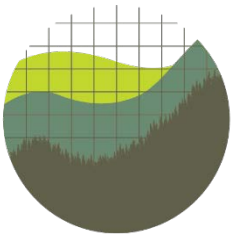

Institute *for*
Policy Integrity
NEW YORK UNIVERSITY SCHOOL OF LAW

May 31, 2019

VIA ELECTRONIC SUBMISSION

Attn: James Tamm, Office of Rulemaking, Fuel Economy Division, National Highway Traffic Safety Administration; Christopher Lieske, Office of Transportation and Air Quality, Assessment and Standards Division, U.S. Environmental Protection Agency

Re: The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, NHTSA–2018–0067; EPA–HQ–OAR–2018–0283; FRL–9981–74–OAR; RIN-2127–AL76; RIN 2060–AU09

The Institute for Policy Integrity ("Policy Integrity") at New York University School of Law[1] submits the attached supplemental comments to the National Highway Traffic Safety Administration ("NHTSA") and the Environmental Protection Agency ("EPA") (collectively, "the agencies") on the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, 83 Fed. Reg. 42,986 (Aug. 24, 2018) ("Proposed Rule"). Policy Integrity is a non-partisan think tank dedicated to improving the quality of government decisionmaking through advocacy and scholarship in the fields of administrative law, economics, and public policy.

In October 2018, Policy Integrity previously submitted comments ("October comments") raising concerns with economic analysis that the agencies used to support the Proposed Rule, including the proposed rollback of fuel economy and greenhouse gas emissions standards for model years 2021 through 2025 ("baseline standards").[2] In December 2018, Policy Integrity submitted supplemental comments ("December comments") highlighting concerns with the economic analysis in a report by NERA Economic Consulting ("NERA") and Trinity Consultants ("NERA/Trinity Report"), submitted as an attachment to the comments of the Alliance of Automobile Manufacturers ("Alliance").[3] The Alliance recently submitted further comments, including an attachment from NERA ("NERA Response"), which purports to rebut critiques of the NERA/Trinity Report submitted by Policy Integrity, the California Air Resources Board, and

[1] This document does not purport to present New York University School of Law's views, if any.

[2] Comment by the Institute for Policy Integrity at New York University School of Law, NHTSA-2018-0067-12213 and EPA-HQ-OAR-2018-0283-5083 (Oct. 26, 2018).

[3] *See* Supplemental Comments by the Institute for Policy Integrity at New York University School of Law, NHTSA-2018-0067-12362 (Dec. 21, 2018); Comments of the Alliance of Automobile Manufacturers, NHTSA-2018-0067-12073 and EPA-HQ-OAR-2018-0283-6186 (Oct. 26, 2018), attaching NERA Economic Consulting & Trinity Consultants, Evaluation of Alternative Passenger Car and Light Truck Corporate Average Fuel Economy (CAFE) Standards for Model Years 2021-2026 (Oct. 26, 2018).

a number of non-governmental organizations.[4] However, NERA's responses misstate Policy Integrity's October and December comments, fail to respond to those comments, or are incorrect. We have provided more detail on each of the topics discussed in the NERA Response in an attached Appendix and we ask that the entire Appendix be included in the record.

Respectfully,

Bethany Davis Noll
Peter Howard
Jason Schwartz
Avi Zevin

Institute for Policy Integrity
New York University School of Law

[4] Comments of the Alliance of Automobile Manufacturers, NHTSA-2018-0067-12392 (April 10, 2018), attaching NERA Economic Consulting, Response to Comments on NERA/Trinity Report (April 10, 2019).

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APPENDIX

Policy Integrity Comments[1]

[1] References to academic articles and working papers cited herein are provided in a reference list at the end of these comments and, when publicly available, have been submitted into the docket. All other references are already available in the docket.

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I. Procedural Issues

As Policy Integrity noted in its December comments, the Alliance and NERA/Trinity failed to provide critical details regarding their modeling and methodologies, including data, assumptions, equations, and results.[6] The Alliance and NERA purport to have now included this with their responsive comment, filed at the end of April 2019.[7] Given the late date, if the agencies intend to rely on NERA's modeling, methodologies, or assumptions, the agencies must reopen a comment period so that interested parties can review and evaluate NERA's approach more fully and

[2] This document does not purport to present New York University School of Law's views, if any.

[3] Comment by the Institute for Policy Integrity at New York University School of Law, NHTSA-2018-0067-12213 and EPA-HQ-OAR-2018-0283-5083 (Oct. 26, 2018) ("Policy Integrity October Comments").

[4] *See* Supplemental Comments by the Institute for Policy Integrity at New York University School of Law, NHTSA-2018-0067-12362 (Dec. 21, 2018) ("Policy Integrity December Comments"); Comments of the Alliance of Automobile Manufacturers, NHTSA-2018-0067-12073 and EPA-HQ-OAR-2018-0283-6186 (Oct. 26, 2018) ("Alliance Comments"), attaching NERA Economic Consulting & Trinity Consultants, Evaluation of Alternative Passenger Car and Light Truck Corporate Average Fuel Economy (CAFE) Standards for Model Years 2021-2026 (Oct. 26, 2018) ("NERA/Trinity Report").

[5] Comments of the Alliance of Automobile Manufacturers, NHTSA-2018-0067-12392 (April 10, 2018) ("Alliance Supplemental Comments"), attaching NERA Economic Consulting, Response to Comments on NERA/Trinity Report (April 10, 2019) ("NERA Response").

[6] Policy Integrity December Comments at 1.

[7] *See* NERA Response at 3; Alliance Supplemental Comments, attaching NERA Economic Consulting, Memo to Alliance of Automobile Manufacturers re: CAFÉ Standards Analysis: Data Back Up (April 10, 2019).

comment on it. The agencies would also need to provide an updated environmental impact statement.

Moreover, while the Alliance and NERA claim to have posted "backup files for the modeling and the data we use," Policy Integrity's initial, high-level review of the submitted documents reveals that critical information is still missing. NERA claims that it has included "Stata do" files that would allow third parties to reproduce NERA's results, but we do not see these in the docket. In addition, NERA still has not provided the results of its New Vehicle Market Model and scrappage model. NERA has now provided numbers on total fleet size but has not provided the sales or scrappage effects embedded in those results, and it is not possible for reviewers to calculate those effects given the information provided. Nor does NERA provide statistical validation of those models or the other models used in the analysis. All of this information is essential to understanding NERA's models and methodology. The agencies, therefore, cannot rely on NERA's analysis when finalizing fuel economy or greenhouse gas emission standards; doing so would fail to provide the public with an adequate opportunity to fully understand and comment on the agencies' course of action.

II. New Vehicle Market Model

NERA's response attempts to rebut Policy Integrity, CARB, and NGO criticisms of the nested logit consumer choice model that NERA developed to estimate new vehicle sales and consumer willingness to pay for fuel economy.[8] In its December comments, Policy Integrity highlighted the fact that NERA used an untested consumer choice model that suffers from several flaws, many of which have caused the agencies to reject the use of such models in the past.[9] Policy Integrity also cited economic literature calling into question whether consumer choice models such as the model NERA used in its economic analysis are useful in the policymaking context, citing, in particular, the models' failure to account for manufacturer decisionmaking.[10] NERA fails to provide an adequate response to these points.

A. NERA's New Vehicle Market Model Uses an Untested and Unreliable Methodology

In its response, NERA states that the agencies support the use of vehicle choice models.[11] However, as evidence NERA points only to statements made by NHTSA in 2012, which indicate the agency was interested in developing usable consumer choice models as part of the mid-term evaluation ("MTE"). Yet, NERA's response inexplicably ignores statements by EPA in 2016 *as part of the MTE* that consumer choice models are not yet sufficiently reliable for policymaking and are poor predictors of future vehicle sales by vehicle model and type.[12] EPA's concerns,

[8] NERA Response at 5.

[9] Policy Integrity December Comments at 2-3.

[10] *Id.* at 3.

[11] NERA Response at 5.

[12] EPA, Proposed Determination on the Appropriateness of the Model year 2025-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards under the Midterm Evaluation at A-44, A-47, A-48 (2016), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100Q3DO.PDF?Dockey=P100Q3DO.PDF (concluding that vehicle choice

which Policy Integrity highlighted in its October comments,[13] are consistent with a later report commissioned by EPA,[14] with the economics literature evaluating vehicle choice models,[15] and with the economics literature on the valuation of vehicle attributes using vehicle choice models.[16] Nor does NERA respond to the concerns raised by both agencies as part of the MTE in the Proposed Rule and identified in the NGO's comments that vehicle choice models fail to account for consumer substitution of vehicles and so "even the more accurate consumer choice model may produce unrealistic projections of future sales volumes at the model, segment, or manufacturer level."[17]

Economist David Greene reviewed the academic literature that estimates consumer valuation using consumer choice models. In his review, Greene found that "estimating consumer willingness to pay for vehicle attributes is a very difficult problem" because researchers face a variety of identification challenges, including multicollinearity of vehicle attributes, measurement error of attributes, omitted variables, and endogeneity.[18] Additionally, few vehicle choice models capture consumer heterogeneity (i.e., variation of preferences among consumers).[19] Recent work by Benjamin Leard demonstrates that assuming all consumers are the same biases model predictions in a way that overestimates the extent to which price changes influence new vehicle sales.[20] In fact, Leard analyzed the Proposed Rule's rollback of the baseline standards using a model that captures consumer heterogeneity and found that the baseline standards would lead to *higher* vehicle sales relative to the proposed rollback.[21]

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models are insufficient for policy making); *id.* at A-45 (concluding that vehicle choice models are poor predictors of future shares); *id.* at A-44 (finding that vehicle choice models often are out-performed by constant share models and have not been tested for their forecast ability).

[13] *See* Policy Integrity October Comments at 88.

[14] EPA (2018).

[15] Haaf, et al. (2014).

[16] Greene et al. (2018).

[17] Comments of Consumer, Environmental, and Public Health Groups on Proposed Rule at A3, NHTSA-2018-0067-12371 (Dec. 20, 2018), https://www.regulations.gov/document?D=NHTSA-2018-0067-12371 ("NGO Supplemental Comments") ("The Agencies further note that, '[i]f a consumer choice model were to drive projected sales of a given vehicle model below some threshold, as consumers have done in the real market,' the model would need to 'generate a new vehicle model to take its place," as this is how manufacturers adapt to demand changes. 83 Fed. Reg. at 43,077.").

[18] Greene et al. (2018) at 261, 267, 273. Multicollinearity involves the interrelationship of multiple independent variables such that it is difficult to disentangle which variable is the ultimate cause of a dependent variable. Endogeneity occurs when findings about an explanatory variable—for example, about the impact of new vehicle price on sales—cannot be given a causal interpretation because important variables have not been controlled for or because the explanatory variable is jointly determined with the dependent variable. *See* Cameron & Trivedi (2005) at 92.

[19] Greene et al. (2018) at 269, 273.

[20] Leard (2019) at 29.

[21] *Id.* Greene et al. (2018) provides supporting evidence that including consumer characteristics, via the inclusion of household and vehicle attribute interactions, can greatly affect results. Green et al. (2018) at 268-269. Similarly, Haaf et al. (2014) finds that including consumer attributes can improve predictive ability. Haaf et al. (2014).

Evidence indicates that consumers do not make "complex, multidimensional choices," like infrequent vehicle choice decisions, in ways that are represented by consumer choice models. Specifically, consumers appear "not [to] optimize continuous trade-offs among all attributes," and instead initially use simple rules of thumb to decrease their choice set before optimizing across a smaller subset of choices.[22] These challenges "virtually guarantee" model misspecification, particularly in revealed preference models such as the model used by NERA.[23]

Moreover, the subset of vehicle choice models that rely on logit specifications, as with NERA's model, perform poorly in out-of-sample tests (that is, tests of data that were not used to develop the model).[24] Nested logit models, the particular model-type used by NERA, are the least commonly applied logit model, do not perform better than non-nested logit models, and produce less accurate predictions of the mix of vehicles sold in the short-run than merely assuming a continuation of existing sales trends.[25] Because of these challenges, existing vehicle choice models are virtually useless for the agencies' current purposes.[26]

NERA's two-stage nested-logit model is not even consistent with best practices in the vehicle choice model literature.[27] For example, in the first stage, the model inappropriately holds key parameters constant,[28] and in the second stage, the model is not designed to address endogeneity concerns raised in the economic literature.[29] In other words, the models may not be able to identify the correct *causal* relationship between fuel economy changes and vehicle sales. These flaws will further worsen the model's out-of-sample predictive ability (that is, the ability to predict the effects of the baseline standards or the proposed rollback on future vehicle sales).

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[22] Greene et al. (2018) at 273-274; Haaf et al. (2014) at 7.

[23] Haaf et al. (2014) at 1. Model misspecification occurs when, the model is not constructed in a way that accurately represents the data-generating process the model is intending to capture.

[24] Haaf et al. (2014).

[25] Greene et al. (2018) at 262; Haaf et al. (2014) at 1.

[26] EPA (2018) at 7-1 ("Some consistency can be found in the fact that most estimates are positive (consumers would prefer lower fuel costs). This 'consensus' however, encompasses such a wide range of values that it is of little use for informing policy decisions. Unfortunately, the results for other attributes are often just as divergent."); *see also* Greene et al. (2018) at 264, 273-74.

[27] *Compare* NERA/Trinity Report at B-4 (assuming consumer homogeneity in first-stage model) *with* Haaf et al. (2014) at 7 (finding homogeneity assumptions lead to poor out-of-sample prediction and estimation bias); *Compare* NERA/Trinity Report at B-4 to B-5 (estimating willingness to pay in second stage model by regressing calibrated parameters on only fuel efficiency, performance, and vehicle size and certain fixed effects) *with* Leard et al. (2017) at 4 (incorporating additional variables such as safety, reliability, comfort, perceived quality, fuel types, incentives, non-fuel operational costs, pollution, prestige, range, and aesthetics); Klier and Linn (2012) at 188, 199 (same); Haaf et al. (2014) at 7 (same).

[28] *See* Haaf et al. (2014) at 2.

[29] NERA's use of fixed effects is not sufficient to address endogeneity; instrumental variables are necessary. Klier and Linn (2012) at 201 (using instrumental variables to address endogeneity because ear, season, and model fixed effects fail to address brand-specific time trends that are likely present). This is despite the fact that instrumental variables are used in the literature that NERA cites as the basis of its nested-logit model. *See* Grigolon & Verboven (2014) at 925; Klier and Linn (2012) at 199, Berry (1994) at 249.

In its response, NERA argues that its model's willingness-to-pay estimates are consistent with the estimates from the economic literature discussed in Greene et al. (2018). This is ironic because Greene et al. (2018) specifically argues that the level of variability in the literature means that the agencies should not use the literature's willingness-to-pay estimates in policymaking because the uncertainty about the actual value is too great. Moreover, NERA compares its results—that consumers are willing to pay $694 for fuel economy that improves the cost-per-mile of driving by $0.01—to the wrong estimates from Greene et al. (2018). The comparable estimates from Table 8 of Greene et al. (2018) (those estimates that, like NERA, fail to use instrumental variables[30]) show that the literature finds a mean estimate of consumer willingness-to-pay for fuel economy of $1,368.

Given the variability of results from consumer choice models, the agencies cannot rely on any particular model, such as NERA's New Vehicle Market Model, to accurately predict sales effects of fuel economy standards or accurately estimate consumer willingness-to-pay for vehicle attributes. This is compounded by the particular flaws in NERA's nested-logit model.

B. NERA Has Failed to Clearly Establish Whether Its New Vehicle Market Model Accounts for Manufacturer Decisionmaking

In its response, NERA asserts that its New Vehicle Market Model does not include one of the flaws with consumer choice models that Policy Integrity identified in its December comments: the failure of such models to take into account manufacturer decisionmaking.[31] But NERA's response appears inconsistent with the description of its modeling approach included in the NERA/Trinity Report, and NERA has failed to provide sufficient information for the public to evaluate what NERA has actually modeled.

Vehicle prices and sales are not only a function of consumer choices, but also of strategic manufacturer behavior to maximize profits. In order to address this problem, NERA would have to implement a new modeling module that takes into account the relationship between manufacturer behavior and vehicle prices. The description of the New Vehicle Market Model in the NERA/Trinity Report includes no information about any module that models strategic behavior of manufacturers, such as strategic pricing of vehicles. Instead, the NERA/Trinity Report suggests that NERA used NHTSA's Volpe model to identify the technologies that can be deployed in vehicle fleets.[32] As the NERA/Trinity Report explains, Volpe works by selecting a technology mix that is cost-minimizing, not one that is profit maximizing for manufacturers.[33] The vehicle technology costs associated with that technology mix appear to then be passed

[30] NERA did not address endogeneity according to the criteria established in Greene et al. (2018).—that is, the use of instrumental variables. Greene et al. (2018) at 267. Comparing Table 6 and Table 8 makes clear that Greene et al. (2018) find use of fixed effects is not sufficient to address endogeneity.

[31] NERA Response at 6-7.

[32] *See* NERA Response at 4 (showing Volpe model information feeding into New Vehicle Market Model).

[33] NERA/Trinity Report at A-7.

through directly into vehicle prices (with a 1.5x "mark-up").[34] NERA explains that it is those vehicle prices that inform consumer purchasing decisions in the New Vehicle Market Model.[35]

In its response, NERA now claims that it simply failed to fully describe its modeling in the NERA/Trinity Report, and that "[t]he New Vehicle Market Model incorporates strategic adjustments in prices and sales by automobile manufacturers that account for changes in costs for their different vehicles as well as interactions in demand among the different vehicles in the manufacturer's fleet."[36] NERA then claims it is now "provid[ing] information on the specifics of our assumptions regarding manufacturer decisions" in which it explains the use of assumed Bertrand competition (that is, firms competition by setting prices, not quantities).[37] But these new statements are virtually impossible to reconcile with the information that was provided in the NERA/Trinity Report. Either the NERA/Trinity Report failed to mention an entire model that NERA used to incorporate manufacturer responses (and misleadingly suggested that costs were merely passed through to consumers), or the NERA Response fails to accurately characterize the approach NERA has taken and NERA did not actually model strategic manufacturer behavior.

There are a number of reasons why the former appears unlikely:

- The NERA/Trinity Report includes flow-charts to illustrate the workings and interactions among models, which include no mention of a manufacturer model.[38]
- The entire Appendix of the NERA/Trinity Report on the New Vehicle Market Model includes no discussion of manufacturer pricing choices or sales mix.[39]
- Words that would imply the use of a manufacturer responsive model—"Bertrand," "competition," "margin," "equilibrium," "profit maximization" "strategic pricing"—are not used in the NERA/Trinity Report at all.
- As explained above, the NERA/Trinity Report contains language suggesting NERA determined vehicle pricing by merely multiplying the vehicle costs from the Volpe model by a 1.5x markup, and not a pricing model that captures strategic manufacturer behavior.
- While neither NERA's "Stata do" files or any other modeling code are included in the docket, files that have been included further suggest that NERA has not incorporated a manufacturer pricing module. Attachment_05_NERA-Report_data_Summary.xlsx is a file that includes information on modeling outputs. Yet while this file includes "cost"

[34] NERA/Trinity Report at H-1 ("For estimating costs of these technologies to consumers, the CAFE model assumes a retail price equivalent (i.e., a 'mark-up') of 1.5 for fuel economy technologies").

[35] NERA/Trinity Report at B-4 ("As described above, the nested logit choice framework provides a method to estimate consumer demand for differentiated products, *using as data the prices and parameters that measure the relative attractiveness of each product*").

[36] NERA Response at 6.

[37] NERA Response at 6-7. Pindyck & Rubinfeld (2009) at 456-459, 696.

[38] NERA/Trinity Report at 4, B-2.

[39] NERA/Trinity Report at B-1 to B-9.

information, it includes none of the pricing information that would be expected as an output of a manufacturer pricing module.

Because NERA has failed to provide the details of its model and, as described above, relevant files are missing from the record, the public has no way of resolving this discrepancy or fully evaluating NERA's approach to modeling new vehicle sales.

III. Scrappage

NERA argues that "increased demand for used vehicles" will raise used vehicle prices and reduce the turnover of used vehicles.[40] According to NERA, this decreased turnover leads somehow to "increases in the number of existing vehicles."[41] That logical leap is similar to the leap made in the Proposed Rule. But the leap is not supported or explained. Nor is it logical. As the literature shows, vehicle price increases and fuel efficiency increases are likely to, if anything, decrease fleet size.[42] Though NERA claims that its model is "based on well-established economic theory and empirical evidence,"[43] in reality, the literature does not support the finding of a fleet size increase. Many top academics submitted evidence in the record, which also supports Policy Integrity's point.[44]

Moreover, the change in sales of new vehicles and the shift in used vehicle demand are connected, as it is the same consumers who are buying either new or used vehicles. Yet, NERA does not model them as connected. As Policy Integrity explained in its October comments, failure to connect the two effects is a fundamental flaw.[45]

NERA also fails to address Policy Integrity's point that regardless of what happens to fleet size, vehicle miles travelled should not increase (other than due to rebound effect, which is addressed separately below).[46]

IV. Rebound

NERA attempts to support the agencies' use of a 20 percent rebound estimate in the Proposed Rule by responding to critiques that Policy Integrity, CARB, and NGOs submitted in their October comments.[47] Among other critiques, Policy Integrity criticized the agencies' use of studies that evaluated consumer response to changes in the cost of driving that were not

[40] NERA Response at 10.

[41] NERA Response at 10.

[42] *See* Policy Integrity October Comments at 67-69 (summarizing the literature).

[43] NERA Response at 7.

[44] *See* David Bunch, An Evaluation of NHTSA's Economics-based Modeling and Implications for Benefit-Cost Analysis in the NHTSA/EPA August 24, 2018 Notice of Proposed Rulemaking (NPRM), available at https://ww2.arb.ca.gov/expert-reports-specific-subjects-vehicle-technology-vmt-scrappage-consumer-behavior-traffic-safety; Letter from Dr. Mark Jacobsen and Dr. Arthur van Benthem at 2, Docket No. EPA-HQ-OAR-2018-0283 and Docket No. NHTSA-2018-0067 (Oct. 8, 2018).

[45] *See* Policy Integrity October Comments at 63-64.

[46] *See* Policy Integrity October Comments at 79-85.

[47] NERA Response at 15-20.

representative of the kinds of responses that would be expected from the proposed change in U.S. fuel economy standards, including studies that evaluate rebound outside the United States, studies that evaluate rebound over unrepresentative time periods, and studies that evaluate rebound as a result of gas price changes rather than fuel economy changes, among other criteria.[48] In its response, NERA claims that the economic literature supports a 20 percent rebound estimate even under the criteria that Policy Integrity identified for evaluating representative academic studies of rebound.[49] But the analysis of the rebound effect included in NERA's response is, at best, misleading in several regards.

First, NERA attempts to control for studies with unrepresentative criteria by controlling for each of the shortcomings that Policy Integrity identified in the rebound literature one by one, not in combination. As Policy Integrity explained in its October comments, the agencies should not take a simple average of all rebound studies, but rather, consistent with EPA guidelines regarding how to draw valid conclusions from an academic literature that involves multiple estimates, the agencies should evaluate rebound using a meta-analysis of studies.[50] Barring that, the agencies should evaluate only studies that meet pre-determined selection criteria developed in the literature.[51] NERA's alternative approach in its response is to take a simple average of studies that meet one selection criteria. But this approach does not meet EPA's guidelines. Using only studies in Table 3 of NERA's response that meet *all* quality and relevance selection criteria yields only one paper: Hymel and Small (2015).[52] That study estimates rebound to be between 4 percent and 15 percent.[53] And in a letter submitted to the docket, one author of that paper, Kenneth Small, makes clear that due to expected future changes in income and other factors, the best estimate of the type of rebound is at or below the low end of this range.[54] When including all studies that meet all but one criteria, three additional studies meet the selection criteria: Small and Van Dender (2007), Gillingham (2011), and West et al. (2017).[55] Taking an average of those studies yields rebound estimates with a mean between 5 percent and 9 percent and a median of 5 percent to 11 percent. These ranges support the continued use of 10 percent, and not NERA's use of a 20 percent rebound estimate. Moreover, a 10 percent estimate is consistent with the findings of high-quality economic literature reviews, which evaluate studies based on quality and relevance selection criteria,[56] as well as with assumptions used by other government agencies such as U.S. Department of Energy's Energy Information Agency.[57]

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[48] Policy Integrity October Comments at 110-119.

[49] NERA Response at 15-20.

[50] Policy Integrity October Comments at 120-123.

[51] Policy Integrity October Comments at 123-124

[52] Hymel & Small (2015).

[53] NERA Response 19.

[54] Letter from Dr. Kenneth Small, Docket No. EPA-HQ-OAR-2018-0283 and Docket No. NHTSA-2018-0067 (Sept. 14, 2018), https://www.regulations.gov/document?D=EPA-HQ-OAR-2018-0283-2698

[55] Small & Van Dender (2007); Gillingham (2011); West et al. (2017).

[56] Policy Integrity October Comments at 124.

[57] *See* Gillingham (2013) at 26 n.11 (calculating that EIA's NEMS model uses a rebound estimate of 10 percent).

Second, the NERA analysis fails to respond to Policy Integrity's arguments that only some studies estimate the rebound effect of fuel economy improvements, rather than other types of changes that reduce the cost of driving.[58] For example, changes in fuel economy are likely to cause a different level of rebound depending on how much fuel economy improvement changes vehicle purchase prices (that is, how much standards require consumers to make additional capital expenditure). Fuel economy improvements generally require upfront capital expenditure that can cause an "income effect" where consumers substitute away from driving because they have less income due to upfront capital expenditure. NERA, however, merely averages studies that estimate rebound under different capital cost changes. Doing so makes it impossible to determine the appropriate value of the rebound effect for a fuel economy improvement that involves the particular capital cost increase used in NERA's analysis. NERA assumes that a very high capital cost increase will be required to meet the standards. As a result, the rebound effect should be relatively small. For example, a recent working paper demonstrates that energy efficiency mandates can have a *negative* total rebound effect in the United States if standards result in significant upfront product price increases.[59] If NERA is right that the baseline standards will result in a substantial price increase in vehicles, the negative income effect of that price increase would likely overwhelm the substitution effect and lead to a small or even negative rebound effect.

Third, NERA fails to respond to a number of other critiques regarding the use of a 20 percent rebound estimate in Policy Integrity's October comments, including that the agencies point to no new evidence supporting a 20 percent rebound and, in fact, ignore new evidence on rebound that does not support the new 20 percent assumption;[60] and that the agencies' criticism of prior reasoning for selecting a 10 percent rebound estimate does not withstand scrutiny.[61]

V. Baseline Fuel Economy

NERA argues that a cost-benefit calculation of the agencies' proposal should reflect fuel economy improvements that manufacturers would make even without the standards.[62] As support, NERA provides two citations—"Knittel (2012)" and "Wozny (2013)"—to argue that the empirical literature shows that "higher gasoline prices lead to more fuel-efficient vehicles."[63] But NERA has not included the full citation to either study in its references list. We have not identified the particular papers that NERA is intending to reference. The papers by Knittel and Wozny from around that time period—Busse, Knittel, & Zettelmeyer (2013) and Allcott & Wozny (2014)—are about consumer valuation of fuel economy, not the impact of prices on manufacturer behavior.[64] So, it is unclear what support NERA has for this point.

[58] Policy Integrity October Comments at 113-114.

[59] Fullerton & Ta (2019).

[60] Policy Integrity October Comments at 102-105.

[61] Policy Integrity October Comments at 105-109.

[62] NERA Response at 22-23.

[63] NERA Response at 23.

[64] Busse et al. 220 (2013); Allcott & Wozny (2014) at 784.

As explained in Policy Integrity's October comments, the historical evidence shows that manufacturers have not improved fuel economy when not required to do so, even though consumers value fuel economy.[65] Moreover, NERA uses a consumer choice model to estimate consumer valuation and, because those models are unreliable, has likely not correctly estimated consumer valuation. NERA's response also fails to address NGO arguments that if manufacturers do, in fact, implement all fuel economy improvements desired by consumers, the agencies would have a statutory obligation to incorporate, at minimum, that level of fuel economy into the standards rather than flat-lining the standards as proposed.[66]

In addition, if consumers value fuel economy, as NERA assumes, then the agencies should take that into account when calculating the price impact of the baseline standards. Policy Integrity explained this point in its October comments,[67] and NERA's response fails to address the point.

VI. Fuel Savings Benefits

To calculate the fuel saving benefits of the baseline standards, the NERA/Trinity Report considered only the value of fuel economy improvements that it asserts consumers consider when making vehicle purchase decisions.[68] That is, NERA used a purported measure of consumers' willingness to pay for fuel economy improvements to estimate the benefits of fuel savings. This willingness-to-pay measure is likely incorrect because it is derived from NERA's flawed vehicle choice model. But, as Policy Integrity explained in the December comments, even if NERA's estimate of consumer willingness to pay were accurate, limiting the benefits of fuel economy to that level is incorrect and a departure from the approach that the agencies have consistently taken for calculating the benefits of fuel savings. In its response, NERA presents several justifications for its novel approach to calculating fuel saving benefits. None of those justifications withstand scrutiny.

A. Consumer Willingness to Pay for Fuel Economy Is Not the Correct Measure of Fuel Saving Benefits Given Market Failures

NERA argues that it is standard practice to use consumer willingness to pay to measure the consumer benefits of a particular regulatory action.[69] However, NERA fails to acknowledge that for 40 years—under administrations of both parties— NHTSA, EPA, the Department of Energy, and other agencies have not adopted NERA's approach to valuing energy savings. As Policy Integrity's December comments explain in detail, when calculating the benefits of regulations that save energy, the agencies have consistently used the net present value of energy saved rather than measures that purport to capture consumer preferences for energy saving equipement.[70]

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[65] *See* Policy Integrity October Comments at 40-46; *see also* ICCT Comments, Docket #EPA-HQ-OAR-2018-0283-5456, NHTSA-2018-0067-11741, Attachment 3, p. II-1.

[66] *See* NGO Supplemental Comments at A4-A5.

[67] Policy Integrity October Comments at 34-35.

[68] NERA/Trinity Report at 54.

[69] NERA Response at 27.

[70] Policy Integrity December Comments at 5-14.

In fact the Office of Management and Budget's best practices for agency economic analyses, *Circular A-4*, and EPA's *Guidelines for Preparing Economic Analyses* direct agencies not to use a simplistic measure of consumer willingness-to-pay if there are market failures.[71] Instead, Circular A-4 states that for regulations such as fuel economy, where "cost savings . . . accrue to parties affected by a rule who also bear its costs" agencies should "monetize[] whenever possible" those "direct costs that are averted as a result of a regulatory action."[72]

NERA tacitly acknowleges that the approach that agencies have taken for 40 years is appropriate if there are market failures.[73] NERA nonetheless claims that Policy Integrity has failed to provide evidence of failures in the market for fuel economy.[74] But this is wrong.

First, the agencies themselves relied on the presence of market failures to justify the baseline standards.[75] It is the agencies' burden, not that of commenters, to justify a change in approach.[76]

Second, NERA's claim that Policy Integrity failed to provide empirical evidence of market failures is wrong. In its December comments, Policy Integrity cited several papers that clearly discuss empirical evidence documenting market failures, including papers from David Greene, and Gloria Helfand & Ann Wolverton, as well as Policy Integrity's October comments.[77] For example, David Greene discusses the work of Garth Heutel, who finds evidence of consumer loss aversion in the energy efficiency context.[78] Greene also notes that this evidence is consistent with consumer surveys and with research by the National Research Council showing that manufacturers believe that consumers only account for one to four years of fuel savings when purchasing a vehicle .[79] Similarly, Helfand & Wolverton discuss the empirical evidence for loss aversion.[80] Both papers also discuss the empirical evidence for consumers' use of heuristics

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[71] Office of Mgmt. & Budget, Circular A-4 at 19, 21 (2003) (cautioning that willingness to pay is a good measure of benefits only "if" the underlying market is "well-functioning" and requiring agencies to take "market imperfections" into account when valuing regulatory effects) ("Circular A-4"); EPA, Guidelines for Preparing Economic Analyses 7-21 (2010) (market prices are appropriate only "for goods bought and sold in undistorted markets"); *see also id.* at 7-15 (directing use of healthcare costs not otherwise accounted for in individual consumers' willingness-to-pay to avoid morbidity because "these costs represent diversions from other uses in the economy, [and so] represent real costs to society [that] should be accounted for").

[72] Circular A-4 at 37-38.

[73] NERA Response at 27 ("clear 'market failures' are needed to justify using an alternative approach").

[74] NERA Response at 27-28.

[75] 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62,624, 63,118 (Oct. 15, 2012) ("Baseline Standards Rule") ("NHTSA believes the existing literature offers some support for the view that various failures in the market for fuel economy prevent an economically desirable outcome, which implies that there are likely to be substantial private gains from the final rule.")

[76] FCC v. Fox Television Stations, Inc., 556 U.S. 502 (2009).

[77] Policy Integrity December Comments at 4 (citing Greene (2018); Helfand & Wolverton (2011) 112; Policy Integrity October Comments at 38-40).

[78] Greene (2018) at 10 (citing Heutel (2017)).

[79] Greene (2018) at 13.

[80] Helfand & Wolverton (2011) at 133.

when choosing vehicles rather than rationally calculating expected fuel savings due to the difficulty that they have in performing such calculations (termed "bounded rationality").[81] Helfand and Wolverton also cite evidence of consumer myopia when buying vehicles, indicating that consumers may value future fuel savings but fail to fully account for them when purchasing a vehicle.[82] Finally, in addition to discussing and providing evidence of many of the market failures discussed above, Policy Integrity's October comments present a detailed discussion, including citation of empirical evidence, of the positional nature of vehicle attributes and how that causes externalities that can be addressed by fuel economy standards.[83]

Other studies also found empirical evidence for multiple market failures including split incentives, inattention, salience, heuristic decision making, bounded rationality, myopia, learning by using, loss aversion, and capital market failures.[84] A recent study by Kenneth Gillingham, Sebastian Houde, and Arthur van Bentham has found significant empirical evidence of consumer myopia.[85] That study, which takes advantage of a sophisticated natural experiment, also finds empirical evidence that U.S. consumers substantially undervalue fuel economy and that a number of the studies that the agencies point to in order to claim consumers fully value fuel savings suffer from upward estimation bias.[86] Additional studies have found evidence of producer-side market failures, including imperfect competition and knowledge spillovers.[87]

In order to justify an approach that devalues fuel saving benefits, NERA attempts to identify other explanations for the gap between consumers' *ex ante* willingness to pay for fuel economy and the net present value of fuel savings (the "energy efficiency gap") other than market failures. NERA claims "the observed difference" between full valuation and willingness to pay "could be rational in the presence of high sunk costs and uncertainty over fuel savings."[88] But (despite falesely accuring Policy Integrity of ignoring empirical evidene) NERA has provided no empirical evidence of these alternative explanations. The primary study NERA cites for this claim is a 25-year-old paper by Kevin Hassett and Gilbert Metcalf. [89] Yet this paper provides no empirical statistical evidence for the theory that consumer uncertainty leads to the energy efficiency gap. Recent syntheses of the economic literature suggests that consumer uncertainty is

[81] Greene (2018) at 17-18 (discussing Turrentine & Kurani (2007); Sallee (2014)); Helfand & Wolverton (2011) at 131-32 (discussing Turrentine & Kurani (2007); Larrick & Soll (2008); Allcott (2010)).

[82] Helfand and Wolverton (2011) at 126 (citing Kubik (2006)).

[83] Policy Integrity October Comments at 47-51 (citing Heffetz (2011); Carlsson et al. (2007); Alpizar et al. (2005)).

[84] Gerarden et al. (2017) at 1503.

[85] Gillingham et al. (2019).

[86] Gillingham et al. (2019) at 16-17. As indicated in Gillingham et al. (2019), this finding is consistent with Leard et al. (2017).

[87] Houde & Spurlock (2016) at 9-15; Gerarden et al. (2017) at 1489-1490.

[88] NERA Response at 28.

[89] NERA Response at 28 (citing Hassett & Metcalf (1993)). NERA also cites to a paper by Gayer and Viscusi, yet that paper merely cites the Hassett & Metcalf (1993) paper despite twenty years passing for new studies. Gayer and Viscusi also appear to argue that consumer information issues are likely addressed by existing informational provisions. But more recent empirical evidence undermines that conclusion. *See* S. Houde (2018).

an insufficient explanation for the energy efficiency gap at best.[90] In order for consumer uncertainty to explain the energy efficiency gap, it requires three additional assumptions: the purchase of the vehicle must be irreversible, the timing of replacement must be flexible, and investment decisions must be discreet rather than continuous."[91] A recent study concluded that a number of these assumptions are unlikely to hold. Perhaps most importantly, an extensive used-vehicle market means that vehicle purchases are not irreversible. Furthermore, the empirical evidence for the uncertainty hypothesis is "mixed" and empirical studies have not measured the relative importance of this explanation and other explanations such as market failures.[92]

Given the presence of market failures, purported measures of consumers' *ex ante* willingness to pay for fuel economy improvements is not the appropriate approach for measuring the fuel saving benefits of the baseline standards. An approach that fails to fully value the savings that actually accrue to consumers and society is also inconsistent with 40 years of agency practice and with best-practice guidelines for agency cost-benefit analysis.

B. NERA's 60-Month Payback Estimate

NERA asserts that the NGOs misunderstood how NERA estimated the value that consumers place on fuel economy improvements when they claimed that "[t]he NERA/Trinity Approach argues that Americans value only 60 months of the fuel savings."[93] NERA now claims that it has included *all* value that consumers place on fuel economy improvements in its calculation of fuel saving benefits. However, NERA's description of its methodology in its initial report suggests this is, at best, misleading.

The NERA/Trinity Report explains "we measure **the value consumers are observed to place on the prospective fuel savings afforded by improved fuel economy** using the estimates of fuel economy changes from the CAFE model and NERA's estimate of consumers' willingness-to-pay for such changes from the New Vehicle Market Model."[94] When describing the payback period it used to determine which fuel economy technologies manufacturers would include without the standards, th report states that "a value of 60-months was used . . . for consistency with the resulsts of the New Vehicle Market Model (which **provides an estimate of the value new vehicle purchasers place on fuel economy improvements**)."[95]

That is, NERA's response fails to actually rebut the NGO's original criticism. NERA appears to have used the same approach to calcuating the amount of fuel economy consumers would demand without fuel economy standards as it used to calculate the economic value that NERA assumes consumers place on fuel economy improvements.

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[90] Gerarden et al. (2017) at 1513 ("The option value of waiting due to uncertainty regarding future energy prices or technological change may explain part of the apparently suboptimal investment in energy-efficient technologies, but probably not a large part, in most cases").

[91] Id.

[92] *Id.* at 1514.

[93] NERA Response at 28.

[94] NERA/Trinity Report at H-2.

[95] NERA/Trinity Report at A-5.

NERA's current claim that the NGOs are confused and that it has not done what it has described in the NERA/Trinity Report serves only to further support Policy Integrity's concerns that NERA has not provided enough explanation and information for the agencies to rely on the conclusions of the NERA/Trinity Report.

C. The Consistency of NERA's Willingness-to-Pay Estimate With Implicit Consumer Discount Rates Does Not Support Undervaluing Fuel Savings

In its response, NERA cites to research showing that its estimates of consumers' *ex ante* willingness to pay for fuel economy are consistent with implicit consumer discount rates found by a number of studies.[96] However, even if true, the consistency of NERA's estimates with implicit discount rates found in the economic literature does not support NERA's claim that consumers' *ex ante* purchasing decisions reflect the appropriate approach to calcuating fuel savings benefits. Rather, empirical studies that find high implicit consumer discount rates merely reflect the fact that, as a result of market failures, consumers do not make vehicle purchasing decisions that are consistent with maximizing the expected net present value of fuel savings. One of the studies that NERA cites in its response explains that high observed implicit consumer discount rates for fuel economy improvements (around 13 percent) are inconsistent with the discount rates standard economic theory predicts consumers would use (around 6 to 7 percent).[97] Put another way, high implicit consumer discount rates reflect the existence of the enegy efficiency gap. And empirical evidence of the energy efficiency gap does not justify devaluing the consumer and social benefits of fuel savings, it supports using the full valuation of those savings. As a result, NERA's identification of these studies provides no support for the approach to valuing fuel saving benefits included in the NERA/Trinity Report.

In fact, an approach that relies on high private discount rates is inconsistent with best practices for agency cost-benefit analysis. The purpose of regulation is to maximize *societal* net benefits not to maximize benefits of any particular private interests. When consumers operate more efficient vehicles, they consume fewer real economic resources (e.g., barrels of oil which must be extracted, refined, transported, etc.) than they would have had they operated less efficient vehicles. These are real resource savings for society, the value of which is represented by the price of the fuel (i.e., gasoline or diesel) saved and not consumers' *ex ante* subjective valuation of those savings. As a result, it is appropriate to calculate the present value of those future savings using the rate that *society* (not private individuals) discounts future costs and benefits (that is, using a social discount rate).[98] Such an approach is consistent with EPA's *Guidelines for Economic Analysis*, which directs EPA to use a social, rather than private, discount rate to

[96] NERA Response at 28-30.

[97] *See* Allcott & Wozny (2014) at 780 (discussing difference between observed implicit discount rates and "consumers real intertemporal cost of funds"); *id.* at 784 (discussing calculation of real intertemporal cost of funds as the discount rate derived from the opportunity cost of capital if fuel economy improvements are paid for in cash or the interest rate of a loan if fuel economy improvements are financed).

[98] Circular A-4 directs agencies to use discount rates of 3 percent and 7 percent except in specific circumstances such as intergenerational discounting. Circular A-4 at 33. Neither is close to the implied discount rates of 13 percent that NERA uses.

calculate costs and benefits of regulations.[99] It is also consistent with NHTSA's past explanations for why it has consistently calculated fuels savings benefits as the full economic value of those savings.[100]

D. NERA's Undervaluation of Fuel Savings Is Consequential

NERA attempts to minimize the significance of its approach to calculating the benefits of fuel savings by asserting that rolling back the baseline standards would remain net beneficial even if its analysis used the full economic value of fuel saving benefits.[101] But NERA's failure to properly value fuel savings is not harmless error. It is not sufficient that a particular standard level has benefits that exceed costs; when comparing potential standards, the size of the net benefits is relevant. And NERA's response shows that the approach to valuing fuel savings significantly influences which level of standards has the greatest net benefits.[102] As such, the calculation of fuel saving benefits will significantly influence the net benefits of more stringent standards, in the context of statutory mandates that are aimed at maximizing fuel economy and minimizing dangerous air pollution. But because the agencies have historically used the costs and benefits of fuel economy and greenhouse gas emission standards to inform the appropriate level of those standards,[103] reliance on a fundementally flawed economic analysis would render the agency's decisionmaking arbitrary.[104]

Moreover, NERA's calculations show that for Scenario 1 (the Proposed Rule's "preferred alternative") at a 3% discount rate, there is a $42.5 billion difference between the willingness-to-pay approach and full valuation of fuel savings. The total net benefits that NERA/Trinity calculated for Scenario 1 at a 3% discount rate is $98.2 billion. As a result, using the full valuation of fuel savings would, alone, reduce the net benefits of Scenario 1 by almost half.

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[99] EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES 6-1 (2010).

[100] Baseline Standards Rule, 77 Fed. Reg. at 62,992 ("When estimating the aggregate value to the U.S. economy of fuel savings resulting from alternative increases in CAFE standards—or the 'social' value of fuel savings—the agency includes fuel savings over the *entire* expected lifetimes of vehicles that would be subject to higher standards").

[101] NERA Response at 30-32.

[102] *See* NERA Response at 32 (finding that NERA Scenario 1 maximizes net benefits under NERA's flawed approach to valuing fuel saving benefits, whereas Scenario 5 maximizes net benefits under the agencies' historical approach to valuing fuel saving benefits).

[103] *See e.g.*, Baseline Standards Rule, 77 Fed. Reg. at 62,777 ("given the technical feasibility of the standard, the cost per vehicle in light of the savings in fuel costs over the lifetime of the vehicle, the very significant reductions in emissions and in oil usage, and the *significantly greater quantified benefits compared to quantified costs*, EPA is confident that the standards are an appropriate and reasonable balance of the factors to consider under section 202(a)") (emphasis added); *id.* at 63,020 ("[r]egardless of what type of analysis is or is not used, considerations relating to costs and benefits remain an important part of CAFE standard setting"); *Ctr. for Biological Diversity*, 538 F.3d 1172, 1186 (9th Cir. 2008) (explaining that NHTSA used a marginal cost-benefit analysis to determine maximum feasible standards for model years 2008-2011).

[104] *Ctr. for Biological Diversity*, 538 F.3d at 1198 ("Even if NHTSA may use a cost-benefit analysis to determine the "maximum feasible" fuel economy standard, it cannot put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards").

Correcting any one of NERA's and the agencies' many other errors—e.g., relying on accurate technology compliance cost estimates rather than the agencies' overestimates; using a 10% or lower rebound estimate instead of the agencies' unsupported estimate; using the global social cost of carbon at an appropriate discount rate instead of the agencies' so-called "interim" calculation—would likely show that Scenario 1 produces net costs rather than net benefits. Correcting all of these errors would certainly show this.

E. NERA's Citation of Opportunity Costs Does Not Justify Rolling Back the Baseline Standards

NERA attempts to justify the overall conclusions of its economic analysis by pointing to an alleged undercounting of a separate category of consumer costs.[105] Specifically, NERA claims that both its and the agencies' economic analyses failed to account for consumer welfare losses that result because the baseline standards force consumers to forgo vehicle attributes such as horsepower and weight (what NERA calls "performance attributes") that they also value. NERA calls this category of unaccounted-for costs the "opportunity costs" of the standards.[106]

As a preliminary matter, NERA admits that the results they present "cannot be used directly to estimate the offsetting consumer losses from reduced passenger car and light truck performance."[107] By NERA's own admission, its analysis does not and cannot quanitfy these alleged losses. Thus, NERA's analysis cannot be adopted by the agencies in an attempt to justify rolling back the baseline standards.

Moreover, NERA's identification of "opportunity costs" as an additional (unquantified) cost that would support its economic conclusions regarding the baseline standards is fundementally flawed for a number of reasons.

1. The academic literature does not support NERA's assumption about substantial efficiency-performance tradeoffs

In the absence of market failures, a rational consumer would continue to demand fuel economy improvements until the net present value of fuel savings[108] just meets the upfront cost of adding fuel efficiency technology.[109] The fact that in some limited cases technology can be used to

[105] NERA Response at 32-35.

[106] NERA Response at 33-34.

[107] NERA Response at 35.

[108] Rational consumers would also consider the fact that such technology also saves time at the pump and the value of additional miles traveled. However, the presence of these additional consumer benefits does not change the analysis and so, for simplicity, we refer only to the fuel savings.

[109] Helfand & Dorsey-Palmateer (2015) at 438 ("If vehicle buyers minimize costs of ownership, as in standard economic models, then all else equal, they should be willing to purchase additional fuel-saving technology as long as the additional cost of this technology to them is less than the expected discounted fuel savings"); Helfand & Wolverton (2011) at 129-130 ("the relative preference for performance over fuel economy still does not explain the seeming paradox that fuel savings appears to exceed the cost of adding additional fuel economy to the vehicle. One would expect from economic theory that consumers would continue to demand fuel economy improvements until the benefits of a marginal improvement just meets the cost. Only if there are limits on the total amount of

increase fuel economy *or* increase other vehicle attributes that consumers like does not alter this analysis,[110] because there are many technologies that can improve fuel economy, many technologies that can improve performance, and both fuel economy and performance can be improved at the same time.[111] If there are no market failures (including the availability of an efficient credit market for financing), manufacturers would be expected to add both technology that increases performance up to the level that consumers value that performance *and* technology that increases fuel savings up to the level that the net present value of the fuel savings are equal to the cost of the technology. This is true even if, as would be expected, adding both technologies further increases the upfront purchase price of a vehicle, so long as the additional fuel efficiency technology would still save consumers money *on net*.

The only case in which consumers may not receive performance attributes that they might value, would be where there is a technical or engineering constraint that prevented manufacturers from adding technology that increases performance *and* adding technology that improves fuel efficiency.[112] Yet, empirical evidence shows that automakers have been able to add fuel savings without creating a technical constraint on the amount of other attributes that can be added to vehicles.[113]

In its response, NERA reproduces a chart that purports to show that, historically, performance leveled off as fuel economy standards increased in an attempt to suggest that there has been such a tradeoff.[114] However, NERA's chart is misleading because it uses outdated data from when fuel economy standards were constant to incorrectly argue that manufacturers held fuel economy constant in order to advance performance attributes. As a recent figure from the 2018 EPA Automotive Trends Report (reproduced below) demonstrates,[115] since 2008, fuel economy began to rise (as a result of standards adopted by the agencies), yet performance attributes continued on the same upward path that they had prior to adoption of the standards. This evidence undermines

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efficiency that can go in a vehicle does economic theory predict that the marginal benefit of fuel economy should not equal its marginal cost").

[110] *See* EPA, NHTA & CARB, Draft Technical Assessment Report: Midterm Evaluation of Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2022-2025 at 4-26 (2016), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100OXEO.PDF?Dockey=P100OXEO.PDF ("Draft TAR") ("manufacturers may choose to apply technology to improve vehicle performance in lieu of efficiency").

[111] Helfand & Dorsey-Palmateer (2015) at 442 ("Power is also considered a substitute for fuel economy (e.g. Lier & Linn, 2012), though it is possible to increase both power and fuel economy, at a cost").

[112] Helfand & Wolverton (2011) at 129-130 ("Only if there are limits on the total amount of efficiency that can go in a vehicle does economic theory predict that the marginal benefit of fuel economy should not equal its marginal cost").

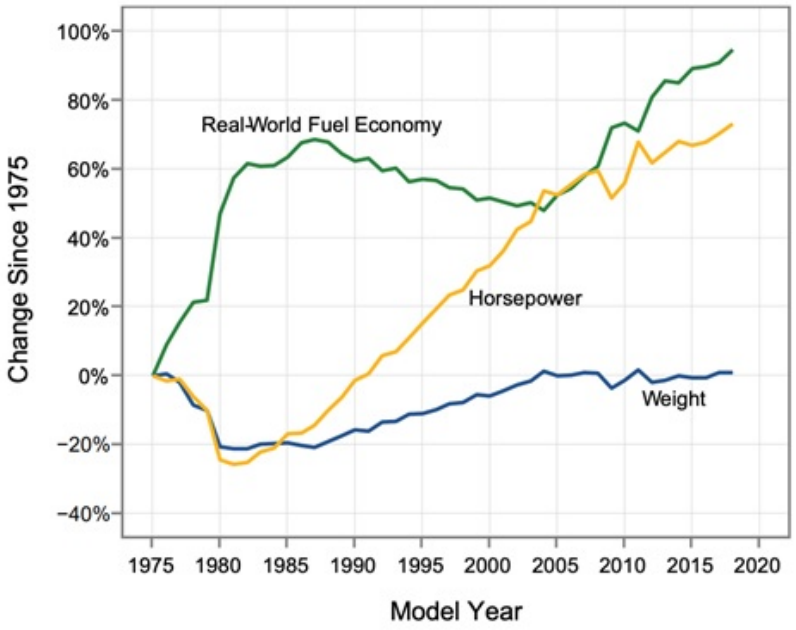
[113] Huang at al. (2018) at 194 (finding that "automakers have typically been able to implement fuel-saving technologies without harm to vehicle operational characteristics" like "acceleration, handling, ride comfort, noise, braking feel, and vibration").

[114] NERA Response at 34.

[115] EPA, 2018 AUTOMOTIVE TRENDS REPORT 30 (2018), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100W5C2.PDF?Dockey=P100W5C2.PDF; *See also* Policy Integrity October Comments at 46, fig. 1 (showing data from 1994-2017, and including acceleration as well as horsepower and weight).

NERA's assertion, based on the outdated data, "that if CAFE standards are tightened, manufacturers would reduce the pace of improvement in these other desirable [performance] features."[116] As the Environmental Defense Fund explained in its October comments to the agencies, EPA concluded as part of the MTE that this change reflects the fact that "the historic tradeoff between performance and fuel economy is far less likely to hold for advanced technology engines."[117]

Figure 3.15. Relative Change in Fuel Economy, Weight, and Horsepower, since Model Year 1975



Moreover, as the agencies discuss in the Draft Technical Assessment Report completed as part of the MTE, even if there is some performance-efficiency tradeoff, studies suggest that there may also be a countervailing effect whereby the increased innovation spurred by the standards ultimately allows both more performance and more efficiency at lower cost.[118] More recent literature notes that learning by doing and knowledge spillovers should further reduce compliance costs, making these tradeoffs less necessary and potentially non-existent.[119]

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[116] NERA Response at 34.

[117] Comments of Environmental Defense Fund Appendix A at 90, NHTSA-2018-0067-12108 (Oct. 26, 2018), https://www.regulations.gov/document?D=NHTSA-2018-0067-12108; *see also* EPA, Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation: Technical Support Document at 4-6 to 4-7 (Nov. 2016), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3L4.pdf; EPA, Final Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation: Response to Comments at 127 (Jan. 2017), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100QQ9Y.pdf.

[118] Draft TAR at 4-32 to 4-34.

[119] Bento et al. (2018) at 1119.

But NERA fails to account for this countervailing effect of the standards on performance.

2. Forgone performance attributes need not result in lost consumer welfare

Even if the baseline standards cause a reduction in vehicle performance attributes compared to what would occur without the standards, NERA has not shown that this will result in a welfare loss. The performance attributes that NERA identifies—such as horsepower and weight—are what the economics literature calls "positional goods."[120] As Policy Integrity explained in detail in its October comments, a fleetwide reduction of positional attributes need not cause *any* aggregate loss of consumer welfare.[121]

Positional goods are goods for which the value to one individual depends on how it compares with similar goods possessed by others.[122] In other words, the good is valued according to how much of the good others have, rather than according to innate characteristics of the good itself. A growing body of research indicates that many consumers do not necessarily want the biggest and fastest vehicle, so long as their vehicle is bigger and faster than their friends' and neighbors' vehicles.[123] Yet the purchase by one consumer of a faster vehicle inflicts a negative externality of diminished status on all other consumers who value having relatively faster vehicles; when those consumers compensate by upgrading to even faster vehicles as well, the first consumer suffers negative externalities in turn.

Because vehicle purchase decisions are made non-cooperatively but in fact alter the spending behavior and perceived safety of others, consumers get stuck on a "positional treadmill" that does not increase welfare.[124] Yet if any individual unilaterally tries to opt out of this "expenditure arms race," it would only move that consumer backwards on the status or safety hierarchy, which for most consumers is unacceptable.[125] If consumers could maintain their relative position with respect to performance attributes, they might not suffer any welfare loss.[126]

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[120] Frank (1985) at 101.

[121] Policy Integrity October Comments at 47-51.

[122] Frank (1985) at 101.

[123] Specifically, a majority of people surveyed would trade a decrease in their car's absolute value for an increase in its relative value compared to other people's cars: in other words, they are happy to have their car lose value so long as everyone else loses more value on average. *See, e.g.*, Carlsson et al. (2007) at 588, 593 (reporting results of a Swedish survey); Alpizar et al. (2005) at 412 (reporting results of Costa Rican survey). Though some such surveys were conducted in other countries, if anything positionality for cars could be stronger in the United States, given the American affinity for cars and the income distribution. *See* Heffner et al. (2005) at 2 ("In the words of automobile psychologist G. Clotaire Rapaille, Americans are in 'a permanent search of an identity' and 'cars are very key . . . [they are] maybe the best way for Americans to express themselves.'"); Hopkins & Kornienko (2004) (noting that positional effects increase as society's income increases, because the portion of income spent on conspicuous consumption increases); Carlsson et al. (2007) at 588, 593 (finding support for hypothesis that "visible goods and their characteristics, such as the value of cars, are more positional than less visible goods and their characteristics, such as car safety").

[124] Frank (2005) at 137.

[125] Frank (2005) at 105-06.

[126] Frank & Sunstein (2001) at 326 ("when a regulation requires all workers to purchase additional safety, each worker gives up the same amount of other goods, so no worker experiences a decline in relative living standards.

Reducing the amount of performance attributes that consumers want in ways that do not change the relative position of consumers will, therefore, not necessarily lead to aggregate welfare losses.

3. An analysis of lost performance would have to account for the benefits of reducing externalities of lost performance

If the agencies decide that the baseline standards result in consumers purchasing vehicles with fewer performance attributes, as NERA claims, the agencies would have to take into account the avoided negative externalities that such performance attributes would have imposed on society. Yet NERA fails to include the negative externalities associated with those vehicle attributes.

Economics has long recognized the various implicit subsidies and externalities imposed on society by vehicles. These include: road and parking construction and maintenance costs, the space used for parking, accidents, road congestion, and pollution.[127] Drivers with higher horsepower vehicles are much more likely to speed—by 10 miles per hour or more—increasing the risk of accidents, damages, and fatalities.[128] Vehicles with attributes that allow faster acceleration also cause a greater number of and more consequential accidents.[129] Similarly, increased weight of a consumer's vehicle imposes a negative externality on the safety of others in an accident.[130] Heavier vehicles also increase the cost of road maintenance and repair.[131] According to academic literature, the cost of these externalities is sizable.[132]

Looking only at the performance attribute benefits of the rollback without also accounting for the costs, as NERA has done, inappropriately puts a thumb on the scale of rolling back the baseline standards.[133]

If relative living standards matter, then an individual will value an across-the-board increase in safety more highly than an increase in safety that he alone purchases").

[127] Tietenberg & Lewis (2018) at 375-376.

[128] Insurance Institute for Highway Safety & Highway Loss Data Institute, *Flexing Muscle: Sports Car Ratings Show Range of Performance*, 52 STATUS REPORT, no. 5, 2016, at 1, https://www.iihs.org/iihs/sr/statusreport/article/51/5/2; Robertson (2018) at 200; McCartt & Hu (2017); Hu & Cicchino (2018); NHTSA, *How Vehicle Age and Model Year Relate to Driver Injury Severity in Fatal Crashes, Traffic Safety Facts: Research Note* (2013), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811825 (showing increased speed increases fatalities).

[129] Kim et al. (2006) at 981.

[130] Anderson & Auffhammer (2013); Policy Integrity, Comments on the Request for Comment on Reconsideration of the Final Determination of the Mid-Term Evaluation of Greenhouse Gas Emissions Standards for Model Year 2022-2025 Light-Duty Vehicles at 12-13 (2017), https://policyintegrity.org/documents/CAFE_standards_jobs_and_preferences_-_Institute_for_Policy_Integrity_(003).pdf.

[131] Ahmed et al. (2015) at 1080.

[132] Gerarden et al. (2017) at 1498; Lemp & Kockelman (2008) at 493-494. The magnitude of these externalities have been studied extensively in the fuel tax literature. *See e.g.* Parry & Small (2005).

[133] *Ctr. for Biological Diversity*, 538 F.3d at 1198.

4. The studies NERA cites do not support the lost opportunity cost values used in its cursory analysis

NERA relies on three studies to support its conclusions regarding the opportunity cost of the baseline standards: Klier and Linn (2013), Klier and Linn (2016), and Leard et al. (2017).[134] But these studies do not provide sufficient support for NERA's claims. Klier and Linn (2013) appears to be a working paper version of Klier and Linn (2016). Linn is a co-author on Leard et al. (2017). Therefore, despite claiming that there are "numerous studies" that support its argument,[135] the total of NERA's evidence includes two unique papers—one of which is currently unpublished—from one group of researchers. Regardless of the academic quality of these particular studies, the point is that the literature NERA attempts to rely on is in its infancy; considerably more research and verification is required before this literature could potentially be used to inform policy. Even the authors of Klier and Linn (2016) refer to their estimates as "rough" and "back-of-the-envelope estimates" that may "overestimate costs."[136]

This conclusion is consistent with a review of the economic literature that EPA commissioned as part of the MTE, which was completed in 2018.[137] That study concluded that consumer valuation of performance attributes is too uncertain to rely on, finding the literature "encompasses such a wide range of values that it is of little use for informing policy decisions . . . The lack of consensus we have found in the literature points to major challenges for researchers attempting to model consumer preferences for vehicles and their attributes." [138] In a follow-up paper, the author of EPA's commissioned study, David Greene, found "striking[ly]" high variation in willingness-to-pay estimates across the literature.[139] As such, Greene et al. (2018) concluded that focusing on any specific willingness-to-pay estimate is methodologically suspect.[140] Yet NERA relies on the same literature that was reviewed by Greene and fails to explain why reliance on these particular estimates is reasonable given the conclusion of that previous literature review.

There are also a number of specific reasons why these papers cannot serve as the basis for reliable calculations of consumers' alleged lost welfare from purportedly forgone performance attributes, consistent with criticisms of NERA's approach to calculating other costs and benefits. First, all three papers assume homogenous consumers.[141] Yet, as Leard himself notes in a recent working paper, incorporating consumer differences in vehicle choice models that derive willingness-to-pay estimates can affect the model's predictions by orders of magnitude.[142]

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[134] NERA Response at 33 n.25.

[135] NERA Response at 33.

[136] Klier & Linn (2016) at 52-53.

[137] EPA (2018).

[138] EPA (2018) at 7-1, 7-3.

[139] Greene et al. (2018) at 264, 273; *id.* at 274 (even after trimming outlines, "one standard deviation exceeds the mean of the [willingness to pay] estimates for most of the attributes...[and] the interquartile range also exceeds the median").

[140] Greene et al. (2018) at 274.

[141] Leard et al. (2017) at 29; *id* at 197 (applying estimates of willingness to pay for vehicle attributes from a model that imposes consumer homogeneity); Klier & Linn (2012) at 29-31; Klier & Linn (2016) at 53.

[142] Leard (2019) at 35, 40.

In addition, Klier and Linn (2016) assumes that standards do not affect vehicle price or market share.[143] This is directly contrary to the modeling assumptions used in Volpe and, as a result, by NERA. Klier and Linn (2016) uses estimates of consumers' willingness to pay for attributes that were developed using a consumer choice model in a prior study;[144] yet, that prior study suffers from a number of shortcomings of consumer choice models discussed above. Moreover, that study relies on several assumptions that may not hold in the real world and so may not be appropriate for policymaking.[145] Klier and Linn (2016) also assumes consumers fully value fuel savings, which is inconsistent with NERA's approach.[146]

Leard et al. (2017) has several features that make its use in this policymaking context inappropriate. The authors employ a survey with a low response rate of 9%. While they address the non-randomness of the individuals that received the survey, they do not appear to address the non-randomness of those that respond (i.e., response bias). Therefore, the results for the subsample that responded may not predict the behavior of all consumers that are affected by the standards. More importantly, they obtain estimates of consumer willingness to pay that the authors characterize as "puzzles."[147] First, the willingness-to-pay estimates suggest that producers are forgoing adoption of fuel savings technologies that could be used to improve performance at a profit. Second, the results that the study finds for consumers' willingness to pay for performance are not high enough to support reducing fuel economy in favor of performance, yet their current and past modeling results suggest manufacturers are reducing fuel economy in favor of performance.[148] The authors suggest these puzzles may be the result of modeling errors (e.g., hidden costs or a failure to model heterogeneous preferences). While this is acceptable in a working paper, reliance on such a study is not appropriate for policymaking.

The papers NERA cites also reinforce the points made above regarding the fact that standards speed up technological innovation.[149] Contrary to NERA's assumptions, this will reduce any tradeoff that may exist between fuel economy attributes and performance attributes over time.[150] In fact, another study previously cited by the agencies suggests that the type of approach adopted in Klier and Linn (2016) may underestimate technological progress and, therefore, may overestimate performance tradeoffs.[151]

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[143] Klier & Linn (2016) at 52.

[144] *See* Klier & Linn (2016) at 52 (citing Klier & Linn (2012)).

[145] Klier & Linn (2012) assumes that: (1) major engine attributes are captured as omissions will lead to biased estimates, (2) engine characteristics are uncorrelated with unobserved vehicle characteristics (i.e., firms are not matching engine platform to vehicle attributes unobserved by the authors), (3) vehicle attributes unobserved by the authors are not adjusted in response to CAFE standards, (4) no vehicles enter the market, and (5) producers do not have other dynamic considerations when making their product decisions. Klier & Linn (2012) at 201, 211.

[146] Klier & Linn (2016) at 53.

[147] Leard et al. (2017) at 29.

[148] Leard et al. (2017) at 29.

[149] Klier & Linn (2016) at 43.

[150] Klier & Linn (2016) at 48-50.

[151] MacKenzie & Heywood (2015) at 919-920; Draft TAR at 4-30.

5. Including lost opportunity cost without recalculating compliance costs would be arbitrary

NERA uses NHTSA's Volpe model to estimate the expected technology that manufactures will deploy to meet the baseline standards, and the costs of that technology.[152] NHTSA's Volpe model assumes that manufacturers will produce vehicles that have roughly the same performance attributes as they would have had without the standards.[153] But holding performance attributes constant when calculating compliance costs cannot be reconciled with NERA's attempt to calculate consumer welfare from forgone performance attributes. NERA has calculated costs using an assumption that *no attributes will be forgone*. But NERA then attempts to monetize performance attributes that will be forgone. These assumptions are plainly inconsistent.

Put another way, NERA claims that rolling back the baseline standards will reduce vehicle prices because vehicles will not include the cost of technology to improve efficiency. At the same time, NERA suggests it would be appropriate to count as benefits of the rollback the additional performance attributes consumers will allegedly purchase when they are not required to purchase efficiency. But, of course, obtaining that additional performance requires technology, which will raise the price of the vehicle. In other words, NERA has failed to account for the cost of performance-enhancing technology while claiming that consumers benefit from additional performance when the baseline standards are rolled back. This is inconsistent.

If NERA is right that consumers will lose welfare due to opportunity costs, the modeling of compliance costs would also have to allow manufacturers the flexibility to produce vehicles with a different mix of attributes and costs that (according to the modeling) better meets consumers demand. Doing so would substantially *reduce* the compliance costs of the rule because the cost modeling would allow manufacturers to produce lower-cost, but lower-performing, vehicles that comply with the standards.[154]

F. Policy Integrity's Critiques of Consumer Benefits Are Not Limited to NERA's Calculation of the Benefits of Fuel Savings

In its response, NERA asserts that Policy Integrity did not question NERA's approach for calcuating consumer benefits of the baseline standards other than fuel savings, including time consumers save by having to refuel less often.[155]

In fact, in its initial comments to the agencies, Policy Integrity raised a number of detailed concerns regarding the methodology for calculating refueling benefits.[156] And NERA's

[152] NERA/Trinity Report at 5.

[153] Proposed Rule, 83 Fed. Reg. at 43,027.

[154] Helfand & Dorsey-Palmateer at 450; s*ee* Bento et al. (2018) at 4 ("[B]oth the 2016 TAR and 2018 NPRM have likely overestimated compliance costs. Neither analysis considers the full extent of options that manufacturers have available to respond to these policies, including changes in vehicle prices, performance, and *other attributes*") (emphasis added).

[155] NERA Response at 24.

[156] Policy Integrity October Comments at 51-56.

methodology for calucating the benefits of reduced refueling time "follow[s] the formulation used in the NHTSA/EPA PRIA for estimating the value to consumers from reduced refueling time with one minor difference."[157] As a result, the critiques in Policy Integrity's initial comments also call into question NERA's approach. Specifically, the methodology used by the agencies and NERA underestimates the refueling benefits of the baseline standards (and therefore the forgone benefits of the proposal) by overestimating rebound; uses outdated data; fails to recognize any value of time saved for children under 16; erases 40 percent of time saved based on the incorrect assumption that consumers on a fixed schedule will see no savings; and ignores the fuel saving and emission reduction benefits of avoided refueling trips. Neither the original NERA/Trinity Report nor NERA's response rebuts any of these critiques.

VII. Conclusion

The agencies should not rely on NERA's analysis in any final rule that establishes greenhouse gas emissions or fuel economy standards.

[157] NERA/Trinity Report at H-3.

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The following documents are cited in the May 2019 comments submitted by the Institute for Policy Integrity. Where there are no copyright restrictions, the documents are attached so as to make them part of the record. For the documents where there are copyright concerns, we ask that the agencies include them in the record. Many of those documents were cited by the agencies and are thus already part of the record. Where available, we have included links for ease of reference.

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