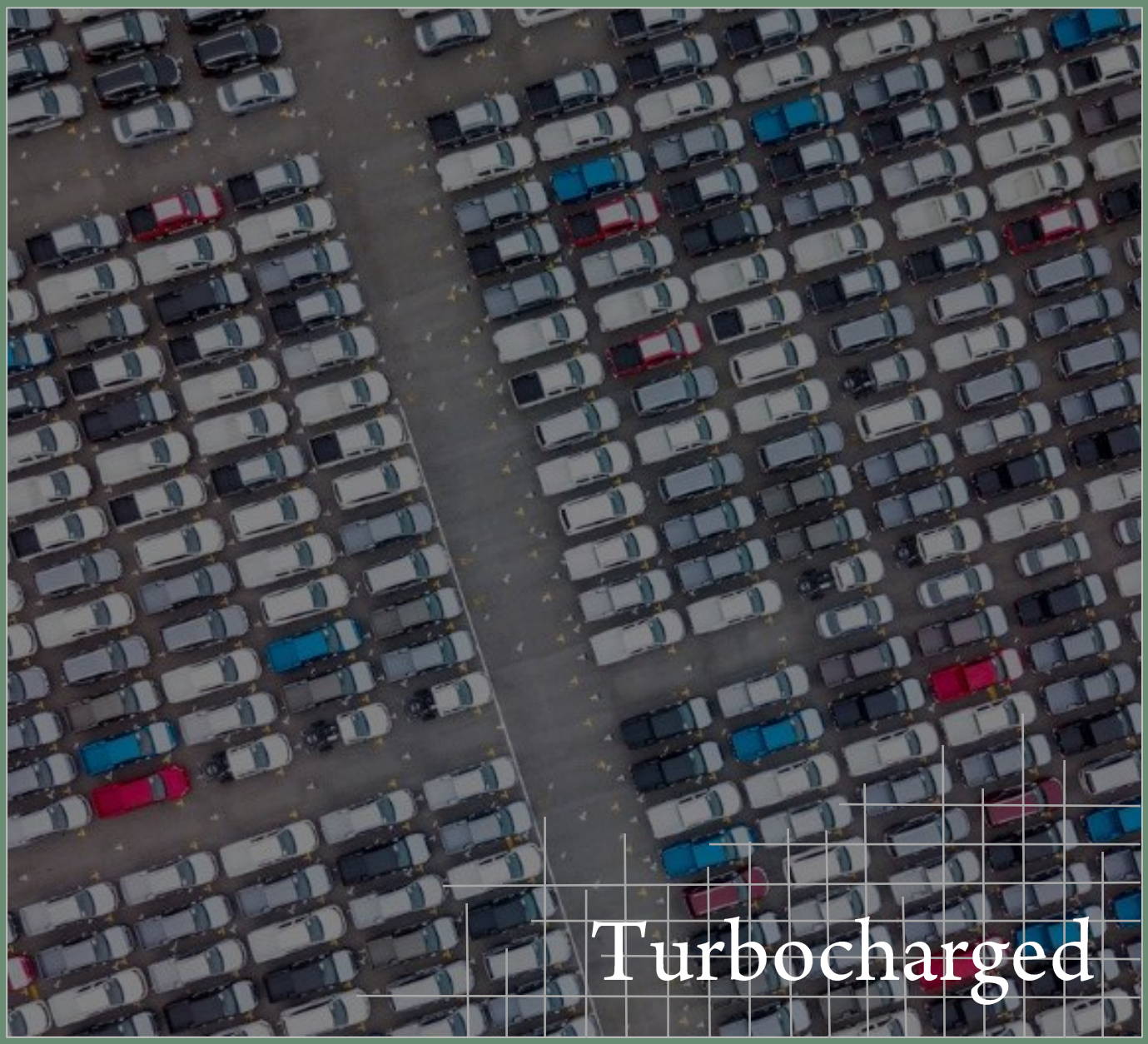


Turbocharged

How One Revision in the SAFE Rule Economic Analysis Obscures Billions of Dollars in Social Harms

Institute *for* Policy Integrity

NEW YORK UNIVERSITY SCHOOL OF LAW

November 2020

Peter Howard

Max Sarinsky

Institute for Policy Integrity
New York University School of Law
Wilf Hall, 139 MacDougal Street
New York, New York 10012

Peter Howard is the economics director at the Institute for Policy Integrity at NYU School of Law, where Max Sarinsky is an attorney. The authors thank Bethany Davis Noll for her editing and feedback on earlier drafts of this report.

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.[2] In this report, we focus on the rule's estimate of vehicle sale price elasticity, which substantially inflates the rollback's effect on new vehicle purchases.

In the SAFE Rule, the Environmental Protection Agency and the National Highway Traffic Safety Administration ("the agencies") drastically roll back the fuel-economy and greenhouse gas emission standards for light vehicles established under the Obama Administration ("baseline standards").[3] One of the agencies' main justifications for the SAFE Rule is that compliance with the baseline standards would have been too costly for both automakers and car buyers.[4] Despite their own projection that the rollback, on net, will harm society by increasing fuel expenditures, exacerbating vehicular pollution, and causing other substantial social costs,[5] the agencies nonetheless claim that the SAFE Rule reflects sound policy by lowering compliance costs, which will cause a "reduction in per-vehicle costs to consumers" that will "enhance the ability of the fleet to

[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 light vehicle standards set by Obama Administration for Model Years 2022–2025 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. Additionally, Policy Integrity published a report highlighting errors in the agencies' estimates of vehicle prices in the SAFE Rule. *See* Sylwia Bialek & Max Sarinsky, *Overinflated: The SAFE Rule's Overstated Estimates of Vehicle-Price Impacts* (2020), https://policyintegrity.org/files/publications/Overinflated_the_SAFE_Rules_Overstated_Estimates_of_Vehicle-Price_Impacts.pdf.

[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 ("The costs to both industry and automotive consumers would have been too high under the standards set forth in 2012.").

[5] *Id.* (concluding that the SAFE Rule's costs exceed benefits by between $13.1 billion–$22 billion, assuming a 3 percent discount rate). Although the agencies project that the rule will result in net benefits at a 7 percent discount rate, those benefits are only between $6.4 billion and $16.1 billion—much smaller than the projected net costs using a 3 percent discount rate. *Id.* Averaging the results at the two discount rates therefore shows that the rule is net costly. It is also worth emphasizing that these numbers reflect both calculation errors and unrealistically optimistic projections of the SAFE Rule's impacts, which collectively obscure tens of billions of dollars of net costs to society. *See infra* note 7.

turn over to newer, cleaner and safer vehicles."[6] Even assuming that this justification were sufficient to promulgate a rule that the agencies acknowledge will harm society on net, the claim—like so many others made by the agencies to justify the SAFE Rule[7]—is highly exaggerated and based on key errors underlying the rule.

Specifically, this report highlights a fundamental error in the agencies' projections about the SAFE Rule's impacts on car sales. The agencies project that the SAFE Rule will reduce compliance costs, which in turn will lower the sticker price of new vehicles[8] and produce an increase in new car sales. But due to a faulty assumption that abruptly appeared in their final analysis, the agencies drastically overstate the connection between sticker price and vehicle sales—an economic metric known as "own-price elasticity of demand" (or simply "price elasticity"). The agencies' chosen price elasticity conflicts with the economic literature, the recommendations of solicited experts, and the agencies' own analysis of other key inputs for assessing the rule's impacts. Particularly confounding is the fact that the agencies drastically—and with virtually no justification—amended their price elasticity estimate from the proposed version of the SAFE Rule.

Correcting the price-elasticity estimate reveals that the SAFE Rule will have far less of an impact on vehicle sales than the agencies theorize, undercutting a main justification for the rule. Indeed, holding the agencies' other assumptions constant, correcting this error wipes away all of the fleet-size increases that the agencies project over the next five to seven years. Correcting the error also shows that the SAFE Rule is far more socially harmful than the agencies acknowledge. While the SAFE Rule is already net-costly under the agencies' own projections, correcting this single error adds another $4–$8 billion in net costs to the rollback.

---

[6] 85 Fed. Reg. at 24,176.

[7] While this report details the agencies' errors only with regard to price elasticity, many of their other assumptions—from their valuation of climate damages to their price and scrappage models—have been heavily criticized for disregarding key costs of the SAFE Rule. *See* , e.g., 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 (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 (highlighting calculation errors along with errors in sales and scrapping models, congestion costs, technology costs, and other aspects of the agencies' analysis) (hereinafter "Petition for Reconsideration"); 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 (for 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 2018-2020 in the analyses); Richard L. Revesz, *Insight: Clean Car Standards Rollback Is 'Arbitrary and Capricious'*, Bloomberg (Apr. 14, 2020), https://news.bloomberglaw.com/environment-and-energy/insight-clean-car-standards-rollback-is-arbitrary-and-capricious (highlighting "obvious analytical flaws" in agencies' analysis and criticizing agencies for promulgating a net-costly rule); Richard L. Revesz & Avi Zevin, *Trump's Clean Car Standards Rollback Is Based on Too Many Lies to Count*, Slate (Apr. 1, 2020), https://slate.com/news-and-politics/2020/04/trumps-epa-clean-car-standards-rollback-lies.html (explaining fallacy of agencies' theories about opportunity costs).

[8] The agencies overstate the link between compliance costs and sticker price, such that the SAFE Rule will indeed produce a far smaller reduction in vehicle sticker price than the agencies project. *See* Sylwia Bialek & Max Sarinsky, *Overinflated: The SAFE Rule's Overstated Estimates of Vehicle-Price Impacts* (2020), https://policyintegrity.org/files/publications/Overinflated_the_SAFE_Rules_Overstated_Estimates_of_Vehicle-Price_Impacts.pdf.

Background on Price Elasticity and the Agencies' Approach

Price elasticity measures the sensitivity of the sales of a particular product to fluctuations in that product's price. While sales will typically increase when prices drop and decrease when prices rise, the strength of that relationship will depend on buyers' need for the product and the availability of substitutes. Sales of necessity products with few comparable substitutes are likely insensitive to price fluctuations. In economic terms, we say that such products are *inelastic*. By contrast, products that are less essential or that can be easily substituted by other products are typically *elastic*, meaning that their sales are more sensitive to price fluctuations.[9]

Automobiles generally fall into the former category. Because automobiles are essential goods in most areas of the United States (and lack any comparable substitute), both economic theory and observed behavior finds that vehicle sales are relatively inelastic—meaning that price fluctuations produce just modest changes in vehicle sales.[10] In the regulatory proposal underlying the SAFE Rule, for instance, the agencies projected that the price elasticity for new car and light truck sales "ranged from -0.2 to -0.3"—meaning, in other words, that a 1 percent increase in sticker price would decrease sales by only 0.2–0.3 percent.[11] While the agencies' analysis for their regulatory proposal was widely criticized for incorporating numerous unsound assumptions and reaching implausible results[12]—including, perhaps most notably, its conclusion that the rollback would violate basic supply-and-demand principles by causing a decline in fleet size while

[9] Robert S. Pindyck & Daniel L. Rubinfeld, Microeconomics 26–30 (1989) (providing background on price elasticity and using the example of butter and margarine to explain that products with close substitutes are more elastic).

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

[11] The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, 83 Fed. Reg. 42,986, 43,075 (proposed Aug. 24, 2018).

[12] For instance, EPA's own Science Advisory Board highlighted many "important weaknesses in both the[] theoretical underpinnings and the[] econometric implementation" of the assumptions underlying the agencies' analysis of their regulatory proposal, highlighting "implausible results regarding the overall size of the vehicle fleet," "implausible assumptions about the use of older vehicles, as well as with an assumed rebound effect that is large relative to the literature [and] considering other problems and inconsistencies," concluding that "these weaknesses are of sufficient magnitude that commenters … suggest that a corrected analysis could reverse the sign of result, indicating that the augural standards provide a better outcome than the proposed revision preferred by the agencies." EPA Sci. Advisory Bd., Consideration of the Scientific and Technical Basis of the EPA's Proposed Rule 1–2 (2020) (hereinafter "SAB Report").

simultaneously reducing compliance cost[13]—their price elasticity estimate was a rare element of this analysis that was not irrational.[14]

Yet in the final rule, the agencies abruptly reject their earlier elasticity estimate and drastically increase the price elasticity. Specifically, the agencies ditch their previous conclusion that changes in vehicle prices "have moderate effects on total sales"[15] by increasing their price elasticity estimate more than three-fold. Under their new estimate, the agencies now claim that the price elasticity for new vehicles is -1—meaning that new car sales decline by 1 percent for every 1 percent increase in sticker price.[16] While hardly their only modeling revision—the agencies made many alterations to their sales and scrappage models in the final version of the rule—this revision is significant for drastically affecting the agencies' findings about sales impacts and fleet size, and, as detailed below, making the SAFE Rule appear billions of dollars less harmful than it actually is by affecting key projections such as pollution emissions and traffic fatalities resulting from the rule.

The agencies offer minimal justification for this substantial revision, and the explanation that they do provide is without merit—it misunderstands the problem, cherry-picks a few studies from the relevant literature, and is inconsistent with their approach to estimating other key parameters for assessing the rule's impacts. As detailed below, a full review of the relevant economic literature confirms that vehicles are an inelastic good—with a price elasticity far below -1 in absolute terms—and that by arbitrarily and erroneously revising this metric, the agencies paper over billions of dollars of additional harm that the SAFE Rule will cause.

---

[13] *See, e.g.*, *id.* at 1 (criticizing the "implausible results regarding the overall size of the vehicle fleet, implying that the revised standards would reduce the size of the vehicle fleet relative to the augural standards when economic theory suggests that the fleet should grow due to a decline in the prices of new vehicles"). In the final SAFE Rule, the agencies presume that purchasers value fuel savings from efficient vehicles during the first 30 months of ownership, 85 Fed. Reg. at 24,278, and thus include expected fuel savings in modeling consumer demand. While including consumers' valuation of fuel savings is appropriate when modeling demand, the agencies lack reasonable justification to cut off the amount of this valuation at 30 months. Assuming a higher valuation of fuel savings would dampen the impact of regulation on vehicle sales.

[14] This is not to say that the agencies' methodology for estimating price elasticity in their regulatory proposal was flawless. For instance, Policy Integrity criticized the methodology that the agencies used to construct their sales model in their regulatory proposal. *See* Inst. for Pol'y Integrity, Comments on Proposed Rule 60–61 (Oct. 26, 2018), *available at* https://policyintegrity.org/documents/Emissions_Standards_EPA_NHTSA_Comments_Oct2018.pdf (hereinafter "Policy Integrity Comments"). However, Policy Integrity did not disagree with the agencies' ultimate conclusion that price elasticity for new vehicles is relatively low.

[15] 83 Fed. Reg. at 43,075.

[16] 85 Fed. Reg. at 24,617.

The Agencies Cherry-Pick the Data, Relying on Older Studies that Look at Too Short a Timeframe to Produce an Unrealistically High Elasticity

The agencies offer only two sentences and a handful of citations as justification for their decision to drastically increase the price elasticity in their final analysis, but even that minimal explanation reveals significant errors in their approach.

Citing three economic studies, the agencies claim that "there is a broad consensus in the economic literature that the price elasticity of demand for automobiles is approximately -1.0."[17] But closer evaluation of these cited studies reveals that they are not representative of the full literature, are inappropriate for analyzing the SAFE Rule's long-term impacts, and hardly represent any "broad consensus."

Most significantly, the three studies that the agencies rely on focus on the elasticity of motor vehicles in the short-run,[18] but this is not the proper timeframe to assess the SAFE Rule's long-term impacts. Many products have differing price elasticities depending on the time-frame. A short-run elasticity is defined as the price elasticity within one year,[19] whereas a long-run elasticity measures effects beginning approximately 5–10 years into the future.[20] While ideally the agencies would model a short- to long-run transition, it is the long-run elasticity that ultimately provides the more appropriate rate for analyzing the aggregate impacts of the SAFE Rule, since the standards set forth in the rule have long-term impacts.

For instance, in a regulatory proposal from 2016, EPA explained that a "short run elasticity estimate . . . may not be appropriate for standards that apply several years into the future."[21] The SAFE Rule not only imposes standards through model year 2026, but the agencies also project the rule's sales impacts over thirty years.[22] For this reason, one of the experts that the agencies solicited to review their analysis, Dr. John Graham, advised the agencies that long-run price elasticity

---

[17] *Id.* at 24,617 & n.1641 (citing Andrew N. Kleit, The Effect of Annual Changes in Automobile Fuel Economy Standards, 2 J. Reg. Econ. 151 (1990); Robert Bordley, An Overlapping Choice Set Model of Automotive Price Elasticities, 28 Transp. Res. Part B: Methodological 401 (1993); Patrick S. McCarthy, Market Price and Income Elasticities of New Vehicle Demands, 78 Rev. Econ. & Stat. 543 (1996)).

[18] Although the agencies do not say so specifically, a review of the three cited studies makes clear that they are providing short-run price elasticity estimates—not long-run estimates. Bordley (1993) and McCarthy (1996) say so explicitly. And while Kleit (1990) does not clearly specify the timeframe of its analysis, thirteen of the sixteen analyses cited in the paper that it relies upon for its elasticity estimate (Irvine (1983)) are short-run estimates. F. Owen Irvine, *Demand Equations for Individual New Car Models Estimated Using Transaction Prices with Implications for Regulatory Issues*, 49 S. Econ. J. 764 (1983).

[19] *See* Robert S. Pindyck & Daniel L. Rubinfeld, Microeconomics 30 (1989) (describing short-run elasticity as measuring "one year or less").

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

[21] EPA, Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards Under the Midterm Evaluation A-40 (2016).

[22] *See* 85 Fed. Reg. at 24,617 tbl.VI-154. Short-run price elasticity rates, by contrast, look at sales impacts for only about one year. *See* Robert S. Pindyck & Daniel L. Rubinfeld, Microeconomics 30 (1989).

provides the "proper focus" for analyzing the SAFE Rule's impacts, explaining that the available literature, as a whole, supports an elasticity that is much lower in absolute terms than the agencies' estimate of -1.0.[23]

Echoing Dr. Graham's analysis, EPA's Science Advisory Board explained in its report on this rule that "the long-run price elasticity for new vehicles is likely to be smaller than the short-run price elasticity … since a consumer can easily hold on to their existing vehicle a bit longer… [whereas] an old vehicle will not be functional forever."[24] The agencies similarly recognized when setting the baseline standards in 2012 that price elasticity for motor vehicles is "smaller in the long run," because "though people may be able to change the timing of their purchase when price changes in the short term, they must eventually make the investment" in a new car even if higher prices remain long-term.[25] In that prior rulemaking, the agencies also recognized that "long-run elasticity may better reflect behavior" over the lifetime of the fuel-efficiency program, but explained that recent estimates of long-run price elasticity were unavailable at that time.[26]

That is no longer the case, however, as considerable research on the elasticity of motor vehicles has been published over the last several years. And those estimates reveal that the long-run price elasticity for new vehicles is far lower (in absolute terms) than the -1.0 estimate that the agencies rely upon, and is much closer to the -0.2 to -0.3 range that they applied in their regulatory proposal. Three relevant studies published in the past two years find that the market's long-run elasticity is -0.13,[27] -0.27,[28] and -0.4,[29] respectively. The other two available estimates produced over the past two decades are -0.61[30] and -1.0,[31] respectively. And prior estimates likewise tend to find that long-run elasticity is far lower than the -1.0 short-run estimate that the agencies rely

---

[23] CAFE Model Peer Review B-35 (revised July 2019), *available at* https://www.regulations.gov/document?D=NHTSA-2018-0067-0055 (second attachment).

[24] SAB Report at 22; *see also* Robert S. Pindyck & Daniel L. Rubinfeld, Microeconomics 32–33 (1989) (explaining that, for durable goods such as automobiles, "the short-run income elasticity of demand will be much larger than the long-run elasticity").

[25] 77 Fed. Reg. at 63,102 n.1300. Although the agencies fail to recognize in the SAFE Rule that short-run elasticity estimates for motor vehicles are generally higher than long-run estimates, one paper that they cite found precisely this, producing a short-run elasticity estimate of -0.79 and a long-run elasticity estimate of -0.61. Sean P. McAlinden et al., The Potential Effects of the 2017-2025 EPA/NHTSA GHG/Fuel Economy Mandates of the US Economy, Center for Automotive Research 27 (2016), cited in 85 Fed. Reg. at 24,617 n. 1642.

[26] 77 Fed. Reg. at 63,102 n.1300.

[27] Antonio M. Bento et al., *Estimating the Costs and Benefits of Fuel-Economy Standards*, 1 ENVTL. & ENERGY POLICY & ECON. 129 (2020).

[28] James H. Stock et al., Comments on Notice of Proposed Rulemaking for The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks 20 (Oct. 26, 2018), *available at* https://www.regulations.gov/document?D=EPA-HQ-OAR-2018-0283-6220.

[29] Benjamin Leard, Estimating Consumer Substitution Between New and Used Passenger Vehicles, Resources for the Future Working Paper 19-02 (2019).

[30] McAlinden et al. (2016), *supra*.

[31] Steven Berry et al., *Differentiated Products Demand Systems from a Combination of Micro and Macro Data: The New Car Market*, 112 J. POLITICAL ECON. 68 (2004).

upon.[32] All told, a full review of the literature supports a long-run price elasticity of roughly -0.6. Focusing only on more recent estimates lowers that estimate even further, to -0.5 (for estimates since 2000) or even -0.4 (for estimates since 2010).

Estimates of Vehicle Price Elasticity

Author(s)	Year	Time Period	Short-Run	Long-Run
McAlinden et al. (2016) – cited in SAFE Rule				
Atkinson	1952	1925-1940	-1.33	-
Nerlove	1957	1922-1941; 1948-1953	-0.9	-1.2
Suits	1958	1929-1941; 1949-1956	-	-0.57
Chow	1960	1921-1953	-	-0.7
Suits	1961	1929-1941; 1949-1956	-	-0.675
Hymans, Ackley, and Juster	1970	1954-1968	-1.14	-0.46
Hess	1977	1952-1972	-1.63	-
Trandel	1991	1983-1985	-1.43	-
Levinsohn	1988	1983-1985	-0.82	-
McCarthy	1996	1989	-0.87	
Bordley	1993	Assumed	-1	
Fischer, Harrington, and Parry	2007	Not indicated	-1	-0.82
Irvine (1983) – basis for estimate in Kleit (1990), which was cited in SAFE Rule				
Dyckman	1975	1929-1962	-1.45	
Hamburger	1967	1954-1964	-1.17	
Evans	1969	1948-1964	-3.1	-1.5
Hymans	1970	1954-1968	-1.07	-0.36
Rippe and Feldman	1976	1958-1973	-1.14	-0.6
Carlson	1978	1965-1975	-1.1	
Additional Estimates in the Record – cited by agencies in SAFE Rule or prior rulemakings				
Goldberg	1998	1984-1990	-0.9	
Juster and Wachtel	1972	1949-1967	-0.7	
Lave and Train	1979	1976	-0.8	
McAlinden et al.	2015	1953-2013	-0.79	-0.61
Recent Estimates – not cited by agencies in SAFE Rule or prior rulemakings				
Berry et al.	2004	1993		-1
Gillingham and Stock	2018	1967-2016		-0.27
Leard	2020	2013		-0.4
Bento et al.	2020	Not indicated		-0.13
Dou and Linn	2020	1996 to 2016	-1.5	

[32] *See* Petition for Reconsideration, *supra* note 7, at 44.

Averages				
Mean			-1.2	-0.6
Median			-1.1	-0.6
Averages of Recent Estimates				
Mean published since 1980			-1.0	-0.5
Median published since 1980			-1.0	-0.5
Mean published since 2000			-1.1	-0.5
Median published since 2000			-1.0	-0.5
Mean published since 2010			-	-0.4
Median published since 2010			-	-0.3
Averages Without Inconsistent Estimates				
Mean			-1.1	-0.5
Median			-1.1	-0.6
Mean: Published since 2000			-1.1	-0.4
Median: Published since 2000			-1.0	-0.4

Source: Petition for Reconsideration at 43–45

The agencies never clearly acknowledge that they are using a short-run estimate of price elasticity, and attempt to paper over the distinction between short-run and long-run elasticity. In one footnote—their only acknowledgment in the final rule of the theoretical distinction between short-run and long-run price elasticity—the agencies, citing a 2016 study, appear to suggest that empirical estimates of the two parameters are very similar.[33] But this study does not capture several more recent estimates showing a very low long-run elasticity, and a comprehensive analysis of all the available literature shows that the long-run elasticity is far lower than the agencies suggest. In any event, the elasticity averages in this footnote's cited study— -0.72 for long-run, and -0.79 for short-run[34]—are both well below the -1.0 estimate that the agencies adopt. If anything, therefore, the agencies' citation to this single study serves to further highlight the implausibility of their elasticity estimate.

Furthermore, the studies that the agencies rely on are fairly old, as all three were published in the early-to-mid 1990s.[35] In fact, some of the studies rely on much older data than that: One of the three cited papers relies exclusively on a 1983 estimate, which in turn was based on various estimates relying on data going all the way back to 1929, when the Ford Model A was still in

[33] *See* 85 Fed. Reg. at 24,617 n.1642 ("[A] recent review of 12 studies examining vehicle price elasticities conducted by the Center of Automotive Research ('CAR') found an 'average short-run elasticity of -1.09' and focusing 'only those models which also employ time series methods, the average short-run own-price elasticity is higher yet, at -1.25.' CAR's own analysis found a -.79 short-run elasticity. Appendix II of the CAR report shows that the long-run elasticities ranged from -.46 and -1.2 with an average of -.72.'").

[34] *Id.*

[35] *See id*. at 24,617 n.1641.

production.[36] While older studies supply useful information and should be considered, newer studies, when they are available, are typically more reliable because they rely upon more up-to-date data and employ more advanced estimation techniques. With cars, for instance, the market has changed over the past quarter-century with the proliferation of SUVs and hybrid vehicles, and may be affected by macroeconomic indicators such as increases in gross domestic product. And here, notably, the agencies disregard a number of newer studies. A recent literature review identified five studies published since 2000 estimating the price elasticity of motor vehicles, all of which the agencies overlook in the SAFE Rule.[37] And as noted above, these studies produce a median long-run elasticity estimate of -0.5.[38] The agencies offer no justification for—or even acknowledgement of—their decision to overlook these relevant estimates.

The agencies' disregard for the available literature—focusing on just a few older studies that measure elasticity under an inapplicable short-run timeframe—not only produces an unreasonably high elasticity estimate, but is also inconsistent with their approach to modeling other elements of this same rule. When estimating rebound elasticity—that is, the degree to which individuals increase driving when the per-mile price of gasoline declines due to improved vehicle efficiency—the agencies purport to rely on "the totality of empirical evidence" and "examin[e] the widest possible range of research" rather than "restricting the available evidence by categorically excluding or according less weight" to studies "that do not meet selection criteria."[39] In particular, the agencies discuss the importance of "recent estimates" in projecting the rebound effect.[40] In contrast, the agencies rely on just a few studies to drastically increase price elasticity from their earlier estimate, and disregard the most recent and authoritative evidence.

The agencies are also inconsistent in selecting the timespan of key parameters. With the rebound effect, the agencies acknowledge that "the most appropriate measure for the agencies to rely on is the current long-run fuel economy rebound effect"[41]—which, as detailed above, is a reasonable approach because the agencies use this parameter to estimate the impacts of the SAFE Rule over many years.[42] Yet again, however, this is entirely inconsistent with the agencies' approach to price elasticity, which is derived from short-run estimates without any comparable emphasis on the rule's long-term effects.

---

[36] *See* Irvine (1983), cited in Kleit (1990). For a review of the economic studies that Irvine relies upon to produce his estimate, including their years of publication and underlying data, *see* Petition for Reconsideration, *supra* note 7, at 44.

[37] Petition for Reconsideration, *supra* note 7, at 44 (displaying "Recent Estimates").

[38] *See id.*

[39] 85 Fed. Reg. at 24,674.

[40] *Id.* at 24,672.

[41] *Id.*; accord *id.* at 24,674–75 ("[T]he agencies agree with many commenters that both the extended time span encompassed by their analysis of the impacts of CAFE and CO2 standards and the long expected lifetimes of vehicles subject to this final rule means that estimates of the long-run rebound effect are most relevant for purposes of the final rule analysis.").

[42] Despite correctly using a long-run rebound effect, the agencies arbitrarily use an inflated rebound effect of 20 percent, whereas available estimates suggest that the effect is approximately 10 percent. Policy Integrity Comments at 99–126.

In other words, the agencies opportunistically use short-run estimates only when it suits their interests. According to our modeling, had the agencies used a short-run estimate of rebound when analyzing the rule's impacts—an incorrect approach, to be sure, but one that would at least be consistent with their faulty approach to estimating price elasticity—they would have concluded that the rule is net costly to the tune of $47.9–$59.2 billion at a 3 percent discount rate, or by $7.4–$18.3 billion at a 7 percent rate.[43] The agencies properly choose a long-run rebound when doing so makes the SAFE Rule less harmful, yet incorrectly and inconsistently use a short-run price elasticity when doing so inflates the rule's sales impacts and obscures substantial costs of the rule.

Through these inconsistent approaches, the agencies are able to select a price-elasticity parameter that suits their analysis and makes the SAFE Rule appear far less socially detrimental than it truly is. Indeed, as detailed in the next section, the agencies' unrealistic parameter for price elasticity masks billions of dollars of social harm.

[43] For this illustrative analysis, we applied a 5 percent rebound rate, which is consistent with the short-run estimates in Kenneth Gillingham et al., *The Rebound Effect and Energy Efficiency Policy*, 10 REV. ENVTL. ECON. & POL'Y 68 (2016). All other parameters of the agencies' analysis—including their price elasticity of -1.0—were kept constant.

By Inflating the Price Elasticity in Their Final Analysis, the Agencies Obscure Billions of Dollars in Social Costs Along With Other Flaws in Their Analysis

By increasing the elasticity in their final analysis to an unsupported and unrealistic -1.0, the agencies are able to claim that the SAFE Rule will produce a far greater increase in vehicle sales than a fair analysis would show, and thereby obscure billions of dollars in social costs that the rule can be realistically expected to cause. Particularly when combined with the numerous other errors that the agencies make,[44] this error rebuts the agencies' key justifications for the SAFE Rule.

Just how much does this one revision affect their analysis? Using the agencies' economic model, Policy Integrity ran the numbers to find out. In reviewing these results, keep in mind that the agencies' own analysis of the rule—assuming the unrealistic price elasticity of -1.0—already shows that the rule is harmful to society, producing net social costs of $13.1–$22 billion at a 3 percent discount rate and net benefits of only $6.4–$16.1 billion at a 7 percent discount rate.[45] Simply averaging the results from the two discount rates shows that the rule is net costly by billions of dollars under the agencies' own analysis.[46]

Using a more realistic price elasticity estimate reveals that the rule is far more harmful than the agencies acknowledge. With a price elasticity of -0.6—the median long-run elasticity throughout all available literature—the rule is net costly by $18.1–$27.3 billion at a 3 percent discount rate and net beneficial by just $2.7–$12.1 billion at a 7 percent discount rate. And with a price elasticity of -0.4—the median long-run elasticity of recent estimates—the rule scores even worse: between $20.7–$30 billion in net costs at the 3 percent rate, with net benefits at the 7 percent rate of only $0.8–$10.2 billion. Therefore, **inflating the price elasticity obscures at least $4–$8 billion in net costs**, and results in a rule that is net costly by approximately $10 billion according to an average of the two discount rates.[47]

---

[44] *See supra* note 7.

[45] *Id.* at 24,176.

[46] *See* Revesz, *supra* note 7 ("[T]he approach that puts the Trump administration's action in the most favorable plausible light would be to average the impacts under the two rates. And the rollback fails under this standard."). It is also worth keeping in mind that the agencies' numbers rely on several miscalculations regarding congestion cost. Simply correcting these miscalculations (without correcting for the conceptual errors and unrealistic assumptions that the agencies rely upon) shows that the SAFE Rule is billions of dollars more costly than the agencies acknowledge, wiping out the benefits that the agencies claim at a 7 percent discount rate. *See* Petition for Reconsideration at 5–9.

[47] Again, this average does not even account for the agencies' miscalculations in their own analysis, which would make the result net costly by billions of additional dollars. *See id.*

Cost-Benefit Analysis Results Depending on Price Elasticity

	3% Discount Rate		7% Discount Rate	
Elasticity	NHTSA's CAFE Rule	EPA's CO_2 Rule	NHTSA's CAFE Rule	EPA's CO_2 Rule
-1 (agencies' approach)	-13.1	-22.0	16.1	6.4
-0.8 (approximate lower-bound estimate for short-run elasticity)	-15.6	-24.7	14.1	4.6
-0.6 (long-run median for all estimates)	-18.1	-27.3	12.1	2.7
-0.4 (long-run median for recent estimates)	-20.7	-30.0	10.2	0.8
-0.2 (approximate lower-bound estimate for long-run elasticity)	-23.2	-32.7	8.2	-1.0

* All figures are in $ billion.

There's more. Applying the correct price elasticity range substantially reduces the SAFE Rule's sales impacts such that the analysis—without further modifications—would now conclude that the rule likely results in an aggregate decrease in fleet size over the next five to seven years. But as noted above, this outcome violates basic economic principles of supply and demand, since a reduction in vehicle prices should not decrease fleet size. For this reason, after the agencies initially concluded at the regulatory proposal stage that this rule would decrease fleet size, EPA's Science Advisory Board and numerous commenters highlighted the fallacy of their logic.[48] These comments focused largely on the agencies' flawed scrappage model, which illogically concluded that the regulatory rollback would increase the scrappage of older vehicles.[49]

Yet rather than correct their scrappage model in the final SAFE Rule—as many commenters urged them to—the agencies just make small tweaks to that model[50] while drastically inflating price elasticity to flip their erroneous conclusion regarding fleet size. As detailed above, however, this revision to price elasticity is inconsistent with the literature. Rather than artificially inflate price elasticity in order to correct their fleet-size results, the agencies should have actually corrected their scrappage model.

---

[48] *See supra* notes 10–11 and accompanying text.

[49] *See, e.g.*, SAB Report at 1 ("Two of the new modules recently added to the Department of Transportation's Volpe CAFE Model, the sales and scrappage equations, have important weaknesses in both their theoretical underpinnings and their econometric implementation. Together, the new modules generate implausible results regarding the overall size of the vehicle fleet, implying that the revised standards would reduce the size of the vehicle fleet relative to the augural standards when economic theory suggests that the fleet should grow due to a decline in the prices of new vehicles.").

[50] *See, e.g.*, Petition for Reconsideration at 22–24, 45–49 (highlighting some errors that remain with the scrappage model).

Policy Integrity made two simple adjustments to the agencies' model to illustrate what the effects of such a change may look like. Specifically, Policy Integrity 1) set the price elasticity at -0.4, which as detailed above is a far superior estimate, and 2) reduced the scrappage elasticity to an amount that results in a fleet-size increase in every period.[51] Because lower scrappage means more older cars that lack the safety and efficiency features of newer models, this revision reveals even further costs to the SAFE Rule. In fact, we found that such a revision would likely reduce net benefits by another $1 billion or more—on top of the $4–$8 billion in costs from correcting the price elasticity alone.

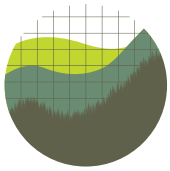
However, even leaving aside the flaws in the scrappage model and other errors in the sales model, it is clear that the agencies' selection of -1.0 as the price elasticity is improper, vastly exaggerates the rule's sales impacts, and masks billions of dollars in social cost.

Conclusion

The agencies' assumptions about price elasticity—abruptly inserted into their final analysis with little presage or rationale—are unsupported, unrealistic, and inconsistent with their approach to estimating other key parameters. Yet through this revision, the agencies paper over billions of dollars in costs, not to mention the effects of other errors in their modeling of the SAFE Rule. While the rule is net costly even under the agencies' faulty assumption of a high price elasticity, correcting this error reveals that the rule is far more costly than the agencies acknowledge. When combined with additional errors identified in other Policy Integrity reports,[52] we see that the systematic errors made by the agencies imply that the SAFE Rule is not cost-benefit justified under any plausible discount rate.

[51] Specifically, Policy Integrity adjusted the scrappage elasticity to approximately 80 percent of the agencies' estimates, making the analysis of both rules conclude that fleet size increases over both the short- and long-term. This was a simple parametric adjustment. An alternative methodology would be to hold fleet size constant, as recommended by both the EPA and economist Howard K. Gruenspecht. *See* Summary points from EPA review of CAFE model (NPRM version)–Effect of EPA code revisions, Meeting with Office of Management and Budget/OIRA 6/18/2018, slides 2-3, https://www.regulations.gov/document?D=EPA-HQ-OAR-2018-0283-0453 (fifth Attachment at PDF pages 4-5); Howard K. Gruenspecht, Differentiated Regulation: The Case of Auto Emissions Standards, 72 Am. Econ. Rev. 328, 328–29 (1982); *see* generally Policy Integrity Comments at 89–91. This latter methodology requires a structural change to the model and is beyond the scope of this report.

[52] *See supra* note 2 and accompanying text.



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

Institute for Policy Integrity
New York University School of Law
Wilf Hall, 139 MacDougal Street, New York, New York 10012
policyintegrity.org