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BENEFITS OF RECENT IMPROVEMENTS IN VEHICLE FUEL ECONOMY ON OVERALL FUEL CONSUMPTION AND EMISSIONS

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16. Abstract <p>For the past several years, we have calculated (on a monthly basis) the average, sales-weighted fuel economy of all light-duty vehicles (cars, pickup trucks, vans, and SUVs) sold in the U.S. The results indicate that, from October 2007 to September 2012, the average fuel economy has improved by 18%, from 20.1 mpg to 23.8 mpg. This brief note quantifies the consequences of this improvement on overall fuel consumption and vehicle emissions.</p> <p>Because of their improved fuel economy, the vehicles sold since October 2007 saved a <i>cumulative</i> total of about 6.1 billion gallons of fuel—equivalent to the current total consumption of all vehicles in the U.S. for about 13 days. This reduction in the amount of fuel translates to a reduction of about 120 billion pounds of carbon-dioxide emissions.</p> <p>In terms of the <i>current</i> savings, for the most recent month—September 2012—the savings amount to 293 million gallons of fuel, or about 5.7 billion pounds of carbon dioxide. These savings are equivalent to about 2.9% of the average monthly consumption of fuel and of carbon-dioxide emissions from all light-duty vehicles on the road.</p>					
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Content

Acknowledgment	ii
Analysis.....	1
References.....	4

Analysis

In this brief note, we discuss recent sizeable improvements in vehicle fuel economy, and their consequences for overall fuel consumption and vehicle emissions. However, before we get into the details, we will first take a broader, historical view concerning where we have been. This brief detour will place the magnitude of the recent changes in the context of the progress achieved since the 1920s.

In 1923, the actual, on-road fuel economy of the entire fleet (including cars, trucks, buses, and motorcycles) was 14.0 mpg. Fuel economy then *declined* to 11.9 mpg in 1973, before it started to climb rapidly, reaching 16.9 mpg in 1991. The changes thereafter have been small, with overall fuel economy in 2007 at 17.2 mpg (Sivak and Schoettle, 2012a).

The data for only cars show the same trends as the data for all vehicles: a decline in fuel economy until 1973, a relatively sharp improvement from 1973 through 1991, and only a minor improvement between 1991 and 2007 (Sivak and Schoettle, 2012a).

Now let us take a look at the most recent additions to our vehicular fleet. For the past several years, we have calculated (on a monthly basis) the average, sales-weighted fuel economy of all purchased light-duty vehicles (cars, pickup trucks, vans, and SUVs). Our data (Sivak and Schoettle, 2012b) start with October 2007 (the conventional beginning month of model year 2008 vehicle sales), and currently the latest entry is for September 2012. (These data are based on the EPA “window sticker” ratings; they are not the actual, on-road values.)

So what do our data tell us? The average, sales-weighted fuel economy of all new light-duty vehicles has improved from 20.1 mpg in October 2007 to 23.8 mpg in September 2012, for a gain of 18%. While this improvement is rather modest in absolute terms, it is substantial in comparison to the above-discussed changes between 1923 and 2007.

During the five years covered by our monitoring, we have collected data on 61 million new light-duty vehicles. Because most of them are still on the road, they represent about one quarter—a substantial portion—of the approximately 230 million light-duty vehicles in use (FHWA, 2012¹). That led us to pose the following question: How much fuel have we saved by driving these 61 million vehicles with improved fuel economy, as opposed to driving 61 million vehicles that would have experienced no improvements in fuel economy, retaining the lower fuel economy of the vehicles sold in the first month of our monitoring (October 2007)?

We will answer this question from two related perspectives, both assuming that all 61 million of the monitored vehicles are still on the road. The first perspective involves the *cumulative* amount of fuel saved. Assuming that all vehicles were driven 12,888 miles every year (a recent estimate of the average annual distance driven in the U.S.; NHTS, 2011), we find that the 61 million new vehicles saved about 6.1 billion gallons of fuel. That is equivalent to the consumption of fuel of all motor vehicles in the U.S. for about 13 days (FHWA, 2012¹).

Another way to assess the benefits of the improved fuel economy is to examine the *current* savings in the use of fuel. For the most recent month—September 2012—the savings amount to 293 million gallons of fuel.

The reductions in the amount of fuel consumed are important in themselves. However, they also represent reductions in emissions. For example, combustion of one gallon of gasoline creates about 19.6 pounds of carbon-dioxide emissions (22.4 pounds for diesel) (EIA, 2012). Consequently, the cumulative 6.1 billion gallons of fuel saved since late 2007 represent a cumulative reduction of about 120 billion pounds of carbon dioxide² (using the gasoline conversion). Analogously, the 293 million gallons of fuel saved during the month of September 2012 represent a reduction of about 5.7 billion pounds of carbon dioxide²—or about 2.9% of the average monthly consumption of fuel and of carbon-dioxide emissions from all light-duty vehicles in the fleet (FHWA, 2012¹).

¹ The FHWA data are for 2010—the latest year available.

² The carbon-dioxide savings are conservative, because they do not take into account that some of the 61 million monitored vehicles are diesel powered (and thus produce more carbon dioxide than gasoline-powered vehicles).

The improvements in vehicle fuel economy over the past five years are noteworthy, especially in relation to the improvements during the preceding eight decades. As a consequence, we have seen sizeable savings in fuel consumed and emissions produced. The new fuel economy (CAFE) standards, issued in August 2012 (NHTSA, 2012), will accelerate this progress.

References

- EIA [Energy Information Administration]. 2012. *Fuel emission coefficients; Table 2: Carbon dioxide emission factors for transportation fuels*. Available at <http://www.eia.gov/oiaf/1605/coefficients.html#tbl2>.
- FHWA [Federal Highway Administration]. 2012. *Highway Statistics 2010; Annual vehicle distance traveled in miles and related data – 2010*. Available at <http://www.fhwa.dot.gov/policyinformation/statistics/2010/vm1.cfm>.
- NHTS [National Household Travel Survey]. 2011. *Summary of travel trends: 2009 National Household Travel Survey*. Available at <http://nhts.ornl.gov/2009/pub/stt.pdf>.
- NHTSA [National Highway Traffic Safety Administration]. 2012. *2017 and later model year light-duty vehicle greenhouse gas emissions and Corporate Average Fuel Economy standards*. Available at http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cape/2017-25_CAFE_Final_Rule.pdf.
- Sivak, M. and Schoettle, B. (2012a). Eco-driving: Strategic, tactical, and operational decisions of the driver that influence vehicle fuel economy. *Transport Policy*, 22, 66-69.
- Sivak, M. and Schoettle, B. (2012b). *Average sales-weighted fuel economy of purchased new vehicles* [updated monthly]. Ann Arbor: The University of Michigan Transportation Research Institute. Available at http://www.umich.edu/~umtriswt/EDI_sales-weighted-mpg.html