Consumer Behavior towards Scheduling and Pricing of Electric Cars Recharging: Theoretical and Experimental Analysis

This article-based dissertation consists of five self-contained chapters. The first chapter presents the motivation of the dissertation and a summary of the four papers containing the dissertation. Three of the chapters are applied microeconomics papers dealing with the economics of recharging electric cars. The last chapter deals with analysis of energy consumption rate and its determinants of electric cars under the hands of customers. A variety of techniques are used including analysis of field data, economics laboratory experiments and theoretical modeling with simulation.

Chapter one presents an introduction to the main parts of the dissertation and a summary of the articles containing the dissertation.

Chapter two, ‘The Economics of Workplace Recharging’, proposes a microeconomic model of the demand for and supply of recharging facility at workplace (WPC), and uses the approach to shed light on the incentives and barriers employees and employers face when deciding on the demand for and supply of WPC. Using the model and simulation, the paper also examines the existence of WPC market under the current prices, and finds that no WPC contract exists that an employer is willing to offer and, at the same time, that the majority of employees are willing to accept. To overcome the lack of demand for or under-provision of workplace recharging, various remedies are discussed and suggested.

Chapter three, ‘Myopic Loss Aversion Behavior under Ultimatum Game Framework in the Scheduling and Pricing of Electric Vehicle Recharging’, proposes, and tests at laboratory, contracts about recharging BEVs combining the ultimatum game framework and the myopic loss aversion (MLA) behavioral hypothesis. The model represents the behavior of EV-owners trading-off between the amount of the discount on fee for postponing recharging, the risk of being eligible to the discount and the risk of not recharging the BEV on time for unforeseen trips. Findings from the experiment show that indeed individuals perform decisions exhibiting MLA behavior. The intuition from the result is that presenting time-of-use recharging price as long-term contracts may curtail MLA behavior and help BEV owners to choose cost minimizing recharging time and, simultaneously, may help to reduce BEVs impact on the electricity grid system.

The fourth chapter, ‘Using the Peer Effect in Scheduling and Pricing Electric Vehicles Recharging: Laboratory Evidence about Peer Effect in Risk-Taking’, presents experimental evidence about peer effect in risk taking in general and, in particular, the use of peer effect in scheduling BEVs recharging. The study investigates whether individuals want to see the choices of others, if observing peers’ choices influences the observers’ choices, to what extent the peer effect is pervasive and who are being influenced by peers’ choices as well as the role the type of peer information plays on peer effects. The results show that a lion share of individuals want to see peers’ choices, but only a moderate percentage of them, mostly those with relatively lower scores in our math test (usually used to test cognitive ability) and lacking self-confidence, use the peers’ choices to revise their intrinsic choices. The results reveal also that the type of peer information plays a significant role in peer effects.

The fifth chapter, ‘Harnessing Big-Data for Estimating the Energy Consumption and Driving Range of Electric Vehicles’, analyzes the electricity consumption of BEVs and its sensitivity to the various driving environments in the hands of customers. The results show that the energy consumption rate of BEVs is highly sensitive to weather conditions and to driving styles. The results may help individuals to make informed decisions about BEV choice, manufacturers to build trust with customers by provide more accurate information, and governments to design policies based on reliable information.