The postulation that individually rational, self-maximizing behaviors bring about
group (Pareto) optimality constitutes one of the most appealing characteristics of
the perfectly competitive market. The market is often regarded as an effective means
to allocate economic resources efficiently. However, in the presence of an imperfect
market structure, externalities, imperfect information, and public goods, the mar-
ket fails to provide an effective mechanism for efficient resource use. Not only
have inefficient outcomes appeared, but gravely detrimental events—such as the
global financial crisis and catastrophe-bound industrial pollution problem—have
also emerged under the current market system. With market failures prevailing, op-
timization in economic activities is one of the remedies available.

Strategic behaviors in the market are increasingly pervasive, and as a result, game
theory has emerged as one of the fundamental tools in pure and applied research in
economics. Because economic activities in the modern corporate world are dynamic
processes, economic decisions are more appropriately analyzed in an intertempo-
ral framework. Dynamic cooperation suggests the possibility of socially optimal
and group efficient solutions to economic decision problems involving strategic ac-
tion.

In dynamic cooperation, a stringent condition is required for a scheme to be
dynamically stable. In particular, the optimality principle must remain optimal
throughout the game, that is, at any instant of time along the optimal state tra-
jectory determined at the outset. This condition is known as time consistency. In
the presence of stochastic elements, a more stringent condition—that of subgame
consistency—is required for a credible cooperative solution. In particular, a coop-
erative solution is subgame consistent if an extension of the solution policy to a
situation with a later starting time, and any realizable state brought about by prior
optimal behavior, would remain optimal. The notion of subgame consistency orig-
inated in Yeung and Petrosyan (2004), which develops a generalized theorem for
the derivation of an analytically tractable “payoff distribution procedure” leading
to subgame consistent solutions. Time consistency for the economic optimization
problem requires dynamical consistency for all subgames along the group optimal
trajectory; then time consistency in this context reflects optimal-trajectory-subgame
consistency.
This book provides a treatise on subgame consistent economic optimization. In particular, dynamically stable game-theoretic optimization techniques are developed to establish the foundation for an effective policy menu to tackle suboptimal problems that the conventional market mechanism fails to resolve. The book is expected to be used as an analytical tool for advanced graduate students, game theorists, economists, mathematicians, and researchers in this field.

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Finally, we would like to dedicate this text to honor the memory of a pioneering researcher and Nobel Laureate in the field of economic optimization—our late Saint Petersburg colleague Leonid Vitalyevich Kantorovich—in his 100th birthday tribute.

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