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Production and Pricing Problems in Make-To-Order Supply Chain with Cap-and-Trade Regulation

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Abstract

This paper studies the production and pricing problems in MTO (make-to-order) supply chain containing an upstream manufacturer who produces two products based on MTO production and a downstream retailer. The manufacturer is regulated by cap-and-trade regulation and determines the wholesale prices of the two products. To comply with the regulation, the manufacturer can buy or sell emission permits through an outside market. The retailer determines its order quantities to meet the price-sensitive demands. We derive the optimal total emissions and production quantities of the two products, and based on them, we analyze the impact of emission trading price on the optimal production decisions and the two firms' optimal profits. The emission trading decisions follow a two-threshold policy and the optimal total emissions are increasing in the cap. However, contrary to intuition, the optimal production quantities of the two products may be decreasing in the cap. The manufacturer's optimal profit is decreasing (increasing) in the buying (selling) price of emission permits, and that the retailer's optimal profit is decreasing in the buying (selling) price of emission permits. The optimal total emissions are decreasing in buying or selling price of emission permits, however, the optimal production quantities of the two products may be increasing (decreasing) in the buying (selling) price of emission permits. Numerical examples are conducted to illustrate our findings and some managerial insights are presented.

Keywords: cap-and-trade; supply chain; production; pricing

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