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AN ANALYSIS ON THE HOUSEHOLD USAGE FOR ALTERNATIVE-FUEL VEHICLES USING THE BAYESIAN MULTIPLE DISCRETE – CONTINUOUS EXTREME VALUE (MDCEV) MODEL

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Overview

As the problems of the exhaustion of petroleum and environmental pollution due to automobile usage become serious, Alternative-fuel and fuel efficient vehicles are considered as the solution of these problems because of low fuel price and green energy. The major automobile manufacturers have spent much expenditure to develop alternative-fuel vehicles and governments have incentives that they encourage consumer to purchase these vehicles. Actually, the governments of countries such as USA and Japan have supported the development and diffusion of alternative-fuel vehicles.

There are many previous studies which analyzed the consumer preference for alternative-fuel vehicles (Brownstone and Train 1999; Ewing and Sarigollu 2000; Dagsvik et al. 2002; Horne et al. 2005). These studies used stated preference data, and multinomial logit (Ewing and Sarigollu 2000; M. Horne et al. 2005), mixed logit and multinomial probit model (Brownstone and Train 1999) were used in estimation. Various fuel types and important attributes for selecting car were considered in previous studies. However, these studies analyzed only the purchasing choice, although the usage after purchasing cars. Therefore, the analysis on actual effect of policy is requires considering the purchasing choice and mileage after purchasing simultaneously.

The purpose of this study is to address consumer preference for important attribute of vehicles and predict the consumer usage pattern in the future when all alternatives-fuel vehicles are introduced and diffused. In this research, we try to simulate the various scenarios and predict the choice and mileage of these cars. Using this prediction, the amount of fuel usage and the amount of the emission of pollution materials are estimated. The direction of policy is presented based on this result.

Methods

We also adopted the stated preference analysis for the passenger car survey since alternative-fuel vehicles are new product or not yet introduced in the market. We use the MDCEV (Multiple Discrete-Continuous Extreme Value) model (Bhat, 2006) which can analyze multiple choice, discrete choice and continuous usage. The model uses the utility equation of itself and include the concepts as baseline utility and satiation. The Bayesian mixed method having advantages compared with classical approach is used in the estimation allowing the heterogeneity across individuals and it's different from Bhat (2006).

Results

We present the estimation results of baseline utility and satiation. In the estimation of baseline utility, the order of preferences is gasoline, disel, LPG, CNG, and hybrid (gasoline+electricity). However , in the estimation of satiation, the order of marginal utilities of additional usage (mileage) is Hybrid, LPG, disel, CNG, and gasoline. Therefore, in order to analyze the mileage of consumer use, we simulate the scenarios in which 5 type fuel automobiles exist. In the basic scenario, the order of estimated mileage is gasoline, hybrid, disel, CNG, and LPG. We simulate the case of the carbon tax imposition additionally and tax reduction for alternative-fuel cars.

Conclusions

Gasoline car has still superior position in the automobile market due to the stability of performance and related infrastructure such as fuel charge and maintenance. And hybrid car is on the rise as a powerful alternative according to this result, though hybrid car has disadvantages in purchasing price. However, if the purpose of a policy is fossil fuel saving or the reduction of environmental pollution, consideration and simulation based on consumer preference are required.

References

Bhat, C. R. and Sudeshna Sen, "Household vehicle type holdings and usage: an application of the multiple discrete-continuous extreme value (MDCEV) model," *Transportation Research Part B*, Vol. 40, 2006, pp 35-53.