IS THERE ROOM FOR GAME THEORY IN THE AUSTRIAN PARADIGM?

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Introduction

On many occasions, Austrian economics and game theory have crossed paths. Opportunities for creative engagement have often been missed, however. It looks almost as if Austrian economists and game theorists have been condemned to play a "centipede game": neither player has an incentive to even make the first move! This is regrettable, I would argue. Not because seeking to keep in place some epistemological boundaries between schools of thought is always a futile effort. But rather because game theory has over the years become such a far-reaching, diverse and dynamic research program, it seems that not taking on board at least some of the contributions it has made to economic and political theory (not to mention evolutionary biology) means renouncing to ask crucial questions relevant to political economy. I hasten to add that fortunately *not* all opportunities for initiating a dialogue have been missed (e.g., Foss 2000; Cevolani 2011; Sauce 2014; Arena and Larrouy 2015). But the point of this paper is explore avenues for deepening this dialogue. I do not intend to argue that Austrian economists and, more generally speaking, classical liberal scholars, should concede that game theory has definitely won the battle of ideas. Game theory has its own limitations and its proponents have often promised more than it has been able to deliver. My intention is rather to reflect on the extent to which game theoretic concepts—as well as methodological controversies within the field—could inform the thinking of classical liberal theorists, including Austrian economists more strictly defined.

Socio-economic systems, including self-organizing systems (or "spontaneous orders") are by definition complex. Consequently, any contribution to the philosophy and practice of the "social sciences"—and the controversy about the meaning of that phrase itself being

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indicative of the problem—is bound to be open to challenge. The uneasy coexistence of game theory and Austrian economics being just one example of this permanent state of epistemological turmoil. Any rapprochement between distinct schools of thought in most cases should be understood more as a temporary truce than a permanent resolution of their differences. This is not necessarily something to be lamented. When issues are discussed with a view to better comprehend what is truly at stake, when intellectual pluralism and tolerance prevail (see Garnett et al 2009), clearheaded views about what scholarly inquiry can achieve will emerge. Paradoxically, it could well be that "less is more." That is to say, I do not propose here a definitive answer to the question of whether and how the gap between Austrian economics and game theory can be bridged. But I do want to propose options that could bring us a little closer to that goal. More specifically, I argue that in spite of the remarkable insights that game theory offers on so many aspects of economic and political life, there are obvious limits to how far it can be integrated into the core of the Austrian economics research program. Not all differences in that respect can or ought to be papered over. However, game theory can speak to the concerns of political economists seeking to find ways of either "nudging," or even more radically redesigning, institutions, and shifting policy priorities in order to achieve a transition toward what Mark Pennington (2013) calls a "robust political economy." It can also contribute to an evaluation of the feasibility of anarchism, if that is the ultimate goal of this transition.

In the first section, I briefly summarize the history of game theory, underscoring the historical junctures where it has crossed paths with Austrian economics. Then in section 2, I examine the extent to which game theory and Austrian economics are compatible or possibly even mutually reinforcing. In section 3, I turn to more normative issues having to do with a transition toward a more robust political economy.

Game Theory and Austrian Economics: Family Resemblances?

There is by now a sizeable literature on the history of game theory (Weintraub 1992; Leonard 1995; 2010; Dimand and Dimand 1996; Giocoli 2003; 2009; Erickson 2015) which reveals the extent to which it has been shaped by a series of on-going and sometimes tortuous debates about cross-cutting methodological and discipline-specific issues. But there is general agreement that in it originated with the publication in 1944 of John von Neumann and Oskar Morgenstern's *The*

Theory of Games and Economic Behavior. One of the stated purposes of this seminal work was "to find the mathematically complete principles which define 'rational behavior' for the participants in a social economy, and to derive from them the general characteristics of that behavior" (2004 [1944]: 31). Another milestone in the history of game theory was of course the publication in 1951 of John Nash's article outlining what became known as the "Nash equilibrium" in non-cooperative games. Before examining these major achievements, I want to briefly examine some of their more or less distant antecedents.

Strategic thinking is an essential aspect of life in a social setting. People make choices, knowing full well that others do the same; some of these merely involve practical decisions, other choices involve moral challenges. Therefore, it is not surprising that one finds examples of game theoretic reasoning in the Bible or the Talmudic tradition (Aumann 2002; Brams, 2011: chapter 2). And of course all successful military leaders, going back to Pericles or Hannibal, have devised winning strategies (although the term itself in its modern connotation did not emerge until the beginning of the 19th century). Niccolo Machiavelli famously strategized about war and politics in his *The Prince*. Jean-Jacques Rousseau's allegory of the dilemma faced by hunters who have to choose between cooperating in hunting a stag or going off individually after a rabbit is the origin of the much discussed eponymous game. If one can talk of fashion trends in game theory, it would seem that "stag hunt" has dethroned Prisoner's Dilemma (PD) as the most discussed game (e.g., Skyrms 2004). But in a sense Rousseau was the first critic of the application of game theory to politics: in the *Social Contract*, he goes to great length to explain that the "General Will" can emerge only when voters vote sincerely listening exclusively to their conscience. Strategic voting can only result in the qualitatively inferior—at least in Rousseau's eyes—sum of individual interests (or "particular wills").

Rousseau was not a game theorist but, more controversially, Chwe (2013) argues that not only did Jane Austen provide in her novels examples of situations that can serve to illustrate game theoretic dilemmas, but that she was *herself* a game theorist of sort. Addressing critics of game theory who tend to argue that the fundamental assumptions of game theory mesh with the world view of the elites in power, Chwe counter-argues that Austen subtly shows that those who have power often display a sort of "cluelessness" that those with less power and privileges can take advantage of.

Antoine-Augustin Cournot (1838) was the first economist to systematically use mathematics to analyze economic problems. One of the problems he was interested in was prices setting by monopolies and duopolies, that is to say, exceptions to ordinary market competition. The model he formulated provides an equilibrium that matches what contemporary game theory suggests will result in a monopolistic setting. In a situation of imperfect competition, such as a duopoly, economic agents take into account what they anticipate their competitors will do. The outcome of their strategic reasoning is a less socially beneficial one than one would prevail under perfect competition where, by definition, economic agents do not take into account the decisions of other agents. Cournot reached his conclusion without making use of the concepts deployed by game theorists but he can still be regarded as one of the early precursors of strategic modeling in economics who anticipated the Nash equilibrium, albeit only in one specific case. Nash's genius is to have thought of his equilibrium as a solution to *all* non-cooperative games.

The turn of the last century was a crucial time in the history of mathematics, mathematical logic and the philosophy of science. Ground-breaking innovations at the cross-roads of these disciplines were undertaken by brilliant thinkers, particularly in the German-speaking world. It was in this context that John von Neumann and Oskar Morgenstern were educated and began their academic careers before they eventually and somehow serendipitously met in the United States. Two streams of apparently unrelated inquiries were captivating mathematicians and philosophers in Mitteleuropa: set theory and the game of chess. Set theory dates back to the second half of the nineteenth century—and in particular to contributions by Georg Cantor. But by the end of that century, paradoxes and antinomies were discovered by Cantor himself and Bertrand Russell (Leonard 1995: 733). David Hilbert's effort to address these challenges became what is known as the Hilbert program which attracted a number of prominent mathematicians. Ernst Zermelo was one of them. As was common in the German-speaking world at that time, Zermelo was intrigued by chess. The authority on the game in Zermelo's times was the chess master Emanuel Lasker who was also a well-trained mathematician and dilettante philosopher; in his book, *Struggle*, Lasker combined logic and psychology in explaining his strategic approach, which aimed at creating confusion in the mind of his adversaries (Leonard 2013: 10-11). This belief that games involve complex decisions upon

which logic and mathematics can provide only an incomplete perspective was shared by the French mathematician Emile Borel who worked on a mathematical analysis of games, but maintained that in the end the choices players make can never be reduced to abstract logic. Zermelo, by contrast, wanted to treat chess as nothing more than a mathematical problem. In a paper published in 1912, Zermelo proved by following what is today called "backward induction" that it is always the case that one of three "solutions" exist: either white has a winning strategy; or black has a winning strategy; or "each of the two player has a strategy guaranteeing at least a draw" (Maschler et al. 2013: 3). None of this was unfamiliar to von Neumann, who knew Zermelo and had studied under Hilbert, but he worked on a much more ambitious problem: finding a solution to *all* zero-sum games. In a paper he presented to the Göttingen Mathematical Society in 1926, von Neumann laid down a proof for the so-called minimax theorem. (The paper was published in German in 1928.) All two-person zero-sum games have either a pure (maximin-minimax) or "mixed" (i.e., randomized) winning strategy.[1] Interestingly, as Leonard (1995: 734) notes, "with the minimax theorem, the prevailing probabilistic view of the world in physics was being reflected in von Neumann's theory of human interactions."

After presenting that paper, von Neumann's mercurial mind turned to other unrelated problems. But he returned to the mathematics of games on the urging of Oskar Morgenstern in the early 1940s. The focus on economics of their co-authored book is attributable to Morgenstern, however. In fact, the long introductory chapter bears the imprint of Morgenstern's rather unique views on economic theory. Morgenstern was highly critical of practically all schools of thought in economics: "he criticized Hicks, Hayek, Keynes, Samuelson, the business cycle theorists and all his colleagues at the Princeton Economics Department (which featured names such as Viner and Baumol)" (Giocoli 2003, 170). Before moving to the US, Morgenstern had been influenced by two schools of thought that are seemingly irreconcilable

1 In 1953 the French Mathematician Maurice Fréchet tried to downplay the role played by von Neumann in pioneering game theory by insisting that Emile Borel had actually paved the way for him by introducing the contrast between pure and mixed strategies; in his reply (1953), von Neumann insisted that when he wrote his 1928 paper he had not read Borel's 1921 paper. Moreover, von Neumann remarked that in that paper Borel suggested that there may not be an equilibrium in a zero-sum game whereas, of course, the minimax theorem proves the existence of such an equilibrium.

but which somehow he managed to unite in his research program. The first was Austrian economics: Morgenstern attended von Mises' seminar in Vienna and worked as an assistant to Hans Mayer. From both he acquired the typically Austrian scepticism toward Walrasian general equilibrium.[2] As is well known, Austrian economists (then and now) are opposed to using mathematics to study what they consider irreducibly complex economic problems. In his book *The Limits of Economics* (1937), Morgenstern expressed his critical opinions about the relevance, or lack thereof, of statistics in economic analysis. But—and this is the second facet of his research program—Morgenstern was very much influenced by the epistemological views of the mathematician Karl Menger whom he met in the 1930s.[3] Karl Menger argued in favour of not only the axiomatization of mathematics but also of a similarly formalist approach to the study of social phenomena (Giocoli 2003, 170). Morgenstern's mathematical skills were limited but when the opportunity arose, he teamed with von Neumann in the hope of setting economics on a sound mathematical footing (i.e., set theory), while unmooring it from the neoclassical paradigm.

Von Neumann and Morgenstern's *The Theory of games and Economic Behavior* is a massive (it includes 67 chapters!) and somewhat loosely structured book. It deals with (from 2 to n-person) zero-sum games and cooperative games. Their treatment of the first topic in terms of a maximin equilibrium or mixed strategies when necessary (a concept, incidentally, which required the articulation of the then novel idea of "expected utilities") remains canonical. But their analysis of cooperative games was only a beginning in what still remains a somewhat underdeveloped subfield of game theory; von Neumann and Morgenstern introduced the notions of winning coalitions, and majority games, and they proposed the "stable set" as a solution for

2 Mayer is rarely mentioned by Austrian economists—and in fact Hayek dismissed him as a rather insignificant scholar (an it is true that he did not publish much); this was due largely to the disgraceful way in which Mayer rallied to the Nazis when they took power in 1938 and helped them purged the Jews and liberals from his department. And when the Soviets took over in 1945, he successfully managed to keep his position. But, as Leonard (2013: 77-78) argues on the basis of a close reading of his writings on economic theory, Mayer's views of market processes were not very different from those of Hayek and Mises.

3 Karl Menger was the son of the founding father of the Austrian school—Carl Menger, which is somewhat ironic since Karl was close to the logical positivist Vienna Circle, whereas his father never saw much need for the use of mathematics in economics.

such games. But today the "stable set" is only one of several solution concepts for cooperative games (Michener et al 1984).

The second momentous step in the history of game theory took place in the very early 1950s when John Nash proposed a solution to all non zero-sum non-cooperative games. The Nash equilibrium (NE) consists of the best response of each player to each other's strategies; in some games, there will be more than one such equilibrium (e.g., "chicken"). Nash was not an economist but it is interesting to note that the only course in economics he took was taught by Bert Hoselitz, who was a former student of Ludwig von Mises (Kelly 2009, 39). Although it turned out that the Nash equilibrium is far more relevant to the social sciences than von Neumann's works, it took quite some time for scholars outside of a small group of mathematicians located mostly at Princeton or the RAND Corporation to perceive its significance. And even members of this group of mathematicians were a little confused. As related by Paul Erickson (2015: 130), when Arthur Tucker came up with the now famous "Prisoner's dilemma"[4] (PD), opinion among them was divided between those who realized PD was a typical example of a game with an obvious NE (i.e., playing the dominant strategies Defect-Defect), and those who relied on von Neumann's work to argue that a coalition would form to play Cooperate-Cooperate; the latter is more attractive because it is Pareto-efficient (but the coalition is unfeasible in the absence of enforcement mechanisms).

Game theory made few inroads into the social sciences until the late 1970s. Then it took off in the 1980s not only in economics but also in political science and, somewhat more surprisingly, in biology. Obviously, I cannot pretend to offer a fine-grained analysis of all these developments. What follows is a rough but I hope reasonably accurate outline of game theory's inroads into economics. In the early years, economists were intrigued at first (Kuhn 2007), however, even in economics the new approach petered out. This is not difficult to understand in view of von Neumann and Morgenstern's (and Morgenstern's in particular) very explicit goal of displacing the kind of mathematics that was then common practice in economics—not to mention that in 1944 many economists were not very proficient in mathematics.

There are several reasons why economists rather quickly lost interest in game theory. At a more commonsensical level, it seems clear that non-zero sum games offer very limited possibilities for modeling

4 Some authors prefer to write "prisoners' dilemma."

market exchanges that are supposed to be mutually beneficial for all parties involved in the transaction. Cooperative games, on the other hand, had been presented by von Neumann and Morgenstern in a rather tentative manner and the "stable set" solution they formulated is more useful for understanding why collations are unstable than for making predictions. But how can we explain that they took so long to come to grip with Nash's work on non-cooperative non zero-sum games? As Nicola Giocoli (2003, 2) remarks, it is difficult to square the indifference economists showed toward the Nash equilibrium in the 1950s and 1960s with Robert Aumann's assertion that "Nash equilibrium embodies the most important and fundamental idea of economics, that people act in accordance with their incentives." The answer proposed by Giocoli (2003, 3-10) was that economic methodology first had to transition from a view of the economy "as systems of forces" to one that posits "systems of relations." From the standpoint of the former, "economics is a discipline whose main subject is the analysis of the economic processes generated by market and non-market forces, including—but by no means exclusively—the processes leading to an equilibrium; whereas from the latter, "economics is a discipline whose main subject is the investigation of the existence and properties of economic equilibria in terms of the validation and mutual consistency of given formal conditions but which has little if anything to say about the meaningfulness of these equilibria for the analysis of real economic systems." It is easy to appreciate why the systems of relations image of economic modeling is consistent with the mathematical language of set theory. To a large extent it is as a result of their encounter with game theory that economists began to pose economic problems in set theoretic terms, whether or not they apply the specific tools of game theory. Mark Blaug spoke of a "formalist revolution" to account for this transformation (Giocoli 2003, 6).[5]

The transition to a more formalist approach was also facilitated by the formidably important contribution made to economic game theory by John Harsanyi. What economists—and other social scientists—have founds disappointing about game theory is the existence of multiple equilibria. While it is reassuring to learn that social reality is not rigidly determined, from an empirical perspective, it is frustrating not to be able to explain what rational agents can be expected to do in a whole range of situations.[6] Is there a way to choose among

5 For a biting critique of this development, see McCloskey (2002).

6 All zero-sum equilibria have the same value but this is not the case in non zero-sum games.

theoretically possible equilibria? And how can game theory be used to model choices based on incomplete information, that is to say, when at least one of the players involved is not entirely certain about what game he or she is actually playing. Real life economic agents are, after all, rarely all knowledgeable about the markets in which they operate. Harsaniy and other theorists (e.g., R. Selten) who contributed to what Giocoli calls the "refinement literature" was to address the problem of multiple equilibria and incomplete knowledge. The first can rather easily done by describing games in their extensive form which eliminates unfeasible equilibria based on non-credible threats However, backward induction is far from being an uncontroversial analytical method (Cachanosky 2010, 64-65; Bacharach 1992). The second problem is where Harsanyi made his most decisive contribution by proving that games of incomplete information, in which at least one player is uncertain about the game being played, can be transformed via Bayesian statistics into more manageable games of imperfect information, in which at least one player does not where he/she happens to be on the decision tree.

The latest trends in game theory extend along three axes: i) evolutionary game theory which originated in the pioneering work of John Maynard Smith (1982) which dispenses with the conventional definition of "rational" players; ii) behavioural/experimental game theory which stands as the cornerstone of behavioural economics, that is to say, the new "mainstream"; and iii) epistemic game theory (e.g., Dekel and Sinischalchi 2015) which deals with the questions that surface when one moves away from convenient assumption about what players believe (e.g., "common knowledge"). Space lacks here to discuss these trends in detail but what matters about them from my standpoint is that they open up promising avenues for the exchange of ideas between game theorists and Austrian economists, as I explain below.

Game Theory and Austrian Economics: Opening up a Conversation but no Convergence in Sight

Roger Koppl (2009) convincingly argues that the "mainstream" in contemporary economics is now synonymous with approaches that might be somewhat unorthodox but nevertheless encompass all the areas in which the elite of the discipline want to situate themselves. (Orthodox neoclassical economics, in other words, is a stagnant and

imperiled status quo.) Furthermore, Koppl contends that Austrian economists and this changing mainstream agree on a number of methodological points even if many remain unexplored (but see Andersson 2012). Curiously, he does not include game theory in this emerging "mainstream" but that could be due to the fact that nowadays game theory is no longer a unified program that can easily be unequivocally described. Nevertheless, the most advanced and promising areas of research in game theory borrow from, and overlap with, many of the approaches that Koppl associates with the mainstream. This is true in particular of "bounded rationality" models, and of the new institutionalism. Not only does bounded rationality now belongs to the mainstream but it is evidently consistent with Austrian economics; what is perhaps insufficiently recognized is that it also has become central to game theory—or, in any event, to experimental game theory.[7] Similarly, new institutionalism, which builds on the works of Douglass North and Oliver Williamson, opens up avenues for intellectual exchanges with Austrian economics. Koppl (2009, 235) stands on firm ground when he remarks:

> From the beginning, Austrian economists recognized that institutions matter and included close institutional analysis in their work. Carl Menger's theory of the evolution of money is the standard example of an Austrian theory of institutions.

Contemporary Austrians (e.g., Peter Boettke, Emily Chamlee-Wright) have made important contributions to institutional analysis. Much of the work of game theorists lately has happened in the field of Industrial Organization, e.g., "mechanism design" (Giocoli 2009) and more broadly institutional reforms (Scott 2014; Binmore 2009). In spite of these overlapping concerns, the three schools of thought I have been comparing so far have not yet been meshed in some grand synthesis. (But arguably the literature on common-pool resources inspired by the work of Elinor Ostrom has served as catalyst for initiating discussions involving researchers linked in varying degrees to institutionalism, game theory and Austrian economics.)

As I noted above, Koppl provides indirect support for the argument that Austrian economics and game theory are not completely at odd but for answers to the question of how and to what extent scholars immersed in these fields could find common ground, we can turn to a small but apparently growing literature. Nicolai Floss' (2000, 13)

7 For a (rearguard?) defence of neoclassical rationality, however, see Binmore (2015).

"stocktaking" exercises is a good starting point for weighing "the merits and drawbacks of game theory in economics from the perspective of Austrian economics." His mixed assessment is replicated, albeit in varying ways, by the authors I discuss below.

Floss agrees with Koppl (2009) that general equilibrium has been moved to the side line of contemporary economics but he credits game theory for this state of affairs. Now general equilibrium has of course always been a favorite target of Austrian economics. Moreover, there are parallels to be drawn between the Austrian view of the market process and "the new game theoretical Industrial Organization" (Floss 2000, 42), something to which I already alluded. Floss acknowledges the validity of typically Austrian critiques of game theory, such as doubts about the excessive simplifications implied by formal models, the incompatibility of the hyper-rationality of economic agents posited by game theory with Misesian praxeology, and the game theorists lack of concern for the process of adjustment to equilibrium. But he contends that the distance between the two school is not as great as often thought, especially if one takes more recent works into account. There is a certain Austrian flavour in the attention paid by game theorists—going right back to Morgenstern—to (individual) plan formation and plan consistency. Also the problem posed by multiple equilibria is potentially resolvable in terms of the intervention of entrepreneurs. Finally, there is a significant amount of work by game theorists about spontaneous order (e.g., Sugden [1986] 2005). But perhaps the most enthusiastic supporters of the idea of a convergence between Austrian economics and game theory are scholars (Oprea and Powell 2010; Cevolani 2011) who focus on the parallels between Hayek and experimental game theory, in particular the work of Vernon Smith. For Cevolani, Hayek's ideas resonate through a number of themes that are central to experimental game theory: individualism, subjectivism, and pattern predictions.

Nicolas Cachanosky (2010, 54) regards Floss' assessment of the possibility of a convergence between Austrian economics and game theory as being overly optimistic:

> there still exist essential differences between game theory and spontaneous orders, at least in Hayekian understanding. That is, even if we maintain that game theory involves spontaneous orders, we may be unwarranted to call them Hayekian.

This is definitely an important distinction. It rest on what Cachanosky perceives to be Hayek's insight about the difference between knowledge and information (see also Boettke and O'Donnell 2012). As he puts it,

> If information and knowledge are different kinds of concepts, they cannot be mixed together to assume that perfect information guarantees the existence of an equilibrium. Knowledge as a qualitative concept cannot be overlooked, as it is ultimately needed to understand the economy as a spontaneous order (Cachanosky 2010, 69).

The qualitative aspect of the sort of knowledge with which Hayek was preoccupied concern the "subjective valuations of different possible scenarios" (Cachanosky 2010, 70). This is indeed an important distinction and a critique which certainly applies to classical game theory. But more recent work, building on Bayesian statistics, on how agents operate on the basis of subjective beliefs and learn to revise their beliefs may be cited as reasons to play down this contrast. Cachanosky (2010, 84) argues that individuals do not actually use Bayesian probabilities but that is an empirical question about which some work is being done (e.g., Andersen et al. 2014). Moreover, Michael Bacharach's unique (and admittedly not very well known) perspective on game theory place a great deal of emphasis on subjectivity and the role of tacit knowledge in a manner that evokes Hayek's cognitive theory (Bacharach 1986; 2006; Arena and Larrouy 2015). Similarly, Cachanosky's contention that Hayek's evolutionism stands in sharp contrast with game theory's rationalist constructivism applies better to von Neumann's dream of axiomatizing the social sciences than to evolutionary game theory. I am not claiming that evolutionary game theory is essentially Hayekian but simply that game theory has moved some distance away from the contructivism that Cachanosky targets.

Somewhere in-between the positive and negative positions staked out by Floss and Cachanosky, Loïc Sauce (2014) agrees with the latter that there are some fundamental differences but argues Austrian economics and game theory are complementary: they are appropriate for studying different empirical realities. Responding to Foss (2000) Loic Sauce (2014, 11) argues that "Austrian economics can in no way benefit from game theory to analyze the coordination problem because their respective epistemics are largely incompatible." That is because from the standpoint of game theory, "there exist a uniform,

isomorphic and non-ambiguous relationship between information, knowledge, meaning and learning." By contrast, Austrian economics is characterized by a "plastic-universe vision" in which information being transmitted "is dispersed, asymmetric, practical, local, contextual, largely ephemeral and unorganized" (Sauce 2014, 9). However, Sauce argues that these visions are more or less apt to analyze the market process; neither is absolutely valid, and the context must be carefully examined. Sauce suggests that analysts should look at empirical reality as a continuum: under some circumstances, the Austrian pole is more relevant, under other circumstances, the epistemics of game theory might prove more useful. More specifically,

> Transaction costs stabilize the market structure and reduce uncertainty about the strategy set of incumbents. Consequently, when entrepreneurs face high levels of transaction costs (and a fortiori sunk costs), the application of [the epistemics] of game theory is relevant. On the other hand, the epistemic assumptions of Austrian economics are more relevant when forward and second-hand markets are liquid or when entrepreneurs are acting on perfectly contestable markets where costlessly reversible entry, such as "hit and run" strategies, is not precluded (Sauce 2014, 17).

Formulating Strategies for Transitioning to a "Robust Political Economy"

Austrian economics and game theory are never going be merged into one paradigm, for reasons that were explained above. But when it comes to turning away from interventionism, game theory offers invaluable tools for addressing the questions that such a choice entails. Austrian economists do not have to give up their unique analytical lenses for examining the market process. They should not hesitate, however, to draw from game theory if and when they wish to begin to *strategize* about how to implement some of their ideas. I do not want to suggest that game theory offers *the* best way to move toward Pennington's "robust political economy," let alone complete anarchism. But it serves to more clearly outline the challenges that what can metaphorically be described as a reformulation of the "social contract." (Using this metaphor does not necessarily commit one to a contractarian theory of political order; it is merely a convenient short hand for describing the magnitude of the problem and to sig-

nify that it involves navigating around formidable political and ideological obstacles. [8]) I certainly do not wish to claim that all classical liberal will necessarily pose the problem in exactly the same terms. My point is rather that game theory can help them think through the issues at stake. I do not intend to discuss here the very practical, tactical, challenges that policy-makers and elected officials face. This is the domain of policy advisors, party strategists, etc. Whether and to what extent they find game theory useful in this regard is not my concern. I am concerned about the battle of ideas that is on-going and which inevitably feeds the practical political process. This battle of ideas has not yet been won by any camp yet; if anything, classical liberals seem to be on the defensive today. All the more reason to rethink some of the strategies that classical liberals have pursued.

I would like to suggest that there are two (not completely separable) questions that need to be addressed—and, if it is indeed time to re-think classical liberal tropes, addressed in new ways. The first is that of deciding whether radical alternatives to the centralized interventionist state—be it anarchy or a very minimal state—are sustainable. If they are not, there is no point in working hard to achieve an unrealistic utopia; and if so, defenders of market freedom will have to settle for a modest state, by contemporary standards, but give up the idea of a radically trimmed state. The paradox here being that in a sense the existing institutional structure of the modern interventionist state is an odd mixture of "design" and spontaneous order. Moving away from it—rewriting the social contract, to use the metaphor I allude to above—would actually be a design exercise of major proportion, unless we are contemplating incremental changes over a very long time scale. Invoking the virtues of spontaneous orders will not do, since the problem is precisely how can a spontaneous order be rescued from at least a century of trying to circumscribe and regulate it. game theory can illuminate both questions and has indeed be used extensively by many participants in these debates; this is not to say, of course, that it is the *only* window on the question.

In game theoretic terms, the first question boils down to whether the implacable logic of PD can be avoided or mitigated. The most

8 I agree with James Buchanan ([1972] 2005, 78) that we can give a positive answer to the question: "When and if we fully recognize that the contract is a myth designed in part to rationalize existing institutional structures of society, can we simultaneously use the contractual derivation to develop criteria for evaluating changes or modification of these structures?"

radical alternative to present institutions and prevailing beliefs is Murray Rothbard's (1973; 1982) anarchy, but one can also refer to Robert Nozick's (1974) well know work on this subject. Rothbard did not devote much effort to discussing exactly how a society could transition from statism to anarchy (and Nozick even less). This is just as well because my concern at this point is not the feasibility of the transition (a question I address further below) but the sustainability of the alternative socio-economic order. So let us assume that a large enough consensus has emerged to dismantle the interventionist state and that the transition has been successful. The question at stake then is whether domestic peace and respect for property rights would prevail. Rothbard's vision paints a society in which the administration of justice would be privatized to great advantages for everyone. But prominent economists such as Winston Bush, James Buchanan and Gordon Tullock (see Stringham 2005) raised serious doubts. For them, the spectre of the Hobbesian dilemma cannot be dispelled. Buchanan ([1972] 2005), deploying a range of game theoretic concepts, from PD to coalition games, argues that an unequal initial distribution of resources would degenerate into instability in an anarchic environment because predators have strong incentives to violate the "basic law code." According to Warren Samuels (2005), the plutocrats would use their wealth to enforce whatever preferences they might have.

Defenders of anarchy, however, have also found useful rhetorical weapons in game theory. Players can use signals to avoid being trapped in a PD (Osborne 2005). It is also well known that repeated non-cooperative games can lead to cooperation (Axelrod 1984). And PD is far from being the only model that counts. game theory can be used to explain how players can coordinate their choices in ways that lead to the emergence of useful social conventions (Sugden 2005). In fact, there are historical examples of societies where markets flourished but where the central state was ineffective and distant, namely late medieval cities, and the American colonies (before the revolution). Although unconsciously, of course, the burghers of medieval cities probably deployed these strategic resources in dealing with feudal lords and thus managed to protect and develop their liberties. But it is significant that we have to go back quite a while in time to find such examples, and even those examples hardly qualify as instances of Rothbardian anarchy. In any event, my goal here is not to settle the quarrel between those who think that anarchy is or is not

sustainable. It is merely to underline that not only game theory is relevant to such debates but that it is almost unavoidable for addressing fundamental constitutional issues in which libertarians and classical liberals have a deep interest.

Briefly, the same could be said of the question of the stability of a limited, Lockean state. If the state can be used as an instrument to resolve a PD between opposing private interests, once a state is created it will be involved in a PD between itself and those who gave their consent to create a limited state. Powerful vested political and commercial interests can rationally choose to "defect" and aggrandize their powers (Powell 2005); this is something that Adam Smith was well aware of. Since the late ninetieth century, that is to say, since the beginning of the age of mass democracy, another important reason for the expansion of the interventionist state has been the emergence of powerful coalitions of trade unions, socialist parties, and their intellectual allies. The resulting welfare state has been the dominant institutional structure in North America and Europe from the 1940s to the 1970s. Then new coalitions emerged in the late 1970s to push back the welfare state, although their effect has been more to contain the growth of the welfare state than to roll it back significantly. And of course we are now witnessing in many liberal democracies the birth of new illiberal populist coalitions that depending on the countries one considers, are more or less opposed to free markets but have in common a deep scepticism toward international trade and the free movement of people. Cooperative game theory stresses that in the long run coalitions are inherently unstable; the same is true of transitory equilibria resulting from repeated non-cooperative games (this is called the "folk theorem"). Looking back at the last 70 years or so, we've seen the rise and falls of coalitions that were more or less favorable to free markets. At the present time, the wind is blowing against that ideal. It would seem that the fate of Austrian economists resembles Sisyphus' plight: their work is never done!

Keeping in mind this sort of instability which should perhaps be interpreted as a precautionary warning that slow progress is preferable to hasty reforms, what about the question of how to rewrite the social contract? This is of course a very large question that far exceeds the limits of this paper. But it is interesting to note that it has been tackled rather brilliantly by Ken Binmore (1994; 1998; 2005) who is certainly one of the best known game theorist today. In his own words

(Binmore 2005, 185), Binmore describes his ideological orientation as "defending the kind of *whiggery* that motivated the authors of the Glorious Revolution of 1688 and the Declaration of Independence of 1776."[9] This situates him closer to classical liberals than egalitarian liberals such as John Rawls or Ronald Dworkin who have also written on the need for a new social contract. But that is beside the point. I am not interested here in debating which social contract is better but rather how and to what extent game theory can shed light on the choice of successful strategies that can serve the goals of a wide range of liberal reformers, including those who would be more inclined to facilitate the implementation of Pennington's "robust political economy" or some similar more or less Hayekian market friendly program. (I set aside the question of how to bring about Rothbardian anarchy which is quite simply too radical a change to foresee.) Since people in their ordinary lives are always involved in a delicate balance of cooperation and conflict, it makes no sense for reformers to ignore this basic reality. Some social contracts are simply unfeasible; for example, no wide enough consensus can emerge that would generate without coercion a Rothbardian anarchy. The problem then becomes one of choosing among alternatives from the feasible set. The answer to that problem for Binmore resides in a meshing of the cooperative outcomes of repeated games with the moral norms (e.g., reciprocal fairness) that is practically "wired" in our human nature as a result of evolution. Taking these opportunities seriously should help in the production of feasible and satisfactory social contract, i.e., one that is both efficient economically and reasonably just. Because for him a reasonably just social contract is stable but never static, Binmore does not distinguish very clearly between features that would allow it to adapt to changing circumstances and those that would bring about a new contract in the first place but it is doubtful that in reality a social contract can ever be created *de novo*. Austrian economists may not entirely agree with the contents of the social contract Binmore advocates, but they can draw lessons from the question of *how* to "design" a feasible contract. Both in terms of the final outcome and the design issue, Binmore recommends a high degree of decentralization. For advocates of a "robust political economy," this is almost a tautology (see, for example, the chapter on environmental protection in *Robust Political economy*). But with respect to the implementation process, classical liberals can draw some important lessons from Bin-

9 Elsewhere (Binmore 1994, 1) Binmore defines whiggery as "bourgeois liberalism."

more reflections: the best negotiation strategy is one that uses incentives instead of specifying goals. This is a very Hayekian idea: a spontaneous order can be nudged occasionally but not driven toward pre-determined objectives. Then it is up to the members of different communities to negotiate satisfactory "solutions" and to experiment with them. There is more than one way to design market friendly programs, and different jurisdictions with different social norms will follow different paths. Federalism would certainly help in that respect, and so would the principle of subsidiarity.

Binmore's ideas about social change are not beyond criticism. I did not choose his approach because I consider it the best in all respects.[10] It merely illustrates how a prominent game theorist draws from the resources of game theory and evolutionary psychology to tackle the sort of questions Austrian economists interested in public policy (in a broad sense) will themselves have to confront. Nevertheless, it is reassuring to note that other game theorists draw relatively comparable conclusions from evolutionary game theory. The economists Samuel Bowles and Herbert Gintis (2002; 2013), for example, also insist on the centrality of fairness in the way in which real human beings "play" in the game of life. In fact, they place a greater emphasis on the potentialities for social cooperation than Binmore arguably does, although the distance is not considerable. In their definition of *reciprocity*, they insist on the importance of negative altruism, i.e., the will to punish free loaders (which goes beyond Binmore's tit-for-tat definition of reciprocity). The upshot is that a game does not have to be repeated to lead to cooperation. Neither Bowles nor Gintis are very favorable to Austrian economics per se but their findings suggest that if pro-market reformers can find ways to embed the notion of fair reciprocity in the programs they advocate, they might gain more traction than relying exclusively on abstract natural law or utilitarian arguments. The key here is to align policy reforms with prevailing norms; it is not enough to show that such reforms would "float all boats" in the long run but that some mechanisms can be put in place to ensure a fair allocation of the costs associated with the transition away from centralized bureaucratic schemes. One possible way of doing so is to combine greater reliance on markets and private property rights with the implementation of a Basic Income Guarantee (BIG).

10 For a thoughtful but rather critical review of Binmore's *Natural Justice*, see Mackie (2006); see also the symposium on Binmore in the journal *Politics, Philosophy & Economics* (February 2006).

Space lacks here to explore this particular issue which I mention only to illustrate what a focus on fairness *could* imply.[11]

These remarks in no way exhaust the scope of game theoretic concepts and models that could be deployed to effect policy changes but space lacks here to discuss them all (but see McCain 2009).

Conclusion

To conclude, game theory has made such important contributions to the social sciences, philosophy, and evolutionary biology/psychology that it cannot be completely shunted by any research program without it becoming parochial and insular. As I have underlined, opinions differ as to what are the potential "gains from trade" between Austrian economics and game theory. But exploration of this question should continue. All the same, no complete convergence between these approaches is in sight, nor would it be desirable. However, Austrian economists should not consider game theory as a threatening incursion into their domain when it is used as a reference point for achieving institutional reforms and for deciding on political strategies aimed at the implementation of market-friendly policy recommendations. As I see them, the lessons of game theory are that negotiations are generally fraught with unexpected difficulties and that the best way to minimize these obstacles is to proceed cautiously at a decentralized level. Social and cultural norms (to the evolution of which Hayek paid a great deal of attention) act as severe constraints on reformers. It is best to experiment at the local level or, in any event, in a setting where lessons can be learned and cooperation is more likely to result from such learning process. In a way, game theory is rediscovering an insight that Alexis de Tocqueville had brilliantly proffered almost two centuries ago!

11 Austrian economists are divided about the desirability and feasibility of a BIG (see Nell [2013]); I have myself written that while attractive, it seems to be politically unrealistic (Dobuzinskis 2013). The recent referendum in Switzerland bears my point, although interesting pilot programs are initiated or contemplated in Finland, the Netherlands and a few other places.

References

Andersen, Steffen, John Fountain, Glenn W. Harrison and E. Elisabeth Rutstrom (2014). "Estimating Subjective Probabilities." *Risk and Unertainty* 48, no. 3: 207-229.

Andersson, David, ed. (2012). *The Spatial Market Process* Advances in Autrain Economics vol. 16. Bingley, UK: Emerald Group.

Arena, Richard and Lauren Larrouy (2015). "The Role of Psychology in Austrain Economics and Game Theory: Subjectivity and Coordination," GREDEG Working Paper. Nice: University of Nice Sophia Antipolis.

Aumann, Robert (2002). "Game Theory in the Talmud." Research Bulletin Series on Jewish Law and Economics. Ramat Gan: Bar-Ilan University.

Bacharach, Michael (1986). "The Problem of Agents' Beliefs in Economic Theory." In M. Baranzini and R. Scazzieri, eds. *Foundations of Economics.* Oxford: Blackwell.

Bacharach, Michael (1992). "Backward Induction and beliefs about Oneself." *Synthese* 91, no. 3: 247-284.

Bacharach, Michael (2006). *Beyond Individual Choice: Teams and Frames in Game Theory*, Natalie Gold and Robert Sugden, eds. Princeton: Princeton University Press.

Binmore, Ken (1994). *Playing Fair: Game Theory and the Social Contract I*. Cambridge, MA: MIT Press.

Binmore, Ken (1998). *Just Playing: Game Theory and the Social Contract II*. Cambridge, MA: MIT Press.

Binmore, Ken (2005). *Natural Justice*. Oxford: Oxford University Press.

Binmore, Ken (2009). "Game Theory and Institutions." Working Paper. London: Centre for Economic Learning and Social Evolution.

Bowles, Samuel and Herbert Gintis (2002). "Homo Reciprocan." *Nature* 415: 125-128.

Bowles, Samuel and Herbert Gintis (2013). *A Cooperative Species: Human Reciprocity and its Evolution*. Princeton: Princeton University Press.

Brams, Steven J. (2011). *Game Theory and the Humanities*. Cambridge, MA: MIT Press.

Buchanan, James ([1972] 2005). "Before Public Choice." In Edward Stringham, ed. (2005). *Anarchy, State and Public Choice*. Cheltenham, UK: Edward Elgar.

Cachanosky, Nicolas (2010). "Spontaneous Orders and Game Theory: A Comparative Conceptial Analysis." *Revista de Instituciones, Ideas y Mercados* 52 (May): 52-88.

Cevolani, Gustavo (2011). "Hayek in the Lab: Austrian School, Game Theory and Experimental Economics." *Logic and Philosophy of Science* IX, no. 1: 429-436.

Chwe, Michael Suk-Young (2013). *Jane Austen, Game Theorist*. Princeton University Press.

Dekel, Eddie and Marciano Siniscalchi (2015). "Epistemic Game Theory." In *Handbook of Game Theory* Vol. 4, eds. H. Peyton Young and Schmuel Zamir. Amsterdam: Elsevier.

Dimand, Mary A. and Robert Dimand (1996). *The History of Game Theory, Volume 1: From the beginnings to 1945.* New York: Routledge.

Dobuzinskis, Laurent (2013). "A Little Less than BIG: A Pragmatic Perspective on Remedying Injustice." In G.L. Nell, ed. *Basic Income and the Free Market: Austrian Economics and the Potential for Efficient Redistribution*. Palgrave Macmillan.

Erickson, Paul (2015). *The World Game Theorists Made*. Chicago: University of Chicago Press.

Floss, Nicolai (2000). "Austrian Economics and Game Theory: A Stocktaking and an Evaluation." *Review of Austrian Economics* 13: 41-58.

Garnett, Robert, Erik K. Olsen and Martha Starr, eds. (2009). *Economic Pluralism*. London: Routledge.

Giocoli, Nicola (2003). *Modeling Rational Agents: From Interwar Economics to Early Modern Game Theory*. Cheltenham, UK: Edward Elgar.

Giocoli, Nicola (2009). "Three Alternative (?) Stories on the late 20th-Century Rise of Game Theory." *Studi e Note de Economia* XIV, no. 2: 187-210.

Kelly, Yvan J. (2009). "Mises, Morgenstern, Hoselitz, and Nash: The Austrian Connection in Early Game Theory." *The Quarterly Journal of Austrian Economics* 12, no. 3: 37-42.

Koppl, Roger (2009). "Austrian Economics at the Cutting Edge." *Review of Austrian Economics* 19: 231-241.

Leonard, Robert (1995). "From Parlor Games to Social Science: Von Neumann, Morgenstern, and the Creation of Game Theory 1928-1944." *Journal of Economic Literature* 33, no. 2: 730-761.

Leonard, Robert (2010). *Von Neumann, Morgenstern, and the Creation of Game Theory: From Chess to Social Science, 1900—1960*. Cambridge: Cambridge University Press.

Mackie, Gerry (2006). Review of *Natural Justice* in *Ethics* 116, no. 4: 776-780.

Maschler, Michael, Eilon Solan and Shmuel Zamir (2013). *Game Theory*. Cambridge; Cambridge University Press.

Michener, H. Andrew, Kathryn Potter, Greg B. Macheel and Charles G. Depies (1984). "A Test of the von Neumann-Morgenstern Stable Set Solution in Cooperative Non-Sidepayment N-Person Games." *Systems Research and Behavioral Science* 29, no. 1: 13-27.

McCain, Roger A. (2009). *Game Theory and Public Policy*. Cheltenham, UK: Edward Elgar.

Nell, Guinevere L., ed. (2013). *Basic Income and the Free Market: Austrian Economics and the Potential for Efficient Redistribution*. New York: Palgrave Macmillan.

Oprea, Ryan and Benjamin Powell (2010). "Why Austrians Should Quit Worrying and Learn to Love the Lab." In Roger Koppl, Steven Horwitz, and Pierre Desrochers, eds. *What is so Austrian about Austrian Economics?* (Advances in Austrian Economics, Volume 14). Bingley, UK: Emerald Group Publishing Limited.

Osborne, Jason ([1972] 2005). "Jungle or Just Bush? Anarchy and the Evolution of Cooperation." In Edward Stringham, ed. (2005). *Anarchy, State and Public Choice*. Cheltenham, UK: Edward Elgar.

Pennington, Mark (2011). *Robust Political Economy: Classical Liberalism and the Future of Public Policy*. Cheltenham, UK: Edward Elgar.

Rothbard, Murray (1973). *For a New Liberty*. New York: Macmillan.

Rothbard, Murray (1982). *The Ethics of Liberty*. Atlantic Highlands, NJ: Humanities Press.

Sauce, Loïc (2014). "Austrian Economics and Game Theory: Any Gains from Trade?" Working Paper, Paris: ISTEC Business School.

Samuels, Warren ([1974] 2005). "Anarchism and the Theory of Power." In Edward Stringham, ed. (2005). *Anarchy, State and Public Choice*. Cheltenham, UK: Edward Elgar.

Scott, W. Richard (2014). *Institutions and Organizations,* 4th ed. Los Angeles: SAGE.

Skyrms, Brian (2004). *The Stag Hunt and the Evolution of Social Structure*. Cambridge: Cambridge University Press.

Smith, John Maynard (1982). *Evolution and the Theory of Games*. Cambridge: Cambridge University Press.

Stringham, Edward, ed. (2005). *Anarchy, State and Public Choice*. Cheltenham, UK: Edward Elgar.

Sugden, Robert ([1986] 2005). *The Economics of Rights, Cooperation and Welfare*. New York: Palgrave Macmillan.

von Neumann, John and Oskar Morgenstern ([1944] 2004). *The Theory of Games and Economic Behavior*. Princeton: Princeton University Press.

Weintraub, E. Roy, ed. (1992). *Toward a History of Game Theory*. Durham, NC: Duke University Press.