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

October 26, 2021

To: National Highway Traffic Safety Administration

Subject: Comments on "Corporate Average Fuel Economy Standards for Model Years 2024–2026 Passenger Cars and Light Trucks," 86 Fed. Reg. 49,602 (Sept. 3, 2021)

Docket ID: NHTSA-2021-0053

The Institute for Policy Integrity at New York University School of Law ("Policy Integrity")[1] respectfully submits the following comments on the National Highway Traffic Safety Administration's ("NHSTA") *Corporate Average Fuel Economy Standards for Model Years 2024–2026 Passenger Cars and Light Trucks* ("Proposed Rule"),[2] which proposes to revise NHTSA's final rule entitled *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks* ("SAFE 2").[3]

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. Concerning NHTSA's proposed fuel economy standards for light-duty vehicles in model years ("MY") 2024–2026, Policy Integrity makes these recommendations:

- **NHTSA should focus on the persistent market failures that consumers face (rather than on alleged technology tradeoffs between fuel economy and performance).** NHTSA should reconsider its estimate that consumers value 2.5 years' worth of fuel savings in light of the best available evidence, and should consider whether there are grounds to select different estimates for use in its baseline technology assumptions as compared to in the sales module. Tradeoffs between fuel economy and performance attributes are rare, such that any potential opportunity costs are minimal. In any estimate of opportunity costs from allegedly forgone attributes, NHTSA should consider how compliance cost effects, diminishing returns to performance, safety externalities related to performance, and positional externalities caused by high-status performance attributes would all offset such estimates.
- **NHTSA should correct multiple errors in its sales model, or consider returning to its prior static fleet forecasts.** NHTSA's sales elasticity estimate is much too high compared to the best evidence on long-run elasticity. NHTSA should consider adopting the lowest estimate of elasticity that can be justified by the literature, perhaps around -0.2 to -0.3 or lower, to compensate for its claimed inability to properly adjust the consumer valuation estimate in the sales module. NHTSA's fleet share equation is inappropriately biased toward trucks. Given all these problems, NHTSA should consider returning to a static fleet forecast.
- **NHTSA should account for negative safety impacts from larger vehicles.** NHTSA currently relies on outdated studies regarding the relationship between fuel economy standards, down-

[1] This document does not purport to represent the views, if any, of New York University School of Law. Policy Integrity thanks Alex Jonlin for his research assistance as part of the NYU School of Law's Regulatory Policy Clinic.

[2] 86 Fed. Reg. 49,602 (Sept. 3, 2021) (Docket No. NHTSA-2021-0053).

[3] 85 Fed. Reg. 24,174 (Apr. 30, 2020) (Docket No. EPA-HQ-OAR-2018-0283).

weighting, and vehicle safety when its own analysis shows this relationship is statistically insignificant. In analyzing the impact of its standards on vehicle safety, NHTSA should give additional weight to externalities such as pedestrian fatalities and the impact of increased weight distribution between vehicles. NHTSA should also fully analyze any correlation between its footprint curve and trends in vehicle upsizing as it relates to both vehicle safety and lost emissions reductions.

- **NHTSA has begun to make other appropriate changes to its modeling approach, but should make further adjustments in the future to more fully capture the benefits of strong standards.** NHTSA's use of a 15% rebound effect is more appropriate than its use of 20% in SAFE 2, but remains inappropriately conservative. A 10% rebound value is more consistent with the literature and would show a more accurate estimate of the proposal's net benefits. NHTSA should not rely on a statistically insignificant relationship between safety and vehicle mass, nor on aberrant data on vehicle-miles travelled.
- **NHTSA should coordinate with EPA to address inconsistencies in the agencies' analyses**. Statements made by NHTSA in the Proposed Rule to support using unnecessarily conservative estimates in its own analysis could cast doubt on EPA's assumptions in their Proposed Rule. The two agencies should work toward consistency in their analyses in order to minimize legal risk in the Final Rules.
- **NHTSA should fully value all significant upstream emissions reductions, including those occurring abroad**. NHTSA is inappropriately excluding considering of emissions reductions associated with at least some upstream fuel extraction, refining, and other activities that occur outside U.S. borders. Such a practice is especially inappropriate for greenhouse gas emissions, which have the same effect on climate change regardless of their point of origin.
- **NHTSA should consider lower discount rates and, after implementing the methodological corrections recommended by these comments, recalculate costs and benefits for its policy alternatives. NHTSA should then select an alternative to increase net social welfare and achieve distributional goals.** NHTSA should consider whether, given that essentially all of its proposal's costs and benefits fall either to consumers or to society as a whole, a consumption-based discount rate is most appropriate, and based on updated data should consider a consumption-based discount rate of 2%. After recalculating costs and benefits consistent with these comments' recommendations, NHTSA should also consider unquantified effects and distributional goals, and select an appropriate alternative that will advance social welfare and distributional justice.

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I. Consumers Face Persistent Market Failures (Rather Than Technology Tradeoffs); NHTSA Should Revise Its 2.5-Year Valuation Assumption and Avoid Inaccurate Estimates of Alleged Opportunity Costs

In NHTSA's cost-benefit analysis, private benefits exceed private costs for all alternatives.[4] This fact raises the recurring question of why consumers cannot or do not on their own obtain these private net benefits for themselves in the marketplace without the need for additional government regulation. The longstanding explanation adopted by both NHSTA and EPA, grounded in the literature, is that a variety of persistent market failures prevents consumers from obtaining on their own the fuel economy that would save them money in the long run.[5]

It is indisputably correct for NHTSA to fully value the fuel savings in the tally of total net benefits resulting from the proposed standards,[6] because regardless of consumers' *ex ante* valuation of future fuel savings before they buy a new car, once they experience those savings in their wallets and bank accounts, they will value those savings. Moreover, from society's perspective, if fewer valuable resources are being consumed, that is a clear benefit.[7]

Even as NHTSA fully values fuel savings in the cost-benefit calculations, other parts of NHTSA's model try to capture the reality that consumers historically and currently do not purchase all the available fuel economy technologies that would save them money over time. For such purposes, NHTSA assumes that consumers value only 2.5 years' worth of fuel savings, taking the midpoint of the 2- to 3-year range that manufacturers have reportedly provided to the agency.[8] This assumption affects the model's results in countervailing ways. On the one hand, the assumption is used to estimate how much fuel economy technology manufacturers would voluntarily add to cars in the baseline scenario without additional standards. As a result, a relatively high estimate of the share of future fuel savings that consumers value would cause NHTSA's model to assume that manufacturers will voluntarily supply fuel economy at an unrealistically high rate, inconsistent with historical patterns which saw little gain in fuel economy without regulatory intervention. Estimating a high rate of voluntary technology adoption would decrease both the costs and the benefits of any proposed regulatory standards.

On the other hand, the assumed share of future fuel savings that consumers value is also used to estimate how consumers will react to new vehicles' net price changes, with a sales elasticity estimate multiplied by the difference between the increased purchase price and 2.5 years' worth of fuel savings. Here, a relatively low estimate causes NHTSA's model to assume that fuel savings will not offset most of the new vehicles' increased technology costs, leading to an unrealistically large sales effect in which consumers abandon their planned purchases of new vehicles. Estimating an unrealistically large overall

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[4] *See* NHTSA, *Preliminary Regulatory Impact Analysis: Proposed Rulemaking for Model Years 2024–2026 Light-Duty Vehicle Corporate Average Fuel Economy Standards* at 187 tbl.6-20 (2021) [hereinafter PRIA] (showing private benefits versus private costs for Alternatives 1–3 at the 3% discount rate). See *infra* Section VII for more on why the 3% consumption-based discount rate is a more appropriate valuation to consider in this rulemaking (and why a lower discount rate is likely even more appropriate).

[5] *See* Bethany A. Davis Noll et al., *Shortchanged: How the Trump Administration's Rollback of the Clean Car Standards Deprives Consumers of Fuel Savings* 20, 24–25 (2020), https://policyintegrity.org/files/publications/Clean_Car_Standards_Rollback_and_Fuel_Savings_Report.pdf [hereinafter *Shortchanged*] (recounting NHTSA's regulatory precedents); *id.* at 17 n.157 (noting that, even in the SAFE rule, NHTSA admitted that the energy efficiency gap existed, despite its "reservations" about market failures). Note that benefits to consumers include not just fuel savings, but also time savings and rebound driving.

[6] *See* 86 Fed. Reg. at 49,729 ("[W]hen estimating the societal value of fuel economy improvements, we use the full present value of discounted fuel savings over the expected life of the vehicle because it represents a real resource savings.").

[7] *See Shortchanged*, *supra* note 5, at 22.

[8] 86 Fed. Reg. at 49,710.

sales effect causes NHTSA to assume that relatively more miles will be driven in older, dirtier cars, thus undermining the proposed standards' estimated net benefits.

In the Proposed Rule, NHTSA admits that its 2.5-year estimate is problematic and calls for comment.[9] But the agency also continues to speculate as to why, if consumers have a non-zero valuation of fuel savings, did fuel economy levels historically remain relatively flat in the absence of regulatory standards. NHTSA puts forward a new explanation in the Proposed Rule: specifically, that consumers trade off vehicle attributes in an attempt to optimize their welfare in face of budgetary constraints, and that at points in history, fuel economy standards have been set above where consumers on their own would value fuel economy.[10] This concept "implies that fuel economy standards prevent consumers from achieving their optimal bundle of fuel economy and performance given their current preferences, creating an opportunity cost to consumers in the form of lost performance."[11] As a result, NHTSA raises the issue of whether to value opportunity costs.[12]

This theory, though creative, has limitations. To begin, there is no empirical test of its validity. Other narratives can be constructed just as easily to explain historical patterns: for example, if fuel economy has historically lacked salience for most consumers while horsepower is a "positional good,"[13] that can explain why, barring large fuel price shocks, consumers demanded little fuel economy in the past when fuel economy standards remained stagnant, while consumers continued to demand more horsepower without ever seeming satisfied with their new vehicles' performance.[14] NHTSA offers no test of why its new theory better explains history or better predicts the future than such alternate narratives. Indeed, as explored more below, NHTSA should return to a stronger reliance on the existence of market failures as an explanation for why fuel economy has historically remained relatively flat in the absence of regulatory standards, as such market failures are well documented in the literature and in NTHSA's regulatory history.

NHTSA's new theory also raises numerous questions, explored more in the subsections below. First, are consumers actually budget-constrained, or do consumers instead face market failures in accessing financing? Second, if standards were previously set above where consumers valued fuel economy, was consumers' apparent undervaluation of fuel economy the result of market failures? Third, even if technological tradeoffs between fuel economy and performance once existed, do they necessarily still exist, does it make any economic sense to assume they would exist indefinitely into the future without some change in price and supply, or can both fuel economy and performance in fact be increased together at the same time? Fourth, are consumers experiencing any net welfare gains from the performance attributes that are allegedly being traded against fuel economy? Any estimate of the opportunity costs of allegedly forgone attributes would need to consider compliance cost effects, diminishing returns to performance, safety externalities related to performance, and positional

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[9] NHTSA, *Technical Support Document: Proposed Rulemaking for Model Years 2024–2026 Light-Duty Vehicle Corporate Average Fuel Economy Standards* 399 (2021) [hereinafter TSD] (calling it "conservative"); *id.* at 405 (noting that the manufacturer-provided estimate could be incorrect, and that manufacturers help shape consumer preferences in the first place).

[10] 86 Fed. Reg. at 49,725 (claiming that this "logic appears to explain the trends in fuel economy and vehicle performance . . . between 1986 and 2004").

[11] *Id.* at 49,724.

[12] *Id.* at 49,727.

[13] That is, horsepower is a status good, and consumers derive value at least in part based on how their level of horsepower compares to other cars' horsepower. Yet as consumers compete for more and more horsepower, the absolute amount of horsepower increases but consumers' relative status remains largely unchanged, meaning consumers never get most of the assumed welfare benefits of their additional horsepower. *See infra* Section I.F.4 for more on positional externalities.

[14] See Policy Integrity's 2018 Comments, comparing horsepower against consumer satisfaction.

externalities caused by high-status performance attributes. This section explore each of these questions in turn.

This section also recommends that NHTSA should reconsider the 2.5-year estimate. NHTSA should assess whether, based on the best available evidence, there is reason to pick a relatively lower estimate to use in calculating the levels of technology that will be adopted in the baseline scenario, but a relatively higher estimate to use in modeling sales effects. Barring either that or a return to the pre-2020 assumption of a static fleet forecast with sales held constant, NHTSA should at least select the lowest estimate of sales elasticity that can be supported in the literature, to minimize the potential for its model to produce unrealistic results based on overly strong assumptions about consumer valuation of fuel savings.

A. Rather Than Budget Constraints, Consumers May Face Market Failures Preventing Efficient Access to Credit to Finance Both Fuel Economy and Performance Attributes

In the absence of market failures, a rational consumer would continue to demand fuel economy improvements until the net present value of fuel savings[15] just meets the upfront cost of adding fuel efficiency technology.[16] This conclusion does not change even if certain specific attribute improvements were somehow inconsistent with certain specific fuel-economy technologies. There are many technological options for improving fuel economy, and there are many technological options for improving other features such as performance; some technologies even improve *both* fuel economy *and* performance or other attributes simultaneously, and there is no reason to assume the rest of the technological options are inherently incompatible.[17]

If there were no market failures, manufacturers would be expected to provide the optimal level of fuel economy *and* the optimal level of other vehicle features. Technology that increases fuel savings would

[15] Rational consumers would also consider the fact that such technology 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.

[16] Gloria Helfand & Reid Dorsey-Palmateer, *The Energy Efficiency Gap in EPA's Benefit-Cost Analysis of Vehicle Greenhouse Gas Regulations: A Case Study*, 6 J. Benefit Cost Analysis 432, 438 (2015) ("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."), https://doi.org/10.1017/bca.2015.13; Gloria Helfand & Ann Wolverton, *Evaluating the Consumer Response to Fuel Economy: A Review of Literature*, 5 Int'l Rev. Env't & Res. Econ. 103, 129–30 (2011) ("[T]he 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 efficiency that can go in a vehicle does economic theory predict that the marginal benefit of fuel economy should not equal its marginal cost.").

[17] *See, e.g.*, EPA, NHTSA & 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 4-35 to 4-36 (2016), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100OXEO.PDF?Dockey=P100OXEO.PDF [hereinafter Draft TAR] (citing numerous examples of fuel economy technologies that also improve other features); EPA, *Proposed Determination on the Appropriateness of the Model Year 2022–2025 Light-Duty Vehicle Greenhouse Gas Standards Under the Midterm Evaluation: Technical Support Document*, at A-49 (2016) [hereinafter Proposed Determination] ("First, it is possible for automakers to continue to improve some other vehicle attributes, such as infotainment systems, in the absence of the standards. Second, EPA believes that the standards are contributing to innovation and adoption that would not have happened in the absence of the standards. In some cases, that innovation has contributed both to reduced GHG emissions and to improvements in other vehicle characteristics. For instance, Ford points out that the MY2015 F-150, with high-strength steel frame and high-strength, aluminum alloy body, provides better towing and hauling in addition to reduced GHG emissions."); Helfand & Dorsey-Palmateer, *supra* note 16, at 442 ("Power is also considered a substitute for fuel economy (e.g., Klier & Linn, 2012), though it is possible to increase both power and fuel economy, at a cost.").

be included up to the level where the net present value of the fuel savings is equal to the cost of the technology, *and* other features would also be provided up to the level that consumers value those features. This is true even if, as would be expected, adding both fuel economy and other features further increases the upfront purchase price of a vehicle, so long as the additional features are valued by the consumer at least as much as they changed the cost of the vehicle, and so long as additional fuel efficiency technology would still save consumers money *on net*. While potential lumpiness in the technology supply curves could cause some long-run inefficiencies, it is not clear (absent market failures) why firms would systematically under-invest in producing these technologies over time or why the price for these technologies would not eventually rise with pent-up consumer demand.

NHSTA suggests that consumers' fixed budgets constrain their ability to pay upfront for a car that has both fuel economy improvements and all of the additional features they want. This assumption is questionable for several reasons. First, as much as 20% of new vehicle sales are not to individual consumers, but to fleets: rental cars, corporate fleets, and government and institutional fleets.[18] NHTSA does not explain why these consumers would face significant budget constraints that would impede their ability to get both all the fuel economy and all the performance attributes that is net beneficial to drivers. Large rental car fleets and corporate fleets, for example, should have ready access to debt to finance the purchase of fuel economy technologies that—but for other market failures—should pay for themselves over time. More likely, a variety of market failures (such as split incentives for rental car companies, or short-termism for corporate fleets; *see infra* Section I.C) is contributing to consumers' under-investment in fuel economy.

Even for individual consumers, given that 85% of new vehicle purchases are financed by loans,[19] the wide availability of vehicle financing means that a consumer's budget constraint should not force them to choose between fuel savings and other features. Fuel economy improvements save consumers money every time they drive. A rational consumer would be willing to pay for the additional cost of greater fuel economy through a higher monthly loan payment, which will be offset over time by the economic value of fuel saved—and, similarly, a rational bank or lender would be willing to offer such a loan affordably, knowing that the long-term fuel savings will help the consumer make the monthly loan payments. A consumer who wants and is willing to pay for a vehicle with an additional feature (such as greater horsepower) should still have the same ability to buy that feature: they simply also have to either pay upfront or adjust their loan to finance enough fuel economy technologies to meet the regulatory requirements—but the lifetime fuel savings will pay back the cost of those additional technologies.[20]

With sufficient financing options, price should never make these vehicle features mutually exclusive. In fact, evidence suggests that there are plenty of loans that offer consumers *rate reductions* for fuel-

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[18] *Strong Fleet Sales Help Prop up Slow September*, Cox Automotive (Oct. 3, 2019), https://www.coxautoinc.com/market-insights/september-2019-fleet/ (explaining that rental, government, and commercial fleets make up over 17 percent of all new vehicle sales); EPA, *Regulatory Impact Analysis: Final Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards* 4-116 (2012) (noting that rental, corporate, and government fleets make up "about 20% of new vehicle sales"); U.S. Dep't of Energy, FOTW #1003, https://www.energy.gov/eere/vehicles/articles/fotw-1003-november-13-2017-cars-constituted-larger-fraction-light-duty (Nov. 13, 2017) (showing new light-duty sales to rental, corporate, utility, and government fleets).

[19] 85 Fed. Reg. at 24,706.

[20] If a consumer anticipates selling the car before the end of its life, the value of the remaining fuel savings would be reflected in the car's resale value, and so should still accrue to the vehicle's initial purchaser.

efficient vehicles.[21] If consumers were systematically unable or unwilling to access an efficient credit market to finance cost-saving fuel economy technologies, that itself suggests the existence of a market failure. Notably, a majority of individual consumers rely on dealerships to arrange financing for their new vehicle purchases.[22] As explored more below (*see infra* Section I.C), dealerships have a variety of perceived or real incentives not to disclose all information about fuel-efficient vehicle options to their consumers. Similarly, dealers may know about the potential availability of lenders willing to offer more favorable terms on efficient vehicles, and yet they have little incentive to match consumers with such lenders rather than with the lenders that offer the dealers the best profit-sharing arrangements. This information asymmetry may partly block consumers' access to efficient levels of financing.

To the extent any budget constraints are caused by market failures based on information issues, NHTSA should not be assuming budget constraints in its attempts to explain past fuel economy trends or predict future consumer responses to fuel economy standards.

B. Increased Fuel Economy Does Not Necessarily Come at the Expense of Other Attributes

NHTSA repeatedly assumes that fuel economy almost inevitably trades off against performance attributes,[23] such that fuel economy standards will cause manufacturers to forgo the development of additional performance attributes and so impose opportunity costs on buyers.[24]

Yet many fuel-efficient technologies, like turbocharging[25] and certain hybridization technologies,[26] can increase both fuel economy and vehicle performance and are entirely compatible with other features,[27]

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[21] Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 43,726, 43,804 (Aug. 10, 2021) (citing a new memorandum to file documenting such lenders); *see also* Comments from University of California, Berkeley's Environmental Law Clinic at 16–17 (Sept. 5, 2018), https://www.regulations.gov/document?D=EPA-HQ-OAR-2018-0283-0879 (citing a November 2016 memorandum commissioned by EPA, identifying over 60 financial institutions that offer loan rate reductions to consumers that purchase fuel-efficient vehicles); Memorandum from Hsing-Hsiang Huang & Gloria Helfand to EPA, Lending Institutions That Provide Discounts for More Fuel-Efficient Vehicles (Nov. 2016), *available at* https://www.regulations.gov/document?D=EPA-HQ-OAR-2015-0827-5832 ("EPA believes this information is valuable in illustrating the current practice of lenders providing green auto loans that factor in the consumer fuel savings from more efficient vehicles into the lending terms.").

[22] Andreas Grunewald et al., *Auto Dealer Loan Intermediation: Consumer Behavior and Competitive Effects* (NBER Working Paper 28136, Nov. 2020) (finding that "at least 80 percent of auto loans are 'indirect', i.e. obtained through auto dealers," and documenting the problematic incentives whereby dealers profit at the expense of consumers); *see also* Gayle Sato, *Do More People Finance Auto Loans at a Bank or Dealership?*, Experian, Oct. 26, 2020, https://www.experian.com/blogs/ask-experian/do-more-people-finance-auto-loans-at-a-bank-or-dealership/ (suggesting over 61% of new car financing is through the manufacturer or dealership).

[23] *E.g.*, 86 Fed. Reg. at 49,644.

[24] PRIA, *supra* note 4, at 69 (suggesting that NHTSA's calculation "omits any opportunity costs imposed on buyers by manufacturers' decisions to redeploy additional technology to increase the reference fleet's fuel economy rather than improve other features of vehicles that buyers also value, and this omission is likely to understate the economic costs of meeting higher standards.").

[25] *See* NHTSA & EPA, SAFE Rule Final Regulatory Impact Analysis 239 (2020) https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/final_safe_fria_web_version_200330.pdf [hereinafter SAFE FRIA] (relaying comments from industry that "manufacturers may apply turbocharging to improve not just fuel economy, but also to improve vehicle performance"); *see also id.* at 317.

[26] *See id.* at 320 ("[A] PHEV50 may have an electric motor and battery appropriately sized to operate in all electric mode through the repeated accelerations and high speeds in the US06 driving cycle, but the resulting motor and battery size enables the PHEV50 slightly to over-perform in 0-60 acceleration."); *see also id.* at 324 (concluding it is "an appropriate outcome" that certain electrification or hybridization options lead to a "small increase in passing performance").

[27] *See id. at* 326 (explaining that multiple options exist for "technology [to] provide both improved fuel economy and performance").

as a plethora of evidence has shown.[28] Additional examples include increasing the number of gear ratios in new transmissions, which help the engine both run more efficiently and in the optimal "power band" for performance.[29] Numerous fuel-economy technologies can also improve braking, handling, towing, hauling, steering responsiveness, torque vectoring, and multiple other non-performance attributes: for example, high-strength aluminum alloy bodies can provide better towing, better performance, *and also* improve fuel economy and reduce greenhouse gas emissions.[30]

In fact, research has demonstrated that the probability of a light-duty vehicle obtaining a negative evaluation of its operational characteristics is lower when that vehicle has fuel-saving technologies—in other words, more fuel-efficient light-duty vehicles are less associated with negative performance reviews.[31]

Historical empirical evidence shows that automakers have been able to add fuel economy without creating a technical constraint on the amount of other features that can be added to vehicles.[32] The only situation that would force vehicle manufacturers to trade off energy efficiency against other features would be if there is a technical or engineering constraint that made it impossible to add both those features and the technologies that improve fuel economy, or if the technology for improving fuel economy necessarily increases the marginal cost of adding additional features.[33] Researchers have found only isolated examples of inherent tradeoffs in practice, and there is no evidence that such problems alone could explain the energy efficiency gap.[34] And to the extent such tradeoffs existed in the past, they may not in the future.

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[28] *See* EPA, Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Standards under the Midterm Evaluation: Technical Support Document at 4-20 (2016), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3L4.pdf [hereinafter Midterm TSD] (discussing, e.g., Hsing-Hsiang Huang et al., *Re-Searching for Hidden Costs: Evidence from the Adoption of Fuel-Saving Technologies in Light-Duty Vehicles*, 65 TRANSP. RES. 194, 194 (2018) (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"); *see also* Draft TAR, *supra* note 17.

[29] *See* SAFE FRIA, *supra* note 25, at 326 ("[I]f a new transmission is applied to a vehicle, the greater number of gear ratios helps the engine run in its most efficient range which improves fuel economy, but also helps the engine to run in the optimal 'power band' which improves performance.").

[30] *See* Draft TAR, *supra* note 17, at 4-35 to 4-36; Proposed Determination, *supra* note 17, at A-49 (citing evidence presented by Ford about the F-150).

[31] *See* Gloria Helfand et al., *Searching for Hidden Costs: A Technology-Based Approach to the Energy Efficiency Gap in Light-Duty Vehicles*, 98 ENERGY POL'Y 590, 605 (2016) ("Though we are unable to demonstrate causality or robustness, we find that technologies are more likely to be associated with reducing negative reviews of operational characteristics than with increasing them."); 86 Fed. Reg. at 43,787 (citing more recent work by Huang, Helfand, and co-authors).

[32] Huang et al., *supra* note 28, 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").

[33] *See* Gloria Helfand & Ann Wolverton, *Evaluating the Consumer Response to Fuel Economy: A Review of Literature*, 5 INT'L REV. ENV'T & RSCH. ECON. 103, 130 (2011), https://www.nowpublishers.com/article/Details/IRERE-0040 ("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.").

[34] *See* Christopher Knittel, *Automobiles on Steroids: Product Attribute Trade-Offs and Technological Progress in the Automobile Sector*, 101 AM. ECON. REV. 3368, 3379 (2012); Thomas Klier & Joshua Linn, *The Effect of Vehicle Fuel Economy Standards on Technology Adoption*, 133 J. PUB. ECON. 41, 49 (2016). These two publications are often cited to support the notion of inherent tradeoffs. However, the authors never make any connection between opportunity costs and the energy efficiency paradox. The publications use historical data to observe possible tradeoffs that manufacturers may have made in the past between installing fuel economy technologies versus increasing the horsepower or weight of vehicles. *See also* EPA & NHTSA, *Final Rulemaking to Establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty*

Any possible performance tradeoffs are likely to decline over time, with technological advancements and manufacturer learning.[35] While in the short run manufacturers may face some constraints in overhauling a vehicle's design, in the long run they have greater flexibility to improve their designs and reduce compliance costs in ways that obviate any need for tradeoffs.[36] Furthermore, recent technological advancements have likely disrupted any historical tradeoffs between fuel economy and vehicle features that may have occurred in the past. As part of the Midterm Evaluation, EPA found that the recent simultaneous increase in fuel economy and vehicle features since 2008 reflects the fact that any historical tradeoff between performance and fuel economy is far less likely to hold for advanced technology engines.[37] EPA also pointed to literature that there may be technical limitations on increasing certain features such as acceleration that are independent of fuel economy improvements.[38] Recent studies using more sophisticated methodologies have confirmed this finding.[39] EPA's latest proposed vehicle standards concluded that there is persuasive evidence that manufacturers can implement fuel-efficiency technologies without imposing hidden costs,[40] especially because the marginal rate of substitution between power and fuel economy changed over time, such that newer technology improvements do not reduce power.[41]

More recent literature also notes that learning by doing and knowledge spillovers should further reduce compliance costs, making any tradeoffs less necessary and potentially non-existent.[42] Studies suggest that this may be caused by an effect whereby the increased innovation spurred by the standards ultimately enables manufacturers to also provide other features at lower cost.[43] As the agencies discussed in the Midterm Evaluation, in the absence of a forcing mechanism like regulation, risk-averse manufacturers—which face first-mover disadvantages, switchover disruptions, and other barriers—are likely to apply only smaller, incremental innovations to fuel economy, instead of pursuing more major advances that may have greater potential to improve both fuel economy and performance

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Engines and Vehicles—Regulatory Impact Analysis 9-3 (2011) ("[A]n additional explanation—adverse effects on other vehicle attributes—did not elicit supporting information in the public comments.").

[35] *See* Gloria Helfand et al., *Power and Fuel Economy Tradeoffs, and Implications for Benefits and Costs of Vehicle Greenhouse Gas Regulations*, EPA 17 (PowerPoint presentation, 2018), https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2018-0283-6963&attachmentNumber=17&contentType=pdf, *also available at* https://www.epa.gov/sites/production/files/2018-10/documents/sbca-benefit-cost-ghg-regs-helfand-2018-03.pdf ("The tradeoff between power & fuel economy has dropped over time.").

[36] *See* Antonio M. Bento et al., *Flawed Analysis of U.S. Auto Fuel Economy Standards*, 362 SCIENCE 1119, 1119 (2018), https://doi.org/10.1126/science.aav1458.

[37] *See* Midterm TSD, supra note 28, at 4-6 ("[T]he assumption in the previous research that the tradeoffs among acceleration, fuel economy, and weight are constant does not appear to accurately represent the new technologies, and in fact may substantially overestimate the magnitude of the performance-fuel economy tradeoff."); *see also* 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* 127 (2017), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100QQ9Y.pdf ("[F]uel economy and other vehicle attributes are not mutually exclusive, so there is no necessary tradeoff between fuel economy and other vehicle attributes.").

[38] *See* Midterm TSD, supra note 28, at 4-7 (citing Don McKenzie & John Heywood, *Quantifying Efficiency Technology Improvements in U.S. Cars from 1975–2009*, 157 APPLIED ENERGY 918 (2015)).

[39] *See* Helfand et al. *supra* note 35, at 13.

[40] 86 Fed. Reg. at 43,787 (citing Helfand et al., *supra* note 31; Huang et al., *supra* note 28).

[41] *Id.* (citing Watten et al. 2021 and Andrew Moskalik et al., *Representing GHG Reduction Technologies in the Future Fleet with Full Vehicle Simulation* (SAE Int'l, Working Paper No. 2018-01-1273, 2018)).

[42] Bento et al., *supra* note 36, at 1119; Erik Hille & Patrick Möbius, *Environmental Policy, Innovation, and Productivity Growth: Controlling the Effects of Regulation and Endogeneity*, 73 ENV'T & RES. ECON. 1315, 1316, 1328 (2019).

[43] Draft TAR, *supra* note 17, at 4-32 to 4-34.

simultaneously.[44] Consequently, regulation-induced innovation could be especially important to consider.

Furthermore, NHTSA has accounted for such concerns about tradeoffs by assuming in the compliance cost estimates that manufacturers will install whatever additional technologies are needed to maintain key performance levels even as fuel economy is increased.[45] If manufacturers in fact were to trade off reduced performance for increased fuel economy, then the actual costs of achieving that fuel economy would drop substantially, and consumers would see lower purchase prices.[46] The literature consistently shows that if manufacturers are allowed to use attribute tradeoffs to comply with regulatory standards, compliance costs could be "significantly lower" than what the agencies estimate.[47]

Finally, NHTSA's analysis of the Proposed Rule finds that, under a scenario with no new fuel economy standards, the fleet will have on average 0.77% *worse* acceleration performance in MY2029 than the fleet under the agency's preferred fuel economy standards. NHTSA concludes that the difference in performance is "minimal,"[48] which it is. But it also shows that improving fuel economy is not inconsistent with improving performance.

Thus, rather than assuming, contrary to evidence, that consumers are being forced to trade off fuel economy against other attributes under a hypothetical budget constraint, NHTSA should refocus on market failures as an explanation for the energy efficiency gap.

C. Persistent Market Failures Exist and Justify Stronger Fuel Economy Standards

NHTSA should more thoroughly identify the full range of market failures (including "internalities" like myopia and other behavioral responses[49]) that affect different groups of consumers. Rather than repeatedly focusing on the lack of consensus in the literature about precisely which market failure may explain the energy efficiency gap or precisely how large the gap is, NHTSA should focus on the strong overall evidence that multiple market failures continue to plague consumers throughout the vehicle

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[44] *Id.* at 4-32 (citing GDI as an example of major technological diffusion stimulated by regulatory standards, as well as scientific research and popular press on how vehicle standards have driven innovation).

[45] *See, e.g.*, SAFE FRIA, *supra* note 25, at 318–20 (explaining that the agencies' model for estimating compliance costs for light-duty vehicle regulations already accounts for such tradeoffs by holding key attributes "constant" to "maintain performance neutrality").

[46] *See* David Cooke, Union of Concerned Scientists, The Trade-Off Between Fuel Economy and Performance: Implications for the Mid-Term Evaluation of the National Program 7 (2016), Attachment to Docket ID EPA-HQ-OAR-2015-0827-4016.

[47] Research suggests that manufacturers will instead produce different vehicles with mixes of fuel economy and other attributes, allowing those consumers who are willing to pay for extra attributes on top of fuel economy to do so, while those consumers who do not value extra attributes like acceleration as much can purchase cheaper but more efficient vehicles. *See* Kate S. Whitefoot et al., *Compliance by Design: Influence of Acceleration Trade-Offs on CO_2 Emissions and Costs of Fuel Economy and Greenhouse Gas Regulations*, 51 ENV'T SCI. & TECH. 10,307, 10,308, 10,312, 10,313 (2018), https://www.regulations.gov/contentStreamer?documentId=NHTSA-2018-0067-11903&attachmentNumber=1&contentType=pdf (finding significant heterogeneity across vehicles and manufacturers, and noting that competition for those consumers who value acceleration will be reduced; also finding less of a change in sales composition between trucks and cars); *see also* Bento et al., *supra* note 36, at 1121 ("[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)).

[48] 86 Fed. Reg. at 49,644.

[49] Behavioral responses, like myopia, are a kind of market failure (sometimes called "internalities"). For shorthand, these comments sometimes refer to all these effects collectively as "market failures."

market, thus justifying strong fuel economy standards that can help correct such market failures and so deliver net savings to consumers.[50]

NHTSA briefly considers a few market failures, including myopia and loss aversion,[51] framing,[52] lack of information, satisficing, status goods and positional externalities, and simplifying mental heuristics.[53] However, NHTSA wrongly implies that explanations for the energy efficiency gap come from only "behavioral economics."[54] In fact, there are classic externalities as well (including information asymmetries, market power, and externalities from positional goods). For example, while NHTSA mentions consumers having "relatively few choices"[55] as one explanation for the gap, NHTSA does not connect this with the classic market failure of market power. To the contrary, NHTSA seems to ignore the potential for market power, as when it assumes that if "manufacturers do not voluntarily provide the levels of fuel economy this proposal would require," then that "suggests that they believe being required to do so will reduce their sales and profits."[56] In fact, because manufacturers may be able to exercise market power, manufacturers may be maximizing their own profits at the expense of both fuel economy and consumer welfare.[57]

More broadly, NHTSA does not list any of the producer-side explanations for the energy efficiency gap that EPA routinely considers, such as the large fixed costs of investments to switch to new technologies, and the complex and uncertain processes involved in technological innovation and adoption.[58] NHTSA should consider not only EPA's more extensive discussion of market failures, but also the evidence and theories from the broader literature. Additional key market failures to consider include:

- **Dealership incentives, biases, and information asymmetries**. Consumers typically must purchase new vehicles from dealerships, and salespeople have significant influence on consumer purchasing decisions.[59] Yet salespeople's own incentives and biases may cause informational asymmetries that prevent consumers from purchasing optimal fuel efficiency.[60] Studies have found that dealers and salespeople often believe (whether or not it is true) that electric vehicles and other highly efficient cars have lower profits for dealers than gas-powered

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[50] *See generally* Rachel Rothschild & Jason A. Schwartz, Inst. for Pol'y Integrity, *Tune Up: Fixing Market Failures to Cut Fuel Costs and Pollution from Cars and Trucks* (2021), https://policyintegrity.org/files/publications/Tune_Up_Fixing_Market_Failures_to_Cut_Fuel_Costs.pdf [hereinafter *Tune Up*].

[51] 86 Fed. Reg. at 49,710.

[52] *Id.* at 49,710–11. Specifically, without regulations, the consumer goes to the dealership and chooses between a cheaper, less efficient car versus a more expensive, more efficient car; whereas under regulations, the consumer's choice is instead whether to go buy a new car with all the options more efficient and marginally more expensive, or else whether not to go buy a new car at all.

[53] PRIA, *supra* note 4, at 84–85.

[54] 86 Fed. Reg. at 49,710; *see also* PRIA, *supra* note 4, at 84 ("In addition to loss aversion, there are other contributions from the behavioral economics literature that are important to consider when evaluating the energy paradox.").

[55] PRIA, *supra* note 4, at 85.

[56] *Id.* at 69–70.

[57] Manufacturers have also not always been able to rationally plan for consistent profits, as seen in the run-up to the auto bailout.

[58] *See* 86 Fed. Reg. at 43,787.

[59] Cox Automotive, *Evolution of Mobility: The Path to Electric Vehicle Adoption* 29 (2019), https://perma.cc/UV7N-42BE (documenting that 74% of consumers report that a dealer has a strong influence on their purchases).

[60] *See* Fred Lambert, *After Losing Dealers over Its Electric Move, Cadillac Is Now Gaining New Ones*, ELECTREK, Sept. 23, 2021 (reporting that one-fifth of U.S. Cadillac dealers exited from the brand in 2020 rather than commit to selling electric vehicles).

cars,[61] including less profits from dealership-provided service and maintenance opportunities, lower "back-end" profits on trade-ins, and commission structures that may not compensate salespeople for the perceived increased paperwork and transaction costs of selling electric vehicles.[62] Perhaps partly because of such incentives, consumers and "mystery shoppers" conducting research have often complained of poor dealership experiences when trying to purchase electric vehicles,[63] citing salespeople's limited knowledge and dishonesty; misinformation about electric vehicle's costs, range, and other attributes; inconsistent enthusiasm among salespeople for electric vehicles; dealerships' lack of inventory for more efficient and electric vehicles; poor timeliness for completing paperwork and delivery of electric vehicles; limited promotional materials on energy efficiency; and dealerships' inability to facilitate consumers' cost comparisons of electric versus gas vehicles.[64] Some dealerships have admitted that poor sales training is a major barrier to electric vehicle sales.[65] Because consumers rely on dealerships, but dealerships have different incentives and information than consumers, market failures can occur.

- **Split incentives**. When the purchaser of a vehicle does not have to pay the costs of fuel usage, this can create a market failure known as "split incentives" or the "principal-agent problem."[66] Economists have found, for example, that split incentives can lead to undervaluation of fuel economy in the shipping industry, as parties that own or operate trucks are frequently not responsible for fuel costs.[67] A similar dynamic can occur in other contexts, such as in the large rental vehicle fleets of light-duty vehicles, since rental companies do not pay for fuel costs. Government intervention can ensure that purchasers make societally optimal investments in energy efficiency technologies when they receive inadequate market incentives because of principal-agent problems.[68]

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[61] Cox Automotive, *supra* note 59, at 23 (reporting that 54% of surveyed dealers say there is a lower ROI for sales of EVs compared to gas); Eric Cahill et al., *New Car Dealers and Retail Innovation in California's Plug-In Electric Vehicle Market* (U.C. Davis Inst. Of Transp. Stud., Working Paper UCD-ITS-WP-14-04, 2014), https://perma.cc/DJ7T-SGXT (citing real or perceived profitability concerns, especially for compact or midsized vehicles).

[62] Cahill et al., *supra* note 61, at 10 ("[A]s a category, PEVs may not represent a compelling investment to many dealers."); *id.* at 9–10 (noting that dealers have the false perception that PEVs entail longer transaction times and lower profits, when in fact dealers make more than average on PEVs in gross profits).

[63] The research to date has often focused on the sale of electric vehicles, but similar biases and shortcomings may apply to hybrids and other fuel-efficient vehicles as well.

[64] Cahill et al., *supra* note 61; Draft TAR, *supra* note 17, at 6-15 (citing conclusions from the NAS committee); Cox Automotive, *supra* note 59; Gerardo Zarazua de Rubens et al., *Dismissive and Deceptive Car Dealerships Create Barriers to Electric Vehicle Adoption at the Point of Sale*, 3 NATURE ENERGY 501 (2018); Lindsay Matthews et al., *Do We Have a Car for You? Encouraging the Uptake of Electric Vehicles at Point of Sale*, 100 ENERGY POL'Y 79 (2017); Eric Evarts, *Dealers Not Always Plugged in About Electric Cars, Consumer Reports' Study Reveals*, CONSUMER REPORTS, Apr. 22, 2014, https://perma.cc/VYU9-QUW7; Zoe Long et al., *Consumers Continue to Be Confused About Electric Vehicles: Comparing Awareness Among Canadian New Car Buyers in 2013 and 2017*, 14 ENV'T RES. LETTERS 114036 (2019); *see also* Jennifer Lynes, *Dealership Are a Tipping Point*, 3 NATURE ENERGY 457 (2018) (op-ed suggesting that the results from Zarazua de Rubens et al., *supra*, are broadly applicable).

[65] Cox Automotive, *supra* note 59, at 30 (blaming lack of OEM support).

[66] *See* David Vernon & Alan Meier, *Identification and Quantification of Principal-Agent Problems Affecting Energy Efficiency Investments and Use Decisions in the Trucking Industry*, 49 ENERGY POL'Y 266, 267 (2012) ("There are numerous market failures and barriers to investment in energy efficiency in the trucking industry. Split incentives described by principal-agent problems are an important class of existing market failures that obscure price signals.").

[67] *See id.* at 270–71 (finding that "[t]he separation of fuel cost payment and driver behavior . . . appears to be widespread" and that "[u]p to 91% of trucking fuel consumption is exposed to this usage [principal-agent] problem").

[68] *See generally* Kenneth Gillingham & Karen Palmer, *Bridging the Energy Efficiency Gap: Policy Insights from Economic Theory and Empirical Evidence*, 8 REV. ENV'T ECON. & POL'Y 18–38 (2014) (explaining how principal-agent problems and other market failures can explain the energy efficiency gap and provide a basis for regulatory intervention).

- **Network externalities**. The benefits of a new technology sometimes depend on widespread adoption by others, creating a situation where "proven" technologies are chosen even though others would save more money in the long run.[69] Network externalities can affect investments in electric vehicle charging, maintenance facilities, natural-gas refueling, and replacement parts.[70] In turn, these externalities can affect a range of consumers and vehicles, from individuals to businesses, and from passenger cars to heavy-duty trucks. Because consumers buying alternative fuel or more efficient vehicles must make predictions about the future development of these critical networks in order to estimate their long-term savings, various market failures from information asymmetries, myopia, and loss aversion all come into play here. Transaction costs and principal-agent dynamics may also prevent some vehicle consumers from getting access to the charging facilities at their apartment buildings or office buildings that they would require before purchasing electric vehicles, even as those buildings' owners may be uncertain about their tenants' demand for such charging facilities.[71] Fuel economy and vehicle emission standards help resolve the coordination, first-mover, and informational problems facing the developers of this network infrastructure, thereby providing greater certainty that consumers can achieve long-term cost savings.[72]
- **Salience, inattention, and mental accounting**. Evidence continues to show that even though consumers have access to fuel economy labels, they may not accurately or fully factor those values into their decisions. The fuel economy differences among similar vehicles tend to be small on a miles-per-gallon ("MPG") basis and so may not be particularly salient.[73] Salience bias may therefore cause consumers to inefficiently undervalue fuel economy in their vehicle purchasing decisions. Consumers also continue to misunderstand that fuel costs are inversely related to fuel economy (what is known as the "MPG illusion").[74] Consumers may value such information only in relative rather than absolute terms,[75] and so may undervalue potential fuel costs savings. Left-digit bias may also affect consumer interpretation of relative MPG values, as it does when consumers focus on only the left-most digit in prices (e.g., the 99-cent price effect) or in the odometer values on used cars.[76]

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[69] Todd D. Gerarden et al., *Assessing the Energy-Efficiency Gap* 24 (NBER Working Paper No. 20904, 2015), https://www.nber.org/system/files/working_papers/w20904/w20904.pdf.

[70] *See id*.; *see also* Shanjun Li et al., *The Market for Electric Vehicles: Indirect Network Effects and Policy Design*, 4 J. ASS'N ENV'T RES. ECON. 89 (2017) (analyzing how electric vehicles "face several significant barriers to wider adoption, including the high purchase cost, limited driving range, the lack of charging infrastructure, and long charging time"); EPA & NHTSA, *Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles - Phase 2, Regulatory Impact Analysis* 8-7 to 8-8 (2016), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100P7NS.PDF?Dockey=P100P7NS.PDF [hereinafter *2016 Heavy-Duty FRIA*] (noting network externalities for natural gas fueling, repair facilities, and replacement parts).

[71] *See, e.g.*, Luskin Ctr. for Innovation, *Evaluating Multi-Unit Resident Charging Behavior at Direct Current Fast Chargers* (2021), https://perma.cc/7VBW-JZBW.

[72] Resolving the coordination and informational problems facing the developers of network infrastructure may also be an independent justification for government regulation of fuel economy, beyond its contribution to the energy efficiency gap.

[73] Nat'l Acad. of Scis. (NAS), *Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy—2025–2035*, at 11-354 (2021).

[74] *Id.* at 11-352 to -353.

[75] *Id.* at 11-352.

[76] Nicola Lacetera et al., *Heuristic Thinking and Limited Attention in the Car Market* (Nat'l Bureau of Econ. Rsch., Working Paper No. 17030, 2011).

- **Additional myopia and inattention, including short-termism**. Though NHTSA refers to myopia, the evidence for such market failures is more extensive than NHTSA recounts.[77] Though myopia and inattention may more commonly plague individual consumers, economists have also found that managers at certain companies can exhibit similar kinds of inattention and so fail to implement many energy efficiency initiatives despite positive paybacks.[78] Businesses may also face a kind of myopia called short-termism, in which certain corporate employees have an incentive to favor short-term profits over long-term investments if, for example, their personal compensation or career prospects are tied to near-term earnings.[79] Employees with such incentives may have reason to purchase cheaper, less efficient vehicles.[80] To the extent short-termism is exacerbated by an informational asymmetry either between employees (who know that lower vehicle purchase prices will favorably boost short-term earnings reports) and investors (who may not know that more efficient vehicle purchases could have increased their long-run returns), or is caused by myopia, the phenomenon is a market failure.[81] Economic studies suggest that short-termism can affect managers' choices about energy efficiency specifically,[82] and about environmental sustainability more broadly.[83]
- **Manufacturer market power**. NHTSA should start by looking at EPA's explanation of how strategic marketing choices by manufacturers can result in inefficient under-supply of fuel economy to some consumer segments (and inefficient over-supply in other market sectors).[84] Yet even EPA does not fully connect this inefficient pattern to market power. Because of the limited competition in at least some segments of the vehicles market, manufacturers may be able to act strategically when pricing vehicles and when producing vehicles with combinations of different fuel economy and other vehicle features in order to push consumers towards

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[77] *See Tune Up*, *supra* note 50, at 12 (summarizing and citing Helfand & Dorsey-Palmateer, *supra* note 16, at 439; Kenneth Gillingham et al., *Consumer Myopia in Vehicle Purchases: Evidence from a Natural Experiment* (Nat'l Bureau of Econ. Rsch., Working Paper No. 25845, 2019); Denvil Duncan et al., *Most Consumers Don't Buy Hybrids: Is Rational Choice a Sufficient Explanation?*, 10 J. BENEFIT-COST ANALYSIS 1 (2019)); *see also* Tom Turrentine et al., *Fuel Economy: What Drives Consumer Choice?*, 1 ACCESS 14 (2007).

[78] *See* Suresh Muthulingam et al., *Energy Efficiency in Small and Medium-Sized Manufacturing* Firms, 15 MFG. & SERV. OPERATIONS MGMT. 596, 612 (2013) (finding that manager inattention contributed to the non-adoption of energy efficiency initiatives, since initiatives that appear lower on a list of efficiency recommendations, and initiatives that require more managerial attention are less likely to be adopted).

[79] A similar dynamic could exist in government, and so could affect local, state, and federal government fleet purchases, if officials are rewarded for short-term cost savings rather than long-term fiscal health.

[80] This incentive could be muted by a firm's accounting practices if costs and expenses are amortized over time.

[81] *See* Sheila Bair, *Short-Termism and the Risk of Another Financial Crisis*, WASH. POST (July 8, 2011) (op-ed by the former Chair of the FDIC calling short-termism a "market failure"); Marc Jarsulic et al., Ctr. for Am. Progress, *Long-Termism or Lemons: The Role of Public Policy in Promoting Long-Term Investments* 11–12 (2015), https://perma.cc/SYL4-XPUK (including a section called "short-termism as a market failure" attributed to "asymmetric information between managers and investors" and "behav[ing] myopically"); Lynne L. Dallas, *Short-Termism, the Financial Crisis, and Corporate Governance*, 37 J. CORP. L. 265, 310–16 (2012) (reviewing various explanations for short-termisms, including asymmetric information and myopia).

[82] *See* Stephen J. DeCanio, *Barriers Within Firms to Energy-Efficient Investments*, 21 ENERGY POL'Y 906, 907–08 (1993) (explaining how tying management compensation to short-term performance can lead to underinvestment in energy efficiency, and also how stock markets and investors may not be able to detect inefficient management decisions); Suresh Muthulingam et al., *Adoption of Profitable Energy Efficiency Related Process Improvements in Small and Medium Sized Enterprises* 1, 7 (Working Paper, 2008) (finding that managers fail to implement energy efficiency improvements with short payback periods for several reasons, including myopia and a stronger focus on upfront costs than on net benefits, attributed partially to short-termism).

[83] *See* Yujing Gong & Kung-Cheng Ho, *Corporate Social Responsibility and Managerial Short-Termism*, ASIA-PACIFIC J. ACCT & ECON. (2018).

[84] EPA, *Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis* at 8-5 (2021) [hereinafter EPA DRIA].

purchases that lead to higher manufacturer profits at the expense of optimal fuel economy.[85] There is a relatively small number of firms producing several types of vehicles and engines across the light-duty and heavy-duty markets.[86] This market failure therefore could influence purchases by all consumer groups and across several vehicle classifications.

- **First-mover effects**. As NHTSA has considered in the past, first-mover disadvantages may cause manufacturers to under-invest in research into new fuel-efficiency technologies in the face of uncertainty. Economists have noted that the first-mover disadvantage can be especially pronounced when returns to society are greater than those to the investor, as is the case with fuel-efficiency technologies that reduce oil use and greenhouse gas emissions.[87] Short-termism can also compound the first-mover disadvantage, as manufacturers have to balance the immediate costs and risks of research against the longer-term profits from future sales. Since each manufacturer faces muted incentives to be the first to research and deploy new technologies, without regulations, no manufacturer is likely to produce vehicles with the socially optimal level of energy efficiency.[88] Because manufacturers are responding to consumer demand for fuel economy that multiple other market failures have already depressed, this first-mover dynamic can exacerbate the energy efficiency gap.[89] First-mover effects can also affect vehicle consumers, including corporate and institutional purchasers.[90] Without regulatory incentives, firms may underinvest in purchasing such efficiency-enhancing technology as they all wait for their competitors to go first and bear the costs of testing the implementation of new technology.

- **Information costs and asymmetries, including experience goods**. NHTSA mentions the idea that consumers may value fuel economy differently once they experience it for themselves,[91] but does not connect this idea with market failures or explore it more broadly. Indeed, consumers may also lack information to fully value many of the benefits of more efficient vehicles—not just fuel economy, but also the benefit of not having to stop as often (or at all) to refuel—until after

[85] *See generally* Carolyn Fischer, Res. for the Future, *Imperfect Competition, Consumer Behavior, and the Provision of Fuel Efficiency in Light-Duty Vehicles* (2010), https://www.rff.org/documents/1472/RFF-DP-10-60.pdf.

[86] *See id.* at 3 (explaining that "the largest four firms accounted for 75.5 percent of the value of shipments in the automobile market and 95.7 percent of the light-duty and utility vehicle market"); NAS, *supra* note 73, at 11-356 (citing that the top ten firms accounted for 90% of light-duty sales in 2018); *see also* Winston Harrington & Alan Krupnick, Res. for the Future, *Improving Fuel Economy in Heavy-Duty Vehicles* (2012), https://media.rff.org/documents/RFF-DP-12-02.pdf (explaining that the heavy-duty trucking industry "is dominated by a small number of large manufacturers" and is even smaller than it would seem at first glance because of "affiliations, partnerships, and outright ownership of one company by another").

[87] Nat'l Rsch. Council (NRC), *Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles* 319 (2015), http://nap.edu/21744.

[88] *See 2016 Heavy-Duty FRIA*, *supra* note 70, at 8-8 ("Manufacturers may be hesitant to offer technologies for which there is not strong demand, especially if the technologies require significant research and development expenses and other costs of brining the technology to a market of uncertain demand.").

[89] Because it creates externalities and coordination issues that raise the cost of developing beneficial technologies, the first-mover disadvantage facing manufacturers may also be an independent justification for government regulation of fuel economy, beyond its contribution to the energy efficiency gap.

[90] For example, some focus-group studies of medium- and heavy-duty truck purchasers have found that they may hesitate to purchase more fuel-efficient vehicles because they are unsure about their reliability. *See* Heather Klemick et al., Nat'l Ctr. for Env't Econ., *Heavy-Duty Trucking and the Energy Efficiency Paradox* 12, 20 (2014), https://www.epa.gov/sites/default/files/2014-12/documents/heavy-duty_trucking_and_the_energy_efficiency_paradox.pdf.

[91] TSD, *supra* note 9, at 406–07.

the consumer has already purchased and experienced the good.[92] Because insufficient information can mute consumer demand for fuel economy, this can also lead manufacturers to underinvest in fuel economy and in lowering greenhouse gas emissions.

Even for the market failures that NHTSA does mention briefly (like positionality[93]), there is considerably more evidence that NHTSA could cite in support.[94] NHTSA should cite these additional market failures and evidence, and NHTSA should offer a clearer conclusion that there is considerable evidence that at least some market failures (including "internalities" like myopia and other behavioral responses) are responsible for consumers purchasing less vehicle efficiency than would benefit them, and so there is a clear role for regulations to correct these market failures.

D. NHTSA Should Rebalance Its Literature Summary

While noting the variation in the literature, NHTSA correctly concludes that "[t]here is substantial evidence that consumers do not fully value lifetime fuel savings."[95] NHTSA should emphasize that conclusion even more, rather than the fact that "there is no consensus in the literature about how consumers value fuel economy improvements."[96] Even if there is not full consensus about precisely which market failure may explain the energy efficiency gap or precisely how large the gap is, there is persuasive evidence in the literature that at least some market failures are responsible.

NHTSA's TSD continues to highlight in Table 4-2 three studies (Busse et al. 2013, Allcott & Wozny 2014, Sallee et al. 2016) that show relatively high levels of consumer valuation,[97] and which in the past have been used to cast doubt on the existence of the energy efficiency gap.[98] It is unclear why NHTSA singles out these particular studies in a table, given more recent literature that shows much lower levels of consumer valuation.[99]

The table's presentation of those three studies is also somewhat misleading. For example, while Sallee et al. does find near full valuation by consumer groups at some discount rates, it also finds "modest undervaluation" of "70 to 86%" among large-scale fleet operators.[100] Only one of these three studies (Busse et al.) includes any direct examination of new vehicle sales, and even that estimate "is based on more limited information";[101] the other two studies, Sallee et al. and Allcott & Wozny, both focus exclusively on used vehicles.[102] And each of the three studies has various other limitations and idiosyncrasies with its choice of data and methodology. Sallee et al., for example, excludes data on

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[92] These kinds of "experience goods" can create market failures. *See* Cass R. Sunstein, *Rear Visibility and Some Unresolved Problems for Economic Analysis (with Notes on Experience Goods)*, 10 J. BENEFIT-COST ANALYSIS 317, 342–46 (2019). Experience goods have been associated with plug-in hybrids. *See* Margaret Taylor & K. Sydny Fugita, Lawrence Berkeley Nat'l Lab'y, *Consumer Behavior and the Plug-In Electric Vehicle Purchase Decision Process: A Research Synthesis* 9, 49 (2018).

[93] PRIA, *supra* note 4, at 85.

[94] *See Tune Up*, *supra* note 50, at 17 (citing evidence and explaining the market failure affects not only individual consumers, but institutions and businesses as well, as when luxury corporate cars are offered to employees as status-boosting perks).

[95] 86 Fed. Reg. at 49,710.

[96] *Id*. at 49,729.

[97] TSD, *supra* note 9, at 403.

[98] *See* 85 Fed. Reg. at 24,604.

[99] Indeed, NHTSA discusses some of the more recent literature at TSD, *supra* note 9, at 404. *See also* Kevin Ankney et al., *What Should Federal Agencies Assume for How Much Consumers Are Willing to Pay for Fuel Cost Savings?*, Resources, https://www.resources.org/common-resources/what-should-federal-agencies-assume-for-how-much-consumers-are-willing-to-pay-for-fuel-cost-savings/.

[100] 83 Fed. Reg. at 43,703.

[101] *Id.* at 43,073.

[102] *Id.*

hybrid vehicles.[103] More recently, Leard et al. (2021) produced very different results using Busse et al.'s methodology and could not explain the difference.[104]

It is important for NHTSA to provide a more balanced summary of the literature, so that it can use the literature as a tool to help set appropriate assumptions about how much fuel savings consumers will value.

E. Replacing the Constant 2.5 Year Assumption

NHTSA estimates both in its technology baseline and in its sales/scrappage modules that consumers will value 2.5 years' worth of fuel savings. This number comes from reports by manufacturers to NHTSA that "consumers only value between 2 to 3 years-worth of fuel savings."[105] Though this anecdotal evidence certainly offers some support to the idea that consumers have not historically and do not currently fully value lifetime fuel savings when buying new vehicles, this should not be the sole piece of evidence to use to select such an influential value.

NHTSA in fact recognizes that the manufacturers may be biased in their assessment: "It is, of course, possible that manufacturers are incorrect in their assumptions; the same manufacturers, for example, long assumed [wrongly] that consumers would not pay extra for safety features. And manufacturers play a role in shaping consumer preferences. Otherwise they would not spend large sums on advertising."[106] Notably, NHTSA has also previously cited a different range, of 2-4 years, with a midpoint value of 3 years, not 2.5 years.[107] If NHTSA wants to continue using manufacturer estimates as one piece of evidence, it should provide more documentation for the source of this value.

But NHTSA should consider other data to inform its estimate. For example, recent literature may indicate a range of 1.6 to 7 years.[108] NHTSA could also consider convening an expert elicitation, which is a well-recognized technique for estimating uncertain values.[109]

NHTSA should also consider whether it can support different estimates of consumer valuation to use in the technology baseline than in the sales/scrappage modules. In the past, NHTSA has suggested that manufacturers' assumptions about consumer valuation (i.e., the value that should be used in the

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[103] 2018 PRIA, *supra* note 118, at 936 n.487.

[104] Benjamin Leard et al., *How Much Do Consumers Value Fuel Economy and Performance?*, REV. ECON. & STAT. (forthcoming 2021), https://doi.org/10.1162/rest_a_01045. The authors try to explain the difference as possibly that consumers react differently to small changes in fuel economy versus larger changes in fuel prices, or maybe it is the time period ("suggesting that differences in sample period, rather than methodology, explain the discrepancies"). But, ultimately, they cannot fully explain the different results. They fail to consider the potential that consumers react irrationally under various market failures. For example, the salience of fuel prices could vary widely between time periods. Leard et al. also acknowledge that their results do not account for market failures around innovation or underprovision of fuel economy, do not account for whether standards may increase the rate of technology adoption, and also implicitly do not account for whether innovation may change any possible tradeoffs.

[105] 86 Fed. Reg. at 49,710.

[106] TSD, *supra* note 9, at 405.; *see also* 77 Fed. Reg. at 63,103 ("[I]t is possible that manufacturers are providing more or less fuel economy than consumers wish to purchase, because they do not correctly understand consumers' valuation of fuel economy").

[107] 77 Fed. Reg. at 63,103.

[108] Ankney et al., *supra* note 99.

[109] *See* OMB, *Circular A-4*, at 41 (2003); Peter Howard & Derek Sylvan, Inst. for Pol'y Integrity, *Expert Elicitation and the Social Cost of Greenhouse Gases* (2021), https://policyintegrity.org/files/publications/Expert_Elicitation_and_the_Social_Cost_of_Greenhouse_Gases.pdf (explaining the role of the technique).

technology baseline) are likely lower than consumers' actual valuations (i.e., the value that should be used in the sales/scrappage modules):

> NHTSA believes it is unlikely that manufacturers and consumers would value improvements in fuel economy identically, and believes that on average, manufacturers will behave more conservatively in their assumptions of how consumers value fuel economy than how on average consumers will actually behave. NHTSA expects that in practice the number of years fuel is valued by manufacturers will be shorter than the number of years fuel is valued by consumers.[110]

In the Proposed Rule, NHTSA now offers some additional reasons why consumer valuations could change over time in light of more stringent standards, such that the value used in the sale/scrappage model to predict future behavior under the standards should be higher than the value used in the technology baseline assumption to predict behavior in the absence of standards. For example, "the possibility that consumers' perceptions of utility at the time of purchase (decision utility) may differ from the utility consumers experience while consuming a good and that experienced utility may be the preferrable metric for policy evaluation has been raised in the economic literature (Kahneman and Sugden, 2005). It seems plausible that as consumers experience the fuel savings benefits of increased fuel economy, their valuation of the fuel economy increases required by regulation may adjust over time towards the full lifetime discounted present value. In addition, behavioral economic theory accepts that consumers' willingness to pay for fuel economy may change depending on the context of consumers' car purchase decisions."[111] NHTSA also suggests that the context for consumers' decisions about fuel economy may change under standards as compared to without standards,[112] and that as consumers experience fuel savings from new standards, it will reduce their uncertainty and so "soften (or even eliminate) their usual aversion to potential losses."[113]

NHTSA can reinforce these reasons by more fully considering the range of potential market failures. New standards may help "soften" various market failures besides loss aversion in ways that could change consumers' valuations over time. Once fuel economy increases under future regulations, consumers will fully value the actual fuel savings that show up as extra money in their bank accounts or wallets; and, over time, consumers may therefore begin to more fully account for fuel savings in future purchasing decisions. As stronger vehicle emissions standards begin to place more vehicles with higher fuel economy into the marketplace, consumers will see more of their friends and neighbors driving fuel-efficient vehicles, more marketing materials and dealership presentations on fuel-efficient vehicles, more charging stations and maintenance facilities to service fuel-efficient vehicles, more labels with higher MPG numbers, and so forth. As the regulations begin to correct some of the market failures that currently exist, and as the marketplace changes in response, consumer behaviors will change as well, and consumers will likely begin to factor fuel economy more into their purchasing decisions over time.

Standards could help soften or eliminate some information failures (as with dealerships incentives), some producer-side failures, some network externalities, some behavioral failures (like experience goods), some first-mover disadvantages among both consumers and producers, and other effects. Some

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[110] 77 Fed. Reg. at 63,107.

[111] 86 Fed. Reg. at 49,729.

[112] *Id.* at 49,710–11; see also TSD, *supra* note 9, at 405 ("On the other hand, when the fuel economy of all new vehicles is increasing as a consequence of fuel economy standards, consumers might approximately fully value expected fuel savings (see, e.g., NASEM, 2021, Ch. 11.3.4).").

[113] TSD, *supra* note 9, at 407.; *see also* 86 Fed. Reg. at 49,711 ("[T]he fact that standards generally increase gradually over a period of years allows time for consumers and other information sources to verify that fuel savings are real and of substantial value.").

effects could actually increase consumers' valuations: if fuel economy becomes a sufficiently visible good, it may continue to attract status and so become a "positional good" that consumers compete for, much as consumers currently compete for horsepower (only with positive externalities in the form of reduced fuel consumption and emissions produced by the competition for the most efficient vehicles, rather than with negative externalities in the form of increased safety risks produced by the competition for the fastest vehicles; *see infra* Section I.F.4 explaining positional goods).

On the other hand, other market failures may persist despite the existence of standards, such as myopia, some degree of loss aversion, market power, and first-mover disadvantages around whatever the next technological breakthroughs might be. Consequently, though standards may help increase consumers' valuation of fuel savings, consumers may never fully, rationally value lifetime fuel savings, and as such, there will likely be a continuing need for regulatory standards over time.

NHTSA asks for comments on several alternatives to its constant 2.5 year assumption. In particular, NHTSA asks whether it should instead assume in the baseline scenario that consumers fully value fuel savings, or else assume that "buyers value improved fuel economy identically under both the baseline scenario and with stricter CAFE standards in place."[114] The first alternative is clearly wrong, for all the reasons explore above. The second alternative is, effectively, what NHTSA is already doing, by assuming 2.5 years' worth of valuation in both the technology baseline and in the sales/scrappage model.

In fact, for the reasons provided above, a better alternative may be to look to all available evidence (including, for example, the 1.7–7 year range from recent literature) and pick a relatively lower value for the baseline scenario (such as the 1.7 year estimate from Gillingham et al. 2021), and a relatively higher value for the sales/scrappage model (such as the 7 year estimate from Leard et al. 2021). NHTSA has begun exploring reasons why consumer valuations may change in light of the standards, and NHTSA should consider whether it has enough support from literature, comments, and its own experience to support this approach.

If NHTSA instead concludes that such a divergence is not yet sufficiently supported by the literature and requires more study, NHTSA should err on the side of picking a lower value that is appropriate for the baseline scenario and using that lower estimate consistently in all applications (such as Gillingham et al.'s 1.7-year estimate). But NHTSA must pair this approach with a second essential adjustment to its current methodology. Specifically, NHTSA should then compensate for the application of a low estimate of consumer valuation in the sales/scrappage modules by also picking the lowest sales elasticity estimate that can be justified in the literature. This combination will preserve a more realistic approach to technology adoption in the baseline scenario while also ensuring that the sales module does not yield unrealistically high estimates of sales effects based on the failure to more fully apply fuel savings to offset costs in the net price calculation in the sales module.

F. Be Cautious with Any Opportunity Cost Estimates, As Consumers Do Not Necessarily Lose Net Welfare from Allegedly Forgone Attributes

NHTSA admits that any potential opportunity costs experienced by consumers who may give up other vehicle attributes to achieve fuel economy will be, at most, "modest," and in fact NHTSA suggests it is difficult to anticipate the "net effect," [115] perhaps recognizing some of the potential drawbacks that come with forgone attributes (see *infra* Sections I.F.3-4). Nevertheless, NHTSA asks whether and how it should estimate the opportunity costs of forgone attributes. As discussed above (*see supra* Sections I.A-

[114] TSD, *supra* note 9, at 405.

[115] PRIA, *supra* note 4, at 69 ("It is difficult to anticipate the net effect of these omissions, but the agency's view is that they are likely to have modest effects on the true economic costs of meeting stricter CAFE standards.").

B), there is no reason to assume that fuel economy will necessarily lead to continued tradeoffs against performance features. But even if it did, NHTSA should be very careful when making any such estimates. Accurate methodologies do not currently exist, and ancillary effects, diminishing returns, compliance cost reductions, and positional externalities would all need to be weighed against any alleged opportunity costs.

1. *NHTSA's Past Attempts to Estimate Opportunity Costs Were Severely Flawed*

NHTSA asks whether its previous attempts to estimate opportunity costs during the SAFE rulemaking were "appropriate."[116] They were not.

To begin, because there are market failures (like positional externalities surrounding horsepower, *see infra* Section I.F.4), market data will not necessarily produce reliable evidence of consumers' actual willingness to pay for various performance attributes.[117] So in any methodology, NHTSA should be aware of the limits of using market data to estimate consumer willingness to pay.

NHTSA and EPA made two different attempts during the SAFE rulemaking to estimate alleged opportunity costs, both of which were severely flawed. In the proposed SAFE rule, NHTSA and EPA cited sparse and questionable evidence to produce what they called "illustrative" and "rough" estimates of the so-called "opportunity cost" of supposed forgone attributes of vehicle performance.[118] Specifically, the agencies attempted to estimate the alleged tradeoffs between fuel economy and either horsepower, torque, weight, or volume, and then value consumers' willingness to pay for those specific attributes. Both prongs of that analysis were seriously flawed however, as commenters explained.[119] For example, the Midterm Evaluation had announced that EPA would commission a study to investigate consumers' willingness to pay for specific attributes like horsepower as a measure of possible opportunity costs.[120] But that study found, in 2018, that there was "very little useful consensus" in the literature on such estimates and, as a result, the methodology of trying to assign specific dollar values to allegedly lost vehicle attributes was of "little use for informing policy decisions."[121]

In their economic analysis of the proposed SAFE rule, the agencies found that "sufficiently detailed information on the potential improvements in car and light truck attributes . . . is not currently available,"[122] and that "the specific improvements in attributes other than fuel economy that producers are likely to make to their individual car and light truck models when they face less demanding fuel

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[116] 86 Fed. Reg. at 49,737.

[117] OMB, *supra* note 109, at 20 (warning about using market prices for revealed preferences if there are market failures).

[118] NHTSA & EPA, Preliminary Regulatory Impact Analysis: The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021–2026 Passenger Cars and Light Trucks 943, 1091, 1097 (2018) [hereinafter 2018 PRIA].

[119] One of the authors the agencies rely on for their analysis, "Whitefoot," *see* 2018 PRIA, *supra* note 118, at 1096, also submitted public comments, which said that the agencies' assumptions were not supported by the literature, *see* Comments from Jeremy J. Michalek & Kate S. Whitefoot, Comment on the Notice of Proposed Rulemaking for the Safer Affordable Fuel-Efficient Vehicle Rule for Model Years 20121-2026 Passenger Cars and Light Trucks 9–10 (Oct. 26, 2018), https://www.regulations.gov/document?D=NHTSA-2018-0067-11903 ("[T]he agencies include an assumed loss of value to consumers associated with undesirable attributes of fuel-saving technologies, but a number of fuel saving technologies actually increase performance, and publications in peer-reviewed scientific journals have found that (1) the evidence of hidden costs to vehicle operation characteristics from fuel saving technologies is limited and (2) taking advantage of fuel economy / performance tradeoffs while accounting for pricing and consumer demand allows automakers to comply at lower costs than agencies estimate, not higher costs.").

[120] Draft TAR, *supra* note 17, at 4-36.

[121] EPA, *Consumer Willingness to Pay for Vehicle Attributes: What Is the Current State of Knowledge?* 7-1 (2018), https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=OTAQ&dirEntryId=339388 [hereinafter EPA, *Consumer WTP*]

[122] 2018 PRIA, *supra* note 118, at 1091.

economy standards cannot be estimated."[123] This conclusion was supported by the EPA's Science Advisory Board.[124]

The agencies admitted in the proposed SAFE rule that their estimates of opportunity costs "were not developed at the same level of detail or precision" as the rest of the analysis; consequently, the agencies never attempted to incorporate their proposed estimates even into a sensitivity case let alone into their main analysis.[125] In their final rollback, the agencies abandoned that particular methodology of attempting to measure willingness to pay for specific allegedly lost attributes, which sent the agencies in search instead of related but novel economic tricks to try to support their rollback.

In the final SAFE rule, the agencies proposed as a sensitivity analysis that perhaps they could place a dollar figure on the alleged opportunity costs. But recognizing they had no way to accurately estimate such a cost directly, and so unwilling to repeat the flawed methodology from the proposed rollback, the agencies instead suggested subtracting 42 months' worth of fuel savings—a significant portion of total fuel savings, and an amount based on a questionable methodology—as a proxy estimate for the sensitivity analysis.[126]

If the agencies had actually wanted to measure lost consumer surplus from supposedly forgone attributes, they would have needed first to model actual tradeoffs chosen by manufacturers, which would likely have revealed that the Clean Car Standards had much lower compliance costs (*see infra* Section I.F.2). Then the agencies would have needed to estimate consumers' willingness to pay for such attributes, as well as the cost of providing such additional attributes. But there is a reason that the agencies abandoned that very approach from their preliminary regulatory impact analysis: the agencies recognized that "sufficiently detailed information on the potential improvements in car and light truck attributes . . . is not currently available,"[127] and that "the specific improvements in attributes other than fuel economy that producers are likely to make to their individual car and light truck models when they face less demanding fuel economy standards cannot be estimated."[128]

The literature also has not estimated consumer valuation of vehicle features with enough consistency to be useable for policymaking.[129] During the Midterm Evaluation, the agencies announced an EPA-commissioned study "to determine whether there are robust [willingness-to-pay] values that could be used for monetizing at least some of the opportunity costs and ancillary benefits" of fuel economy standards (to the extent they exist).[130] That study concluded "we have found very little useful consensus" regarding "estimates of the values of various vehicle attributes,"[131] and that the willingness-to-pay estimates "encompass[ ] such a wide range of values that [they are] of little use for informing

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[123] *Id.* at 1097.

[124] EPA Sci. Advisory Bd., Consideration of the Scientific and Technical Basis for the EPA's Proposed Rule Titled *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks*, at 22 (Feb. 27, 2020), https://yosemite.epa.gov/sab/sabproduct.nsf/LookupWebReportsLastMonthBOARD/1FACEE5C03725F268525851F006319BB/$File/EPA-SAB-20-003+.pdf ("We concur with the agencies that it is not yet feasible to quantify the impact on new vehicle sales of additional vehicle characteristics (beyond fuel economy) that are desired by consumers but restrained by federal standards.").

[125] 2018 PRIA, *supra* note 118, at 1097; *see also id.* at 1531–34 (not listing an opportunity cost sensitivity analysis).

[126] 85 Fed. Reg. at 24,702 (explaining that the proxy estimate is based on "fuel savings over the first seventy-two months (less the first thirty months)").

[127] 2018 PRIA, *supra* note 118, at 1091.

[128] *Id.* at 1097.

[129] *See, e.g.*, Comments from Michalek & Whitefoot, *supra* note 119, at 9–10 (critiquing the agencies' opportunity cost estimates from the PRIA, despite Whitefoot being one of the main authors that the agencies had relied on).

[130] Draft TAR, *supra* note 17, at 4-36.

[131] EPA, *Consumer WTP*, *supra* note 121, at 7-1.

policy decisions."[132] 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.[133] As such, Greene et al. (2018) concluded that focusing on any specific willingness-to-pay estimate is methodologically suspect.[134]

Additionally, the literature largely estimates consumers' *historical* willingness to pay for small changes in vehicle features. But these marginal willingness-to-pay estimates are not good measures of the changes that NHTSA asserts might happen absent the future fuel economy standards. As vehicles become more featured (e.g., have higher horsepower), consumers may not continue to value additional features (e.g., endlessly increasing acceleration rates) at the same rate. The agencies should not rely on historical estimates of consumers' valuation of marginal vehicle feature improvements to estimate how much they would value additional future changes in vehicle features.[135]

Moreover, the agencies' past proxy estimation of opportunity costs failed to consider substantial countervailing effects. In particular, if there were tradeoffs between fuel economy and other vehicle attributes, it would significantly lower estimated compliance costs (*see* Section I.F.2). In fact, the current methodology for estimating compliance costs adopts assumptions that would almost certainly entail simultaneous improvements in vehicle performance features like acceleration, none of which have been valued by the agencies or weighed against the hypothetical opportunity costs. Furthermore, the other attributes consumers might desire are associated with various externalities, and the agencies have not valued the external costs or benefits of any such attributes (*see* Section I.F.3). Finally, even if the fuel economy standards would result in consumers purchasing vehicles with fewer other features, it does not follow that consumers would lose welfare. Because cars are status goods with position value, consumers would not be relatively worse off if *everyone's* vehicles, and not just their own, had fewer features that consumers primarily value in relation to their neighbors (*see* Section I.F.4).

2. Assuming Lost Welfare from Forgone Vehicle Features Is Inconsistent with NHTSA's Compliance Costs Calculations

The idea that consumers would lose net welfare from forgone attributes cannot be reconciled with NHTSA's current analysis of the costs of the standards. NHTSA calculates the costs of the fuel economy standards by assuming key vehicle performance attributes are held constant.[136] In the past, the agencies have concluded that any vehicle attribute not held perfectly constant by this assumption would be a "de minimis" change, and the agencies have admitted the change could likely be that regulatory standards *improve* vehicle performance and other attributes.[137] Yet it cannot both be true that, (1) for the purpose of calculating vehicle prices, non-efficiency features are the same as (or better than) they would have been without the standards and that, (2) for the purpose of calculating forgone benefits, non-efficiency features are worse than they would have been without the standards.

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[132] *Id.*

[133] David Greene et al., *Consumer Willingness to Pay for Vehicle Attributes: What Do We Know?*, 118 TRANSP. RES. PART A: POL'Y & PRAC. 258, 264, 273 (2018); *see also id.* at 274 (finding that, even after trimming outliers, "one standard deviation exceeds the mean of the [willingness to pay] estimates for most of the attributes" and that "the interquartile range also exceeds the median").

[134] *Id.* at 274.

[135] Methodologies are available to address this concern that the agencies should have considered, including two-stage hedonic regression. *See* Qin Fan & Jonathan Rubin, *Two-Stage Hedonic Price Model for Light-Duty Vehicles*, 2157 TRANSP. RES. REC. 119, 119 (2010).

[136] *See* 86 Fed. Reg. at 49,644.

[137] SAFE FRIA, *supra* note 25, at, at 316.

If NHTSA wants to assume that the standards will force some manufacturers to sacrifice features like horsepower for the sake of fuel economy, then NHTSA would need to actually model what vehicle features manufacturers would have provided—and what those features would have cost. This would involve a substantial change to the agencies' methodology for calculating compliance costs.[138] Specifically, NHTSA would need to relax the assumption that non-efficiency features will be held constant. Relaxing the assumption that vehicle attributes are held constant would show that compliance with the fuel economy standards likely will produce vehicles that are *less expensive* than the current modeling found. That is because relaxing the constant-features assumption for each vehicle would allow the agencies to model what manufacturers may do in the real world: produce vehicles with a different mix of features and costs that better meets consumer demand. The literature consistently shows that if manufacturers are allowed to use attribute-tradeoffs to comply with regulatory standards, compliance costs could be "significantly lower" than what the agencies estimate.[139] Instead, manufacturers will produce different vehicles with mixes of fuel economy and other attributes, allowing those consumers who are willing to pay for extra attributes on top of fuel economy to do so, while those consumers who do not value extra attributes like acceleration as much can purchase cheaper but more efficient vehicles.[140]

Finally, NHTSA does not currently consider or value the indirect improvements to performance and other features associated with the fuel economy standards under the existing compliance cost estimates and the constant-performance assumption. As NHTSA has admitted in the past, not only is it possible that holding attributes constant will lead to other performance improvements, but it is "unavoidable" and "expected."[141] For example, if installing certain fuel economy technologies in a certain vehicle would decrease that car's 0-60 mph initial acceleration, the agencies' model assumes that manufacturers will install additional technologies to bring that acceleration back up to par; but such additional technologies are likely to improve not just 0-60 mph initial acceleration, but other attributes that consumers value, like 50-80 mph passing acceleration or the vehicle's ability to maintain speed on an incline.[142] Indeed, various commenters noted that the agencies' constant-performance assumption *overcorrected* in multiple ways that would increase overall vehicle performance, precisely along the lines of that example above.[143] Yet when the agencies' model assumes that manufacturers will install technologies—at extra cost—to ensure there is no loss of 0-60 mph acceleration, the agencies do not value the consumer

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[138] *See* Cooke, *supra* note 46, at 7.

[139] Whitefoot et al., *supra* note 47, at 10,313; *see also* Helfand & Dorsey-Palmateer, *supra* note 16, at 450; Bento et al., *supra* note 36, 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)).

[140] Whitefoot, Fowlie & Skerlos, *supra* note 47, at 10,308, 10,312 (finding significant heterogeneity across vehicles and manufacturers, and noting that competition for those consumers who value acceleration will be reduced; also finding less of a change in sales composition between trucks and cars).

[141] SAFE FRIA, *supra* note 25, at 317, 324.

[142] *Id.* at 319–20 ("[A]s one criterion target is reached after the application of a specific technology or technology package, other criteria may be better than their target values. For example, if the engine size is decreased until the low speed acceleration target is just met, it is possible that the resulting engine size would cause high speed acceleration performance to be better than its target. Or, a PHEV50 may have an electric motor and battery appropriately sized to operate in all electric mode through the repeated accelerations and high speeds in the US06 driving cycle, but the resulting motor and battery size enables the PHEV50 slightly to over-perform in 0-60 acceleration, which utilizes the power of both the electric motor and combustion engine." (citation omitted)).

[143] This is particularly so for the acceleration of electric vehicles. *Id.* at 323 (citing CARB's comments as explaining that, for electric vehicles, the Argonne simulations showed that 76 of 88 strong electrified packages "resulted in notably faster 0 to 60 mph acceleration times and passing times").

welfare gains that may come from any incidental increases in performance to, for example, 50-80 mph acceleration or other attributes.

Furthermore, as the agencies have acknowledged in the past, many fuel economy technologies actually improve various performance attributes. During the Midterm Evaluation, the agencies listed numerous examples of how fuel-economy technologies could improve braking, handling, towing, hauling, steering responsiveness, torque vectoring, and a host of other attributes.[144] NHTSA never monetizes the value of any of these attributes associated with increased fuel economy standards.

3. *Ancillary Effects and Diminishing Returns Could Swamp Much If Not All of Any Estimated Opportunity Costs*

Economic research has long recognized the various implicit subsidies and externalities imposed on society by vehicles. These include: accidents, road congestion, road and parking construction and maintenance costs, the space used for parking, and pollution.[145] 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.[146] Vehicles with features that allow faster acceleration also cause a greater number of and more consequential accidents.[147] Vehicles with internal combustion engines are more dangerous than those with electric engines due to the latter's additional crumple space.[148] Heavier vehicles also increase the cost of road maintenance and repair.[149] Vehicles with greater acceleration also may be driven in ways that consume more fuel and so emit more pollution.[150] And as discussed below, certain status features like horsepower impose negative positional externalities on other drivers. According to academic literature, the total cost of these all these externalities is sizable.[151]

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[144] *See* Draft TAR, *supra* note 17, at 4-35 to 4-36 (other benefits include durability, corrosion resistance, smoother compressor transition, less noise, improved launch feel, improved automatic parking features, improved trailer hitch connection assistance, reduced cabin warm-up time, greater passenger comfort, adaptive headlight systems); Proposed Determination, *supra* note 17, at A-49 (citing evidence presented from Ford about the F-150).

[145] THOMAS TIETENBERG & LYNNE LEWIS, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS 375–76 (11th ed. 2018).

[146] Ins. Inst. for Highway Safety & Highway Loss Data Inst., *Flexing Muscle: Sports Car Ratings Show Range of Performance*, 52 STATUS REPORT, 2016, at 1, https://perma.cc/4RDD-34RQ; Leon Robertson, *Road Death Trend in the United States: Implied Effects of Prevention*, 39 J. PUB. HEALTH POL'Y 193, 200 (2018); Anne T. McCartt & Wen Hu, *Effects of Vehicle Power on Passenger Vehicle Speeds*, 18 TRAFFIC INJ. PREVENTION 500 (2017); Wen Hu & Jessica B. Cicchino, *An Examination of the Increases in Pedestrian Motor-Vehicle Crash Fatalities During 2009–2016*, 67 J. SAFETY RES. 37 (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).

[147] Hong Sok Kim et al., *Factors Associated with Automobile Accidents and Survival*, 38 ACCIDENT ANALYSIS & PREVENTION 981, 981 (2006).

[148] *See* Jeff Bartlett, *Tesla Model S Aces Government Crash Test*, CONSUMER REPORTS (Aug. 21, 2013), https://perma.cc/64RE-9YM8.

[149] Anwaar Ahmed et al., *Estimating the Marginal Cost of Pavement Damage by Highway Users on the Basis of Practical Schedules for Pavement Maintenance, Rehabilitation and Reconstruction*, 11 STRUCTURE & INFRASTRUCTURE ENGINEERING 1069, 1080 (2015).

[150] *See* Jack N. Barkenbus, *Eco-Driving: An Overlooked Climate Change Initiative*, 38 ENERGY POL'Y 762, 763 (2010) (discussing how aggressive acceleration can increase emissions); *id.* at 764 ("Cars are more than simply a means of transportation to many, and are sometimes prized for capabilities that run counter to prudent eco-driving principles. Horsepower and acceleration are key examples. . . . Considerable advertising to consumers is still predicated on acceleration and horsepower. Is it any wonder, therefore, that upon purchase of these vehicles that Americans seek to maximize these features?").

[151] Todd D. Gerarden et al., *Assessing the Energy-Efficiency Gap*, 55 J. ECON. LITERATURE. 1486, 1498 (2017); Jason D. Lemp & Kara M. Kockelman, *Quantifying the External Costs of Vehicle Use: Evidence from America's Top-Selling Light-Duty Models*, 13 TRANSP. RES. PART D: TRANSPORT & ENV'T 491, 493–94 (2008). The magnitude of these externalities has been studied extensively in the fuel tax literature. *See e.g.*, Ian W. H. Parry & Kenneth A. Small, *Does Britain or the United States Have the Right Gasoline Tax?*, 95 AM. ECON. REV. 1276 (2005).

Furthermore, there is no legitimate reason[152] to believe that consumers will continue to value endlessly increasing performance attributes like acceleration. Consumer satisfaction surveys suggest that consumers may be more satisfied, and are not less satisfied, with cars with greater fuel efficiency,[153] while there has been no obvious association between historical performance improvements and reported consumer satisfaction.[154]

4. Forgone Vehicle Features Do Not Necessarily Result in Lost Consumer Welfare

Even if fuel economy standards would cause a reduction in other vehicle features compared to what would occur without the standards, it does not necessarily follow that consumers will lose welfare. In fact, there are strong reasons to believe that society will not lose welfare if everyone forgoes some features. This is because the features that NHTSA identify—such as horsepower and weight—are what the economics literature calls "positional goods."[155] And a fleetwide reduction of positional goods need not cause any aggregate loss of consumer welfare.[156]

Positional goods are goods for which the value to one individual depends on how it compares with similar goods possessed by others.[157] In other words, the good is valued according to how much status a good imparts in relation to the amount of the good *others* have, rather than according to innate characteristics of the good itself. [158] A growing body of research indicates that cars are positional goods;[159] namely, 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.[160] According to a recent U.S.

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[152] One exception, explored more below, may be the motivation from positional goods, which presents its own costs.

[153] *See* 86 Fed. Reg. at 43,787 nn.151–52 (citing studies).

[154] *See* Inst. for Pol'y Integrity, Comments on The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks 40–46 (Oct. 26, 2018), https://policyintegrity.org/documents/Emissions_Standards_EPA_NHTSA_Comments_Oct2018.pdf [hereinafter Policy Integrity Oct. 2018 Comments] (comparing changes in vehicle attributes over time to consumer satisfaction surveys).

[155] Robert H. Frank, *The Demand for Unobservable and Other Nonpositional Goods*, 75 AM. ECON. REV. 101, 101 (1985).

[156] Policy Integrity Oct. 2018 Comments, *supra* note 154, at 47–51.

[157] Frank, *supra* note 155, at 101.

[158] *Id.* at 107 ("When an individual's ability level cannot be observed directly, such observable components of his consumption bundle constitute a signal to others about his total income level, and on average, therefore, about his level of ability. . . . [I]mperfect information about ability might create incentives for people to rearrange consumption patterns to favor observable goods.").

[159] *See e.g.*, Anco Hoen & Karst T. Geurs, *The Influence of Positionality in Car-Purchasing Behaviour on the Downsizing of New Cars*, 16 TRANSP. RES. PART D: TRANSP. ENV'T 402 (2011) ("The stated choice experiments presented in this paper showed that cars and specific car attributes, such as size, engine capacity and interior, are positional goods, even though not all outcomes were consistent with the relative consumption theory. Willingness-to-pay for these car attributes differed between situations in which respondents were asked to imagine living in a world with, on average, either smaller or larger cars. Car size and engine size appear to particularly add to positionality.").

[160] 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.*, Fredrik Carlsson et al., *Do You Enjoy Having More than Others? Survey Evidence of Positional Goods*, 74 ECONOMICA 586, 588, 593 (2007) (reporting results of a Swedish survey); Francisco Alpizar et al., *How Much Do We Care About Absolute Versus Relative Income and Consumption?*, 56 J. ECON. BEHAV. & ORG. 405, 412 (2005) (reporting results of Costa Rican survey). Though some such surveys were conducted in other countries, positionality for cars likely would be stronger in the United States, given the American affinity for cars and the income distribution. *See* Reid R. Heffner et al., *Effects of Vehicle Image in Gasoline-Hybrid Electric Vehicles*, (U.C. Davis Inst. of Transp. Stud., UCD-ITS-RR-05-08, 2005) ("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.'" (citations omitted) (alterations in original)); Ed Hopkins & Tatiana Kornienko, *Running to Keep in the Same Place: Consumer Choice as a Game of Status*, 94 AM. ECON. REV. 1085 (2004) (noting that positional effects increase as society's income increases, because the portion of income spent on

survey on the visibility of 31 expenditure categories (from food to mobile phones), new or used motor vehicle purchases were the second most visible expenditure; related expenditures on gasoline/diesel, vehicle maintenance, and insurance were all substantially less visible.[161]

The trouble with positional goods is they impose externalities. If Joan buys a fast, flashy sportscar to move up the status hierarchy, John's fast, flashy sportscar is no longer as rare. John feels relatively worse off and so will have to invest in an even faster, flashier car just to restore his previous status position. Joan's purchase made John feel worse off (a positional externality), and then John's subsequent purchase made Joan feel worse off (another positional externality), and at the end they wind up with the same relative status that they started with. As a result, both consumers spend resources without actually improving their relative status.[162]

Because vehicle purchase decisions are made non-cooperatively but in fact alter the spending behavior of others, consumers get stuck on a "positional treadmill" that does not increase welfare.[163] Yet if any individual unilaterally tries to opt out of this "expenditure arms race," it would only move that consumer backwards on the status hierarchy.[164] If consumers could maintain their *relative* position with respect to positional vehicle features, they might not suffer any welfare loss.[165]

Therefore, even if the fuel economy standards were to reduce the availability of some features due to a tradeoff with fuel economy, the standards would do so in a way that serves as a cooperative solution that allows consumers to achieve what they could not in the non-cooperative open market: an increase in fuel economy and decrease in other features (compared to what would have existed without the standards) without losing position in the status hierarchy.[166]

Because of the positional nature of many vehicle features, NHTSA cannot assume that fuel economy standards will impose opportunity costs by preventing consumers from buying more performance features.[167] The fact that consumers claim to value both performance and fuel economy, yet during

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conspicuous consumption increases); Carlsson et al., *supra*, at 588 (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"); *see also* Birgitta Gatersleben*, The Car as a Material Possession: Exploring the Link Between Materialism and Car Ownership and Use*, *in* AUTO MOTIVES 137-48 (Karen Lucas et al. eds., 2011), https://doi.org/10.1108/9780857242341-007; Bryan Lufkin, *What Google Street View Tells Us About Income*, BBC (Jan. 6, 2018), https://www.bbc.com/worklife/article/20180105-how-your-car-signals-your-income; Liza Barth, *Cars as Status Symbols*, CONSUMER REPORTS (Dec. 18, 2007), https://www.consumerreports.org/cro/news/2007/12/cars-as-status-symbols/index.htm; *Top 14 Status Symbol Cars at Bargain Prices*, MOTORTREND (May 15, 2014), https://www.motortrend.com/news/top-14-status-symbol-cars-at-bargain-prices.

[161] Ori Heffetz, *A Test of Conspicuous Consumption: Visibility and Income Elasticities*, 93 REV. ECON. & STAT. 1101, 1106 (2011) (reporting that vehicle purchase had a visibility index of 0.73, second only to tobacco products (0.76); and that gasoline/diesel had a visibility index of 0.39, car repairs were at 0.42, and car insurance fell near the bottom at 0.23).

[162] Theory also predicts that manufacturers will overinvest in researching status features, at the expense of non-status features. Ben Cooper et al., *Status Effects and Negative Utility Growth*, 111 ECON. J. 642 (2001).

[163] Robert H. Frank, *Positional Externalities Cause Large and Preventable Welfare Losses*, 95 AM. ECON. REV. 137, 137 (2005).

[164] *Id.*

[165] Robert H. Frank & Cass R. Sunstein, *Cost-Benefit Analysis and Relative Position*, 68 U. CHI. L. REV. 323, 326 (2001) ("[W]hen 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. 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.").

[166] Correcting collective action problems is a classic case for regulation. "Analytically, positional externalities are no different from ordinary environmental pollutants." *Id.* at 364. Such regulation is not about taking public action just because one consumer's increased consumption makes another consumer unhappy or envious; rather, regulation is justified to address a market failure. *Id.* at 365.

[167] Hoen & Geurs, *supra* note 159, at 407 ("Willingness-to-pay for these car attributes differed between situations in which respondents were asked to imagine living in a world with, on average, either smaller or larger cars. Car size and engine size

many years without new standards, consumers pursued only increased performance of visible, status attributes and not increased fuel economy—only to experience little to no increase in their overall satisfaction with new vehicle purchases[168]—strongly suggests that performance attributes are positional goods and that a variety of market failures interfere with consumers' ability to pursue their optimal levels of fuel economy. Regulatory standards can address these market failures.

G. Conclusion

Consumer face a variety of persistent market failures, rather than technological tradeoffs, which prevent them from obtaining efficient levels of fuel economy. NHTSA should focus on such market failures to justify strong fuel economy standards that will deliver net private benefits. Technological tradeoffs are unlikely, and NHTSA need not estimate alleged opportunity costs from forgone benefits. If it does, NHTSA would need to adjust such estimates for compliance cost effects, diminishing returns to performance, safety externalities related to performance, and positional externalities caused by high-status performance attributes.

Market failures also explain why, whereas consumers historically and currently do not exhibit a high valuation of future fuel savings in their purchasing decisions, in a future scenario with new standards, consumer valuations may increase. NHTSA should revise its 2.5 year estimate in light of the best available economic theories and evidence, and not based solely on anecdotes reported by self-interested manufacturers. There may be grounds to select a lower estimate of consumer valuation to use in the baseline scenario, and a higher estimate to use in the sales/scrappage modules. Short of that, NHTSA should select the lowest estimate of sales elasticity that can be justified from the literature (*see* Section II.A-B), to offset the unrealistically low consumer valuation figure currently used in the sales/scrappage module.

II. NHTSA Should Correct Multiple Problems with the Sales Model

Before the 2020 SAFE rule, "all previous CAFE rulemaking analyses used static fleet forecasts that . . . projected identical sales and retirements across the alternatives, for each manufacturer down to the make/model level."[169] In the Proposed Rule, NHTSA adopts the sales model developed during the SAFE rulemaking, which combines an elasticity estimate, consumer valuation estimate, fleet share estimates, and other factors to forecast future mixes of new and used cars and trucks. However, as this section and the previous section explained, there are multiple problems with these components of the sales model. It is also not clear whether NHTSA could "back-cast" its model to accurately match what has happened historically. Given all these problems, the value added by the sales model is uncertain at best, and in fact NHTSA's sales model may produce results that are less realistic than the simplifying static forecast it previously used. NHTSA should strongly consider whether its modeling would be more reliable overall if it excluded its sales and scrappage estimates. Short of that, NHTSA should select values for the elasticity and other factors that will minimize the potential for the model to produce unrealistic results that could skew the agency's economic analysis.

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appear to particularly add to positionality. . . . Ignoring positionality may result in an overestimation of welfare costs associated with CO2 measures that lead to downsizing of the average passenger car.").

[168] *See* Policy Integrity Oct. 2018 Comments, *supra* note 154, at 40-46 (comparing changes in vehicle attributes over time to consumer satisfaction surveys).

[169] 86 Fed. Reg. at 49,711; TSD, *supra* note 9, at 397.

A. NHTSA Should Use Long-Run (Not Just Short-Run) Estimates for Sales Elasticity in the Final Rule

As in the final SAFE 2 Rule, NHTSA has used a value of -1 to estimate the price elasticity of demand.[170] NHTSA bases this estimate on literature more than 25 years old, and relies primarily on estimates of short-run elasticity.[171] Based on the best available evidence, NHTSA should in fact focus its main analysis on a much lower demand elasticity based on long-run estimates.

Price elasticity measures the sensitivity of the sales of a particular product to fluctuations in that product's price. While sales will typically increase when prices drop and decrease when prices rise, the strength of that relationship will depend on buyers' need for the product and the availability of substitutes. Sales of necessity products with few comparable substitutes are likely more insensitive to price fluctuations. In economic terms, such products are *inelastic*. By contrast, products that are less essential or that can be easily substituted by other products are typically *elastic*, meaning that their sales are more sensitive to price fluctuations.[172]

Automobiles currently fall into the former category. Because automobiles are typically considered to be essential goods in most areas of the United States today, due to the current lack of adequate comparable substitutes, both economic theory and observed behavior finds that vehicle sales are relatively inelastic—meaning that price fluctuations produce just modest changes in vehicle sales in the long run.[173]

As shown in Table 1 (see appendix), the economic literature generally finds a relatively higher elasticity for short-run estimates of vehicle sales (effects within one year)[174] but much lower elasticity for longer-run estimates (especially for effects beginning five to ten years in the future).[175] This reflects that vehicle sales are more elastic in the very short term because a consumer may delay a car purchase for a year or so when faced with higher prices, but most consumers facing modest prices changes are not willing to delay their car purchase more than that, given the general necessity of vehicle ownership and relative inability of current alternative modes of transportation to provide a complete substitute.[176] Given that tailpipe emissions standards apply several model years in the future, and that the analytical model used by EPA and NHTSA projects sales impacts 30 years in the future, EPA and NHTSA have previously indicated that short-run estimates of elasticity are not appropriate.[177]

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[170] TSD, *supra* note 9, at 411–12.

[171] *Id.* at 412 nn.576 & 577.

[172] ROBERT S. PINDYCK & DANIEL L. RUBINFELD, MICROECONOMICS 26–30 (1989) (providing background on price elasticity and using the example of butter and margarine to explain that products with close substitutes are more elastic).

[173] Saul H. Hymans, *Consumer Durable Spending: Explanation and Prediction* (Brookings Papers on Econ. Activity, 1970), https://www.brookings.edu/wp-content/uploads/1970/06/1970b_bpea_hymans_ackley_juster.pdf ("The automobile has apparently become so necessary in the American economy that its price elasticity is beginning to resemble that of food."). The agencies relied on this paper when setting the baseline standards. *See* 77 Fed. Reg. at 63,102 n.1300.

[174] *See* PINDYCK & RUBINFELD, *supra* note 172, at 30 (describing short-run elasticity as measuring "one year or less").

[175] See Thomas H. Klier & Joshua Linn, *The Effect of Vehicle Fuel Economy Standards on Technology Adoption*, 133 J. PUB. ECON. 41, 44 (2016).

[176] EPA Sci. Advisory Bd., *supra* note 124, at 22 (2020) ("[T]he long-run price elasticity for new vehicles is likely to be smaller than the short-run price elasticity . . . since a consumer can easily hold on to their existing vehicle a bit longer . . . [whereas] an old vehicle will not be functional forever."); *see also* 77 Fed. Reg. at 63,102 n.1300 (EPA and NHTSA similarly recognizing in 2012 that price elasticity for motor vehicles is "smaller in the long run" because, "though people may be able to change the timing of their purchase when price changes in the short term, they must eventually make the investment" in a new car even if higher prices remain long-term.).

[177] Draft TAR, *supra* note 17, at A-40.

In the regulatory proposal underlying the SAFE 2 Rule, EPA and NHTSA projected that the price elasticity for new car and light truck sales "ranged from -0.2 to -0.3"—meaning, in other words, that a 1 percent increase in sticker price would decrease sales by only 0.2–0.3 percent.[178] Yet in the final Safe 2 Rule, the agencies abruptly rejected their earlier elasticity estimate and drastically increased the price elasticity more than three-fold. The agencies claimed that the price elasticity for new vehicles was -1—meaning that new car sales would decline by 1 percent for every 1 percent increase in sticker price.[179] But the agencies offered minimal justification for this substantial revision. And by making this change in the final rule, the agencies did not provide an opportunity for comment.[180]

Policy Integrity provides these comments now to urge NHTSA not to rely on the overly conservative estimate of demand elasticity from the SAFE 2 Rule. The agency should instead conduct a full review of the relevant economic literature, which confirms that vehicles are currently an inelastic good in the long run—with a price elasticity far below -1 in absolute terms.

After EPA and NHTSA abruptly changed the demand elasticity in the final SAFE 2 Rule, Policy Integrity issued a report reviewing the relevant literature.[181] As further explained in this report, the SAFE 2 Rule erroneously relied on short-run estimates of demand elasticity even though long-run estimates are more appropriate for standards that apply several years into the future,[182] and even though the agencies used long-run estimates of other inputs elsewhere in their rule analysis.[183] Table 1 (see appendix) demonstrates that NHTSA's continued use of -1 is overly conservative compared to the most current literature.

The estimate chosen for sales elasticity has a significant impact on NHTSA's analysis, as it directly influences the dynamic fleet share model's projection of sales and scrappage impacts and fleet size, thus affecting key projections such as criteria pollutant and greenhouse gas emissions.[184] By continuing to use the conservative demand elasticity from the SAFE 2 Rule, NHTSA is undervaluing the net benefits of its new proposed standards significantly.[185]

In its main analysis of its Final Rule, NHTSA should base its analysis on the best available estimates of long-run sales elasticity. An estimate around -0.4 or lower would be appropriate for a long-run estimate based on the most recent literature. As discussed both above and in the next subsection, given how the sales elasticity figure interacts with the assumption about how many months of fuel savings consumers

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[178] 83 Fed. Reg. at 43,075.

[179] 85 Fed. Reg. at 24,617.

[180] *See* Ctr. for Biological Diversity et al., Petition for Reconsideration of EPA's Final Rule—The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks 42–43 (June 29, 2020) (Docket No. EPA-HQ-OAR-2018-0283).

[181] Peter Howard & Max Sarinsky, Inst. for Pol'y Integrity, *Turbocharged: How One Revision in the SAFE Rule Economic Analysis Obscures Billions of Dollars in Social Harms* (2020), https://policyintegrity.org/publications/detail/turbocharged [hereinafter *Turbocharged*].

[182] *Id.* at 5–7.

[183] NHTSA & EPA, *Final Regulatory Impact Analysis: The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021–2026 Passenger Cars and Light Trucks* 968 n.1900 (2020), https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/final_safe_fria_web_version_200701.pdf [hereinafter *SAFE 2 Final RIA*] ("Most of the vehicles affected by today's standards will remain on the roads for at least a decade, with a significant fraction surviving considerably longer. As such, long-run estimates are more likely to reflect the lifetime mileage accumulation of the new fleet than either short-run or medium-run estimates. Furthermore, a long-run rebound estimate better reflects the cumulative impact of successive CAFE and CO_2 standards such as those adopted by the agencies beginning as early as 2010.").

[184] *Turbocharged*, *supra* note 181, at 4; *see also* SAFE 2 Final RIA, *supra* note 183, at 883–87.

[185] *See* PRIA, *supra* note 4, at 228 tbl.7-1 (showing sensitivity case for demand elasticity of -20% (-0.8) results in net benefits $4.4 billion higher than reference case using -1 elasticity).

will value, there is reason to move toward the low end of the range of elasticity estimates consistent with the literature, and so NHTSA should consider values in the -0.2 to -0.3 range. NHTSA could consider higher estimates as sensitivity analysis, but a value as high as -1.0 is not supported by the literature to estimate the long-run elasticity—indeed, the literature demonstrates that -1.0 would be on the high end for even short-run elasticity. If NHTSA uses a value of -1.0, it should be as a sensitivity analysis that makes clear it is very conservatively focusing on the high end of the range for short-run elasticity.

In future rulemakings, NHTSA should consider making further structural adjustments to the way it models sales, scrappage, and demand elasticity. Review of the recently released EPA technical report entitled "The Effects of New-Vehicle Price Changes on New- and Used-Vehicle Markets and Scrappage" is instructive.[186] This report suggests a dynamic transition path model for elasticity that recognizes that the fleet will equilibrate from any initial price shocks toward the new, long-run steady state after a period of years or decades as consumers are initially pushed into the used vehicle market and then demand brings them back to the new vehicle market.[187] This report builds on equilibrium simulations from Jacobsen and van Benthem and confirms the appropriateness of using long-run estimates for elasticity, and provides another reason why short-run estimates will be too high.[188]

B. If NHTSA Cannot Adjust Up the Consumer Valuation Estimate in the Sales Model, It Should Adjust Down the Elasticity Estimate

As explained above, NHTSA's current estimate of 2.5 years' worth of consumer valuation of fuel savings has countervailing effects in different parts of the model, and extreme assumptions could lead to unrealistic results. If the value is set too high, then the baseline scenario will assume unrealistic voluntary levels of technology adoption, resulting in an underestimate of both the costs and benefits of the proposed standards. If the value is set too low, then fuel savings do not offset enough of the technology price in the sales module, leading to an unrealistic sales effect that we do not observe, since we observe fleet size remaining more or less constant.

One potential solution proposed above may be to set a relatively lower value for the baseline and a relatively higher value for use in the sales and scrappage models. However, NHTSA seems to claim that it cannot adjust the figure used in the sales model. NHTSA does run a sensitivity analysis that uses a 60-month period instead of a 30-month period, but NHTSA explains: "An important limitation of this [sensitivity] case's implementation in the CAFE Model: *the current sales and scrappage modules do not respond to changes in the payback period assumption*. This means that, while the technology application assumes buyers are willing to pay for any technology that pays back in the first 60 months of avoided fuel costs, the sales and scrappage modules would both still treat too large a portion of those technology costs as true price increases. In the reference case, those assumptions are harmonized, but they are not (yet) flexible enough to accommodate alternative assumptions like the 60-month payback described here. CAFE Model development will continue in order to improve this flexibility."[189]

If NHTSA is not able to develop the flexibility to change the payback period assumption in the sales and scrappage modules, then NHTSA needs to adjust those modules in another way that achieve comparable results. The solution (short of dropping the entire sales model, as suggested above), is to pick the lowest reasonable estimate of elasticity that can be supported in the literature. A value around -0.2 to -0.3, or slightly lower, based on the most recent available literature, may be appropriate (see Table 1 in the

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[186] Mark Jacobsen et al., *The Effects of New-Vehicle Price Changes on New- and Used-Vehicle Markets and Scrappage*, EPA (2021), https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=352754&Lab=OTAQ.

[187] *Id.*

[188] *Id.* at 1–3.

[189] PRIA, *supra* note 4, at 231.

appendix of these comments). A lower sales elasticity figure will also help hold the fleet mix more constant, bringing NHTSA back toward its prior longstanding practice of a static fleet forecast.

C. NHTSA's Fleet Share Equations Wrongly Assume an Inevitable Shift to Light-Duty Trucks

NHTSA uses a "dynamic fleet share module" to estimate the mix of passenger cars versus light-duty trucks in future model years. However, the equations are biased by an assumed inevitable shift toward light-duty trucks and away from passenger cars. To the extent this fleet share module inaccurately overestimates the future fleet's proportion of light-duty trucks, NHTSA will underestimate fuel savings and overestimate emissions under the various policy alternatives.

There are at least three related problems with NHTSA's fleet share equations. First, the share of cars and trucks are "independently estimate[d]," and only later are the "two independently estimated share . . . normalized to ensure that they sum to one."[190] Second, while the equations include factors for fuel economy, fuel price, and horsepower, they omit any consideration of vehicle price or other attributes.[191] Third, the fuel economy coefficient for cars is set to a negative number, while the coefficient for trucks is set to a positive number.[192]

As a result, any improvement in the average fuel economy for cars will lead the module to assume a *reduction* in the share of cars, regardless of whether the relative price for trucks may have increased or whether the relative fuel economy or other attributes for trucks may not have improved. Assuming that—holding everything else equal—any improvement in fuel economy for cars will inevitably drive consumers to buy *fewer cars* (and so more trucks) is counterintuitive. The counterintuitive result is produced not just by the assumed negative coefficient for cars, but by the failure to estimate the equations jointly and by the omitted variables. NHTSA's module ignores the importance of relative attributes. When a consumer is deciding whether to buy a new car or a new light-duty truck, that consumer will compare the relative prices of cars versus trucks as well as their relative fuel economy and relative performance. NHTSA's module ignores this.

NHTSA claims that its approach "does not suggest that consumers dislike fuel economy in passenger cars, but merely recognizes the fact that fuel economy has diminishing returns in terms of fuel savings. As the fuel economy of light trucks increases, the tradeoff between passenger car and light truck purchases increasingly involves a consideration of other attributes."[193] Even if it is true that consumers tend to prefer light-trucks with comparable fuel economy to cars, NHTSA's equations are not making that relative comparison; instead, NHTSA is independently estimating that, regardless of vehicle price or any relative increase in trucks' fuel economy, an increase in cars' fuel economy will decrease their share. That assumption is wrong. NHTSA is also mistaken to assume that fuel economy uniquely has "diminishing returns." Economic theory would also predict diminishing returns on continually improved horsepower, for example. As a result, the assumption that any absolute increase in horsepower (again, regardless of the relative change in horsepower compared to cars) will continually shift more consumers toward trucks may also be wrong.

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[190] 86 Fed. Reg. at 49,712.

[191] NHTSA seems to assume that prices will not affect the fleet share model because, "[d]espite the fact that light trucks have generally higher transaction prices than passenger cars, there is no guarantee that regulatory costs will be higher for light-trucks than for cars." TSD, *supra* note 9, at 414–15. This is not a reason to ignore the effect of relative prices on purchasing decisions. It is irrelevant whether it is "guarantee[d]" that trucks will have higher compliance costs than cars; relative price is something that NHTSA can estimate and should have considered in any equation to estimate fleet share.

[192] TSD, *supra* note 9, 416 tbl.4-4.

[193] 86 Fed. Reg. at 49,712–13.

D. Conclusion

NHTSA's estimate of sales elasticity is inconsistent with the best available literature; NHTSA should switch to a lower, long-run estimate. Indeed, NHTSA should select the lowest estimate of elasticity that can be justified by the literature (around -0.2 to -0.3, or slightly lower) to compensate for its apparent inability to properly adjust the consumer valuation figure currently applied to the sales model (i.e., the 2.5 year assumption). A lower elasticity estimate will also produce results more in line with NHTSA's prior longstanding practice of assuming a static fleet forecast. Indeed, other elements of NTHSA's current approach to fleet forecasting are also problematic. Its fleet share equations are inherently biased toward a larger share for trucks in a way that is counterintuitive to basic economic logic. Holding VMT (vehicle-miles-traveled) constant is another unrealistic assumption that leads to distorted effects in the sales model. In reality, some consumers leaving the new car market will not move to used cars, but instead will use outside options, like public transportation or ride-sharing, such that total VMT should actually slightly decrease.

For all these reasons, NHTSA should consider whether its sales model's results are less reliable and less realistic than its previous practice of a static fleet forecast. If so, NHTSA should strongly consider excluding its sales and scrappage estimates. Short of that, NHTSA should select values for the elasticity and other factors that will minimize the potential for the model to produce unrealistic results that could skew the agency's economic analysis.

III. NHTSA Should Reevaluate How Fuel Economy Standards Affect Vehicle Safety

A. NHTSA Should Not Rely on a Statistically Insignificant Relationship Between Safety and Vehicle Mass

In the SAFE 2 rulemaking, EPA and NHTSA claimed that the impact of the baseline standards on vehicle mass justified rolling back the prior standards. According to the agencies, the Obama-era standards would have caused manufacturers to reduce the weight of new cars and light trucks and therefore increased the risk of injury for vehicle occupants.[194] As Policy Integrity previously commented,[195] the agencies' reliance on the mass-related fatalities was flawed because the agencies' own analysis showed no relationship between vehicle mass and safety.[196]

NHTSA's continued reliance on the mass-related fatalities in the Proposed Rule is flawed because NHTSA's own analysis shows the effect of mass reductions in light duty vehicles is not statistically significant at the 95thor 90th percent confidence level.[197] In other words, the effect of mass reduction on safety cannot be reliably distinguished from zero. Only once the agency calculates the impact at the 85th percent confidence level do the results show any statistical significance.[198] But anything lower than the 90th percent confidence interval is likely not reliable.[199]

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[194] 83 Fed. Reg. at 43,067.

[195] Policy Integrity Oct. 2018 Comments, *supra* note 154, at 125–28.

[196] *Id.* at 125–26.

[197] PRIA, *supra* note 4, at 109.

[198] *Id.* at 110–11.

[199] *See* Jeffrey M. Wooldridge, *Introductory Econometrics*, 4 S.-W. CENGAGE LEARNING 137 (2009) (explaining that reliance on variables that are statistically significant below 90% requires further study). Ninety-five percent is the default confidence interval in commonly used statistical programs like STATA, SAS, and MATLAB. *See, e.g.*, Stata, *Linear Regression* 1, https://www.stata.com/manuals13/rregress.pdf; SAS, *Example 4.9 Computing Confidence Limits for the Mean, Standard Deviation, and Variance*,

Notably, the impact of mass is even less significant now than it was when the Obama-era standards were issued. In 2012 and 2016, EPA and NHTSA found minimal evidence of any relationship between mass and safety, and that evidence was statistically significant only at the 90th confidence interval, which is weak evidence.[200] In SAFE 2, and again here, NHTSA is not even able to say that much. The fact that the mass effects are not statistically significant even at the 90th confidence interval now is consistent with the most recent literature on this topic.

In a recent paper, Wenzel reviewed NHTSA's data and concluded that the "effect of mass reduction while maintaining footprint on societal U.S. fatality risk is small, and not statistically significant at the 95% or 90% confidence level for all vehicle types."[201] According to the study, "[r]educing vehicle mass does not consistently increase risk across all footprint deciles for any combination of vehicle type and crash type."[202] In fact, after running a decline analysis, Wenzel finds that reducing mass *increases* safety more than decreases safety for the vast majority of crash and vehicle combinations:

> Reducing vehicle mass does not consistently increase risk across all footprint deciles for any combination of vehicle type and crash type. Risk increases with decreasing mass in a majority of footprint deciles for only 6 of the 27 crash and vehicle combinations, but few of these increases are statistically significant. On the other hand, risk decreases with decreasing mass in a majority of footprint deciles for 16 of the 27 crash and vehicle combinations; in some cases these risk reductions are large and statistically significant. If reducing vehicle mass while maintaining footprint inherently leads to an increase in risk, the coefficients on mass reduction should be more consistently positive, and with a larger R2, across the 27 vehicle/crash combinations, than shown in the analysis.[203]

Wenzel found that the impact of mass was insignificant even as the weight of trucks has trended upwards over time.[204]

If anything, the research and analysis actually could support a conclusion that reducing mass *improves* safety.[205] For example, Bento et al. looked at impacts of CAFE standards on weight distribution and mean weight and found that pre-footprint standards actually decreased fatalities on net by reducing weight of vehicles (even as it spread out the distribution). Specifically, they found that pre-footprint regulations saved 393 lives nationally.[206]

Moreover, footprint-based standards were introduced in 2012 to mitigate the potential negative effects of decreasing the mass of vehicles (i.e., by creating crumple space). And when footprint is held fixed, "no judicious combination of mass reductions in the various classes of vehicles results in a statistically significant fatality increase and many potential combinations are safety-neutral as point estimates."[207] Similarly, a 2015 study by the National Academy of Sciences found that "a reduction in the weight of

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http://support.sas.com/documentation/cdl/en/procstat/67528/HTML/default/viewer.htm#procstat_univariate_examples09.htm; MathWorks, *Help Center: paramci*, https://www.mathworks.com/help/stats/prob.normaldistribution.paramci.html; RePEc, *Help: outreg2*, http://repec.org/bocode/o/outreg2.html.

[200] Draft TAR, *supra* note 17, at 8-21, 8-22, 8-27, 8-31; 77 Fed. Reg. at 62,747–48.

[201] Tom Wenzel, *Assessment of NHTSA's Report "Relationships Between Fatality Risk, Mass, and Footprint in Model Year 2004-2011 Passenger Cars and LTVs,"* at x (2018), https://escholarship.org/uc/item/4726g6jq.

[202] *Id.* at v.

[203] *Id.*

[204] *See* 83 Fed. Reg. at 43,111–12 (describing an upward trend in vehicle mass).

[205] *See, e.g.*, Wenzel (2018), *supra* note 201, at 110.

[206] Antonio Bento et al., *The Effect of Fuel Economy Standards on Vehicle Weight Dispersion and Accident Fatalities* 24–25 (2017), https://resources.environment.yale.edu/gillingham/Bentoetal_CAFEAttributesAccidents.pdf.

[207] Wenzel (2018), *supra* note 201, at x.

vehicles is not generally associated with greater societal safety risks" as long as the size mix of vehicles remains roughly the same.[208] Similarly, in a 2013 study, Jacobsen found no evidence that footprint standards affect fatalities.[209]

There may be several reasons other than the fact that standards are footprint-based, to explain the evidence showing that mass reductions do not affect safety.

First, other independent factors likely reduce the impact of mass on safety. For example, as NHTSA concedes, the "designs and materials of more recent model year vehicles may have weakened the historical statistical relationships between mass, size, and safety."[210] Additionally, fuel efficiency and safety ratings may be positively related via production decisions.[211]

Second, recent work by Tolouei also supports the finding that narrowing the weight distribution of vehicles will save lives.[212] As the National Academy of Sciences has explained, manufacturers will reduce mass "across all vehicle sizes, with proportionately more mass removed from heavier vehicles."[213] This decreases any negative effect that mass reductions would have on safety.[214] These findings reflect the fact that safety is positional. The safety of vehicle occupants in a two-car crash is dependent on the characteristics of *both* vehicles. If each vehicle has had proportional reductions in mass, the safety implications of reduced mass is significantly lessened. And, as Tolouei finds, lightweighting the largest vehicles while maintaining the weight of the smallest vehicles such that the maximum weight difference between two vehicles in a crash is smaller can have a positive impact on safety.[215]

As the evidence shows, there is no negative safety impact due to down-weighting. EPA is on record reaching a similar conclusion. In 2017, EPA explained in the Final Determination that the fleet can absorb modest levels of mass reduction without any net increase in fatalities.[216] And in EPA's companion Proposed Rule, EPA notes that any projected increase in fatal and non-fatal injuries are almost entirely a result of increased VMT, rather than mass reduction, and that the risk per vehicle mile travelled from increasing the stringency of its standards would remain "virtually unchanged" from the baseline standards.[217] While NHTSA relies on a National Research Council report from 2002 and other studies conducted before the agency shifted to footprint-based standards,[218] the most current literature supports EPA's conclusions that the relationship between increasing fuel economy, mass reduction, and safety is weak at best.

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[208] Nat'l Rsch. Council, *supra* note 87, at 363–64 (finding 10.2) ; *see also* Soren T. Anderson et al., *Automobile Fuel Economy Standards: Impacts, Efficiency, and Alternatives*, 5 REV. ENV'T ECON. & POL'Y 89, 94–95 (2011) (concluding that "the impact of fuel economy standards on road safety is less clear" and that, "based on the available literature, it is difficult to draw definitive conclusions about the direction, let alone the magnitude, of the link between external accident costs and fuel economy regulations").

[209] Mark R. Jacobsen, *Fuel Economy and Safety: The Influences of Vehicle Class and Driver Behavior*, 5 AM. ECON. J.: APPLIED ECON. 1, 2 (2013).

[210] TSD, *supra* note 9, at 618.

[211] Chialin Chen & Yu Ren, *Exploring the Relationship Between Vehicle Safety and Fuel Efficiency in Automotive Design*, 15 TRANSP. RSCH. PART D 112, 114 (2010).

[212] Reza Tolouei, *Carbon Policies Targeting Road Transport: Is There a Safety Consequence?*, 8 TRANSP. RSCH. PROCEDIA 259, 267 (2015), https://www.sciencedirect.com/science/article/pii/S2352146515001362.

[213] Nat'l Rsch. Council, *supra* note 87, at 240.

[214] *Id.*; Wenzel (2018), *supra* note 201, at 110.

[215] Toluei (2015), *supra* note 212, at 269.

[216] EPA, Final Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards under the Midterm Evaluation, at 26–27 (January 2017).

[217] 86 Fed. Reg. at 43,786; *see also* EPA DRIA, *supra* note 84, at 5-10.

[218] PRIA, *supra* note 4, at 101 n.96 & 103 n.98.

Finally, NHTSA continues to focus on mass, despite discussing elsewhere the significant rise in horsepower and performance. Given the evidence about acceleration and the clear signs of an externality problem with speed (i.e., speed limits and other enforcement efforts to reduce speed in order to prevent vehicle accidents), it seems that the agency could better use its resources by shifting away from so much focus on the statistically insignificant evidence on mass reductions. NHTSA should instead focus its resources on further research on the safety implications of other vehicle attributes such as horsepower[219] or body design.[220] Relatedly, much of the existing vehicle safety research has focused on the private risk to vehicle occupants in single-car or two-car crashes, without as much focus on externalities such as the risks to pedestrians, cyclists, and occupants of other vehicles who could see a safety *benefit* from decreased relative vehicle mass.[221] Especially as the popularity of alternatives to vehicle ownership continue to rise[222] and the likelihood of vehicle-bike or vehicle-pedestrian collisions increase,[223] NHTSA should take a more holistic approach to vehicle safety that looks outside the vehicle itself and considers the vehicle's impact on its surroundings.

B. NHTSA Should Flatten the Footprint Curve to Avoid Incentivizing Larger Vehicles

NHTSA seeks comment on "whether, to the extent that vehicle upsizing trends and fuel economy curves are causally related instead of correlated, it is the curve shape versus the choice of footprint that creates this relationship (or, alternatively, whether the relationship if any derives from vehicle classification)."[224] As discussed below, Policy Integrity recommends that NHTSA reconsider its footprint-based curves based on the most recent information regarding vehicle safety and changes in fleet mix.

When NHTSA first adopted footprint-based standards for MY2008-2011, it did so in response to a 2002 National Research Council ("NRC") report suggesting that increasingly stringent fuel economy standards could negatively impact vehicle safety if automakers complied with the standards by reducing vehicle size and weight.[225] NHTSA believed that using a continuous function to set the footprint curve would minimize the risk that automakers might upsize vehicles or shift their fleet mix in order to reach the less stringent fuel economy targets.[226] But the agency's analysis of potential safety and emissions impacts from its new footprint curve was largely qualitative rather than quantitative. The agency did note that future rulemaking efforts should consider "projected trends in fleet mix and fleet size" when establishing new footprint curves.[227]

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[219] *See, e.g.*, EPA, *The 2020 EPA Automotive Trends Report* 27 (2021) [hereinafter *2020 Trends Report*] (reporting that the average MY2019 vehicle produces 140% more horsepower than the average MY1981 vehicle).

[220] *See, e.g.*, Samuel S. Monfort & Becky C. Mueller, *Pedestrian Injuries from Cars and SUVs: Updated Crash Outcomes from the Vulnerable Road User Injury Prevention Alliance*, Ins. Inst. For Highway Safety (2020), https://www.iihs.org/api/datastoredocument/bibliography/2203 (reporting that SUVs and light trucks with higher leading edges are two to three times more likely to kill pedestrians in single-vehicle collisions).

[221] *See* Toluei (2015), *supra* note 212, at 269.

[222] *See, e.g.*, Adrienne Bernhard, *The Great Bicycle Boom of 2020*, BBC, https://www.bbc.com/future/bespoke/made-on-earth/the-great-bicycle-boom-of-2020.html.

[223] *See, e.g.*, Winnie Hu, *De Blasio Vowed to Make City Streets Safer. They've Turned More Deadly.*, N.Y. Times (pub. Sept. 30, 2021, updated Oct. 7, 2021), https://www.nytimes.com/2021/09/30/nyregion/traffic-deaths-nyc.html ("At least 189 people — including 87 pedestrians and 12 cyclists — have been killed by crashes on [New York City] streets through Sept. 14, up nearly 26 percent from the same period last year and the highest number of deaths in that period since 2013, according to city records.").

[224] 86 Fed. Reg. at 49,361.

[225] *Reforming the Automobile Fuel Economy Standards Program*, 68 Fed. Reg. 74,908, 74,909–10 (Dec. 29, 2003); *see also* Nat'l Rsch. Council, *Effectiveness and Impact of Corporate Average Fuel Economy Standards* 88 (2002), https://www.nap.edu/catalog/10172/effectiveness-and-impact-of-corporate-average-fuel-economy-cafe-standards.

[226] 71 Fed. Reg. 17,566, 17,618 (Apr. 6, 2006).

[227] *Id.*

Shortly after the first affected model years under NHTSA's new footprint-based standards had passed, economists predicted that continuing to use vehicle footprint might incentivize automakers to manufacture larger vehicles and thereby undermine gains in fuel economy.[228] Indeed, one study found that using a footprint-based attribute system to set fuel economy standards might be resulting in up to 76 million tons of additional carbon dioxide emitted each year compared to setting flat standards.[229]

Now, nearly two decades after the NRC report NHTSA originally relied on was released, NHTSA has significantly more data available to assess whether its footprint curve is supported by the current literature on vehicle safety. It also has fleet data to assess if the agency's original contention that its curve would not incentivize vehicle upsizing or shifts in the fleet toward larger vehicles has proven correct.

As discussed in the preceding section (III.A), the most recent literature—and NHTSA's own analysis—show that there is not a statistically significant relationship between safety and vehicle downsizing. Rather, the literature suggests that *increasing* vehicle size and size distribution may have a more significant negative impact on vehicle safety.[230] Current trends in fleet makeup show that the fleet mix has shifted heavily in favor of crossovers and SUVs[231] and the weight difference between the lightest and heaviest vehicles has dramatically increased.[232] The shifting vehicle marketplace, and the most recent literature on vehicle safety, demonstrate that conditions have changed since NTHSA first adopted footprint-based standards.

NHTSA should evaluate whether changes to its footprint curve could help address the incentives that may have helped shift the market toward larger vehicles. There is some research indicating that flattening the curve could help reduce or remove these incentives, especially if the curve for light trucks is flattened further than for passenger cars.[233] NHTSA should also bear in mind that while consumers certainly value the size of their vehicles, at least some size-related attributes may be "positional goods" (*see supra* Section I.F.4), such that increases in vehicles' absolute size without changing consumers' relative position may not have delivered the assumed welfare gains that drove consumers to buy bigger vehicles in the first place.

Given the scarce research on the form of the curve itself, NHTSA should consider convening an expert elicitation to assist in optimizing the footprint curves in order to set maximum feasible standards that do not incentivize upsizing that negatively affects safety and undermines improvements in fuel economy.

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[228] *See, e.g.*, Kate S. Whitefoot & Steven J. Skerlos, *Design Incentives to Increase Vehicle Size Created from the U.S. Footprint-Based Fuel Economy Standards*, 41 ENERGY POL'Y 402, 410 (2012), https://doi.org/10.1016/j.enpol.2011.10.062.

[229] *Id.* at 410.

[230] Toluei (2015), *supra* note 212, at 269.

[231] *2020 Trends Report*, *supra* note 219, at 13–17 (discussing trends in fleet mix over time and noting that the market share of sedans has declined from 80% in 1975 to 33% in 2019, while SUVs have risen from less than 10% in 1975 to 49% in 2019).

[232] *Id.* at 24 ("In model year 1975, the difference between the heaviest and lightest vehicle types was about 215 pounds, or about 5% of the average new vehicle. By model year 2019, the difference between the heaviest and lightest vehicle types had increased to almost 1,600 pounds, or about 38% of the average new vehicle weight. Over that time, the weight of an average new sedan/wagon fell 13% while the weight of an average new pickup increased 27%.").

[233] Whitefoot & Skerlos (2012), *supra* note 228, at 409 ("Results indicate that if the slope of the function for passenger cars is reduced by a third and the slope of the function for light trucks is reduced by half, then the sales-weighted average footprint does not increase for this scenario of consumer preferences.").

IV. NHTSA Has Begun to Make Appropriate Changes to Its Modeling Approach; Further Adjustments in the Future Would More Fully Capture the Benefits of Strong Standards

In this rulemaking, NHTSA has chosen to rely on the same CCEMS model used by EPA and NHTSA to develop the SAFE 2 standards. Policy Integrity previously provided comments on the SAFE proposal and issued public reports on the final SAFE 2 Rule analyzing technical and economic flaws that cause this model to overestimate the costs and undervalue the benefits of strong standards.[234] While NHTSA has begun to make appropriate adjustments to address some of these flaws, Policy Integrity recommends NHTSA make further changes to its model for the final rule, to work closely with EPA to maintain consistency in analysis with the companion greenhouse gas emission standards where appropriate, and to continue to refine its model for future rulemakings. In general, the below suggestions would not change the direction of NHTSA's cost-benefit analysis (i.e., the proposal would continue to have net benefits), but rather could significantly increase the magnitude of estimated net benefits of these and future standards by more properly estimating the effects of stronger standards.

Policy Integrity provides the following comments to support NHTSA's proposed changes in input choices for the CCEMS model, as well as to encourage NHTSA to consider further changes for the final rule and in future rulemakings.

A. NHTSA Correctly Estimates a Smaller Rebound Effect than in SAFE 2, but Should Go Further

While EPA and NHTSA previous relied on a 10% rebound estimate in the Clean Car Standards issued in 2012, the agencies used a 20% rebound estimate in the final SAFE 2 Rule in 2020.[235] The agencies' departure from prior practice in the SAFE rulemaking was arbitrary and capricious, and EPA's return to 10% in their companion proposal[236] is more consistent with the best available evidence. NHTSA, on the other hand, has proposed lowering its estimate to only 15% and seeks comment on choosing a different value for the final rule.[237] Not only does a value of 15% introduce inconsistency between the two agencies' analysis, it is also overly conservative compared with the academic literature.

To arrive at the new estimate in the SAFE 2 Rule, the agencies in 2020 made significant changes to their assumptions about the magnitude of the rebound effect. These changes resulted in a significant increase in the costs and fatalities that the agencies attributed to the baseline standards.[238] Those fatalities and costs helped serve as the agencies' justification for the misguided 2020 rollback of those standards.[239] But the agencies' methodological changes in the 2018 SAFE proposal and 2020 final SAFE 2 Rule were inconsistent with the best available evidence regarding rebound.

Policy Integrity provided comments during the SAFE rulemaking demonstrating that EPA and NHTSA's selection of a 20% value for rebound effect was arbitrary and capricious because EPA and NHTSA failed

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[234] *See generally* Policy Integrity Oct. 2018 Comments, *supra* note 154; *Report Series: the Flawed Analysis Underlying the Rollback of the Clean Car Standards*, Inst. for Pol'y Integrity (Dec. 3, 2020), https://policyintegrity.org/projects/update/report-series-the-flawed-analysis-underlying-the-rollback-of-the-clean-car-standards.

[235] *Compare* 77 Fed. Reg. at 62,716, 62,924 (10%), *with* 85 Fed. Reg. at 24,676 (20%).

[236] 86 Fed. Reg. at 43,770.

[237] 86 Fed. Reg. at 49,715.

[238] SAFE 2 Final RIA, *supra* note 183, at 1803–04, 1807–08 tbls.VII-482, -484 (showing higher net benefits of roll back under agencies' new rebound assumptions ("Reference Case") than under previous rebound assumptions ("Rebound Effect at 10%")); *id.* at 1789–96 tbls.VII-478, -479 (same for fatalities).

[239] 85 Fed. Reg. at 25,038 (explaining that EPA and NHTSA considered increased emissions that resulted from additional driving due to the rebound effect); *id.* at 24,906 (explaining that EPA and NHTSA considered increased fatalities that resulted from additional driving due to the rebound effect).

to adequately explain their departure from a 10% rebound effect. [240] The agencies ignored studies that supported a lower rebound value, including studies relied upon by the agencies in the past and new studies published since the prior rulemaking.[241] Overall, the agencies failed to present sufficient evidence in 2020 to support abandoning their prior use of a 10% rebound effect.[242]

By lowering the value of rebound effect to 15% in the Proposed Rule, NHTSA has somewhat improved the accuracy of the CCEMS model for this rulemaking by using a value closer to that supported by an appropriate meta-analysis of the academic literature.[243] However, this value remains conservatively and unnecessarily high. As Policy Integrity has previously commented, the literature supports an even lower rebound effect.[244] NHTSA should further reduce its estimate for rebound to 10% in keeping with prior comments submitted by Policy Integrity. As NHTSA recognizes, even small changes in rebound can "influence[] overall costs and benefits associated with the regulatory alternatives under consideration as well as the estimate of lives saved under various regulatory alternatives," since a conservatively high rebound effect "diminishes the economic and environmental benefits associated with increased fuel efficiency."[245] And as shown in NHTSA's sensitivity analysis, using a 10% estimate for rebound increases the net benefits on a MY basis for the Preferred Alternative by $3.7 billion as compared to the reference case.[246]

In the SAFE rulemaking, the agencies calculated a simple average from the arbitrarily incomplete set of studies they considered—a flawed methodology that led to an improperly inflated rebound effect.[247] As Policy Integrity noted in previous comments, a meta-analysis focusing on closely matched studies—as EPA did in their companion proposal[248]—is a much more rigorous approach to evaluate results based on multiple studies.[249] In this rulemaking, NTHSA indicates it has focused on studies that "are derived from extremely robust and reliable data, employ identification strategies that are likely to prove effective at isolating the rebound effect, and apply rigorous estimation methods."[250] But NHTSA does not explain what identification strategies it looked for, or provide analysis explaining which studies it used to arrive at its estimate of 15%. For a more accurate evaluation of the available literature, NHTSA should go further and give preference to closely matched studies, especially those with the following characteristics: [251]

- Measures rebound due to changes in fuel efficiency, rather than proxy measures such as cost of driving or fuel price changes.[252]

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[240] Policy Integrity Oct. 2018 Comments, *supra* note 154, at 98–124.

[241] *Id.* at 101–05 & tbl.3.

[242] *Id.* at 105–09.

[243] *See id.* at 122–23 (reporting that a meta-analysis of economic literature based on closely matched studies arrives at consensus rebound effect of 10%).

[244] *See id.* at 98–124.

[245] 86 Fed. Reg. at 49,714.

[246] PRIA, *supra* note 4, at 227 tbl.7-2.

[247] *See* Policy Integrity Oct. 2018 Comments, *supra* note 154, at 110.

[248] EPA DRIA, *supra* note 84, at 3-12 to 3-15.

[249] *See* Policy Integrity Oct. 2018 Comments, *supra* note 154, at 119, 122–23.

[250] TSD, *supra* note 9, at 469.

[251] See Policy Integrity Oct. 2018 Comments, *supra* note 154, at 110–18, for more detailed descriptions of the most relevant literature.

[252] Changes in the cost of driving, and particularly changes in gasoline prices, are highly salient and so have more influence on consumer behavior than fuel efficiency changes. In addition, many of the recent studies that measure the change in cost of driving have been measures of consumer response to fuel price *increases*, but consumers tend to be more responsive to price

- U.S.-based national studies rather than studies of rebound in other countries or within single U.S. states.[253]
- Measures that best reflect the time period of the analysis (i.e., 2024-2050), including studies that use more recent data (i.e., measures conducted after the 2008 recession).[254]
- Studies using strong statistical methods and data.[255]

NHTSA does not explain why it has chosen a rebound value of 15% when its own analysis shows that a proper weighing of the most relevant estimates finds that "the rebound effect is likely in the range from 5-15 percent and is more likely to lie toward the lower end of that range."[256] As we move further from the 2008 recession, it becomes even more inappropriate to use a high estimate for rebound. The literature supports that the rebound effect declines with rising income because household demand for vehicle travel reaches saturation levels and the opportunity cost of spending time in a vehicle increases.[257] Since total U.S. GDP is expected to increase over the relevant time period, the rebound effect should decrease compared to previous estimates made when income was depressed. NHTSA should reconsider its use of a conservatively high value of rebound and use a value of 10% in the Final Rule as the literature supports, and as EPA does in its companion rulemaking.

B. NHTSA Should Not Rely on Aberrant Data to Predict Future VMT

National VMT saw a steep decline in 2020 due to the COVID-19 pandemic. NHTSA has chosen to model future VMT by inputting the 2020 shock as a datapoint for *2019* and then forecasting a "reasonable path for VMT growth relative to pandemic levels" and assuming that VMT will "eventually return[] to a growth trend similar to before the pandemic, but at a lower level of VMT."[258] However, this substitution overcomplicates NHTSA's modeling, introduces unnecessary uncertainty into its VMT predictions, and seems contrary to current evidence of a much faster VMT snapback.

Because 2020's sharp decline in VMT is an extreme outlier, it is not reasonable for the model to use past trends to predict a gradual recovery. Instead, we have already seen national VMT data approach 2019 peaks.[259] For example, New York City has already seen bridge and tunnel traffic increase to within 3% of 2019 peaks after dropping as low as 70% below 2019 levels during the pandemic.[260] And there is some

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increases than decreases and because fuel efficiency acts like a price *decrease*, studies that measure rebound based on price increases may overestimate fuel efficiency rebound. *See* Policy Integrity Oct. 2018 Comments, *supra* note 154, at 111–13.

[253] The United States differs substantially from other regions in terms of the price of gasoline, the density of the population, and income levels, each of which has been shown in various studies to affect the rebound effect. In addition, studies at the national scale are more relevant than studies of various states and subregions, as the latter only capture subsets of the relevant population. *See* Policy Integrity Oct. 2018 Comments, *supra* note 154, at 113–14.

[254] The relevant time period for estimating income growth and rebound is the period during which consumers will be using vehicles subject to the baseline standards, not earlier time periods (especially those with stagnant GDP). Policy Integrity Oct. 2018 Comments, *supra* note 154, at 105–09.

[255] *See id.* at 115–16 (explaining that the most relevant studies account for the fact that fuel economy is endogenous in order to disentangle to what extent VMT is rising because of fuel efficiency and to what extent it has risen due to changes in other factors).

[256] TSD, *supra* note 9, at 469.

[257] *See* Policy Integrity Oct. 2018 Comments, *supra* note 154, at 105–09.

[258] TSD, *supra* note 9, at 473.

[259] FHWA, *Traffic Volumes Trend: August 2021* (2021) , https://www.fhwa.dot.gov/policyinformation/travel_monitoring/21augtvt/21augtvt.pdf (showing current national VMT already greatly exceeding 2020 data and approaching 2019 levels).

[260] Port Auth. of N.Y. & N.J., *Port Authority Reports Facility Volumes for August 2021* (Sept. 28, 2021), https://www.panynj.gov/port-authority/en/press-room/press-release-archives/2021-press-releases/port-authority-reports-facility-volumes-for-august-2021.html (reporting that bridge and tunnel vehicular traffic in New York City area for August 2021

evidence that VMT may soon exceed pre-pandemic levels due to post-pandemic ride-switching away from public transportation systems that have seen a much slower recovery than vehicle traffic.[261]

NHTSA should treat the 2020 data as the short-term outlier that it is, and either remove it from the data set entirely or treat it as an indicator variable such that the model will not rely on it to predict future trends. NHTSA can revisit these assumptions when it sets future standards once the clear effect of the COVID-19 pandemic on VMT has been identified for the long-run.

V. NHTSA Should Work with EPA to Resolve Inconsistences Between the Agencies' Analyses

As discussed *infra*, there are some noticeable differences in the analyses between EPA and NHTSA.[262] For example, EPA uses a 10% estimate of rebound while NHTSA uses 15%.[263] And while both agencies used a sales elasticity of -1.0 in their Proposed Rules, EPA included a sensitivity analysis for -0.4 and took comment on whether to further reduce their estimate in the Final Rule.[264] In addition, the agencies take different approaches in their consideration of vehicle safety.[265]

While both agencies' analyses show their Proposed Rules are net beneficial, because their approaches are not identical, they could be misinterpreted in ways that could wrongly cast doubt on their cost-benefit analysis. To reduce legal risk, EPA and NHTSA should strive for analytical consistency as they finalize their regulations.

Consistent with judicial deference, EPA and NHTSA may be able to rationally justify reliance on different estimates for rebound, sales elasticity, and other technical and economic assumptions. However, such a strategy does not come without risk. Though deference to technical valuations is broad, a court may invalidate a regulation if a key analytical input is insufficiently explained or inconsistent with evidence and practice. Should EPA and NHTSA apply different estimates in their analyses, critics could point to such an alleged inconsistency in an attempt to misleadingly argue that their analyses are arbitrary. More problematically, critics could point to statements made by each agency to argue that the other agency's choices are irrational. To the extent that EPA and NHTSA can agree on more consistent presentations and discussions, it may help minimize the risk of such misinterpretations. NHTSA should especially be careful not to use any language that could be taken out of context to misleadingly criticize EPA's less conservative (but well supported) approach. Any assumptions that cannot be harmonized should be thoroughly justified in a way that does not cast doubt on the other agency's chosen approach.

VI. NHTSA Underestimates Upstream Emissions Reductions

To begin, many of the issues highlighted above—an unnecessarily high rebound estimate, an inappropriately high sales elasticity estimate—cause NHTSA's model to overestimate how rebound driving and assumed shifts to used vehicles may partly offset emissions reductions, and so leads NHTSA to underestimate the total upstream and downstream emissions reductions that can be achieved by

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was only 3% below pre-pandemic August 2019 levels); *see also* NYU Wagner Rudin Ctr. for Transp. & Sam Schwartz Eng'g, *Transportation During Coronavirus in New York City* 1 (2020), https://wagner.nyu.edu/files/faculty/publications/Full%20Report.pdf.

[261] *See, e.g.*, Port Auth. of N.Y. & N.J., *supra* note 260 (reporting that, in August 2020, PATH light rail ridership was down 62% from August 2019 compared to vehicular traffic down only 3%); N.Y. MTA, Day-by-Day Ridership Numbers, https://new.mta.info/coronavirus/ridership (last visited Oct. 21, 2021) (showing declines in weekday transit ridership of more than 40% compared to pre-pandemic trips).

[262] See also the Joint Comments on the Social Cost of Greenhouse Gases that Policy Integrity submitted with other groups to this docket.

[263] *See supra* section IV.A.

[264] *See supra* section II.A.

[265] *See supra* section III.A.

various regulatory alternatives. Correcting those methodological issues will produce more accurate estimates of emissions reductions and will show greater climate, environmental, and public health benefits.

Moreover, NHTSA may be wrongly ignoring a significant portion of upstream emissions, by counting only domestic emissions.

Though neither the preamble nor the preliminary regulatory impact analysis ("PRIA") are clear on this point, the draft technical support document ("TSD") includes a section that "provides the calculation methodology of these updated upstream emission factors (in g/mmBTU) for the following regulated criteria pollutants as well as greenhouse gases."[266] That section of the TSD specifies that the CAFE model makes "two upstream adjustments": one for the "Share of Fuel Savings Leading to Reduced Domestic Fuel Refining," and another for the "Share of Reduced Domestic Refining from Domestic Crude."[267] The section concludes that "the final CAFE aggregation applies a fuel savings adjustment to the Petroleum Refining process and a combined fuel savings and *reduced domestic refining adjustment to the pair of Petroleum Extraction and Petroleum Transportation processes* for . . . *each pollutant* in the full set of pollutants."[268] This strongly suggests that NHTSA may not be counting any emissions related to upstream fuel activities that occur abroad, including for greenhouse gas emissions emitted abroad.

The draft supplemental environmental impact statement (DSEIS) confirms that "NHTSA estimated *domestic upstream* emissions of CO2, criteria air pollutants, and toxic air pollutants. Upstream emissions considered in this SEIS include *those that occur within the United States* during the recovery, extraction, and transportation of crude petroleum, as well as during the refining, storage, and distribution of transportation of fuels."[269] Assuming this is an accurate description of how NHTSA calculated emissions not just for the DSEIS but for its main regulatory analysis as well, NHTSA is not counting carbon dioxide, methane, nitrous oxide, particulate matter, or any other pollutants emitted during the recovery, extraction, or transportation of crude petroleum overseas, or during the refining, storage, or distribution of transportation fuels that occurs overseas.

This omission could ignore a significant quantity of upstream emissions. According to the TSD, NHTSA is assuming that "50 percent of any reduction in U.S. gasoline consumption resulting from this proposal would lead to lower domestic refining activity,"[270] meaning that the other 50 percent would correspond with reduced imports of refined fuel.[271] And of the 50 percent affecting fuel refined domestically, NHTSA is assuming that 100% would relate to imported crude, with no effect on the U.S. production of crude oil.[272] In other words, for every reduction in domestic fuel consumption of 100 gallons resulting from the proposed regulation, U.S. imports of refined fuel would change by 50 gallons, and U.S. imports of crude oil for domestic refining would change by 50 gallons. If NHTSA is indeed counting only domestic upstream emissions, NHTSA may be ignoring 100% of upstream emissions from fuel extraction, 50% of

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[266] TSD, *supra* note 9, at 476.

[267] *Id.* at 482.

[268] *Id.* at 483 (emphasis added).

[269] NHTSA, *Draft Supplemental Environmental Impact Statement: Corporate Average Fuel Economy Standards Model Years 2024-2026*, at 2-17 (2021) (emphasis added); *see also id.* ("GREET's emissions factors are also used to estimate domestic emissions from transportation, storage, and distribution of motor fuels that are imported to the United States in refined form."); *id.* at 3-5 (observing "changes in aggregate domestic upstream emissions varying over time and among pollutants and regulatory alternatives").

[270] TSD, *supra* note 9, at 567.

[271] *See id.* at 562.

[272] *Compare id.* at 562 (explaining the previous 90%/10% assumption), *with id.* at 568 (explaining the new 100% assumption).

upstream emissions from refining, and some significant portion of upstream emissions from the distribution, transportation, and storage of crude or finished gasoline before it reaches U.S. shores.

Ignoring these significant upstream emissions just because they originate outside U.S. borders would be wrong for several reasons. First, the National Environmental Policy Act requires agencies to adopt a global perspective not just in their environmental impact statements,[273] but more broadly declares a national environmental policy and requires of all agencies that "to the fullest extent possible[,] the policies, regulations, and public laws of the United States *shall be interpreted and administered* in accordance with the policies set forth in this chapter,"[274] including the need to "recognize the worldwide and long-range character of environmental problems" and to "lend appropriate support" to help "maximize international cooperation."[275] In other words, especially because adopting a global perspective on climate damages will advance U.S. foreign policy goals,[276] NEPA requires NHTSA to interpret all of the laws it administers, including EPCA, in ways that recognize the worldwide character of environmental problems. Ignoring significant upstream foreign emissions in both the EIS and in its main analysis under EPCA would undermine this national policy.

Second, emissions that originate abroad can still have direct impacts on the United States. This is especially true of greenhouse gases, which are global pollutants that readily mix in the atmosphere and affect global climate. All greenhouse gases, regardless of their point of origin anywhere on the planet, will cause the same climate damages for the United States. Though criteria and toxic pollutants are usually thought of as local pollution, even some criteria and toxic pollutants emitted abroad can directly affect the United States. For example, in 2017, Canada supplied 43% of all crude imported into the United States, 45% of imported finished motor gasoline, and 30% of imported gasoline blending components; Mexico further supplied another 8% of crude imported into the United States.[277] EPA has in the past recognized that U.S. emissions of criteria and toxic pollution can affect health and welfare in our neighboring countries;[278] similarly, depending on the location of Canada and Mexico's fuel

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[273] 42 U.S.C. § 4332(2)(F).

[274] *Id.* § 4332(1) (emphasis added).

[275] *Id*. § 4332(2)(F); *see also EDF v. Massey*, 986 F.2d 528, 536 (D.C. Cir. 1993) ("Section 102(2)(F) further supports the conclusion that Congress, when enacting NEPA, was concerned with worldwide as well as domestic problems facing the environment. . . . Compliance with one of the subsections can hardly be construed to relieve the agency from its duty to fulfill the obligations articulated in other subsections."); *NRDC v. NRC*, 647 F.2d 1345, 1387 (D.C. Cir. 1981) (J. Robinson, concurring; J. Wilkey wrote for the court, but there was no majority opinion) (concluding that, even if a conflict with another statute prevents the agency from conducting an environmental impact statement, that "does not imply that NRC may ignore its other NEPA obligations," including the "provision for multinational cooperation" and the "policy of the United States with respect to the ecological well-being of this planet"; rather, the agency "should remain cognizant of this responsibility"); *Greene Cnty. Planning Bd. v. Fed. Power Comm'n*, 455 F.2d 412, 424 (2d Cir. 1972) ("The Commission's 'hands-off' attitude is even more startling in view of the explicit requirement in NEPA that the Commission 'recognize the worldwide and long-range character of environmental problems' and interpret its mandate under the Federal Power Act in accordance with the policies set forth in NEPA.").

[276] See the Joint Comments on the Social Cost of Greenhouse Gases that Policy Integrity and other groups submitted separately to this docket.

[277] In 2017, the United States imported from all countries 2.9 billion barrels of crude, 11 million barrels of finished motor gasoline, and 220 million barrels of motor gasoline blending components. Of that, Canada supplied 1.25 billion barrels of crude (43%), 5 million barrels of finished motor gasoline (45%), and 66 million barrels of motor gasoline blending components (30%). Mexico supplied 222 million barrels of crude (8%) and 1.5 million barrels of blending components (<1%). EIA, *Petroleum & Other Liquids*, https://www.eia.gov/dnav/pet/pet_move_impcus_d_nus_Z00_mbbl_a.htm.

[278] In the analysis of the Cross-State Air Pollution Rule, EPA noted— though could not quantify—the "substantial health and environmental benefits that are likely to occur for Canadians" as U.S. states reduce their emissions of particulate matter and ozone—pollutants that can drift long distances across geographic borders. Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone, 75 Fed. Reg. 45,210, 45,351 (Aug. 2, 2010). Similarly, in the Mercury and Air

production and distribution facilities and on prevailing winds, their emissions can affect health and welfare in the United States. None of these upstream emissions—and especially the global greenhouse gas pollutants—should be completely ignored.

Third, as detailed further in comments submitted separately to this docket by Policy Integrity and other groups on the social cost of greenhouse gases, through international spillover effects, foreign reciprocity, the extraterritorial interest of the U.S. government and its citizens, and altruism, worldwide climate effects also affect U.S. welfare and matter to U.S. decisionmakers and the public.

To the extent the proposed rule, PRIA, and draft EIS undercount significant emissions, the final rule, final RIA, and final EIS should correct those underestimates.

VII. After Considering a Lower Discount Rate and Recalculating Costs and Benefits, NHTSA Should Select the Alternative to Increase Net Social Welfare and Achieve Distributional Goals

The Energy Policy and Conservation Act (EPCA) requires NHTSA to set fuel economy standards at the "maximum feasible" level that manufacturers can achieve in that model year, while considering technological feasibility, economic practicability, the effect of other motor vehicle standards, and the need to conserve energy.[279] By refocusing on statutory factors and setting more stringent standards in this Proposed Rule, NHTSA is properly exercising its authority to set maximum feasible standards. In addition, the executive order that instructed NHTSA to revise the SAFE 2 Rule reminded agencies to simultaneously advance the interests of public health, the environment, justice, workers, and communities.[280] A related presidential memorandum, issued the same day, reaffirmed the principles of Executive Orders 12,866 and 13,563[281]—including that agencies should select regulatory alternatives that "maximize net benefits" while also accounting for distributive impacts and equity.[282] NHTSA should follow these principles in setting its vehicle standards.

Unlike the net costly SAFE 2 Rule, which would increase emissions and jeopardize public welfare, NHTSA's Proposed Rule will reduce emissions and increase net social welfare and so is justifiable. Recalculating the costs and benefits of the various alternatives based on the recommendations above will also likely increase the net benefits of both Alternatives 2 and 3, as will any updates to the valuation of the social cost of greenhouse gases. A net beneficial analysis is a strong predictor of "economic practicability." However, it is not the only consideration. In addition to the quantified benefits reflected in NHTSA's analysis, there are other unquantified and distributive effects that NHTSA should take into consideration as part of a full evaluation of the impacts of its Proposed Rule. To the extent the net benefits of Alternatives 2 or 3 may appear low, NHTSA should consider, for example, the many significant unquantified climate effects not currently included in the estimates of the social cost of greenhouse gases.

Toxics Standards, EPA concluded that a reduction of mercury emissions from U.S. power plants would generate health benefits for foreign consumers of fish, both from U.S. exports and from fish sourced in foreign countries. EPA did not quantify these foreign health benefits, however, due to complexities in the scientific modeling. EPA, *Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards* 65 (2011) ("Reductions in domestic fish tissue concentrations can also impact the health of foreign consumers . . . [and] reductions in U.S. power plant emissions will result in a lowering of the global burden of elemental mercury.").

[279] 49 U.S.C. § 32902(a), (f).

[280] Exec. Order 13,990 §§ 1, 2(a)(ii), 86 Fed. Reg. 7037, 7037 (signed Jan. 20, 2021; published Jan. 25, 2021).

[281] Memorandum on Modernizing Regulatory Review, 86 Fed. Reg. 7223, 7223 (signed Jan. 20, 2021; published Jan. 26, 2021).

[282] Exec. Order 12,866 § 1(a), 58 Fed. Reg. 51,735, 51,735 (Oct. 4, 1993).

In addition, NHTSA should give more weight to its cost-benefit analysis in terms of Calendar Year 2021-2050, which presents a more realistic estimate of longer-term impacts compared to the Model Year perspective. Consideration of long-term impacts is especially important when considering greenhouse gas emissions given the long time horizons of climate change and the welfare of future generations. Currently, NHTSA's analysis shows that Alternative 3 has higher net benefits when calculated over a Calendar Year perspective, but Alternative 2 has higher net benefits than Alternative 3 does when calculated over a Model Year perspective.[283] NHTSA should implement the methodology changes suggested above to ensure its analysis more accurately calculates the net benefits of strong standards and the incremental costs and benefits across alternatives. A more accurate cost-benefit analysis may result in different incremental analysis between NHTSA's preferred Alternative 2 and the more stringent Alternative 3.

In its current analysis of the costs and benefits across Model Years 1981-2029, NHTSA finds that the sign of its cost-benefit calculation changes for some alternatives depending on the discount rate selected.[284] According to guidance on regulatory analysis, this is a clear indication that the discount rate is a "critical parameter value," and so calls for further sensitivity analysis around the appropriate discount rate.[285] The 3% and 7% discount rates are "default" values that the Office of Management and Budget proposed in guidance published in 2003 based on data going back to 1973.[286] The 7% capital-based value was intended for use when regulatory effects may tend to displace private investment; by comparison, the 3% consumption-based value was estimated to be the "appropriate" rate "[w]hen regulation primarily and directly affects private consumption (e.g., through higher consumer prices for goods and services)."[287] As NHTSA already begins to explore, because its model assumes full passthrough of costs to consumers, essentially all of its costs and benefits—fuel savings, vehicle price, climate effects, energy security, public health effect, rebound-related benefits and costs—will fall either to the consumers of vehicles or to society as a whole.[288] As such, a consumption-based discount rate is the more appropriate value.[289] To the extent NHTSA calculates costs and benefits based on a 7% capital-based rate, it should be considered as a lower-bound, very conservative sensitivity analysis, in case unexpectedly practically *all* costs were borne directly by manufacturers and affected their private investments, rather than being passed along to consumers. Therefore, NHTSA should focus on its cost-benefit analyses conducted using consumption-based discount rates.

Moreover, since the 3% consumption-based estimate was calculated in 2003, market conditions have changed considerably. Based on more updated market data alone, a discount rate of 2% or lower would be a more appropriate estimate of a consumption-based rate.[290] Consequently, NHTSA should also conduct a sensitivity analysis discounting all its costs and benefits at a 2% rate. The selection of a

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[283] 86 Fed. Reg. at 49,607.

[284] *See* 86 Fed. Reg. at 49,607 tbl.I-3.

[285] OMB, *supra* note 109, at 41.

[286] *Id.* at 33.

[287] *Id.*

[288] PRIA, *supra* note 4, at 97.

[289] OMB, *supra* note 109, at 33; *see also* Peter Howard & Jason A. Schwartz, Inst. for Pol'y Integrity, *About Time: Recalibrating the Discount Rate for the Social Cost of Greenhouse Gases* 6–7 (2021), https://policyintegrity.org/files/publications/About_Time.pdf (explaining why capital-based rates are inappropriate for many policy contexts).

[290] Howard & Schwartz, *supra* note 289, at 8–10; Council of Econ. Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* 4–7, 12 (2017).

different discount rate, more consistent with updated data, may also change the relative ranking of Alternative 2 as compared to Alternative 3.

NHTSA should similarly analyze the relative distributional effects of the more stringent Alternative 3 as compared to NHTSA's Preferred Alternative 2.[291] NHTSA should consider the economic effects to lower-income households as well as the environmental justice effects from changes to criteria and toxic pollution, and the environmental justice gains associated with the increased climate benefits from more stringent alternatives.[292]

After comparing Alternatives 2 and 3 based on an updated cost-benefit analysis and factoring in unquantified effects and distributional effects, NHTSA should also consider whether a different alternative may be more appropriate. For example, NHTSA raises the possibility of combining an Alternative 2-based standard for MY2024 with Alternative 3-based standards for MY2025 and MY2026.[293] NHTSA should consider whether some level of increased stringency above Alternative 2 will better advance its statutory purposes of maximizing fuel economy considering the environmental, health, and security needs of the United States to conserve energy.

Respectfully,

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[291] *See* Jack Lienke et al., Inst. for Pol'y Integrity, *Making Regulations Fair: How Cost-Benefit Analysis Can Promote Equity and Advance Environmental Justice* (2021), https://policyintegrity.org/files/publications/Making_Regulations_Fair_2021.08.31.pdf (for guidance on integrating such an analysis).

[292] *See* Iliana Paul et al., Inst. for Pol'y Integrity, *Improving Environmental Justice Analysis: Executive Order 12,898 and Climate Change* (Policy Integrity Report 2021), https://policyintegrity.org/publications/detail/improving-environmental-justice-analysis (on the distributional effects of climate change).

[293] 86 Fed. Reg. at 49,756.

Attachments

1.	Inst. for Pol'y Integrity, Comments on The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks (Oct. 26, 2018)
2.	Brief for Inst. for Pol'y Integrity as Amicus Curiae, *Competitive Enter. Inst. v. Nat'l Highway Traffic Safety Admin.*, No. 20-1145 (D.C. Cir. Jan. 21, 2021)
3.	Sylwia Bialek & Max Sarinsky, *Overinflated: The SAFE Rule's Overstated Estimates of Vehicle-Price Impacts* (2020)
4.	Peter Howard & Max Sarinsky, *Turbocharged: How One Revision in the SAFE Rule Economic Analysis Obscures Billions of Dollars in Social Harms* (2020)
5.	Bethany A. Davis Noll, et al., *Shortchanged: How the Trump Administration's Rollback of the Clean Car Standards Deprives Consumers of Fuel Savings* (2020)
6.	Rachel Rothschild & Jason A. Schwartz, Inst. for Pol'y Integrity, *Tune Up: Fixing Market Failures to Cut Fuel Costs and Pollution from Cars and Trucks* (2021)

Appendix: Table 1. Estimates of Vehicle Price Elasticity[294]

Author(s)	Year	Time Period	Short-Run	Long-Run
McAlinden et al. (2016) – cited in SAFE Rule				
Atkinson	1952	1925-1940	-1.33	-
Nerlove	1957	1922-1941; 1948-1953	-0.9	-1.2
Suits	1958	1929-1941; 1949-1956	-	-0.57
Chow	1960	1921-1953	-	-0.7
Suits	1961	1929-1941; 1949-1956	-	-0.675
Hymans, Ackley, and Juster	1970	1954-1968	-1.14	-0.46
Hess	1977	1952-1972	-1.63	-
Trandel	1991	1983-1985	-1.43	-
Levinsohn	1988	1983-1985	-0.82	-
McCarthy	1996	1989	-0.87	
Bordley	1993	Assumed	-1	
Fischer, Harrington, and Parry	2007	Not indicated	-1	-0.36
Irvine (1983) – basis for estimate in Kleit (1990), which was cited in SAFE Rule				
Dyckman	1975	1929-1962	-1.45	
Hamburger	1967	1954-1964	-1.17	
Evans	1969	1948-1964	-3.1	-1.5
Hymans	1970	1954-1968	-1.07	-0.36
Rippe and Feldman	1976	1958-1973	-1.14	-0.6
Carlson	1978	1965-1975	-1.1	
Additional Estimates in the Record – cited by agencies in SAFE Rule or prior rulemakings				
Goldberg	1998	1984-1990	-0.9	
Juster and Wachtel	1972	1949-1967	-0.7	
Lave and Train	1979	1976	-0.8	
McAlinden et al.	2015	1953-2013	-0.79	-0.61

[294] *Turbocharged*, *supra* note 181, at 7–8 (adapted from Petition for Reconsideration, *supra* note 180, at 43–45, with changes made consistent with James H. Stock et al., Comments to EPA & NHTSA on SAFE 2 Rule, Oct. 28, 2018; C. Fischer et al., *Should Automobile Fuel Economy Standards be Tightened?*, 28 ENERGY J. 1-29 (2007); and Benjamin Leard, *Estimating Consumer Substitution Between New and Used Passenger Vehicles* (RFF Working Paper 19-01, Aug. 2021), https://media.rff.org/documents/WP_19-01_rev_2021.pdf).

Table 1, cont.

Author(s)	Year	Time Period	Short-Run	Long-Run
Recent Estimates – not cited by agencies in SAFE Rule or prior rulemakings				
Berry et al.	2004	1993		-1
Stock et al.	2018	1967-2016		-0.06
Leard	2021	2013		-0.34
Bento et al.	2020	Not indicated		-0.13
Dou and Linn	2020	1996 to 2016	-1.5	
Averages				
Mean			-1.2	-0.6
Median			-1.1	-0.6
Averages of Recent Estimates				
Mean published since 1980			-1.0	-0.4
Median published since 1980			-1.0	-0.4
Mean published since 2000			-1.1	-0.4
Median published since 2000			-1.0	-0.4
Mean published since 2010			-	-0.3
Median published since 2010			-	-0.2
Averages Without Inconsistent Estimates[295]				
Mean			-1.1	-0.4
Median			-1.1	-0.5
Mean: Published since 2000			-1.1	-0.3
Median: Published since 2000			-1.0	-0.3

[295] This presentation of averages tests the sensitivity of the results to removing several estimates that may be inconsistent with current evidence and theory. Specifically, for this run, we remove: Nerlove (1957), because the long-run elasticity reported was higher than the short-run elasticity, which is inconsistent with current understanding of vehicles as comparatively inelastic; Evans (1969), because the long-run estimate is an extreme outlier suggesting that cars are elastic, contrary to current understandings; and Berry et al. (2004), because its elasticity value is assumed, not derived, *see also* Leard (2021) (on the inconsistencies with Berry et al.).