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Integrating Institutional and Neoclassical Economics Using Game Theory

Dan Friesner
Gonzaga University

Dan Axelsen
PricewaterhouseCoopers LLP

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DAN FRIESNER
GONZAGA UNIVERSITY

DAN AXELSEN
PRICEWATERHOUSECOOPERS LLP

ABSTRACT

We contend that economics is in need of a new paradigm. When taught in the traditional neoclassical construct, economics is not appealing to many students, particularly those taking economics to satisfy general education requirements. This, in turn, may explain why economic literacy in the U.S. is trending downward. Our approach uses game theory to teach economics by juxtaposing neoclassical and institutional economic paradigms so that students not only better understand the neoclassical model, but also are exposed to alternative approaches in economics. To better understand neoclassical models, we incorporate three institutional criticisms of neoclassical economics: (1) the assumption that all individuals are perfectly rational, (2) the propensity to create theories using static models that take as given (and usually ignore) important, exogenous factors influencing decision-making processes, and (3) an emphasis on modeling techniques and less of an emphasis on what is actually being modeled and how it is being modeled. We also integrate institutional and neoclassical economics by illustrating how history, culture, and emotion interact with the traditional neoclassical principles to inform economic decision-making via simple (evolutionary) games that can be used in the classroom.

I. INTRODUCTION

Neoclassical economics (NCE) has become the dominant means of teaching and practicing economics. NCE efficiently illustrates how formal models can be used to describe economic and social behavior. However, to make these models tractable, neoclassical economists generally posit a series of assumptions. These assumptions often limit the ability of such models to accurately and precisely explain decision-making in the world as it actually exists. This, in turn, reduces the depth and breadth of skills and information transferred to economics students in the classroom. While assumptions allow the economist the means to model the world in its simplest form, the end result is often unrealistic because the “true” world is much more complex than the model allows it to be.

Institutional economists further this argument by identifying several assumptions that limit the viability of NCE models. They argue that NCE models can be criticized on at least three grounds. The first is the assumption that all individuals are perfectly rational. That is, emotions and values are independent of the decision-making process of the rational economic agent. Realistically, individuals do not always make decisions that maximize their net benefits, as if each rational agent is the same as the next with the exception of current “preferences”. While this assumption may be appropriate in certain instances (or possibly on aggregate or on average), other social science researchers (including marketers, sociologists, psychologists, ethicists and non-neoclassical economists) argue that this definition of rationality is too strict. Instead, individuals “make mistakes” and act on impulse, emotion, and incorporate their values in their decision-making, especially under time and information constraint.

A second criticism of NCE is the propensity of neoclassical economists to create theories and testable hypotheses using static models. Static models generally take as given (and usually ignore) important, exogenous factors influencing decision-making processes. As such, little thought is given to how past experiences influence current decision-making, or the role that the evolution of economic and/or political institutions plays in current decision-making. To some extent these assumptions are self-supporting; if one holds constant an individual’s history and experience, the assumption of perfect rationality seems plausible. However, ignoring these factors also leads to limited (and possibly inaccurate) theories and testable hypotheses, especially if we believe that history and past experience can in fact shape current decision-making. Often NCE only analyzes the “where you are at?” and not the “how did you get there?” hypotheses.

A third, and perhaps more important criticism, is that neoclassical economists, particularly when teaching at the principles level, often present an economic model as an end in and of itself. That is, neoclassical economists usually assume that no alternatives which explain the same behavioral processes exist. Moreover, the model itself often becomes the focus of learning, not the issue the model attempts to address (Hansen, 1991). The values, underlying assumptions and the way in which these values and assumptions shape the outcomes of the model are not taught, discussed, or explained to the student. This becomes especially problematic when i) other behavioral models do exist and they are ignored or ii) when the neoclassical model does not provide an accurate or precise explanation for the phenomenon in which it is attempting to explain. As a result, economics loses its appeal to students taking an economics course for the first time.

Recently, economists have begun searching for approaches to address these issues. One promising approach is the use of game theory. Game theory was developed by mathematicians and has been applied in a variety of fields (including anthropology and evolutionary biology) where static models are not the norm. Game theory can be used to address how history, experience, and culture influence and shape decision-making. Evolutionary games have also been adapted to include various types (or levels of) rationality. This allows the decision-maker to exhibit "bounded-rationality" – that is, to make mistakes or act on impulse, but subsequently learn from those mistakes and make better (self-interested) decisions over time.

Now, on the institutional side, some consideration must be given to the fact that many institutional economists are skeptical about (or adamantly against) the use of formal economic modeling. Depending on one's view about the use of formal modeling, game theory can serve one of two distinct purposes. For those who do not have an aversion to formal modeling, game theory can be a useful tool for advancing institutionalist thought. At a technical level, neoclassical economists such as Douglass North and Oliver Williamson have used game theory to address institutional issues for several decades (Dugger, 1995; Fiori, 2002). More recently, several studies have used game theory as a tool to analyze decisions from a purely institutional perspective. For example, Tomass (1997) uses game theory to address irrational behavior and sectarian cleansing. Villena and Villena (2004) demonstrate that under many conditions, Veblen's theory of evolutionary economics is consistent with that of evolutionary game theory. These papers imply that as long as institutional economists are willing to adopt (or tolerate) a formal approach to economics, game theory can be a useful technical tool.

Alternatively, if one is unwilling to cede the use of formal economic models in institutional thought, one can apply these tools as another means to demonstrate the shortcomings of NCE. That is, one can use the same tools advanced by NCE to show that NCE does not always fulfill its goal of adequately describing decision-making processes. In this case, our paper argues that game theory can be used as a critical device, which can be introduced into economic pedagogy.

In either case, our intent is to provide a case study that demonstrates the pedagogical uses of game theory in general and evolutionary economic games in particular. Although game theory can be used to teach economics at every level, we focus our attention on incorporating these tools into principles of economics courses because this is often the only economics course students take.

The remainder of this paper proceeds in four steps. We first provide a review of literature that demonstrates the need for a new paradigm at the principles level. Next, we briefly discuss the premise of both institutional economics and game theory, with an emphasis on the similarities (and differences) between the two modes of thought. Third, we provide a series of examples to illustrate how institutionalist thought can be integrated into simple, evolutionary games for classroom use. We conclude the paper by discussing our findings and provide several recommendations for future work.

II. WHY A NEW PARADIGM IS IMPORTANT

Economic literacy in the US is low and principles courses are having little to no impact on economic literacy (Walstad and Rebeck, 2002; Walstad and Algood, 1997). Given that 40 percent of all college students take at least on economics course one would expect economic literacy to be higher (Siegfried, 2000). One possible explanation for low economic literacy given relatively high levels of economic exposure is that educators are not able to convey economic concepts to students in a way that allows students to retain and learn the information. As a result, economic educators have begun to explore different approaches that might improve economic literacy. Two common approaches are to institute an "active learning" approach (Becker, 2001; Siegfried and Sanderson, 2003) and to change the institutional framework, for example, by altering student to teacher ratios (Siegfried and Sanderson, 2003).

Hansen, Salemi and Siegfried (2002) provides a different recommendation, discussing content they believe should be cut from the introductory curriculum. On the micro side, they advocate limiting the use of graphs and elasticities, the discussion of cost curves and comparisons of different types of imperfectly competitive markets. On the macro side, they suggest eliminating aggregate demand/supply analysis, removing formulas for Keynesian multipliers and reducing the amount of time spent covering national income accounting. They also follow Becker (2001) and Siegfried and Sanderson (2003) by advocating, whenever possible, the use of active learning as well as adding "really cool stuff" to the course content.

A related approach posited by Knoedler and Underwood (2003, 2004) and Underwood (2004), argues that, at its essence, economics is a study based on critical thinking. The problem with traditional principles of economics courses is that, by paying too much attention to the tools, students are led to believe that the tools are an end in and of itself. Thus, students learn (or more likely memorize) how the tools works, not what issue the tools are attempting to address. As a result, students are not learning critical thinking skills. Instead, they are learning analytical thinking skills, which are more easily forgotten, less easily applied to real-world problems, and less interesting to students. Moreover, adding case studies and supporting information to a tools-oriented economics course is less interesting and less conducive to learning because it forces the instructor to find a case that "fits" the tool being discussed. And because most economic models make a number of questionable assumptions to maintain tractability (for example, rationality and the use of static models) it is often difficult for an instructor to find a convincing, interesting case that closely fits the tool. The authors are also careful to note that analytical skills are neither more nor less important than critical thinking skills. Instead, they argue that the way in which introductory economics courses are currently taught does not strike a proper balance between analytical and critical thinking. As a result, adding critical thinking content to (and at the same time reducing analytical content in) introductory courses should enhance learning outcomes.

In making these arguments, Knoedler and Underwood (2003, 2004) and Underwood (2004) also provide an interesting criticism of the aforementioned studies. The problem with teaching and learning introductory economics is not what material is cut from the course or what "neat stuff" is added. Instead, the problem is the tools, themselves, that are used to convey economic concepts. More specifically, because more Ph.D. programs train economists to think within a formal structure (usually a neoclassical paradigm), that, in turn, is how they relate those economic issues to their students. But as long as these tools and paradigms are used in principles of economics courses, the problem will persist. Thus, the aforementioned studies at best marginally reduce the problem, and at worst are ineffective.

The solution, according to Knoedler and Underwood (2003, 2004) is to take a historical (or institutional) approach to teaching principles of economics. That is, the "neat stuff" posited by Becker should not simply be "added on" to current course material; it should instead be the focal point of the lecture or class discussion – at least at the principles level. The role of the instructor, then (whether through a chalk and talk method, one of active learning, or some combination of the two) is to encourage students to think critically about the decision-making processes, history and cultural influences surrounding an event to subsequently deduce the underlying economic principle(s). In doing so, students learn economic concepts in a manner that is more effective and interesting because they are able to take a real-world problem and figure out the economics on the basis of their own experiences, logic and intuition.

Despite its novelty, Reardon (2004) notes that such an approach is not without its drawbacks. Perhaps most importantly, economics instructors, the majority of whom are trained as neoclassical economists, are loathed to give up their tool-oriented approach in favor of an alternative approach, however novel, unless there is a definable method of presenting these economic concepts to students. Put another way, there is a significant opportunity cost to instructors in changing the paradigm by which economics is taught. As a result, even if this new paradigm is successful in increasing interest and retention of economic concepts, academic economists will be unwilling to adopt it. Consequently, this new paradigm is not viable unless it can be placed within a structure familiar to most (neoclassical) economists.

In this paper, we argue that there is at least one common thread that links traditional economics courses to the paradigm posited by Knoedler and Underwood – the use of game theory in general, and evolutionary game theory in particular. If this link exists, then it may be possible to make changes in how instructors teach introductory economics courses to ensure that students who successfully complete these courses gain some added value. In the next section, we establish how game theory represents that link.

III. GAME THEORY AS A MEANS OF COMBINING CRITICAL THINKING WITH ECONOMIC CONTENT

Our analysis operates under a series of assumptions regarding the value and content of the economics discipline as a whole. First, we assume that economics is a social science that can be learned and applied to explain and predict individual decision-making. That is, we assume that the discipline of economics has validity, and thus makes a unique contribution to the depth and breadth of human knowledge. Secondly, we assume that economics does take its fundamental genesis from the process of critical thought. Lastly, we assume that economics is relevant enough to students' lives that, if an economics course is taken seriously by its students and conducted appropriately by its instructor, a significant portion (if not a majority) of students will find the course interesting and useful.

Taken in tandem, these assumptions guarantee that there is *at least one* approach to teaching economics (and principles of economics courses in particular) that adds some value to the typical student's base of knowledge. If these assumptions hold, the crucial issues are i) whether (evolutionary) game theory can be categorized as one of these "optimal" approaches and ii) whether game theory is sufficiently general enough that it can be accepted by mainstream (neoclassical) economists as a legitimate and viable alternative to the traditional approach. Our intent is not to show that game theory is the *only* such approach. Indeed, there are likely a number of equally viable approaches, of which game theory is only one possibility. One such alternative is to teach economics using a "history of thought" approach. That is, to teach economic tools and concepts within a historical perspective, and then show how those ideas (and their accompanying formalistic models) evolve over time. As the models and ideas change, one can then highlight the shortcoming of those models, and how historical and institutional changes were responsible for those shortcomings.

Given our assumptions, we can address these issues by answering the following series of questions:

1) Is game theory “mainstream”?
2) Can game theory be used to teach a broad group of students?
3) Does game theory reduce the emphasis on learning a set of economic models and place more emphasis on using historical and cultural context, critical thinking and logical deduction to analyze decision-making?
4) Can game theory be used to relax potentially unrealistic assumptions (including rationality and the use of static models) inherent in traditional neoclassic analysis?
5) Can game theory be taught in a way that makes economic concepts “really cool” to a majority of students?

The remainder of this section attempts to address each of these questions. While it is nearly impossible to answer each of these questions in absolute terms, our goal is to provide a compelling argument stating that the answers to these questions are “yes”.

1. IS GAME THEORY “MAINSTREAM”?

Game theory has become an integral part of graduate and undergraduate economic education. As evidence, game theory has made its way into many principles’ texts (McEachern, 2006; Frank and Bernanke, 2001; Colander, 2004; McConnell and Brue, 2005) and has become a part of micro economic fields such as public choice and industrial organization (Triole, 1988; Mueller, 1997). At the principles level game theory has begun to show in more than just the oligopoly chapters. For instance, Frank and Bernanke (2001) use game theory in their information economics chapter. Game theory is also being used to teach econometrics and macro theory (Alesina, Boubini and Cohen, 1997). Therefore, we do believe that game theory is a part of “mainstream” economics and generally accepted by neoclassical economists and some institutional economists as a viable pedagogical tool.

2. CAN GAME THEORY BE USED TO TEACH A BROAD GROUP OF STUDENTS?

A thorough understanding of game theory is not restricted to students with high levels of mathematical training. Game theory can be used to teach students at all levels of mathematics. Secondly, because game theory was developed by mathematicians it has found its way into many different disciplines including anthropology, evolutionary biology, ethics and psychology (just to name a few). The Dixit and Skeath (2004) text is a good example of how game theory can be used to blend economics with other disciplines. As a result, economics becomes more interesting to non-majors, who can use economic reasoning to address issues that do interest them. This could be very important in reaching students who are taking economics only to satisfy general education requirements. For the economics major, game theory teaches students the concepts that would have been learned in the traditional construct, in addition to teaching students the role that assumptions play in shaping outcomes. That is, game theory teaches students to think both critically and analytically.

3. DOES GAME THEORY EMPHASIZE HISTORY, CULTURAL CONTEXT, CRITICAL THINKING AND LOGICAL DEDUCTION?

Game theory is well grounded in the case study approach to teaching. Therefore, in order to model the game appropriately the modeler must understand the players in the game, their tastes and preferences, the historical and cultural context and the general characteristics of the players involved in the game. It is only when these fundamental characteristics of the game are understood that the game can be modeled appropriately and the outcomes understood (Foss, 2000). The case makes the game come alive to students, and as a result is more interesting to students. This is a far cry from the "guns" and "butter" examples so many of us had to endure in our principle's courses.

4. CAN GAME THEORY BE USED TO RELAX POTENTIALLY UNREALISTIC ASSUMPTIONS INHERENT IN TRADITIONAL NEOCLASSICAL ANALYSIS?

There is a substantial literature on learning in economic games, as well as an emphasis on dynamic, repeated decision making in game theory, both of which are the common criticisms of the neoclassical paradigm (McCain, 2004; Dixit and Skeath, 2004; Gardener, 2003). In the next section, we provide some examples of how to incorporate games into principles-level teaching. Moreover, we have specifically chosen as our examples some games that highlight the failure of the neoclassical paradigm as well as show the advantage of game theory in teaching these same concepts.

5. CAN GAME THEORY BE A WAY TO MAKE ECONOMICS "REALLY COOL" TO A MAJORITY OF STUDENTS?

At its very essence, game theory is exactly what its name suggests – games. From the beginning of one's life to the end of one's life, we play games. All that changes over the course of most of our lives is the type of games we play. As children, we play board games and games of "chase", such as "hide and go seek". As young adults (as college students) the games we play are more social and soul searching; for instance, games related to dating, partying, and pop culture. But regardless of the game(s) being played, they all involve interactive decision-making; that is, making "good" choices when those choices influence (or are influenced by) the choices of others. Thus, game theory is not only relevant to students of economics, but "fun", "interesting" and "really cool" as well, so long as the instructor is careful to choose case studies and hypothetical examples that directly relate and are interesting to students' lives.

IV. PEDAGOGICAL ILLUSTRATIONS

In this section we illustrate how game theory can be incorporated into economic pedagogy at the introductory level. Special emphasis is given to evolutionary and bounded rationality games, as they also highlight how game theory can be used to relax some of the unrealistic assumptions inherent in the traditional neoclassical paradigm in addition to incorporating tenants of institutional economics.

We assume that students (and the reader) are familiar with the concept of a Nash Equilibrium, and how it can be applied to solve both simultaneous and sequential games. We refer the reader to Dixit and Skeath (2004) or Gardener (2003) if this is not the case. If an introductory economics course were to be based solely around game theory, the instructor would likely introduce this technique at the beginning of the course, prior to discussing any substantial economic content. As such, this assumption seems innocuous.

The difference between our approach and that of traditional NCE principles courses is that, by forcing the students to create the game and conduct the sensitivity analyses themselves, they are learning critical thinking skills. By solving the game, students are also learning the analytical skills traditionally emphasized in these courses. Thus, the use of game theory (especially when applied in the context of case analysis and story problems) provides a unique blend of skills necessary for student retention and interest. Additionally, by choosing cases and/or story problems that are of interest to students, one can also incorporate the "really cool stuff" advocated by Becker (2001).

1. A STORY PROBLEM THAT PROVIDES AN ALTERNATIVE TO TRADITIONAL UTILITY MAXIMIZATION

Pam A. likes K-Rock, and K-Rock likes Pam A. The problem is that they both have their reputation to uphold, thus neither wants to ask the other out. One way for them to minimize their respective egos is to try and be at the same establishment, at the same time, so that they can flirt with one another. K-Rock spoke with T-Lee, Pam A.'s former husband, and found out that she hangs out at two different places, depending on her "mood". Pam A. either goes to the Reflex too drink herbal tea and listen to mellow tunes, or she goes to the Go-Go (a techno-club) for some dancing. Suppose that K-Rock really enjoys going to the Reflex and is only interested in going to the Go-Go if Pam A. is there. Alternatively, Pam A. prefers the Go-Go, particularly if K-Rock shows up.

This scenario provides information about both players' value set. There is also information regarding the tradeoffs and alternatives faced by both players. To this point, however, there is no quantitative definition of the payoffs, e.g., the happiness received from various choices by each player and no mention of rationality or maximization.

Consequently, in order to set up and solve the game, students must make some additional assumptions about these issues. Suppose, for example, that students choose to assume that i) decisions are to be made simultaneously, ii) individuals are rational and self-interested and iii) the payoffs can be defined qualitatively via an ordered ranking from "best" to "worst". Given these assumptions, the game may be constructed as follows:

FIGURE 1
THE BASIC GAME IN NORMAL FORM

K-Rock

		Reflex	Go-Go
Pam A.	Reflex	(better,best)	(worst,worst)
	Go-Go	(OK,OK)	(best,better)

Each cell in the table (or normal form game) contains a pair of "payoffs", or potential outcomes for each player. Reading from left to right, the first payoff in each cell corresponds to the decision-maker listed on the rows of the table. The second payoff corresponds to the individual listed on the columns of the table. Based on the Nash equilibrium concept, this game can be solved to deduce two "optimal" decisions: one where both individuals meet at the Reflex and one where both meet at the Go-Go.

This set of assumptions produces an equilibrium that is of particular interest to institutional economics: multiple equilibria. That is, when one has limited (usually qualitative) information on which to base decisions, and when one specifically takes values and culture into account, it is often the case that there is more than one "optimal", or "equally best" decision. The question then becomes whether and how individuals choose among these different "optimal" choices. If one can reasonably assume numerical values for each of the payoffs, then a parsimonious approach is to assume that each party simply "guesses", or randomly chooses one of the optimal alternatives a certain proportion of the time. In this case, one can find a "mixed strategy Nash Equilibrium" (MSNE), which simply identifies each of these proportions (or empirical probabilities).

To calculate the MSNE, let us assume, for example, that happiness for each party can be measured on a 0 to 100 interval, with the "best" outcome equal to 100, a "better" outcome equal to 66.67, an "OK" outcome equal to 33.33, and a "worst" outcome equal to 0 for each player. One might choose to label this interval in percentage terms, so that 100 implies "complete happiness" and 0 implies "complete unhappiness". Students may also assume different numerical payoff structures, which, in turn, dictate the MSNE. Instructors may choose to determine the MSNE under several different payoff systems to further underscore the fact that values dictate assumptions which, in turn, dictate decisions.

Given our numerical values (which are consistent with the initial game's pure strategy Nash equilibria), the new game consequently takes the following form:

FIGURE 2
ADDING NUMERICAL VALUES

		K-Rock: Reflex	K-Rock: Go-Go
Pam A.	Reflex	(66.67,100)	(0,0)
	Go-Go	(33.33,33.33)	(100,66.67)

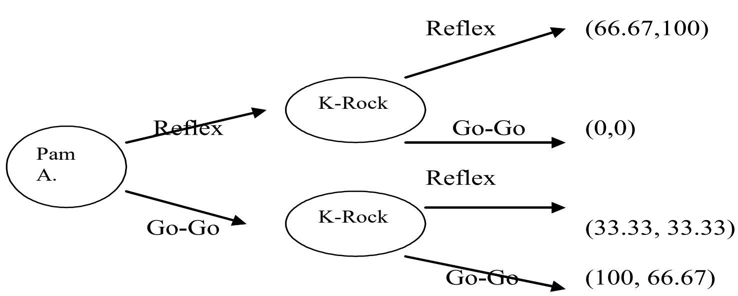
The idea behind the MSNE is that, if each player randomly chooses an alternative a proportion of the time, then each player will obtain an expected value (or a weighted average of the two outcomes, where the proportions are the weights) for each alternative. If there are two "optimal" choices, then each, at least on average, should yield the same net payoff. Moreover, by definition, each player must choose some alternative; thus the sum of the proportions must equal one. The trick to the MSNE is that one individual's expected value depends on the proportion (or probability) that the other individual makes a specific choice. That is, Pam A.'s average happiness depends on what K-Rock chooses, and vice-versa. In algebraic terms, this can be represented for Pam A. as:

1. $EV^{Reflex}_{PamA.} = \left(p^{Reflex}_{K-Rock}\right)66.67 + \left(p^{Go-Go}_{K-Rock}\right)0$
2. $EV^{Go-Go}_{PamA.} = \left(p^{Reflex}_{K-Rock}\right)33.33 + \left(p^{Go-Go}_{K-Rock}\right)100$
3. $EV^{Reflex}_{PamA.} = EV^{Go-Go}_{PamA.}$
4. $p^{Reflex}_{K-Rock} + p^{Go-Go}_{K-Rock} = 1$

Using algebra, we find that K-Rock randomly chooses to frequent the Go-Go 25 percent of the time and the Reflex 75 percent of the time. By similar logic, we find that Pam A. goes to the Reflex 25 percent of the time and the Go-Go 75 percent of the time. The average payoff for each player is then 50.

Yet another drawback to NCE is the over-use of static models. Our previous example can also be considered a static game, since it is assuming that each individual makes his or her decision simultaneously. However, we can easily adapt our current game to a dynamic format by allowing individuals to make sequential decisions (holding all other assumptions in place). To do so, we need only construct a decision tree with the payoffs from the previous game. Let us assume that Pam A. makes her choice first. In this case, the decision tree takes the following form:

FIGURE 3
THE GAME IN DYNAMIC FORM

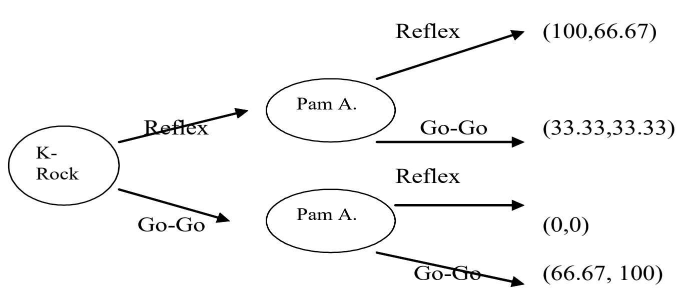


Note that whoever makes the first decision also has their payoffs listed first. The second decision-maker's payoffs are listed next.

To find the Nash equilibrium, we employ a technique known as backward induction. The idea behind this technique is, in order to incorporate strategy into each individual's decisions', we must solve the game in reverse. Since this is a two-stage game, we start with K-Rock's decision set. If Pam A. goes to the Reflex, K-Rock's best option is also to go to the Reflex. On the other hand, if Pam A. goes to the Go-Go, K-Rock will also choose the Go-Go. Now move back to the first decision of the game. If Pam A. chooses to go to the Reflex, she knows that K-Rock will choose to follow her there, giving her a payoff of 66.67. On the other hand, she also anticipates that K-Rock will also follow her to the Go-Go if she chooses this option. Since she likes the Go-Go better than the Reflex (especially since K-Rock follows her there), she chooses the Go-Go, as does K-Rock.

As with the static game, the dynamic game also allows an instructor to stress how values and culture shape decision-making. First, note that, by allowing one individual to make decisions prior to the other, we no longer have multiple "best" choices. Instead, the individual choosing first was able to influence the joint decision-making process such that this individual (in this case, Pam A.) was able to obtain an outcome that was the best she could hope for (she goes to the Go-Go which she prefers and meets K-Rock there). A related question that naturally arises is whether the outcome would be different if the order of decision-making were reversed. If so, then, again, the individual choosing first is able to skew the decision-making process in his or her favor. In game theory, this is known as a "first mover advantage". In an institutional economics framework, this is the influence of history, culture and psychology on decision-making. To verify whether such an advantage exists, we reverse the order of play and utilize backward induction:

FIGURE 4
FIRST MOVER ADVANTAGE



Using logic similar to the previous game, we do indeed find that there is a first mover advantage. In this case, Pam A. now follows K-Rock. K-Rock, anticipating this, now chooses to go to the venue he prefers most – the Reflex. So by reversing the order of decision-making, K-Rock is made better off at the expense of Pam A, but both are better off than they would have been if they had not gone to the same venue.

As an economics instructor, the concept of a first mover advantage allows the instructor a tremendous opportunity to discuss the role values, culture, and history play in decision-making. For example, in this case an assumption about which player moves first is roughly equivalent to making an assumption about who holds "power" in the relationship, or the role that culture (which helps shape "power") plays in decision-making. It has been more typical in American society, for instance, for the male to pursue the female.

Now let us discuss an example within an economics context. In games of business and market structure, the firm that moves first is essentially the dominant firm in the market. This naturally leads to a class discussion about how and why that firm has developed the dominant position in the first place. For instance, many smaller firms trying to compete with larger firms (i.e., Microsoft, IBM, etc.) often have to observe these firms' moves before making their business decisions (moves). If these smaller firms move first, they expose themselves to being "smashed" by larger firms. Again, as the moves are reversed, and the larger firm goes first they might employ "predatory" behavior. This, in turn, leads to a discussion of culture, values, and history.

A third criticism of NCE is that it often requires the assumption of both rationality and perfect foresight. As a result, it is impossible in traditional NCE (especially at a level commensurate with principles of economics courses) to learn by making mistakes (also known as "bounded rationality"), or through repeated interaction (which also encompasses learning over time). Again, we can use some simple algebra and game theory techniques to allow our dating example to account for these factors.

Suppose that we have a large number of men and women in Los Angeles similar to Pam A. and K-Rock (allowing two players to interact repeatedly over time would produce a similar result). For simplicity, we assume that all of the K-Rocks and Pam As have similar "likes and dislikes", or payoffs, about where they go to hang out. Each K-Rock is "randomly matched" (perhaps through a friend, or through word of mouth about where the women are planning to hang out) to a Pam A. After being randomly matched, each "couple" must simultaneously and non-cooperatively decide where to go. Let x be the proportion (or probability) of Pam As who choose to go to the Reflex (the other 1-x go to the Go-Go), and define y as the proportion of K-Rocks that go to the Reflex (again, the other 1-y go to the Go-Go).

To start, let's consider the choices for the Pam As. Their expected payoffs (or expected values) from going to the Reflex and the Go-Go, respectively, are given by:

5. $EV_{PamA.}^{\mathrm{Re}\,flex} = 66.67y + 0(1-y) = 66.67y$

6. $EV_{PamA.}^{Go-Go} = 33.33y + 100(1-y) = 100 - 66.67y$

Similarly, K-Rocks expected payoffs are given by:

7. $EV_{K-Rock}^{\mathrm{Re}\,flex} = 100x + 33.33(1-x) = 33.33 + 66.67x$

8. $EV_{K-Rock}^{Go-Go} = 0x + 66.67(1-x) = 66.67(1-x)$

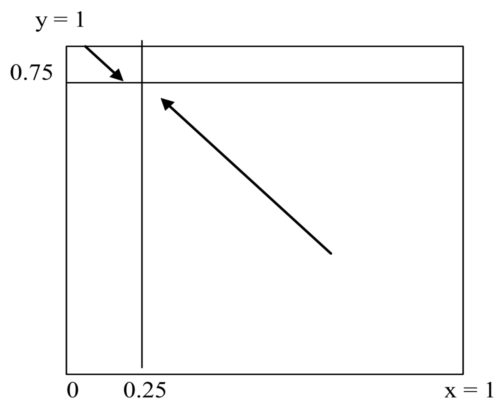
The central idea behind bounded rationality and repeated interaction is that, as the value of y (the proportion of K-Rocks going to the Reflex) increases, the Pam As who go to the Reflex will be better off than if they had gone to the Go-Go. Similarly, as x (the proportion of Pam As going to the Reflex) increases, each K-Rock is betteroff if he goes to the Reflex rather than the Go-Go (and vice versa if x and y decline). In common sense terms, this implies that the men want to be where most of the women are, and the women also want to be where most of the men are. Moreover, if a K-Rock can obtain a greater than average payoff by going to the Reflex, he will; otherwise, he will go to the Go-Go. The Pam As make an analogous decision. Thus, a greater (smaller) value for x will induce more K-Rocks to "switch" from the Go-Go to the Reflex (the Reflex to the Go-Go). An increase (or decrease) in y will have an analogous impact on the women.

The real difficulty with this scenario is that as changes in x induce more K-Rocks to switch to leave the Go-Go and head to the Reflex, this in turn changes y – the proportion of K-Rocks at the Reflex. This forces some women to switch locations as well. In short, there is feedback between the two groups of individuals, making it difficult for people to make a correct choice about where to hang out.

The equilibrium occurs when men and women stop "switching" locations. We note that one, naive way for the Pam As to stop switching locations (thus halting any change in x) when $EV_{PamA.}^{\mathrm{Re}\,flex} = EV_{PamA.}^{Go-Go}$. This occurs when y = 0.75. Values of y > 0.75 induce more women to go to the Reflex (thus increasing x), while values of y < 0.75 have the opposite effect. Analogously, the K-Rocks may naively cease switching (and halting any change in y) when $EV_{K-Rock}^{\mathrm{Re}\,flex} = EV_{K-Rock}^{Go-Go}$, which occurs when x = 0.25. The men switch to the Reflex when x > 0.25 and switch to the Go-Go when x < 0.25.

Taken in tandem, we reach a naive equilibrium (equivalent to our MSNE) where a quarter of the women go to the Reflex and three quarters of the men go to the Reflex. Figure 5 provides a phase diagram that depicts these joint decisions graphically:

FIGURE 5
BOUNDED RATIONALITY

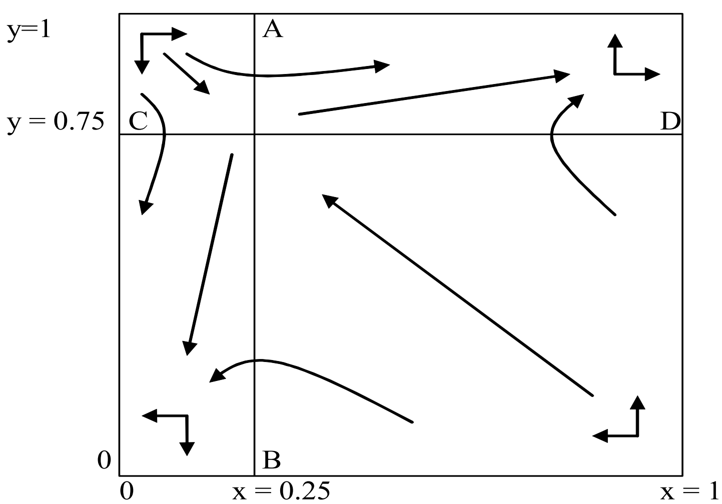


These mechanics raise several important questions, the most notable of which are how this analysis allows individuals to make mistakes, and how this analysis models repeated behavior. First, individuals make mistakes because of the feedback mechanism; as women switch from one location to another, the men are also forced to switch, and verse-vica. Consequently, the evolutionary stable equilibrium must be considered as an "average" or "long-run" concept. As long as individuals are still moving towards the equilibrium, they are still in the process of either making mistakes or learning from those mistakes. The analysis of repeated behavior stems from the fact that we are looking at a large number of individuals making these choices (or the same individual making a large number of choices over time). Thus, this process is consistent with the notion of a repeated experiment.

A final criticism of NCE that evolutionary game theory addresses is the "falsity" or "instability" of static equilibria. That is, by allowing individuals to evolve and/or make mistakes over time, the "optimal" decisions made in a static environment may, in fact, not be optimal, or "stable" at all. Our simple evolutionary game illustrates this effectively by examining the algebra and phase diagram in further detail. More specifically, further inspection reveals two *additional* equilibria; one at x = 0 and y = 0 (i.e., both the men and the women go to the Go-Go) and one at x = 1 and y = 1 (both go to the Reflex). That is, people may also stop switching when they "run out of options", or in mathematical terms, reach a boundary. The interesting result that occurs from this game is that the existence of these boundary equilibria makes the mixed strategy equilibrium unstable, and thus not an optimal choice.

To illustrate this, we need only consider a simple exercise, which is illustrated in Figure 6. If the two individuals don't make any mistakes and/or start near x = .25 and y = .75 (i.e., the intersection of the line segments AB and CD), it is conceivable that they could end up at the MSNE. But if any mistakes are made, or if one starts out at a point away from the MSNE (for example, at a point in the lower left quadrant where x = 0.2 and y = 0.5), then these decision-makers will gravitate towards the equilibrium where the men and the women both go to the same location. In this case, the men and the women are both better off by switching to the Go-Go, so that x = 0 and y = 0. Alternatively, if mistakes or decisions place the individuals in the upper-right quadrant, say, at x = .5 and y = .8, then both individuals are better off both going to the Reflex; that is moving towards x = 1 and y = 1. Similar arguments can be made if the men and women start in the other two quadrants. Thus, the completed diagram takes the following form:

FIGURE 6
FALSE EQUILIBRIA



To demonstrate this result algebraically, simply have students plug these values for x and y into the expected value functions for Pam A. and K-Rock. One will find that, for each player, the expected value of going to the Go-Go outweighs the expected value (or payoff) for going to the Reflex. As such, both the men and women will switch to the Go-Go. Over time or repeated decision-making, this reduces both x and y to zero.

This finding lends credence to two institutional criticisms of NCE. First, as mentioned previously, it is not always the case that the equilibrium posited in a static model is, in fact, optimal. In this example, the MSNE is not stable, particularly if mistakes are made.

A second, and perhaps more important, criticism is the concept of path dependency. If we look at a simple, normal form version of this game, we see that there are two pure strategy equilibria; one in which both sexes go to the Go-Go, and one in which both go to the Reflex. The evolutionary game shows us that which equilibrium we end up at depends crucially on where decision-making starts, and whether mistakes are made. Thus, the optimal decision is often a function of the path that is taken and the static solution is often not accurate when evolutionary path is not considered.

The strength of incorporating evolutionary games into economic pedagogy is that, but utilizing a simple example, one can actually make stronger conclusions about human behavior than had the instructor utilized a static model. In this simple example, we allow individuals to make mistakes and/or act irrationally, yet come to a conclusion that makes more sense to students: i) eventually, the men and the women meet at the "right" location and ii) where the "right" location is depends on the interactions, mistakes, cultures and values of the decision-makers.

V. CONCLUSIONS

We have tried to illustrate how institutional economists can use game theory to integrate institutional pedagogy with neoclassical pedagogy at the principles of economics level of education. In addition, although game theory is commonplace and generally accepted by mainstream economists, it can be used by institutional economists to demonstrate how these traditional means of analyses often lead to unrealistic outcomes – at least with regard to the institutional viewpoint – and, used by neoclassical economists to teach students critical thinking in addition to analytical thinking.

We began with a static analysis that is typical of those used in a principles course. From here, we introduced timing, relaxed rationality, and considered evolutionary and cultural perspectives in our game. After considering these important aspects we found that the evolutionary solution to the game was much different than the static solution. We then discussed how and why it was different, highlighting assumptions specified in the static game, and illuminating the fact that outcomes often depend on the path that is taken and that the static outcome is often not optimal when all of the relevant pieces are considered. As students begin to understand how assumptions shape outcomes they too begin to learn "critically". However, students are also learning the analytical skills that employers seek - those skills that differentiate an economist from many other disciplines.

We believe that game theory can be used by institutional economists at the principles level because it does not have to be taught using advanced mathematics, if taught creatively can be relevant and interesting to students and can combine adjacently institutional and neoclassical paradigms and analytical and critical thinking. Game theory is especially important to institutional pedagogy because evolution, history, and culture can be integrated into games. Not only are these things integrated, but they can set the foundation of the game and often shape the game's outcome(s). Game theory can also be used by institutional economists who want to analytically demonstrate how and why static models, which assume rationality of all economic agents, typically used by neoclassical economists to teach economic principles are often unrealistic and lead to incorrect outcomes; evolutionary game theory can serve this specific purpose, among others.

REFERENCES

Alesina, A., Boubini, N. & G. Cohen (1997). *Political cycles and the macroeconomy*. Cambridge, MA: MIT Press.

Becker, W. (2001). How to make economics the sexy social science. *Chronicle of Higher Education,* December 7.

Colander, D. (2004). *Economics* (Fifth Edition). New York, NY: McGraw-Hill.

Dixit, A. & S. Skeath (2004). *Games of strategy* (SecondEdition). New York, NY: W.W.
Norton and Co.

Dugger, W. (1995). Douglass C. North's new institutionalism. *Journal of Economic Issues,* 29(2), 453-459.

Fiori, S. (2002). Alternative visions of change in Douglass North's new institutionalism. *Journal of Economic Issues,* 36, 1025-1043.

Frank, R. & B. Bernanke. (2001). *Principles of economics*. New York, NY: McGraw-Hill.

Foss, N. (2000). Austrian economics and game theory: A stocktaking and evaluation. *Review of Austrian Economics,* 13, 41-58.

Gardener, R. (2003). *Games for business and economics* (Second Edition). Hoboken, NJ: John Wiley and Sons.

Hansen, W. L. (1991). The education and training of economics doctorates. *Journal of Economic Literature,* 29(3), 1054-1087.

Hansen, W. L., Salemi, M. & J. Siegfried (2002). Promoting economic literacy in the introductory economics course. *American Economic Review,* 92(2), 463-472.

Knoedler, J. & D. Underwood (2003). Teaching principles of economics: A proposal for a multi-paradigmatic approach. *Journal of Economic Issues,* 37(3), 697-725.

Knoedler, J. & D. Underwood (2004). Suggestions to effectuate a multiparadigmatic approach to the teaching principles of economics: A reply. *Journal of Economic Issues,* 38(3), 843-845.

McCain, R. (2004). *Game theory: A non-technical introduction to the analysis of strategy*. Mason, OH: Thomson/Southwestern Publishers.

McConnell, C. & S. Brue (2005). *Economics: Principles, problems and policies* (Sixteenth Edition). New York, NY: Mc-Graw-Hill.

McEachern, W. (2006). *Economics: A contemporary introduction* (Seventh Edition). Mason, OH: Thomson/Southwestern Publishers.

Mueller, D. (1997). *Public choice II: A revised edition of public choice*. Cambridge, UK: Cambridge University Press.

Reardon, J. (2004). Suggestions to effectuate a multiparadigmatic approach to the teaching principles of economics. *Journal of Economic Issues,* 38 (3), 839-842.

Siegfried, J. (2000). How many college students are exposed to economics. *Journal of Economic Education,* Spring, 202-204.

Siegfried, J. & A. Sanderson (2003). Keeping economics from becoming a sexy social science. S*outhern Economic Journal,* 70(1), 209-214.

Tirole, J. (1988). *The theory of industrial organization*. Cambridge, MA: MIT Press.

Tomass, M. (1997). Game theory models with instrumentally irrational players: A case study of civil war and sectarian cleansing. *Journal of Economic Issues,* 31, 623-632.

Underwood, D. (2004). Principles of macroeconomics: towards a multiparadigmatic approach. *Journal of Economic Issues,* 38(2), 571-581.

Villena, M. G. & M. J. Villena (2004). Evolutionary game theory and Thorstein Veblen's evolutionary economics: Is EGT Veblenian? *Journal of Economic Issues,* 38, 585-610.

Walstad, W. & S. Algood (1999). What do college seniors know about economics? *American Economic Review,* 89(2), 350-354.

Walstad, W. & K. Rebeck (2002). Assessing the economic knowledge and economic opinions of adults. *Quarterly Review of Economics and Finance,* 42(5), 921-935.