Estimation of Vehicle Lifetime in the Used Car Market

Topic: Thematic IO analysis: Transport & Policy Analysis &
Author: Izumi Uchida
Co-Authors: Yuya NAKAMOTO, Shigemi KAGAWA

IEA (2012) has reported that the number of conventional gasoline vehicles (CGVs) owned in the world will decrease by 2050, whereas the demand for next-generation vehicles such as hybrid vehicles and electric vehicles will significantly increase by 2050. With this background, previous studies (e.g., Kagawa et al., 2008, 2011, 2013; Nakamoto et al., 2018) estimated the effects of vehicle lifetime extensions of countries on a specific country and global CO2 emissions and they found that vehicle lifetime extensions played a crucial role in the climate mitigation. Although the previous studies focused on a vehicle life-cycle from a new purchase to vehicle-scrapping and used the physical vehicle lifetime, they did not consider economic vehicle lifetime with a focus of vehicle replacement cycle. The novelty of this study is that we used the detailed micro data on vehicle replacements provided by the Car User Report 2017 (Proto Corporation, 2017) and estimated the economic vehicle lifetime with a focus of a vehicle life-cycle from a new purchase to a car replacement. In doing it, we focused on three vehicle types of CGV, hybrid vehicle, and electric vehicle and assumed their vehicle lifetimes followed a normal distribution or a Weibull distribution. From the results, we found that when car owners â€˜newlyâ€™ purchase a CGV, they will replace it after 6.8 years on average. In addition, when car owners purchase a â€˜usedâ€™ CGV, they will replace it after 5.4 years on average, thus the economic lifetime of the used CGVs is 1.4 years shorter than that of new CGVs. We further used the stock-flow model of vehicles based on the estimated vehicle lifetime (e.g., Kagawa et al., 2012) and analyzed how car replacement cycles of the three types affected life-cycle CO2 emissions associated with final demand of vehicles during the study period: 1990 to 2030.