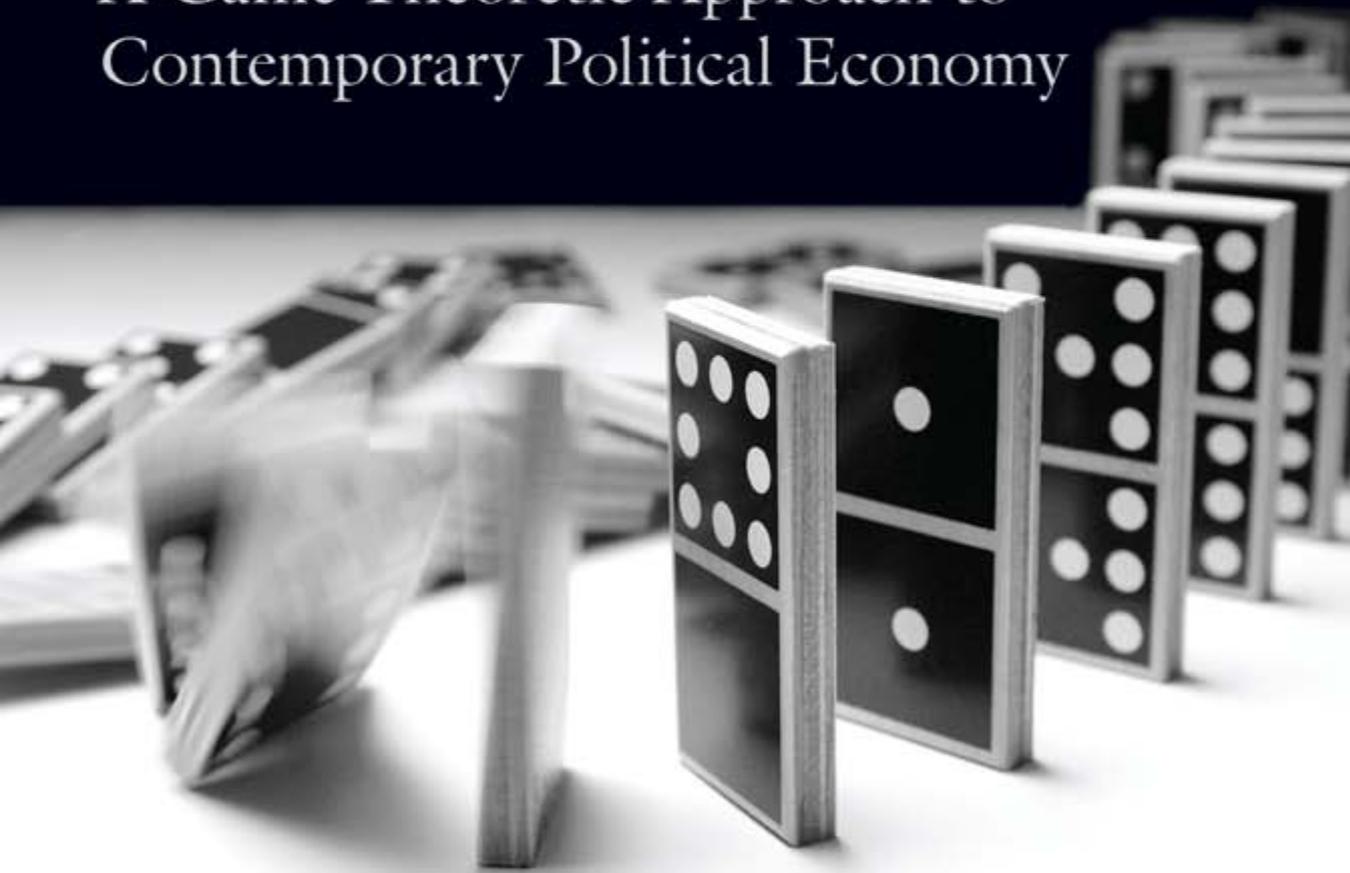


# COLLECTIVE ACTION & EXCHANGE

A Game-Theoretic Approach to  
Contemporary Political Economy



William D. Ferguson

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COLLECTIVE ACTION AND EXCHANGE



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AND EXCHANGE**

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**WILLIAM D. FERGUSON**

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*Dedicated to the memory of Elinor (Lin) Ostrom, political  
scientist, and my father Allen R. Ferguson, economist.*



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What is missing from the policy analyst's tool kit—and from the set of accepted, well-developed theories of human organization—is an adequately specified theory of collective action whereby a group of principals can organize themselves voluntarily to retain the residuals of their own efforts.

Elinor Ostrom



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In 1995, while on sabbatical from Grinnell College, I attended Herbert Gintis' graduate course in game theory at the University of Massachusetts. Herb's enthusiasm for the power of game theory and its relationship to political economy has inspired me since. On returning to Grinnell, I started a faculty political economy reading group. Discussions with colleagues David Ellison, Wade Jacoby, Jack Mutti, Monty Roper, Pablo Silva, and Eliza Willis informed my perspective on political economy. In 1998, Wade Jacoby and I participated in a faculty–faculty tutorial on institutional political economy. Wade introduced me to the work of Elinor Ostrom. I began teaching my seminar in political economy at Grinnell College in the fall of 2001, and in the spring of 2005 I started teaching applied game theory as an upper-level economics class. This book draws upon both classes, and I thank my former students for their inquisitive enthusiasm. In June 2007, I wrote a memo to my economics department colleagues on incorporating new developments in economic theory into the undergraduate economics curriculum. Janet Seiz encouraged me to submit this memo as a paper. After revision and helpful encouragement from Lee Hansen and David Colander, “Curriculum for the Twenty-First Century: Recent Advances in Economic Theory and Undergraduate Economics” appeared in the *Journal of Economic Education*. While discussing a draft of this paper, my colleague Mark Montgomery suggested that I write a book. Fortunately, by that time, I had already met my future editor Margo Beth Fleming.

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COLLECTIVE ACTION AND EXCHANGE



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# I PRELIMINARIES



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## INTRODUCTION: A FARMER'S MARKET

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The Dane County Farmers' Market meets on Saturday mornings at Capitol Square in Madison, Wisconsin. Like many such markets, it is a place where small farmers can sell fresh produce to local customers. Local residents and visitors wander among clean, well-ordered stalls with displays of high-quality local produce and clearly marked prices. Farmers compete on the basis of price and readily observable quality. Exchanges are friendly, and most customers leave satisfied. The setting appears to fit an economist's conception of the benefits of unregulated free-market competition among many buyers and sellers (Basu 2000, 193–96).

Looking somewhat deeper, however, economist Kaushik Basu discovered a rule book. This book details how participating farmer-vendors must behave and stipulates the penalties for specific violations. In addition to rules that regulate fairly obvious concerns, such as how to set up and clean stalls, vendors must file an "Application For Permission to Sell." Basu (2000, 194) quotes from the rule book as follows:

Raw fruits and vegetables must be grown from cuttings grown by the vendor or from seeds and transplants. . . . Purchased plant materials must be grown on the vendor's premises for at least 60 days before they can be offered for sale at the market. . . . Eggs must be produced by hens which have been raised by the vendor for 75 percent of their production weight. . . . Sellers must not bring pets into the Market for health and safety reasons. The sale or giving away of animals on the Capitol grounds is prohibited. . . . Vendors must discourage sales to people in vehicles or lengthy double parking by customers. . . . Vendors selling wild-gathered items must have an application to sell filed with the market prior to arrival at the market and either have proof of land ownership or show written permission from the landowner to gather the product. . . . Vendors must have photocopies of all necessary licenses.

The rule book has 18 pages. Why are there so many detailed regulations for what appears to be a free market? What would happen if vendors failed to discourage double-parking or sold animals? What if vendors sold eggs from chickens they had not raised for 75% of production weight, or sold produce they had not grown on their premises for at least 60 days? What if they resold produce purchased from a supermarket or warehouse at a markup?

What if they failed to clean their stalls? Indeed, what would happen if there were no process for applying for permits to sell, no rules indicating who qualifies, or no way to enforce the rules? What if anyone could sell anything they wanted? How would stalls be allocated? Would disputes arise? Would consumers want to go to the market? Would producers of quality locally grown produce want to sell there?

This example of market governance illustrates why economics is really political economy. It raises the question as to whether there really is such a thing as a free market. It also raises the question of whether rules like these are coercive or voluntary. These rules are coercive in the sense that individuals who might profit by violating them (for instance, by reselling produce purchased at a warehouse) can be punished. Yet they also reflect largely voluntary efforts by vendors at self-organization: the vendors themselves made the rules and set up an enforcement mechanism. The boundary between voluntary action and coercion appears imprecise. The rule book, then, indicates that such governance is part of the political economy of the Dane County Farmers' Market.<sup>1</sup> More generally, governance and markets are not separable.

This interaction between rules and trade illustrates the thesis of this book: successful market exchange, and, more fundamentally, successful economic development, both require some resolution of underlying *collective-action problems*—that is, problems that arise when the individual pursuit of self-interest generates socially undesirable outcomes. It is easy to imagine that a vendor might profit from purchasing produce at a warehouse or supermarket and then reselling it at the Dane County Market at a markup. After all, such purchase and resale could be easier and cheaper than growing and marketing one's own produce. Indeed, violation of any of these rules—selling animals, chatting with double-parkers—could be in somebody's self-interest. Although it is not obvious that each rule is necessary or even well formulated (some may be silly, and some may reflect the interests of the committee that drafted them), absent some set of mutually understood and accepted rules for determining who is allowed to sell what kind of produce, the market would probably not function at all.

The farmers' elaborate set of trading rules thus exemplifies an apparently successful effort by a community to resolve a set of collective-action problems that would arise if potential market participants were to behave in any fashion that suited their individual interests—such as reselling produce from grocery stores. These rules also illustrate an exercise of self-governance that operates within a larger institutional context—the city of Madison, the state of Wisconsin, and so forth. According to the classical philosopher David Hume, some form of government emerges when some group would suffer in its absence (1739/1978, Bk. III, Sec. VII). Exchange, collective action, and governance are thus intricately linked. This book explores their connections.

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# 1 COLLECTIVE-ACTION PROBLEMS AND INNOVATIVE THEORY

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## 1.1. COLLECTIVE-ACTION PROBLEMS, POLITICAL ECONOMY, AND EXCHANGE

*Collective-action problems* (CAPs) arise from any deviation between unfettered pursuit of individual goals (typically, self-interest) and the perceived well-being of at least a portion of some group—be it a nation, region, community, firm, or sports club. Because CAPs represent the archetypal dilemma of strategic interaction among purposeful agents, and because exchange underlies economic and social development, the relationships between collective action and exchange serve as the unifying principle of this book. Collective-action problems reveal the logic behind multiple market failures, notably those associated with public goods, externalities, common-pool resources, and problems of coordination and enforcement. Furthermore, market success depends on resolving CAPs, especially those related to coordination and enforcement. Thus CAPs and the potential for their resolution lie at the foundations of political economy.

There are two basic types of collective-action problems: first- and second-order CAPs. *First-order* CAPs signify free-rider problems that are associated with providing public goods, reducing the production of negative externalities, increasing the production of positive externalities, and limiting the use of common-pool resources to sustainable levels. We define all of these terms broadly. For example, an institution is a public good, as is establishing a sense of trust that facilitates exchange within a community. *Second-order* CAPs are problems of orchestrating the coordination and/or enforcement needed to render agreements for resolving first-order CAPs credible. Indeed, coordination and enforcement are themselves types of public goods—namely, public goods that lend credibility to agreements.

Collective-action problems matter for political economy not only because they represent key linkages between politics and market exchange, but also because they indicate the core rationale for economic and social policy. Most policies seek to resolve or ameliorate CAPs (with varying degrees of success or failure). More fundamentally, the existence of first-order CAPs signifies market or group failure, and successful exchange requires some prior resolution of second-order CAPs. In fact, resolution of second-order CAPs precedes

reliable definition and enforcement of the property rights that underlie market exchange. Furthermore, such resolution facilitates the formation of institutional environments, as well as the associated mutual understandings and trust that allow multiple forms of economic, political, and social exchange to occur at all. Resolution of collective-action problems thus underlies all substantive economic, political, and social development.

## 1.2. ANALYTICAL APPROACHES TO COLLECTIVE ACTION AND EXCHANGE

Much of the motivation for this book arises from relatively recent developments in game theory, economics, and policy theory. These developments both expand and refocus political-economic inquiry. They permit the formalization and modeling of principles that previously had been too complex or considered too indeterminate—and were thus relegated to the sidelines of analysis until recently. Our summary of these developments serves three purposes: it offers intellectual context, points to general methodology, and outlines important concepts that will appear in the remainder of this text.

Our discussion now proceeds to thumbnail sketches of eight critical realms of newly emerging theory: game theory, social network analysis, information economics, social preference theory, rationality theory, institutional and governance theory, policy theory, and spatial-location theory.<sup>1</sup> This section concludes by merging these ideas into a unified conception of game-theoretic political economy that summarizes the book's core assertions.

### Game Theory

If CAPs represent the archetypal strategic dilemma for political economy, then game theory offers its methodological bedrock. Formally, game theory facilitates modeling strategic interaction among two or more agents. *Strategic interaction* occurs whenever agents share *strategic interdependence*—meaning that their actions affect outcomes for others and that agents typically understand such interdependence.<sup>2</sup> In an oligopoly, for instance, one firm's production can affect the quantities produced and prices set by other firms. Similarly, a decision by a contractor to hide mistakes can affect its client's profits. In political campaigns, one candidate's decision to advertise can alter prospects for opponents. Likewise, a decision by one student to invite another to a high-school prom may affect the happiness of would-be partners. These types of strategic interaction permeate this book's game-theoretic discussion of collective action and exchange.

By contrast, the constrained-maximization approach of traditional economics and rational choice theory often fails to address strategic interaction. Herein lies a core distinction between recent political-economy approaches to exchange and more conventional approaches based on pure competition and similar models. In pure competition, an agent's decisions focus only on self and environment. Firms and consumers individually choose their quantities produced or purchased—and respond to such external variables as market prices—without reference to actions of other participants. Others' actions merely become indistinguishable elements of an environment (a field) that constrains individual activity

and affects outcomes. Although the sum of others' actions can (as part of the field) influence prices, no individual consumer or firm can have such impact. Given this lack of influence, agents can safely disregard others' strategies in their decision calculus.

Strategic interaction is more complicated and intricate than constrained maximization because other parties matter. For example, an oligopolistic firm considers the expected behavior of its (few) competitors before deciding on price or output—while understanding that its competitors share a similar strategic perspective. Such strategic interaction constitutes a *game*, not just an individual decision. Indeed, the constrained-maximization perspective of the traditional approach applies only to exceptional cases. Furthermore, even in competitive markets, game theory can represent transactions that involve any type of commitment, such as a contract, or any private information—such as knowing far more about one's qualities, motivation, or behavior than others do (Dixit, Skeath, and Reiley 2009, 19). Conditions of this sort are ubiquitous in complex economies. Even though market competition can undermine many possible strategies and force players to reveal information, economic choices remain profoundly strategic because outcomes depend on numerous interactions among participants.

This text draws upon four broad types of game theory: classical, evolutionary, behavioral, and epistemic. In classical game theory, agents share some level of mutual awareness of their interdependence. Chosen actions reflect best-response *strategies*—that is, action plans that specify responses to every conceivable contingency—most notably, envisioned combinations of others' actions. Game *outcomes* reflect the conditions (or states of the world) that follow from a game's enacted combinations of strategies. Examples of game outcomes include the price of an item, the distribution of resources, and the election of a candidate. Each possible outcome generates payoffs to each involved player, where *payoffs* capture the net utility gain (or subjective valuation) from that outcome. Utility returns may be either material (as in money) or social (as in status). Classical game theory thus mimics traditional economic reasoning by utilizing best-response maximization; yet it embeds such responses in strategic domains. Applications of these principles, moreover, extend beyond economics to any strategic interaction.

Evolutionary game theory offers an alternative perspective—one in which strategies consist of programmed or inherited “phenotypes.”<sup>3</sup> In social scientific applications, inheritance reflects prior education and other forms of cultural (rather than genetic) transmission. Individuals—and, by extension, populations—inherit behavioral orientations, strategies, or established practices in various combinations.<sup>4</sup> Thus some individuals are naturally aggressive and others are shy; some speak Chinese, others English. As in classical game theory, specific combinations of strategies operating within particular contexts generate outcomes with payoffs, but evolutionary payoffs do not indicate players' utility, but instead show the fitness or reproductive viability of their employed strategies. Strategies that earn high fitness payoffs reproduce or transmit abundantly; low-payoff strategies (failed practices) fade away over time. Evolutionary game theory thus facilitates modeling of learning processes and other forms of selective social adaptation.<sup>5</sup>

Behavioral game theory uses experimentation in contexts guided by game-theoretic precepts (e.g., prisoners' dilemma scenarios) to explore relationships between context,

perceptions, and agents' actual behavior. Experimental findings may then be incorporated into the other three types of game-theoretic modeling—for example, by informing representations of payoffs. Finally, epistemic game theory focuses on the cognitive dimensions of strategic interactions. Using classical reasoning with emphasis on the extent and limits of agents' prior knowledge and expectations, it illustrates how certain shared understandings can guide or correlate strategic decisions among multiple players. Epistemic game theory is especially useful for modeling the impact of institutions on strategic behavior.<sup>6</sup>

In short, game theory offers an extraordinarily flexible and widely applicable set of modeling techniques. Its use informs not only political science and economics but also biology, psychology, sociology, anthropology, business strategizing, and policymaking. In political economy, game theory enables us to model multiple intricate micro-level transactions within small groups, as well as macro-level patterns among nations or across populations. We may then specify the microfoundations of exchange as strategic social interactions that arise within or among groups of purposeful agents, rather than as a mere summation of independent acts of maximization. In so doing, game theory fosters a truly social scientific modeling framework for political economy. Agents' choices and even their preferences may depend on and respond to anticipated activity or reactions from other parties—all conditioned by social and institutional contexts. Even though game theory can incorporate such social influences, it also posits individuals (or unified organizations, such as firms) as critical decision-making or response units as it models goal-oriented and adaptive behavior. Game theory thus retains the core efficient rigor of economic or rational-choice logic—but vastly enhances its domain and profoundly alters its implications.<sup>7</sup> Modeling multiple facets of political economy becomes feasible.

Game-theoretic modeling permeates this book. As we shall see, the simple two-player prisoners' dilemma illustrates the core idea of a collective-action problem, and the analysis builds from there. Our approach to game theory mixes intuitive logic with relatively accessible mathematics. We use models to illustrate specific assertions or perspectives on political-economic interactions at multiple levels of analysis. Because it is never possible to model everything at once, the choice of modeling technique (e.g., the relevant type of game) will depend upon our analytical purpose and its accompanying questions. Much of the discussion in this text thus complements game-theoretic modeling with descriptions of problems, discussion of context, examples, intuitive arguments, relevant principles, and more general theory.

### Social Network Analysis

Social network analysis offers a related modeling approach that focuses on connections among multiple agents. *Social networks* are configurations of relationships or communication pathways that, somehow, connect people. Virtually all economic, political, and social exchanges operate within social networks. Organizations are networks. A CEO, for instance, occupies a specific position within a complex corporate network. Political parties are networks, as are social clubs. Markets rely on, arise from, and sometimes embody networks of exchange among various buyers and sellers. Families and communities are networks. Net-

work analysis encompasses all such entities. It allows specification and examination of the pathways that transmit information, ideas, influence, goods, services, and the like among specific groupings or vast populations of agents. Network analysis facilitates analyzing the origins and development of such pathways, the associated patterns of transmission among agents, possible micro- or macro-level impacts of such transmissions, and how the positioning of agents within networks affects the content or influence of their transmissions. Social network analysis thus provides another method for investigating how social context shapes the evolution, operation, and impact of social, political, and economic exchange.<sup>8</sup>

### Information Economics

Information economics explicitly addresses implications of costly, incomplete, and asymmetric information on economic behavior. According to Joseph Stiglitz (2002), information economics alters the prevailing paradigm for economic theory. Not only does asymmetric information introduce a new set of strategic variables, it implies that contracts and other forms of agreement may not be fully enforceable. Second-order CAPs follow. The ensuing enforcement problems, in turn, indicate that labor and capital markets routinely fail to clear. Furthermore, such markets face unavoidable (though often manageable) efficiency losses—as well as exercises of power within exchange relationships. A political dimension of exchange thus emerges.

The game-theoretic distinction between imperfect and incomplete information speaks to the importance of information economics. *Imperfect information* connotes an equally distributed lack of knowledge regarding states of the environment or an equally shared inability to observe the actions of others. Such imperfect information underlies traditional risk analysis. Although agents may not know the exact values of certain variables, they do know the underlying probability distributions and can therefore maximize on the basis of expected values. *Incomplete information* poses more difficult problems. It connotes any information asymmetry among participants concerning conditions in their environment or any lack of knowledge among them concerning the characteristics, motivations (payoffs), or strategies available to other participants in their strategic interactions.

Information economics stresses that asymmetry permits strategic manipulation of information.<sup>9</sup> In this regard, the concept of *adverse selection* (Akerlof 1970) reflects the intuitive notion that, prior to signing a contract or conducting exchange, sellers usually know more about the quality of exchangeable goods or services than do buyers. Such asymmetry can lead to no exchange (a complete market failure) if buyers lack confidence in quality, sellers lack confidence in marketability, or both. Inefficient exchanges of lower-than-expected quality are also possible. More fundamentally, adverse selection implies imperfect definition or understanding of the de facto property rights to be exchanged because rights related to quality are unclear.

Similarly, principal-agent models indicate problems of post-contractual asymmetric information (moral hazard problems).<sup>10</sup> In these models, a *principal* contracts with an *agent* to perform certain services. Because providing service is costly to the agent, their interests differ. Additionally, the principal cannot fully observe or verify the agent's actions. The

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