

Application of Stochastic Cooperative Games in Water Resources

Ariel Dinar, Stefano Moretti, Fioravante Patrone and Stefano Zara

Speaker: Stefano Moretti

e-mail: moretti@dima.unige.it

University of Genoa, Department of Mathematics

ITALY

ABSTRACT

Traditionally, cooperative game theory has been applied to a variety of water resource problems assuming a deterministic pattern of supply. On the other hand, in view of the important role that water plays in regional and local projects, and taking into account that with climate change affecting the water cycle, the world is expected to face more stochastic and extreme events of water supply, incorporating stochastic consideration of water supply becomes more acute in designing water facilities. Moreover, various water users may have different attitudes toward risk, depending on their economic, managerial, and institutional capacity. Therefore, the combination of stochastic events and players' risk attitude become increasingly an important issue in designing water related economic activities that depend on cooperation among the users.

In this paper we will apply a Stochastic GT framework, based on the work of Suijs and Borm (1996). We will use an example of a water treatment plant to illustrate the approach, although the principles hold also for cases of other water-related joint cost, such as for storage, etc. Our goal will be to offer, in the most simplified setting, some instances of problems which appear whenever one tries to take into account the stochastic aspects of the problem which is being modelled.

References

- [1] Dinar, A. and D. Zilberman, The Economics of Resource-mailConservation, Pollution-Reduction Technology Selection: The Case of Irrigation Water. *Resources and Energy*, 13:323-348, 1991.
- [2] Dinar, A., M. B. Campbell, and D. Zilberman, Adoption of Improved Irrigation and Drainage Reduction Technologies Under Limiting Environmental Conditions. *Environmental & Resource Economics*, 2:373-398, 1992.
- [3] Dinar, Ariel and Richard E. Howitt, 1997. 'Mechanisms for Allocation of Environmental Control Cost: Empirical Tests of Acceptability and Stability', *Journal of Environmental Management*, 49:183-203.
- [4] Moretti, Stefano, Henk Norde, Kim Hang ham Do, and Stef Tijs, 2002. 'Connection Problems in Mountains and Monotonic Allocation Schemes'. *Sociedad de Estadistica e Investigacion Operativa Top* 10(1):83-99.
- [5] Owen, G., 1995. 'Game Theory', Academic Press, Third edition, pp.447.
- [6] Stra±n, P. D., and J. P. Heaney, 1981. 'Game Theory and the Tennessee Valley Authority', *International Journal of Game Theory*, 10(1):35-43.
- [7] Suijs, J. and P. Borm, 1996. 'Cooperative games with stochastic payoffs: deterministic equivalents', *Tilburg University, Faculty of Economics and Business Administration Research Memoranda*, n.713.
- [8] Suzuki, M. and M. Nakayama, 1976. 'The Cost Assignment of Cooperative Water Resource Development -A Game Theoretic Approach', *Management Science*, 22:1081-1086.