

Recycling: Friend or enemy of exhaustible resources?

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Focus on Research

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Our paper analyzes the best extraction strategies for the provider of an exhaustible resource that can be recycled. We show how prospective recycling modifies the Hotelling rule. We characterize various entry possibilities. The benevolent extractor may accommodate or promote recycling, while the self-interested extractor may accommodate or deter recycling.

Recycling is a fast-growing industry in a world where the issue of **resource conservation** is becoming more acute. For instance, Bakshi and Long (2009) point out that the percentage of municipal solid waste recycled in the United States has increased almost fivefold between 1960 and 2007. The question as to whether recycling conserves resources is particularly relevant with regard to exhaustible resources that can be partially recycled after use.

Our purpose is to provide a simple theoretical insight into the following issues. How do the extractors influence the amount of recycled material that they will later have to compete with? Does the prospect of recycling accelerate or slow down the depletion of exhaustible resources?

To answer these questions, we analyze a **two-period Cournot model** where one extractor faces one recycler in the second period. We assume that the recycler maximizes profit and incurs a fixed cost to enter the market. This entry is an opportunity or a threat for the extractor, depending on whether it maximizes social welfare or its own revenue.

When the extractor maximizes social welfare, it views recycling as a desirable activity because recycling creates a valuable expansion of the resource stock. As a result, the benevolent extractor accelerates the resource depletion to enhance the market position of the recycler. Depending on the size of the fixed cost of recycling, there are two entry possibilities. If the fixed cost is low, then the extractor accommodates the recycler's entry by providing more input than needed to cover the costs of recycling. If the fixed cost is high, then the extractor promotes recycling by providing just enough input to offset the costs of recycling.

When the extractor maximizes its own profit, it views recycling as a threat to its market position. In that case, we find that the extractor must slow down the resource depletion for two different reasons depending on the size of the fixed cost of recycling. If the fixed cost is low, then the extractor can do no better than accommodate the recycler's entry. In this equilibrium, the extractor accepts some output reduction in the first period to defend its market position in the second period by triggering a less aggressive reaction from the recycler. If the fixed cost is high, the extractor deters recycling by signaling its intention to flood the market with virgin product in the second period.

REFERENCE

Baksi, S., and N. V. Long. 2009. [Endogenous Consumer Participation and the Recycling Problem](https://onlinelibrary.wiley.com/doi/full/10.1111/j.1467-8454.2009.00376.x)(<https://onlinelibrary.wiley.com/doi/full/10.1111/j.1467-8454.2009.00376.x>), Australian Economic Papers, 48, 4, 281-295.

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Reference

Ba, Bocar Samba, Mahenc, Philippe. 2018. "Is Recycling a Threat or an Opportunity for the Extractor of an Exhaustible Resource?", *Environmental and Resource Economics*, August 2019, Volume 73, Issue 4, 1109–1134.

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