Duality Based Analysis of Japanese Residential Gas Demand

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abstract

This article discusses a novel estimation method for the gas demand function in Japan where the price per unit decreases as the demand exceeds certain thresholds, which is called decreasing block rate pricing. The demand function under decreasing block rate pricing is described by the well-known discrete/continuous choice model. However, the conventional approach imposes highly nonlinear constraints on the model parameters, and the maximization of the likelihood function under such constraints is difficult to be implemented. To overcome this difficulty, we first apply the idea of duality in consumer theory in order to approximate the conditional expenditure and linearize the constraints. Then, we take a Bayesian approach and estimate the model parameters under linear constraints using Markov chain Monte Carlo simulation. Our proposed method is adopted to analyze Japanese residential gas demand.