

Tradable Permits Under Environmental and Cost-reducing R&D

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Abstract

This paper models the simultaneous investments in cost-reducing and environmental R&D by asymmetric firms competing à la Cournot. Pollution rights are allocated by the regulator, and firms can trade pollution permits. Both R&D competition and R&D cooperation are considered; in the latter case, firms fully share information about technologies. In a 3-stage game, firms first invest in R&D, then trade permits, and then compete in output. The strategic interaction between different types of R&D investments is analyzed. It is found that the permit price depends on total permits only, not on their initial allocations. The optimal allocation of pollution rights by the social planner is also considered; the allocation of permits between firms matters for social welfare in the presence of environmental R&D under noncooperative R&D, but is irrelevant under cooperative R&D. Moreover, it is optimal to give firms less permits when spillovers are higher. In addition, grandfathering permits (proportion to pre-permit output) is studied under R&D noncooperation. Compared with social optimal allocation, grandfathering allocates too many permits to the large firm and too many permits to the small firm. Furthermore, an R&D budget constraint is introduced. When the constraint is binding, firms underinvest more in standard R&D than in environmental R&D.