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From: Dr. Mark Jacobsen and Dr. Arthur van Benthem

Topic: Comment on fleet turnover modeling in the Notice of Proposed Rulemaking for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks, Docket No. EPA-HQ-OAR-2018-0283 and Docket No. NHTSA-2018-0067

We are transportation and energy economists at the University of California San Diego and the University of Pennsylvania. We have done extensive research on gasoline policy, including the U.S. Corporate Average Fuel Economy (CAFE) standards. Our research, and in particular our paper "Vehicle Scrappage and Gasoline Policy", has been cited in the Notice of Proposed Rulemaking (NPRM) and the Preliminary Regulatory Impact Assessment (PRIA) multiple times.[1] We therefore consider ourselves well-positioned to comment on the way in which NHTSA has modeled the effect of the proposed rollback of the CAFE standards on fleet turnover, fleet size, and the consequent effects on gasoline consumption, safety, and external economic costs.

Fleet turnover plays a major role in the benefit-cost analysis of the proposed CAFE rollback. In particular, the NPRM and PRIA conclude that a rollback of the standards will result in a substantially smaller vehicle fleet and a significant reduction in miles driven, leading to fewer fatalities and lower external costs and damages. The purpose of this letter is to explain why we consider this to be at odds with basic economic logic and intuition.

To substantiate this point, we first comment on what our previous research concluded, and what it did *not* establish. We then comment on what economic theory predicts about fleet size effects.

In Jacobsen and van Benthem (2015), we estimate how scrap rates respond to changes in used vehicle prices. We find that used vehicles are scrapped at lower rates as their resale values increase. We do *not* estimate the effect of fuel-economy standards on total fleet size and our research should not be interpreted as such. A numerical estimate of the effect of standards on total fleet size effect would additionally require an estimate of the rate at which consumers switch from cars to alternative modes of transport when vehicle prices increase. Such an estimate is not made in the paper.

[1] Jacobsen, M.R. and van Benthem, A.A., "Vehicle Scrappage and Gasoline Policy," *American Economic Review*, vol. 105, no. 3, 2015, pp. 1312–1338, doi:10.1257/aer.20130935.

Rather, we use a fleet turnover model to calculate that fuel savings from a tightening of standards would be overstated by approximately 15% relative to an evaluation that fails to account for the scrappage effect. This corresponds to the difference between (i) a projection of gasoline consumption that does *not* account for changes in scrap rates for used vehicles as their prices increase due to the stricter new-vehicle standards; and (ii) a projection that lets the used fleet respond according to our empirically estimated "scrap responsiveness." We conclude that gasoline consumption after a tightening of fuel economy standards is higher in case (ii) than case (i). Therefore, under a rollback, case (i) where scrap rates are fixed would imply that the used fleet would increase proportionally to the increase in new vehicles sales. Under case (ii), where the correct scrap response is taken into account, the increase in the used fleet under a rollback would be mitigated somewhat by the fact that used vehicle prices fall (as consumers move toward new models), accelerating scrappage.

While we agree that the scrappage effects we study will mitigate changes in the used fleet, we do not believe they could be strong enough to completely reverse the direction of change in the used fleet. The logic is as follows: Basic economic theory predicts that tighter standards make new vehicles more expensive, and fewer will be sold. As a result, used vehicles – which are "produced" from new cars – also become scarcer and thus more expensive.[2] As a consequence, when standards increase vehicle prices, the total fleet size should decrease over time. How much smaller the fleet will be depends on the magnitude of the price changes and the aggregate elasticity to the outside good. In cities with well-developed public transit, for example, the fleet should shrink more than it would in rural areas where there may be limited outside options.

Conversely, a rollback should lead to lower prices and increased demand for vehicles, resulting in a larger fleet that will also be newer on average. A rollback of the standard will make both new and used vehicles cheaper. Former non-car owners will enter the market, tempted by the cheaper used vehicles, cheaper new vehicles, or both. We see no case in which this set of price changes would cause someone who formerly owned a car to decide to opt out of the car market altogether. In other words, the fleet size should be expected to increase rather than decrease.

As a side note, we mention that this does not mean a rollback translates to higher sales of every individual vehicle model. For example, hybrid sales are likely to go down even as sales of most other models go up. In theory, if consumers differ in how price sensitive they are and how they choose their vehicles, the effect on the total fleet size could be muted or exaggerated relative to the simple "representative vehicle" case. This, however, is beyond the level of sophistication in the extant academic literature.

In summary, while the Jacobsen and van Benthem (2015) paper cannot inform *by how much* the total vehicle fleet would expand under a CAFE rollback (since we do not estimate by how much it shrinks under CAFE), all the evidence and economic logic points to a *larger* total vehicle fleet under a rollback, at odds with NHTSA's fleet turnover model. This error alone would significantly change the benefit-cost analysis in the proposed rollback. Specifically, the 2018

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[2] Consistent with this, the average prices for new and used vehicle models (classified as small vs. large and car vs. light-duty truck) do appear in Jacobsen and van Benthem's simulation model and all these prices increase when standards are tightened. See page 1333 of Jacobsen and van Benthem for average price effects.

proposal argues that the rollback will shrink the overall fleet by six million vehicles in the year 2029, compared to the current standards. The PRIA and NPRM are not detailed enough to allow us to ascertain exactly how the 2018 analysis reaches this conclusion, but we conjecture that it is a result of scrap rate modeling that does not perform correctly out of sample.[3]

We claim that the total fleet size under the rollback should increase relative to no rollback; this would mean *at least* six million vehicles more than in the current analysis (by the year 2029). This has important implications. A larger fleet leads to higher miles driven, a greater increase in gasoline use, and larger external costs: When total driving increases the external effects of local air pollution, greenhouse gases, traffic fatalities, congestion, and energy security will be larger than reported in the 2018 analysis, potentially by significant amounts.

Crash fatalities and injuries can actually increase (as opposed to decrease) with the rollback. The 2018 analysis concludes the rollback will result in a $90.7 billion gain from reduced fatalities and property damages (Table II.25 in the NPRM), a result driven almost exclusively by a 2.4% reduction in fleet-wide VMT after eliminating the driving rebound assumed to have occurred under the 2016 standards. If conservatively we hold fleet size fixed and add back the six million used cars, this $90.7 billion gain is likely to fall to near zero. This is a conservative calculation and should be interpreted as a lower bound, since we actually anticipate the fleet will grow.

We encourage NHTSA and EPA to correct these flaws in the modeling in a revised benefit-cost analysis which, to be consistent with economic theory, should show an increase in the total fleet size under a CAFE rollback.

Yours sincerely,

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[3] Page 244 of the NPRM argues that "leakage" in the current NHTSA scrappage model is 12 to 18%, suggesting that NHTSA's model is consistent with our analysis (approximately 15% leakage). While the reported numbers are indeed similar, they are not directly comparable since the comparison we use is against fixed scrappage (that is, all scrap rates remaining the same as before the policy change). The comparison being used to calculate the 12-18% value in the NHTSA model appears to still allow scrap rate changes (for example via changes in new car fuel economy); it only removes the part of the scrap rate increase coming from new car price. We conjecture that additional factors in the scrap rate equation on page 1049 of the PRIA (beyond just new car price) must be driving the much larger increases in scrappage necessary to reach the conclusion of a fleet size decline under a rollback.