Overinflated

The SAFE Rule's Overstated Estimates of Vehicle-Price Impacts

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Executive Summary

This report is part of a series that documents how the assumptions underlying The Safer Affordable Fuel Efficient (SAFE) Vehicles Final Rule for Model Years 2021–2026 Passenger Cars and Light Trucks ("SAFE Rule"),[1] are skewed to make the rule look less harmful than it actually is. In the SAFE Rule, the Environmental Protection Agency and the National Highway Traffic Safety Administration ("the agencies")[2] have significantly rolled back the greenhouse gas emission and fuel-economy standards for light vehicles established under the Obama Administration for the vehicle Model Years 2021 to 2025 ("baseline standards").[3]

To justify the SAFE Rule, the agencies make assumptions about how automakers' costs of compliance with fuel-economy and greenhouse gas emission standards translate into changes in vehicle prices that consumers face. The agencies then rely on those price changes to justify their decisions to roll back the baseline standards.

But those assumptions allow the agencies to inflate the effect of the baseline standards on vehicle prices, artificially mask key costs of the SAFE Rule, and thus create the illusion that rolling back the baseline standards is less socially harmful than it truly is. Accordingly, while the agencies conclude that the SAFE Rule is net costly using a consumption discount rate[4]—and ultimately conclude that the benefits "straddle zero" upon looking at the impacts using a private capital discount rate[5]—a proper

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[1] 85 Fed. Reg. 24,174 (Apr. 30, 2020).

[2] Policy Integrity previously published a report detailing the errors in the agencies' suggestion that higher fuel economy requires a trade-off with other vehicle features such as horsepower and towing capacity as well as a report analyzing trends in fuel prices, vehicle sales, automaker compliance, and safety to show that the baseline standards can be met at low cost while delivering large benefits to consumers and the economy. *See* Bethany Davis Noll, Peter Howard, Jason A. Schwartz & Avi Zevin, *Shortchanged: How the Trump Administration's Rollback of the Clean Car Standards Deprives Consumers of Fuel Savings* (June 4, 2020), https://policyintegrity.org/publications/detail/shortchanged-the-trump-administrations-rollback-of-the-clean-car-standards; Bethany Davis Noll, Peter Howard, & Jeffrey Shrader, *Analyzing EPA's Vehicle-Emissions Decisions. Why Withdrawing the 2022-2025 Standards Is Economically Flawed* (May 1, 2018), https://policyintegrity.org/publications/detail/analyzing-epas-fuel-efficiency-decisions1. Other reports are forthcoming.

[3] 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).

[4] 85 Fed. Reg. at 24,176 (concluding that the SAFE Rule's costs exceed benefits by $13.1 billion (CAFE program) and $22 billion (GHG program), assuming a 3 percent discount rate). The consumption discount rate refers to "the rate at which society discounts future consumption flows to their present value," and is typically valued at 3 percent in regulatory impact analyses. Office of Mgmt. & Budget, Circular A-4 on Regulatory Analysis 33 (2003). This discount rate is appropriate for regulations that "primarily and directly affects private consumption," including most environmental regulations. *Id.*

[5] *Id.* The private capital discount rate, typically valued at 7 percent, reflects "an estimate of the average before-tax rate of return to private capital in the U.S. economy" and is appropriate for regulations that primarily impact "the allocation of capital." Circular A-4 at 33. As Policy Integrity is explaining in a forthcoming report, the private discount rate is not the proper rate to use for the SAFE Rule because the rule primarily impacts private consumption rather than capital allocation, and so the lower consumption discount rate is appropriate. Moreover, while the agencies find that the SAFE Rule has net benefits at a 7 percent discount rate, those benefits are only $6.4 billion (GHG program) and $16.1 billion (CAFE program)—much smaller than the projected net costs using a 3 percent discount rate. 85 Fed. Reg. at 24,176.

analysis of the SAFE Rule's sales effects would reveal that the rule is much more costly and socially detrimental than the agencies acknowledge.

This report highlights three critical problems in the agencies' assumptions about vehicle prices. First, when assessing automaker compliance-cost savings from the SAFE Rule, the agencies inflate the non-technology compliance-cost savings (such as marketing, additional guarantees, and overhead) through a controversial and unsound methodology known as "retail price equivalents." Second, the agencies overstate the degree to which automakers pass compliance costs through to consumers, thereby further overstating the SAFE Rule's impacts on vehicle prices. And third, when modeling how the passed-through costs are spread across the vehicle mix, the agencies disregard the impact of "sales mixing"—that is, the strategic dispersion of vehicle price increases across an automaker's fleet—leading to an even further exaggeration of the SAFE Rule's impacts on vehicle prices.

By vastly overestimating the SAFE Rule's impacts on vehicle prices, the agencies in turn overstate the rule's impacts on consumer welfare and purchasing decisions. This is because, through the agencies' inflated conclusions about the SAFE Rule's impacts on vehicle prices, the agencies conclude that many consumers who would forego purchasing a new vehicle under the baseline standards will now purchase a vehicle following the rollback. In reality, this effect is far smaller than the agencies project.[6]

These three errors also have key implications for the SAFE Rule's projected scrappage impacts. Under the agencies' false conclusion that many more people would have kept their cars longer before scrapping them under the baseline standards, the agencies' analysis shows that rolling back the standards would lead to a newer vehicle fleet, unjustifiably decreasing the emissions damages of the rollback. Even taking the agencies' deeply flawed scrappage model at face value, the inflated compliance cost estimates improperly increase the size of this effect.

When this chain of errors in the agencies' compliance-cost and vehicle-pricing assumptions is corrected, the agencies' proffered justification for the SAFE Rule (insofar as it made any sense to begin with) evaporates. Indeed, while the agencies adopt the SAFE Rule upon concluding that the costs of compliance with the baseline standards were "too high,"[7] a proper accounting of vehicle prices reveals that the upfront compliance costs of the baseline standards were vastly lower than the agencies project, undermining the justification for the SAFE Rule.

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[6] While this report focuses only on errors that the agencies make in projecting the sticker price of new vehicles, the agencies make other substantial errors in their sales and scrappage models that further inflate the rule's sales impacts and call into question their conclusion that the rule will lead to a total increase in new vehicle sales. For instance, the agencies exaggerate the relationship between prices and sales, known as "price elasticity." *See* Ctr. for Biological Diversity et al., Petition for Reconsideration of EPA's Final Rule—The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks 39–45 (June 29, 2020) (Docket No. EPA-HQ-OAR-2018-0283), https://ago.vermont.gov/wp-content/uploads/2020/08/20200629-UCS-et-al-SAFE-Part-II-Petition-for-Reconsideration_Print_Copy.pdf. The agencies' sales and scrappage modeling as well as data manipulation have also been criticized heavily for underestimating the social costs of the SAFE Rule, among numerous other errors. *See*, *e.g.*, Dave Cooke, *EPA Made So Many Mistakes with Clean Cars Rollback, Even Its Own Lawyers Want to Know What's Up*. Union of Concerned Scientists (July 30, 2020) https://blog.ucsusa.org/dave-cooke/epa-made-so-many-mistakes-with-clean-cars-rollback-even-its-own-lawyers-want-to-know-whats-up (providing a broad overview of the issues); Robinson Meyer, *Trump's New Auto Rollback Is an Economic Disaster*, The Atlantic (Apr. 13, 2020) (criticizing inclusion of years 2018-20 in the analyses).

[7] *Id*.

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I. The Agencies Inflate Total Automaker Compliance-Cost Savings Through the Controversial Methodology of Retail Price Equivalents

Summary of Retail Price Equivalents

- In the SAFE Rule, the agencies model the compliance costs of the baseline standards to help assess the purported cost savings of the rollback. To do so, they multiply the direct cost of compliance technologies with a constant—known as the Retail Price Equivalent ("RPE")—meant to represent non-technological costs such as overhead and marketing.
- In their primary analysis, the agencies assume an RPE of 1.5. In other words, the agencies assume that indirect, non-technological compliance costs are equal to half of technological costs across all producers and technologies.
- Yet in prior rulemakings, the agencies have accounted for indirect costs through another approach—the Indirect Cost Multiplier ("ICM")—or by using lower values of RPE. There is strong evidence that these prior approaches, rather than the agencies' approach in the SAFE Rule, are conceptually correct. The agencies did not provide a satisfactory explanation for disregarding the ICM methodology.
- Analyses included in the SAFE Rule show that under the ICM approach or a lower value of RPE, the savings in total compliance costs driven by rolling back the baseline standards would be almost 20% lower than under an RPE of 1.5, thus demonstrating that the SAFE Rule's supposed cost savings may be much smaller than the agencies have estimated.

Background

To predict the effects of this rollback, the agencies need, among other things, to calculate vehicle costs under both the baseline standards and the SAFE Rule. To do that, they run a model that predicts what fuel-economy and emission-reduction technologies vehicle manufacturers choose under the relevant regulatory scenario. The engineering costs of installing those technologies is then multiplied by a retail price equivalent.

The logic behind RPEs is to reflect the indirect costs that manufacturers incur in addition to direct production costs, such as corporate operations, marketing, and sales. The indirect costs also include a typical rate of profit. Conceptually, RPE can be calculated as a ratio of revenue from vehicle sales to direct costs of producing the vehicles. The RPE multiplier is constant across all producers and technologies.[8]

Under their primary analysis of the SAFE Rule, the agencies assume an RPE multiplier of 1.5.[9] This multiplier is important for the analysis of the SAFE Rule, as it is a key input in determining the costs of compliance and thus, ultimately, the rule's sales and scrappage effects. With a higher RPE, the analysis

[8] *See* 77 Fed. Reg. at 62,708 (explaining that RPE "includes all forms of indirect costs for a manufacturer and assumes that the ratio applies equally for all technologies").

[9] 85 Fed. Reg. at 24,351.

would show that the baseline standards were more expensive to comply with, making their rollback seem more socially desirable than it would with a lower RPE. Under the RPE of 1.5 that the agencies use, for instance, the sales difference between the baseline CAFE standards and the weakened standards in the SAFE Rule is 2.7 million new vehicles from Model Years 2019 to 2029.[10]

In addition to their primary analysis, the agencies also conduct sensitivity analyses examining the impacts of the SAFE Rule at RPEs of 1.1, 1.24, and 2.0. With an RPE of 1.1, the projected sales boost from the SAFE Rule's CAFE standards decreases to 1.8 million. Yet with the RPE value set at 2.0, the rollback results in 4.5 million additional cars sold.[11] The sales effects are closely interlinked with the ultimate findings about the rule's costs and benefits: Net benefits of the SAFE Rule's CAFE standards switch from -$52.7 billion under an RPE of 1.1 to +$50.5 billion with an RPE markup of 2.0.[12]

That wide range of sales effects under alternative multiplier values demonstrates that the evaluations of the SAFE Rule are extremely sensitive to the choice of RPE, making the assessment of indirect costs incredibly significant.

The Agencies' Controversial Methodological Choice Likely Produces an Inflated Estimate of Cost Savings

While the use of the RPE approach and the exact RPE value have a huge impact on the analysis of the SAFE Rule, the agencies do not sufficiently justify their decision to rely on an RPE of 1.5. For one, the proper value of the RPE is controversial, and many believe a lower value is appropriate.[13] Moreover, there are questions about whether RPE is conceptually correct, and using an alternative approach that the agencies have previously relied upon would also reduce the SAFE Rule's projected cost savings.

Conceptually, indirect costs might be different among various car makes and models, undercutting the rationale for a constant RPE. For instance, van Velzen et al. (2019) argue that electric vehicles are commonly sold at or below production costs in the early years of sales given the high initial investment (and given that once market share has increased by offering a low price, standardization efficiencies kick in and this lowers the production cost). Therefore, they estimate the RPE of battery electric vehicles to be around 1.0, and claim that producers will need to increase the RPE at some point in the future in order to recoup investments.[14]

Indirect costs may also differ substantially across different technologies. As Rogozhin et al. (2010) explained: "A concern in using the RPE multiplier in cost analysis for individual technologies is that the indirect costs of vehicle modifications are not likely to be the same for different technologies. For example, less complex technologies could require less retooling or research and development . . .

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[10] *Id*. at 24,925.

[11] At the RPE of 1.24, the agencies project that the SAFE Rule will increase vehicle sales by 2.1 million, a difference of 600,000 from the primary analysis. Final Regulatory Impact Analysis: The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021–2026 Passenger Cars and Light Trucks 1790 tbl. VII-478 (updated July 1, 2020) (hereinafter "FRIA"). The FRIA refers to these RPEs as "Technology Cost Markup."

[12] *Id.* at 375 tbl. VI-33 (projecting impacts of various RPEs on the CAFE program at a 3 percent discount rate).

[13] *See* National Research Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* (2002), https://doi.org/10.17226/10172. *See also* Jack Faucett Associates, *Update of EPA's Motor Vehicle Emission Control Equipment Retail Price Equivalent (RPE) Calculation Formula* (1985).

[14] Arjan van Velzen, Jan Anne Annema, Geerten van de Kaa & Bert van Wee, *Proposing a More Comprehensive Future Total Cost of Ownership Estimation Framework for Electric Vehicles*, 129 Energy Policy 1034 (2019).

efforts than more complex technologies."[15] Likewise, as the agencies have recognized, "the indirect costs of new technologies vary, both with the complexity of the technology and with the time frame."[16] In the case of the specific technology improvements at issue here, such as vehicle electrification, engine improvements, and aerodynamic improvements, there is thus little reason to believe that the share of indirect costs should be reasonably captured by RPE, which represents the estimated share of indirect costs across all technologies.

And indeed, past analyses prepared by the agencies for Model Years 2012-2016 and 2017-2025 relied heavily on another methodology, called indirect cost markup (ICM). While this methodology also scales up the direct technology costs by a factor, that scaling factor varies depending on the particular technology and the applicable timeframe (i.e., short-run vs. long-run effects).[17] The indirect cost multiplier attempts to assign costs to products based on the activities they require.[18] Although assigning specific cost multipliers to individual technologies can be somewhat tricky and is subject to dispute,[19] the agencies have developed reasonable methods to do so in their prior analyses.[20]

As the agencies explained in 2017, "EPA considers the ICM approach to be the more appropriate approach and . . . this position is supported by many stakeholders."[21] Indeed, comments submitted to the agencies by distinguished scientific organizations have broadly supported the ICM methodology.[22] In

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[15] Alex Rogozhin, Michael Gallaher, Gloria Helfand & Walter McManus, *Using Indirect Cost Multipliers to Estimate the Total Cost of Adding New Technology in the Automobile Industry*, 124 Int'l J. Production Econ. 360 (2010).

[16] Final Regulatory Impact Analysis: Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks 176 (2010) (hereinafter, "2010 FRIA"); *see also* 85 Fed. Reg. at 24,352–53 ("[T]he indirect cost multipliers increase with the complexity of the technology and decrease over time.").

[17] *See, e.g.*, 2010 FRIA at 176–78.

[18] RTI International and Transportation Research Institute (University of Michigan), *Automobile Industry Retail Price Equivalent and Indirect Cost Multipliers* (2009) (prepared for EPA).

[19] Nat'l Acads. of Scis., *Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles* 248 (2015) ("In theory, this [ICM] approach seems clearly superior to assuming identical impacts for all technologies regardless of their nature. However, attribution can be ambiguous, especially for future costs."); *see also id.* at 259 ("The committee conceptually agrees with the Agencies' method of using an indirect cost multiplier instead of a retail price equivalent to estimate the costs of each technology since ICM takes into account design challenges and the activities required to implement each technology. In the absence of empirical data, however, the committee was unable to determine the accuracy of the Agencies' ICMs.").

[20] *See* 2010 FRIA at 178–80 (estimating indirect cost multipliers depending on technology complexity).

[21] Response to Comments: Final Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards Under the Midterm Evaluation 104 (2017). For the rules for model years 2012-2016 and 2017-2025, the RPE was used only as a sensitivity check, and for the Draft Technical Assessment Report ("Draft TAR") produced as part of the agencies' 2016 mid-term evaluation of the baseline standards, the two methods were used in parallel to acknowledge the uncertainty surrounding both methods.

[22] Numerous commenters have supported the use of ICM in prior fuel-efficiency rulemakings. *See, e.g.*, *id.* at 44 ("In commenting on the Draft TAR, multiple comments from NGOs (American Council for an Energy-Efficient Economy (ACEEE), Union of Concerned Scientists (UCS), and Environmental Defense Fund (EDF)) supported EPA's use of Indirect Cost Multipliers (ICMs) rather than retail price equivalents (RPEs) as a means of estimating indirect costs."). The same is true of this rulemaking. *See* 85 Fed. Reg. at 24,365 ("Several responders submitted comments on the issue of indirect costs. The International Council on Clean Transportation (ICCT) stated that 'The agencies abandoned their previously-used indirect cost multiplier method for estimating total costs, which was vetted with peer review, and more complexly handled differing technologies with different supply chain and manufacturing aspects. The agencies have, at this point, opted to use a simplistic retail price equivalent method, which crudely

short, while the exact valuations for the ICM methodology are subject to some dispute, there is broad recognition that the methodology is conceptually superior to RPE and that its results merit genuine consideration.

Yet despite the fact that both the commenters here and the agencies in previous proceedings have touted the ICM methodology, the main analysis and scenarios in assessing the SAFE Rule rely solely on the RPE methodology. Attempting to justify their methodological change, the agencies acknowledge that ICM has "conceptual merit" yet claim that "data to support such estimates is scant and, in some cases, nonexistent."[23] But while there is admittedly some uncertainty over the proper ICM estimates, the agencies are incorrect that adequate data does not exist and lack sufficient justification to entirely disregard the ICM approach in their primary analysis.

In fact, in the SAFE Rule the agencies provide an estimate of costs computed based on ICM (with ICM values slightly increased compared to values used by the agencies previously)—which the agencies bury in the text and surround by claims about substantial uncertainty around the ICM method.[24] Critically, in that analysis the agencies find that the ICM value produces similar results as the RPE value of 1.24—and therefore use that RPE value as a proxy for the ICM approach in their sensitivity analyses.[25] And as discussed above, because the RPE of 1.24 is considerably lower than the RPE value of 1.5 used in the primary analysis, the agencies have no choice but to conclude that the rollback looks substantially worse when an RPE of 1.24—standing in for the ICM method—is applied.

For instance, in their analysis of the SAFE Rule, the agencies find that while "the relative effects of ICMs may vary somewhat by scenario," in one case "the application of ICMs produces total technology cost estimates roughly 18 percent lower than those that would result from applying a single RPE factor to all technologies, or, conversely, the RPE produces [cost] estimates that averaged 21 percent higher than the ICM."[26] And by projecting lower cost savings from the rollback, the ICM method also reduces the sales impacts and overall net benefits of the SAFE Rule. Specifically, the agencies project that with an RPE of 1.24 (which, again, they use as a proxy for the ICM method) the rule will cause a far lower sales boost

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assumes all technologies have a 50 percent markup from the direct manufacturing technology cost. We recommend the agencies revert back to the previously-used and better substantiated ICM approach.' . . . A private commenter, Thomas Stephens, noted that 'In Section II. Technical Foundation for NPRM Analysis, under 1. Data Sources and Processes for Developing Individual Technology Assumptions, the agencies state that indirect costs are estimated using a Retail Price Equivalent (RPE) factor. Concerns with RPE factors and the difficulty of accounting for differences in indirect costs of different technologies when using this approach were identified by the EPA (Rogozhin et al., Using indirect cost multipliers to estimate the total cost of adding new technology in the automobile industry, International Journal of Production Economics 124, 360-368, 2010), which suggested using indirect cost (IC) multipliers instead of RPE factors. The EPA developed and updated [indirect cost] multipliers for relevant vehicle technologies with automotive industry input and review. The agencies should consider using these [indirect cost] multipliers to estimate indirect manufacturing costs instead of RPE factors.'").

[23] 85 Fed. Reg. at 24,350. *See also id.* at 24,364 ("On balance, and considering the relative merits of both approaches for realistically estimating indirect costs, the agencies consider the RPE method to be a more reliable basis for estimating indirect costs."); *id.* at 24,366 (claiming that ICM values "have not been validated" and "conflict with the empirically derived RPE value").

[24] See FRIA at 374–75 & tbl. VI-32 (summarizing compliance costs depending on the method used for computing indirect costs); *see also* Preliminary Regulatory Impact Analysis: The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021 – 2026 Passenger Cars and Light Trucks 1194–95 & tbl. 9-90 (2018).

[25] FRIA at 374.

[26] *Id*.

than under their main analysis.[27] And they conclude that the rule is net costly at this RPE no matter the discount rate: the SAFE Rule's CAFE program would result in net benefits of -$41.7 billion at a 3 percent discount rate, or -$5.1 billion using a 7 percent discount rate.[28]

The agencies' main argument against ICM is the presence of uncertainties associated with that methodology. But while some uncertainty exists with ICMs, those values were derived through a rigorous peer review[29] and mere imprecision in those estimates does not justify discarding them and returning to the RPE methodology that the agencies acknowledge to be flawed. Technologies to comply with fuel-efficiency and greenhouse gas emission standards are frequently of low complexity, such as rolling-resistance tires, and so it is intuitive that they may have lower indirect costs than technologies that, for instance, improve vehicle acceleration. At minimum, the agencies should have conducted further analysis of ICMs, or assessed the RPE and ICM methods in tandem as they did in 2016.[30] By reverting entirely to the RPE methodology that overstates the indirect costs of complying with this rule, according to available estimates, the agencies likely overstate the compliance costs of the baseline standards and attendant cost savings of the SAFE Rule, perhaps drastically so.

[27] *Id*. at 1790 tbl. VII-478 (projecting that the SAFE Rule's CAFE program would increase new vehicle sales by 2.1 million assuming an RPE of 1.24—a decline of 600,000 vehicles from the primary analysis applying an RPE of 1.5).

[28] *Id.* at 1804, 1806. The same is true of the greenhouse gas standards, with net benefits of -$42.3 billion at a 3 percent discount rate and -$9.3 billion at a 7 percent rate. *Id.* at 1808, 1810. The agencies' main analyses of both the CAFE and greenhouse gas standards (using an RPE of 1.5) indicate that the rollback is net costly under 3 percent discount rates but slightly net beneficial when 7 percent discount rates are used. *See supra* notes 3–4 and accompanying text.

[29] *See, e.g.*, Rogozhin et al. (2010), *supra* note 16.

[30] 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 5-239 (2016) ("For this Draft TAR analysis, recognizing there are uncertainties in the use of either ICM or RPE as indicators of indirect costs, … EPA chose to assess indirect costs using both the ICM and RPE approaches.").

II. The Agencies Further Overestimate Cost Savings by Irrationally Assuming that Manufacturers Pass 100% of Compliance Costs on to Purchasers

Summary of Pass-Through Considerations

- The agencies assume that all compliance costs (both direct and indirect, including profit margin) are fully passed on to consumers.
- This contrasts with literature, both theoretical and empirical, finding that while automakers may pass some compliance costs to their consumers, there is usually less than full pass-through. Faced with this countervailing evidence, the agencies do not provide a strong justification for assuming full pass-through.
- Discarding the assumption of full pass-through reveals that the SAFE Rule saves fewer compliance costs and is thus is far more costly to consumers than the agencies acknowledge.

Background

After determining how much automaker compliance costs allegedly increased under the baseline standards, the agencies need to make assumptions about how those cost increases translate into higher sticker prices for new vehicles. The degree to which manufacturers pass on the cost shocks (i.e. sudden additional costs) to consumers is referred to as "pass-through." In analyzing the SAFE Rule, the agencies assume that additional compliance costs (both direct and indirect) from the baseline standards would be fully passed on to consumers in the form of higher prices. Importantly, full pass-through combined with the RPE approach, discussed above, implies that strengthening the standards (as the agencies did in the baseline standards) substantially increases retail prices, due to increased costs incurred by the producers to directly comply with fuel-economy and greenhouse gas emission standards as well as increases in the markup for those additional costs.

The Agencies' Assumption of Full Pass-Through Is Not Reasonable

In contrast to the agencies' assumption in the SAFE Rule, however, the economic literature—both empirical and theoretical—finds that companies frequently do not fully pass through additional costs.[31]

[31] The bulk of the evidence for incomplete pass-through stems from studies that measure the impact of changes in the exchange rate or reductions in tariffs. Recently, incomplete pass-through has also been documented in the domestic setting. One study, for instance, found incomplete pass-through of energy input price changes across industries of the U.S. manufacturing sector. Sharat Ganapati, Joseph Shapiro & Reed Walker, *Energy Cost Pass-Through in U.S. Manufacturing: Estimates and Implications for Carbon Taxes*, 12 Am. Econ. J.: Applied Econ. 303 (2020). The assumption of full pass-through was prevalent in the older trade literature as the workhorse model in international economics (which much of the literature relied on) assumes constant elasticity of substitution demand and monopolistic competition. Those assumptions together have been shown to imply constant markups and complete pass-through in equilibrium. *See* Costas Arkolakis, Arnaud Costinot & Andrés Rodríguez-Clare, *New Trade Models, Same Old Gains?*, 102 Am. Econ. Rev. 94 (2012). However, if vehicle manufacturers do not face constant elasticity of substitution demand then the marginal cost shocks do not directly translate into price changes, meaning prices are substantially less volatile than costs.

The empirically estimated pass-through rates vary vastly across markets and implemented policies, with some studies finding even negative pass-through rates.[32] There are numerous explanations for why cost increases are not passed one-for-one into the prices paid by consumers and why there is heterogeneity of pass-through rates.

For one, economic theory suggests that fixed costs should not determine price levels, and there is empirical evidence that firms indeed only partly account for fixed costs when setting their prices.[33] The literature also finds that competition is one of the significant determinants of the exact pass-through level: Generally, competitive markets yield higher pass-through rates, because in a competitive market the consumer price already represents the marginal cost of production and so a variable cost shock is necessarily passed onto consumers.[34] Moreover, the nature of the demand has also been shown to affect pass-through. In a competitive market, if demand is perfectly "elastic"—meaning that a higher retail price leads to a large drop in sales—producers will bear the full impact of a production-cost increase. Conversely, if consumers are not price-sensitive, they will bear the burden of the cost increase.[35] Finally, the empirical work documents that more-profitable producers absorb a greater proportion of a cost shock into their markups, meaning that their pass-through rate is lower than it is for less-profitable producers.[36]

Indeed, one study—Gron and Swenson (2000)—looking particularly at the U.S. automobile market, confirms that full pass-through does not occur in this market. Analyzing automotive data from 1984 to 1994, the authors firmly reject the hypothesis of full cost pass-through and constant markups, finding that automobile manufacturers do not fully pass along additional costs to their consumers.[37]

Yet the agencies reject this strong evidence and instead rely on the assumption of complete cost pass-through, citing two peer reviewers of the CAFE model and the competitive character of the automotive sector in support of their decision.[38] But neither of these two justifications holds up.

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[32] For an explanation of the mechanism behind the negative pass-through rate, see Francesco Gullì, *Pollution Under Environmental Regulation in Energy Markets* (2013).

[33] *See, e.g.*, Michael Lucas, *Pricing Decisions and the Neoclassical Theory of the Firm*, 14 Mgmt. Accounting Res. 201 (2003) (reviewing accounting and economic studies on how firms set prices with respect to fixed costs).

[34] The pass-through differences between various market structures depend mostly on convexity of demand curves, with competitive markets leading to higher pass-through rates unless demand is very convex. *See* E. Glen Weyl & Michal Fabinger, *Pass-Through as an Economic Tool: Principles of Incidence under Imperfect Competition,* 121 J. Political Econ. 528 (2013). *See* also Francesco Gullì & Liliya Chernyavs'ka, *Theory and Empirical Evidence for Carbon Cost Pass-Through to Energy Prices*, 5 Annual Rev. Resource Econ. 349 (2013).

[35] The relationship between demand and pass-through is more complex for imperfectly competitive markets than it is for competitive markets. For an explanation of how demand characteristics affect pass-through in markets depending on producers' market power, see RBB Economics, *Cost Pass-Through: Theory, Measurement, and Potential Policy Implications A Report Prepared for the Office of Fair Trading* 14-17 (2014), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/320912/Cost_Pass-Through_Report.pdf.

[36] *See* Nicolas Berman, Philippe Martin & Thierry Mayer, *How Do Different Exporters React to Exchange Rate Changes?*, 127 Quarterly J. Econ. 437 (2012) (for evidence based on French data); Mary Amiti, Oleg Itskhoki & Jozef Konings, *Importers, Exporters, and Exchange Rate Disconnect*, 104 Am. Econ. Rev. 1942 (2014) (for evidence based on Belgian data).

[37] Anne Gron & Deborah Swenson, *Cost Pass-Through in the U.S. Automobile Market*, 82 Rev. Econ. & Statistics 316 (2000).

[38] *See* 85 Fed. Reg. at 24,595.

First, using the peer reviews to support full pass-through is a stretch to say the least. Indeed, as the agencies themselves acknowledge, the peer reviewers questioned the assumption of full pass-through and flagged it as an issue for further examination.[39] For instance one reviewer, Ph.D. economist and university professor James Sallee—one of the experts whom the agencies rely on in the SAFE Rule to justify their assumption of full pass-through—in fact explained that the agencies' assumption of full pass-through "likely overstates the effects of technology deployment costs on new car sales," and that, in reality, "only true marginal costs of technology would be reflected in the price."[40] Sallee further explained that assuming full pass-through for fixed costs, as the agencies do in the SAFE Rule, "distort[s] the sales response model."[41]

Second, the agencies are wrong to justify their assumption of full pass-through on the alleged competitiveness of the domestic automotive market. In competitive markets, pricing is typically determined by marginal costs—that is, the cost added by producing an additional unit of a product. But a substantial share of the compliance costs with fuel-efficiency regulations is fixed, or, in other words, non-marginal. For instance, redesigning an assembly line to implement engine changes or launching a particular marketing campaign to explain to consumers the advantage of a new fuel-economy technology cost the same, no matter how many vehicles are sold. In a perfectly competitive market, those fixed costs would not affect the final price, because in competitive markets the consumer price reflects the manufacturer's marginal cost and not fixed cost. In other words, cost shocks that have a fixed cost component will have a pass-through rate lower than 1 in competitive markets.[42] Thus, the agencies' assumption that the automotive market is competitive does not justify their hypothesis of full pass-through of costs, and, when considered in proper context, in fact supports the opposite conclusion.[43]

Additionally, the assumption of full pass-through conflicts with the agencies' prior statements. As recently as 2016, the agencies acknowledged that automakers likely "absorb some of the increased technology costs" rather than pass them onto consumers.[44] While concluding at that time that they lacked "sufficient information to model the way in which manufacturers actually price their current and future fleets," the agencies acknowledged that simply adding technology costs onto existing vehicle prices was "not accurate" for projecting future sticker prices because manufacturers may absorb some of the technology costs or engage in other pricing strategies."[45] Just four years later, however, the agencies now reverse course, claiming without reasonable justification that automakers fully pass through increased cost.

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[39] CAFE Model Peer Review B-3 (revised July 2019).

[40] *Id.* at B-55.

[41] *Id.*

[42] This point was also made by James Sallee in his review. See *id.* at B-7.

[43] The agencies also contradict themselves in characterizing the market structure of the automotive sector. Some sections of the rule discuss "strategic" actions of manufacturers, in particular "strategic pricing" decisions. But this conflicts with the assumption of the sector being competitive since strategic pricing is a feature of imperfectly competitive markets. *See, e.g.*, 85 Fed. Reg. at 24,596 ("[M]anufacturers are better positioned to incorporate smaller price adjustments into their current strategic pricing models."); *id.* at 24,625 ("Manufacturers have strategic, complex pricing models that rely on extensive market research and reflect each company's strategic interests in each segment.").

[44] 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 13-93 (2016).

[45] *Id.* at 13-94, 13-95.

And this error is significant. Assuming full pass-through, especially when combined with the assumption of a high RPE value, results in the conclusion that the baseline standards produced substantial sales declines, and thus makes the SAFE Rule appear far less costly than it really is. Correcting the pass-through would make the results more realistic. While projecting the precise impact of this error is difficult because the agencies do not conduct sensitivity analyses for pass-through rates, we can approximate the effects of the agencies' pass-through assumption by looking at the sensitivity analyses around retail price multipliers. This is because pass-through and RPE are both constant factors scaling up costs of compliance when computing the vehicle price changes driven by regulation. Therefore, they both produce the same effects on sales, rebound, and scrappage analyses. For that reason, we can assess the impacts of decreasing pass-through by looking at the impacts of a proportional RPE decrease.

For instance, we can look at the sensitivity analysis with an RPE of 1.24, which tells us the effects of a pass-through value of 0.82 (meaning 82% of added costs are passed along to consumers). Such pass-through would imply that the SAFE Rule's CAFE standards would increase vehicle sales by over 500,000 fewer cars than the agencies project by assuming full pass-through.[46] For the greenhouse gas emissions program, that pass-through assumption results in a similar decline from the agencies' unrealistic projection.[47] Thus, because the agencies justify the SAFE Rule in part on the purported sales increase of reducing the standards and the used vehicle scrappage effects, the use of more realistic, lower pass-through rates undermines their justification for the SAFE Rule and reveals the rule to be far more socially harmful than the agencies admit.

[46] FRIA at 1790 tbl. VII-478.

[47] *Id.* at 1794 tbl. VII-479.

III. The Agencies Also Inflate the SAFE Rule's Cost Savings by Disregarding Automakers' Well-Documented Sales-Mixing Strategies

Summary of Sales-Mix Considerations

- The agencies assume in their analysis of the SAFE Rule that any price increase caused by fuel-economy requirements is the same for every vehicle.
- But this contrasts with both empirical literature and economic theory finding that manufacturers reduce compliance cost and maximize profit by tailoring price increases to individual products, which is known as "sales mixing."
- Accounting for sales mixing further reduces the compliance costs of the baseline standards and thereby reveals that the rollback does not save costs to the degree predicted by the agencies and, conversely, that the rollback is much more socially detrimental than estimated.
- The agencies fail to provide a reasonable justification for disregarding well-documented sales-mixing effects.

Background

After establishing how much costs from the baseline standards get passed through to consumers, the agencies need to make assumptions about how manufacturers split that total amount among individual vehicles—in other words, how much individual car prices increase when standards are strengthened. But manufacturers can act strategically in how the price increases are spread across their fleets. Strategically passing the cost increase to individual vehicles—called "sales mixing" or, in the context of regulatory compliance, "shadow pricing"—increases profits compared to simply increasing the prices of all vehicles by the same amount as the agencies assume in the SAFE Rule.

The obvious way that manufacturers can decrease compliance cost and thereby maximize profit when standards are strengthened is to increase the price of gas-guzzlers more than the price of fuel-efficient cars. (Conversely, when standards are weakened—as the SAFE Rule does—the price of gas-guzzlers may decline more than the price of efficient vehicles). Doing so encourages the purchase of fuel-efficient cars, which, in turn, means that manufacturers can achieve a lower average fuel-economy and lower greenhouse gas emissions and thereby satisfy federal standards in part by shifting consumer choices rather than making technological investments. Accordingly, this sales-mixing strategy decreases the compliance cost that automakers face compared to the naïve strategy of increasing all vehicle prices equally.[48]

Vehicle manufacturers pursue sales mixing to reduce the overall compliance cost of the standards, while also ensuring a profit-maximizing recovery of those costs. This involves sophisticated pricing strategies to account for flexibility of consumer demand for individual vehicle types. By

[48] The agencies do separately model the rule's impacts on the price of passenger cars versus light trucks, but assume no sales-mixing within those broad categories.

strategically spreading price increases across segments (or even vehicles) with different price elasticities, automakers limit their sales losses and recoup part of the compliance cost of the standards, thereby decreasing the overall cost of the regulatory regime.

The evidence for sales-mixing impacts is not just theoretical: In fact, there is a widespread agreement among economists that sales-mixing is used by vehicle manufacturers. Empirical studies supporting the use of sales mixing by automakers include Goldberg (1998),[49] Austin & Dinan (2005),[50] Anderson & Sallee (2011),[51] and others[52]—providing firm evidence that automakers use sales mixing to reduce and recoup the compliance cost of more stringent technical standards.

Given this widespread empirical and theoretical evidence of sales mixing, the agencies should have assessed the impacts of the SAFE Rule assuming that manufacturers rely on sales mixing. In their analysis, however, the agencies assume that vehicle manufacturers act very naïvely and increase the price of every vehicle by the same amount[53]—disregarding common strategies that automakers have adopted in the past to maximize profit. The agencies provide no sensitivity analyses around that assumption, failing to recognize even the possibility that automakers may employ sales mixing.

The Agencies Fail to Rationally Justify Their Assumption of No Sales Mixing

The agencies attempt to justify their decision to ignore sales mixing by pointing to uncertainty around how manufacturers would apply the practice. Specifically, they explain that while it is "likely that manufacturers employ pricing strategies that push regulatory costs … into the prices of models and segments with less elastic demand, the extent to which any [manufacturer] is able to succeed at this is unknown by the agencies," and so the agencies simply disregard this effect and assume uniform price increases.[54]

But this excuse makes no sense. Tellingly, for one, the agencies acknowledge that sales mixing occurs. While the precise extent of sales mixing may be somewhat uncertain, the agencies could and should have used the existing empirical literature to make educated projections about the extent of sales mixing. In contrast, assuming no sales mixing—while simultaneously acknowledging that some sales mixing occurs—is irrational. Indeed, the agencies do not allow similar lack of readily available information to keep them from making other assumptions in the SAFE Rule when doing so makes the

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[49] Pinelopi Goldberg, *The Effects of the Corporate Average Fuel Efficiency Standards in the US*, 46 J. Industrial Econ. 1 (1998).

[50] David Austin & Terry Dinan, *Clearing the Air: The Costs and Consequences of Higher CAFE Standards and Increased Gasoline Taxes*, 50 J. Envtl. Econ. & Mgmt. 562 (2005).

[51] Soren Anderson & James Sallee, *Using Loopholes to Reveal the Marginal Cost of Regulation: The Case of Fuel-Economy Standards*, 101 Am. Econ. Rev. 1375 (2011).

[52] *See, e.g.*, Anne C. Mulkern, *Economists see errors in government claims on pricing*, E&E NEWS (Aug. 6, 2018), https://www.eenews.net/climatewire/2018/08/06/stories/1060092785 (giving an overview of economic thinking on pricing and quoting economist Mark Jacobsen, associate professor of economics at the University of California, San Diego as saying that "'[a]utomakers don't always raise the price of cars relative to the costs of meeting fuel economy standards" but rather have "price points they're trying to meet for specific markets").

[53] The agencies estimate the sales difference between the baseline standards and the SAFE Rule by the average compliance cost and the sales elasticity (which in the model assumes to be -1), without any accounting for sales mixing.

[54] 85 Fed. Reg. at 24,595.

SAFE Rule look less harmful—such as with the scrappage model, for instance.[55] Since we know that sales mixing reduces compliance cost for the baseline standards and thereby makes this SAFE Rule less cost-saving, the assumption of no sales mixing unequivocally inflates the benefits of this rule. While the precise effect of sales mixing is likely subject to some uncertainty, we can be confident that it at least has some impact—not none, as the agencies falsely assume.

The further justification that the agencies provide underscores that they may not fully comprehend the use of sales mixing. For instance, while the agencies correctly acknowledge that "luxury vehicles . . . often have fuel economy levels below (or CO2 levels above) their targets on the curves"[56]—which implies that these vehicles have a high shadow cost as they force the regulated company to apply disproportionally high fuel-economy improvements to other models to stay compliant on the fleet level—they then fail to draw this statement to its logical conclusion. According to the logic of sales mixing, manufacturers should increase the price of luxury vehicles to comply with more stringent standards, thus causing some drop in the sales of those vehicles.[57] But rather than recognizing that the profit-maximizing strategy to comply with the baseline standards would be to sell fewer luxury vehicles at higher prices, the agencies suggest the possibility of *increasing* the sales of those cars, surmising "that selling more of [the luxury vehicles would] compensate for lost profit elsewhere."[58] Increasing the sales of the luxury cars would require lowering the price of those vehicles relative to other cars—thus making it more difficult and expensive for agencies to comply with the baseline standards—and would not comport with the observed practice of sales mixing.

Had the agencies properly accounted for sales mixing, they would have recognized that the SAFE Rule is even more harmful than they acknowledge. For one, sales mixing would partially mitigate any negative sales effect of the baseline standards claimed in the SAFE Rule. Appropriately accounting for sales mixing would have also shown that the SAFE Rule will increase the proportion of gas-guzzlers

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[55] *See id.* at 24,628 ("The agencies agree that there is uncertainty around the magnitude of the sales and scrappage response, but do not agree that sign of either effect is uncertain. Importantly, excluding modeling of the sales and scrappage effects would only make sense if there was a legitimate existential concern—the sales and scrappage effects are founded in very basic economic theory. … Furthermore, the agencies believe that assessing the magnitudes of the sales and scrappage effects is a tractable task for researchers and sufficient data exists to quantify these effects. Thus, excluding these effects would be a serious omission that limits accurate accounting of the costs and benefits of fuel economy standards. Other stakeholders commented that the NPRM analysis did not thoroughly consider the uncertainty around the magnitudes of the sales and scrappage responses. … The agencies believe it is better to consider a range of the scrappage and sales response to address concerns about uncertainty, and that excluding them would be inappropriate.").

[56] *Id.* at 24,595.

[57] An additional argument for increasing the price of luxury vehicles more than the price of vehicles in other segments is the demand for luxury vehicles is likely the least price elastic. Price elasticity of different car segments has been summarized in Consumer Vehicle Choice Model Documentation. Assessment and Standards Division Office of Transportation and Air Quality U.S. Environmental Protection Agency Prepared for EPA by Oak Ridge National Laboratory. EPA-420-B-12-052 (Aug. 2012) ("Based on these estimates, we assume that price elasticities at make/model level are around -4 for non-luxury cars (-4 is about the central value of the literature estimates) and around -2 for luxury and sport cars (-2 is about the central estimate).").

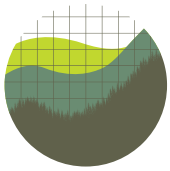
[58] 85 Fed. Reg. at 24,595. The agencies make a similar mistake when they likewise assert that "[w]hile manufacturers could conceivably push some small cost increases into the prices of their vehicle segments that have less elastic demand to cover accordingly small increases in stringency, larger stringency increases would exhaust the ability of such segments to absorb additional costs." *Id.* at 24,596. This comment ignores the fact that, even with extreme price increases, there might be limits to what can be achieved through sales mixing, and not accounting for sales mixing still overestimates the costs.

relative to the baseline standards because automakers will strategically decrease the price of those vehicles the most, meaning that the rollback leads to more fuel costs and environmental damages than currently reported. As a result, a proper analysis of the SAFE Rule that includes sales-mixing effects would indicate that the SAFE Rule will produce substantially higher social costs than the agencies project.

Conclusion

The agencies' unsupported and unreasonable assumptions about automobile sales—inflating the compliance costs of the baseline standards (and thus inflating the supposed savings of the SAFE Rule) by assuming high indirect costs, overstating how much such costs are passed through to the consumers, and disregarding the impacts of sales mixing—all serve to exaggerate the compliance costs of the baseline standards and understate the harms of the SAFE Rule. The agencies fail to justify any of these assumptions, while the economic literature shows that all three are likely incorrect.

A proper analysis of these three assumptions that corrects for the agencies' errors reveals two critical truths about the SAFE Rule. For one, it shows that the SAFE Rule is far more costly than the agencies acknowledge—meaning that the rule is not only net costly for society (which the agencies' existing analysis already reveals), but very substantially so. And second, such an analysis undermines a key justification that the agencies provide for the SAFE Rule itself—that compliance costs for the baseline standards were too high and thus the SAFE Rule saves significant compliance costs. In reality, the agencies inflate the SAFE Rule's cost savings by ignoring how the industry actually works.



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