ON MODELING ENERGY DEMAND VS SERVICE DEMAND FOR INDIVIDUAL MOTORIZED MOBILITY IN AUSTRIA

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Overview

Energy consumption in individual motorized transport is still increasing as well as the resulting problems such as air pollution, increasing greenhouse gas emissions, rising dependency on oil imports from politically unstable countries and looming peak-oil. These problems lead to an urgent need for implementing efficient policy measures.

To get a reliable appraisal of the effects of different types of policies it is very important to know the impact of different parameters like income, prices and vehicle investment costs on energy consumption. More precisely, it is of interest to get some insight how these economic parameters impact service demand (more vehicles, larger cars, more total km driven) and fuel intensities.

The core objective of this paper is to analyse the impact of various economic and technical parameters – changing fuel prices, households income, car efficiency, investment costs of cars – on the overall service and energy demand in individual transport in Austria. The impact of fuel prices, income and investment costs of cars on the underlying parameters of service demand such as overall demand for vehicles, changes in cars size and power, mobility (km driven) will be analysed.

The focus of this work is to indentify a drivers (and slowers) of energy consumption in the transport sector.

Methods

Firstly the method of approach builds on conventional estimation of energy consumption (E) depending on price (p) and income (PCE-private consumption expenditure).

$$E_t = C \; p_t^A PCE_t^B E_{t-1}^{\lambda}$$

In this paper for service demand – mobility a more detailed decomposition approach is applied. The analysis is based on the premise that customers do not intend to consume gasoline or diesel per se but rather the energy service (S) individual motorized mobility:

$$S = E\eta = \frac{E}{i}$$

i… intensity of fuel consumption

Service demand (S) is estimated by means of an econometric analysis:

$$S_t = C \; p_{st}^{\alpha} PCE_t^{\beta} IC_t^{\delta}$$

P_s…..Service price

IC…..investment costs

In principle short-term and long-term components of service have been analysed. Short-term service demand considers consumer behavior with respect to kilometers driven, long-term service demand takes into account parameters like size and quality of cars and number of vehicles.

The data base is a time series for the investigated parameters considered in this investigation for the period 1970 to 2006.

Results

The major results of this analysis are:

Energy consumption:

- The price impacts energy consumption only if prices are increasing or high - period 1970-1985; there is no impact over the period 1985-2003 (decreasing or low prices);
- The estimation over the whole period 1970-2006 does not provide useful results for the price elasticity because it is diluted!

- Total energy demand is depending significantly on income in every model (income elasticity between 0.9 and 1.4).

Long-term service demand:

- The number and size of new cars per year is depending significantly on fuel prices (price elasticity: -0.15), income (income elasticity: 0.63) and the changes in investment costs of new cars (elasticity: -0.24).
- Total car stock is depending significantly only on income (elasticity: 1.40).
- The overall power/quality index is depending slightly but significantly on fuel prices (price elasticity: -0.03), income (income elasticity: 0.12) and long-term investment cost elasticity (-0.11).

Short-term service demand:

- Total short-term service demand expressed as total km driven per year is depending significantly on fuel prices (price elasticity: -0.38) and income (income elasticity: 1.16). The magnitude of the price elasticity indicates that there is a considerable rebound in service demand if prices fall! The significance of the price elasticity is also an important sign that decreases in energy service price lead to a rebound in service demand. Note, that long-term vehicle stock elasticity was not significant in any model for total km driven per year.
- Specific short-term service demand (average km per vehicle and per year) is depending significantly on fuel prices (price elasticity: -0.15) and income (income elasticity: 0.61) but it also depends significantly on the change in vehicle stock (-0.72). That is to say, the larger the vehicle stock is, the lower are specific km driven per vehicle!

Conclusions

The major conclusions of this analysis are: The chosen parameters provide very good estimates for explaining the demand for vehicles, mobility and energy consumption in Austria.

From an aggregated estimate of energy consumption over the period 1970-2006 it is not possible to extract the full set of explanations. Yet a more detailed analysis revealed that separating periods of rising/high prices (1970-1985) and the period of decreasing/low prices (1985-2003) shows that there is a significant price impact for rising prices but not vice versa.

Also, a significant impact of cross-border “tank tourism” is identified.

The analyses of underlying service demand parameters and efficiency provides additional and deeper insight on the impact of different econometric parameters. Actually, all components of short-term and long-term service demand depend significantly on income. The long-term components – number of new vehicles and the power index – also depend on fuel prices and investment costs.

The share of new diesel vehicles is significantly dependent with best fitting on service price and service demand.

Finally, it has to be stated that fuel price increases lead to significant efficiency improvements and straightforward energy savings. However, these effects are – if prices drop – outweighed by increases especially in short-term km driven.

With respect to the future development of the Austrian individual mobility system the perception is that only a broad portfolio of policy instruments – consisting mainly of tax policies for fuels as well as car investment and standards – will bring about significant reductions in energy consumption as well as related CO2 emissions.

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