JOINT IMPACTS OF EMISSION TRADING AND CONSUMER LOW-CARBON AWARENESS ON FIRM'S DECISION

Wen Wen, Nanjing University of Aeronautics and Astronautics, Phone +86 15051868283, E-mail: wenwen@nuaa.edu.cn
Peng Zhou, Nanjing University of Aeronautics and Astronautics, Phone +86 25 84893751, E-mail: cemzp@nuaa.edu.cn

Overview

According to the Fifth Assessment Report of IPCC, about 41% of global CO_2 emissions between 2000 and 2010 came from the industrial and transportation sectors directly (IPCC, 2014). As such, great effort should be put onto firms' production and operations management for reducing CO_2 emissions and mitigating global warming (Plambeck, 2012). Alternative policy instruments, e.g. carbon emission trading, have been designed and implemented to induce firms' low-carbon behaviors in different countries or regions (Jotzo & Löschel, 2014). On the demand side, consumers have gradually realized the seriousness of global warming and indicated interest in environmental-friendly or low-carbon products, which is likely to affect firms' market share and profits, and thus influence their decisions (Liu et al., 2012). How will firms act under the double-side pressures, i.e. the up-side one from governmental regulations and the down-side one from customers' requirements for low-carbon products? This paper aims to answer this question through production and pricing perspectives with optimization method, and try to find empirical inspirations from the model results.

The paper is organized as follows. After the introduction,we develop a monopolistic firm's decision model, with product carbon intensity and price as decision variables. In Section 3, we obtain the optimal solutions and discuss the joint impacts of carbon price and consumer low-carbon awareness on firm decisions. Section 4 proposes numerical experiments for illustrating model results and extending discussions. Section 5 concludes the paper.

Methods

Optimization.
Numerical expetiment.

Results

First, with unit product's carbon emission quantity and price as the decision variables, the carbon-constrained decision model for a monopolistic firm is established.

Second, the firm's optimal emission abatement and pricing strategies are obtained, indicating that carbon price and consumer low-carbon awareness both have positive effects on a firm's emission reduction effort while have intricate impacts on its pricing strategy.

Third, numerical experiments are proposed to show the impacts of various influential factors on the equilibrium results. It's found that demand sensitivity toward product price has a sharply decreasing cutting effect on product price and firm's profit.

Conclusions

The carbon cap is like a piece of cake allocated to the firm for compensating its emission charges, which has no effect to its emission abatement nor pricing decisions. A firm's carbon emission reduction effort is always enhanced by carbon price and consumer low-carbon awareness, while decreased by abatement cost coefficient and consumer's sensitivity toward product price. The optimal pricing strategy for a firm is to pass through part of its carbon emission cost as well as abatement cost to its consumers, while drops to some certain extent according to the level of consumer low-carbon awareness and price sensitivity for compensating consumers' aversion toward carbon emissions. The firm's equilibrium payoff drops first and then recovers with the increase of carbon price, and keeps going down with the increase of consumer low-carbon awareness. Generally, it is easier to induce emission abatement behavior for a firm with lower marginal emission abatement cost, or with less price sensitive consumers.

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