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Curriculum for the Twenty-First Century: Recent Advances in Economic Theory and Undergraduate Economics

William D. Ferguson[a]
[a] Grinnell College,

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CONTENT ARTICLES IN ECONOMICS

Curriculum for the Twenty-First Century: Recent Advances in Economic Theory and Undergraduate Economics

William D. Ferguson

Undergraduate economics lags behind cutting-edge economic theory. The author briefly reviews six related advances that profoundly extend and deepen economic analysis: game-theoretic modeling, collective-action problems, information economics and contracting, social preference theory, conceptualizing rationality, and institutional theory. He offers suggestions for incorporating these into the undergraduate classes at various levels. He argues that game-theoretic representation of collective-action problems offers a unifying framework, on par with supply and demand, for political economy. Blending in the other developments deepens our micro-level understanding of internal and external contract enforcement, with implications on nonclearing markets, power, and distribution. At the macro level, these concepts illuminate the role of institutions in economic development and long-term growth. Undergraduate curricula should incorporate these new approaches.

Keywords *contemporary economic theory, undergraduate curriculum*

JEL codes *A10, A22, B52*

Over the past 25 years, cutting-edge developments in economic theory have transformed its foundational logic, yet the undergraduate (UG) curriculum lags behind. UG economics, although deeply analytical and extremely informative, focuses too much on atomized individual motivation with costless, symmetric information, yielding transparent transactions with few if any enforcement problems. It relies too frequently on informed individual maximization decisions as a foundation for economic exchange, with insufficient attention to social and strategic interaction among players, asymmetric information, problems of collective action, including enforcement, distributional strife, power, and the roles of social norms and formal institutions. Analytical consideration of these areas deepens and extends the domain of economic reasoning as it generates new and sometimes surprising implications. We should teach accordingly.

William D. Ferguson is a professor of economics at Grinnell College (ferguso1@grinnell.edu).

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I offer a thumbnail sketch of six innovative realms in contemporary economic theory: game theory and related modeling, collective-action problems (CAPs), information economics and contracting, social preference theory, rationality theory, and institutional theory—arguing that all deserve far greater prominence in the UG curriculum.[1] Discussion addresses each of these realms in order. Game theory offers a unifying modeling foundation for remaining arguments, and CAPs represent a unifying point of departure; CAPs lie at the foundation of political economy because they shed light on both market success and failure. The remaining realms imply multiple dimensions of CAPs and suggest mechanisms that may facilitate or impede their resolution. Discussion moves through these remaining developments, relating them to CAPs, with suggestions on teaching at various levels. Integrating these concepts fosters a comprehensive, flexible game-theoretic approach to political economy. The argument closes with final curricular suggestions and a call to update the undergraduate curriculum accordingly.

GAME THEORY AS THE MICRO FOUNDATION FOR POLITICAL ECONOMY

Game theory facilitates formal representation of strategic interaction among small or large groups of agents. Applied to economics, it moves conceptual micro foundations away from constrained individual maximization, toward strategic social interaction among groups of purposeful agents. It thereby transforms economics into a true social science where individual decisions and even preferences can be contingent on anticipated activity (reactions) or preferences of other parties and, moreover, arise from and respond to social or institutional contexts. Yet game theory retains individuals or unified organizations (e.g., firms) as critical decision-making units and facilitates modeling of goal-oriented (substantively rational) or adaptive (procedurally rational) behavior. Game theory, therefore, retains the core parsimonious rigor of economic logic but vastly enhances its domain and profoundly alters its implications.[2]

Traditionally, the economics curriculum primarily relegated game theory to oligopoly, where strategic interaction is obvious. Game theory now has a more prominent role, appearing in intermediate micro textbooks, and many introductory textbooks (e.g., Baumol and Blinder 2009, 250–56; Colander 2008, chap. 14; Hall and Lieberman 2008, 304–13; Hubbard and O'Brien 2009, chap. 13; Krugman and Wells 2009, 396–401; Mankiw 2009, 369–78; Stiglitz and Walsh 2006, chap. 14) as well as management textbooks, among others. There are courses devoted to game theory. Yet its significance as a unifying modeling methodology, which can subsume traditional modeling as a special case, has yet to be seriously addressed.

As Dixit and Skeath (2004, 19) pointed out, even in competitive markets, game theory can represent economic interactions that incorporate any dimension of commitment (e.g., contracts) or private information—conditions that are virtually ubiquitous in complex economies. Although market competition can undermine many possible strategies and force players to reveal information, economic decision-making remains profoundly strategic because agents cannot take decisions of others for granted. Ultimately, game theory offers microfoundations for multiple relationships of competition and cooperation, or lack thereof, facing resource and institutional constraints and generating various outcomes that are intended or not: political economy.

Game theory, classical or evolutionary, fosters modeling all of the remaining concepts. Indeed, game theory has contributed significantly to their emergence as serious areas of economic inquiry.

Ultimately game theory can illustrate foundations of both market success and market failure. The UG curriculum therefore should strive to present game theory as a unifying foundation for economic analysis, beginning at the introductory level.

CAPS

For the purposes of political economy, CAPs represent the archetypal dilemma of strategic interaction among purposeful agents: CAPs connote a divergence between unfettered pursuit of self-interest and socially desirable outcomes for some group (nation, region, community, firm, etc.). CAPs reside at the foundations of political economy; they present a common denominator for multiple market failures—public goods, externalities, common resources, as well as enforcement or commitment problems associated with information asymmetries. In so doing, they illuminate critical requisites for market success, for example, definition and enforcement of relevant property rights and establishing sufficient trust. Furthermore, CAPs motivate the core rationale for policy: policies should resolve or ameliorate CAPs, although their effects vary enormously. Absent CAPs, moreover, there would be no substantive role for institutions in exchange. Accordingly, CAPs belong at the center of the UG curriculum—on par with supply and demand models. Juxtaposition of the two offers multiple opportunities for analytical skill development.

The historical literature offers insight. Hume (1978 [1740]) and Adam Smith (1976 [1776]) were optimists: group interaction resolves CAPs via reciprocity and convention for Hume and self-interested exchange for Smith; juxtaposition of the two is instructive (Smith 1976 [1776], 10–36; Hume 1978 [1740], 484–549). By contrast, for Hardin (1968), the "tragedy" of common resource depletion occurs unless external enforcement intervenes. Olson (1971) allowed some room for optimism: individuals contribute to public goals only if their marginal benefit exceeds their marginal cost, but small groups can orchestrate contribution via selective *social* incentives; large groups may sometimes do so via federations. Ostrom (1990, 2000) offered middle ground: with appropriate conditions, groups can self-organize to resolve common-resource CAPs; identifying relevant conditions constitutes an important domain of policy analysis. Fehr and Schmidt (1999) related cooperation to fairness.

Although CAPs underlie issues covered in traditional UG curricula, for example, public-good provision, they rarely appear explicitly as an analytical concept—a critical unifying framework remains unexplored. Important market failures associated with CAPs include the following:

1. public-good provision;
2. externalities;
3. common resource depletion;
4. collusion in oligopoly; and
5. problems of enforcement.

Problems 1–4, *first-order* CAPs, exhibit variations on free riding. They appear in UG classes, but too often without the informative CAP label. Problem 5, a *second-order* CAP—often required for resolution of first-order CAPs—is less commonly identified as a market failure, despite its profound implications on market performance.

Simple two-person prisoners' dilemma (PD) games offer an intuitive modeling framework that can represent all of these CAPs and indicate important structural elements. Consider the following game (table 1) where players may either cooperate (Co) or defect (Df):

TABLE 1
General Prisoner's Dilemma Game

	Player B	
Player A	Cooperate	Defect
Cooperate	*C, C*	*L, H*
Defect	*H, L*	*D, D*

Notes: C = cooperative payoff; D = Defect payoff; H = high payoff; L = low payoff. Whenever $H > C > D > L$, there is a symmetric PD game.

Concerning problem 1, public-good provision, we may define Co as *contribute* and Df as *do not*. In principles classes, one might assign numerical values for a story like the following: Two neighbors may contribute to planting a garden between them. If produced, the garden is worth 9 to all; total cost of production = 10. If both play Co, each receives $9 - 5 = 4$. If both play Df, both receive 0. If one chooses Co and the other chooses Df, the first receives $9 - 10 = -1$; the second gets 9.[3] Instructors might explain or ask students to generate the matrix, dominant strategies, the Nash equilibrium, the social optimum, and then discuss free-rider problems and the marginal costs/benefits of strategies Co and Df.

It is straightforward now to modify the story to represent problems 2–4. For each, the instructor can develop numerical examples with relevant profit equations that specify payoffs for each player in each cell or use variable payoffs to illustrate general principles. I recommend stressing that these problems often share the PD structure of the public-good game.

2. Externalities:
   a. For negative: Co = control pollution (at a cost); Df = do not. Players are firms (communities, regions, nations).
   b. For positive: Co = produce socially beneficial quantity of research and development; Df = produce profit-maximizing quantity.
3. Common Resources: Two fishing companies, Janet's and Ned's use the same lake. Co = limit use (catch 50 fish); Df = do not (catch 100). The firm that limits use faces a competitive disadvantage in the market.
4. Oligopoly (duopoly): Co = limit output to monopoly level; Df = produce Cournot output.

Many principles textbooks use a PD model for oligopoly. Notably, Hubbard and O'Brien (2009, chap. 13) related strategic behavior to entry deterrence, bargaining, and the role of competition, with useful examples including the OPEC cartel. Yet, even that book does not use PD models for problems 1, 2, 3, and 5. I advocate this more comprehensive approach with emphasis on comparing and contrasting issues such as when society at large may suffer or benefit.

Turning to problem 5, enforcement mechanisms can in principle resolve any of these CAPs. If we assume perfect exogenous enforcement, via punishment for Df or reward for Co, we generate table 2. Many variations arise: punishment (p) could apply when there is only one defector or with two; amount p may differ by player, and so on. Instructors may generate conditions for relative values of reward (r) or p that retain a PD game, produce a cooperative equilibrium, or yield other games (chicken, assurance). One can complicate the model slightly by adding parameters for imperfect observation, perhaps reflecting incomplete knowledge of government enforcers. For

TABLE 2
Prisoner's Dilemma with Rewards and Punishments

	Player B	
Player A	Cooperate	Defect
Cooperate	$C + r, C + r$	$L + r, H - p$
Defect	$H - p, L + r$	$D - p, D - p$

Notes: $r \geq 0$ is a reward (r) for choices of Cooperate (C). $p \geq 0$ is a punishment (p) for choices of Defect (D).

example, the $H - p$ payoffs could become $H - \lambda p$, where $\lambda < 1$ is the probability of observing Df.

Moving further, one can drop the assumption of automatic enforcement and instead treat enforcement as a second-order CAP (case 5). Understanding that a potential enforcer may face costs of administering punishment, a potential free rider may go ahead and defect. For example, in the first stage of a two-stage game, firms A and B play the game in table 1 associated with controlling pollution. In stage 2, local governments E and F play a similar game concerning administering punishment (fines). If executing punishment (Co) costs governments (firms may relocate), E and F face a PD game. Anticipating a (Df, Df) outcome in stage 2, firms A and B both defect (no scrubbers are installed).[4]

Altering cost/benefit relationships associated with strategies Co and Df generates alternative game structures including battle of the sexes (Dixit and Skeath 2004), assurance, and chicken. An exercise for more advanced classes: construct profit or utility equations with variable payoffs; translate outcomes to game cells; specify cost-benefit conditions that distinguish PD games from the other games.[5] Instructors then may ask which game variants lend themselves to easier resolution, which games introduce distributional conflict, and the degree to which such conflict may complicate resolution.

For post-principles classes, multiplayer CAP games may promote additional insight. Fehr and Schmidt (1999, 836–37) discuss an n-player public-good equation. Here is a variation that adds possible external enforcement:

$$u_i = -c_i + \alpha \sum_{j=1}^{n} c_j + \zeta r_i - \lambda p_i \tag{1}$$

in which u is utility or profit; $c > 0$ is cost of contribution (no fixed costs); α is marginal return from contribution; ζ is the probability of observing Co; r, p, and λ remain as defined in table 2. Note that i is a member of the group, $j = 1 \ldots n$. For a public-good CAP, $\alpha < 1 < \alpha n$. With no enforcement ($\zeta r_i = \lambda p_i = 0$), the Nash equilibrium is no contribution. Adding external enforcement allows other possibilities: full contribution or alternative games such as chicken or assurance. For any specification, instructors can explain or query about relations between the marginal costs and benefits and predicted levels of contribution. Further inquiries might concern relations among payoffs that could generate any of the mentioned outcomes or relations to social optima. Note that multiplayer assurance suggests path-dependence over time. Multiplayer chicken games can illustrate negative-externality properties of relevant CAPs, as well as a potential for distributional conflict. Dixit and Skeath (2004, chap. 12) offered an intuitive discussion of multiplayer CAP

games. For example, they present the CAP associated with changing software operating systems as a path-dependent multiplayer game of assurance (411–14).

Overall, the analytic richness of CAPs argues for their incorporation into the foundations of UG economics. Instructors may inspire further insight by using the preceding arguments as a foundation for modeling the remaining four cutting-edge developments.

INFORMATION ECONOMICS AND CONTRACTING

Information economics adds complexity to strategic interaction among purposeful agents. For Stiglitz (2002), this term describes theoretical advances that explicitly address costly, incomplete, and asymmetric information. Information economics, he contends, alters the "paradigm" for economic theory, for example by implying multiple contracting problems, efficiency loss, routinely nonclearing labor and capital markets, and nonconcavity in key functions.

I begin with a macroeconomic example of how nonrival knowledge influences economic growth. Easterly (2002, chap. 8) argued the following: Because nonrival knowledge spills over, it is complementary. Unlike labor and physical capital in traditional models, complementary knowledge generates increasing (not diminishing) returns to itself and to concentrations of related skills. Knowledge and skill concentrations, therefore, exhibit critical-mass properties arising from positive feedback dynamics.[6] Vicious circles of stagnation or virtuous growth circles emerge, fostering insight into deep disparities in economic development, and the profoundly uneven geographical distribution of production, with similarly profound implications on economic growth and policy. Easterly's intuitive argument could appear in principles classes, perhaps combined with a traditional LRAS curve, as a foundation for economic growth.

Turning to the microeconomic level, first note the game-theoretic distinction between *imperfect* and *incomplete* information: The former connotes symmetrically distributed lack of knowledge regarding states of the game environment or an inability to observe contemporaneous or previous moves of other players. Games in which moves are made simultaneously are thus games of imperfect information. Incomplete information reaches further, covering cases in which players may be uncertain even of the identity of other players. More precisely, it refers to any information asymmetry or lack of knowledge concerning characteristics, motivations (payoffs), strategies or asymmetric knowledge of prior moves of other players or the environment. Asymmetry invites strategic manipulation of information, as reflected in adverse selection, moral hazard, and related principal-agent (P–A) models.[7]

Beginning with Akerlof (1970), the adverse selection literature developed the intuitive concept that prior to an exchange or agreement, asymmetric information concerning relevant characteristics or quality may lead to undesirable agreements or even preclude exchange: a strong form of market failure. Akerlof's famous lemons example is sufficiently intuitive to describe in principles classes and present more formally in more advanced classes. Colander (2008, 437–41) and Stiglitz and Walsh (2006, 333–35) have discussed adverse selection at an intro level. Watson (2002, 262–64) offered a lemons problem that one could discuss in intermediate micro or related classes. Applications to areas like search in labor markets may readily follow.

Turning to postcontractual problems, asymmetric information creates moral hazard, rendering contracts incomplete, with multiple enforcement issues that often lead to nonclearing markets and

a corresponding political dynamic within economic exchange. Without perfect, costless observation of activities, parties who share less than fully aligned interests may not entirely live up to contractual commitments, as illustrated in P–A models.[8] The key implications are: the exchanging parties must *design* some *internal* enforcement mechanism, *and* relevant markets typically fail to clear. For example, the efficiency wage literature offers mechanisms of contingent renewal, monitoring, and payment of above-market-clearing wages, yielding involuntary unemployment (Shapiro and Stiglitz 1984; Bowles 1985). A similar literature in capital markets yields credit rationing (Stiglitz 1987).

Some principles textbooks (Hubbard and O'Brien 2009, chap. 17; Stiglitz and Walsh 2006, chap. 15) addressed asymmetric information, and upper-level UG classes often discuss adverse selection and moral hazard, including P–A models. Even so, such treatments frequently lack sufficient generality or attention to implications, in particular the failure of labor and capital markets to clear, ensuing distributional outcomes, and the implications of related transactions costs on economic development. Moreover, a traditional UG treatment of nonperfect information focuses on a stochastic interpretation of imperfection as a normal probability distribution whose mean and standard deviation are common knowledge.[9] This practice often amounts to substituting a probability distribution for fundamental insights into human behavior: a simplification that offers a misleading foundation for models of human behavior. Asymmetric information merits more serious attention.

In relevant literature, Williamson (1985), North (1990), and Bowles (2004) addressed enforcement in exchange. Bowles (especially 249–57) focused on endogenous claim enforcement. Parties vie over the distributional outcomes of their exchange, lending a political dynamic to their internal enforcement mechanisms. Williamson's concept of opportunism implies internal enforcement problems as a fundamental influence on the organization of firms, but he did not pursue implications on market clearing. North posed internal enforcement problems (1990, 31) but focused on the importance and limitations of third-party enforcement. Three key implications follow:

1. Enforcement costs constitute a major component of transactions costs (North 1990). Inadequate enforcement precludes or inhibits potentially profitable exchange, impeding or preventing economic development: market failure in its deepest sense. For North, then, one cannot understand economic development or growth without understanding problems of enforcement. Two additional political-economy dimensions follow:
2. Nonclearing markets, arising from P–A problems, yield power relations because parties on the short side of a nonclearing market can credibly threaten to deny long-side parties' access to exchange whose value exceeds that of their next-best alternative (Bowles 2004). North (1990, 31) allowed for power in exchange. Williamson's (1985) opportunism also suggests internal power, hence a need for governance. An economic transaction, then, is *not,* as Lerner (1972, 259) would have it, "a solved political problem."[10] The distributional impacts and power dynamics of nonclearing markets warrant attention that is far more serious.
3. Corollary: Enforcement requires coercion; incomplete contracts imply political economy both within markets and outside them. As indicated, enforcement generates CAPs.

> More generally, because nonaligned interests and information asymmetry create enforcement problems, social, political, and economic institutions necessarily underlie market exchange, development and growth.

By contrast, UG classes often take the institutional prerequisites of successful market exchange for granted. Although this approach can have pedagogical merit, it overlooks important foundations of economic development and policy analysis. Consider table 2 or equation (1): With sufficiently low r, p, λ, and/or ζ, external enforcement may not resolve first-order CAPs. Here, many definitions of Co and Df can apply to development issues (e.g., defection may signify steal, bribe, extort, fail to honor contracts). A related type of adverse selection may constitute failure to adequately screen out Df players, whereas contract enforcement generates related P–A problems. Economic development simply requires sufficient resolution of these problems. Otherwise, high transactions costs preclude complex exchange, and potential gains from specialization remain unrealized.

Principles classes should then at least explicitly state information assumptions and offer an intuitive discussion of information asymmetry, perhaps with adverse selection and moral hazard issues. Stiglitz and Walsh (2006, 337–47) discuss incentive and search problems at an introductory level. Intermediate micro and related classes could fruitfully introduce the notion of endogenous enforcement in P–A models, with its implications on nonclearing markets, distributional conflict, and power.[11] At either level, instructors might use the example of music file-sharing to illustrate CAPs associated with endogenous enforcement.

Overall, information dynamics complicate exchange, dramatically expanding the domain for market failure: Important markets fail to develop or, if developed, routinely fail to clear. Enforcement CAPs abound, generating the *raison d'être* for institutions—informal and formal. I will elaborate on this later. The foundational relationship between asymmetric information and institutional construction and the dynamic implications of nonrival knowledge belong at the center, not the periphery, of the UG curriculum.

SOCIAL PREFERENCE THEORY

Strategic interaction among purposeful agents creates social preference, and social preference influences strategic interaction; economic inquiry expands accordingly. By enlarging the domain over which utility choices operate, social preference informs enforcement dimensions of CAPs, with implications on contracting, the foundations of informal institutions, and how institutions condition economic outcomes.

Unfortunately, traditional textbook theory presents a truncated concept of preference based upon three related limiting assumptions; preference is

1. individual and self-oriented: agents do not care about outcomes for others per se, nor own outcomes relative to others;[12]
2. outcome oriented but not process oriented: individual utility gains from outcomes do not respond to underlying process nor to intentions of others with whom one interacts; or
3. independent/exogenous: preferences arise solely from self; they do not respond to social or economic contact, contexts, or processes.

Bowles (2004, 96–97) named the traditional approach embodied in assumptions 1 and 2, along with assumed common knowledge of such, as the *self-interest axiom*. I adopt this terminology but add assumption 3 to the list.[13]

Contemporary extensions beyond these limiting assumptions revolve around the concept of *social preference* with its implications on social exchange and endogenous preferences. Social preference augments our concept of utility to include concern over outcomes to others, either per se or in relation to one's own outcomes, along with underlying processes, including the intentions of others (Bowles 2004, 96–126; Fehr and Fischbacher 2002). Like game theory and information economics, social preference theory renders the discipline of economics more *social* scientific. Game theory, moreover, facilitates modeling both material and social preference; the domain of economic analysis expands accordingly.

Two important forms of social preference, inequality aversion and strong reciprocity, receive significant attention in the literature.[14] For Bolton and Ockenfels (2000), individual utility depends on one's absolute payoffs as well as payoffs relative to others, with disutility for excessive inequality in either direction.[15] The related concept of strong reciprocity goes further, adding concern for perceived intentions of others. Fehr, Gächter, and Kirchsteiger (1997, 839) defined reciprocity as a willingness to *sacrifice material gain* to reward or punish behavior *perceived* as fair or unfair.[16] In Rabin (1993), the perceived intentions of others affect the utility associated with relative outcomes: my small share hurts more if you deliberately slighted me. A colloquial example of concern for process: The utility gained from a given sum of money may depend in part on whether it is payment for time or effort, an award for accomplishment, a gift, a down payment for a future favor (bribe), an outcome of theft, and the like.

Contemporary literature indicates that social preference theory has neuroscientific foundations. Fehr and Camerer (2007), identified social preference in nodal activity of the human brain, offering formal scientific evidence that conventional treatments lack: utility theory need no longer rely on convenient mathematical assumptions. Experimental evidence complements these findings (Fehr and Fischbacher 2002; Fehr, Gächter and Kirchsteiger 1997; Fehr, Kirchsteiger, and Riedl 1993). Reciprocity, then, is so fundamental to human behavior that it belongs in our utility functions. It is so deeply intuitive that it can be taught in principles courses.

Turning to implications, reciprocity theory allows us to augment analysis of material exchange with social exchange. The latter concerns expressions of approval or disapproval, respect or disrespect, in response to specific actions of others. For economists, social preference motivates social exchange as material preference motivates material exchange. Accordingly, social exchange offers social *incentives* that may reinforce or undermine material incentives.[17]

Reciprocal social exchange fosters enforcement mechanisms that are endogenous to exchange processes. Participants may reward cooperation with or punish defection from agreements—explicit or implicit. Reciprocity, for example, underlies social exchange in employment: morale or lack thereof reflects social exchanges among workgroups or with employers. Morale can ameliorate contracting problems associated with elicitation of careful and informed effort and thereby affect productivity.[18] More generally, social exchange can explain why sole reliance on material incentives may offer ineffective discipline in contexts ranging from work performance to international relations, teenage behavior, or criminal behavior.[19] Likewise, social preference deepens our understanding of strikes, the failure of potentially profitable mergers, and so forth. Reciprocal social exchange then may either facilitate or hinder resolution of the aforementioned CAPs, with or without external enforcement mechanisms.

These arguments may complement discussions of moral hazard, adverse selection, and other market failures in intermediate micro and other postintroductory classes. One may augment payoffs in table 1, table 2, or equation (1) with social rewards and punishments. For example, Fehr and Schmidt (1999, 837) presented a public-good equation with internal punishment.

Finally, social preference theory implies that social or economic contexts influence individual preference rankings, yielding endogenous preference formation. An example of context-specific preference: upon entering an auditorium, people consider relative locations of others; they may, for example, hesitate to sit in front of too many others (Schelling 1978, 11–17). Unlike traditional preferences for oranges or apples, seating preferences respond to decisions of others. Although formal modeling of endogenous preference may lie beyond the UG curriculum, its intuition is straightforward, and considerable insight may be attained in upper-level UG courses via the use of multiplayer assurance games.[20]

Furthermore, if utility is indeed interdependent and preferences reflect both social and material concern, utility choices transform conceptually from single first-order constrained maximization events to n-player games ($n > 1$). Accordingly, interdependent utility creates externalities (spillovers), path dependence, and critical mass tipping points (Schelling 1978), with divergences between individual and group interests, even in competitive settings. CAPs emerge in unexpected places; social preference offers insight into their nature.

Contemporary developments in network economics follow immediately. Network externalities already appear in introductory textbooks as a reason for entry barriers (Hall and Lieberman 2008) and in intermediate textbooks as an influence on demand (e.g., Pindyck and Rubinfeld 2005). Colander (2008) stressed network dimensions of technological lock-in, with examples. Because networks enter all dimensions of exchange processes, their economic influence merits serious inquiry; a framework founded on atomized maximization cannot adequately model their impacts.[21] In this regard, the intuitive NetLogo program provides a platform for agent-based modeling of complex phenomenon, allowing for student exploration of networking and related effects.[22]

Fortunately, contemporary game theory facilitates sophisticated modeling of social preference and social exchange alongside material preference and exchange. As I will argue, social exchange and reciprocity may reflect adherence to social norms and thereby influence the performance of formal institutions, often facilitating or impeding resolution of CAPs. But first, more foundations.

SUBSTANTIVE AND PROCEDURAL RATIONALITY

Concepts in the previous two sections profoundly influence our understanding of the rational bases for exchange and associated strategic social interactions. Unfortunately, UG textbooks often present a truncated notion of rationality. There are two dimensions to this problem, one relatively straightforward, one more complex. The first concerns a restricted concept of substantive rationality; the second involves a failure to even consider procedural rationality. These two types of rationality, moreover, underlie the distinction between classical and evolutionary game theory, as applied to the social sciences.

Substantive rationality, defined as consistent (transitive) goal-oriented behavior (Basu 2000, 37), underlies classical game theory. Substantive rationality thus may incorporate social preference in addition to material preference.[23] As discussed in the previous section, even a minimal treatment of reciprocity implies a social-preference component to rationality. Traditional UG

economic rationality, however, focuses on the self-interest axiom. To fully explain substantive rationality, instructors need only augment traditional discussion of material preference with a discussion of social preference, noting relationships to Basu's definition. I also recommend this approach to utility theory in intermediate microeconomics.

Concerning procedural rationality, institutional and behavioral economists have long argued that bounded (procedural) rationality better represents human behavior than self-oriented optimization. Incomplete information, moreover, can undermine the exercise of substantive rationality.[24] Before recent developments in game theory, however, formal modeling of procedural rationality was virtually impossible; hence the concept remained at the sidelines of economic analysis circa 1980. Nowadays, evolutionary game theory, by itself and in conjunction with agent-based computer simulation, renders such modeling feasible. As already noted, developments in neuroscience offer scientific foundations.[25]

Game theory may be parsed into two broad segments: classical and evolutionary. Classical game theory relies on substantive rationality: employed strategies represent best-response choices. Classical game theory can model the various arguments of this article with considerable insight, but evolutionary game theory adds dynamic adaptive dimensions. Evolutionary game theory, initially developed by biologists, treats strategies as inherited phenotypes.[26] For the social sciences, inheritance emerges from education and other forms of cultural, rather than genetic, transmission. Individuals and, by extension, populations inherit strategies (established practices) in various combinations. Some groups may typically bargain hard, others less so; some may speak Chinese, others English. Furthermore, whereas payoffs in classical game theory represent individual utility values, evolutionary payoffs represent reproductive potential: strategies with high payoffs reproduce (transmit) in high proportions; others (failed practices) fade away over time.[27] Received payoffs, naturally, depend on encountered player/strategy combinations reflecting relevant contexts (society, firm). Polymorphic equilibria, survival of several strategies in specific ratios, are possible.

Evolutionary game theory fosters a sophisticated, tractable concept of procedural rationality because evolutionary screening of socially inherited traits can represent sequential, adaptive learning processes over ranges of potential practices (strategies).[28] For example, Bowles (1998) presented endogenous preferences as outcomes of cultural evolutionary processes. For Colander (2005, 250), the economy should be "analyzed as a 'complex system.'" Accordingly, agent-based models derived from evolutionary game theory can represent complex adaptive processes with outcomes emerging from interactions of purposeful agents (Epstein 2006; Miller and Page 2007). Evolutionary game theory, moreover, can model the evolution of convention (Young 1996) and, by extension, social norms (Basu 2000), or political and economic institutions (Acemoglu, Johnson, and Robinson 2004).[29] Thus, procedural rationality via evolutionary modeling elucidates the complex foundations of exchange and development.

Intuition on substantive rationality is accessible at lower levels. Procedural rationality probably requires game theory background for upper-level courses, although the concept can be introduced earlier.[30] The next section suggests numerous implications for these models.

INSTITUTIONS AND GAME-THEORETIC POLITICAL ECONOMY

Recent advances in institutional economics offer a comprehensive framework for exploring the micro and macro dimensions of strategic social interaction among purposeful agents. By

facilitating a sophisticated understanding of CAPs with myriad implications on market success and failure, institutional theory invites game-theoretic foundations for political economy. It is here that the implications of cutting-edge economic theory manifest themselves most fully.

For a preface, I will caution against interpreting the Coase theorem as a principle for resolution of free-rider problems without serious consideration of CAPs or institutions. The theorem itself states that *in the absence of transactions costs*, parties will bargain to internalize externalities or circumvent free riding. Such negotiations reflect cooperative, rather than noncooperative games. Even ignoring considerable negotiating difficulties posed by distributional strife in a world with social preference, other transactions costs constitute a (nearly) insurmountable barrier. Previous arguments, moreover, imply that transactions costs are ubiquitous to exchange.[31] Thus, I find North's (1990, 12) reading of Coase compelling: "... when it is costly to transact, institutions matter."

Here I define institutions as North (1990, 3) did: "the rules of the game in a society."[32] Formal institutions constitute written laws, regulations, or procedures. Informal institutions constitute unwritten conventions, expected practices within some group such as driving on the right side, or social norms. A social norm is "a behavioral regularity which is both expected and socially enforced" (Fehr and Gächter 2000, 166). Norm enforcement typically involves social exchange, manifesting social preference. Elster (1989) identified a quasiethical nature of social norms.[33]

I have argued that enforcement (sanctioning free riders) underlies potential resolution of CAPs and thus underlies successful market exchange. According to North (1990, 3), institutions "reduce uncertainty"; in so doing, they *may* lower transactions costs enough to facilitate complex exchange. Here game theory is instructive: Game-theoretic models of repeated interactions generate multiple Nash or subgame-perfect equilibria (SPE).[34] Significant coordination problems follow: unable to anticipate strategies of others, agents may eschew commitment to production, investment, or exchange. Rules, however, facilitate coordination by constraining choice sets or influencing expected payoffs. Laws, for example, influence expected returns to bribery. Similarly, by ruling out multiple anti-social behaviors, social norms select among potential equilibria, rendering behavior of others more predictable. Ultimately norms facilitate *second-party* enforcement or coordination among members of social groups. Formal institutions may then reinforce or counteract informal ones by, among other things, offering critical *third-party* enforcement mechanisms.[35]

A simple example might appear in principles classes: In the United States and Mexico, people drive on the right side of the road; in Japan, India, and Britain, they drive on the left. Both conventions, backed up by formal law—which plays a more important role in discouraging other undesirable choices like driving through stop lights—select among equally plausible (Nash) equilibria. Absent this nexus of convention and law, driving would be chaos. Analogously, successful exchange follows certain "rules of the road." Most consumers do not even attempt to shoplift; most surgeons perform their work diligently, even though patients typically lack the knowledge to evaluate their performance. A cynic might say they fear lawsuits. Laws are formal institutions that influence expected payoffs.

Turning to economic development, successful exchange requires sufficient trust to effectively rule out myriad undesirable activities (defection), such as theft. For North (1990), complex exchange—exchange among multiple parties who specialize and need not share either repeated interactions *or social contact*—requires a multifaceted nexus of informal institutions combined with third-party enforcement via formal law, procedure, or regulation. Yet most of human history has unfolded without such institutional solution to fundamental CAPs.[36]

Whereas institutions may indeed reduce transactions costs enough to facilitate complex exchange, they need not generate either efficiency or social optima. To cite an obvious case, North Korea has institutions. At a micro-design level, Vanderbilt noted that despite their rarity in the United States, traffic roundabouts are more efficient than standard intersections (2008, 178). Because there are no markets for institutional design, or for (most) enforcement mechanisms, market competition rarely mediates. Thus, definition and enforcement of property rights and other aspects of institutional design become problems of political economy.[37] In terms of game theory, one might regard deliberate institutional construction as a type of strategic move.[38] Accordingly, institutions at a point in time reflect the balance of bargaining power among relevant players in some previous historical period (North 1990, 16). Likewise, Acemoglu, Johnson, and Robinson (2004) argued that interests of original colonizers critically influenced the historical development of institutions in former European colonies.

In summation, a game-theoretic institutional approach to political economy offers a framework that can integrate all of the preceding arguments. Information is costly and asymmetrically distributed. Contractual and other enforcement problems follow, both within and outside market exchange, generating nonclearing markets, potential for distributional conflict, and ensuing political dimensions of second and third-party enforcement. Utility functions, and indeed rationality itself, incorporate both material and social preference. CAPs thus arise not only from traditional sources—externalities, public goods, and common resources, all broadly defined—but also from contracting/enforcement problems and related issues of social mechanism and institutional design. Accordingly, sufficient enforcement (or trust) underlies market requisites, such as predictable property rights and commitments. Institutions, informal and formal, contribute to resolving (or exacerbating) underlying CAPs with critical implications on transactions costs and hence economic growth and development. Moreover, because property rights affect distribution, conflict over construction of institutions that define and enforce property rights should be expected (Acemoglu, Johnson, and Robinson 2004).[39]

Thus, contemporary economic theory magnifies the potential domain for CAP-related market failure, enhancing analysis of market success, development, growth, and the potential for policy. Game theory, classical and evolutionary, with asymmetric information and social preference, facilitates modeling the dimensions and adaptive dynamics of these problems. The UG curriculum should move decisively in the direction of more explicit development of these concepts at a variety of levels. A few culminating suggestions follow.

SOME PRACTICAL CURRICULAR SUGGESTIONS

All six innovative realms of contemporary theory can enter at different levels in the UG curriculum. For example, I have incorporated all of them into my seminar on Political Economy, and I use simple PD games to illustrate CAP problems 1 through 5 in introductory economics. Here are four related concepts with low cost and high value-added that instructors may wish to experiment with at the introductory and other levels, followed by a few ideas for postintroductory classes.

CAPs as a Unifying Foundation

The core arguments of the section on collective-action problems could appear in principles classes: Various CAPs represent myriad market failures; institutions, informal or formal, may

resolve CAPs; resolution via institutions offers foundations for growth and development. The suggested PD games offer core intuition and a unifying modeling framework. Because principles textbooks already cover market failure, this approach may not require additional class time. Indeed the unifying framework may economize on time as it integrates concepts. Relationships of institutions, for example, broadly accessible property rights, to market success may be of particular interest to instructors who wish to include a modest historical development of market economies. Heilbroner (1986, chap. 2) offered a useful summary of such development, which one may easily incorporate. For a public-good classroom experiment, see Marks, Lehr, and Brastow (2006).

Reciprocity as a Fundamental Element of Utility

The intuition behind reciprocity is so obvious that instructors may readily introduce the concept in principles classes. Indeed, instructors sometimes jump through hoops to move students away from intuitive notions of reciprocity. Classroom example: Ask students to discuss what happens when an instructor assigns a project to a group of, say, four students. How might they share work: equally? If so, what does "equal" mean: time, substance? What do they do about potential free-riders? Are there externalities? More advanced: Is this a social exchange? Can they construct their own norms or borrow (apply) norms from society? If so, what norms would they choose, and how would they establish them? Another angle: courses that discuss the intuition behind moral hazard and adverse selection may discuss reciprocity as a mechanism that could reinforce (or impede) contract enforcement. Extending the group-project example, suppose the students design an informal contract where each agrees to contribute five hours to the project. Observation is imperfect, but if a student were to notice another slacking (e.g., excessive chatting or text messaging during contract time) the observer could report the infraction. The group might sanction the slacker with reciprocal disapproval or anger. Anticipating this possibility, potential violators may adhere to the contract.

Macroeconomics: Nonrival Knowledge and Economic Growth

Solow's neoclassical growth model, most endogenous growth theory, and relevant empirical work share one common idea: technological change lies at the foundation of long-term productivity growth. Easterly (2002, chap. 8) offered an intuitive explanation of how nonrival knowledge, via positive externalities, affects growth, path dependency, and uneven development—another reason for analyzing CAPs. Colander's (2008) introductory textbook discussed the related concept of technological lock-in. Instructors thus may consider replacing traditional intro sketches of the Solow model with Easterly's chapter. One could combine the aggregate supply and demand (AS/AD) model with Easterly to argue that knowledge dynamics critically influence shifts in the long-run aggregate supply (LRAS) curve and growth in labor productivity or per capita gross domestic product. Intermediate macro classes might consider relations between nonrival knowledge and simple endogenous growth models, as in Jones (2008). Classes in economic development likewise might consider implications on growth circles or poverty traps.

More Emphasis on Imperfect Competition with Less on Pure Competition

Hill and Myatt (2007) argue that principles micro courses place too much emphasis on pure competition and too little on imperfect competition. I have already discussed oligopoly. Monopolistic competition also appears in principles textbooks in an approachable fashion. Moreover, it underlies developments in new-Keynesian macroeconomics; in conjunction with increasing returns to knowledge, it underlies endogenous growth models, models of dynamic comparative advantage, theories of distribution, theories of economic development, and recent advances in spatial location theory.[40] Some implications, for example, firm price-making and a desire to increase sales, indicate opportunities for strategic behavior that contrast sharply with pure competition results.

Postintroductory Classes

The preceding arguments may serve as foundation for a more substantive pursuit of contemporary theory in more advanced classes. Here are four general suggestions that instructors might consider for intermediate micro or postintermediate classes on management, contracting, labor, political economy, and the like:

1. Variations of games from tables 1 and 2 and equation (1) can serve to illustrate analytical principles underlying a large variety of CAPs. Distributional dimensions of chicken and battle games lead to a potential for strategic moves associated with institutional construction. It is straightforward to add other strategic moves—various threats or promises—to any of the games and discuss prospects for resolution. Chapter 10 of Dixit and Skeath (2004) offers an intuitive introduction to strategic moves.
2. As already suggested, game or equation payoffs may be augmented to incorporate social exchange (reciprocity) along with external enforcement, yielding instructive 2- and *n*-player CAPs. The associated games may represent types of second-party enforcement, such as reciprocal social exchange over adherence to social norms, along with potential relations to third-party enforcement, with imperfect observation at either level. Instructors may then discuss possible disjuncture between second and third-party enforcement mechanisms, as in legislation that runs against prevailing social norms. Many political-economy implications follow. Furthermore, multiplayer game diagrams as in Dixit and Skeath (2004, chap. 12) offer considerable insight into issues such as path dependence in multiplayer assurance.[41] Ensuing lock-in may underlie problems associated with development of technology or economic development, for example, poverty traps.
3. P–A problems can illustrate the importance of endogenous second-party enforcement and associated issues of mechanism design, along with the political economy of distribution internal to market exchange. I have used a simple efficiency wage model similar to that in Ferguson (1994) in a preintermediate labor economics class. That model can illustrate internal enforcement, nonclearing markets, and implications on distribution and power. Adding an intuitive explanation of fair wage models, noting reciprocity, can offer additional insight related to endogenous enforcement, potential problems with sole reliance on material incentives, and wage distribution. At more advanced levels, one might present repeated PD game analysis of P–A problems to intuitively explore more-complex dimensions of enforcement related to contingent renewal, with incentive-compatibility

and participation constraints.[42] The implications of these models on the exercise of power and potential distributional conflict extend beyond labor markets to the operation of firms, credit enforcement, law and economics, public economics, nongovernmental organizations, transactions costs, and economic development. For a classroom experiment that illustrates P–A problems, see Gächter and Königstein (2009).

4. Many other game-theory ideas, such as signaling games or brinkmanship (see Dixit and Skeath 2004, chap. 9, chap. 14) could complement the above and add considerable insight into issues such as posturing in advance of contract negotiation and ensuing impacts on distribution, transaction costs, and institutional development. Turocy (2009) discussed classroom experiments for teaching signaling games.

CONCLUSION

It is time to move the undergraduate curriculum forward into the present century. We need to adjust the image of market behavior that emerges from the economics major to offer less emphasis on autonomous maximization, transparent transactions, costless enforcement, clearing markets, and neutral distribution. Rather, we need more emphasis on strategic interaction, asymmetric information, social preference, procedural rationality, and enforcement and distributional issues that accompany incomplete contracting, all of which suggest multidimensional CAPs as a core analytical concept. We thus encounter significant contextual roles for informal and formal institutions as prerequisites to sophisticated analysis of market failure, market success, and policy. Recent developments in economic theory provide a complex, nuanced conception of political economy, yet one whose fundamental intuition and basic analysis are accessible to undergraduates. Thus, contemporary theory offers fruitful terrain that should spark undergraduate interest in addition to sharpening insight and analytical skills.

NOTES

1. Related discussions appeared in Colander, Holt, and Rosser (2005), Colander (2006), and Becker (2007). I focus on theory; I mention, but do not analyze important new empirical work in experimental and behavioral economics.
2. The transformative implications of game theory are reflected by recent Nobel Prize awards to Nash, Schelling, Maskin, and Myerson, among others.
3. Table 1 and this example closely parallel discussion in chapters 11 and 12 of Dixit and Skeath (2004).
4. Large group example: society is better off if shoplifters are apprehended, yet without an external enforcement, honest shoppers face a CAP: who would risk confronting a shoplifter?
5. In table 1 we have a symmetric game of assurance when $C > D > H = L$ and a symmetric game of chicken when $H > C$ and $L > D$. In symmetric battle, add subscripts for players, $CA = DB > DA = CB > H = L$. Obviously instructors may wish to adjust notation. See Dixit and Skeath (2004, chap. 4, chap. 12) for an intuitive discussion.
6. Stable equilibria in typical supply/demand models arise from negative feedback.
7. Indeed one could argue that the assumption of perfect information is inconsistent with rational pursuit of self-interest: why rule out potential gains from concealing information?
8. In these models, a principal contracts with an agent to perform costly services, which subsequently the principal can observe only imperfectly.
9. A power law distribution more accurately represents complex phenomenon (Miller and Page 2007).
10. This quotation appeared in Bowles and Gintis (2004, 1430).

11. Bowles (2004, 249–57) discussed P–A models with implications. Colander (2008, 325–30) discussed monitoring and incentive compatibility. See Dixit and Skeath (2004, 277–80) for a managerial incentive model. See Ferguson (1994) for a link between efficiency wages and bargaining accessible to postintermediate labor economics. Maskin (2008) discussed mechanism design and eliciting information: implementation theory.
12. A limited exception: direct offspring in intergenerational models.
13. Bowles (2004, 97) treated violations of assumption 3 as a separate departure from traditional models. Bowles (1998) discussed violations of assumption 3 in detail.
14. Other types of social preference: pure altruism or spite—unconditional willingness to sacrifice absolute payoffs to help or harm others (Fehr and Fischbacher 2002).
15. Fehr and Schmidt (1999) also modeled inequality aversion.
16. Earlier examples of reciprocity appeared in Akerlof (1982), Akerlof and Yellen (1990), and Fehr and Gächter (1998). Bowles (2004, 111) distinguished between *strong* reciprocity and *weak* reciprocity. Weak reciprocity connotes a self-interest motivation for reciprocal behavior, as in tit-for-tat in repeated PD games.
17. Economic approaches to social exchange focus on relations to incentives and scarcity, typically with formal modeling, whereas sociologists focus on relations to social standing. Sociological works include Blau (1964) and Molm (1997). Economic works include Barron and Paulson Gjerde (1997), Fehr and Fischbacher (2002), Gächter and Fehr (1999), Holländer (1990), and Kandel and Lazear (1992).
18. See Akerlof and Yellen (1990), Akerlof and Kranton (2005). Bewley (1999) and Howitt (2002) reviewed survey evidence on managerial concern for morale. Ferguson (2005) applied social exchange to implicit bargaining power in segmented labor markets.
19. Related arguments appeared in Fehr, Kirchsteiger, and Riedl (1993), Fehr and Falk (1999), Fehr and Gächter (2002).
20. See Schelling (1978, 91–110). For a review of literature on endogenous preferences, see Bowles (1998).
21. I will not attempt to summarize network economics. Miller and Page (2007) discussed network effects as complex social phenomena. Colander (2006) addressed complexity and UG economics. Page (2007) discussed problem-solving network effects of diverse group membership. For a comprehensive text, see Jackson (2008).
22. This is free at http://ccl.northwestern.edu/netlogo/. The site offers tutorials and intuitive examples.
23. Dixit and Skeath (2004) used essentially the same definition without the modifier "substantive." Thus, game payoffs may reflect reciprocity, altruism, or spite in addition to standard material rewards.
24. North (1990, chap. 3) offered a scathing critique of traditional assumptions of rational calculation.
25. Spitzer et al. (2007) offered neuroscientific foundations for social norm enforcement. Since many UGs have some exposure to neuroscience from core classes in science or psychology, it is not unreasonable to introduce neural economics, despite an inability to go into depth.
26. See John Maynard Smith (1989). For an insightful recent text, see Gintis (2008). For simulations, see Epstein (2006).
27. For Bowles, strategies (not individuals) are the "*personae dramatis*" of evolutionary game theory (2004, 60).
28. As in biological evolution, selection need not generate any form of social optimum (North 1990, 20–21).
29. Acemoglu, Johnson, and Robinson (2004) do not explicitly discuss evolutionary game theory, but because payoffs influence future configurations, evolutionary modeling could apply.
30. An intuitive summary of evolutionary game theory appears in Dixit and Skeath (2004, chap. 13).
31. Necessary conditions for Coasian bargaining: (1) relevant property rights must be defined; (2) rights must be transferable; and (3) a small number of involved parties (Hall and Lieberman 2008, 473). Example: compared to other CAPs related to externalities or public goods, oligopoly bargaining has a small number of players, definable property rights (limiting output), easy monitoring, and a norm of negotiation over business transactions (how many people pay neighbors to turn down music?). Yet, we often consider oligopoly collusion difficult.
32. Organizations are actors (players), institutions are rules; this distinction is important and often unclear.
33. Basu (2000) discussed types of norms. Ostrom (2000) related norms to social enforcement. See also Akerlof (1982), Akerlof and Yellen (1990), and Fehr and Gächter (2000) for economics of social norms.

34. Fudenberg and Maskin (1986) called this proposition the Folk Theorem; see Gintis (2008, 213–19) for examples.
35. Grief, Milgrom, and Weingast (1994) discussed the role of institutional enforcement mechanisms in advancing medieval trade. Grief (1994) similarly stressed the importance of social organization.
36. "But the fact that growth has been more exceptional than stagnation or decline suggests that 'efficient' property rights are unusual in history" (North 1981, 6).
37. Laswell's (1935) definition of politics: "who gets what, when and how," is instructive: property rights are social mechanisms that partially address these political questions. Definitions are contested.
38. A move designed to alter the expectations of other players in a subsequent game to one's advantage, such as altering an agenda to a subsequent meeting. See Dixit and Skeath (2004, chapter 10).
39. Mountains of lawsuits testify to the contested nature of property right definitions.
40. For endogenous growth, dynamic comparative advantage, and distribution: see Aghion, Caroli, and García-Peñalosa (1999). For development and spatial location theory, see Krugman (1997).
41. With commentary, one could teach this chapter by itself after an intermediate micro treatment of game theory.
42. Chapter 11 of Dixit and Skeath (2004) presents repeated PD games.

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