Beyond the average elasticity – applying quantile panel regression to German household mobility data

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Overview

Over the past three decades, a vast corpus of econometric studies has emerged on the effect of fuel prices on fuel or car mileage demand. Based on a comprehensive overview, Graham and Glaister (2002) found elasticity estimates for the short run between -0.5 and -0.2 and for the long run between -1.35 and -0.23. These results were derived by a battery of different econometric approaches based on time-series, cross-sectional and panel data encompassing all levels of aggregation, from the household to the country level.

As the reviews by Graham and Glaister (2002) and others indicate (see Basso and Oum, 2007, Dahl 2011), virtually all of the studies on fuel price elasticities employ some variant of mean regression, thereby effectively assuming that the magnitude of the elasticity is homogeneous across the population. This article introduces quantile panel regression to evaluate fuel price elasticities for different percentiles of the conditional distribution of car mileage demand while controlling for unobserved heterogeneity.

Methods

In this article, I employ the quantile panel estimator by Abrevaya and Dahl (2008) that was advanced by Bache et al. (2011) to estimate fuel price elasticities at different percentiles of the conditional distribution of car mileage. Moreover, this technique allows to control for unobserved heterogeneity.

Results

Turning to figure 1, the upper panel highlighting the results from treating the panel data as pooled cross-sectional indicates a high and moderately increasing elasticity that is statistically significant at any conventional level for the entire conditional distribution of car mileage demand with the exception of the first percentile.

The lower panel of Figure 1, generated from a quantile panel regression controlling for unobserved heterogeneity, conveys a markedly different picture of the impact of fuel prices on car mileage. As in the pooled quantile regression, households that drive little display relatively high fuel price elasticities. However, for the majority of households the fuel price elasticity estimates are insignificant.

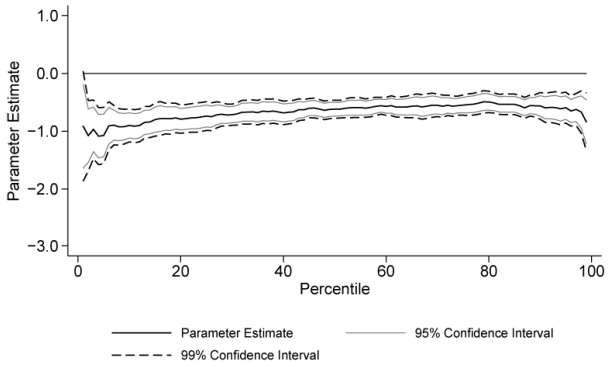
Conclusions

This article shows that introducing quantile panel methods to the field of fuel price elasticities reveals important insights that would otherwise be overlooked using conventional approaches. The results clearly indicate that there is a very high elasticity in the lower part of the distribution of the conditional travel demand in Germany: Households that drive little are highly sensitive to fuel prices. At the same time, there is no statistically significant fuel price elasticity for most of the remaining households.

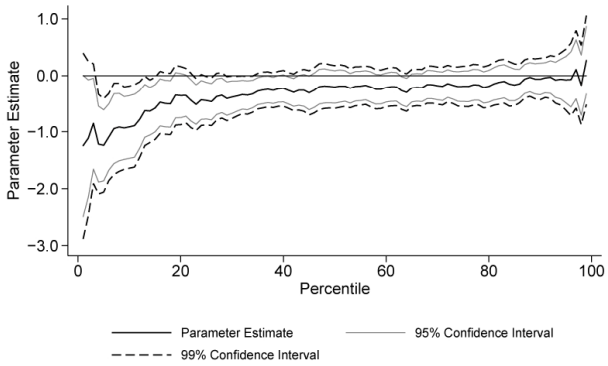
Compared to mean-regression fixed-effects, the quantile panel estimator (Abrevaya and Dahl, 2008 and Bache et al. 2011) allows for a more nuanced interpretation of the results that better captures the heterogeneity of fuel price elasticities.

Figure 1: *The Fuel Price Elasticity of Car Mileage*

(a) *Pooled Quantile Regression Results*



(b) *Panel Quantile Regression Results*



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