

Audit Mechanisms and Green R&D Incentives: A Theoretical Framework for Effective Environmental Policy

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Abstract : This theoretical paper explores the impact of audit mechanisms, emission taxes, and green R&D rewards on firms' behavior, specifically focusing on emission levels and incentives for investing in green innovation. The study examines two types of audit mechanisms: the traditional audit mechanism and the random audit mechanism. While previous studies have analyzed these mechanisms, they have overlooked the role of firms' green innovation -a critical factor influencing emission levels. In the traditional audit mechanism, the environmental agency assigns audit probabilities based on the truthfulness of firms' reported emissions, penalizing untruthful reports upon audit. In contrast, the random audit mechanism applies equal audit probabilities to all firms, with similar penalties for false reporting. Using a three-stage game framework grounded in industrial organization theory, this paper demonstrates that the traditional audit mechanism, combined with emission taxes, effectively incentivizes firms to invest in green R&D. Additionally, the findings suggest that emission tax and penalty rates should be adjusted based on firms' sensitivity to the audit mechanism to achieve optimal reductions in emission levels. The paper further introduces a unit reward system, wherein firms that achieve emissions below a government-set target receive rewards proportional to the extent of their reduction, as verified through audits. The analysis shows that combining audit mechanisms with reward-based incentives significantly reduces emissions, promotes green R&D investment, and encourages truthful reporting. By optimizing emission tax rates, reward rates, and penalty rates, this combined system provides a robust framework for addressing environmental challenges. These findings offer valuable policy insights for environmental agencies and governments aiming to design effective regulatory mechanisms to promote sustainable industrial practices.

Keywords : audit mechanisms, emission tax, green R&D, environmental regulation

Conference Title : ICEMBIT 2025 : International Conference on Economics, Management of Business, Innovation and Technology

Conference Location : London, United Kingdom

Conference Dates : May 22-23, 2025