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George E. Halkos, George J. Papageorgiou

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Pollution, environmental taxes and public debt: A game theory setup

by

George E. Halkos and George J. Papageorgiou
Laboratory of Operations Research
University of Thessaly, Department of Economics

Abstract
As is well known, public debt accumulation can produce disutility and that its accumulation over time must be economically sustainable. Equally, pollutants generated during the production process also result in disutility. One of the policy weapons available to governments in regard to public debt is the generation of primary surpluses in order to sustain a capacity to repay the debt. Affecting this capacity are the cost/benefits involved in reduction of emissions through taxation. In this paper, we address the above factors in an extremely simple, dynamic game in order to find linkages between the notions of public debt, pollution, and taxation. The starting point of the model is identification of the current account as the basis of the equation of motion of the public debt which is considered as a stock. A regulator's task is to raise the nation's primary surplus to reduce the stock of public debt. Nash and Stackelberg differential game solutions are used to explore the strategic interactions. For the Nash equilibrium, it is found that in establishing the cyclical strategies during the game between the polluters on the one hand and the government on the other, the discount rate of the polluters is required to be greater than the government's discount rate. That is, polluters must be more impatient than the government. In the case of the hierarchical setting, the analytical expressions of the strategic variables and the steady state value of the public debt stock are important outcomes of this study. We find the analytical expressions of the reward functions, making the implementation by policy makers an easier task. Finally, we are able to show the conditions under which conflict is more intensive in the two cases of equilibrium, according to the shadow price of the environmental damages.

Keywords: Public debt; Pollution; Taxation**;** Dynamic games; Nash equilibrium; Stackelberg equilibrium.

JEL Codes: C72; H23; Q52; H62.