HERVE MOULIN

Cooperative Microeconomics

A Game-Theoretic Introduction

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This book is dedicated to Victor

Contents

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Overview of the Book

IN THE PAST fifty years, our understanding of the logic of cooperative processes has been revolutionized by the formal tools of microeconomics, in particular the (neo-classical) competitive analysis and the theory of games.

This book gives a partial account of these developments organized in a systematic conceptual framework. I submit that cooperation between selfish economic agents can be conceived in three fundamental "modes," namely, direct agreement, justice, and decentralized behavior. I argue that actual cooperative institutions must accommodate all three modes and postulate that an ideal institution is one where all three modes "converge" on the same outcome.

The first mode of cooperation is by *direct agreements* of the concerned agents. This mode is free of any institutional context, as agents engage voluntarily and freely in face-to-face transactions. Under the efficiency postulate, the formal concept of the core describes the self-enforcing agreements. A configuration where the core is empty (a not infrequent pattern) is one where cooperation by direct agreements is not workable. Another drawback of the direct agreement mode is the transaction cost: when many agents are involved and/or when many decisions must be made over a long period of time, transaction costs may become so high as to wipe out the benefits from cooperation.

Each one of the two other fundamental modes of cooperation is a solution of this difficulty. In the *justice* mode, the community of agents produces a mechanical formula to divide equitably the cooperative surplus among the concerned agents. The justification of the formula is given by a set of ethically meaningful axiomatic properties. Some difficult choices are called for when several desirable axioms turn out to be logically incompatible. The just outcome is enforced by the indivisible collective authority (akin to Rousseau's general will). The justice mode is hard to implement when some of the information necessary to compute the equitable outcome is privately held by the individual participants: they may strategically misrepresent this information, and the eventual outcome will not be just.

In the *decentralized* mode, the community chooses to distribute fully the decision power among individual participants. Cooperation then takes place in a game of strategy, and the role of the collective authority is merely to enforce the rules of the game. The actual cooperative

outcome results from the (noncooperative) equilibrium of selfish interests. The decentralized mode may lead to an inefficient strategic equilibrium (as in the Prisoner's Dilemma) or to the absence of any equilibrium.

The design of a cooperative mechanism tries to combine the virtues of all three modes. An ideal mechanism is one such that i) its noncooperative equilibrium should be unique and compelling, ii) the resulting outcome should be just, and iii) this outcome is also stable in the direct agreement mode. Examples of such convergence of the three modes of cooperation are rare; indeed, a recurrent theme of this book is that the existence of an "ideal" mechanism is often a logical impossibility.

Chapter 1 presents the thesis of this book in nontechnical language.

Chapters 2 and 3 look at the exchange and production of commodities in the private property regime. The core (direct agreement mode) and the competitive equilibrium (decentralized mode) are discussed; the celebrated Edgeworth proposition establishing the conditions under which both concepts pick the same outcomes (hence two modes of cooperation converge) is discussed in some detail.

Chapters 4, 5, and 6 look at the distribution and production of (private or public) commodities in the common property regime (when all agents have equal claims on the resources). Chapter 4 discusses the interpretation of fairness as no envy (justice mode), and its relation to competitive equilibrium analysis. Chapter 5 considers the alternative interpretation of fairness as the stand alone test, and its relation to core analysis. Chapter 6 examines decentralized mechanisms for the production of private or public goods, and their relation to the above fairness properties.

Chapter 7 is a concise exposition of cooperative game theory (in the transferable utility context), focusing on core existence results (direct agreement mode) and the Shapley value (justice mode).

The book is elementary and self-contained. No attempt is made at giving complete proofs of the relevant theorems under the weakest assumptions. Instead, the intuition of the general results is developed in the simplest possible numerical examples. Numerous exercises allow the reader to appreciate the capabilities and the limits of the modeling tools.

The book lies at the crossroads of several research fields actively plowed by the literature of the last four decades. Those are competitive equilibrium analysis, cooperative game theory, collective decision (in particular, axiomatic) and fair division, mechanism design, and the implementation problem. Although all of these tightly related topics are discussed at some length, none of them is properly surveyed.

All bibliographical references are gathered at the end of the book, along with a brief list of books of general interest to our topic.