

WHEN DO FIRMS SWITCH TO GREEN PACKAGING? A GAME-THEORETIC THRESHOLD MODEL OF CONSUMER AWARENESS

Abstract

Firms produce over 282 billion pounds of plastic packaging each year. We use literary analysis to lay out the motivation and data for our paper, and then use game theory to show the effect of consumer awareness.

Research Question

How environmentally conscious must consumers become before firms voluntarily switch to green packaging?

Methodology

We use a simple game-theoretic 4x4 table to show that a Prisoner's dilemma exists since the dominant strategy is always for firms to choose plastic. We develop a continuous model to develop an expression for when firms switch to green packaging. Lastly, some extensions considered are greenwashing, where companies like Coca-Cola advertise greenness but are truly prioritizing plastic, and taxes and subsidies.

Findings

- Previous literature establishes the connection between consumers and firms, but we write an equation to support it.
- Adoption threshold: Firms go green only when consumer awareness exceeds $\lambda^* = \sqrt{(2kF)/B}$. Higher costs (F, k) raise it; higher consumer rewards (B) lower it.
- Prisoner's Dilemma: Plastic is the dominant strategy, so both firms stay plastic even though both would earn more going green.
- The final equation was $\sqrt{(2kF)/B}$.
- Greenwashing: Awareness raises the payoff from claiming greenness, not from actually investing, so exaggeration pays once λ exceeds $p\phi/B$ unless penalties are high enough.
- Policy equivalence: Subsidies and plastic taxes both lower the effective adoption cost

Conclusion

Environmental consumer consciousness may be insufficient to induce firms to adopt green packaging. We derive a closed-form threshold, $\lambda^* = \sqrt{(2kF)/B}$, beyond which voluntary adoption occurs. Firm competition reduces this threshold, but competition can also cause both firms to underperform or both firms to switch. Greenwashing reduces the correlation between environmental performance and consumer environmental consciousness because consumer consciousness penalizes investment and rewards claims. Taxes on plastic and subsidies can reduce the effective cost of adoption and can also partially substitute for insufficient consumer environmental consciousness. Effective environmental performance requires regulation and an effort to combat greenwashing.



Discussion

Environmental improvement in packaging might not solely result from consumer awareness. Firms only switch above a threshold $\lambda^* = \sqrt{(2kF)/B}$ and competition may induce a switch even if the result is a worse outcome for all firms. Greenwashing reduces the relationship between awareness and environmental improvement. Plastic taxes and subsidies can substitute for low awareness. Strong results would require policy and effective detection of greenwashing.

References

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