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The effect of emission charges on output and emissions in dynamic Cournot duopoly

Robert Mamada ^{a,*}, Charles Perrings ^b^a College of Humanities and Social Sciences, Grand Canyon University, United States of America^b School of Life Sciences, Arizona State University, United States of America

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ABSTRACT

We consider the effect of emission charges on market structure, output, and emissions in Cournot competition. Assuming myopic decision making and a partial adjustment process, we analyze the impact of emission charges on the stability of duopoly/monopoly and on the level of emissions. We show that where marginal emission charges are increasing in the level of emissions, duopoly is stable. However, where marginal emission charges are decreasing in emissions, duopoly is unstable, and the system converges on monopoly. Equilibrium output and emissions are also shown to be higher under cost structures favoring monopoly than under cost structures favoring duopoly.

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1. Introduction & literature review

In this paper, we revisit the relation between emission charges, output and emissions when market structure is endogenous. In the industrial organization literature, the question has been posed as to whether environmental taxes lead to anti-competitive behavior among polluting firms. [Benchekroun and Chaudhuri \(2011\)](#), for example, found that the imposition of an emissions tax that depends on the pollution stock could induce stable cartelization in an oligopolistic polluting industry. Here we ask what impact emission charges have on industrial structure, and how this affects output and emissions at the Cournot–Nash equilibrium of the system. We take the simplest case, Cournot duopoly, and ask what effect emissions charges have on emissions, output, and competition. The paper is motivated by findings, originally due to [Katsoulacos and Xepapadeas \(1995\)](#), that optimal emissions taxes should be strictly less than the marginal external damage cost of emissions by both oligopolistic and monopolistic firms, and should be increasing in the number of firms. We do not consider the social problem, but wish to understand how firms react to emissions charges at different levels.

Following [Vives \(2001\)](#), we consider the case where firms engaged in Cournot competition adjust output so as to close the gap between current and desired output. Using this process we consider the effect of emission charges on the number of firms at the Cournot–Nash equilibrium, and how this influences aggregate output and emissions. Without loss of generality, we take the case of duopoly, and evaluate the impact of emission charges on the stability of duopoly.

Key statements

Conclusion

We do not explore the optimal emission charge in this paper, but note that if emission taxes are indeed sensitive to marke...

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