Shortchanged

How the Trump Administration's Rollback of the Clean Car Standards Deprives Consumers of Fuel Savings

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Executive Summary

On April 30, 2020, the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) published the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule,[1] drastically rolling back the 2012 rule known as the Clean Car Standards.[2]

The Clean Car Standards were designed to save consumers hundreds of billions of dollars at the pump and significantly reduce greenhouse gas emissions from passenger vehicles by imposing average annual emissions cuts and fuel efficiency improvements, at a rate expected to increase efficiency by nearly 5% each year until reaching a fleetwide average of around 50 miles per gallon by 2025.[3]

The SAFE Rule, by contrast, will cause significant increases in emissions and fuel costs relative to the Clean Car Standards. The agencies admit that—even according to the most favorable numbers they can muster—their own cost-benefit analysis shows that the rollback is costly for society, resulting in $13.1–$22 *billion in net costs* when calculated at a 3% discount rate.[4] While the agencies claim that, under an alternative 7% discount rate, their rollback would instead show a few billion in gains,[5] at best the agencies admit that the rule's main cost-benefit analysis barely "straddle[s] zero."[6] And that is before considering the host of analytical flaws and omissions that still plague the agencies' main analysis, such as the tens of billions of dollars in climate costs that the agencies arbitrarily omit.[7] According to the agencies' own analysis, under the SAFE Rule, consumers will spend an additional $1,110 to $1,461 on gasoline over the life of the vehicle, depending on the discount rate used.[8] And the agencies admit that rolling back the Clean Car Standards will result in nearly a billion additional metric tons of carbon dioxide released into the atmosphere.[9]

The agencies landed on this analysis after their 2018 proposal to flatline the standards was roundly criticized, by public comments,[10] NHTSA's own peer review of the models,[11] EPA's Science Advisory Board,[12] and public articles.[13] That proposal showed net benefits for the rollback,[14] but to do so it relied heavily on spurious claims that a rollback would reduce car prices and then somehow—against the principles of basic economics—reduce the number of total cars on the road, thus yielding the alleged safety benefit of having fewer total vehicle-miles traveled overall.[15] In light of the harsh and valid critiques, the agencies could no longer rely on those inaccurate safety benefits calculated in their proposal.

Now, in the face of a cost-benefit analysis that at best "straddle[s] zero," the agencies struggle to find a justification for the SAFE Rule. At several points in the final rule, the agencies embrace a new economic analysis that focuses on upfront costs to manufacturers and consumers and claims that the Clean Car Standards' upfront costs were "too high."[16] But agencies are required to assess regulatory impacts from the perspective of society and are not permitted to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards."[17] And from the societal perspective, the agencies' own analysis shows that the Clean Car Standards' upfront costs were not "too high" when compared against long-term net benefits to consumers and the environment.

Buried in the thousands of pages that the agencies have published to justify the SAFE Rule is a "sensitivity case" that assumes that increased fuel economy must come at the expense of other vehicle features that consumers value, such as horsepower, and that the supposed "opportunity cost" of these lost features can be approximated by arbitrarily subtracting away a substantial portion of the valuable fuel savings that the Clean Car Standards would have delivered.[18] Though

they explicitly do not adopt that sensitivity case, the agencies connect these "opportunity costs" to the "upfront costs" they prefer to focus on and also claim that, for consumers, these opportunity costs must offset the fuel saving benefits they would receive from increased vehicle efficiency.[19]

Only by selectively focusing on these hypothesized "opportunity costs" and artificially undercounting the lost fuel savings does the rollback begin to appear net beneficial.[20] Yet using a theory of opportunity costs to devalue fuel savings would represent a severely flawed and completely unjustified departure from how EPA and NHTSA have historically calculated the benefits of regulations that save fuel—and from how other agencies, such as the Department of Energy (DOE) and the Department of Interior, have calculated the benefits of energy savings—over the last four decades under administrations of both political parties.

Agencies have consistently used the full net present value of lifetime fuel savings to calculate the benefits of vehicle regulations, because doing so follows economic best practices and guidance for agency cost-benefit analysis. Due to market failures, consumers' vehicle purchasing decisions may not take into account the full economic value of the future fuel savings they will experience over time—a phenomenon that economists have termed the "energy efficiency gap." But avoided fuel consumption represents real resource savings to the economy regardless of what consumers expected at the time of purchase. And, once those savings appear in their pocketbooks, consumers will fully value and use that money—a dollar is a dollar, whether or not consumers fully expected or valued it when they were deciding which car to buy. It is precisely because market failures create a divergence between consumers' *ex ante* valuation of potential fuel savings and their *ex post* realization of actual fuel savings that well-designed regulations to increase fuel efficiency will provide benefits to consumers and increase net public welfare. Weakening the standards will force society and consumers to forgo the full amount of those benefits, not merely a fraction of the benefits.

In the final rule, the agencies ultimately decline to take a clear position on the "energy efficiency gap" and calculate the full fuel savings in their main cost-benefit analysis.[21] Yet they repeatedly use the theory of opportunity costs to cast doubt on market failures, and they try to support their rollback by undermining the full valuation of the fuel savings from the Clean Car Standards. The agencies assert that the economic welfare from saving money at the pump might be offset because they incorrectly allege that the Clean Car Standards prevent consumers from buying vehicles with other features that they also value—features like horsepower, acceleration, or towing capacity. But that reasoning has never before been used in an energy saving regulation issued by NHTSA, EPA, or DOE. And for good reason: it has no sound basis.

First, the agencies' novel explanation for the energy efficiency gap—that it might largely reflect a tradeoff with other vehicle features, like horsepower or acceleration, that consumers value more than energy savings—assumes away the existence of the market failures that cause consumers to miss out on fuel savings. But the economics research is clear that market failures play a substantial role in consumers' failure to purchase vehicles with optimal levels of fuel economy. This rollback will cause consumers to lose out on valuable fuel efficiency improvements that they would have benefited from but may not have purchased on their own. The only way to reasonably to assess the Final Rule is to fully account for those losses.

Second, the agencies have not justified an assumption that requiring fuel economy improvements will necessarily lead manufacturers to reduce vehicle features to the detriment of consumers. Consumers remain free to demand—and automakers remain free to provide—whatever vehicle features consumers value, and the cost of additional features like acceleration would be reflected in the vehicle prices. Further, the wide availability of vehicle financing means that the

cost of fuel economy improvements can be "paid for" out of the savings consumers save at the pump, and therefore consumers can save money from fuel economy improvements from the moment they purchase a vehicle. Nothing about the standards changes this reality. In fact, recent research suggests that fuel economy improvements may result in technology development that will also either automatically or cheaply provide other features that consumers value.

Third, an assumption that the Clean Car Standards would force consumers to give up vehicle features is plainly inconsistent with the agencies' evaluation of the cost of complying with the Clean Car Standards. The agencies analyze the costs of the vehicle standards by comparing the price of vehicles under the standards against the cost of identical vehicles without the fuel economy or emission improvements. The cost estimates assume that key vehicle features other than fuel economy will be unaffected by the standards. The agencies cannot both rely on a cost analysis that assumes the vehicle fleet will be identical except for the change in fuel economy, while at the same time arguing that the vehicle fleet will be different and that the difference will cause consumers to experience a welfare loss. If the agencies want to assume that manufacturers will trade off other vehicle features to achieve fuel economy, then the agencies would have to significantly lower their estimates of compliance costs for the Clean Car Standards, as well as model how much manufacturers would charge to install those other vehicle features—all of which would ultimately show that their rollback will not achieve the cost savings they attribute to it.

Fourth, the literature that the agencies cite to support the theory of opportunity costs is sparse and does not provide sufficient justification for any radical departures from past regulatory approaches. The agencies have also ignored contrary evidence, including studies commissioned by EPA that have found that increased fuel economy is not associated with negative evaluations of vehicle performance or other attributes.

Finally, it is not even clear that consumers would benefit, on net, if other attributes like acceleration continued to increase indefinitely across the entire fleet, because consumers may value only their own vehicle's *relative* acceleration as compared to the rest of the fleet, and do not necessarily benefit from an absolute increase in fleetwide acceleration. In fact, increasing the overall level of acceleration among new vehicles likely would increase the seriousness of accidents—a cost that would have to be taken into account along with any alleged benefits of increasing vehicle features. As the agencies' discussion of opportunity costs does not address these issues, it is incomplete and misleading.

While this report focuses on how the agencies' theory of opportunity costs fails to accurately consider the value of the fuel that would have been saved with more efficient vehicles, it is important to recognize that this is only one of many analytical errors that the agencies have made. For example, the agencies have also drastically undercounted the climate change damages from weakening greenhouse gas emission requirements.[22] The agencies used flawed models that overestimate the cost of technology needed to improve fuel economy and have failed to properly account for flexibility mechanisms that reduce compliance costs.[23] And the agencies continue to claim the Clean Car Standards would impose safety costs that are not supported by credible modeling.[24]

Put together, these and other serious errors lead the agencies to the demonstrably wrong conclusion—that rolling back the Clean Car Standards can be justified by focusing on upfront vehicle price effects while ignoring longer term losses to fuel savings and the environment. Correcting these errors would show that the agencies have taken an action that will cause much more harm than good to the pocketbooks and health of American consumers and that, overall, will leave America seriously shortchanged.

I. Background on Regulation of Vehicle Emissions and Fuel Economy

Under the Clean Air Act, EPA sets limits on the air pollution—including greenhouse gases—emitted by new cars and light trucks ("light-duty vehicles") sold in the United States.[25] Under the Energy Policy and Conservation Act ("EPCA"), NHTSA establishes Corporate Average Fuel Economy ("CAFE") Standards for light-duty vehicles to regulate fuel consumption.[26] Since 2010, EPA and NHTSA have implemented a coordinated regulatory program that establishes harmonized greenhouse gas and fuel economy standards under the two statutes.[27]

A. Vehicle Emissions Standards and Fuel Economy Standards Deliver Important Consumer Savings and Other Benefits

Government regulation is most typically justified to correct a "market failure": an inefficient outcome in which the market, left to itself, fails to allocate goods in the way that will maximize net social welfare. A classic market failure is pollution. For example, drivers do not fully consider how their vehicle choices and driving decisions affect the rest of society by emitting pollution from the production and combustion of gasoline. Without regulation, drivers can "externalize" those pollution costs onto society and so choose vehicles that emit an inefficient amount of pollution. Regulations, like vehicle emissions standards and fuel economy standards, can correct this market failure by addressing the pollution externality and efficiently requiring consumers to "internalize" their pollution costs by purchasing vehicles with technologies to reduce the combustion of gasoline per mile. If the total benefits of the regulation (such as the health and environmental benefits of reducing pollution) outweigh the regulatory costs (such as an increase in vehicle prices), then the regulation is cost-benefit justified and efficient.

Besides the social benefits of decreasing pollution and improving energy security by reducing the consumption of gasoline,[28] vehicle emissions standards and fuel economy standards also deliver private benefits for consumers. Energy efficiency standards produce benefits by enabling consumers to receive a given level of services at lower operating costs. In the case of automobile fuel economy, consumers receive a given level of transportation services (vehicle-miles traveled) while spending less on fuel. Not only do more efficient vehicles require less gasoline per mile driven—meaning that consumers pay less for each mile they have to drive—but consumers also can drive farther on each gallon of gas and stop less often to refuel.[29]

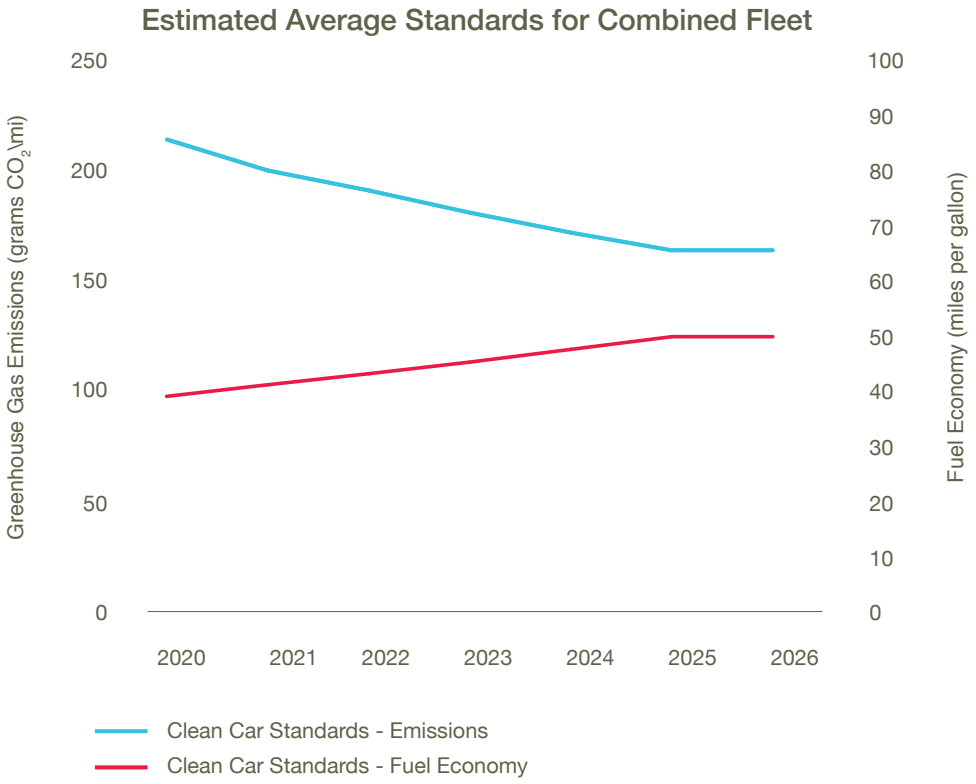
While perfectly informed and fully rational consumers could, in theory, achieve these benefits for themselves under optimal market conditions simply by purchasing more efficient vehicles, as the economics literature has explored in detail, real-world consumers often make upfront vehicle purchasing decisions that fail to fully account for future fuel savings.[30] Fuel efficiency technologies save consumers and society money over the life of a vehicle, but those technologies also may increase the initial purchase price of a vehicle. Economic theory predicts that a rational consumer will choose to buy a vehicle with greater fuel efficiency as long as the marginal cost of the upfront purchase price is at least slightly less than the expected marginal benefit of fuel savings (that is, the net present value of the fuel saved).[31] However, in practice, consumers do not always behave consistently with standard economic theory.[32] Real consumers may not always be willing to pay $1 more when purchasing a vehicle today in exchange for an expected savings in future fuel costs that would be worth today just over $1. Instead consumers may demand much more than $1 in net present expected fuel savings before

they are willing to pay $1 upfront to purchase a more efficient vehicle. Another way of expressing the same phenomenon is by measuring the implicit rate at which consumers discount future fuel savings when purchasing vehicles. In practice, consumers appear to use irrationally high discount rates—that is, they treat future fuel savings as worth very little today.[33] In the economics literature, this observed fact is termed the "energy paradox" or "energy efficiency gap."[34]

A suite of market failures collectively explains the energy efficiency gap: for example, consumers face informational costs to acquire and act on fuel-economy data; consumers experience "loss aversion" and so irrationally inflate the cost of an upfront expense over the benefits of long-term savings; manufacturers confront a first-mover disincentive that discourages being the first to experiment with new fuel-economy technologies; and so forth. Section IV below explores the details and empirical support for these market failures more thoroughly. But the general existence of these market failures explains why consumers are not, in fact, able to demand the optimal amount of fuel economy in the unregulated marketplace. Regulations that address these market failures, therefore, achieve not just social benefits but private benefits for consumers as well. Both EPA and NHTSA had long recognized and acted on such market failures (*see infra* Section V), and in 2012 they reaffirmed the need to address these market failures through efficient regulation.

B. In 2012, the Agencies Established Emissions and Fuel Economy Standards—and in 2016-2017, They Reaffirmed Those Standards

In 2012, EPA and NHTSA jointly issued the Clean Car Standards, harmonizing greenhouse gas emissions and fuel economy standards for light-duty vehicles in model years 2017 through 2021.[35] In the 2012 rulemaking, EPA also promulgated emission standards for model years 2022 through 2025. Due to limitations in NHTSA's statutory authority,[36] the fuel economy standards set in 2012 could not yet extend through model year 2025. Rather, NHTSA identified fuel economy standards for model years 2022 through 2025 that represented its best estimate of what the maximum feasible fuel economy standards would be for those model years.[37]



The Clean Car Standards were expected to result in an increase in fuel economy and a decrease in greenhouse gas emission rates of, on average, approximately 5 percent per year.[38] The standards were supported by extensive technical and economic analyses.[39] EPA and NHTSA conducted a rigorous cost-benefit analysis that showed the Clean Car Standards would result in over $450 billion in net benefits, with any increase in consumer costs significantly outweighed by fuel savings, greenhouse gas emission reductions, and other benefits.[40]

As part of the 2012 joint rulemaking, NHTSA made a commitment to evaluate the appropriateness of model year 2022–2025 standards by 2018 and to promulgate standards for those model year vehicles based on that evaluation.[41] In the same rulemaking, EPA also made a commitment to reassess the appropriateness of the standards for model years 2022–2025 by 2018.[42] As a result, from 2015 to 2017, the agencies conducted a "Midterm Evaluation" of the model year 2022–2025 standards, including extensive analysis undertaken in coordination with the California Air Resources Board (CARB). This analysis, as described in a 1200-page Draft Technical Assessment Report (TAR), confirmed that the Clean Car Standards would result in substantial net benefits.[43] In particular, the TAR, the Technical Support Document (TSD) for EPA's Proposed Determination to reaffirm the standards, and the exhaustive response to public comments received during the Midterm Evaluation all confirmed that consumers would experience substantial fuel savings from the standards, that those fuel savings should be fully counted as the private benefits of correcting ongoing market failures, and that there was no evidence that consumers would experience negative tradeoffs between fuel economy and vehicle performance under the standards.[44] The agencies' analyses drew heavily on a National Research Council report, which reached similar conclusions about technological feasibility and the costs and benefits of the Clean Car Standards.[45] In January 2017, EPA issued a Final Determination that the Clean Car Standards remained appropriate and would result in substantial improvements in economic welfare, based in part on the conclusion that improvements in technology would allow the standards to be reached at significantly lower cost than originally projected.[46] In fact, EPA's Administrator found that the record supported further increasing the stringency of the standards, but she declined to do so, citing the value of regulatory certainty.[47]

C. In 2018, EPA and NHTSA Proposed to Weaken the Clean Car Standards

Notwithstanding the extensive analyses from the National Research Council and the Midterm Evaluation, in April 2018, EPA withdrew its 2017 Final Determination and issued a new conclusion that the Clean Car Standards were "not appropriate."[48] EPA announced it would consider revising the greenhouse gas emission standards in coordination with NHTSA.[49]

In August 2018, EPA and NHTSA issued a proposal to freeze both fuel economy and greenhouse gas emission standards at their model year 2020 levels and apply those frozen standards at least through model year 2026.[50] The agencies made a number of unsupportable changes to the analytical approach they had taken when promulgating the Clean Car Standards and during their Midterm Evaluation of those standards. Based on these unsound changes to their analysis, the agencies found in 2018 that, contrary to all prior analyses, the Clean Car Standards would instead impose high consumer costs and safety costs while achieving only limited environmental benefits.

Most prominently, the agencies claimed that the Clean Car Standards would impose substantial safety costs because they would cause an increase in driving. Specifically, the agencies' deeply flawed economic modeling predicted that consumers would retain their used cars for longer than they otherwise would have, which would lead, in turn, to both a massive increase in the total number of cars on the road as well as an increase in total vehicle-miles traveled.[51] And because more cars and vehicle-miles traveled translates into more traffic accidents, the increase in vehicle-miles traveled meant that the agencies could claim that the Clean Car Standards would lead to a substantial increase in fatalities.

But while economic theory might support the idea that new vehicle price increases could change the *distribution* of new and used vehicles, economic theory provides no support for the idea that a shift from new to used vehicles will cause an increase in the *total number* of vehicles on the road.[52] In fact, if the Clean Car Standards were to increase the price of both new and used vehicles, and that increase exceeded consumers' valuation of future fuel savings, standard economic theory would predict a *reduction* in the number of vehicles. As the price of all vehicles goes up, consumers would be expected to reduce vehicle purchases, such as by forgoing buying a used car for their teen or shifting to alternative modes of transportation.

Nor does the academic literature or standard economic theory support the proposed rollback's assumption that with more vehicles on the road, total vehicle-miles traveled would increase irrespective of demand for driving. Again, if anything, an increase in the purchase price of both new and used vehicles would, all other things equal, likely cause aggregate vehicle-miles traveled to decrease.[53] This is because if vehicle purchasers faced higher vehicle purchase prices, they would have less money to spend on other things, including on fuel for driving.[54]

These conceptual errors, as well as myriad methodological problems with the specific models the agencies developed,[55] led the very experts whose work formed the basis of the agencies' proposed safety conclusions to roundly criticize those conclusions.[56] The press reported that the agencies had "flunked [their] math homework."[57]

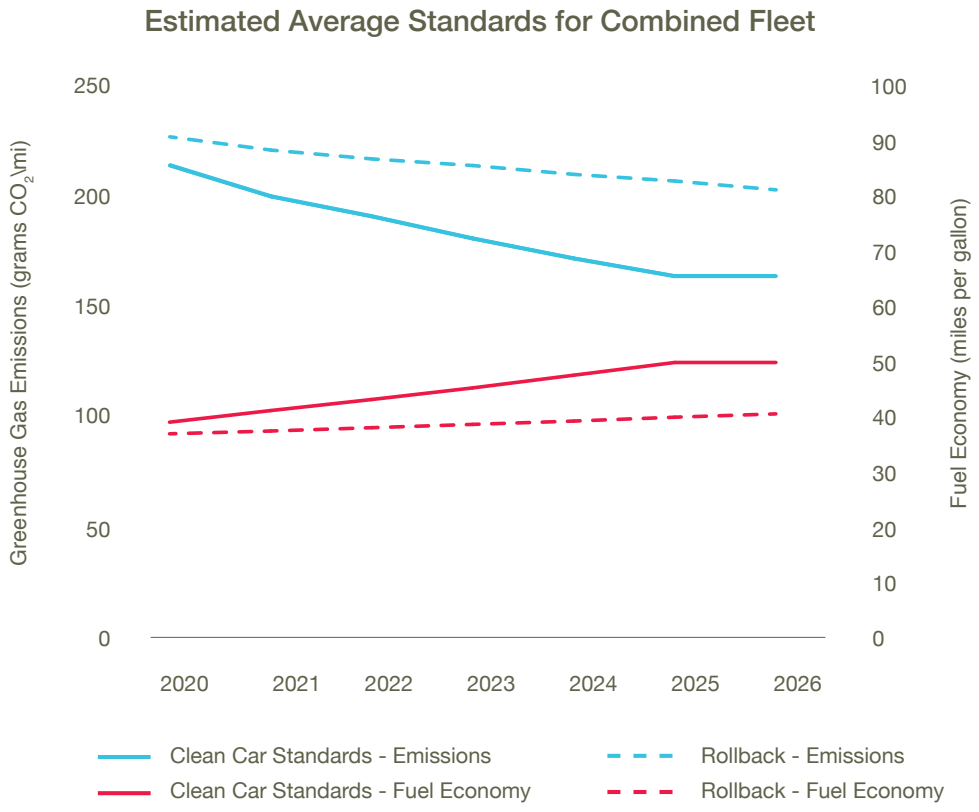
The proposal also contained a few additional flawed, underexplained, and unsupported hypotheticals, which would later reemerge in altered form during the final rollback. The proposed rollback's cost-benefit analysis appropriately counted all the lost fuel savings that consumers would miss out on without the more efficient vehicles produced under the Clean Car Standards.[58] But the agencies also very briefly described—buried fifteen hundred pages deep into the regulatory impact analysis—two "sensitivity cases" that instead imagined what the costs and benefits would be if consumers valued less than 100% of their total fuel savings and other benefits.[59] The agencies did not endorse these scenarios and gave no justification for why these notional scenarios should be considered or what the implications of considering them were.

Entirely separately, the agencies also speculated in the proposed rollback that perhaps the addition of fuel economy technologies would result in some losses of other vehicle attributes, like horsepower. Making no effort to respond to the Midterm Evaluation's firm rebuttal of that very same argument not even two years earlier, the proposal cited sparse and questionable evidence to produce what it called "illustrative" and "rough" estimates of the so-called "opportunity cost" of supposed forgone attributes of vehicle performance.[60] 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.[61] 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.[62] 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."[63]

The agencies admitted in the proposal 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.[64] In their final rollback, the agencies abandon 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.

II. EPA and NHTSA's Final Rollback Invokes a Novel and Untenable Economic Analysis of Opportunity Costs

In April 2020, EPA and NHTSA issued a final rule that substantially weakens greenhouse gas emission and fuel economy standards as compared to the Clean Car Standards.[65] The Clean Car Standards would have required, on average, 5% annual reductions in greenhouse gas emissions and increases in fuel economy for model years 2021 through 2025; the SAFE Rule is dramatically weaker, requiring only 1.5% annual improvements.[66] Even under the agencies' own analysis, compared to the Clean Car Standards, the SAFE Rule will cost individual drivers up to $1500 more on gasoline over the life of their vehicles,[67] and vehicles will emit nearly a billion additional metric tons of carbon dioxide.[68] But these estimates of consumer losses and environmental losses from rolling back the Clean Car Standards may be grossly understated, as the agencies project—without any valid basis—that automakers will voluntarily over-comply with the SAFE Rule's standards.[69] That unjustifiable projection effectively erases from the agencies' analysis significant additional fuel-savings and greenhouse gas benefits that the Clean Car Standards would have achieved.[70]



In the Final Rule, the agencies have made some methodological changes that reduce the unexplained extra driving and therefore the safety costs that the proposed rollback had previously attributed to the Clean Car Standards. As a result of the agencies' new (though still flawed[71]) assumptions, the projected safety costs that they previously pointed to in order to support rolling back the Clean Car Standards have in large part disappeared.

The agencies now admit that—even according to the most favorable numbers they can muster—their own cost-benefit analysis shows that the rollback is costly for society, resulting in $13.1–$22 *billion in net costs* when calculated at a 3% discount rate.[72] While the agencies claim that, under an alternative 7% discount rate, their rollback would instead show $6.4–$16.1 billion in gains,[73] averaging together those two ranges of estimates from the different discount rates still strongly suggests that the rollback's cost-benefit analysis is likely underwater by billions of dollars in social losses.[74] At best, the agencies' analysis shows that the Final Rule's net benefits barely "straddle zero."[75] And that is before considering the host of analytical flaws and omissions that still plague the agencies' main analysis, such as the tens of billions of dollars in climate costs that the agencies arbitrarily omit.[76]

To justify this rollback when the benefits are "directionally uncertain,"[77] the agencies claim they can focus their regulatory choice on avoiding the Clean Car Standards' "upfront costs"—meaning both the price of purchasing a more efficient vehicle and the "opportunity cost" to consumers of supposedly having to forgo vehicle performance to achieve fuel economy.[78] The focus on upfront costs effectively ignores or devalues a sizeable chunk of the substantial longer-term lost fuel savings, as if consumers would not value having more money in their pockets in the future.[79] Indeed, such an emphasis on upfront costs is akin to selectively and inconsistently applying a very high discount rate just to future fuel savings, but not to future payments on vehicle loans, in contravention of guidelines for best analytical practices.[80]

To support their focus on upfront costs, the agencies hypothesize that consumers must experience opportunity costs from lost attributes, a theory that the agencies propound based on scant empirical evidence and with no effort to respond to the contrary evidence from the Midterm Evaluation and public comments that no such opportunity cost tradeoff exists.[81] The agencies even try to go so far as to claim that the possibility of opportunity costs—together with an unsubstantiated assertion that it may be perfectly rational for consumers to apply exceedingly high discount rates to future fuel savings—could explain away all private market failures and the existence of the energy efficiency gap.[82]

Then the agencies speculate that, if there are no market failures besides pollution and energy security, perhaps there may be no private cost savings for regulations to address, and the agencies may be able to ignore *all* the forgone consumer benefits of their rollback.[83] Though their main cost-benefit tables continue to fully value fuel savings,[84] the agencies muse at several points in the final rule about whether they could ignore all the rollback's "$26.1 billion in private losses to consumers," and focus instead only on the external gains they attribute to the rollback.[85] They also assert that fully valuing lifetime fuel savings actually "distorts the comparison," because they believe that "upfront" costs, like opportunity costs, are the "more important factor."[86] As a somewhat less extreme alternative to ignoring 100% of consumer losses, the agencies also propose as a sensitivity analysis that perhaps they can place a dollar figure on the alleged opportunity costs. But recognizing they have no way to accurately estimate such a cost directly, and so unwilling to repeat the flawed methodology from the proposed rollback, the agencies instead suggest subtracting 42 months' worth of fuel savings—a significant portion of total fuel savings, and an amount based on an unsound methodology—as a proxy estimate for the sensitivity analysis.[87] Only by ignoring the lost consumer benefits or significantly undercounting them as in the sensitivity case, could the agencies' rollback finally start to appear cost-benefit justified.[88] But the agencies did not adopt their sensitivity analysis into the main calculations of the Final Rule's costs and benefits, thus demonstrating that even they doubt the basis for such estimates of opportunity costs.

The remainder of this report details why the suggestion that a theory of opportunity costs might support a focus on upfront costs, while erasing a significant portion of consumer benefits, is flawed at every step of the analysis. As explained in Section III, there is no evidence that hidden opportunity costs[89] would have occurred under the Clean Car Standards: the agencies' analysis is theoretically and empirically weak, their own model already accounts for possible tradeoffs

between fuel economy and other vehicle features, and the agencies also observe that many fuel economy-technologies actually improve other vehicle attributes. Instead of such allegedly hidden opportunity costs, Section IV recalls that it is market failures that explain the energy efficiency gap and so justify the use of efficient regulations to achieve private cost savings. Section V details how any undercounting of consumer benefits would fly in the face of past practice across agencies over the last four decades under Administrations of both political parties and, further, is inconsistent with best practices for agency economic analysis. Finally, as shown in Section VI, the agencies' attempt in the sensitivity analysis to monetize the opportunity costs related to consumers' valuation of other vehicle characteristics does not withstand scrutiny, especially as the agencies ignore the effect of those other vehicle characteristics on compliance costs and externalities like safety effects.

In short, the agencies wrongfully cast doubt on well-established market failures and wave their hands toward suspect estimates of opportunity costs to justify an otherwise costly rollback. Their attempts fail, and the agencies cannot escape the reality that their rollback shortchanges consumers by depriving them of valuable fuel savings.

III. The Agencies Do Not Prove That Any Hidden Opportunity Costs Exist

The agencies' entire argument for why they might be able to ignore a significant portion of consumer benefits hinges on the premise that "consumers have a scarcity of resources," that manufacturers and consumers must make tradeoffs between fuel economy and other vehicle features,[90] and therefore that consumers face an "up-front . . . opportunity cost of any other desirable features that consumers give up when they choose the more efficient [vehicle]."[91] For each element of that premise, the agencies fail to marshal adequate theoretical or empirical support, and they fail to square their assertions with contrary evidence from public comments, past agency evaluations, and even other portions of the agencies' own regulatory impact analysis. Many fuel economy technologies increase performance or are entirely compatible with other vehicle features. Even if manufacturers may occasionally reduce select vehicle features like weight to achieve an inexpensive boost to fuel economy, such compliance choices would significantly decrease regulatory costs in ways that the agencies have not accounted for, may lead to other benefits that the agencies have not accounted for, and are unlikely to ultimately decrease net consumer welfare (*see infra* Section VI). In short, the agencies' claims about potential widespread consumer welfare losses from opportunity costs under the Clean Car Standards are not supported by the evidence they present.

A. The Agencies Ignore That Consumers Can Access Financing to Purchase Fuel-Economy Technologies That Will Pay for Themselves

The agencies claim that consumers are forced by budget constraints to forgo other features in order to purchase vehicles that meet fuel economy requirements.[92] The agencies ultimately do not even have quite enough confidence in this claim to base their main cost-benefit analysis on it.[93] In any event, the agencies have not explained why consumers would be unable to purchase vehicles with improved fuel economy *and* any desired other features. In the absence of market failures, a rational consumer would continue to demand fuel economy improvements until the net present value of fuel savings[94] just meets the upfront cost of adding fuel efficiency technology.[95] 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.[96] 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 be included up to the level that 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*.

The agencies claim 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.[97] But especially given that 85% of new vehicle purchases are

financed by loans,[98] 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 that 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 under the Clean Car Standards: 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.[99] The agencies never explain why they think consumers are rationally weighing upfront opportunity costs against longer term fuel savings but are simultaneously being irrational about accessing the credit market to finance fuel efficiency technologies that can pay for themselves.

With sufficient financing options, price should never make these vehicle features mutually exclusive. In fact, evidence in the rulemaking record suggests that there are plenty of loans that offer consumers *rate reductions* for fuel-efficient vehicles.[100] 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, and such a market failure would justify regulation. The agencies never explain why an efficient credit market would not preclude their claims about opportunity costs.

B. The Agencies Offer No Consistent Theory of Unaccounted Technological Tradeoffs

Absent market failures, the only cases in which there would be a tradeoff between fuel economy and other features would be if there is a technical or engineering constraint that prevented manufacturers from adding those features *and* adding technology that improves fuel efficiency,[101] or if the technology for improving fuel economy necessarily increases the marginal cost of adding additional features (such as the cost of adding the next unit of performance). The agencies have not shown that these conditions occur frequently enough to support their claims that the standards "have a significant impact on vehicle utility and performance."[102]

To the contrary, the agencies admit that many technologies can provide both improved fuel economy and improved performance, undercutting their theory that all fuel economy improvements entail opportunity costs.[103] Examples listed in the final regulatory impact analysis include increasing the number of gear ratios in new transmissions to help the engine both run more efficiently and in the optimal "power band" for performance;[104] small mass reductions that improve both fuel economy and performance;[105] turbocharging;[106] certain hybridization technologies, which simultaneously and necessarily improve both fuel economy and performance;[107] and other options discussed by the agencies and commenters.[108] Previously, during the Midterm Evaluation, the agencies also listed numerous examples of how fuel-economy technologies could 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.[109]

In fact, "[i]n response to [public] comments," the agencies conducted an analysis of how different regulatory alternatives would affect fleetwide performance, and they initially calculated that the original Clean Car Standards might have *increased*

vehicle acceleration times by 7.5%, versus only a 3.1% improvement to acceleration achieved under the agencies' own proposed rollback.[110] After making certain "refinements" to the sales data and changing other analytical assumptions, the agencies still find only a "negligible 0.1 percent difference" in acceleration between the Clean Car Standards and the proposed rollback.[111] Thus, regardless of which estimate is accurate, the agencies' own analysis shows it is at least possible that more stringent regulatory standards can improve performance and, even in the worst-case analysis, there is only a "negligible" difference in performance.

A negligible difference in vehicle performance between various regulatory alternatives would not be surprising because, assuming any tradeoffs even exist between fuel economy and other attributes, the agencies' model for estimating compliance costs already accounts for such tradeoffs by holding key attributes "constant"[112] to "maintain performance neutrality."[113] In other words, the model assumes that manufacturers will spend whatever additional costs are necessary to hold constant all the key non-fuel economy features of their vehicles.[114] If, for example, installing some specific fuel economy technology in a particular vehicle were to reduce that vehicle's acceleration times, the agencies' model adds in the extra costs of installing yet more improvements to bring those acceleration times back up to par.[115] According to the agencies' description of their model, this assumption *"eliminates the need to assess"* any possible opportunity costs,[116] because key performance characteristics are held constant across regulatory alternatives, and the agencies conclude that any other attribute changes not directly accounted for by their model would be "de minimis."[117] In fact, the agencies admit that if any attribute changes are not fully accounted for in their model already, there is no reason to think that the unaccounted for attribute changes are degradations rather than improvements in performance,[118] especially given the number of technological options that improve both fuel economy and other attributes simultaneously.[119]

The agencies' preliminary regulatory impact analysis for their proposed rollback offered yet one more admission that there should be no significant opportunity costs on net (though the relevant language was deleted from the final regulatory impact analysis, without explanation). The preliminary regulatory impact analysis explained that the agencies' baseline assumptions about what the vehicle fleet will look like without any further regulatory changes simplifies conditions by omitting the normal, gradual improvements in technology that would naturally lead to annual improvements of vehicle features.[120] In the preliminary regulatory impact analysis, the agencies explained how this simplifying assumption resulted in an overestimate of the actual compliance costs to achieve fuel economy improvements, and that overestimate would at least partly, if not entirely, offset any opportunity costs.[121]

In sum, the agencies' own analysis shows that fuel economy technologies will often improve vehicle performance, that vehicle performance under more stringent standards should be negligibly different or even improved compared to weaker standards, and that the costs to avoid consumer welfare impacts from any possible attribute-tradeoffs have already been accounted for in the model and compliance cost estimates. To repeat: manufacturers can combine technologies and attributes in multiple packages, many of which entail no performance tradeoff, and the agencies' compliance cost model assumes that manufacturers will add whatever extra costs may be necessary to hold vehicle performance constant. Of course, in the real world, it is possible that manufacturers are not offering vehicles that combine fuel economy with other features that consumers are willing to pay for. But such an occurrence would be symptomatic of a supply-side market failure (*see infra* Section IV), and the solution to such market failures would be efficient regulation.

C. The Agencies Offer Very Limited Empirical Evidence for Their Opportunity Cost Theory

The agencies' asserted "ample empirical evidence . . . from different authors" of a tradeoff between fuel economy and other vehicle attributes is based on just *two studies*—"Knittel" and "Klier and Linn"—neither of which looks at any attribute besides weight and horsepower/torque.[122] Moreover, the evidence available from those two studies does not support the agencies' specific claims. One of the studies (Klier & Linn 2016), for example, found "no evidence that the standards affected the direction" of technology adoption between fuel economy and other attributes for U.S. cars,[123] and even with respect to the rate of technological adoption for increasing other attributes, the study found rather mixed evidence for both U.S. cars and trucks.[124] For the other study (Knittel 2012), the agencies seem to actually be citing figures from an older, unpublished version of the analysis,[125] and they fail to disclaim that some of the numbers they cite in the final rule (like torque for cars) were not statistically significant.[126] In fact, the agencies seem to *invert all the data* from these studies. For example, the agencies claim that "Klier & Linn estimate reducing the average fuel economy of cars by one percent would enable producers to increase their average horsepower by 0.24 percent"[127]—but Klier & Linn actually reported the relationship in the opposite direction: that a one percent increase in horsepower (not in fuel economy) decreases fuel economy (not horsepower) by 0.24 percent.[128]

Perhaps tellingly, the agencies dropped a study they had cited in the preliminary regulatory impact analysis—a paper they listed as "Mackenzie."[129] Though it is not obvious which paper they meant, the reference is almost certainly to a 2015 paper by MacKenzie and Heywood. During the Midterm Evaluation, the agencies had discussed that paper at length specifically because it had raised significant "questions" about the methodology employed by the other two works.[130]

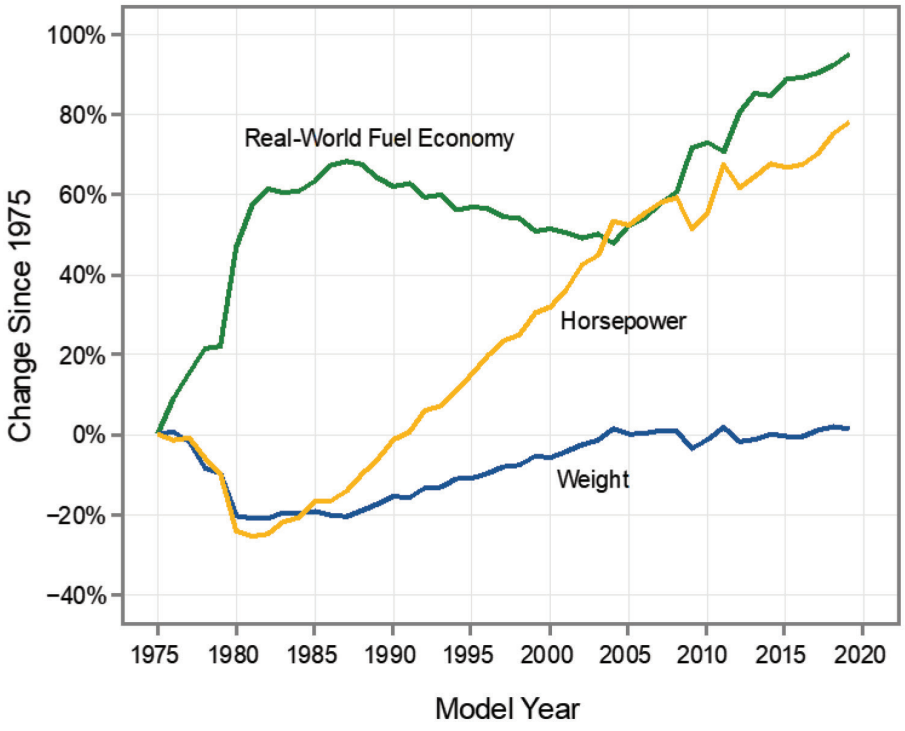
More broadly, the Midterm Evaluation heavily criticized the three works by Knittel, Klier & Linn, and MacKenzie & Heywood.[131] Among other problems highlighted by the agencies: the works largely assume no technological progress, and especially do not allow for innovations in the powertrain or technologies like strong, lightweight aluminum frames, thus overlooking the possibility for future technologies to improve both fuel economy and performance;[132] the works similarly do not allow for the possibility that regulatory standards could stimulate innovation;[133] they largely focus on changes in absolute horsepower, when consumers probably only care about relative acceleration or harder-to-quantify related attributes like handling and cornering;[134] and their data is skewed by the vehicles and technological combinations that historically have been made available by manufacturers for sale, which are affected by the very supply-side market failures that regulations can address.[135] The Midterm Evaluation reviewed both Knittel and Klier & Linn and found "statistical flaws that reduce their usefulness in projecting future trends."[136] In relying heavily on these two studies to support their entire claim that opportunity costs should now count against the Clean Car Standards' hundreds of billions of dollars in consumer fuel savings, the agencies fail to grapple with any of these past criticisms.

D. The Agencies Ignore Contrary Evidence

Public comments,[137] the agencies own prior evaluations,[138] research that the agencies themselves have commissioned,[139] and other evidence presented in the rulemaking record[140] all offer a contrary view: that there is no evidence of that negative performance is systematically associated with fuel economy technologies.[141] In fact, research has shown that the probability of a vehicle obtaining a negative evaluation of its operational characteristics is lower when that vehicle has fuel-saving technologies;[142] that any possible performance tradeoffs would likely decline over time;[143] and that "learning by doing" and knowledge spillovers should reduce manufacturers' compliance costs in ways that may obviate any need for tradeoffs.[144]

More generally, as the agencies have observed in prior evaluations, 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.[145] As a recent figure from the 2019 EPA Automotive Trends Report (reproduced below) demonstrates,[146] since 2008, fuel economy began to rise (as a result of standards adopted by the agencies), yet features such as horsepower and weight continued on a similar upward path as they had prior to adoption of the standards. That graphical evidence certainly does not reveal any apparent tradeoff between increasing fuel economy and the continued increase in horsepower.

Relative Change in Fuel Economy, Weight, and Horsepower Over Time, from EPA's 2019 Automotive Trends Report



Furthermore, recent technological advancements have likely disrupted any historical tradeoffs between fuel economy and vehicle features that may have occurred before 2008 and that the agencies now try use to support their claims about future, ongoing tradeoffs.[147] 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.[148] 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.[149] Recent studies using more sophisticated methodologies have confirmed this finding.[150] 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.[151] Studies suggest that this may be caused by a countervailing effect whereby the increased innovation spurred by the standards ultimately enables manufacturers to also provide other features at lower cost.[152] 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 simultaneously.[153] Consequently, regulation-induced innovation could be especially important to consider.

As a result of all of this uncertainty, in their economic analysis of the proposed rule, the agencies found that "sufficiently detailed information on the potential improvements in car and light truck attributes . . . is not currently available,"[154] 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."[155] This conclusion was supported by the EPA's Science Advisory Board.[156] The agencies have not provided any reason to depart from these prior conclusions.

IV. Market Failures Cause the "Energy Efficiency Gap," and So Regulations Are Warranted to Deliver Both Private and Social Net Benefits

The agencies muse repeatedly through the final rule that, if only they could prove that no private market failures were responsible for consumers underinvesting in fuel economy, or if only the energy efficiency gap were not real, they might be able to ignore *all* the forgone consumer benefits of their rollback. Ultimately the agencies balked at taking that leap and instead continued to fully value fuel savings in their main cost-benefit tables.[157] Nonetheless, the agencies speculate at several points that "if no market failure exists to motivate the $26.1 billion in private losses to consumers," then the rollback would appear to be beneficial.[158] But there is no basis for that hypothesis.

The agencies put forward three ideas about why the energy efficiency gap either does not exist or is not caused by market failure.[159] One is their theory of opportunity costs, suggesting that consumers are unwilling to spend an additional $1 to purchase a vehicle that will save them more than $1 in fuel because there are hidden opportunity costs not being measured. The agencies attempt to deploy their concept of opportunity costs as a pretext to dismiss various market failures: for example, the agencies claim that consumers are not myopically undervaluing long-term savings or irrationally exhibiting loss aversion toward upfront purchase prices, but instead "simply value differences in vehicles' other attributes more highly than they do fuel economy, which would not reveal irrational or myopic behavior."[160]

Section III above showed the many flaws with the agencies' handling of opportunity costs. Additionally, the two papers that the agencies rely on for their theory of opportunity costs—Knittel (2012) and Klier & Linn (2016)—never make any connection between opportunity costs and the energy efficiency paradox.[161] Knittel (2012) and Klier & Linn (2016) 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. The energy efficiency paradox, by contrast, occurs when consumers enter the marketplace, see two cars with identical performance attributes but different fuel economies and different price tags, and are unwilling to pay the additional upfront price for fuel economy that will more than pay for itself over time. The possible existence of manufacturers' past technology tradeoffs is quite simply not an explanation for the energy efficiency paradox.

Besides opportunity costs, the agencies offer two other possible reasons for dismissing market failures. One of their alternative suggestions is that perhaps the increased purchase price for more efficient vehicles is simply being underestimated.[162] The agencies offer no evidence for this claim, nor do they respond to the numerous reasons presented by public comments why the agencies have, in fact, most likely *over*estimated compliance costs and vehicle price effects.[163]

Finally, the agencies offer the bald assertion that it is, perhaps, not irrational for consumers to discount future fuel savings at a rate as high as 24%[164]—a rate eight times higher than the 3% discount rate usually applied to assess how private consumers trade off their consumption over time.[165] The agencies offer no real theory or evidence for why it might be rational for consumers to apply very high discount rates specifically to fuel savings,[166] or how that would explain away all other market failures.[167] Moreover, the agencies do not explain the inconsistency between, on the one hand, assuming that consumers are rational even if they apply exceedingly high discount rates to future fuel savings while, on the other

hand, recognizing that consumers accept only relatively modest interest rates to finance their vehicles. The agencies calculate that 85% of new vehicles are purchased through financing options, at an average interest rate of just 4.25%.[168] The interest rate on a loan reveals the rate at which consumers are willing to trade off future spending versus current consumption.[169] The agencies offer no explanation for why, absent some market failure, consumers would adopt vastly different attitudes toward spending money in the future simply depending on whether the money is to spent buying fuel or paying a loan.

Meanwhile, even as the agencies offer little to no support for their theories, they complain that public commenters did not "provide any empirical evidence" of the various market failures that have long been cited to support energy efficiency regulations.[170] In fact, both public commenters and the agencies' own prior analyses during the Midterm Evaluation explored the support from the economics literature on how private market failures explain the fuel efficiency gap.[171] The literature provides significant theoretical and empirical support for a number of relevant market failures that likely lead consumers to undervalue fuel economy and manufacturers to underprovide vehicles with fuel economy that consumers value. Some key market failures include:

- **Information Costs.**[172] The cost of obtaining detailed and actionable information regarding vehicle fuel economy may lead consumers to purchase vehicles with lower fuel economy than they would optimally prefer. This can also lead manufactures to underinvest in efficiency.

- **Consumer Myopia, Miscalculation, and Rules of Thumb.**[173] Consumers may use heuristics and rules of thumb that underemphasize or miscalculate the value of the fuel that they will save by purchasing more fuel-efficient vehicles, even if consumers would value those savings given a more focused, systematic, or accurate evaluation of the costs and benefits of a purchase decision. For example, consumers that do not intend to keep a vehicle for its full useful life may irrationally consider only the amount of fuel savings they expect to benefit from when driving the vehicle, while ignoring the increased resale value of a more fuel-efficient vehicle.

- **Consumer Loss Aversion.**[174] Consumers may irrationally emphasize the upfront "losses" of purchasing a more expensive, more fuel-efficient vehicle over the somewhat more uncertain gains of future fuel savings. As a result, consumers may not purchase more efficient vehicles, even if they (and society) would have saved more over time than the additional amount they pay upfront.

- **Manufacturer Technology Spillover Effects.**[175] Advancements that improve fuel economy are public goods due to the spillover of fuel economy-improving technologies and of information regarding consumer acceptance of those technologies. That is, manufacturers may underinvest in efficiency-enhancing technology because competitors will be able to learn from their R&D which technologies work the best in the real world and are most appealing to consumers. As a result, manufacturers do not see a private return that fully reflects the benefits of that investment. This limits the incentive that manufacturers have to be the "first mover" that invests in the development and deployment of new fuel saving technologies, even if consumers would prefer to purchase a vehicle with greater fuel economy. Since each manufacturer faces muted incentives, no manufacturer produces vehicles with the socially optimal level of fuel economy.

- **Manufacturer Market Power.**[176] Because of the limited competition in 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 purchases that lead to higher manufacturer profits at the expense of optimal fuel economy.

Market failures in the supply and demand for fuel economy are not merely theoretical. A number of studies find empirical evidence that the market failures outlined above exist and contribute to the energy efficiency gap.[177] EPA's own Scientific Advisory Board (SAB) urged the agencies not to rely solely on the handful of studies that the agencies claim support the conclusion that no energy efficiency gap exists.[178] The SAB presented additional evidence that consumer purchasing decisions do not fully reflect the value of fuel savings:[179]

- "When Hyundai and Kia were forced to downgrade their EPA mileage ratings on selected 2011-2013 models, the resulting changes in vehicle prices imply that consumers of these vehicles value savings in fuel expenditures at a much lower rate (approximately 15-38%) than full valuation."[180]

- "An especially sharp example of this phenomenon is the [hybrid electric] version of the popular Toyota RAV4, which has a short payback period for its modest $700 price premium, without any apparent compromise in performance, seating capacity, or other desired vehicle characteristics. Toyota reports that fewer than 25% of consumers are selecting the [hybrid electric] version of the RAV4."[181]

- More generally across all hybrid electric versions offered from 2004 to 2015, even when the hybrid version "is visually identical to a gasoline version of the same model and requires no significant compromises in performance, trunk space or other vehicle attributes," and when fuel savings would "more than pay for [the] price premiums," "fewer than 20% of consumers opt for the [hybrid electric vehicle] option."[182]

Not only did commenters and the SAB present empirical evidence of market failures, but the agencies themselves relied on market failures to justify the Clean Car Standards (see Text Box below) and reaffirmed the existence of those market failures during the midterm evaluation process. In any attempt to ignore those market failures, the burden would be on the agencies to justify such a dramatic change of course in their rollback.

Ultimately, the agencies could not even convince themselves entirely of their own theories. At one point, the agencies seem to "agree with [public] commenters that the market failures CAFE and CO_2 standards can help address *are likely to exist*."[183] Later, the agencies conclude that "despite our expressed reservations," their main analysis must assume that a "fuel efficiency gap persists."[184] They also acknowledge that, at a minimum, consumers may not fully anticipate how greater efficiency will increase a vehicle's trade-in value, thus seeming to recognize some irrational consumer myopia with respect to a significant portion of the vehicle's lifetime fuel savings.[185]

The presence of these market failures means that, absent government policy, the market does not by itself produce efficient amounts of fuel economy. Well-designed regulation has the potential to improve social welfare by correcting or compensating for the market failures discussed above.[186] With well-designed regulation, consumers will have more money to spend on other things, regardless of whether they would have paid for fuel saving technology upfront.[187] Similarly, well-designed regulation can compensate for these market failures and align consumer purchasing decisions with the optimal level of societal savings.[188]

Fuel economy standards create net consumer and societal benefits when the benefits of correcting market failures (especially the economic value of the additional fuel saved) exceed the costs (such as the cost of the technology required to improve fuel economy).[189] Yet, the agencies now cast doubt on well-established market failures in their repeated efforts to suggest—despite calculating the full value of lost fuel savings in their main cost-benefit analysis—that fully valuing fuel savings somehow "distorts" the analysis.[190] As the next section details, the agencies' attempts to dismiss market

failures and so call into question fuel saving benefits fly in the face of best economic practices and forty years of regulatory history during which multiple federal agencies under multiple presidential administrations have consistently counted the full economic value of energy savings.

The Agencies' Current Attempt to Cast Doubt on Market Failures Contradicts Prior Agency Analysis

When issuing previous fuel economy and greenhouse gas emission regulations, the agencies concluded that market failures explain at least part of the energy efficiency gap and, as a result, provided a key justification for regulation. The existence of the energy efficiency gap was reaffirmed in a peer review of the modeling the agencies used to develop the proposed rule.[191] The agencies' attempt to undermine the full value of fuel savings by casting doubt on market failures arbitrarily breaks with this prior practice.

In their 2010 rulemaking establishing the first joint fuel economy and greenhouse gas emission standards, the agencies pointed to market failures as a reason why standards would produce fuel savings benefits.[192] For example, EPA pointed to the same consumer-side market failures outlined above:

- "Consumers might be myopic and hence undervalue the long-term.
- Consumers might lack information or a full appreciation of information even when it is presented.
- Consumers might be especially averse to the short-term losses associated with the higher prices of energy efficient products relative to the uncertain future fuel savings."[193]

EPA also pointed to comments identifying manufacturer-side market failures including "imperfect competition among auto manufacturers . . . ."[194]

In the 2012 rulemaking establishing the Clean Car Standards, the agencies found that the energy efficiency gap could be caused by consumers' lack of "information necessary to estimate the value of future fuel savings," from consumers' "not hav[ing] a full understanding of this information even when it is presented," from consumers' use of "simplified decision rules" in the face of a complicated choice, and from consumers' focus on "visible attributes that convey status."[195] The agencies also discussed supply-side market failures, explaining that imperfect competition in the vehicle market could "reduce[] producers' profit incentive to supply the level of fuel economy that buyers are willing to pay for,"[196] and that asymmetric information between manufacturers and consumers could also cause fuel economy to "remain persistently lower than that demanded by potential buyers."[197]

As part of the Midterm Evaluation, EPA once again recounted the potential for the market failures identified above to create a gap between consumer purchasing behavior and fuel savings that can be closed by the Clean Car Standards.[198] This included discussion of consumer-side market failures such as lack of information, myopia and rules of thumb, and loss aversion, among other explanations.[199] EPA also stated that "some of the gap in energy efficiency may be explained from the producer's side" and recounted evidence about strategic manufacturer behavior and technology spillovers.[200]

In the Final Rule, even as the main cost-benefit tables continue to report full fuel saving effects, the agencies have arbitrarily broken with prior practices by attempting to cast doubt both on the presence of market failures and on the full valuation of the fuel savings from the Clean Car Standards.

V. Counting Less Than the Full Fuel Savings Benefits of Regulation Is Inconsistent with Decades of Agency Practice and Regulatory Guidance

The agencies break from longstanding practices on the valuation of energy savings in several different ways. Though their main cost-benefit tables continue to fully value fuel savings,[201] the agencies use opportunity costs and other theories to cast doubt on the existence of market failures (*see supra* Section IV), and they then suggest that—if there were no market failures—they could ignore all the forgone consumer benefits of their rollback.[202] They also assert that fully valuing lifetime fuel savings actually "distorts the comparison" because they believe that "upfront" costs, like opportunity costs, are the "more important factor."[203] As a somewhat less extreme alternative to ignoring 100% of consumer losses, the agencies also propose as a sensitivity analysis that perhaps they can place a dollar figure on the alleged opportunity costs. But recognizing they have no way to accurately estimate such a cost directly, the agencies instead suggest subtracting 42 months' worth of fuel savings—a significant portion of total fuel savings—as a proxy estimate.[204] Only by significantly undercounting or entirely ignoring the benefits like fuel savings could the agencies' rollback finally start to appear cost-benefit justified.[205]

Counting anything less than the full value of fuel savings would diverge from the approach the agencies had consistently taken for over forty years, under administrations of both political parties. The longstanding approach has been simply to multiply the quantity of fuel that a regulation is expected to save consumers each year by the economic value—that is, the expected price—of all the fuel saved, discounting the savings that will accrue in the future back to their present-day value using a standard discount rate, and adding up all years of savings. This longstanding approach can be characterized as counting the net present economic value of fuel saved or the "full economic value of fuel savings."

Not only has that approach been used consistently by NHTSA and EPA over the last 40 years, it has also been consistently used by other federal agencies that promulgate rules with substantial energy saving benefits and is enshrined in guidance on regulatory impact analysis. In fact, we have identified no rulemaking where any agencies calculated the benefits of an energy-saving regulation based on consumers' perceived willingness to pay, as the agencies' "Implicit Opportunity Cost" sensitivity analysis would effectively do. Even during the Trump Administration, the Department of Energy has thus far continued to value energy savings using the full economic value based on expected prices.[206]

The following sections first review best practices for regulatory analysis, and then provide a series of examples demonstrating that both NHTSA and EPA have consistently used the full economic value of saved fuel when considering the costs and benefits of regulations that result in fuel savings. This is followed by examples from other agencies, demonstrating that the agencies' historic approach has been broadly consistent across the federal government.[207] The agencies' suggestion in the Final Rule that they can focus predominantly just on upfront costs—either to the complete exclusion of all longer-term consumer benefits or after erasing 42 months' worth of consumers' fuel savings—represents a sharp and unjustified departure from 40 years of sound economic analysis.

A. Regulatory Guidance Makes Clear That Fully Valuing Energy Savings Is the Best Practice for Cost-Benefit Analysis

Using the full economic value of fuel savings to calculate the consumer and societal benefits of regulations that save fuel is not only the longstanding practice of the agencies under administrations of both political parties—it is economically rational and consistent with best practices for agency cost-benefit analyses.

The agencies assert that consumers' observed unwillingness to pay for fuel economy is somehow evidence that there are no market failures.[208] In fact, in the presence of market failures, consumers' observed willingness to pay may not fully reflect the true welfare benefits they receive from purchasing vehicles with more fuel economy, and manufacturers may produce vehicles with less fuel economy than consumers are willing to pay for. This can be seen from both the consumer and the societal perspective. From the *consumer* perspective, the presence of market failures means that *ex ante* measures of consumers' willingness to pay for fuel economy will not reflect the *ex post* value consumers actually experience from fuel savings once they have purchased the vehicle. From a *societal* perspective, failures in the market for fuel economy mean that there is a divergence between consumer vehicle purchasing decisions and the value that society receives when consumers buy more fuel-efficient vehicles. When consumers operate more efficient vehicles, they consume fewer real economic resources (e.g., barrels of oil which must be extracted, refined, and transported) than they would have had they operated less efficient vehicles. These are real resource savings for society, the value of which is represented by the price of the fuel (i.e., gasoline or diesel) saved (not taking into account externalities such as air pollution and energy security). Government intervention—such as fuel economy standards that guarantee manufacturers produce vehicles with minimum levels of fuel economy—can lead to a more economically efficient level of fuel economy in vehicles by bridging the gap between consumers' willingness to pay for fuel saving and the economic value of the savings that accrue to consumers and society. The benefits produced by such regulation are the additional fuel savings that occur beyond what the distorted market would produce on its own.

The societal perspective on energy savings seems particularly crucial given the relevant statutory contexts. For example, NHTSA sets its CAFE Standards under the Energy Policy and Conservation Act (EPCA), which Congress specifically adopted for the purpose of conserving energy in response to a national energy crisis.[209] Failing to view energy savings from society's perspective would therefore seem inconsistent with EPCA's core purpose. Indeed, the agencies ultimately acknowledge that, whatever their assumptions about the private valuation of fuel savings, when accounting for social costs and benefits, the full lifetime fuel savings should be included.[210] Their simultaneous attempts to either ignore all lost consumer benefits or erase 42 months' worth of fuel savings in the sensitivity case are therefore inconsistent with sound economic principles and guidance.

The Office of Management and Budget's *Circular A-4*[211]—a guide for agencies on regulatory cost-benefit analysis issued under President George W. Bush and endorsed by the Trump Administration[212]—includes a specific discussion regarding how to evaluate fuel economy and other similar regulations where "cost savings . . . accrue to parties affected by a rule who also bear its costs."[213] For those regulations, agencies should monetize those "direct costs that are averted as a result of a regulatory action."[214] In the case of fuel economy, the "direct costs that are averted" are the fuel savings. In order to determine the appropriate price of fuel saved, *Circular A-4* explains that the best measure of the economic value of market goods affected by regulation is the market price of those resources.[215] Circular A-4 also cautions that willingness to pay is a good measure of benefits only "if" the underlying market is "well-functioning" and requires agencies to take "market imperfections" into account when valuing regulatory effects.[216] As a result of the market failures discussed above, when

calculating benefits of the standards, the agencies should use the value of *fuel saved* (based on the market price of fuel) and not the value consumers appear to place on *fuel economy* (based on prices and purchase of vehicles).

EPA's *Guidelines for Economic Analysis* ("Guidelines") also support using the net present value of fuel saved to calculate the benefits of regulations that save fuel.[217] The Guidelines explain that consumers' willingness-to-pay is generally the appropriate measure of quantified social benefits.[218] However, in cases where consumer expectations are likely to be inaccurate, the Guidelines caution that consumer willingness to pay for a product may be an incomplete measure of social benefits.[219] Only in the case of "goods bought and sold in undistorted markets,"[220] should EPA use "market prices . . . to measure the value of market goods and services directly."[221] By implication, market data on consumers' valuation of *fuel economy* is not the appropriate measure of the benefits of fuel economy due to distortions in the market for fuel economy. However, because the market for fuel (as opposed to the market for fuel economy) does not suffer from these same market failures, the benefits of a regulation that saves fuel should be calculated using the market price of the *fuel*.[222] The Guidelines also explain that the purpose of the agency's cost-benefit analysis is to measure the "*social*" benefits (and costs) of regulation.[223] So where, as here, there is a divergence between the private willingness to pay for fuel economy (as expressed in market prices for vehicles) and the social valuation of actual fuel resources saved (expressed in the market price of fuel), the appropriate measure of the benefits of a regulation that saves fuel is the market price of fuel saved.

The Guidelines' discussion of the appropriate discount rate to use when evaluating regulation also supports using the net present value of fuel saved as a measure of the fuel savings benefits of the Final Rule. As explained above, the observed energy efficiency gap could perhaps be characterized as reflecting consumers' use of very high discount rates when evaluating vehicles with increased fuel efficiency—rates multiple times higher than normally assumed for rational consumer behavior.[224] However, because the purpose of regulation is to maximize *societal* (and not private) net benefits, the Guidelines direct EPA to calculate the present value of future savings using the rate that *society* (not a private individual) discounts future costs and benefits (that is, to use a social discount rate).[225] Even when agencies have elected to use private discount rates, they have used discount rates reflecting the actual opportunity cost of capital for buying the more efficient product, rather than the very high discount rate implied by consumers' upfront purchasing decisions (which are the product of market failures).[226] By assuming that consumers have very high discount rates, and by using those rates as an excuse to offset either 42 months of fuel savings or all the private and social benefits from fuel savings, the agencies' analysis fails to follow the approach outlined in EPA's Guidelines. It also fails to follow economic best practice of using a consistent discount rate when estimating costs and benefits.[227] Indeed, the agencies' focus on "upfront costs" is akin to selectively and inconsistently applying a very high discount rate just to future fuel savings, but not to future payments on vehicle loans.

A failure to fully value fuel saving is also inconsistent with the Department of Transportation's guidance documents on cost-benefit analysis. In its *Benefit-Cost Analysis Guidance for Discretionary Grant Programs*, the Department of Transportation explains that the benefits for programs that avoid vehicle use should be calculated based on vehicle operating costs including avoided fuel costs, discounted using a 7 percent discount rate.[228] In its *Operations Benefit/Cost-Analysis Desk Reference*, the Federal Highway Administration explains:

> Vehicle operating costs is usually relatively easy to estimate and is often based on simple valuations applied directly to vehicle miles of travel (VMT). For simple analysis, a static rate of average fuel use (gallons per VMT) is applied to any net change in VMT to estimate the net change in fuel use. A benefit value (cost per gallon of fuel exclusive of fuel taxes) is then applied to the change in the number of gallons of fuel consumed.[229]

The Final Rule will substantially reduce the amount of fuel saved over the life of vehicles that would otherwise have been subject to the Clean Car Standards. Given the fact that an unregulated market will not result in the economically efficient level of fuel savings—due to both consumer-side and producer-side market failures—consumers' willingness to pay for vehicles with greater fuel economy is not the appropriate measure of the economic benefits of those fuel savings. Rather, the agencies must use and fully acknowledge the net present value of fuel saved by society (i.e., using a social discount rate) over the lifetime of vehicles to assess the benefits of the Clean Car Standards and the costs of forgoing those fuel savings imposed by the Final Rule. By casting doubt on the net present value approach in favor of a predominant focus on upfront costs, the agencies analysis is inconsistent with economic theory. Such an approach also breaks with longstanding agency practices, as explored further below.

B. NHTSA Has Consistently Calculated the Benefits of Fuel Economy Regulations Using the Full Economic Value of Fuel Savings

For over forty years, under administrations of both political parties, NHTSA has used the same approach for calculating the fuel saving benefits of fuel economy regulations: the net present value of fuel saved.

Carter Administration. In its very first fuel economy regulation in 1977, NHTSA evaluated "the economic impact of [fuel economy] standards" for model year 1981-1984 passenger vehicles.[230] In conducting this evaluation, NHTSA compared the upfront increase in vehicle costs to consumer lifetime gasoline costs, and determined that "total consumer costs (that is, retail prices, maintenance costs, and gasoline costs) are anticipated to decrease by about $450 per car or $20 billion nationally."[231] In making this calculation, NHTSA explicitly rejected an approach that would have considered only the benefits of fuel savings that consumers were willing to pay for, stating that "since lifetime [fuel savings] benefits do actually accrue to the initial and subsequent owners, they are included in the analysis, regardless of their perception by individuals."[232] As a result, NHTSA included the full economic value of those savings, calculated as the expected quantity of fuel saved times the expected price of fuel.[233]

Reagan Administration. In a regulation that reduced the model year 1985 fuel economy standard for light-duty trucks and established standards for model year 1986 trucks, NHTSA considered the expected economic impacts of its regulation using a similar approach.[234] NHTSA projected that vehicle price increases of $35 "would be offset by operating cost savings of $176 for the average 1986 light truck, due to reduced lifetime gasoline consumption."[235] Just as the agency had during the Carter Administration, the Reagan Administration's NHTSA also considered the full economic value of fuel savings rather than consumers' willingness to pay for fuel economy in its economic analysis.[236]

George H.W. Bush Administration. NHTSA finalized two fuel economy standards during the George H.W. Bush Administration.[237] However, the preambles for these regulations do not include any discussion of consumer fuel savings, and NHTSA no longer has copies of Regulatory Impact Analysis documents for those rulemakings. Nonetheless, it is likely that NHTSA counted the full value of the fuel savings, as there is no evidence that NHTSA took a different approach when analyzing these rules. And as detailed below, EPA under George H.W. Bush used the full economic value of fuel savings to calculate the benefits of its regulations.

Clinton Administration. In 1993, NHTSA finalized a rule to establish fuel economy standards for model year 1995-1997 light trucks.[238] The Final Regulatory Impact Analysis for that rule makes clear that NHTSA considered the full economic value of fuel savings, not consumers' willingness to pay.[239] In 1994, NHTSA issued a regulation establishing

fuel economy standards for model year 1996-1997 light trucks.[240] In the economic analysis supporting that rulemaking, NHTSA evaluated the operating costs of trucks under different levels of fuel economy standards. NHTSA explained that "[o]perating cost expenditures are defined as the present discounted value of dollar expenditures for gasoline that the vehicle owner would have to make over the life of a vehicle."[241] That is, for each fuel economy level analyzed, NHTSA calculated the benefit of saving fuel using the full economic value of fuel savings, not consumers' willingness to pay for that level of fuel economy.

George W. Bush Administration. In 2006, NHTSA again used the full economic value of saved fuel when evaluating the costs and benefits of fuel economy standards for model year 2008-2010 light trucks.[242] NHTSA again considered and rejected an approach that would have limited the benefits of fuel savings to the value that individual consumers ascribe to a given level of fuel economy when purchasing a vehicle.[243] NHTSA explained that it was appropriate to use the full economic value of fuel savings both because it was considering the "broader societal effect" of the standards and because that was the actual value from the consumer perspective:

> The agency believes that CAFE standards should reflect the true economic value of resources that are saved when less fuel is produced and consumed . . . . Consumer's perceptions of these values may differ from their actual impacts, but they will nonetheless experience the full value of actual fuel savings just as they will pay the full increased cost when the vehicle is purchased.[244]

Obama Administration. In 2010, NHTSA and EPA issued harmonized fuel economy and greenhouse gas emission standards for model year 2012-2016 vehicles.[245] In that rulemaking, NHTSA explained that "[t]he main source of economic benefits from raising CAFE standards is the value of the resulting fuel savings over the lifetime of vehicles that are required to achieve higher fuel economy."[246] NHTSA calculated these benefits as the net present value of fuel saved, and not consumers' willingness to pay for savings.[247] In 2012, NHTSA adopted the same approach when it issued regulations establishing the Clean Car Standards jointly with EPA. Together, the agencies calculated the benefits of the standards using the full economic value of fuel savings.[248] The agencies explained that fuel prices multiplied by quantity of fuel saved "determine[s] the value of fuel savings both to new vehicle buyers and to society."[249] From a consumer perspective, NHTSA stated that "the retail price of fuel is the proper measure for valuing fuel savings."[250] From the societal perspective, NHTSA specifically explained that the proper scope of analysis when calculating the fuel savings benefits in the context of a cost-benefit analysis is not consumers' willingness to pay for fuel economy,[251] but "the economic value of fuel savings to *the U.S. economy*."[252] As NHTSA explained:

> When estimating the aggregate value to the U.S. economy of fuel savings resulting from alternative increases in CAFE standards—or the "social" value of fuel savings—the agency includes fuel savings over the *entire* expected lifetimes of vehicles that would be subject to higher standards, rather than over the shorter periods we assume manufacturers employ to represent the preferences of vehicle buyers, or that buyers are assumed to employ when assessing changes in the net price of purchasing and owning new vehicles. Valuing fuel savings over vehicles' entire lifetimes recognizes the savings in fuel costs that subsequent owners of vehicles will experience from higher fuel economy, even if their initial purchasers do not expect to recover the remaining value of fuel savings when they re-sell those vehicles, or for other reasons do not value fuel savings beyond the assumed five-year time horizon.[253]

C. EPA Has Consistently Evaluated the Benefits of Fuel Saving Using the Full Economic Value of Those Savings

Just as with NHTSA, over the past six presidential administrations, EPA has consistently used the net present value of the fuel saved, and not consumers' *ex ante* willingness to pay for fuel economy, to calculate the fuel savings benefits that are produced when its emission standards for mobile sources are met through fuel economy improvements.

Carter Administration. In 1980, EPA proposed a regulation to establish evaporative emission regulations for gasoline-fueled heavy-duty vehicles.[254] EPA projected that this regulation would cause heavy-duty gasoline-fueled vehicles to install closed-loop fuel metering systems that would have the ancillary benefit of improving vehicle fuel economy.[255] When calculating the costs and benefits of the standards, including the fuel economy improvements, EPA used the full economic value of saved gasoline and not a measure of consumers' willingness to pay for fuel economy.[256]

Reagan Administration. In 1987, EPA issued a proposed regulation to comprehensively control evaporative emissions from motor vehicles.[257] As part of that regulation, EPA considered fuel volatility regulations that, if adopted, would have improved the fuel economy of engines.[258] EPA evaluated the economic benefit of this change based on the expected volume of fuel saved multiplied by the expected price of fuel.[259] That is, EPA considered the full economic value of fuel savings and not consumers' willingness to pay for fuel economy.

George H.W. Bush Administration. In 1990, EPA proposed regulations to establish cold temperature carbon monoxide exhaust emission standards for light-duty vehicles.[260] EPA determined that compliance with the proposed standards would involve technology changes that also improved fuel economy.[261] When calculating the net cost for vehicles to comply with the standards, EPA offset the upfront technology costs with the full economic value of the expected fuel savings over the life of each vehicle.[262] EPA did not measure the benefits of fuel savings using a more limited measure such as consumer willingness-to-pay.[263]

Clinton Administration. In 2000, EPA promulgated regulations establishing "Tier 2" motor vehicle emission standards for both exhaust and evaporative emissions.[264] EPA analysis predicted that requirements of this rulemaking regarding On-board Refueling Vapor Recovery would lead to the adoption of technology that improves fuel economy.[265] When calculating the net cost of the standards, EPA used "the net present value of fuel savings over the life of the vehicle."[266] This reflected the full economic value of fuel saved rather than consumers' willingness to pay for fuel economy improvements.

George W. Bush Administration. In a 2004 regulation establishing evaporative emissions from motorcycles, EPA considered a technology that would reduce fuel leaks and, therefore, save fuel.[267] When evaluating the benefits of these fuel savings, EPA used the full economic value of the savings rather than a measure of consumers' willingness to pay for fuel savings.[268]

Obama Administration. In its 2010 rule establishing joint fuel economy and greenhouse gas emissions standards for model year 2012-2016 passenger vehicles, EPA explicitly considered whether the full economic value of fuel savings or consumers' observed willingness to pay for fuel savings is "the appropriate measure of consumer benefit[.]"[269] EPA concluded that full valuation is the better measure because of market failures that prevent consumers from actualizing their fuel economy preferences.[270] EPA also considered the full economic value of fuel savings when calculating the benefits of the Clean Car Standards.[271] EPA specifically rejected using a measure of consumers' willingness to pay for fuel

economy, explaining that "[r]egardless how consumers make their decisions on how much fuel economy to purchase, EPA expects that, in the aggregate, they will gain these fuel savings, which will provide actual money in consumers' pockets."[272]

D. The Department of Energy Has Used the Full Economic Value of Energy Savings When Calculating the Benefits of Appliance Efficiency Standards

The Department of Energy (DOE) has consistently used a similar approach for almost 40 years when promulgating regulations that set minimum energy efficiency standards for appliances and commercial and industrial equipment. Pursuant to EPCA (the same law that directs NHTSA to establish fuel economy standards), DOE sets minimum standards for the energy efficiency of consumer appliances and commercial and industrial equipment.[273] Under EPCA, DOE is directed to establish standards that are "designed to achieve the maximum improvement in energy efficiency . . . which [DOE] determines is technologically feasible and economically justified."[274] In evaluating whether standards are economically justified, DOE is directed to weigh the benefits of more efficient appliances, including energy savings, against the costs of the standards, including higher up-front purchase prices.[275]

In 1980, the Carter Administration's DOE issued the first proposed energy conservation standard for a variety of consumer appliances, including refrigerators, freezers, clothes dryers, water heaters, room air conditioners, home heating equipment, kitchen ranges, central air conditioners, and furnaces.[276] This proposed rule established the key analytical considerations that DOE has used to set energy conservation standards ever since. A critical component of this analysis involves calculating the benefits of the fuel—in the case of appliances, electricity, oil, or natural gas—that is saved due to the standards. DOE presented these benefits as part of two different calculations: (1) the benefits to consumers as represented by the difference in life-cycle cost (LCC)—that is, the sum of the purchase price and the operating expenses discounted over the lifetime of the appliance—between appliances subject to a standard and the baseline; and (2) the benefits to society, including, primarily, the net present value (NPV) of energy savings over the lifetime of the appliance.[277] These calculations were made using the full economic value of energy savings (and of up-front appliance costs), not a measure based on consumers' willingness to pay for standard-compliant appliances or equipment.[278]

Under every administration since, DOE has finalized regulations regarding energy conservation standards that rely on a similar analytical framework to evaluate the economic justification for the standards. That is, when calculating the benefits of the standards, DOE considers the full economic value of energy saved by both the consumer and the nation, rather than a measure of consumers' willingness to pay for the more efficient appliance or equipment. To list just a few examples:

- In 1982, the Reagan DOE issued a rule declining to set energy conservation standards for clothes dryers and kitchen ranges on the grounds that they would "not result in a significant conservation of energy and would not be economically justified."[279] In reaching that conclusion, DOE conducted LCC and NPV analyses using the discounted value of energy saved multiplied by the expected price of electricity, oil, or natural gas (as appropriate for the specific appliance).[280]

- In 1989, the George H.W. Bush DOE finalized a regulation to establish energy conservation standards for refrigerators and freezers and for small gas furnaces.[281] DOE used the same net present value methodology established during the Carter Administration for calculating the costs and benefits of the standards and

comparing them to alternatives.[282] In doing so, DOE considered and rejected comments suggesting it calculate NPV and LCC using very high "implied" discount rates that reflect consumers' upfront purchasing decisions rather than standard market discount rates based on the economic value of fuel savings.[283] In 1991, the George H.W. Bush DOE issued a regulation establishing energy conservation standards for clothes washers, clothes dryers, and dishwashers.[284] DOE used the net present value of energy savings to consumers and society in its calculation of the costs and benefits of the standards.[285]

- In 1996, under President Clinton, DOE issued a new "Process Rule" that was intended to improve the process by which DOE develops and analyzes appliance efficiency standards.[286] The Process Rule reaffirmed the importance of evaluating consumer impacts through the use of the LCC analysis and of evaluating national economic impacts using the NPV analysis.[287] In 1997, DOE issued its first energy conservation standards under the new Process Rule: standards for refrigerators and freezers.[288] These standards were set at the level with the lowest life-cycle cost and highest net present value.[289] Both LCC and NPV were calculated based on multiplying the quantity of energy saved by estimated electricity prices and discounting future savings to present value.[290] The Clinton Administration used a similar methodology for six additional standards.[291]

- In 2002, DOE under President George W. Bush issued new more stringent energy conservation standards for central air conditioners and heat pumps.[292] DOE analyzed the economic effect of these standards based on the standards' LCC and NPV, both of which included the benefits of energy savings calculated using the full economic value of those savings.[293] The Bush Administration promulgated four additional energy conservation standards, calculating the costs and benefits using the same approach.[294]

- The DOE under President Obama promulgated 40 energy conservation standards for consumer, commercial, and industrial appliances. These regulations all included similar analyses that calculated the benefits of energy savings by multiplying the quantity of energy saved by the price of energy and discounting future savings to present value—that is, the full economic value of those savings.[295]

- The Trump Administration DOE has continued to use an identical methodology when considering the economic justification for consumer appliance and commercial and industrial equipment standards.[296]

E. Other Agencies Use the Full Economic Value of Energy Savings When Calculating Benefits of Regulations that Save Energy

A number of other rulemakings have evaluated the economic benefits of energy savings using the full economic value of energy saved rather than a measure of *ex ante* willingness to pay for savings.

- Under the Obama Administration, EPA issued regulations establishing new source performance standards to limit methane leaks from the oil and gas sector.[297] When calculating the benefits of these standards, EPA included the full revenue from recovered natural gas.[298] This was the case even though EPA acknowledged that industry could have chosen to recapture the gas on its own but for various reasons had not—in other words, the economic value of natural gas savings exceeded the industry's willingness to pay for natural gas recovery. The Trump Administration EPA has taken a similar approach to valuing reduced natural gas leaks in its proposal to amend the standards, claiming that "from a social perspective . . . the increased financial returns

from natural gas recovery accrues to entities somewhere along the natural gas supply chain and should be accounted for in the national impacts analysis."[299]

- Under the Obama Administration, the Bureau of Land Management took an approach that was similar to EPA when setting standards to limit methane leaks from the oil and gas sector on federal land.[300] The Bureau included as benefits the full economic value of any natural gas that would be recovered and sold due to the regulation.[301] The Trump Administration has taken the same approach when calculating the costs and benefits of rescinding that rule.[302]

- In regulations establishing energy efficiency standards for new construction of certain government-assisted housing, the Obama Administration Department of Housing and Urban Development and Department of Agriculture calculated the benefits of more stringent standards using the full economic value of energy saved.[303] The agencies justified these standards as a regulatory solution to the market failures embodied by the energy efficiency gap.[304]

For forty years, agencies across the federal government and under administrations of both political parties have used the full economic value of energy savings when calculating the benefits of regulations that save energy. The Department of Energy has even continued thus far to do so during the Trump Administration. On numerous past occasions, NHTSA and EPA explicitly considered and rejected alternative approaches, including using consumer willingness to pay for energy savings. There is no cause now to abandon that longstanding best-practice.

VI. The Agencies' Valuation of Opportunity Costs in the Sensitivity Case Is Flawed and Overlooks Substantial Countervailing Effects

After failing to convince themselves that no market failures exist and that, for the first time in forty years, it would be acceptable to ignore all energy savings,[305] the agencies turn to their alternative sensitivity analysis. In their sensitivity analysis,[306] the agencies hypothesize a proxy value for the alleged opportunity cost of forgone vehicle attributes that they assume must exist (despite all the reasons no such hidden opportunity costs will exist, *see supra* Section III). Having tried and failed in the preliminary regulatory impact analysis to estimate such opportunity costs directly[307]—and acknowledging there is no existing way to estimate the attributes allegedly lost from more efficient vehicles[308]—the agencies now try a proxy estimation in the final rule. Specifically, the agencies claim that since consumers could purchase additional fuel savings on their own in the marketplace but choose not to (ignoring the many market failures that prevent consumers from doing so), it must be because the opportunity cost of allegedly lost attributes is greater than the value of fuel savings.[309] The agencies admit that consumers do value and are willing to pay for the first 30 months' worth of fuel savings.[310] The agencies also exclude the value of fuel savings after 72 months from their proxy calculation, calling the selection of 72 months a "conservative" choice, though the agencies do not sufficiently explain the logic behind their selected timespan, and the cited data would seem to support a lower number.[311] But for the 42 months in between, the agencies' sensitivity case assumes that consumers recognize the fuel savings but are unwilling to pay for those savings on their own because they value something else instead—namely, according to the agencies, the opportunity cost of other attributes.[312] Therefore, the agencies subtract out 42 months' worth of fuel savings as a proxy for the opportunity costs.

For all the reasons explained above, this approach is completely untenable. There is no empirical support for hidden opportunity costs. Opportunity costs, to the extent they exist, would not explain away all the market failures that create the energy efficiency gap (*see supra* Section IV). In forty years, no federal agency has ever counted less than the full value of energy savings (*see supra* Section V). Even more specifically, no agency has ever before used alleged consumer costs associated with reducing other features to justify undercounting other consumer benefits of fuel economy or greenhouse gas emission standards.[313] Nor have other agencies that issue regulations on the basis of energy savings undercounted energy savings benefits by claiming that consumers' undervaluation of energy savings is explained by a rational desire to avoid changes in other features or performance. For example, the Department of Energy's appliance efficiency standards are constructed to apply only to appliances with identical features,[314] and the department finds that such appliance standards save consumers money on net by increasing energy savings beyond what consumers would have purchased without the standards.[315] EPA and NHTSA have not explained in the Final Rule why it would be appropriate to break from those past practices.

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 VI.A). Then the agencies would have needed to estimate consumers' willingness to pay for such 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,"[316] 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."[317]

The literature also has not estimated consumer valuation of vehicle features with enough consistency to be useable for policymaking.[318] 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).[319] That study concluded "we have found very little useful consensus" regarding "estimates of the values of various vehicle attributes,"[320] and that the willingness-to-pay estimates "encompass[ ] such a wide range of values that [they are] of little use for informing policy decisions."[321] 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.[322] As such, Greene et al. (2018) concluded that focusing on any specific willingness-to-pay estimate is methodologically suspect.[323]

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 the agencies assert might happen absent the Clean Car 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.[324]

Moreover, the agencies' proxy estimation of opportunity costs fails to consider substantial countervailing effects, as the rest of this Section details. In particular, if there were tradeoffs between fuel economy and other vehicle attributes, it would significantly lower the agencies' estimate of the compliance costs for the Clean Car Standards. In fact, the agencies' 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. Finally, even if the Clean Car Standards would result in consumers purchasing vehicles with fewer other features, it does not follow that consumers would lose welfare. 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.

A. Assuming Lost Welfare from Forgone Vehicle Features Is Inconsistent with the Agencies' Compliance Costs Calculations

The idea that consumers would lose net welfare from forgone attributes cannot be reconciled with the agencies' current analysis of the costs of the standards. The agencies calculate the costs of the Clean Car Standards by assuming key vehicle performance attributes are held constant between the baseline scenario with the Clean Car Standards and the scenario with the rollback.[325] The agencies conclude that any vehicle attribute not held perfectly constant by this assumption would be a "de minimis" change, and the agencies admit the change could likely be that regulatory standards *improve* vehicle performance and other attributes.[326] This is the same approach that NHTSA and EPA have used historically to evaluate the cost of complying with fuel economy and emission standards.[327] Yet the agencies now, for the first time, also claim that consumers may lose welfare because they are forgoing features that they would have had without the standards.[328] It cannot both be true that, (1) for the purpose of calculating vehicle prices, non-efficiency features are the

same as they would have been without the standards and that, (2) for the purpose of calculating forgone benefits of the rollback, non-efficiency features would have been different.

At the same time as the agencies' sensitivity analysis seeks to count as benefits of the rollback the additional features consumers will allegedly now be able to purchase instead of fuel economy (by using such alleged benefits as a reason to offset 42 months' worth of fuel savings), the agencies fail to count how those additional features also require technology that will raise the price of the vehicle (compared to a vehicle without the performance features). Instead, the agencies make the conclusory assumption that their estimate of opportunity costs is "net of the [technology] cost of these attributes" and so can be added on top of the "technology cost/savings estimated in the primary analysis."[329] But if the agencies are correct that, once free of fuel economy standards, manufacturers will redeploy their technology advancements toward improving other vehicle features such as performance while staying within consumers' assumed "budget constraint," the agencies may have incorrectly attributed some cost savings to their rollback. At the very least, the agencies have not sufficiently explained why they do not need to account for the cost of such additional features in the price of new vehicles. And if vehicle prices will not actually drop when fuel economy standards are repealed (because the technology that would have been used to improve fuel economy will instead be used to improve other features), then the agencies' conclusions about the effect of the rollback on new vehicle prices and sales, used vehicle scrappage, and the corresponding benefits from those effects are overstated.

If the agencies want to assume that the Clean Car Standards would have forced some manufacturers to sacrifice features like horsepower for the sake of fuel economy, then the agencies 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.[330] Specifically, the agencies would need to relax the assumption that non-efficiency features will be held constant.[331] Relaxing the assumption that vehicle attributes are held constant would show that compliance with the Clean Car Standards likely will produce vehicles that are *less expensive* than the agencies' prior modeling found—and therefore, that rolling back the standards will produce even fewer cost savings than the agencies now estimate.[332] 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. 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.[333]

Finally, the agencies fail to consider or value the indirect improvements to performance and other features associated with the Clean Car Standards under the agencies' existing compliance cost estimates and the constant-performance assumption. As the agencies admit, not only is it possible that holding attributes constant will lead to other performance improvements, but it is "unavoidable" and "expected."[334] 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.[335] 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.[336] 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 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 acknowledge, many fuel economy technologies actually improve various performance attributes.[337] 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.[338] The agencies never monetize the value of any of these attributes associated with the Clean Car Standards.

B. The Agencies Fail to Consider How Ancillary Effects Could Swamp Much If Not All of Their Estimated Opportunity Costs

The agencies' identification of lost welfare from consumers purportedly purchasing vehicles with fewer other features ignores the important countervailing benefit of avoiding significant negative externalities that such features impose on society.

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.[339] 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.[340] Vehicles with features that allow faster acceleration also cause a greater number of and more consequential accidents.[341] Vehicles with internal combustion engines are more dangerous than those with electric engines due to the latter's additional crumple space.[342] Heavier vehicles also increase the cost of road maintenance and repair.[343] Vehicles with greater acceleration also may be driven in ways that consume more fuel and so emit more pollution.[344] And as discussed below (Section VI.C), 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.[345]

Ignoring such externalities is inconsistent with the position the agencies have now taken with respect to the indirect risks from "rebound" driving. "Rebound" miles are the additional miles that consumers can afford to and choose to drive once greater fuel economy lowers their fuel costs per mile driven. Such additional driving does carry some risks, such as slightly increased risks of accidents. The agencies claim it would be inconsistent to assume that drivers are rational and informed enough to internalize the risks of additional driving from the rebound effect, but not sufficiently rational and informed to weigh the fuel savings versus opportunity costs of purchasing vehicles with fuel economy versus other attributes.[346] However, the agencies in fact do *not* assume that drivers fully internalize all the risks of rebound driving, and they instead assume that consumers at least partly externalize the safety risks of their additional driving onto the other drivers and passengers with whom they share the road.[347] It therefore is inconsistent to count supposed opportunity costs from consumers not having the bigger, faster cars they supposedly want without also counting the externalities of those bigger, faster cars.[348]

Looking only at the benefits of allegedly forgone features without also accounting for the other side of the ledger, as the agencies have done, inappropriately puts a thumb on the scale in rolling back the Clean Car Standards.[349]

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

Even if the Clean Car Standards would have caused a reduction in other vehicle features compared to what would occur without the standards, and even if the agencies had reasonably estimated the amount consumers have historically been willing to pay for vehicles with those features, the agencies have not shown that a society-wide reduction in features will result in welfare losses that can be calculated by summing the average consumers' willingness to pay for those features. In fact, there are strong reasons to believe that society will not lose welfare when everyone forgoes some features. This is because the features that the agencies identify—such as horsepower and weight—are what the economics literature calls "positional goods."[350] And a fleetwide reduction of positional goods need not cause any aggregate loss of consumer welfare.[351]

Positional goods are goods for which the value to one individual depends on how it compares with similar goods possessed by others.[352] 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.[353] A growing body of research indicates that cars are positional goods;[354] 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.[355] According to a recent U.S. 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.[356]

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.[357]

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.[358] 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.[359] If consumers could maintain their *relative* position with respect to positional vehicle features, they might not suffer any welfare loss.[360]

Therefore, even if the Clean Car Standards were to reduce the availability of some features due to a tradeoff with fuel economy, they 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.[361]

Because of the positional nature of many vehicle features, the agencies cannot assume that rolling back the Clean Car Standards will improve welfare by allowing consumers to select a vehicle with more of those features and less fuel efficiency.[362] That consumers are individually willing to pay for positional features does not establish that a regulation that (purportedly) collectively reduces the provision of those features will cause consumers to lose aggregate welfare. As a result, the agencies have not supported any assumption that, even if there were a tradeoff between fuel efficiency and other features, such a tradeoff includes a corresponding welfare loss that justifies undercounting the economic value of fuel saved when calculating fuel savings benefits.

Conclusion

By rolling back the Clean Car Standards, the agencies have adopted a regulation that will result in significant additional fuel usage and greenhouse gas emissions. Reversing course, as the agencies have done, requires a nonarbitrary, well-reasoned analytical basis.[363] But even the agencies' own flawed modeling and analysis show that the net benefits of their rollback at best "straddle zero."[364] A proper and balanced analysis consistent with economic best practices and the agencies' historical regulatory practices would demonstrate that the benefits of the Clean Car Standards exceeded their costs by an even greater magnitude than the agencies admit.

To justify this rollback when the benefits are "directionally uncertain,"[365] the agencies claim they can focus their regulatory choice on avoiding the Clean Car Standards' "upfront costs"—meaning both the price of purchasing a more efficient vehicle and the unproven "opportunity cost" to consumers of supposedly having to forgo vehicle performance to achieve fuel economy.[366] The focus on upfront costs effectively ignores or devalues a sizeable chunk of the substantial longer-term lost fuel savings, as if consumers would not value having more money in their pockets in the future.[367] The agencies even nearly go so far as to claim that the possibility of opportunity costs—together with an unsubstantiated assertion that it may be perfectly rational for consumers to apply exceedingly high discount rates to future fuel savings—could explain away all private market failures and perhaps allow the agencies to ignore *all* the forgone consumer benefits of their rollback. The agencies muse at several points in the SAFE Rule about whether they could ignore all the rollback's "$26.1 billion in private losses to consumers," and focus instead only on the external gains they attribute to the rollback.[368] As a somewhat less extreme alternative, the agencies also propose as a sensitivity analysis that perhaps they can estimate opportunity costs by proxy, by arbitrarily subtracting away 42 months' worth of fuel savings—a significant portion of total fuel savings.[369] Only by significantly undercounting or entirely ignoring key benefits like fuel savings could the agencies' rollback finally start to appear cost-benefit justified.[370]

But even the agencies ultimately back away from completely dismissing market failures,[371] and their main cost-benefit tables fully value fuel savings.[372] And in any event, the agencies' suggestion that a theory of opportunity costs might support a focus on upfront costs while erasing a significant portion of consumer benefits is flawed at every step of the analysis. There is no evidence that hidden opportunity costs will occur: the agencies' analysis is theoretically and empirically flawed, and their own model already accounts for possible tradeoffs between fuel economy and other vehicle features and finds many fuel economy-technologies actually improve other vehicle attributes. Instead of such allegedly hidden opportunity costs, the economics literature shows that market failures explain the energy efficiency gap and so justify the use of efficient regulations to achieve private cost savings. Any undercounting of consumer benefits from fuel savings flies in the face of past practice across agencies over the last four decades under Administrations of both political parties and, further, is inconsistent with best practices for agency economic analysis. Finally, the agencies' attempt in their sensitivity analysis to quantify opportunity costs related to consumers' valuation of other vehicle characteristics does not withstand scrutiny, especially as the agencies ignore the effect of those other vehicle characteristics on compliance costs and externalities like safety effects.

In short, the agencies wrongfully cast doubt on well-established market failures and wave their hands toward arbitrary estimates of opportunity costs to justify an otherwise costly rollback. Their attempts fail, and the agencies cannot escape the reality that their rollback shortchanges consumers by depriving them of valuable fuel savings.

Endnotes

1 The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, 85 Fed. Reg. 24,174 (Apr. 30, 2020) [hereinafter Final Rule].

2 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62,624 (Oct. 15, 2012) [hereinafter Clean Car Standards].

3 *See* NHTSA, *Fact Sheet* 1, 4 (2012), https://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/CAFE_2017-25_Fact_Sheet.pdf (reporting that NHTSA's standards would reach a combined fleet-wide average of 48.7-49.7 mpg, while EPA's—if achieved all through fuel economy improvements and not air conditioning improvements—would hit 54.5 mpg by 2025, with an overall rate of improvement of about 4.7-4.9%). NHTSA also estimated that the Clean Car Standards "would lead to fuel savings totaling about 170 billion gallons throughout the lives of light duty vehicles sold in MYs 2017–2025" (worth up to $488 billion in savings), and "corresponding reductions in CO_2 emissions totaling 1.8 billion metric tons" (which would achieve $49 billion in economic benefits). 77 Fed. Reg. at 62,629.

4 Final Rule, *supra* note 1, 85 Fed Reg. at 24,176.

5 *Id.*

6 *Id.* at 24,176.

7 *See, e.g.,* Institute for Policy Integrity, Key Economic Errors in the Clean Car Standards Rollback 2 (2020), https://policyintegrity.org/files/media/Vehicles_Emissions_Rollback_-_Key_Economic_Errors.pdf [hereinafter "Key Errors"]; *see also* Institute for Policy Integrity et al., Comments on Quantifying and Monetizing Greenhouse Gas Emissions in the Safer Affordable Fuel-Efficient Vehicles Proposed Rule and Preliminary Regulatory Impact Analysis at 1-4 (Oct. 26, 2018), https://policyintegrity.org/documents/Emissions_Standards_PRIA_SCC_Comments_Oct2018.pdf [hereinafter "Joint SCC Comments"] (more fully explaining the underestimation of the social cost of carbon that persists in the Final Rule).

8 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,180-81, tables I-5 & I-6 (showing a low estimate of consumers' net present fuel costs of $1,110 under the CAFE standards at a 7% discount rate, and a high estimate of $1,461 under the CO_2 standards at a 3% discount rate; in all cases, consumers lose money per vehicle even after comparing fuel costs against more modest purchase price savings).

9 *Id.* at 25,054-55, tables VII-116 & VII-118 (reporting an increase of 867.2 million metric tons of carbon dioxide under the CO_2 standard and 922.5 million metric tons under the CAFE standard, as well as significant increases in methane and nitrous oxide). *But see* NHTSA, SAFE Rule Final Environmental Impact Statement 5-35 (2020) (reporting that the final standard, labeled "Alternative 3," will increase carbon dioxide emissions by 7,800 million metric tons over the next eighty years); *and see* Joint SCC Comments, *supra* note 7, at 1-4 (explaining that the agencies inaccurately and incompletely quantified emissions, especially upstream methane emissions).

10 *See, e.g.,* Institute for Policy Integrity, Comments on The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars & Light Trucks at 13-98 (Oct. 26, 2018), NHTSA-2018-0067-12213 and EPA-HQ-OAR-2018-0283-5083, *available at* https://policyintegrity.org/documents/Emissions_Standards_EPA_NHTSA_Comments_Oct2018.pdf [hereinafter Policy Integrity Oct. 2018 Comments]; Cal. Air Res. Bd., Analysis in Support of Comments on the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model years 2021-2026 Passenger Cars & Light Trucks at 188-282 (Oct. 26, 2018), https://www.regulations.gov/contentStreamer?documentId=NHTSA-2018-0067-11873&attachmentNumber=2&contentType=pdf; Mark Jacobsen & Arthur van Benthem, Comment on fleet turnover modeling in the Notice of Proposed Rulemaking for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars & Light Trucks (Oct. 8, 2018), https://www.regulations.gov/document?D=NHTSA-2018-0067-7788;. Antonio Bento, Comments on Notice of Proposed Rulemaking for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars & Light Trucks (Oct. 22, 2018), https://www.regulations.gov/document?D=NHTSA-2018-0067-11598; *see also* Cal. Air Res. Bd., *Expert Reports on Specific Subjects (Vehicle Technology, VMT, Scrappage, Consumer Behavior, Traffic Safety etc.)*, https://ww2.arb.ca.gov/expert-reports-specific-subjects-vehicle-technology-vmt-scrappage-consumer-behavior-traffic-safety (last visited May 26, 2020) (collecting 12 reports authored by multiple experts, including Dr. Kenneth Gillingham, Dr. David Greene, and Dr. David Bunch).

11 *See generally* NHTSA, CAFE Model Peer Review Revised (Jul. 2019), https://www.regulations.gov/contentStreamer?documentId=NHTSA-2018-0067-0055&attachmentNumber=2&contentType=pdf [hereinafter CAFE Peer Review].

12 EPA Science Advisory Board, 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 21 (Feb. 27, 2020), https://yosemite.epa.gov/sab/sabproduct.nsf/LookupWebReportsLastMonthBOARD/1FACEE5C03725F268525851F006319BB/$File/EPA-SAB-20-003+.pdf [hereinafter SAFE Rule SAB Review]

13 *See, e.g.,* Robinson Meyer, *The Trump Administration Flunked Its Math Homework*, Atlantic (Oct. 31, 2018), https://www.theatlantic.com/science/archive/2018/10/trumps-clean-car-rollback-is-riddled-with-math-errors-clouding-its-legal-future/574249/; Antonio Bento, Kenneth Gillingham, Mark. R. Jacobsen, Christopher R. Knittel, Benjamin Leard, Joshua Linn, Virginia McConnell, David Rapson, James M. Sallee, Arthur A. van Benthem, & Kate S. Whitefoot, *Flawed Analyses of U.S. Auto Fuel Economy Standards*, 362 Sci. 1119 (Dec. 7, 2018), https://doi.org/10.1126/science.aav1458.

14 *See* The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, Proposed Rule, 83 Fed. Reg. 42,986, 42,998 (Aug. 24, 2018) [hereinafter "Proposed Rule"].

15 Policy Integrity Oct. 2018 Comments, *supra* note 10, at 13-98.

16 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,176; *see also id.* at 25,119, 25,172 (admitting that the final rule does not maximize net social benefits, and explaining that instead the final rule was chosen to limit upfront costs).

17 *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1198 (9th Cir. 2008).

18 *See* Final Rule, *supra* note 1, 85 Fed. Reg. at 24,177, n.10, 24,701.

19 *See, e.g., id.* at 24,701-02, 25,110-11, 25,171.

20 *Id.* at 24,177 n.10 (claiming that if the agencies account for opportunity costs, then "the Final Rule would generate benefits . . . at 3% and 7% discount rates"). The agencies have performed other sensitivity analyses that show that the harms of the rule could actually be even worse than they appear in the main analysis. For example, if the Interagency Working Group's social cost of carbon estimates (central estimate at a 3% discount rate) are used instead of the agencies' dramatic underestimate of the costs of climate change, the rule is no longer net beneficial at the 7% discount rate, but instead causes $19-$27 billion in net costs. NHTSA & EPA, SAFE Rule Final Regulatory Impact Analysis at 1805, table VII-483, 1809, table VII-485 (Mar. 2020) https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/final_safe_fria_web_version_200330.pdf [hereinafter "FRIA"].

21 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,612-13 ("the agencies do not take a position in this rule on whether a fuel efficiency gap exists or constitutes a failure of private markets").

22 *See* Policy Integrity, Key Errors, *supra* note 7, at 2.

23 *Id.* at 1.

24 *See, e.g., id.* at 2 (explaining how the agencies are still overestimating accidents associated with the rebound effect).

25 Clean Air Act, § 202(a), 42 U.S.C. § 7521(a) (2020).

26 Energy Policy and Conservation Act, 49 U.S.C. § 32902(f) (2020); *see also* Proposed Rule, *supra* note 14, at 42,995, 43,015, 43,205 (explaining that EPCA requires NHTSA to set standards to conserve energy).

27 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule, 75 Fed. Reg. 25,324 (May 7, 2010) [hereinafter Model Year 2012-2016 Joint Standards].

28 Besides pollution, consumers also do not fully consider how their consumption of gasoline affects national importation of oil and the associated national security implications. Energy security is another externality that energy efficiency regulations can address.

29 Time saved refueling and the welfare benefits of additional driving through the "rebound effect" are important consumer benefits. For example, the rebound effect means that a consumer can drive a more efficient vehicle a few miles farther than a less efficient car on the same $20 of gasoline—and may choose to drive more as a result. This extra driving produces consumer benefits but may come with some costs such as fuel usage and externalities. The agencies have continued to make analytical errors in estimating the rebound effects, the refueling time effect, and associated costs and benefits. *See, e.g.,* Policy Integrity, Key Errors, *supra* note 7, at 2. However, for simplicity, this report will focus on fuel savings as the most important consumer benefit. Note also that, even if fuel savings were not considered a private consumer benefit, they would still represent real resources saved and so also create a benefit from the perspective of society. *See infra* Section V.E.

30 *See* David Greene, Anushah Hossain, Julia Hofmann, Gloria Helfand & Robert Beach, *Consumer Willingness to Pay for Vehicle Attributes: What Do We Know?*, 118 Transp. Res. Part A: Pol'y & Prac. 258 (2018), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6260949/ (meta-analysis of the academic literature regarding consumers' willingness to pay for fuel economy and other attributes).

31 Gloria Helfand & Ann Wolverton, *Evaluating the Consumer Response to Fuel Economy: A Review of Literature*, 5 Int'l Rev. Envtl. & Res. Econ. 103, 128-30 (2011), https://www.nowpublishers.com/article/Details/IRERE-0040 ("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."). Fuel efficiency improvements also save consumers time by reducing the need to refuel the vehicle and can save consumers in maintenance costs. A rational consumer would also take these time and maintenance cost savings into account when making a vehicle purchase decision.

32 Greene et al., *supra* note 30, at 270-71.

[33] Nat'l Res. Council, Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles 317 (2015), http://nap.edu/21744.

[34] Helfand & Wolverton, *supra* note 31, at 126 ("Th[e] disconnect between net present value estimates of energy-conserving cost savings and what consumers actually spend on energy conservation is often referred to as the Energy Paradox."); Nat'l Res. Council, *supra* note 33, at 312. There is an extensive academic literature on the causes of the energy efficiency gap and what precisely is meant by "the energy efficiency gap." *See* Adam B. Jaffe & Robert N. Stavins, *The Energy-Efficiency Gap: What Does it Mean?*, 22 Energy Pol'y 804 (1994). For clarity, this report uses the term to mean the difference between the net present value of energy savings from efficiency improvements and the amount consumers are willing to pay *ex ante* for those efficiency improvements.

[35] Clean Car Standards, *supra* note 2.

[36] 49 U.S.C. § 32902(b)(3)(B) (prohibiting NHTSA from issuing standards for more than 5 model years at a time).

[37] NHTSA's MY 2022-2025 standards are sometimes referred to as "augural standards." *See* Clean Car Standards, *supra* note 2, 77 Fed. Reg. at 62,629-30 n.8.

[38] NHTSA, Fact Sheet, *supra* note 3, at 4; EPA, Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards at 10-4, Table 10-4 (2012). The particular standards vary by automaker and depend on the mix of vehicles sold each year. Each automaker must meet an emissions standard based on the emissions from the fleet of vehicles that they sell. Each vehicle in the fleet has an emissions "target" based on the size of the vehicle and whether the vehicle is a car or a light truck. Larger vehicles and light trucks have more lenient targets. If an automaker cannot meet its standard, it can buy credits from other automakers that have more than met their standard in previous years.

[39] EPA, Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards (2012); NHTSA, Final Regulatory Impact Analysis: Corporate Average Fuel Economy for MY 2017-MY 2025 Passenger Cars and Light Trucks (2012); EPA & NHTSA, Joint Technical Support Document: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards (2012).

[40] Clean Car Standards, *supra* note 2, 77 Fed. Reg. at 62,629 (reporting that EPA's CO2 standards would achieve $451 billion in lifetime net benefits at a 3% discount rate, or $326 billion at a 7% discount rate).

[41] *Id.* at 62,652.

[42] *Id.*

[43] 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 12-74, 13-102 (2016), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100OXEO.PDF?Dockey=P100OXEO.PDF [hereinafter Draft TAR].

[44] *Id.* at 4-26 to 4-36; 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 4-1 to 4-55 (2016), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3L4.pdf [hereinafter Midterm TSD]; *see also* EPA, Proposed Determination at 26, A-43 to A-61 (2016), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100Q3DO.pdf [hereinafter Proposed Determination]; EPA, Final Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation: Response to Comments at 127, 130-31 (2017), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100QQ9Y.pdf [hereinafter Response to Comments].

[45] *See* Draft TAR, *supra* note 43, at 2-8 (citing the NRC report as a key source); *See generally* Nat'l Res. Council, *supra* note 33.

[46] *See* EPA, Final Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation at 29 (2017), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100QQ91.pdf [hereinafter 2017 Final Determination]. EPA's Final Determination relied on substantial additional technical and economic analysis that built upon the analysis in the TAR, as well as public comments on the TAR and the Proposed Determination. EPA, Proposed Determination, *supra* note 44; EPA, Midterm TSD, *supra* note 44; EPA, Response to Comments, *supra* note 44.

[47] EPA, 2017 Final Determination, *supra* note 46, at 30.

[48] Mid-Term Evaluation of Greenhouse Gas Emissions Standards for Model Year 2022-2025 Light-Duty Vehicles, 83 Fed. Reg. 16,077, 16,078 (Apr. 13, 2018) [hereinafter Revised Final Determination]. The conclusion that the Clean Car Standards were "not appropriate" was not supported by the evidence. *See* Bethany Davis Noll, Peter Howard & Jeffrey Shrader, Institute for Policy Integrity, Analyzing EPA's Vehicle-Emissions Decisions: Why Withdrawing the 2022-2025 Standards Is Economically Flawed (2018), https://policyintegrity.org/files/publications/Analyzing_EPAs_Fuel-Efficiency_Decisions_Policy_Brief.pdf. In litigation over this decision, the U.S. Court of Appeals for the D.C. Circuit made clear that EPA must consider the evidence developed for the Midterm Evaluation in any final rule changing the Clean Car Standards. *California v.*

Environmental Protection Agency, 940 F.3d 1342, 1351 (D.C. Cir. 2019) (holding that the withdrawal of the 2017 Final Determination was not a final agency action subject to judicial review, but reminding EPA that any final regulatory changes will require a reasoned explanation for disregarding the facts underlying the record developed during the midterm valuation process).

49 Revised Final Determination, *supra* note 48, 83 Fed. Reg. at 16,087.

50 Proposed Rule, *supra* note 14, 83 Fed. Reg. at 42,986.

51 NHTSA & EPA, Preliminary Regulatory Impact Analysis: The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021-2026 Passenger Cars and Light Trucks 1004 (Aug. 23, 2018) [hereinafter PRIA]; Proposed Rule, *supra* note 14, 83 Fed. Reg. at 43,095.

52 Policy Integrity Oct. 2018 Comments, *supra* note 10, at 62-79.

53 Vehicle miles traveled may nonetheless increase for the separate reason that more efficient vehicles have lower operating costs, which allows consumers to drive more for the same cost. This "rebound effect" was included separately in the agencies' analysis. While conceptually correct, the agencies' proposed and final rules are also flawed because they substantially overestimate the level of the rebound effect. *See id.* at 99-125; Policy Integrity, Key Errors, *supra* note 7, at 2.

54 Sarah E. West, *Distributional Effects of Alternative Vehicle Pollution Control Policies*, 88 J. Pub. Econ. 735, 739-40 (2004); Lucas W. Davis, *Durable Goods and Residential Demand for Energy and Water: Evidence from a Field Trial*, 39 RAND J. Econ. 530, 532-33 (2008).

55 *See* Policy Integrity Oct. 2018 Comments, *supra* note 10, at 59-98.

56 *See, e.g.,* Cal. Air Res. Bd., Expert Reports, *supra* note 10 (collecting 12 reports authored by multiple experts). NHTSA's own peer review of the new modeling "raises fundamental issues regarding the model's specification and implementation." NHTSA, CAFE Peer Review, *supra* note 11, at B-3.

57 Robinson Meyer, *supra* note 13; *see also* Bento et al., *supra* note 13.

58 *See* PRIA, *supra* note 51, at 12 (indicating that the reference case counts 100% of consumer benefits).

59 *Id.* at 1531; *see also id.* at 12; Proposed Rule, *supra* note 14, 83 Fed. Reg. at 43,353 (briefly mentioning but not explaining the rationale for the sensitivity cases).

60 PRIA, *supra* note 51, at 943, 1091, 1097.

61 One of the authors the agencies rely on for their analysis, "Whitefoot," *see id.* 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 at 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.").

62 Draft TAR, *supra* note 43, at 4-36.

63 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.

64 PRIA, *supra* note 51, at 1097; *see also id.* at 1531-34 (not listing an opportunity cost sensitivity analysis).

65 Final Rule, *supra* note 1.

66 Compare NHTSA, Fact Sheet, *supra* note 3, with Final Rule, *supra* note 1, 85 Fed. Reg. at 24,175.

67 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,180-81, tables I-5 & I-6 (showing a low estimate of consumers' net present fuel costs of $1,110 under the CAFE standards at a 7% discount rate, and a high estimate of $1,461 under the CO2 standards at a 3% discount rate; in all cases, consumers lose money per vehicle even after comparing fuel costs against more modest purchase price savings).

68 *Id.* at 25,054-55, tables VII-116 & VII-118 (reporting an increase of 867.2 million metric tons of carbon dioxide under the CO2 standard and 922.5 million metric tons under the CAFE standard, as well as significant increases in methane and nitrous oxide). *But see supra* note 9 for important caveats about why emissions may be underestimated.

69 Final Rule, *supra* note 1, 85 Fed. Reg. at 25,107-08 (discussing over-compliance under various alternatives).

70 *See id.* at 24,232 (summarizing EDF's criticism of the over-compliance assumption).

71 *See, e.g.,* Policy Integrity, Key Errors, *supra* note 7, at 2 (noting the continued errors in estimating rebound-related safety effects, among other errors).

72 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,176.

73 *Id.*

74 The average across the two discount rates for each regulatory program would suggest negative $7.8 billion for the CO_2 program versus positive $1.5 billion for the CAFE program.

And there are, in fact, many reasons to favor the calculations at the 3% discount rate. *See, e.g.,* EPA, Guidelines for Preparing Economic Analyses 6-18, 19 (Dec. 17, 2010), https://www.epa.gov/sites/production/files/2017-08/documents/ee-0568-50.pdf [hereinafter EPA Guidelines] (explaining that for policies with long time horizons, when benefits stretch out over fifty years or more, a 3% consumption rate of interest should be the primary choice of discount rate, as well as other approach like a declining discount rate schedule).

75 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,176.

76 *See, e.g.,* Policy Integrity, Key Errors, *supra* note 7, at 2; *see also* Joint SCC Comments, *supra* note 7 (more fully explaining the underestimation of the social cost of carbon that persists in the Final Rule).

77 Final Rule, *supra* note 1, 85 Fed. Reg. at 25,099.

78 *See, e.g., id.* at 24,604 (defining "up-front costs" to include the "opportunity cost of any other desirable feature"); *id.* at 25,171 (same); *id.* at 25,111, n.2479 (discussing EPA's focus on upfront costs and then citing to the sensitivity case's analysis of opportunity costs); *id.* at 25,109 (explaining that EPA considers any "significant impact on vehicle utility and performance" when considering consumer costs); *id.* at 25,120 (basing EPA's regulatory decision on hard-to-quantify costs); *id.* at 24,214 (weighing "consumer demand for . . . other vehicle attributes" as part of NHTSA's statutory factors); *id.* at 25,141 (referencing "upfront . . . tradeoffs" in balancing NHTSA's statutory factors).

79 *See, e.g., id.* at 25,171 (comparing NHTSA's focus on upfront costs, including opportunity costs, to its skepticism that fuel savings exist that consumers could not purchase on their own); *id.* at 25,110-11, n.2479 (claiming that valuing lifetime fuel saving on equal footing with upfront costs "distorts the comparison," and then citing to the sensitivity case's analysis of opportunity costs). A focus on upfront costs, while devaluing longer term costs, is analytically equivalent to using an extremely high (and unjustified) discount rate.

80 *See, e.g.,* Office of Mgmt. & Budget, Circular A-4: Regulatory Analysis at 9 (2003) ("In undertaking these analyses, it is important to keep in mind the larger objective of analytical consistency."); *id.* at 33 (recommending a 3% discount rate for regulations that "primarily and directly affect[ ] private consumption (e.g., through higher consumer prices for goods and services").

81 *See infra* Section III.

82 *See infra* Section IV.

83 *See infra* note 85.

84 *See* Final Rule, *supra* note 1, 85 Fed. Reg. at 24,201-08 (counting "retail fuel savings" as a forgone social benefit of the rollback).

85 *Id.* at 24,612 ("If either case is true—that the analysis is incomplete regarding consumer valuation of other vehicle attributes or discount rates used in regulatory analysis inaccurately represent consumers' time preferences—no market failure would exist to support the hypothesis of a fuel efficiency gap. In either case, the agencies' central analysis would overstate both the net private and social benefits from adopting more stringent fuel economy and CO_2 emissions standards. . . . Because government action cannot improve net social benefits in the absence of a market failure, if no market failure exists to motivate the $26.1 billion in private losses to consumers, the net benefits of these final standards would be $42.2 billion."); *see also id.* at 24,701 (same); FRIA, *supra* note 20, at 1011 (same); *id.* at 116 (touting that, as opposed to consideration of private costs and benefits, "external net benefits—those incremental reductions and increases in the harms associated with market failure upon which there is little disagreement or doubt—are higher for less stringent alternatives").

86 Final Rule, *supra* note 1, 85 Fed. Reg. at 25,110-1, n.2479 (citing to the sensitivity case's implicit opportunity cost analysis).

87 *Id.* at 24,701-02 (explaining that the proxy estimate is based on "fuel savings over the first seventy-two months (less the first thirty months").

88 *See id.* at 24,177 n.10.

89 By hidden opportunity costs, we refer to attribute tradeoffs that allegedly are not already accounted for in the agencies' model, which already assumes additional technology costs sufficient to hold vehicle performance and features constant without trading off attributes against fuel economy.

90 The agencies talk about not just the value of forgone attributes but also about getting consumers back "savings" that they could spend on entirely different, non-vehicle goods. *Id.* at 24,702. The agencies never explain what "savings" they are possibly referring to or how any "savings" could occur other than what is already reflected in the technology cost savings estimate in the primary analysis.

91 *Id.* at 24,604.

92 *Id.* at 24,612.

93 *Id.* at 24,612-13 (refusing to fully adopt the position that no market failures exist and the energy efficiency gap is due solely to constrained optimization).

94 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

[95] 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."); Helfand & Wolverton, *supra* note 31, at 129-130 ("[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.").

[96] *See, e.g.,* Draft TAR, *supra* note 43, at 4-35 to 4-36 (citing numerous examples of fuel economy technologies that also improve other features); EPA, Proposed Determination, *supra* note 44, at A-49 ("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 95, 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.").

[97] Final Rule, *supra* note 1, 85 Fed. Reg. at 24,612 (also explaining that the "central analysis" in the Final Rule "does not account for the possibility that imposing stricter standards may require manufacturers to make sacrifices in other vehicle features that compete with fuel economy, and that some buyers may value more highly").

[98] *Id.* at 24,706.

[99] 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.

[100] 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.").

[101] Helfand & Wolverton, *supra* note 31, at 130 ("Only if there are limits on the total amount of efficiency that can go in a vehicle does economic theory predict that the marginal benefit of fuel economy should not equal its marginal cost.").

[102] *See* Final Rule, *supra* note 1, 85 Fed. Reg. at 25,109; accord. *id.* at 25,115; *see also id.* at 24,612 ("As such, it is not necessary that purchasers do not value lifetime fuel savings—and, in all likelihood, purchasers would prefer vehicles with better fuel efficiency and all of their preferred attributes—but rather consumers are forced to choose between fuel economy and other vehicle attributes while weighing how much each attribute contributes to the total cost of the vehicle.").

Note, for example, that in the FRIA, *supra* note 20, at 314, table VI-23 lists attributes that "could be impacted," but the table does not present evidence of such tradeoffs (i.e., it says "could be," not "are impacted"), nor do the agencies adequately explain why there would be such real-world engineering constraints.

[103] *See* FRIA, *supra* note 20, at 326 (explaining that multiple options exist for "technology [to] provide both improved fuel economy and performance").

[104] *Id.* ("[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.").

[105] *Id.* ("Another example is applying a small amount of mass reduction that improves both fuel economy and performance by a small amount.").

[106] *Id.* at 239 (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.

[107] *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").

[108] *See* Comment by the International Council on Clean Transportation (ICCT) at II-11 to II-16, NHTSA-2018-0067-11741 and EPA-HQ-OAR-2018-0283-5456 (Oct. 25, 2018), *available at* https://www.regulations.gov/contentStreamer?documentId=NHTSA-2018-0067-11741&attachmentNumber=3&contentType=pdf (discussing how technologies such as 10-speed engines, variable valve and direction injection, turbocharging, lightweighting, and high-volt hybridization simultaneously and necessarily improve both fuel economy and features such as performance); *see also* FRIA, *supra* note 20, at 322-27 (discussing comments from CARB, ICCT, and others on how the CAFE model's constant-performance assumption overcorrected in ways that would increase performance, particularly with respect to electric vehicles' acceleration).

For yet other technologies, the agencies offer no plausible theory for how any possible performance tradeoffs would occur: how would more efficient LED lighting, for example, ever be associated with changes to handling or acceleration? *See* EPA, Proposed Determination, *supra* note 44, at A-55.

[109] *See* Draft TAR, *supra* note 43, at 4-35 to 4-36; EPA, Proposed Determination, *supra* note 44, at A-49 (citing evidence presented from Ford about the F-150).

[110] FRIA, *supra* note 20, at 329.

[111] *Id.* The agencies do not seem to provide data on how the final rule, as opposed to the proposed rollback, fares with respect to acceleration.

[112] *Id.* at 303 ("[C]ertain attributes were held at constant levels within each technology class to maintain vehicle functionality, performance and utility including noise, vibration, and harshness (NVH), safety, performance and other utilities important for customer satisfaction. For example, in addition to the vehicle performance constraints discussed in Section VI.B.3.a)(6), the analysis does not allow the frontal area of the vehicle to change, in order to maintain utility like ground clearance, head-room space, and cargo space, and a cold-start penalty is used to account for fuel economy degradation for heater performance and emissions system catalyst light-off.").

[113] *Id.* at 318 (explaining that low-speed acceleration, high-speed acceleration, gradeability, and towing capacity are held constant).

[114] Note that the constant-performance assumption is applied to estimate technology costs under both the baseline and the regulatory alternatives. If the agencies wanted to try to model actual opportunity costs, they would first have to model an alternative baseline that would allow for cost-reducing tradeoffs as well as technological advancement.

[115] *Id.* at 318-19. The agencies have long used this constant-performance cost assumption in their model, and the approach has been endorsed by manufacturers as reasonable. *Id.* at 320. For their part, environmental organizations have complained that the assumption results in an overestimate of costs and, in fact, overcorrects and improves vehicle performance. *Id.* at 322-27.

[116] *Id.* at 317 (emphasis added).

[117] *Id.* at 316 ("The agencies believe that any minimal remaining differences, which may directionally either improve or degrade vehicle attributes, utility and performance are small enough to have de minimis impact on the analysis.").

[118] *Id.* ("any minimal remaining differences, *which may directionally either improve or degrade vehicle attributes*") (emphasis added).

[119] *See supra* notes 103-108 and accompanying text.

[120] PRIA, *supra* note 51, at 943 ("[B]y using a reference fleet from a previous model year (2016), the analysis does not incorporate the normal gradual improvements in vehicle technology that enable slow but steady increases in fuel economy and other features that buyers value.").

[121] *Id.* (first explaining that "the estimates of the cost to improve the fuel economy of the reference fleet to meet higher CAFE standards during future model years may overstate the incremental cost of the additional technology that would be required," then mentioning possible opportunity costs, and concluding "it is difficult to anticipate the net effect of these over- and under-estimates," suggesting that the over-estimated technological costs could almost—or perhaps even completely—offset any possible underestimated opportunity costs).

[122] Final Rule, *supra* note 1, 85 Fed. Reg. at 24,702.

[123] Thomas Klier & Joshua Linn, *The Effect of Vehicle Fuel Economy Standards on Technology Adoption*, 133 J. Pub. Econ. 41, 49 (2016). The study did find statistically significant effects for European cars, but the magnitude of the effects was "relatively small." *Id.* at 51.

[124] *Id.* at 50 (reporting an effect for cars in just one of three time periods analyzed, and an effect for trucks that decreased almost to statistical insignificance over time; the overall effect for cars is smaller than for trucks).

[125] *Compare* Final Rule, *supra* note 1, 85 Fed. Reg. at 24,703, table VI-185 (citing results from "Knittel" as 0.26% for cars-HP, 0.08% for cars-torque, 0.39% for cars-weight, 0.06% of trucks-HP, 0.31% for trucks-torque, and 0.36% for trucks-weight) *with* Christopher Knittel, *Automobiles on Steroids: Product Attribute Trade-Offs and Technological Progress in the Automobile Sector*, 101 Am. Econ. Rev. 3368, 3379 (2012) (explaining that "I focus on [results from] Model 3"); *id.* at 3381 (reporting Model 3 results for cars as 0.262 for HP but 0.045 for torque (not 0.08) and 0.419 for weight (not 0.39), and listing no set of results that matches the agencies' data); *id.* at 3383 (similarly reporting slightly different results for trucks). *But see* Christopher Knittel, *Automobiles on Steroids* (Ctr. for the Study of Energy Mkts., Working Paper No. 187, 2009), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.362.4558&rep=rep1&type=pdf at 30

(reporting results for cars that, in Model 2, do match the agencies' data); *id.* at 32 (reporting results for trucks that, in Model 2, do match the agencies' data).

126 *See* Knittel (2012), *supra* note 125, at 3381 (showing that the results for cars' torque were not statistically significant; *id.* at 3383 (showing that the results for trucks' horsepower were only statistically significant at the 10% level); *see also* Knittel (2009) *supra* note 125, at 32 (reporting that the results for trucks' horsepower were not statistically significant even at the 10% level).

127 FRIA, *supra* note 20, at 1015.

128 Klier & Linn, *supra* note 123, at 46 ("[A] 1% increase in horsepower increases the log fuel consumption rate by about 0.24.").

129 *Compare* PRIA, *supra* note 51, at 1091, table 8-31 *with* FRIA, *supra* note 20, at 1015, table VI-220.

130 Draft TAR, *supra* note 43, at 4-30.

131 *Id.* at 4-29 to 4-32; *see also* EPA, Midterm TSD, *supra* note 44, at 4-4 to 4-7. The Midterm Evaluation's critiques of MacKenzie and Heywood include that even their acceleration data does not reflect consumers' actual experience of performance, which is more about handling, cornering, and so forth; that tradeoffs based on historic data may not apply to newer technologies; and their failure to consider how the standards themselves can affect the rate of technological innovation.

132 Draft TAR, *supra* note 43, at 4-30 ("In these studies, a large vehicle with significant mass reduction and improved fuel economy would show up in the data to have the same attributes as a small efficient car, though consumers would view them very differently."). Assumptions about holding constant other attributes, like manual transmission and turbocharging, might also have skewed some of the results in these works.

133 *Id.* at 4-30, 4-31 to 4-32; *see also* Proposed Determination, *supra* note 44, at A-50 (explaining that studies of attribute tradeoffs have not been "capable of distinguishing between innovation and adoption).

134 Draft TAR, *supra* note 43, at 4-30 (also explaining that, with respect to weight, "In these studies, a large vehicle with significant mass reduction and improved fuel economy would show up in the data to have the same attributes as a smaller efficient car, though consumers would view them very differently."). *See also* Gloria Helfand et al., EPA, Power and Fuel Economy Tradeoffs, and Implications for Benefits and Costs of Vehicle Greenhouse Gas Regulations at 7 (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 [hereinafter Helfand et al. Powerpoint] (questioning whether people really care about horsepower, or just acceleration); Kate S. Whitefoot, Meredith L. Fowlie & Steven J. Skerlos, *Compliance by Design: Influence of Acceleration Trade-Offs on CO_2 Emissions and Costs of Fuel Economy and Greenhouse Gas Regulations*, 51 Envtl. Sci. & Tech. 10,307, 10,308 (2018), *available at* https://www.regulations.gov/contentStreamer?documentId=NHTSA-2018-0067-11903&attachmentNumber=1&contentType=pdf ("A[nother] concern [with Klier and Linn 2016] is that correlations between attributes of interest (e.g., energy efficiency) and attributes that are difficult to quantify or otherwise unobservable in historical data (e.g., vehicle shape) can make it difficult to identify attribute tradeoffs econometrically."). Even MacKenzie & Heywood focus on acceleration and not handling, Draft TAR, *supra* note 43, at 4-31.

135 Draft TAR, *supra* note 43, at 4-31 ("Manufacturers do not produce vehicles with all possible combinations of horsepower, fuel economy, and weight; instead, the vehicles they produce include a mix of those characteristics that the companies believe consumers prefer. . . . As a result, the tradeoff estimates may not represent strictly technological tradeoffs, but also manufacturer choices that potentially bias tradeoff estimates"). *See also* Helfand et al. Powerpoint, *supra* note 134, at 7 ("The data are not a random sample of all possible combination of power & fuel economy: Only vehicles produced."); Whitefoot, Fowlie & Skerlos, *supra* note 134, at 10,308 ("One limitation of this approach [by Klier and Linn 2016] is that many combinations of product attributes are not observed in the marketplace, but are technologically feasible and potentially optimal under future policy scenarios.").

136 Proposed Determination, *supra* note 44, at A-49.

137 Comments from Environmental Defense Fund at 86-89 (Oct. 26, 2018), https://www.regulations.gov/contentStreamer?documentId=NHTSA-2018-0067 12108&attachmentNumber=3&contentType=pdf; Policy Integrity Oct. 2018 Comments, *supra* note 10, at 50. Comments from Michalek & Whitefoot, *supra* note 61, at 9-10.

138 Draft TAR, *supra* note 43, at 4-26 to 4-36; Proposed Determination, *supra* note 44, at A-48 to A-51.

139 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 (2018); 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 (2016).

140 Helfand et al Powerpoint, *supra* note 134; Hsing-Hsiang Huang, Gloria Helfand & Kevin Bolon, EPA, Consumer Satisfaction with New Vehicles Subject to Greenhouse Gas and Fuel Economy Standards (Powerpoint Presentation, 2018), https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2018-0283-6963&attachmentNumber=1&contentType=pdf; Hsing-Hsiang Huang et al., Re-Searching for Hid-

den Costs with Producer Heterogeneity (Powerpoint Presentation, 2017), https://www.regulations.gov/contentStreamer?documentId=NHTSA-2018-0067-11768&attachmentNumber=2&contentType=pdf.

141 *See supra* notes 137-140.

142 Helfand et al. (2016), *supra* note 139, at 605 ("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.").

143 Helfand et al. Powerpoint, *supra* note 134, at 17 ("The tradeoff between power & fuel economy has dropped over time.").

144 Antonio M. Bento, Kenneth Gillingham, Mark. R. Jacobsen, Christopher R. Knittel, Benjamin Leard, Joshua Linn, Virginia McConnell, David Rapson, James M. Sallee, Arthur A. van Benthem, & Kate S. Whitefoot, *Flawed Analysis of U.S. Auto Fuel Economy Standards*, 362 Sci. 1119, 1119 (2018), https://doi.org/10.1126/science.aav1458.

145 Draft TAR, *supra* note 43 & Midterm TSD, *supra* note 44, at 4-20, discussing, e.g., Hsing-Hsiang Huang, Gloria Helfand, Kevin Bolon, Robert Beach, Mandy Sha, & Amanda Smith, *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").

146 EPA, 2019 Automotive Trends Report 30 (2020), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100YVFS.pdf. *See also* Policy Integrity Oct. 2018 Comments, *supra* note 10 at 46 (showing data from 1994-2017 and including acceleration as well as horsepower and weight).

147 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,703-05 (attempting to use historical differences in the rates of technological increases as evidence of future tradeoffs between fuel economy and other attributes).

148 *See* Midterm TSD, *supra* note 44, at 2-247 to 2-249, 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, Response to Comments, *supra* note 44, at 127 ("[F]uel economy and other vehicle attributes are not mutually exclusive, so there is no necessary tradeoff between fuel economy and other vehicle attributes.").

149 *See* Midterm TSD, *supra* note 44, at 4-7 (citing Don McKenzie & John Heywood, *Quantifying Efficiency Technology Improvements in U.S. Cars from 1975-2009*, 157 Applied Energy 918 (2015)).

150 *See* Helfand et al. Powerpoint, *supra* note 134, at 13.

151 Bento et al., *supra* note 144, at 1119; Erik Hille & Patrick Möbius, *Environmental Policy, Innovation, and Productivity Growth: Controlling the Effects of Regulation and Endogeneity*, 73 Envtl. & Res. Econ. 1315, 1316, 1328 (2019).

152 Draft TAR, *supra* note 43, at 4-32 to 4-34.

153 *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).

154 PRIA, *supra* note 51, at 1091.

155 *Id.* at 1097.

156 SAFE Rule SAB Review, *supra* note 12, at 22 ("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.").

157 *See* Final Rule, *supra* note 1, 85 Fed. Reg. at 24,201-08 (counting "retail fuel savings" as a forgone social benefit of the rollback). *But see id.* at 24,613 (expressing "reservations" about market failures and suggesting the energy efficiency gap is "of smaller magnitude than the agencies found in previous analyses").

158 *Id.* at 24,612 ("If either case is true—that the analysis is incomplete regarding consumer valuation of other vehicle attributes or discount rates used in regulatory analysis inaccurately represent consumers' time preferences—no market failure would exist to support the hypothesis of a fuel efficiency gap. In either case, the agencies' central analysis would overstate both the net private and social benefits from adopting more stringent fuel economy and CO2 emissions standards. . . . Because government action cannot improve net social benefits in the absence of a market failure, if no market failure exists to motivate the $26.1 billion in private losses to consumers, the net benefits of these final standards would be $42.2 billion."); *see also id.* at 24,701 (same); FRIA, *supra* note 20, at 1011 (same); *id.* at 116 (touting that, as opposed to consideration of private costs and benefits, "external net benefits—those incremental reductions and increases in the harms associated with market failure upon which there is little disagreement or doubt—are higher for less stringent alternatives").

159 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,608, 24,610-12 (using opportunity costs and high discount rates as theories to explain away market failures like loss aversion, positional externalities, myopia, and satisficing, and also claiming that purchase prices are underestimated by engineering studies).

160 *Id.* at 24,611.

161 *See* Knittel (2012), *supra* note 125 (not mentioning the energy efficiency paradox); Klier & Linn, *supra* note 123 (same); *see also* Don McKenzie & John Heywood, *Quantifying Efficiency Technology Improvements in U.S. Cars from 1975-2009*, 157 Applied Energy 918 (2015) (same).

[162] Final Rule, *supra* note 1, 85 Fed. Reg. at 24,610 ("Most obviously, it does not acknowledge the possibility that engineering studies systematically underestimate costs to produce vehicles with higher fuel economy.").

[163] For example, the failure to fully model flexible compliance options and incomplete pass-through of costs to consumers. *See* Policy Integrity, Key Errors, *supra* note 7, at 1; Policy Integrity Oct. 2018 Comments, *supra* note 10, at 13-31.

[164] *See* Final Rule, *supra* note 1, 85 Fed. Reg. at 24,605 (reporting that, in one of the agencies' three preferred studies (Allcott & Wozney), consumers are only fully valuing future fuel savings if consumers were applying "discount rates of 24 percent or higher.").

[165] *See* Office of Mgmt. & Budget, Circular A-4, *supra* note 80, at 33.

[166] The best the agencies offer is to summarize three studies and find that, if consumers use a discount rate of 5-6%, they "value at least half—and perhaps all—of the savings in future fuel costs." Final Rule, *supra* note 1, 85 Fed Reg. at 24,606. Public comments extensively critiqued the agencies' exclusive reliance on those three studies. *See, e.g.,* Policy Integrity Oct. 2018 Comments, *supra* note 10, at 33-50. *See also* SAFE Rule SAB Review, *supra* note 12, at 20 ("A more recent working paper by Leard et al. (2017) with a somewhat similar research design produces a much lower estimate of consumer valuation of fuel economy than reported by the three original published studies.") (citing Benjamin Leard, Joshua Linn & Yichen Zhou, *How Much Do Consumers Value Fuel Economy and Performance? Evidence from Technology Adoption* (Res. for Future Report, June 2017), https://media.rff.org/documents/RFF-Rpt-WTP_FuelEconomy26Performance.pdf); Antonio M. Bento et al., *Estimating the Costs and Benefits of Fuel-Economy Standards*, in Environmental and Energy Policy and the Economy, vol. 1 (Matthew J. Kotchen et al., eds., 2020) ("The empirical literature that provides estimates for [consumer valuation of fuel savings] continues to evolve, with some studies . . . suggesting substantial amounts of undervaluation.").

[167] *See, e.g.,* Klier & Linn, *supra* note 123, at 52-53 & n.15 (conducting a "back-of-the-envelope" comparison which showed that even if U.S. fuel economy standards had been significantly more stringent and even if U.S. consumers only valued future fuel savings at a 10% discount rate, willingness to pay for allegedly lost horsepower would only offset around half of fuel savings). In other words, this study, which the agencies rely heavily on for evidence, suggests that even opportunity costs and high discount rates together cannot fully explain the energy efficiency gap. *See also id.* at 52-53 (reporting that for European cars, the opportunity cost of lost attributes is less than 15% of the value of fuel savings). Thus, Klier & Linn (2016) does not support the agencies' assertions that there is no energy efficiency gap.

[168] Final Rule, *supra* note 1, 85 Fed. Reg. at 24,706-07.

[169] *See* Office of Mgmt. & Budget, Circular A-4, *supra* note 80, at 11 (connecting interest rates and discount rates); EPA Guidelines, *supra* note 74, at 6-7 (same).

[170] Final Rule, *supra* note 1, 85 Fed. Reg. at 24,609-10.

[171] *See* Draft TAR, *supra* note 43, at 6-5 to 6-9; EPA, Proposed Determination, *supra* note 44, at A-27 to A-34; Helfand & Wolverton, *supra* note 31, at 124-40 (reviewing the literature regarding justifications for the energy paradox); Todd D. Gerarden et al., *Assessing the Energy-Efficiency Gap*, 55 J. Econ. Literature. 1486, 1487-88 (2017) (listing traditional and behavioral market failures); *see also*, e.g., Policy Integrity Oct. 2018 Comments, *supra* note 10, at 38-40 (explaining reasons for the energy efficiency gap).

[172] James Sallee, *Rational Inattention and Energy Efficiency*, 57 J. Law & Econ. 781, 782-85 (2014).

[173] Helfand & Dorsey-Palmateer, *supra* note 95, at 439.

[174] David L. Greene, *Consumers' Willingness to Pay for Fuel Economy and Implications for Sales of New Vehicles and Scrappage of Used Vehicles,* Environmental Defense Fund 5 (Oct. 21, 2018), https://www.edf.org/sites/default/files/CARB_Report_Greene_UTenn_Consumer_Behavior_Modeling.pdf (describing behavioral economic explanations for the fuel efficiency paradox, including loss aversion).

[175] Nat'l Research Council, *supra* note 33, at 319 (2015) (explaining that manufacturers may face a first-mover disadvantage for developing new fuel-efficiency technologies, and regulation can help overcome that perceived disadvantage as well as bring down costs through economies of scale and learning, and thus may "lead to a more optimal provision of fuel economy in the marketplace").

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

[177] Gerarden et al., *supra* note 171, at 1489-90, 1503 (reviewing the academic literature assessing the fuel efficiency gap and concluding that empirical evidence supports the importance of information costs, consumer inattention and myopia, and manufacturer market power); Kenneth Gillingham, Sebastian Houde, & Arthur van Bentham, *Consumer Myopia in Vehicle Purchases: Evidence from a Natural Experiment* (Nat'l Bureau of Econ. Research, Working Paper No. 25845, 2019), https://www.nber.org/papers/w25845 (finding significant empirical evidence of consumer myopia); Antonio Bento et al., *Estimating the Costs and Benefits of Fuel-Economy Standards* (Nat'l Bureau of Econ. Research, Working Paper No. 26309, 2019), https://www.nber.org/chapters/c14288; Greene, *supra* note 174 (finding substantial empirical evidence in the literature for consumer loss aversion in the energy efficiency context); Helfand & Wolverton, *supra* note 31, at 133 (finding empirical evidence in the literature

for consumer myopia, loss aversion, and use of rules of thumb when making vehicle purchase decisions due to the difficulty of calculating fuel savings); Sebastian Houde & C. Anna Spurlock, *Minimum Energy Efficiency Standards for Appliances: Old and New Economic Rationales*, 5 Econ. Energy & Envtl. Policy 65 (2016) (finding evidence of manufacturer technology spillovers).

178 SAFE Rule SAB Review, *supra* note 12, at 21 ("The SAB finds that caution is warranted in the interpretation of the three recent econometric studies of consumer valuation. They evaluate how consumers respond to changes in fuel prices, not changes in the technologies offered on new vehicles. In a rational-choice framework, changes in fuel price and changes in technology can have an equivalent impact on the present value of fuel expenditures. From a behavioral perspective, however, seemingly equivalent changes in fuel price and technology may be perceived quite differently by consumers" (citing Greene and Welch 2016); *see also* Hunt Allcott, *Paternalism and Energy Efficiency: An Overview,* 8 Ann. Rev. Econ. 145 (2016) (identifying shortcomings in studies that find no fuel efficiency gap, including failure to fully address the endogeneity of attention and the costly acquisition of information, and reliance on assumptions about fuel costs, price forecasts, and discount rates (which may also be heterogenous instead of homogenous as assumed in these papers)).

179 SAFE Rule SAB Review, *supra* note 12, at 20 ("A more recent working paper by Leard et al. (2017) with a somewhat similar research design produces a much lower estimate of consumer valuation of fuel economy than reported by the three original published studies.") (citing Benjamin Leard, Joshua Linn & Yichen Zhou, *How Much Do Consumers Value Fuel Economy and Performance? Evidence from Technology Adoption* (Res. for Future Report, June 2017), https://media.rff.org/documents/RFF-Rpt-WTP_FuelEconomy26Performance.pdf); *see also* Antonio M. Bento et al., *Estimating the Costs and Benefits of Fuel-Economy Standards*, in Environmental and Energy Policy and the Economy, vol. 1 (Matthew J. Kotchen et al., eds., 2020) ("The empirical literature that provides estimates for [consumer valuation of fuel savings] continues to evolve, with some studies . . . suggesting substantial amounts of undervaluation.").

180 SAFE Rule SAB Review, *supra* note 12, at 21 (citing Kenneth Gillingham et al., *Consumer Myopia in Vehicle Purchases: Evidence from a Natural Experiment* (NBER Working Paper No. 25845, 2019), *available at* https://environment.yale.edu/gillingham/GillinghamHoudevanBenthem_ConsumerMyopia.pdf).

181 *Id.* (citing D. Neil, *Toyota RAV4 Hybrid: Great Performance, Even Better Fuel Economy*, Wall St. J., Apr. 19, 2019).

182 *Id.* (citing D. Duncan et al., Most Consumers Don't Buy Hybrids: Is Rational Choice a Sufficient Explanation? 10 J. Benefit-Cost Analysis 1 (2019)).

183 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,608. *But see id.* (claiming that CAFE and CO_2 standards cannot "resolve, or even mitigate, most of the various phenomena [that commenters] describe as market failures").

184 *Id.* at 24,613 (though arguing the energy efficiency gap is "of smaller magnitude than the agencies found in previous analyses").

185 *See id.* at 25,110 n.2476. Even if a consumer is not planning to keep a car for its full lifespan and so may not directly benefit from lifetime fuel savings, a rational consumer would be willing to pay upfront for the fact that "improved fuel economy can improve resale value of a vehicle." *Id.*

186 *See* David L. Greene, Consumers' Willingness to Pay for Fuel Economy and Implication for Sales of New Vehicles and Scrappage of Used Vehicles at 20 (2018), https://ww2.arb.ca.gov/sites/default/files/2018-10/10-21-2018_Greene_UTenn-Consumer_Behavior_Modeling.pdf; Nat'l Research Council, *supra* note 33, at 314, 319 (explaining that fuel economy standards can be an economically efficient solution given market failures). In fact, some recent literature has found that efficiency standards can outperform taxes as a tool for addressing both misperception of energy savings and externalities associated with energy use. Sébastien Houde & Erica Myers, *Heterogeneous (Mis-) Perceptions of Energy Costs: Implications for Measurement and Policy Design* 2-3 (Nat'l Bureau of Econ. Research, Working Paper No. 25722, 2019), http://www.nber.org/papers/w25722.

187 Draft TAR, *supra* note 43, at 6-9 ("If the gap exists, then the standards are providing net benefits to vehicle buyers, even if it is unclear why this is happening").

188 Nat'l Research Council, *supra* note 33, at 360 (describing social benefits of the Clean Car Standards including "[t]he private benefit of the fuel savings . . . though it may not be considered by car buyers at the time of purchase").

189 Fuel economy standards also create net social benefits by reducing externalities such as pollution and by addressing fuel security concerns. Those benefits would be on top of the benefits to consumers and society from directly saving fuel.

190 Final Rule, *supra* note 1, 85 Fed. Reg. at 25,110-11 ("[C]onsider[ing] fuel savings, spread over the lifetime of the vehicle . . . compared to the upfront vehicle costs . . . distorts the comparison. Instead, EPA concludes that the upfront vehicle technology costs (and associated financing costs) are a more important factor."); *see also supra* note 158 (collecting cites from the final rule where the agencies speculate that, if no market failures exist, then they need not count any private losses).

191 CAFE Peer Review, *supra* note 11, at 211, B-34.

192 Model Year 2012-2016 Joint Standards, 75 Fed. Reg. at 25,510 ("The existence of large private net benefits from this rule, then, suggests" the market for vehicles is not one with "full information, perfect foresight, perfect competition, and financially rational consumers and producers").

193 *Id.* at 25,511. NHTSA also identified these market failures as explanations for the energy efficiency gap in its Regulatory Impact Analysis. NHTSA, Final Regulatory Impact Analysis: Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks 421 (2010).

194 Model Year 2012-2016 Joint Standards, 75 Fed. Reg. at 25,512.

195 Clean Car Standards, *supra* note 2, 77 Fed. Reg. at 62,914.

196 NHTSA, Final Regulatory Impact Analysis: Corporate Average Fuel Economy for MY 2017-MY2025 Passenger Cars and Light Trucks 987-88 (2012).

197 *Id.*

198 Proposed Determination, *supra* note 44, at A-29 to A-30.

199 *Id.* at A-29.

200 *Id.* at A-31 to A-33.

201 *See* Final Rule, *supra* note 1, 85 Fed. Reg. at 24,201-08 (counting "retail fuel savings" as a forgone social benefit of the rollback).

202 *See supra* note 158 (collecting references).

203 Final Rule, *supra* note 1, 85 Fed. Reg. at 25,110-11 & n.2479 (citing to the implicit opportunity cost analysis).

204 *Id.* at 24,701-02 (42 months equals "the fuel savings over the first seventy-two months (less the first thirty months").

205 *See id.* at 24,177 n.10.

206 *See, e.g.,* Energy Conservation Program: Energy Conservation Standards for Walk-In Cooler and Freezer Refrigeration Systems, 82 Fed. Reg. 31,808, 31,843, 31,811 (July 10, 2017); *see also infra* Section V.D.

207 Though this section discusses examples across agencies and parties it is not an exhaustive list of all regulations that improve energy efficiency.

208 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,611 (arguing that consumer's "tendency to underinvest in fuel economy" because of "differing attitudes about the importance of future costs relative to more immediate ones" should not be "dismissed" as irrational, but instead can help "readily explain" the energy efficiency gap).

209 *See, e.g.,* Proposed Rule, *supra* note 14, 83 Fed. Reg. at 42,995, 43,015, 43,205 (explaining that EPCA requires NHTSA to set standards to conserve energy); Final Rule, *supra* note 1, 85 Fed. Reg. at 24,214 (explaining the "need of the United States to conserve energy" factor).

210 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,606 n.1590.

211 Circular A-4, *supra* note 80.

212 *See* Office of Mgmt. & Budget, *Guidance Implementing Executive Order 13771* at 9 (Apr. 5, 2017), https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2017/M-17-21-OMB.pdf.

213 Circular A-4, *supra* note 80, at 37-38.

214 *Id.*

215 *Id.* at 19 ("Market prices provide rich data for estimating benefits and costs based on willingness-to-pay if the goods and services affected by the regulation are traded in well-functioning competitive markets"); *id.* at 21 ("Economists ordinarily consider market prices as the most accurate measure of the marginal value of goods and services to society").

216 *Id.* at 19, 21 (cautioning that willingness to pay is a good measure of benefits only "if" the underlying market is "well-functioning" and requiring agencies to take "market imperfections" into account when valuing regulatory effects); EPA Guidelines, *supra* note 74, at 7-21 (market prices are appropriate only "[f]or goods bought and sold in undistorted markets"); *see also id.* at 7-15 (directing use of healthcare costs not otherwise accounted for in individual consumers' willingness-to-pay to avoid morbidity because "these costs represent diversions from other uses in the economy, [and so] represent real costs to society [that] should be accounted for").

217 *See generally* EPA Guidelines, *supra* note 74.

218 *Id.* at 7-6.

219 *Id.* at 7-15 (directing use of healthcare costs not otherwise accounted for in individual consumers' willingness-to-pay to avoid morbidity because "these costs represent diversions from other uses in the economy, [and so] represent real costs to society [that] should be accounted for"); *see also* Helfand & Dorsey-Palmateer, *supra* note 95, at 446 (discussing Guidelines' recommendation to use professional estimates of mortality risk when calculating benefits of reduced mortality rather than inaccurate consumer expectations of that risk).

220 EPA Guidelines, *supra* note 74, at 7-21.

221 *Id.* at 7-7.

222 Of course, the production and use of vehicle fuel suffers from other market failures such as air pollution and market power. These failures, however, have been separately calculated in the agencies' cost-benefit analysis. *See, e.g.,* FRIA, *supra* note 20, at 116 (agreeing that climate change and energy security externalities are "paramount" and "there is little disagreement or doubt" about such market failures).

223 EPA Guidelines, *supra* note 74, at 7-6; *id.* at 8-1 ("In conducting a [cost-benefit analysis], the correct measure to use is the social cost").

224 Nat'l Research Council, *supra* note 33, at 315 ("Short payback periods imply high discount rates for fuel economy, which may indicate undervaluation of fuel economy"); *id.*

at 317 (discussing studies that compared implicit consumer discount rates of 13%-42% with rational discount rate of 6%). *See also supra* notes 164-169 and accompanying text.

225 EPA Guidelines, *supra* note 74, at 6-1.

226 *See* Energy Conservation Program for Consumer Products: Energy Conservation Standards for Two Types of Consumer Products, 54 Fed. Reg. 47,916, 47,921-22 (Nov. 17, 1989) (rejecting use of discount rates implied from historical consumer purchasing decisions rather than average cost of capital for financing purchases of more efficient appliances). EPA Guidelines, *supra* note 74, at 6-1.

227 *See* Kenneth Arrow et al., Determining Benefits and Costs for Future Generations, 341 Sci. 349 (2013).

228 U.S. Dep't of Transportation, Benefit-Cost Analysis Guidance for Discretionary Grant Programs 9, 13, 30 (2018), https://www.transportation.gov/sites/dot.gov/files/docs/mission/office-policy/transportation-policy/14091/benefit-cost-analysis-guidance-2018.pdf.

229 Federal Highway Administration, Operations Benefit/Cost-Analysis Desk Reference 40 (2012), https://ops.fhwa.dot.gov/publications/fhwahop12028/fhwahop12028.pdf.

230 Passenger Automobile Average Fuel Economy Standards, 42 Fed. Reg. 33,534, 33,550 (June 30, 1977).

231 *Id.* at 33,550-551.

232 NHTSA, Final Impact Assessment of the Automotive Fuel Economy Standards for Model Year 1981-84 Passenger Cars at I-24 (June 30, 1977) ("An important issue which is often raised is that the new car buyer would be impacted more by costs than benefits as that person more readily perceives initial costs than benefits accruing over the life . . . of the vehicle. In our view all costs (and benefits of owning and operating a vehicle) incurred over the economic vehicle life . . . must be accounted for in the analysis, and not only those faced by any one owner, such as the new car buyer").

233 *Id.*

234 Light Truck Average Fuel Economy Standards Model Years 1985–86, 49 Fed. Reg. 41,250, 41,252 (Oct. 22, 1984).

235 *Id.*

236 NHTSA, Final Regulatory Impact Analysis for Model Years 1985-86 Light Truck Fuel Economy Standards at IV-22 (Sept. 1984) ("Operating cost savings are defined as the present value of dollar savings in gasoline that the vehicle owner would realize over the life of the 1986 vehicles").

237 Light Truck Average Fuel Economy Standards; Model Year 1992, 55 Fed. Reg. 12,487 (Apr. 4, 1990); Light Truck Average Fuel Economy Standards; Model Years 1993-1994, 56 Fed. Reg. 13,773 (Apr. 4, 1991).

238 Light Truck Average Fuel Economy Standards Model Year 1995, 58 Fed. Reg. 18,019 (Apr. 7, 1993).

239 NHTSA, Final Regulatory Impact Analysis: Average Fuel Economy Standards for Model Year 1995 Light Trucks at VI-10, VI-14 (Mar. 1993).

240 Light Truck Average Fuel Economy Standards; Model Years 1996-1997, 59 Fed. Reg. 16,312 (Apr. 6, 1994).

241 NHTSA, Final Regulatory Evaluation: Average Fuel Economy Standards for Model Years 1996-1997 Light Trucks at VI-11 (Dec. 1993).

242 *See* Average Fuel Economy Standards for Light Trucks Model Years 2008–2011, 71 Fed. Reg. 17,566, 17,631 (Apr. 6, 2006) [hereinafter MY 2008-2011 Light Truck Standards]; *see also* NHTSA, Final Regulatory Impact Analysis: Corporate Average Fuel Economy and CAFE Reform for MY 2008-2011 Light Trucks at VIII-21 (Mar. 2006), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/2006_friapublic.pdf [hereinafter MY 2008-2011 Light Truck FRIA] (explaining the methodology for calculating the benefits of fuel savings).

243 MY 2008-2011 Light Truck Standards, *supra* note 242, 71 Fed. Reg. at 17,631; MY 2008-2011 Light Truck FRIA at VII-20.

244 MY 2008-2011 Light Truck Standards, *supra* note 242 , 71 Fed. Reg. at 17,631; *see also* MY 2008-2011 Light Truck FRIA at VII-20 to VII-21.

245 Model Year 2012-2016 Joint Standards, 75 Fed. Reg. at 25,324.

246 NHTSA, Final Regulatory Impact Analysis: Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks at 371 (Mar. 2010).

247 *Id.* at 380. NHTSA discussed but ultimately rejected alternative approaches to calculating the value of fuel savings, including offsetting fuel savings with estimates of the value of forgone performance features. *Id.* at 432-33.

248 Clean Car Standards, *supra* note 2, 77 Fed. Reg. at 62,715.

249 EPA & NHTSA, Joint Technical Support Document: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards at 4-7 (Aug. 2012).

250 NHTSA MY 2017-2025 FRIA, *supra* note 196, at 863.

251 Clean Car Standards Rule, 77 Fed. Reg. at 62,992.

252 NHTSA MY 2017-2025 FRIA at 863 (emphasis in original).

253 Clean Car Standards Rule, 77 Fed. Reg. at 62,992.

254 Evaporative Emission Regulation and Test Procedure for Gasoline-Fueled Heavy-Duty Vehicles, 45 Fed. Reg. 28,922 (proposed Apr. 30, 1980).

255 *Id.* at 28,924.

256 *Id.*

[257] Regulation of Fuels and Fuel Additives: Volatility Regulations for Gasoline and Alcohol Blends Sold in 1989 and Later Calendar Years, 52 Fed. Reg. 31,274 (proposed Aug. 19, 1987).

[258] EPA, Draft Regulatory Impact Analysis: Control of Gasoline Volatility and Evaporative Hydrocarbon Emissions from New Motor Vehicles at 5-24 (July 1987), https://bit.ly/2Br7pkx.

[259] *Id.* at 5-60 to 5-61.

[260] Interim Regulations for Cold Temperature Carbon Monoxide Emissions from Light-Duty Vehicles and Light-Duty Trucks, 55 Fed. Reg. 38,250 (Sept. 17, 1990).

[261] *Id.* at 38,264.

[262] *Id.*

[263] *Id.*

[264] Control of Air Pollution from New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements, 65 Fed. Reg. 6698 (Feb. 10, 2000).

[265] Regulatory Impact Analysis - Control of Air Pollution from New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements at V-27 (Dec. 1999), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100F1UV.PDF?Dockey=P100F1UV.PDF.

[266] *Id.* at V-31 n.9.

[267] Control of Emissions from Highway Motorcycles, 69 Fed. Reg. 2398, 2429 (Jan. 15, 2004).

[268] *Id. See also* Final Regulatory Support Document: Control of Emissions from Highway Motorcycles at 5-5 (Dec. 2003), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100231W.PDF?Dockey=P100231W.PDF.

[269] Model Year 2012-2016 Joint Standards, *supra* note 27, 75 Fed. Reg. at 25,512.

[270] *Id.*

[271] Clean Car Standards, *supra* note 2, 77 Fed. Reg. at 62,715.

[272] *Id.* at 62,924.

[273] 42 U.S.C. § 6295.

[274] *Id.* at § 6295(o)(2)(A).

[275] *See id.* at § 6295(o)(2)(B)(i) (enumerating factors for DOE to consider).

[276] Energy Conservation Program for Consumer Products, 45 Fed. Reg. 43,976 (proposed June 30, 1980).

[277] *Id.* at 44,005-07.

[278] *Id.* at 44,005 n.1.

[279] Energy Conservation Program for Consumer Products; Final Rule for Clothes Dryers and Kitchens Ranges and Ovens, 47 Fed. Reg. 57,198, 57,198 (Dec. 22, 1982).

[280] *Id.* at 57,202, 57,211, 57,212.

[281] Energy Conservation Program for Consumer Products: Energy Conservation Standards for Two Types of Consumer Products, 54 Fed. Reg. 47,916 (Nov. 17, 1989).

[282] *Id.* at 47,942.

[283] *Id.* at 47,921-923.

[284] Energy Conservation Program for Consumer Products: Final Rule Regarding Energy Conservation Standards for Three Types of Consumer Products, 56 Fed. Reg. 22,250 (May 14, 1991).

[285] *Id.* at 22,254.

[286] Energy Conservation Program for Consumer Products: Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products, 61 Fed. Reg. 36,974 (July 15, 1996).

[287] *Id.* at 36,983.

[288] Energy Conservation Program for Consumer Products: Energy Conservation Standards for Refrigerators, Refrigerator-Freezers and Freezers, 62 Fed. Reg. 23,102 (Apr. 28, 1997).

[289] *Id.* at 23,109, 23,112.

[290] *Id.*

[291] *See* Energy Conservation Program for Consumer Products: Final Rule Regarding Energy Conservation Standards for: Room Air Conditioners, 62 Fed. Reg. 50,122, 50,139 (Sept. 24, 1997); Energy Conservation Program for Consumer Products; Energy Conservation Standards for: Electric Cooking Products (Electric Cooktops, Electric Self-Cleaning-Ovens, and Microwave Ovens), 63 Fed. Reg. 48,038, 48,050 (Sept. 8, 1998); Energy Conservation Program for Consumer Products: Fluorescent Lamp Ballasts Energy Conservation Standards, 65 Fed. Reg. 56,740, 56,745 (Sept. 19, 2000); Energy Conservation Program for Consumer Products: Clothes Washer Energy Conservation Standards, 66 Fed. Reg. 3314 (Jan. 12, 2001); Energy Conservation Program for Consumer Products: Energy Conservation Standards for: Water Heaters, 66 Fed. Reg. 4474, 4483-94 (Jan. 17, 2001); Energy Conservation Program for Consumer Products: Central Air Conditioners and Heat Pumps Energy Conservation Standards, 66 Fed. Reg. 7170 (Jan. 22, 2001).

[292] Energy Conservation Program for Consumer Products; Central Air Conditioners and Heat Pumps Energy Conservation Standards, 67 Fed. Reg. 36,368 (May 23, 2002).

[293] *Id.* at 36,400, 36,401-02.

[294] *See* Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule, 72 Fed. Reg. 58,190 (Oct. 12, 2007); Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces and Boilers, 72 Fed. Reg. 65,136 (Nov. 19, 2007); Energy Conservation Program for Commercial and Industrial

Equipment: Packaged Terminal Air Conditioner and Packaged Terminal Heat Pump Energy Conservation Standards, 73 Fed. Reg. 58,772 (Oct. 7, 2008); Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards for Commercial Ice-Cream Freezers; Self-Contained Commercial Refrigerators, Commercial Freezers, and Commercial Refrigerator-Freezers Without Doors; and Remote Condensing Commercial Refrigerators, Commercial Freezers, and Commercial Refrigerator-Freezers, 74 Fed. Reg. 1092 (Jan. 9, 2009).

295 *See, e.g.,* Energy Conservation Program: Energy Conservation Standards and Test Procedures for General Service Fluorescent Lamps and Incandescent Reflector Lamps, 74 Fed. Reg. 34,080, 34,098 (July 14, 2009) ("DOE calculated the sum of the purchase price and the operating expense—discounted over the lifetime of the equipment—to estimate the range in LCC benefits that consumers would expect to achieve due to standards . . . . Another tool calculates national energy savings and national NPV that would result from the adoption of energy conservation standards."); Energy Conservation Program: Energy Conservation Standards for Ceiling Fans, 82 Fed. Reg. 6826, 6828 (Jan. 19, 2017) ("The cumulative net present value (NPV) of total consumer costs and savings of the standards for ceiling fans ranges from $4.488 billion (at a 7-percent discount rate) to $12.123 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs for ceiling fans purchased in 2020-2049."); *see also* U.S. Dep't. Of Energy, Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Ceiling Fans at 8-14 (2016), https://www.regulations.gov/document?D=EERE-2012-BT-STD-0045-0149 (detailing the calculation of LCC operating cost to be the net present value of seasonal energy consumption times seasonal electricity prices over the lifetime of the ceiling fan); *id.* at 10-8 (explaining that for the calculation of NPV, "DOE calculated annual [total operating cost] for ceiling fans by summing over the operating costs of all product classes and sectors in the affected stock").

296 *See e.g.,* Energy Conservation Program: Energy Conservation Standards for Walk-In Cooler and Freezer Refrigeration Systems, 82 Fed. Reg. 31,808, 31,843, 31,811 (July 10, 2017). DOE recently finalized revisions to its Process Rule. *See* Energy Conservation Program for Appliance Standards: Proposed Procedures for Use in New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Commercial/Industrial Equipment, 85 Fed. Reg. 8626 (Feb. 14, 2020). Notably, the revised Process Rule preserves that private impacts to consumers should be estimated based on "national average energy prices and energy usage," likely indicating an intent to continue fully valuing energy savings. *Id.* at 8706 (while also noting that sensitivity analyses will employ both high and low discount rates from both the private and social perspective). However, DOE also announced its intentions to undertake a peer review of its analytical methodologies, including its approach to "welfare analysis," *id.* at 8686, and possibly also a reconsideration of "consumer discount rates," *id.* at 8687. In a new supplemental proposal issued together with the final revisions to the Process Rule, DOE also suggested it could start factoring into its analysis "potential consumer welfare impacts," including whether consumers suffer from lost performance, as with the alleged inconvenience of longer cycle times on more efficient appliances—a subject that would be examined during the forthcoming peer review. Energy Conservation Program for Appliance Standards: Procedures for Evaluating Statutory Factors for Use in New or Revised Energy Conservation Standards, 85 Fed. Reg. 8483, 8486-87 (Feb. 14, 2020). Whether DOE will attempt to change its approach to valuing energy savings following this peer review remains to be seen.

297 Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources, 81 Fed. Reg. 35,824 (June 3, 2016).

298 EPA, Regulatory Impact Analysis of the Final Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources at 3-14–15 (2016), https://perma.cc/HPT9-8CFN.

299 EPA, Regulatory Impact Analysis for the Proposed Reconsideration of the Oil and Natural Gas Sector Emission Standards for New, Reconstructed, and Modified Sources at 2-13 (2018), https://perma.cc/UDB2-KEM5.

300 Waste Prevention, Production Subject to Royalties, and Resource Conservation, 81 Fed. Reg. 83,008, 83,069 (Nov. 18, 2016).

301 Bureau of Land Mgmt., Regulatory Impact Analysis for: Revisions to 43 CFR 3100 (Onshore Oil and Gas Leasing) and 43 CFR 3600 (Onshore Oil and Gas Operations at 107 (Nov. 10, 2016), https://www.regulations.gov/document?D=BLM-2016-0001-9127.

302 Bureau of Land Mgmt., Regulatory Impact Analysis for the Final Rule to Rescind or Revise Certain Requirements of the 2016 Waste Prevention Rule at 47 (Aug. 31, 2018), https://www.regulations.gov/document?D=BLM-2018-0001-223607.

303 Final Affordability Determination—Energy Efficiency Standards, 80 Fed. Reg. 25,901, 25,921 (May 6, 2015).

304 *Id.* at 25,910-911.

305 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,612-13 ("In sum, the agencies do not take a position in this rule on whether a fuel efficiency gap exists or constitutes a failure of private markets . . . despite our expressed reservations.").

306 Despite being just one of many sensitivity analyses, and despite many other sensitivity analyses showing the rollback will be even more costly than the agencies admit, this

particular sensitivity analysis on opportunity costs is given special prominence in the final rule. *See* Final Rule, *supra* note 1, 85 Fed. Reg. at 24,177 & n.10, 24,587, 25,026-32.

307 See *supra* notes 60-63 and accompanying text.

308 PRIA, *supra* note 51, at 1097.

309 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,701-02.

310 In modeling the effect of the final standards on new vehicle sales and the "scrappage" of used vehicles, the agencies assume that consumers value the first 2.5-years' worth of fuel savings. There are many reasons why 2.5 years is almost certainly too short a time period. *See, e.g.,* Ctr. for Biological Diversity et al., Comments on the Proposed SAFE Rule, Appendix A at 172-74 (Oct. 2018), https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2018-0283-5070&attachmentNumber=2&contentType=pdf; Policy Integrity Oct. 2018 Comments, *supra* note 10, at 38; Consumers Union, Consumer Fed. of Am. & Am. Council for an Energy-Efficient Economy, Joint Comments on SAFE Rule 25-29 (Oct. 25, 2018), https://www.regulations.gov/document/NHTSA-2018-0067-11731 (Attachment A). This report does not fully engage with all the problems of the 2.5 year-willingness-to-pay assumption.

Confusingly, the agencies refer to 30 months of "undiscounted" fuel savings. Final Rule, *supra* note 1, 85 Fed. Reg. at 24,701. The references to "undiscounted" amounts, and how discounting plays into their proxy estimate of opportunity cost, are never fully explained.

311 *See* Final Rule, *supra* note 1, 85 Fed. Reg. at 24,701-02. The agencies claim their estimate is "conservative" because 72 months is a "conservative" choice. *Id.* at 24,702, n.1834. They cite six numbers from reports or comments (77, 67, 71.4, 78, 68, 60), and say that 72 "is comfortably within the range of these estimates, but errs toward the lower-end and therefore provides a conservative estimate." *Id.* There are several problems with this. First, the mean of those six numbers is 70.2, and the median is 69.7. Thus, 72 is not the "lower end" of that range, since 70 would be the middle. If they had only offset months 30-70 as a proxy for opportunity costs, instead of months 30-72 as they did, their estimated opportunity cost values would have been lower. Second, their list of six estimates includes duplicates. They provide the wrong link for the Chicago Fed report (the actual link is https://www.chicagofed.org/~/media/others/events/2016/automotive-outlook-symposium/traub-060316-pdf.pdf), but the 77 month statistics attributed to the Fed as an estimate of average new vehicle ownership is actually simply from data from IHS Automotive, reporting Q1 for 2015. That is the same source as used by the State Comptrollers comments (i.e., IHS Markit), which use IHS's more recent estimate of 78 months. *See* EPA–HQ–OAR–2018–0283– 4153, at 2 (cited by 85 Fed. Reg. at 24,702 n.1834). So those two data points (77 and 78) are essentially duplicates, based on the same exact source. Throwing out the lower estimate (77) and taking only the higher estimate (78) leaves five data points: 67, 71.4, 78, 68, 60. For that range, the mean is 68.8 and the median is 68. Again, had the agencies used 68 or 69 months instead, their estimate of opportunity cost would be even lower. And again, 72 is not the "lower end" of the range, especially after duplicates are removed.

312 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,701-02.

313 The agencies have previously suggested that fuel efficiency improvements may result in forgone improvements in other vehicle features that may have occurred without the standards. *See* Draft TAR, *supra* note 43, at 4-28 ("[T]he potential for tradeoffs between reducing GHG emissions and improving other vehicle attributes deserves consideration."). But the agencies did not previously tie those costs to the benefits of fuel savings or conclude that tradeoffs between efficiency and other features would reduce consumer welfare.

314 *See, e.g.,* Energy Conservation Program for Consumer Products; Proposed Rule, 45 Fed. Reg. 43,976, 43,983 (June 30, 1980) (describing methodology for setting appliance standards, including establishing different classes of appliances "distinguished by capacity or a performance-related feature which affects energy efficiency but provides utility to the consumer"). DOE engages in a similar approach in its more recent appliance standards rulemaking. *See, e.g.* Energy Conservation Program: Energy Conservation Standards for Dehumidifiers, 81 Fed. Reg. 38,338, 38,346 (June 13, 2016) ("In establishing product classes, and in evaluating design options and the impact of potential standard levels, DOE evaluates potential standards that would not lessen the utility or performance of the considered products."). Though see *supra* note 296 on recent DOE proposals to study possible lost consumer welfare.

315 Energy Conservation Program for Consumer Products; Proposed Rule, 45 Fed. Reg. at 43,987-88 (describing net energy savings that accrue to consumers even after refrigerators have been subcategorized so that consumers do not lose performance features); U.S. Dep't of Energy, Final Rule Technical Support Document: Residential Dehumidifiers at 10-2–17 (2016), https://www.regulations.gov/document?D=EERE-2012-BT-STD-0027-0046 (calculating private energy savings of new standards as compared to a no-new-standards case that assumes some but not optimal improvement in energy saving).

316 PRIA, *supra* note 51, at 1091.

317 *Id.* at 1097.

318 *See, e.g.,* Comments from Michalek & Whitefoot, *supra* note 61, 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).

319 Draft TAR, *supra* note 43, at 4-36.

320 EPA, Consumer Willingness to Pay for Vehicle Attributes: What is the Current State of Knowledge? at 7-1 (2018) https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=OTAQ&dirEntryId=339388.

321 *Id.*

322 Greene et al., *supra* note 30, at 264, 273; *id.* at 274 (even after trimming outlines, "one standard deviation exceeds the mean of the [willingness to pay] estimates for most of the attributes . . . . [and] the interquartile range also exceeds the median").

323 *Id.* at 274.

324 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).

325 *See supra* notes 112-119 and accompanying text.

326 FRIA, *supra* note 20, at 316.

327 *See* Clean Car Standards, *supra* note 2, 77 Fed. Reg. at 62,714-15 (explaining that the agencies assume, and "continue to believe," that "vehicle attributes will not change as a result of these rules," and that this assumption about compliance costs obviates the need to estimate any potential opportunity costs; furthermore, the agencies did not have "sufficient confidence" in any potential estimates of opportunity costs, and so it would be "premature" to include such estimates).

328 *See supra* notes 90-91 and accompanying text.

329 Final Rule, *supra* note 1, 85 Fed. Reg. at 24702 n.1836.

330 *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).

331 *See supra* notes 112-115 and accompanying text..

332 Whitefoot, Fowlie & Skerlos, *supra* note 134, at 10,313; *see also* Helfand & Dorsey-Palmateer, *supra* note 95, at 450; *see* Bento et al., *supra* note 13, 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).

333 Whitefoot, Fowlie & Skerlos, *supra* note 134, 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).

334 FRIA, *supra* note 20, at 317, 324.

335 *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 overperform in 0-60 acceleration, which utilizes the power of both the electric motor and combustion engine.") (citation omitted).

336 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").

337 *See supra* note 103-109 and accompanying text.

338 *See* Draft TAR, *supra* note 43, 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 43, at A-49 (citing evidence presented from Ford about the F-150).

339 Thomas Tietenberg & Lynne Lewis, Environmental and Natural Resource Economics 375-376 (11th ed. 2018).

340 Ins. Inst. for Highway Safety & Highway Loss Data Inst., *Flexing Muscle: Sports Car Ratings Show Range of Performance*, 52 Status Report, no. 5, 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. of 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).

341 Hong Sok Kim, Hyung Jin Kim, Bongsoo Son, *Factors Associated with Automobile Accidents and Survival*, 38 Accident Analysis & Prevention 981, 981 (2006).

342 *See* Jeff Bartlett, *Tesla Model S Aces Government Crash Test*, Consumer Reports (Aug. 21, 2013), https://perma.cc/64RE-9YM8.

[343] 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 and Infrastructure Engineering 1069, 1080 (2015).

[344] *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 may, 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?").

[345] Gerarden et al., *supra* note 171, at 1498; 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).

[346] Final Rule, *supra* note 1, 85 Fed. Reg. at 24,702.

[347] *Id.* at 24,700 (explaining that the agencies now only assuming 90% of rebound-related risks are internalized by driver, with 10% externalized).

[348] On the other side of the ledger, the agencies also fail to count the positive indirect benefits of potential attribute tradeoffs. Most notably, some literature suggests that allowing manufacturers to trade off acceleration for fuel economy will not just reduce the compliance costs of meeting a given fuel economy target but will actually significantly decrease overall greenhouse gas emissions. Whitefoot, Fowlie & Skerlos, *supra* note 134, at 10,313 ("[W]e find that . . . GHG emissions . . . are significantly lower when these trade-offs are accounted for."). Some fuel economy technologies may be particularly suited to reducing emissions. For example, EPA explained during the Midterm Evaluation that at least some engine designs reduce carbon dioxide emissions. Midterm TSD, *supra* note 44, at 4-6 ("TDS engines reduce CO2 (albeit only slightly) over a range of 0-to-60 time reductions.").

[349] *See* Ctr. for Biological Diversity, 538 F.3d 1172, 1186, 1198 (9th Cir. 2008).

[350] Robert H. Frank, *The Demand for Unobservable and Other Nonpositional Goods*, 75 Am. Econ. Rev. 101, 101 (1985).

[351] Policy Integrity Oct. 2018 Comments, *supra* note 10, at 47-51.

[352] Frank, *supra* note 350, at 101.

[353] *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.").

[354] *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. Environ. 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.").

[355] 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, Fredrik Carlsson & Olof Johansson-Stenman, *How Much Do We Care About Absolute Versus Relative Income and Consumption?*, 56 J. of 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, Kenneth S. Kurani & Thomas S. Turrentine, *Effects of Vehicle Image in Gasoline-Hybrid Electric Vehicles* 2 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); 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 conspicuous consumption increases); Carlsson et al., *supra*, at 588, 593 (finding support for hypothesis that "visible goods and their characteristics, such as the value of cars, are more positional than less visible goods and their characteristics, such as car safety"). *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, Evelyn Blumenberg & Rachel R. Weinberger eds., Emerald Group Publishing Limited)

(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.

356 Ori Heffetz, *A Test of Conspicuous Consumption: Visibility and Income Elasticities*, 93 Rev. Econ. & Stat. 1101, 1106 (2011) (vehicle purchase had a visibility index of 0.73, second only to tobacco products (0.76); 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).

357 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).

358 Robert H. Frank, *Positional Externalities Cause Large and Preventable Welfare Losses*, 95 Am. Econ. Rev. 137, 137 (2005).

359 *Id.*

360 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.").

361 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.

362 Hoen & Geurs, *supra* note 354, 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 appear to particularly add to positionality. . . . Ignoring positionality may result in an overestimation of welfare costs associated with CO_2 measures that lead to downsizing of the average passenger car.").

363 *See* FCC v. Fox Television Stations, Inc., 556 U.S. 502, 515 (2009); Motor Vehicle Mfrs. Ass'n of the U.S. v.; State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43 (1983).

364 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,176.

365 *Id.* at 25,099.

366 *See, e.g., id.* at 24,604 (defining "up-front costs" to include the "opportunity cost of any other desirable feature"); *id.* at 25,171 (same); *id.* at 25,110-11 & n.2479 (discussing EPA's focus on upfront costs, claiming that fully valuing fuel savings "distorts" the analysis, and then citing to the analysis of opportunity costs); *id.* at 25,109 (explaining that EPA considers any "significant impact on vehicle utility and performance" when considering consumer costs); *id.* at 25,120 (basing EPA's regulatory decision on hard-to-quantify costs); *id.* at 24,214 (weighing "consumer demand for . . . other vehicle attributes" as part of NHTSA's statutory factors); *id.* at 25,141 (referencing "upfront . . . tradeoffs" in balancing NHTSA's statutory factors).

367 *See, e.g., id.* at 25,171 (comparing NHTSA's focus on upfront costs, including opportunity costs, to its skepticism that fuel savings exist that consumers could not purchase on their own); *id.* at 25,110-11 & n.2479 (claiming that valuing lifetime fuel saving on equal footing with upfront costs "distorts the comparison," and then citing to the analysis of opportunity costs). A focus on upfront costs, while devaluing longer term costs, is analytically equivalent to using an extremely high (and unjustified) discount rate.

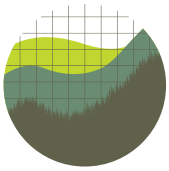
368 *Id.* at 24,612 ("If either case is true—that the analysis is incomplete regarding consumer valuation of other vehicle attributes or discount rates used in regulatory analysis inaccurately represent consumers' time preferences—no market failure would exist to support the hypothesis of a fuel efficiency gap. In either case, the agencies' central analysis would overstate both the net private and social benefits from adopting more stringent fuel economy and CO2 emissions standards. . . . Because government action cannot improve net social benefits in the absence of a market failure, if no market failure exists to motivate the $26.1 billion in private losses to consumers, the net benefits of these final standards would be $42.2 billion."); *see also id.* at 24,701 (same); FRIA, *supra* note 20, at 1011 (same); *id.* at 116 (touting that, as opposed to consideration of private costs and benefits, "external net benefits—those incremental reductions and increases in the harms associated with market failure upon which there is little disagreement or doubt—are higher for less stringent alternatives"); Final Rule, *supra* note 1, 85 Fed. Reg. at 25,110-11 (claiming that fully valuing lifetime fuel savings "distorts" the analysis).

369 Final Rule, *supra* note 1, 85 Fed. Reg. at 24,701.

370 *See id.* at 24,177 n.10.

371 *Id.* at 24,612-13 ("In sum, the agencies do not take a position in this rule on whether a fuel efficiency gap exists or constitutes a failure of private markets . . . despite our expressed reservations.").

372 *See id.* at 24,201-08 (counting "retail fuel savings" as a forgone social benefit of the rollback).



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