February 27, 2019

Submitted via http://www.regulations.gov

Re: Consumer Reports' Response to Alliance Critique Regarding Auto Buyers' Valuation of Fuel Economy Report Submitted in Docket ID Nos. NHTSA-2018-0067; EPA-HQ-OAR-2018-0283 (The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks)

Dear Mr. Tamm and Mr. Lieske:

In a public comment dated October 26, 2018 (Docket ID Nos. NHTSA-2018-0067; EPA-HQ-OAR-2018-0283), the Alliance of Automobile Manufacturers ("Alliance") critiqued a study submitted into the same docket by Consumers Union titled "Auto Buyers' Valuation of Fuel Economy: A Randomized Stated Choice Experiment," authored by Dr. Christine Kormos and Dr. Reuven Sussman. The Consumers Union study was Exhibit 4 from Consumers Union's submission.[1]

This additional comment herein dated February 27, 2019 is submitted by Consumer Reports (formerly known as Consumers Union) to address the flaws of the Alliance's critique. EPA and NHTSA should reject the Alliance's conclusion that this study "*should not be relied upon.*" The Consumers Union study was conducted using sound research methodology and a representative sample of participants who understood the questions asked of them, and the overall relative findings of the study are valid and useful. Further, given that the Alliance sent a letter calling on the administration to roll back the standards, which helped launch this rulemaking process in the first place, their bias is clear and, therefore, the fact that they felt the need to be defensive about this research reinforces the importance of the agency relying on our findings. Detailed point-by-point responses to specific Alliance critiques are provided below.

Alliance Critique #1:

The CU Study's efficiency (D-efficiency) was only 60%, significantly lower than accepted good practice to not schedule anything below 100%.

Consumer Reports Response #1:

Respectfully, the Alliance has accidentally referred to the incorrect D-efficiency value in the report. As outlined in the report (p. 43-44), respondents were randomly assigned to one of seven experimental conditions: those assigned to Conditions 1 – 6 (the "experimental conditions")

[1] Consumers Union's docket submission: https://www.regulations.gov/document?D=NHTSA-2018-0067-12074), and the study is also available at https://consumersunion.org/wp-content/uploads/2018/06/FINAL-Kormos-and-Sussman-2018-–-Auto-buyers-valuation-of-fuel-economy.pdf.

viewed all vehicle attributes, including fuel economy, whereas those respondents assigned to Condition 7 (the "control condition") were not shown the fuel economy attribute. The Alliance has erroneously referred to the D-efficiency for the control condition instead of that used for the design of the experimental conditions.

The design for the control condition, which had a relative D-efficiency of 60%, was used solely to compare respondents' vehicle choices in choice sets that were otherwise identical except for the presence of absence of fuel economy information. However, data from the control condition were not used for any WTP calculations, given that fuel economy information was absent, and so this low D-efficiency value is immaterial.

Importantly, the D-efficiency of the design for the choice models used to calculate WTP for the experimental conditions was 90.95%, which is substantially higher than the general guideline of 80% needed to indicate a "good" design that is balanced and orthogonal (Bliemer & Rose, 2011). Thus, the D-efficiency was higher than the accepted good practice.

Alliance Critique #2:

The CU Study by design incorrectly selected a base of respondents who are not representative of new car buyers who have gone, are going, or intend to go through the car-buying process. For instance, 25% of respondents used their vehicle to commute to school, which would imply that 25% of the sample are students and that the authors used a highly biased sampling methodology.

Consumer Reports Response #2:

A total of 1,883 participants were sampled from across the U.S. who had valid driver licenses and were planning to purchase or lease a vehicle within 10 years. The market research company's (ORC) "Census Balancer" tool was used to ensure that the initial intake of potential respondents mirrors the general population according to gender/age/race/ethnicity/education/ region for the key demographics. As shown in Appendix 3 (p. 51), our final study sample was nearly identical to the 2017 US Census (i.e., general American population) on key demographics, including the age breakdown and education levels. Specifically, a comparison of education levels reveals nearly identical percentages for individuals with "Some college or less" (67.6% our sample and 68.6% Census), "College graduate" (20.4% our sample and 20.0% Census), and "Advanced degree" (11.8% our sample and 11.4% Census). If anything, the sample was ever-so-slightly older, rather than younger, than the general American population.

Additionally, the Alliance reviewers may have misunderstood the finding that 25% of respondents may have used their current vehicles to "commute to school" at least one day per week. This answer could indicate that the respondent commutes to school for part-time studies, or to drive a child to class, as opposed to driving to university or college for full-time studies. That is, using a vehicle to commute to work and school were not mutually exclusive in that participants could respond independently to each question. The above shows that a representative sample was used and not a biased sample as implied by the Alliance comment.

Alliance Critique #3:

Also, it is not clear that the results of the sub-samples would even be statistically significant since the sub-sample population would (assuming an even distribution of the sample across the levels) be only 59 out of the total sample population of 1,883.

Consumer Reports Response #3:

Yes, the sub-sample choice models when the file is split according to intended vehicle class included some small sample size of (n = 59 each) for those who intend to purchase/lease a large SUV and minivan as their next vehicle (comprising 3.2% each of our 1,883 respondents). However, as mentioned in the report (p. 26), the WTP values for price and fuel economy attributes were both significant for all analyses and, as such, could be reliably included in the report.

Alliance Critique #4:

Also, the questionnaire used by the study is not at all similar to the actual car-buying process, since the vehicle options lack many qualities of vehicles that buyers find important; the survey decision is not framed within a wider financial or personal situation; the purchase decision does not occur within the context of a typical sales situation; and the intent of the survey is transparent, causing potential bias toward certain answers.

Consumer Reports Response #4:

One of the limitations of Discrete Choice Experiments (DCEs), along with other economic modeling analyses, is that important characteristics must be reduced to a finite set. Undoubtedly, other factors, such as emotion, values, and family characteristics also affect decision making,[2] but the DCE accurately simulated vehicle decision making, holding all other factors constant. Indeed, this experiment went beyond common DCE practices, and allowed the process to be customized to participants' preferences by narrowing the price range and presenting only vehicle types that they might actually consider (statistically valid procedures discussed below). The list of characteristics and the complete DCE procedure where both carefully pre-tested. Each of the Alliance's points are addressed below.

"*… the questionnaire used by the study is not at all similar to the actual car-buying process, since the vehicle options lack many qualities of vehicles that buyers find important*"

DCEs are commonly used to determine valuation of consumer goods, and to inform policy. Thorough pilot testing was performed, and interviews were conducted with an initial group of respondents to ensure that comparisons were fair and all options received consideration. Consumer surveys and car experts at Consumer Reports were also consulted to determine the key attributes that are important to consumers when considering a vehicle purchase decision. These attributes are also commonly included in other car-attribute DCEs (e.g., see Greene et al., 2018 for a meta-analysis).

[2] Indeed, advertising may alter consumer preferences rather than fulfilling them, as illustrated by Consumer Reports' content analysis of auto ads. This study also entered into the record (Exhibit 5 in CR's comments) found that he auto industry spends $14 billion a year attempting to alter and shape these preferences. The study found that nearly all advertisements (97%) made some sort of emotional appeal, while only 7% made any mention of fuel economy or made any sort of "green" appeal to consumers.

In an open-ended question, "what do you look for when purchasing a new vehicle," participants voluntarily wrote in answers that directly corresponded with our DCE attributes: safety, reliability, price, and fuel economy. These were extracted using algorithms provided by qualitative data-analysis software (NVivo), thus reducing the possibility of experimenter bias.

"… *the survey decision is not framed within a wider financial or personal situation*":

The survey design was framed within each individual respondent's broader financial situation and personal situation, such that respondents' estimated purchase price, their preference for new or used vehicles, and their preferred vehicle class were used to customize elements of the discrete choice experiment. Respondents were presented with tailored versions of the three vehicle options in each of six choice sets in order to increase the realism of the choice environment. This is an acceptable and statistically valid approach.

"… *the purchase decision does not occur within the context of a typical sales situation*":

The study in question allowed respondents to consider trade-offs between fuel economy and other attributes, as well as testing if these trade-offs could be affected by how fuel economy was presented. Given the specific study objectives, a field study would be less effective than the customized and controlled survey-based experiment that was conducted.

A discrete choice experiment was embedded within a randomized controlled trial and both explicit (open-ended, multiple choice, and rank-ordering questions) and implicit (discrete choice experiment) measures of consumer preferences were used to converge on the same answer. The experiment optimized external applicability by using a large nationally representative sample and tailoring the choice task based on participants' specific vehicle class preferences and intended purchase price for their next vehicle.

Such an analysis would be impossible to conduct in the field given that it would not be possible to isolate the effects of variation in individual attributes in such a controlled and systematic manner. Although modeling consumer behavior using only real-world revealed preferences is a valid approach, it nevertheless has drawbacks such not allowing consumers to choose potential options that do not yet exist. Indeed, there are pros and cons to any design, and the advantages of our approach outweigh the disadvantages, given our specific research objectives.

The study in question does not occur within the context of an actual sales situation, which is true of the majority of research in this domain, with rare exceptions. There are, of course, pros and cons to conducting research in a controlled laboratory environment, versus in the field. What this study gains in internal validity, given the degree of experimental control that was able to be exerted (i.e., in terms of random assignment to conditions, etc.), it loses somewhat in real-world realism (external validity). Conversely, field research may gain external validity, but may not be able to exercise a similar degree of control, and thus may have questionable internal validity.

Finally, it should be noted that the "typical sales situation" is not free from influence and bias. Consumers looking to purchase a new car face a lack of clear and transparent pricing information, bundle packages that force them to pay for features and attributes they do not care about to get the few things that that they do want, and a high pressure sales environment designed to wear them down and convince them to purchase unnecessary add-ons they do not need or want. In short, the deck is stacked against the consumer from the start, and the sales

process is not designed to provide consumers what they want, but to convince them to buy what maximizes profits for both automakers and dealers.

"… the intent of the survey is transparent, causing potential bias toward certain answers":

Pilot study participants were assessed via post-survey interviews to determine how transparent the study actually was in terms of whether or not respondents guessed the intent of the study. The results showed that only a very small percentage of pilot test participants correctly surmised that the study was related to fuel economy. Thus, it can be concluded that the vast majority of respondents were unaware of the specific nature of the study.

Alliance Critique #5:

The CU Study also contains significant mathematical errors and statistical process errors. This is due to different sets of questions being given to different respondents based on selected class of vehicle but then blending the results from multiple classes. Each class should be considered a sub-study, yet the CU Study incorrectly mathematically merges their results.

Consumer Reports Response #5:

This criticism from The Alliance appears to be in direct contrast to its previous critique (#4). In the previous critique (#4), The Alliance both criticizes the study for not being realistic enough, and in this critique argues that the efforts made to increase the realism mean that the results are not statistically valid. Taken together and at face value, these two critiques combine to essentially claim that the issue of consumer valuation of fuel economy cannot feasibly be studied in a way that is both realistic enough and considered scientifically valid enough to satisfy The Alliance. The fact that The Alliance failed to cite a single alternative study in its extensive comments that they would find acceptable further indicates that it would reject any study of the consumer valuation of fuel economy.

Regarding the specifics of this critique, the practice of customizing and pooling data is valid (e.g., Axsen, Bailey, & Castro, 2015; Ferguson et al., 2018; Hidrue, Parsons, Kempton, & Gardner, 2011; Potoglou & Kanaroglou, 2007). Contrary to The Alliance claims, survey participants were not given separate questions based upon their selected vehicle classes. To increase the realism of the choice experiment, the level values shown to each respondent were customized based on their self-reported estimated purchase price and preferred vehicle class (small car, mid-sized car, large car, small SUV, mid-sized SUV, large SUV, minivan, and pickup truck). However, the procedure did not compromise the ability to pool results, because levels of each vehicle attribute were similarly systematically varied for each of the eight vehicle classes. The attributes were varied as follows:

1. Purchase price was customized such that the four level values were pivoted around the base of each respondent's self-reported intended purchase price.
2. Fuel economy was tailored based on each respondent's preferred vehicle class for their next purchase/lease (where 25% difference intervals were used among the levels for all of the vehicle classes).

Purchase price and fuel economy were always varied by standard amounts and, thus, remained *relatively* identical, even if absolute values had changed. In addition, it is not uncommon in the discrete choice modeling literature to collapse across choice sets containing such tailored attribute level information (e.g., Axsen, Bailey, & Castro, 2015; Ferguson et al., 2018; Hidrue, Parsons, Kempton, & Gardner, 2011; Potoglou & Kanaroglou, 2007). Although the vehicle sub-classes containing a larger number of respondents were effectively weighted more heavily in the overall analysis that collapses across all vehicle classes, the price and fuel economy attributes were significant in each vehicle sub-class analysis, which allowed us to refer to sub-class WTP values.

Alliance Critique #6:

Additionally, the CU Study incorrectly conflates two separate studies (testing of presentation method and testing of people's responses to fuel economy) together as one study by incorrectly assuming negligible interaction effects between the two tests and not maintaining the tests as linearly independent.

Consumer Reports Response #6:

As is true for any research that uses a randomized controlled trial (RCT) as part of its method, the act of randomly assigning respondents to conditions allows for examination of the data within each condition independently, as it can be assumed that any within-group differences are randomly distributed across the conditions. In terms of collapsing across conditions for our aggregate models, this is acceptable given that the same relative information for the fuel economy levels was used for all conditions, but just represented differently depending on the metric in question for the particular condition (e.g., MPG was translated into the commensurate annual fuel cost, five-year fuel cost, etc., but it is the same underlying MPG driving the calculation of the values in the other conditions). A similar methodological approach was used by Newell and Sillkamaki (2014) in their investigation of whether consumer WTP for hot water heater efficiency varies according to label styles and elements (Newell and Siikamaki 2014).

Alliance Critique #7:

The CU Study finds extreme WTP values of $10,730 for $1,000 in fuel savings per year. Such extreme values are not in line with concepts of decreasing marginal utility and represent a ratio of spending to savings that cannot be scaled indefinitely, nor aligned with other studies, nor aligned with accepted payback periods for the average consumer. For instance, the high end of reported WTP results of $8,587 (assuming $3 per gallon and 12,000 VMT per year) equates to a 26.5-year payback period. Even the lowest amount of $3,330 exceeds a 9-year payback interval. The validity of these WTP results is questioned by the CU Study authors themselves, who go so far as to recommend that the findings should not be relied upon:

> *"Due to the possibility of hypothetical bias, WTP values from the choice experiment may exceed what a consumer would actually be willing-to-pay. Hypothetical bias is not always present in stated choice experiments, although it can result in WTP values that exceed the actual value by a factor of two to three (Loomis, 2011). Thus, it is necessary to use caution in interpreting these pooled valuation findings, as these findings may not translate directly into real-world WTP values."*

Consumer Reports Response #7:

Greene (2010) points out that WTP values vary greatly among DCE studies of fuel economy. In addition, a recent meta-analysis of marginal WTP for vehicle attributes, in n = 52 U.S. studies and 15 groups of attributes (e.g., fuel costs, performance, safety) (Greene et al., 2018), found large variation in WTP estimates for fuel cost. Although the authors identified factors that account for one third of observed variation (e.g., measurement units), they state that the wide variation in WTP estimates reflects consumer preference heterogeneity as well as the challenges of modeling complex consumer behavior. They suggest that insights from behavioral economics – where individuals may use simpler decision rules instead of following rational economic decision-making models – are needed. By subdividing fuel economy valuations by consumer characteristics and buying preferences, the CU study add insights in that regard by identifying further sources of variation in willingness-to-pay for fuel economy.

Having said that, the current study found higher WTP values than other similar studies. There are many possible explanations for this, but one of which is that the study considered more realistic and targeted choice sets, which included larger and less efficient vehicles. Although the primary objective of the study was not quantifying the WTP for fuel economy, the result comes from a nationally representative sample of American drivers, like other studies. The results of the study are primarily useful for (1) reflecting the *relative* value of fuel economy compared to other attributes, and (2) demonstrating that the mode of presentation of fuel economy can affect its valuation. The study is in fact more realistic than prior studies and shows that the WTP values may be larger than previously thought. One potential reason for that is that this work presented a more realistic and tailored choice set than previous work, thus previous work may have been underestimating WTP. For example, it is well known that fuel savings benefits are significantly larger for larger vehicles because they tend to start with much lower fuel economy, but most other studies failed to provide consumers choices sensitive to that context.

The findings provide an indicator of whether consumers care about fuel economy *relative* to other vehicle attributes. While the WTP values in this study are higher than in others, this does not take away from the primary focus of the study, which was to understand the relative value across attributes and across conditions. For example, WTP for safety and reliability is *even higher* than that of fuel economy. Furthermore, the results from the DCEs triangulate with participants' responses to explicit survey questions, thus supporting the finding that consumers value fuel economy more than premium features, trim or acceleration, but less than safety and reliability.

Conclusion:

The CU study was conducted using sound methodologies with a representative sample of participants who understood the procedure, and the overall relative findings of the study are valid and useful.

This study contributes to the broader literature on fuel economy valuation by providing a randomized controlled study within the choice experiment to examine the nuances of how fuel economy is presented. By conducting the study on six experimental conditions (with random assignment), hypothetical bias has been effectively standardized across the experimental conditions, and more realistic choice sets were presented to respondents than typically used in

research on WTP for fuel economy. This approach, therefore, has high internal validity as it allows for controlled experimental manipulation of the presentation of fuel economy information and a relative comparison of WTP values across the conditions. Further, like all good science, this study acknowledges its limitations, rather than ignoring them in an attempt to make a predetermined point.

Respectfully submitted,

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