The Rebound Effect for Passenger Vehicles

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Executive Summary

The United States and many other countries are dramatically tightening fuel economy standards for passenger vehicles. Higher fuel economy reduces per-mile driving costs and may increase miles traveled, which is known as the rebound effect. The magnitude of the elasticity of miles traveled to fuel economy is an important parameter in welfare analysis of fuel economy standards. This paper focuses on estimating the rebound effect using micro data, which include observations by household and vehicle.

All previous studies using micro data employ at least one of three assumptions. The first is that the fuel economy of a vehicle is uncorrelated with household characteristics or other vehicle characteristics that are not measured in the available data. For example, individuals who enjoy driving may be more likely to purchase a vehicle with high performance and low fuel economy. Failing to account for this correlation would result in biased estimates of the rebound effect. Second, multi-vehicle households are assumed to choose fuel economy and miles traveled of their vehicles jointly, so that an increase in the fuel economy of one vehicle could affect the miles traveled of the household's other vehicles. Again, failing to account for this correlation would bias estimates of the rebound effect. Third, most previous studies in the literature assume that miles traveled responds to gasoline prices and fuel economy by equal and opposite amounts. But miles traveled may respond differently to gasoline prices and to fuel economy for a variety of reasons—for example, if individuals have imperfect information about fuel economy.

This paper demonstrates the effect of simultaneously relaxing all three assumptions on the estimated rebound effect. I compare two methods for relaxing the first assumption—including vehicle model fixed effects in a regression of the miles traveled on fuel economy, and instrumenting for fuel economy. The instruments are based on the gasoline prices at the time the vehicle was obtained, as opposed to the gasoline prices at the time miles traveled was measured. The argument is that individuals choose the fuel economy based on the expected gasoline prices over the life of the vehicle. The gasoline price at the time the vehicle was obtained is a proxy for expected gasoline prices; this assumption is supported by other recent research and by the

evidence presented in the paper. The second assumption is relaxed by controlling for the fuel economy of the household's other vehicles, and the third assumption is relaxed by allowing gasoline prices and fuel economy to have separate effects on miles traveled.

Using data from the 2009 National Household Travel Survey, this paper reports estimates of the rebound effect of 0.2 to 0.4, where the rebound effect is defined as the change in miles traveled for a one percent increase in the fuel economy of all vehicles belonging to a household. This estimate is substantially larger than estimates obtained when imposing the first or second assumption, although the differences in the estimates are not statistically significant. Nonetheless, the point estimates suggest that the rebound effect could erode roughly one-third of the fuel savings caused by the regulated increase in US passenger vehicle fuel economy between 2005 and 2014.