

A Dynamic Private Property Resource Game with Asymmetric Firms

Luca Grilli

Department of Economics,

University of Foggia, Italy

luca.grilli@unifg.it

Michele Bisceglia

Department of Management, Economics, and Quantitative Methods

University of Bergamo, Italy

michele.bisceglia@unibg.it

Abstract

In this paper, we consider a non-cooperative linear state differential game in which two competing firms privately hold the same resource in order to produce a common good, as in Colombo and Labrecciosa (2013a,b), but we suppose that each firm can determine a different growth rate for the resource according to private technology owned by each firm. We are considering, for instance, a forest in which grows a single tree species. The growth rate of the trees depends in part on common natural factors for both firms (e.g. biological characteristics, climate, level of pollution) and in part on the technical efficiency of the firms (which results, for example, in the use of different tending or regeneration methods). We assume that there is one x -efficient firm, which is able to breed the trees to the maximum allowed rate given the "environmental conditions" and the other firm accusing a certain efficiency gap caused by a technology that does not allow it to take full advantage of the resource growth potential. Over time both the natural growth rate of the resource and the technological gap can vary. In particular, the variations of the natural resource growth rate may be positive or negative, both transient and permanent. As regards the technological gap, it is more realistic that it tends to shrink over time in a permanent way. We find an asymmetric linear FNE in which the player's strategy only depends on his own resource stock (regardless of the resource assigned to the other player). Then we show the optimal path obtained by the FNE both for the asset stock and for the firms' output levels and we carry on a short-run and a steady state sensitivity analysis w.r.t. the natural growth rate of the resource and the efficiency gap between the two firms. Finally we compare the steady state framework with the symmetric models with private (Colombo and Labrecciosa, 2013b) and with common resource (Benckroun, 2003), also from a social welfare point of view.

Keywords: Feedback Nash Equilibrium; Differential Games; Resource exploitation; Private vs common property.

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