THE RELATIONSHIP BETWEEN URBAN CHARACTERISTICS AND TRANSPORT EXPENDITURES OF CHINESE HOUSEHOLDS

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Overview

Rapid economic growth in the past two decades has increased incomes in Chinese to the point that many households can afford to own and drive private vehicles. Vehicle sales have soared, along with driving, fuel consumption, and the external costs of transport including air pollution, greenhouse gas emissions, congestion, and road injury. Municipal and national governments have responded to these issues with an array of policy measures. There is a need to anticipate the counterfactual growth of transport activity, and thus the benefits of policy, through relating transport demand to economic quantities and transport system characteristics.

Past work exhibits one of two limitations: either it relies on vehicle-ownership trajectories—conditioned on the historical experience in the United States, Europe, Japan, etc.—that do not necessarily apply in China; or it uses data from a tailored survey in a small number of cities to estimate local-, short-term income-elasticities of demand, which are imprecisely related to long-term growth and to trends that may vary across Chinese cities.

To address these shortcomings, we estimate a flexible, welfare-consistent system of demands on urban household data from a large survey with national coverage, and three waves over a 12-year period. We augment these data with indicators of urban form, regional economies, and transport system characteristics, allowing these variables to influence households' budget share equations—particular for the expenditure category of transport and communications.

Methods & data

Lewbel and Pendakur (2009) describe an "exact affine Stone index," or EASI, system of implicit Marshallian demands that preserves rationality while allowing unobserved preference heterogeneity and high rank in Engel curves (up to the number of distinct categories of consumption in the data). Such curves describe how the share of expenditure (budget) in different categories varies across levels of incomes.

We estimate the demand system using data from three sources. First, the China Household Income Project surveyed rural, urban and migrant households in five waves between 1988 and 2013 (S. Li et al. 2008; Luo et al. 2013). Using this public source, we construct household budget shares for eight categories of expenditure, including "transportation and communications," from reported annual spending and total consumption in the urban subsample of the 1995, 2002 and 2007 survey waves. We also include a set of household-level descriptive variables—including age, gender, marital status of the household head, number of dependent children, and others–as suggested by L. Li, Song, and Ma (2015). Second, we collect provincial- or, where available, city-level price indices in the same eight consumption categories, from the consumer price surveys of the National Bureau of Statistics of China (2008).

Finally, we construct city-level measures of population- and GDP density, residential floor area, road network and public transit system extent and density, from base data in provincial statistical yearbooks as

aggregated by CEIC Data ([2016]). By matching on the 6-digit (county-level) *guobiao* (GB) 2260 codes for administrative divisions, we construct a non-panel data set with about 15,000 total observations covering cities in nine provinces, wherein each household's budget shares are augmented with same-year price information, household-level demographics, and descriptive characteristics of cities and local transport systems.

We estimate EASI demand systems on our data set using iterated three-stage least squares regression.

Results

We provide the first estimates, to our knowledge, of Engel curves for Chinese households' transport demand as related to city-level characteristics that describe processes of urbanization. We find that transportation & communication expenditures are slightly elastic with respect to income, and that this elasticity increases gradually with income.

We also investigate the significance and scale of coefficients on city-level covariates, and their interactions with total consumption, especially as they enter the budget share for transport. We further test these findings under a variety of specifications of different rank and subsets of household demographic and city-level covariates, and compare our results to literature on the relationship between urban form and households' transportation consumption, in a context of rising incomes.

Conclusions

Our results build on previous efforts to estimate elasticities of transport demand for Chinese households, shedding new light on how these descriptors of consumption are related to urban characteristics.

An important application of such Engel curves is the projection of transport demand growth and energy consumption in Chinese cities—one that improves on the application of out-of-country, 20th-century trends, and reflects observed variation across and within cities. Models with city-level characteristics—combined with projections of demographics, income, inflation, and planned transit system expansion—allow exploration of correlations between urbanization, economic growth, and aggregate household transport demand.

The demand systems we estimate support policy analysis by allowing consistent estimation of the welfare impacts of transportation demand management policies that either limit expenditure in particular categories, or affect the relative prices of transport goods and services.

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