE standards may affect consumer choices and welfare. If vehicle weight is a key determinant of consumer utility when they value vehicle safety and make vehicle choices, one might wonder how the increasing fuel economy standards will affect consumer's vehicle choices and traffic safety.

It is still uncertain how the new CAFE standards will affect consumer choices, automakers, and traffic safety. Some believe that a fuel economy standard that discourages vehicles with smaller footprints may push consumers' vehicle choices towards bigger cars and reduce fatalities. However, others believe that the new CAFE standards' higher MPG requirement for all vehicles in general may cause many automakers to use lightweighting to meet the standards, which may, in turn, affect consumers' vehicle choices and give rise to larger concerns about traffic safety.

This paper examines the effect of the new CAFE standards on consumer choices and composition of vehicle sales, accounting for the impact of traffic safety. We first formulate and estimate a mixed logit model of consumer demand using micro-level data from National Household Travel Survey (NHTS, 2011). Specifically, we focus on how traffic safety affects consumers' vehicle choices. Because traffic safety depends on both consumers' own behavior and the externality generated by other drivers, we include two measures of traffic safety: one subjective measure, which is a consumer's own safety concern, and one objective measure, traffic fatalities in the state where the consumer lives. We interact the two measures with two vehicle characteristics that are most related to traffic safety: vehicle weight and size (footprint). The coefficients for the interaction terms imply how traffic safety affects a consumer's preference for vehicle weight and size. The demand estimation shows that consumers who think traffic safety is a concern tends to choose heavier cars when buying a car and if a consumer lives in a state with higher traffic fatalities, they tend to choose bigger cars, compared to those living in a state with low traffic fatalities.

Further, using estimates from the demand model, we conduct simulations of three extreme firm responses to assess the potential impact of the new CAFE standards. First, we assume that all automakers, if they do not meet the standards now, will meet the MPG requirement of the new CAFE standards by lightweighting. Second, we assume that automakers who do not meet the MPG requirement, instead of trying to meet the standards, will simply choose to pay the fine. Third, we assume that automakers who do not meet the standards will increase the footprint of the vehicle by 10%. For each scenario, we simulate consumers' choices under alternative MPG targets of CAFE standards and estimate the effects on automakers. The results provide an important reference point of the impact for policy makers when examining the effectiveness of the new CAFE standards. The simulation results show that the effects of CAFE standards vary across vehicle type and origin. Simulation results suggest that the sales impact of the CAFE standards will fall almost entirely on the SUV and light truck segments of the market and on US automakers that use lightweighting. Large-size and heavy American SUVs and light trucks are preferred and enjoy increasing market shares when US automakers can reduce vehicle weights to improve fuel efficiency while maintaining original sizes. On the other hand, SUV and European automakers will benefit when all firms pay CAFE fines. In addition, passenger cars sales will increase when using size increase. Moreover, consumers in states with higher traffic fatalities and higher traffic risks are the most responsive, shifting away from passenger cars when making vehicle choices, because of their preference for larger and heavier vehicles due to concerns for traffic safety.

Finally, we calculate the total equivalent fatalities given the new shares of SUV and light trucks under both scenarios. The simulation results suggests that the new CAFE standards could result in an increase of 8.1 percent in SUV and light trucks shares, which will cause as many as 347 more equivalent fatalities on road each year.

³ The wheelbase is the distance between the centers of the front and rear wheels, which is a measure of the length of a vehicle.

⁴ The track width is the distance between the centerline of two wheels on the same axle, i.e., side to side, which is a measure of the width of a vehicle.

Download English Version:

<https://daneshyari.com/en/article/5104086>

Download Persian Version:

<https://daneshyari.com/article/5104086>

[Daneshyari.com](https://daneshyari.com)