

Enterprise Operations in a Three-Level Supply Chain Under Cap-and-Trade Regulation

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Abstract

Many countries have implemented various policies to reduce carbon emissions. Among the policies available, cap-and-trade regulations have well been accepted as an effective market-based mechanism to curb carbon emissions. This policy offers the opportunity for firms to share the benefits of low-emission in a carbon trading market by selling and purchasing credits. In this paper, we focus on the cap-and-trade emission reduction policy. Specifically, we study an emission-dependent supply chain consisting of a manufacturer, a supplier and a retailer. In this supply chain, a cap on emission permits for the manufacturer is primarily imposed by the government and additional emissions must be purchased from the emission trading market if the permit needed is larger than the cap. We investigate the effects of the emission cap-and-trade on the supply chain members' decisions for decentralized and centralized supply chain using a Stackelberg game model. In the decentralized supply chain, a product's retail price is higher than in the centralized decision-making mode. Moreover, the price of extra emissions under the decentralized supply chain decrease as the carbon emissions cap increases. Our results show that in the centralized supply chain enterprises obtain higher benefits than in the decentralized supply chain. The outcome of this research can help i) policy-makers to make effective emission reduction policies and ii) manufacturers and retailers to make sustainable operations and supply chain decisions.

Keywords

Cap-and-trade, Emission-dependent supply chain, Stackelberg game, decentralized supply chain, centralized supply chain

Biographies

Fatemeh Rezaei is a joint researcher at the Faculty of Economics and Business of KU-Leuven University (Belgium) and IESEG School of Management (France). Fatemeh's research interests mainly concern Project Planning and Scheduling, Project Risk Assessment, and Sustainable Supply Chain Management.

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Linda Zhang is currently a Professor of Operations Management in Department of Operations Management at IÉSEG School of Management (LEM-CNRS 9221), Lille-Paris, France. She obtained her BEng and Ph.D. degrees in Industrial Engineering in China and Singapore, respectively. Her research interests include sustainable supply chain management, healthcare operations management, mass customization, product and production configuration, etc. In these areas, she has published a number of articles in international refereed journals, such as *European Journal of*

*Proceedings of the 5th European International Conference on Industrial Engineering and Operations Management
Rome, Italy, July 26-28, 2022*

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