

An Analysis of Monopolistic and Competitive Take-Back Schemes for Recycling

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Abstract

The establishment of efficient take-back schemes is widely recognized as the first step of achieving high product recovery and recycling rates. In this paper, we study two prevailing types of take-back schemes for electrical and electronic equipment waste (WEEE) recycling: Monopolistic and Competitive. We address key market and operating factors that make one scheme preferable to the other from the viewpoints of the recyclers, manufacturers, and consumers. To this end, we model competitive decision making in both take-back schemes as two-stage sequential games between competing manufacturers and recyclers. Deriving and computing equilibria, we find that the competitive take-back schemes often accomplish a win-win situation; i.e., lower product prices, higher recycler and manufacturer profits. Exceptionally, the recyclers prefer the monopolistic scheme when substitutability level between the manufacturers' original products is high. We show that consolidation of recycling industry could be beneficial to all stakeholders when the economies of scale in recycling/logistics activities are strong. Higher collection rates and lower product substitutability also render recycler consolidation desirable for all stakeholders. Furthermore, we identify a potential free-rider problem in the monopolistic scheme when the discrepancy in the recyclers differ in operational efficiency, and propose mechanisms to eliminate it. We illustrate some of our results through numerical experiments and discuss the implications of our results to policy makers.

Key Words: WEEE, take-back schemes, end-of-life products, recycling, game theory
