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DIFFERENTIAL GAME ANALYSIS OF LOW-CARBON AUTO SUPPLY CHAIN COORDINATION: INFRASTRUCTURE, EMISSION, DYNAMIC CONTRACTS

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Abstract

The dual-credit policy (DCP) has become the main policy to promote new energy vehicles in the context of the Chinese government's subsidy receding. In the context of DCP, based on the theory of differential games and continuous dynamic programming, this paper constructs a secondary supply chain consisting of an automobile manufacturer and retailer producing both new energy vehicles (NEVs) and internal combustion engine vehicles (ICEVs) and explores the manufacturer's investment strategy for efforts in range-related infrastructure development (ERID), the retailer's investment strategy for collaborative efforts in emission reduction (EER), and the pricing strategy for both NEVs and ICEVs. The result shows that (1) the cost-sharing and profit-sharing contracts can improve the low-carbon level of the automotive supply chain, and the contracts can achieve the Pareto improvement of the profits of the supply chain and its participants within a certain feasible domain. (2) The total profits of the supply chain and each participant are positively correlated with the competition strength of NEVs and ICEVs, and the supply chain realizes Pareto optimization when the competition strength is close to the threshold of perfect competition. (3) The manufacturer's ERID cost is positively related to its marginal impact coefficient on goodwill, and the retailer's EER cost is positively related to its marginal impact coefficients on goodwill, so the manufacturer and retailer need to increase their inputs of ERID and EER to promote the healthy competition of NEVs and ICEVs and to form a positive cycle.

Key words: automotive supply chain; contractual coordination; differential game; dual-credit policy; low carbon emission reduction

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