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October 23, 2021

From: Dr. Mark R. Jacobsen

Topic: Comment on demand elasticities and vehicle sales in the Proposed Rulemaking for Model Years 2024-2026 Light-Duty Vehicle Corporate Average Fuel Economy Standards, Docket No. NHTSA-2021-0053

I am a transportation and environmental economist at the University of California San Diego and have worked extensively on questions to do with the composition of the vehicle fleet under a fuel economy standard. My work on scrappage (joint with A. van Benthem) titled "Vehicle Scrappage and Gasoline Policy"[1] is cited in the Technical Support Document[2] (TSD) for the currently proposed rule. My recent work in a US EPA report[3] describing the effects of new vehicle prices on the fleet (joint with R. Beach, C. Cowell, and J. Fletcher) is I believe highly relevant to the present analysis and points to the need for a correction in the way the effect of the policy on new vehicle sales is calculated.

The core calculation that I comment on is the translation between the demand elasticity for new vehicles (defined as the change in demand for new vehicles when the price of new vehicles rises 1%, all else equal) and the effect of a policy on new vehicle sales. I will define the latter effect—that of a 1% increase in new vehicle price on new vehicle sales—as the "policy elasticity." In the current CAFE model[4] the demand elasticity is set to a value of -1 and the policy elasticity is also set to -1. This appears in Equation 73 in Section 5.6 of the CAFE model documentation: each percent increase in vehicle cost (net of fuel saving) results in a 1% decline in sales. Further detail appears in Section 4.2.1.2 of the TSD referenced above, where Equation 4-2 translates an assumed demand elasticity of -1 directly into a sales effect (policy elasticity) of the same magnitude.

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[1] Jacobsen, Mark R. and Arthur van Benthem. "Vehicle Scrappage and Gasoline Policy." *American Economic Review*, Vol. 105, No. 3, 2015.
[2] "Technical Support Document: Proposed Rulemaking for Model Years 2024-2026 Light- Duty Vehicle Corporate Average Fuel Economy Standards" available from: https://www.nhtsa.gov/sites/nhtsa.gov/files/2021-08/CAFE-NHTSA-2127-AM34-TSD-Complete-web-tag.pdf
[3] "The Effects of New-Vehicle Price Changes on New- and Used-Vehicle Markets and Scrappage" available from: https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=OTAQ&dirEntryId=352754
[4] "CAFE Model Documentation." DOT HS 812 934. Available from: https://static.nhtsa.gov/nhtsa/downloads/CAFE/2021-2026_CAFE_Final/CAFE%20Model/CAFE_Model_Documentation_FR_2020.pdf

The reason demand elasticities are not the same as policy elasticities for sales in the new vehicle market comes from the presence of used substitutes. The presence of a used vehicle market means that not "all else" remains equal when policy raises new vehicle prices: in particular, used vehicle prices will increase at the same time because the two are substitutes. When used vehicle prices rise as the result of policy the demand elasticity is no longer the same as the policy elasticity. Specifically, as used vehicle prices rise sales declines in the new market will be smaller in magnitude than the demand elasticity. Intuitively, high used vehicle prices mean that trade-in values have gone up, so the price for new vehicles net of trade-ins is smaller. Or, one could imagine a first-time car-buyer with no trade-in choosing between new and used vehicles. When used vehicles get more expensive the new vehicle looks more attractive in comparison.

The literature on new vehicle demand elasticities tends to estimate them either structurally (where used prices are held fixed within the mathematical construct) or using short term, geographically local, or model-specific variation in new vehicle prices (in which case prices in the larger, slower moving, used vehicle market also remain effectively constant). In contrast, long-lasting national policy on new vehicles will directly influence the used market. Part of the effect will be immediate: consumers who decide to hold on to their existing vehicle longer (i.e. people who postpone trading in a used vehicle for a new one) create a shortage of trade-ins that drives up used vehicle prices. Over time, reduced sales in each succeeding vintage of new vehicles work to create even larger shortages in the used market, further increasing used vehicle price.

Translating between a demand elasticity and a policy elasticity requires a model of used vehicle prices. As an extreme example, a sufficiently large estimated increase in used vehicle prices could produce a policy elasticity of 0 even when the demand elasticity is -1. This will happen, for example, if consumers can neither switch to alternative transportation nor extend the life of their used cars. While consumers would like to switch to a used car (as measured by the demand elasticity) the effect of everyone trying to switch at once is to increase used vehicle price so much that in equilibrium nothing happens to new vehicle sales.

In practice, the effect on used vehicle prices will not be this extreme, both because alternative transportation is a possibility, and because the lifetime of used vehicles can be extended (an effect that NHTSA is already considering in the present analysis). In the EPA report I reference above we perform the relevant calculation for a range of demand elasticities, but we do not specifically investigate a demand elasticity of -1 as is used in the NHTSA modeling. In this comment, I repeat the calculations done in Table 7-2 of the EPA report cited above for a case where the demand elasticity is held at -1. I assume a substitution elasticity to alternative transportation of -0.05 (a value typical of other scenarios in the report). The result is that a demand elasticity of -1 produces a long run policy elasticity of -0.28. This difference between the demand elasticity and policy elasticity is similar to others calculated in the report.

The short run is a considerably more complex problem to analyze since, as mentioned above, only some of the used vehicle price impact is immediate. The EPA report conducts dynamic analysis of a representative vehicle fleet to compute the policy elasticity through time. I repeat that analysis here for a demand elasticity of -1 and a new-vehicle price increase (net of fuel savings) of 1%. The results appear in Figure 1. The figure plots the demand elasticity of -1 in red dashes. The long term effect on new vehicle sales—i.e. the policy elasticity of -0.28 as above—appears in blue dashes. The solid line shows the dynamic trajectory of the impact on sales. As expected the impact on sales is larger at first, since the impact on the used market is smaller at first. In the first year of a policy (year "0" on the horizontal axis) new vehicle sales fall 0.5%, representing a short run policy elasticity of -0.5. This is importantly different from the demand elasticity even in the very first year of a policy. The equilibrium system approaches the long run policy elasticity of -0.28 after about 5 years.

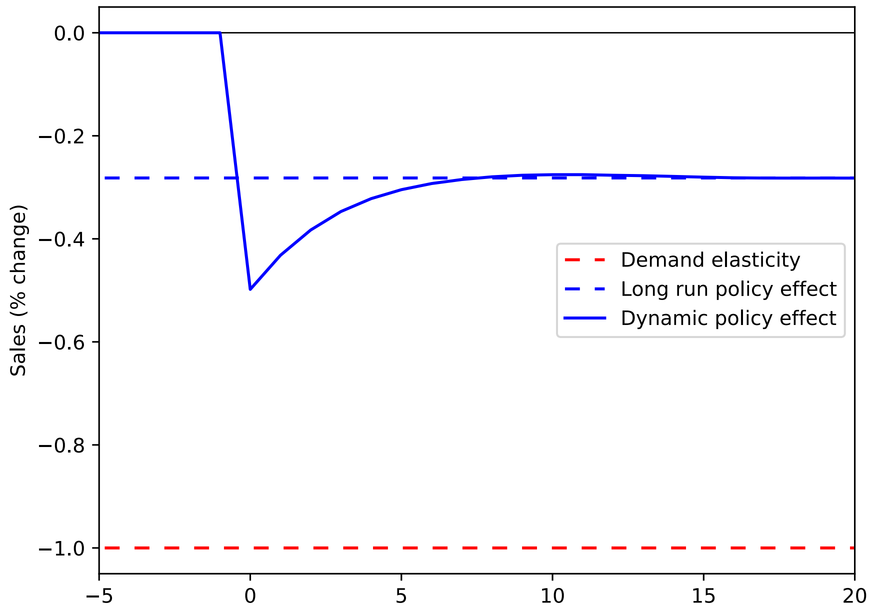

Figure 1: Effect of 1% Increase in Vehicle Cost (Net of Fuel Savings) on Vehicle Sales When Assuming a Demand Elasticity of -1

Correcting the calculation of changes in new vehicle sales to account for the presence of a used market can be done by replacing the estimated demand elasticity with an estimated policy elasticity in Equation 4-2 as described in Section 4.2.1.2 of the TSD. Assuming NHTSA would like to maintain the estimate of -1 for the demand elasticity, the relevant policy elasticity is -0.28 in the long run and -0.5 in the short run. I believe it may be feasible to implement the whole path of elasticities shown in Figure 1 (reflecting the way shortages in the used market become more important over time) but would note that a much simpler method, that is a close approximation to the full path, would be to transition from the short run to the long run policy elasticity linearly over a period of 5 years.

I encourage NHTSA to correct the calculation of policy impact on vehicle sales so that it accounts for changes in the used vehicle market. Since used vehicle prices rise when new vehicle prices rise, this correction will dampen the projected effect of the policy on new vehicle sales.

Yours sincerely,

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