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Forecasting Market Share of Electric Vehicles in Taiwan Using Conjoint Models and Monte Carlo Simulation

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Abstract : Recently, the sale of electrical vehicles (EVs) has increased dramatically due to maturing technology development and decreasing cost. Governments of many countries have made regulations and policies in favor of EVs due to their long-term commitment to net zero carbon emissions. However, due to uncertain factors such as the future price of EVs, forecasting the future market share of EVs is a challenging subject for both the auto industry and local government. This study tries to forecast the market share of EVs using conjoint models and Monte Carlo simulation. The research is conducted in three phases. (1) A conjoint model is established to represent the customer preference structure on purchasing vehicles while five product attributes of both EV and internal combustion engine vehicles (ICEV) are selected. A questionnaire survey is conducted to collect responses from Taiwanese consumers and estimate the part-worth utility functions of all respondents. The resulting part-worth utility functions can be used to estimate the market share, assuming each respondent will purchase the product with the highest total utility. For example, attribute values of an ICEV and a competing EV are given respectively, two total utilities of the two vehicles of a respondent are calculated and then knowing his/her choice. Once the choices of all respondents are known, an estimate of market share can be obtained. (2) Among the attributes, future price is the key attribute that dominates consumers' choice. This study adopts the assumption of a learning curve to predict the future price of EVs. Based on the learning curve method and past price data of EVs, a regression model is established and the probability distribution function of the price of EVs in 2030 is obtained. (3) Since the future price is a random variable from the results of phase 2, a Monte Carlo simulation is then conducted to simulate the choices of all respondents by using their part-worth utility functions. For instance, using one thousand generated future prices of an EV together with other forecasted attribute values of the EV and an ICEV, one thousand market shares can be obtained with a Monte Carlo simulation. The resulting probability distribution of the market share of EVs provides more information than a fixed number forecast, reflecting the uncertain nature of the future development of EVs. The research results can help the auto industry and local government make more appropriate decisions and future action plans.

Keywords : conjoint model, electrical vehicle, learning curve, Monte Carlo simulation
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