Policy Analysis Part 2: CAFE Standards

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POLICY ANALYSIS PART 2: CAFE STANDARDS

I. Executive Summary

Carbon emissions from automobiles are a significant contributor to climate change. As climate change is and continues to be an unaddressed externality, Corporate Average Fuel Economy (CAFE) standards have evolved from a response to oil embargoes to a tool for combating carbon emissions through fuel emissions standards. This paper analyzes the effects of fuel efficiency regulations. We recommend that the Trump administration changes to CAFE standards be reverted to Obama administration levels. We also recommend that policies be put in place to hasten the development and adoption of fully electric vehicles.

II. Problem Definition and Topic Summary

Congress passed legislation creating the CAFE standards in 1975, and these new fuel-economy standards first went into effect for vehicles in model year 1978, setting the standards at 18 mpg for passenger vehicles. The CAFE standards are fleetwide averages of fuel economy for individual automakers and the total fuel economy of an automaker must meet the CAFE standards for that model year. CAFE standards were a response to the 1973 oil embargo by OPEC, which resulted in price increases and fuel shortages in the U.S. (US Department of State, n.d.).

After the oil crisis of the 1970s, gas prices fluctuated for several decades, largely due to international trade relations with oil producing countries and other international events (Council on Foreign Relations, n.d.). Gas prices rose in the 1970s, trended downward in the 1980s with deregulation, and swung back up in the 2000s (Gringer, 2016; see Figure 1, U.S. Energy Information Administration, n.d.).

Despite the fluctuations in gas prices, carbon dioxide (CO_2) emissions per capita decreased during the first several years of CAFE standards, and CO_2 emissions appear to have a rough negative correlation with CAFE standards. In 1990, when CAFE standards were set at 27.5 mpg for passenger vehicles and 20.0 mpg for light trucks, CO_2 emissions were at approximately 19 million tons per capita. They remained relatively stable during the 15 years that CAFE standards stayed at the 1990 rate (see Figure 2, CO_2 Information Analysis Center, n.d.). In 2005, a large downtrend for carbon emissions began and continued for the next several years, coinciding with several years of increases in standards for light trucks, even though passenger vehicles stayed at 27.5 (see Figure 2 and Figure 3, U.S. Department of Transportation, 2014).

The CAFE standards received a major overhaul in 2007 with the Energy Independence and Security Act (EISA). The new CAFE goal of 35 mpg fuel economy for passenger cars, light trucks, and SUVs by 2020 was in large part intended to reduce U.S. dependence on oil (Office of the Press Secretary, 2007). Official EISA documents cited both energy independence and reduced greenhouse gas emissions as goals of the act. This introduced a new environmental angle to the intent behind CAFE standards.

In 2011, President Obama announced that fleetwide fuel economy standards would increase to 54.5 mpg by 2025 (Curtis, 2011). The stated objective of these new standards was to "save consumers money, reduce our dependence on oil, and protect the environment" (Curtis, 2011). As with the 2007 CAFE standards of the Bush administration, the Obama administration attributed the new CAFE standards to environmental motivators, including reducing CO_2 pollution and protecting public health from air pollution (The White House, 2013). In a 2016 midterm review, the standards were reduced to a new goal of between 50-52.6 mpg in 2025, despite findings that automakers were on track to comply with the new standards (US EPA et al., 2016). This reduction was attributed to buyers' preferences for larger vehicles, with senior administration officials saying that the 54.5 mpg fleetwide average "was never a mandate but more of an estimate" (Carty, 2016).

In August of 2018, the Trump administration announced a plan to freeze fuel efficiency standards at around 37 mpg for vehicles sold in the U.S. after 2021 (Davenport, 2018). In addition to reducing the CAFE standards, this proposal could potentially challenge the right for states to have more stringent pollution standards than those set by the federal government, requiring states to all adhere to one national standard. Interestingly, this proposal pivots from the environmental concerns that had motivated the increasingly stringent CAFE standards of the Bush and Obama administrations. Rather, the Trump administration cites boons to manufacturers, savings to consumers, and a reduction in the auto fatalities caused by lighter, more fuel-efficient cars as justifications for freezing CAFE standards (Davenport, 2018).

III. Policy Discussion

The proposed Trump CAFE Standards are called the Safer Affordable Fuel Efficient (SAFE) vehicles rule. These new standards would freeze CAFE standards for vehicles at the model year 2020 standards through model year 2026. Proponents of the plan assert that not only would it reduce burdens on car manufacturers, thus creating jobs, but also that passengers in lighter, more fuel-efficient cars are at an increased risk of auto fatalities (Davenport, 2018). The Trump administration claims that SAFE would result in a $500 billion reduction in societal costs and $176 billion societal net benefits over 50 years. In the "MYs 2021-2026 CAFE Proposal - by the Numbers" Report, the United States Environmental Protection Agency (EPA) claims that there are "no noticeable impact to net emissions… of air pollutants" under the new SAFE Standards. Although these standards hope to maximize social wellbeing by providing lower cost vehicles to the U.S. population, the new standard ignores the added cost of future emissions in 2026 and beyond.

IV. Expected Outcomes

Given the Obama administration CAFE standards of 54.5 mpg by 2025, and the proposed Trump administration's CAFE standards of 37 mpg from 2021 onwards, a number of probable scenarios can be expected. The following section describes several expected outcomes related to the two policies. In the expected outcomes that follow, it is assumed that the Obama CAFE standards will be 54.5 mpg and the proposed Trump CAFE standards will be 37 mpg by 2025.

Outcomes Associated with Obama Policy

The Obama administration policy of increasing requirements to 54.5 mpg by 2025 will markedly reduce the amount of oil consumed by the U.S. transportation sector. In a press release from 2011, the Obama administration detailed that estimates from the CAFE standards will save an estimated 12 billion barrels of oil, as well as eliminate over 6 billion metric tons of CO_2 emissions over the course of the program (NHTSA, 2011). Additionally, the same press release noted that consumers who purchase a new vehicle in 2025 at CAFE standards will save an estimated $8,200 in fuel costs over the life of the vehicle, compared to a vehicle purchased in 2010 (NHTSA, 2011).

However, increased fuel efficiency in passenger vehicles is also associated with what is known as the rebound effect: when vehicles consume less fuel, they are driven more miles. The Obama administration estimated that the rebound effect would reduce fuel savings by 10-30% (Economic Report of the President, 2007). However, Kenneth Gillingham notes that studies of the rebound effect show that a reduction of 10% is most likely (2018).

Furthermore, if increased fuel efficiency in passenger vehicles leads to more miles being driven, it is likely that more traffic fatalities will be associated with this increase. The latest available figures from the Federal Highway Administration, from July 2018, note that in the previous 12 months, 3.2 trillion vehicle miles were driven in the U.S. (2018). Data published by the National Safety Council noted that there were 40,231 traffic fatalities in 2017. If we assume a rebound effect of a 10% increase in the number of miles driven, this also means that traffic fatalities will increase by 10%, resulting in 4,023 additional deaths.

Unintended Consequences of Obama Policy

The Obama administration policy of increasing fuel efficiency with CAFE standards is also associated with some unintended consequences. While CAFE standards are often discussed using fleetwide averages, in fact vehicles are divided into several different categories by the EPA, and the two broadest categories are cars and trucks (The 2018 EPA Automotive Trends Report, March 2019, pp. 13-14).

The increase in production and market share of vehicles classified as trucks under CAFE standards can be seen as a strategy to avoid the stricter fuel efficiency standards required of passenger cars. Thus, an unintended consequence of CAFE standards since the late 1970s, and continuing through today, is that there is a separate classification for trucks, which is less efficient than that of passenger cars, and that auto manufacturers can promote larger and more expensive vehicles to consumers. These larger vehicles made up 47.5% of the vehicles on the road in 2017, and thus total fuel consumption has risen.

Outcomes Associated with Trump Policy

The proposed freeze of CAFE standards by the Trump administration is associated with several outcomes, most notably cost reductions for manufacturers and consumers. The EPA fact sheet on the proposed policy notes that the proposal is for model years 2021 through 2026, and that all numbers are compared to 2012 standards (U.S. DOT & U.S. EPA, 2018). Additionally, the Trump administration is seeking to limit the power that individual states have in setting their own, stricter fuel efficiency standards (Davenport, 2018).

According to the EPA, the impact on consumers will be a one-time reduction of $2,340 in ownership costs (U.S. DOT & U.S. EPA 2018). However, this estimate does not consider the

cost of gasoline. Furthermore, the fact sheet notes that the proposed standards, which may encourage the production of heavier and possibly safer vehicles, will lead to a reduction of traffic fatalities by up to one thousand per year (U.S. DOT & U.S. EPA 2018).

In addition to the benefits for consumers, the proposed policy also estimates a savings of $252.6 billion in reduced regulatory costs for auto manufacturers through 2029, as well as an additional one million vehicles sold due to lower vehicle costs through 2029 (U.S. DOT & U.S. EPA, 2018). If the proposed policy were to go into effect in 2019, that would mean an estimated annual savings of $25.3 billion to auto manufacturers. Additionally, auto manufacturers would benefit from the additional sales of 100,000 vehicles per year, over the course of ten years.

A notable contrast to the Obama policy is that the proposed Trump administration policy will lead to an increase in oil consumed, an increase in CO_2 emissions, and an increase in global temperature. The EPA estimates that fuel consumption will rise by 2-3%, and the U.S. will consume an additional 500,000 barrels of oil per day under this policy (U.S. DOT & U.S. EPA 2018). These increased levels of consumption will lead to an estimated increase of 870 million tons of CO_2 (Sperling, 2018).

An additional outcome from the Trump policy is that it would seek to limit the power that states have to set their own fuel efficiency and pollution standards. This would, in theory, simplify fuel efficiency standards across the nation so that auto manufacturers would not have to produce vehicles with differing fuel efficiency standards for different regions.

Unintended Consequences of Trump Policy

One rationale that the Trump administration has for the new proposed policy is that heavier and less fuel-efficient vehicles are safer. However, this is not always the case -- larger

vehicles are not necessarily associated with fewer highway fatalities compared to other vehicle sizes (Insurance Institute for Highway Safety, 2007). In fact, they may be associated with more roadway fatalities, especially those involving pedestrians. The Governor's Highway Safety Association noted that pedestrian fatalities in 2017 were at their highest level since 1990, stating that larger vehicles "are more likely to kill a human because of the size and weight difference" (NPR, 2019).

Another assertion of the proposed Trump policy is that larger vehicles will be cheaper to purchase due to decreased regulatory costs. However, the proposed policy fails to consider fuel costs over the life of a vehicle. Current projections of future fuel prices show no significant increases in the cost of fuel (McAlinden, Chen, Schultz, & Andrea, 2016), but unforeseen global events may have a dramatic impact on fuel supplies and may therefore lead to price spikes.

Finally, the proposed Trump policy will slow or completely stop innovation in the automobile industry in the U.S. According to numbers noted by Forbes, projections of fuel-efficient technologies such as turbocharging and hybrid vehicles will dramatically fall as a percentage of market share if the proposed policy is implemented (Sperling, 2018).

Rough Estimates Comparing the Costs of the Two Policies

As part of the evaluation of the two policies, it is necessary to compare them on several different levels. These comparisons will be based on estimates from data that is readily available. First, they will be compared using estimates of traffic fatalities associated with the two policies. Secondly, estimated fuel costs per vehicle over a period of 10 years will be compared, as well as total estimated fuel costs. For a third comparison, estimated CO_2 emissions associated with the two policies will be compared; this will include a comparison of societal costs associated with

CO_2 emissions as well. Finally, using these criteria, total costs associated with the two policies will be compared.

The caveat with these rough numbers is that they are estimates using data that were readily available. Furthermore, these estimates do not take all possible costs associated with the two policies into account. Rather, these estimates are for some of the main outcomes associated with the Obama and Trump policies.

Estimated Traffic Fatalities and Associated Costs

We estimated the difference in the cost of lives lost under the Obama and Trump policies, accounting for the rebound effect, and compared the two results (see Table 1). 40,000 deaths occurred due to traffic in 2017 (National Safety Council, n.d.), and the Value of a Statistical Life (VSL) is estimated at $9.2 million (Thomson, 2015). Using these numbers, we estimated the total cost of lives lost.

If the rebound effect associated with more fuel-efficient vehicles of the Obama policy leads to a 10% increase in the number of miles driven, we can estimate a 10% increase in the number of traffic fatalities as well. A 10% increase in the baseline number of fatalities gives us an additional 4,023 deaths, valued at $9.2 million each. The estimated total costs in additional fatalities stemming from the rebound effect of the Obama policy are over $37 billion per year.

In contrast, estimates from the Trump administration state that one thousand additional lives will be saved due to heavier vehicles being safer, resulting in a reduction in costs from traffic fatalities of $9.2 billion.

Estimated Fuel Costs to Consumers

To estimate fuel costs associated with vehicles sold in 2025, we first attempted to find the difference in CAFE fleetwide mpg ratings and real-world mpg estimates (see Table 2). In 2017, the most recent year that data is available, fleetwide average CAFE miles per gallon standards were 35.9 mpg (NHTSA and EPA Propose, n.d.), while estimated real-world fuel efficiency for all passenger vehicles was 24.9 mpg (US EPA, 2018). This is a difference of 30%, and this figure will be the number used to estimate real-world fuel efficiency in 2025 to estimate fuel costs.

If we take the Obama administration's CAFE standard of 54.5 mpg and reduce it by 30%, we have an estimated fleetwide average of 38.2 mpg. The most recent data for total miles driven in the U.S. comes from July 2018, and during the previous 12 months vehicles traveled over 3.2 trillion miles (Moving 12-Month Total on All Highways, July 2018). If we take this number of miles driven and divide it by the estimated real-world fuel efficiency in 2025, we can estimate the total amount of fuel consumed as approximately 84 billion gallons. The U.S. Energy Information Administration estimates that the average price for gasoline in the U.S. in 2025 will be $3.15 per gallon (U.S. Energy Information Administration - EIA - Independent Statistics and Analysis, n.d.). If we calculate this using the data available, we can estimate that total fuel costs for vehicles in 2025 will be nearly $266 billion.

Meanwhile, the fuel costs for individual vehicle owners can be estimated using the following figures. In 2018, it was estimated that the average driver in the U.S. drove 13,476 miles per year (Average Annual Miles per Driver by Age Group, n.d.). Dividing this by the estimated real-world fuel efficiency of 38.15, we get the estimated number of gallons of fuel

consumed annually per vehicle: 353. This figure, multiplied by the estimated cost of gasoline in the U.S. in 2025, gives us the estimated annual fuel cost of one vehicle: $1,113. If we estimate that vehicles have an approximate life of 10 years, this gives us the total fuel costs over the life of the vehicle under Obama's CAFE standards: $11,127.

Changing the estimated real-world mpg from the proposed Trump policy (i.e. the 37 mpg standard, reduced by 30% to equal 25.9 mpg), we can recalculate the figures to compare them to costs under the Obama CAFE standards. Using the 25.9 mpg figure, we can estimate a total expenditure of $391 billion over one year. Additionally, the estimated fuel costs for one vehicle per year are $1,639 in 2025 under the proposed Trump policy, which makes fuel costs over 10 years $16,390.

Estimated CO_2 Emissions and Associated Costs

Using the figures above, we can also estimate CO_2 emissions under the two policies and compare the societal costs of these outputs (see Table 3). By taking the 3.2 trillion miles driven in the U.S. and dividing it by the estimated real-world fuel efficiency numbers from both the Obama and Trump policies (38.15 mpg and 25.9 mpg, respectively), we can estimate the total number of gallons of fuel consumed. Combustion of one gallon of gasoline produces approximately 20 pounds of CO_2, and 2,204.6 pounds of CO_2 makes one metric ton.

We can calculate this and estimate that the total number of CO_2 emissions in 2025 under the Obama policy is approximately 765 million metric tons, while the proposed Trump policy would produce over 1.1 billion metric tons of CO_2. One of the most recent estimates of the median social cost of carbon is that one metric ton of CO_2 emissions is equal to $417 (Ricke, Drouet, Caldeira, & Tavoni, 2018). If we plug this number in, we see that the estimated cost

associated with CO_2 emissions under the Obama policy is over $319 billion, while under the proposed Trump policy this would rise to $470 billion.

Comparison in Policy Costs

In nearly all the estimations above, the Obama policies are less expensive. The proposed Trump policy, while it is associated with some savings due to fewer traffic fatalities, is more expensive for consumers in fuel costs, and in the estimated externality costs associated with increased CO_2 emissions. Taking all these factors into account, this equals a cost of $852 billion under the proposed Trump policy, which would be 27% more expensive than the Obama policy, at a cost of $621 billion (see Table 4).

Fuel Efficiency Calculations

The stated objective of the 2011 Obama CAFE standards was to "save consumers money, reduce our dependence on oil, and protect the environment" (Curtis, 2011). The fleetwide average of 54.5 mpg in the Obama policy encourages auto manufacturers to create more electric and hybrid-plug-in electric vehicles because they have limited fleetwide carbon emissions. However, the large trucks and SUVs in the market are still averaging lower than expected mpg. The 2019 Honda Clarity Hybrid touts a combined 110 mpg for gas/electric usage, with $400 annual fuel costs (USDE, 2019). The 2019 Honda Civic averages 36 mpg with $1,100 annual fuel costs as their standard gas run passenger vehicle. (USDE, 2019). The 2019 Honda Pilot, the fleet's signature SUV, averages 22 mpg and $1,700 in annual fuel costs. The average for just these three vehicles in the fleet is 56 mpg and $1050 in annual fuel costs, thus, the smaller, energy efficient vehicles serve to skew the fleetwide averages downward. By allowing a fleetwide average for miles per gallon, the policy allows automakers to make little to no change

to the fuel economy of light trucks and SUVs and still be within compliance to CAFE Standards. This does not consider the trend for Americans to purchase SUVs at a higher rate than passenger vehicles -- in 2005, light trucks and SUVs accounted for 50% of vehicles sold, compared to 20% when CAFE standards were implemented in 1975 (Economic Report of the President, 2007). While our dependence on oil has gone down, the standards need to be improved if the goal is indeed to protect the environment.

The standard life of a vehicle is 8-10 years. This means that most vehicles on the road are likely to have been made between 2008-2018, and cars manufactured before 2011 will likely be on the road until 2020. Between 1990 and 2016, the number of vehicle miles traveled (VMT) by passenger cars and light trucks increased by approximately 45 percent because of low fuel prices and economic sprawl (EPA, 2019). Due to the rebound effect of lower gas prices causing more miles driven, the true effects of the CAFE standard may not be seen for many years.

V. Evaluative Criteria

Efficacy

When measuring efficacy, both policies contained predicted measurements for consumers' vehicle ownership costs, oil consumption, and ppm of CO_2. In regard to vehicle ownership and operation, the Obama administration states an estimated $8,200 in fuel savings over the lifetime of a new vehicle, while the Trump administration reports a $2,340 reduction in overall average vehicle ownership costs for new vehicles (The White House, 2013; U.S. DOT & U.S. EPA, 2018). Comparing oil consumption estimates, the Obama policy anticipates reduced oil consumption by about 2.2 million barrels per day in 2025, based on the initial 54.5 mpg standard, while the Trump policy estimates about a 0.5 million barrels per day increase in fuel

consumption. Increased oil consumption reduces U.S. energy independence, as well as contributing to pollution and climate change effects. The Obama policy will reduce CO_2 pollution by over 6 billion metric tons, and an NHTSA evaluation of a policy alternative similar to the Obama policy anticipated a reduction of 1.6 ppm in CO_2 concentration by 2100, compared to an increase of 0.65 ppm in CO_2 concentration by 2100 under the Trump policy (US DOT & NHTSA, 2009). Upon review, the Obama policy saves individual consumers almost $6,000 more in vehicular ownership and operation costs, reduces oil consumption by almost 3 million barrels per day when compared to the Trump policy, and reduces CO_2 levels in year 2100 by about 2.2 ppm.

Efficiency

Trump's proposed policy is to keep CAFE standards stagnant at the Model Year (MY) 2020 standards until MY 2026. This is relatively easy to implement because it is a continuation of the status quo. The aim of this policy is resource saving for auto manufacturers and the oil industry. The ongoing labor and material costs of continually redesigning cars in order for them to be capable of 54.5 mpg by 2025 raises the price of vehicles over time. Figure 6 describes the inward shift of the supply of cars in the market under the Obama policy. Since the Trump roll-back of CAFE standards to pre-2011 levels, line S_T represents both the original standards and Trump's new requirements (see Figure 6).

The supply line shift in Figure 7 moves the market equilibrium to a point associated with both higher prices for purchased vehicles and a corresponding lower quantity. Economic conditions in the U.S. auto market will increase under the Obama-era regulations. The Trump-era standards are expected to return auto markets to their previous price and quantity levels because

they reverted requirements on automakers to the pre-Obama standards. Neither policy in this scenario creates deadweight loss because the curves shift, setting benefits and cost equal to each other due to new regulations.

Equity

In evaluating the policies with regard to equity, the strengths of each policy must be examined. The Trump policy cites reduced costs to manufacturers through the reduction of regulatory costs, resulting in a $252.6 billion reduction in regulatory costs through MY 2029. The Trump policy also cites a $2,340 reduction in overall average vehicle ownership costs per new vehicle. When this cost savings is multiplied by 5.3 million (the number of new vehicles sold in 2018), this represents a total cost savings to consumers of $12.4 billion, a relatively small savings when compared to the $252.6 billion reduction in regulatory costs for manufacturers. The policy benefits manufacturers over consumers.

Alternatively, the Obama policy prioritizes reduction of CO_2 pollution and other air pollutants through the increasingly stringent fuel economy standards and incentivizing of alternative technology implementation, such as hybrid and electric vehicles. As air pollution and climate change have both been shown to disproportionately burden developing countries and at-risk populations such as low income and minority groups (Tessum et al., 2019; Balbus & Malina, 2009), policies which do not attempt to reduce pollution and its effects are inequitable as their negative effects are distributed to underprivileged groups more than others.

VI. Policy Recommendations

Based on this analysis we propose two alternatives to the Trump policy. According to the Trump policy, vehicle weight increases would save one thousand lives per year. This gives no

consideration for the difference in current and future fleet vehicle weights. In fact, heavier vehicles could cause more pedestrian fatalities (Romo, 2019). CO_2 emissions under the Obama policy have been decreasing, but could be more efficient if unintended consequences didn't affect driver behavior. Under the Obama policy, vehicles become more fuel efficient, but the better fuel mileage also creates a rebound effect that encourages vehicle owners to drive more since their vehicles are now getting better fuel mileage.

The Trump administration's data on vehicle weights disregards the potential for more deadly crashes by introducing heavier vehicles. According to one study, "SUVs and trucks [...] are more likely to kill a human because of the size and weight difference" (Romo, 2019). The difference in CO_2 emissions between the two policies also fails to support the change. According to our calculations, the Trump policy creates an increase in CO_2 emissions by 32%. The Trump policy also impedes new technologies in the hybrid and electric vehicle market by eliminating all credits and incentives that promote related advances in the industry (Sen, Noori, & Tatari, 2017).

"Presumption of preemption" is a legal term referring to legal debate in relation to the Supremacy Clause within Article VI of the Constitution of the United States. This clause states that the federal law is the supreme law of the land and that no state law can preempt federal law. However, in situations where the government has offered accommodations to states like California regarding its setting of more stringent emission standards on vehicles, the presumption of preemption doesn't apply.

The proposed standard currently faces a lawsuit filed by California, and 17 other states, in federal court on the grounds that the Trump policy conflicts with the Supremacy Clause. This clause assumes that there will be presumption of preemption in regard to conflicts between

federal and state law (Verchick & Mendelson, 2008). The California Air Resources Board (CARB) oversees California's vehicle emission standards, which were set by California voters and have been consistently approved by the EPA. CARB has protections under the Clean Air Act which preempts the CAFE standard (Harvard Law, 2018). In 2013, the EPA granted its most recent waiver to California accepting the state's higher standard, as they have done numerous times since 1968 (US EPA, 2016).

Electric Vehicle Incentive

Our first recommendation as an alternative to the Trump proposal is one that bolsters the Obama standards and adds more incentives and credits to increase Plug-in Hybrid Electric (PHEV) and Electric Vehicle (EV) market share. By bolstering the Obama standard, the price of vehicles goes up in the short run, which should theoretically make gasoline vehicles more comparable in price to PHEVs and EVs. With the lure of a more sustainable and cheaper fuel source, these alternative vehicles become more appealing (Sen, Noori, & Tatari, 2017).

Status Quo

The alternative is to leave the Obama-era CAFE standards as they are. Currently the standards are doing an excellent job in reducing emissions, increasing market share of PHEV and EV, reducing pollution, and they do not conflict with state laws. Before making adjustments that accommodate for vehicle weights, more research needs to be done looking at the effect of vehicle weights in vehicle related fatalities.

Appendix

Figure 1: U.S. real price of motor gasoline from 1980 to 2017 (in real U.S. dollars per gallon)

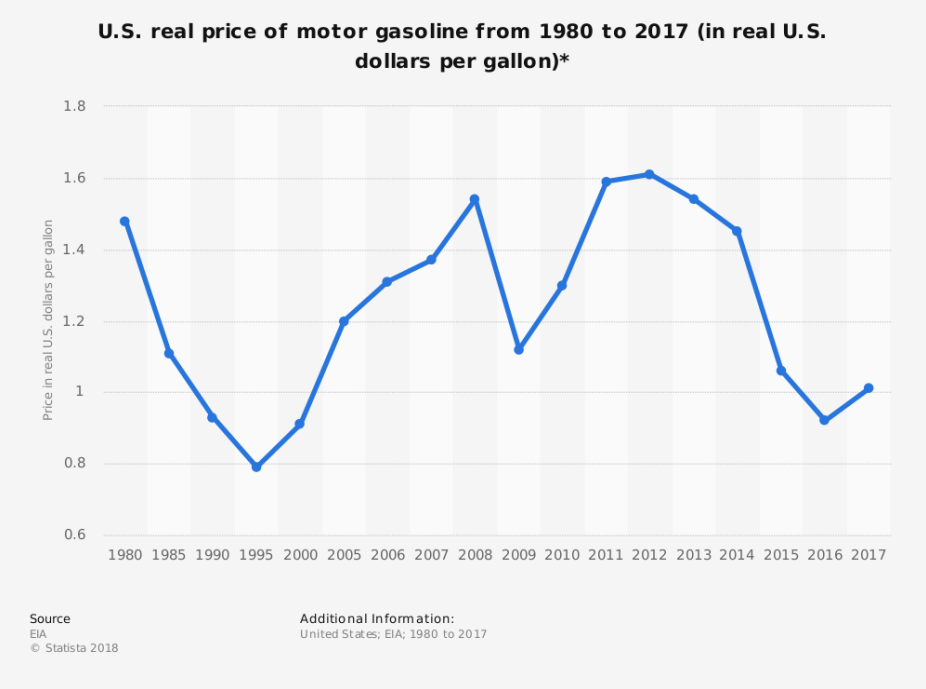
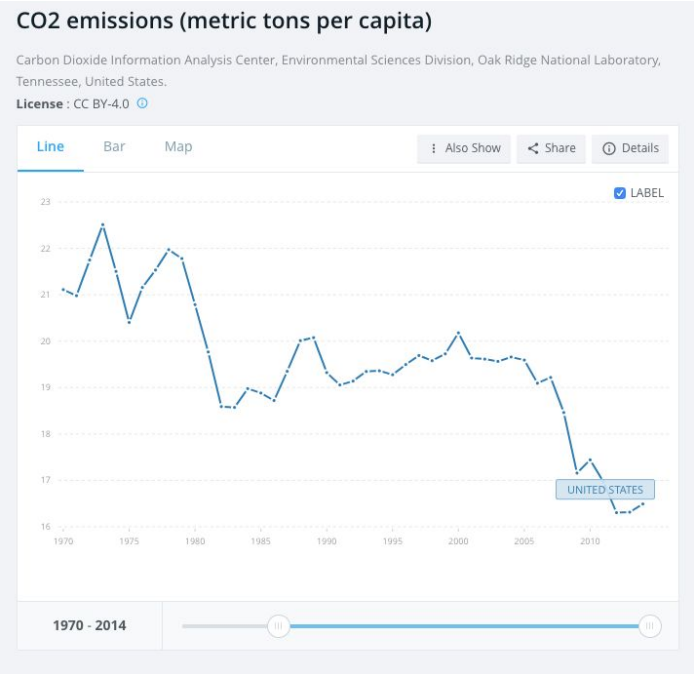


Figure 2: CO2 Emissions (Metric tons per capita)



Retrieved from The World Bank Open Data

Figure 3: CAFE Standards from 1978 to 2014

CAFE STANDARDS

MODEL YEAR	Passenger Cars			Light Trucks		
	Combined	Domestic	Import	Combined	2WD	4WD
1978	18.0					
1979	19.0				17.2	15.8
1980	20.0				16.0	14.0
1981	22.0				16.7	15.0
1982	24.0			17.5	18.0	16.0
1983	26.0			19.0	19.5	17.5
1984	27.0			20.0	20.3	18.5
1985	27.5			19.5	19.7	18.9
1986	26.0			20.0	20.5	19.5
1987	26.0			20.5	21.0	19.5
1988	26.0			20.5	21.0	19.5
1989	26.5			20.5	21.5	19.0
1990	27.5			20.0	20.5	19.0
1991	27.5			20.2	20.7	19.1
1992	27.5			20.2		
1993	27.5			20.4		
1994	27.5			20.5		
1995	27.5			20.6		
1996	27.5			20.7		
1997	27.5			20.7		
1998	27.5			20.7		
1999	27.5			20.7		
2000	27.5			20.7		
2001	27.5			20.7		
2002	27.5			20.7		
2003	27.5			20.7		
2004	27.5			20.7		
2005	27.5			21.0		
2006	27.5			21.6		
2007	27.5			22.2		
2008*	27.5			22.4		
2009*	27.5			23.0		
2010*	27.5			23.4		
2011***	30.2	30.0	30.4	24.3		
2012***	33.0	32.7	33.3	25.3		
2013***	33.5	33.2	34.2	25.8		
2014****	34.2	34.0	34.5	26.2		

(*) - In model years 2008-2010, light truck manufacturers had the option to comply with the "unreformed" standard values or the new "reformed" standard values (vehicle footprints) based upon each manufacturer's unique vehicle fleet characteristics. The values shown for these model years are the harmonic average of the standard values utilized by each manufacturer. The applicable "unreformed" CAFE standard for these model years were 22.5, 23.1 and 23.5 mpg, respectively.

(**) - Starting in Model Year 2011, individual vehicle manufacturers' compliance obligations for each fleet (DP, IP, and LT) are based on the footprints of the vehicles they produce for sale. "Standard" values, as shown here, represent the harmonic average for all vehicles in that model year.

(***) - Model years 2011, 2012 and 2013 projected required average fuel economy standard value are based on EPA & MMY reports.

(****) - Model year 2014 projected required average fuel economy standard value is based on manufacturer submitted MMY reports.

Figure 4: CAFE Timeline

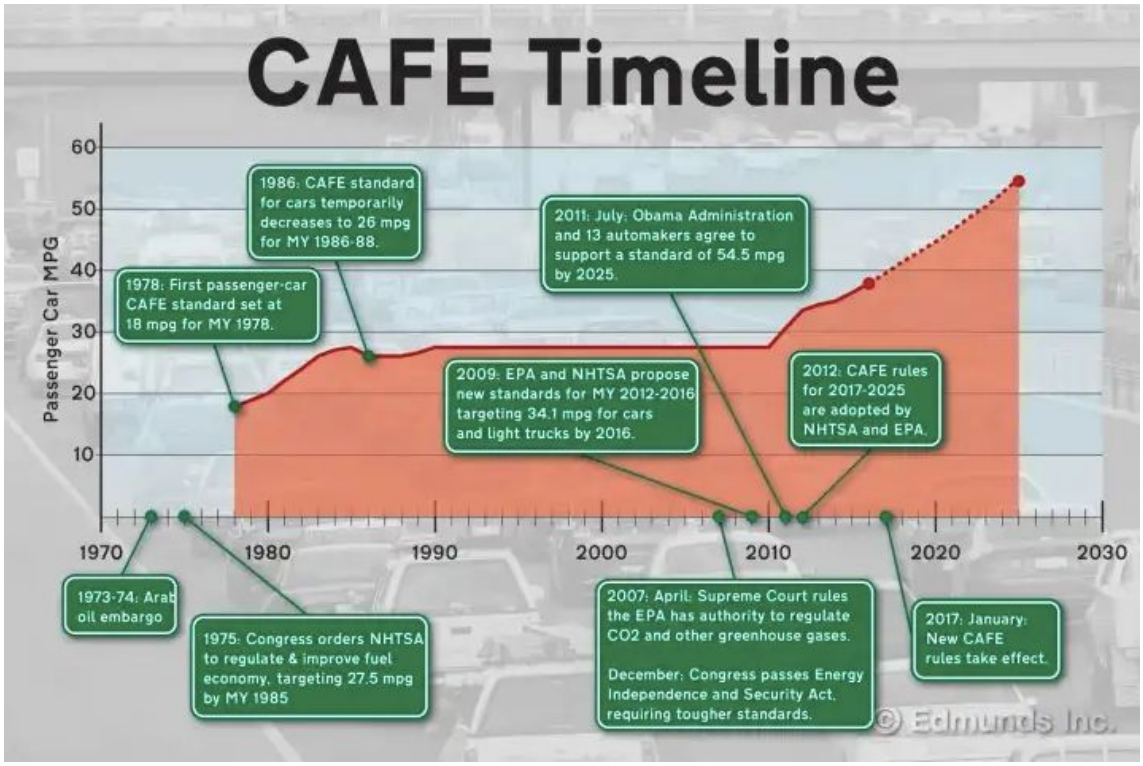
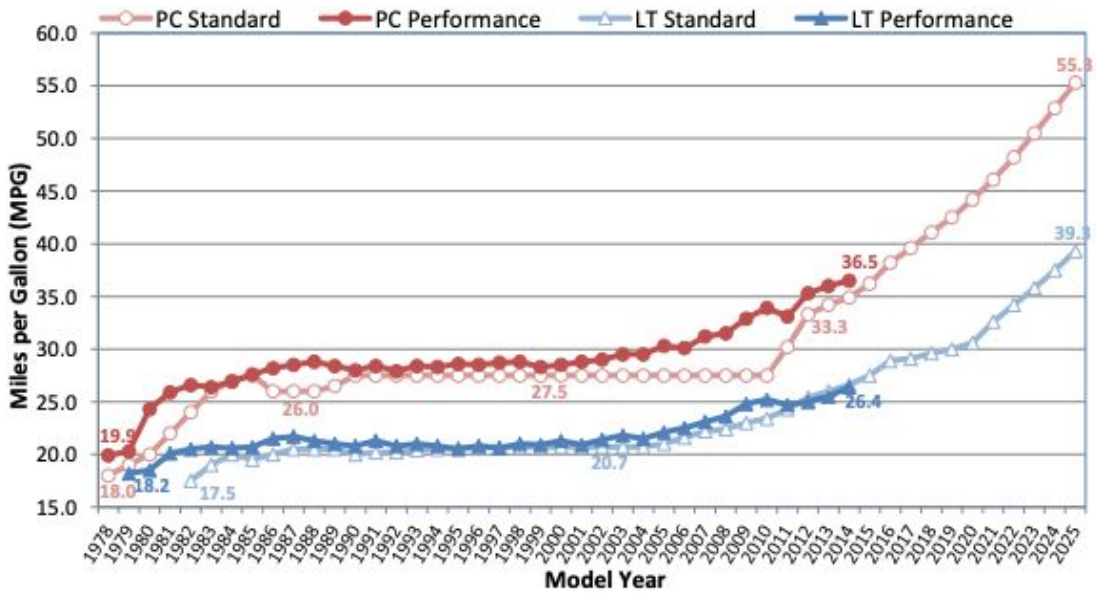


Figure 5: CAFE Summary by Year (Actual Performance & Regulatory Standard) for Passenger Cars (PC) and Light Trucks (LT), Model Years 1978-2025



Source: NHTSA 2009, NHTSA 2011, and NHTSA 2014

Figure 6

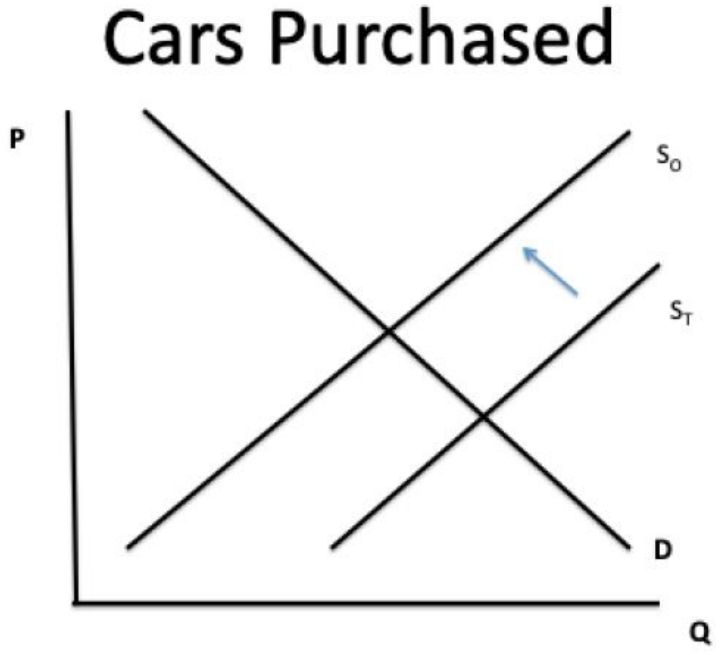


Figure 7

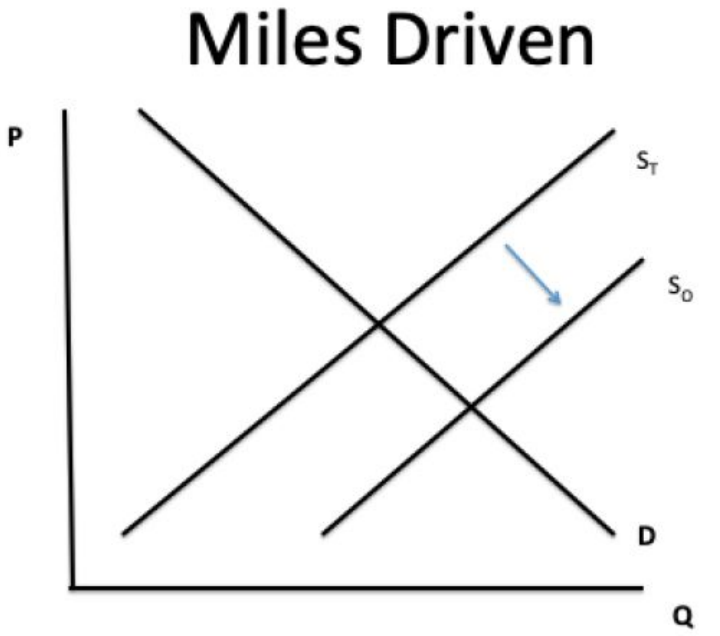


Table 1: Estimated difference in traffic fatalities (based on 2017 traffic deaths)

	Obama Policy	Trump Policy
Difference in traffic fatalities per year (compared to 40,231 baseline).	+4023	-1000
Difference in cost associated with change in traffic fatalities per year.	+$37,012,520,000	-$9,200,000,000

Table 2: Estimated difference in fuel costs

	Obama Policy	Trump Policy	Difference
Estimated total fuel expenditures in 2025	$265,706,422,018	$391,378,378,378	$125,671,956,360
Estimated 1-year fuel costs per vehicle	$1,112.70	$1,638.97	$526.28
Estimated 10-year fuel costs per vehicle	$11,126.97	$16,389.73	$5,262.76

Table 3: Estimated CO_2 emissions and associated costs

	Obama Policy	Trump Policy	Difference
Estimated CO2 emissions (metric tons)	765,229,476	1,127,162,336	361,932,860
Estimated cost of CO2 emissions ($417/metric ton).	$319,100,691,287	$470,026,693,922	$150,926,002,636

Table 4: Comparative policy costs

	Obama Policy	Trump Policy
Differences in Costs Associated with Fatalities	$37,012,520,000	-$9,200,000,000
Estimated Total Fuel Costs	$265,706,422,018	$391,378,378,378
Estimated Costs Associated with CO2 Emissions	$319,100,691,287	$470,026,693,922
Total	$621,819,633,305	$852,205,072,300

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