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Drive Less, Drive Better, or Both?
Behavioral Adjustments to Fuel Price Changes in Germany

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ABSTRACT

The demand for motor fuel should decline when its price rises, but what is the driving mechanism for this? Do people simply drive less, or do they change their driving style so that they also improve their fuel economy while driving less? Or are they by now, at a time when fuel prices are relatively low, virtually insensitive to modest fluctuations in the price of motor fuels?

Using both aggregate and micro-level data, and focusing on different time periods, a large body of literature has examined the responsiveness of gasoline demand or vehicle kilometers traveled (VKTs) to fuel prices, and to the potentially asymmetric response to rising or declining prices. Whether people purchase more fuel-efficient cars when motor fuel prices rise continues to be an important question in research and policy circles, and the evidence is ambiguous (e.g., Busse et al., 2013; Rivers and Schaufele, 2015). There is only very little research, however, on whether people adjust their driving style and affect the on-road fuel economy of their cars when the price of fuel changes. This is an important question to answer because the responsiveness of fuel consumption (and hence CO_2 emissions) to fuel prices is comprised of two components: The price elasticity of VKT and the price elasticity of the fuel economy.

We use data from the German Mobility Panel—where households and their cars are followed for three years, then rotated out—from 2004 to 2019 to answer these questions. Panel participants are asked to record the odometer reading at the beginning of the observation period each Spring, and then again—

along with liters of fuel bought, price per liter, and total paid—at each refueling during the observation period. These records are summarized into monthly distance driven (in kilometers) and an average fuel economy (kilometers per liter of fuel) for that survey wave.

We fit SUR models where log VKTs and the log fuel economy are regressed on fuel prices, car attributes, controls for the stock of cars owned by the household, and household sociodemographics. We include household and Kreis-by-year fixed effects to control for unobserved heterogeneity. Since we control for the stock of cars of the household (which changes little from one wave of the survey to the next), we interpret our results as short-run elasticities.

We find that the miles logged on gasoline cars do decline with the price of gasoline. The price elasticity is around -0.25, and this finding is stable across broad income groups, and rural v. urban location. Working households are less sensitive to fuel price changes. Whatever households do in response to the price of gasoline—perhaps less solo driving, or more transit—it worsens the fuel economy as the price of gasoline increases.

The VKTs and the fuel economy of diesel cars are higher, but they are also insensitive to changes in diesel prices. This finding is consistent with a selection or an extensive v. intensive margin argument: People who must drive many miles for work- or family-related reasons buy diesel vehicles, but then don't adjust their driving as the price of diesel changes.

It seems reasonable to presume that there is much heterogeneity in kilometers driven or driving style and their relationship with fuel price and other covariates, so we fit latent-class models of log kilometers and log fuel economy. We identify two classes for log kilometers. One predicts its members to drive fewer VKT than the other, but the price elasticities are practically the same across the two classes. The resulting posterior for the price elasticity of gasoline demand—which is the price elasticity of VKT minus the price elasticity of the fuel economy—ranges from -0.25 to -0.05, for an average of -0.15.

The story with the fuel economy, however, is not as clean. The latent class model essentially places a 50-50% chance that any given car belongs to one or the other class. Only one of the covariates we used in the logit model of class membership appears to be a significant predictor of class membership. For one class, the price elasticity of the fuel economy is -0.144, and is thus, again, negative. For the other, it is 0.019 and insignificant. The fuel economy would thus appear to be the "weakest link" in the relationship between price and motor fuel demand, and to have the potential to reduce the effectiveness of a carbon tax in reducing emissions.