

BIODIVERSITY THROUGH CO-OPETITION

J. LÓPEZ-GÓMEZ

Department of Applied Mathematics
Complutense University of Madrid, 28040-Madrid, Spain

M. MOLINA-MEYER

Department of Applied Mathematics
Carlos III University, 28911-Leganés, Madrid, Spain

ABSTRACT. Ecology, Economy and Management Science require a huge interdisciplinary effort to ascertain the hidden mechanisms driving the evolution of communities and firm networks. This article shows that strategic alliances in competitive environments might provoke an explosive increment of productivity and stability through a feedback mechanism promoted by cooperation, while competition causes segregation within cooperative profiles. Some further speciation and radiation mechanisms enhancing innovation, facilitated by environmental heterogeneities, or specific market regulations, might explain the biodiversity of life and the high complexity of industrial and financial markets. Extinctions are likely to occur by the lack of adaptation of the strongest competitors to sudden environmental stress.

1. Introduction. This article studies how the combined effects of cooperative and competitive interactions in spatially heterogeneous environments promote persistence and a substantial increment of productivity, diversity and stability in Population Dynamics and Economy [9, 5, 31, 61, 28, 58, 14]. Such analysis is imperative to maintaining existing communities and designing optimal production strategies in Management. To study these effects we use an ideal universal model that combines hybrid interactions with spatial dispersion, based on the competition paradigm model introduced by Lotka [45] and Volterra [60]. Consequently, in particular applications one should refine it in order to set up more realistic models. Very simple prototype models of this type were actually employed by Black & Scholes [8] and Merton [48] to evaluate stock options; in such models, dispersion and distribution rates should be inter-exchanged by volatility rates. The most striking prediction from our mathematical analysis is that partial alliances, even at a very localized level, can provoke a huge added value (overyielding) after the appropriate time span if the strength of the alliance is sufficiently high. As the benefits of strategic inter-firm alliances are difficult to evaluate and the periods of time necessary for revealing the real impact of facilitation in ecosystems might be extraordinarily large, as suggested by the time span necessary to recover diversity in tropical ecosystems

2000 *Mathematics Subject Classification.* Primary: 35K50, 91D25; Secondary: 91B62, 92D25.

Key words and phrases. Competition, cooperation, inter-firm alliances, segregation, biodiversity, financial complexity.

Partially Supported by the Spanish Ministry of Education and Science under Grants REN2003-00707 and CGL2006-00524/BOS of the National Plans of Natural Resources and Global Change and Biodiversity.