GAMES ECONOMISTS PLAY:

Non-Computerized Classroom-Games in College Economics

by

Jurgen Brauer
Associate Professor of Economics
College of Business Administration
Augusta State University
Augusta, GA 30904-2200
Ph.: 1-(706)-667-4544
Fax: 1-(706)-667-4064
E-mail: jbrauer@aug.edu

For Presentation at the
Eastern Economics Association
Annual Meeting
Boston, MA
March 1994

Draft: February 1994

A B S T R A C T

GAMES ECONOMISTS PLAY:

Non-Computerized Classroom-Games in College Economics

by

Jurgen Brauer

The bulk of this paper consists of a compilation of non-computerized classroom-games that can be taught within one or two classperiods of time. The paper briefly abstracts each of the games I found, classifies them (subject matter; objectives; class size; variations; etc.) and provides a source and/or contact reference for each. The paper provides a summary of economic concepts covered. I hope to stimulate economists to construct games either for uncovered subject areas or to construct more efficient games (in time-requirement, in expandability to include more topics, in learning-outcomes, and so on) in subject areas for which games already exist.

Playing games is fun, but playing games with a distinct pedagogical purpose in mind is better. Thus, beyond assembling an embryonic compendium of games, I hope to be making a modest contribution by suggesting how some of the games could be ordered and adapted to be made part of an integrated strategy of teaching economic concepts.

GAMES ECONOMISTS PLAY:
Non-Computerized Classroom-Games in College Economics

Introduction

The computer -- first the mainframe, now increasingly the micro- or personal computer -- is making substantial inroads into or alongside the college economics-classroom. One needs to refer interested readers only to the Economic Science Laboratory at the University of Arizona (phone: 1-602-621-4288), or to a spate of articles in a special issue of the *Journal of Economic Education* or to the nice review paper by Paul Grimes and Margaret Ray (1993) to become roughly familiar with and obtain a good starting point for exploring the use of computers in college-classroom economics. Hooking up via Internet to the teaching of economics network (tch-econ@vax1.elon.edu) or the research in economic education network (econed-l@utdallas.edu) puts one readily in touch with scores of economists knowledgeable about computerized games[1], be they 'freeware' (free for the asking), 'shareware' (you try, then you pay), or commericial packages (often distributed through textbook publishers).

But computerized games, even if free of financial charge, are often -- although by no means always -- costly in the required set-up time and to learn, run, and monitor them. Moreover, and more importantly, the pedagogical nature of computerized games can differ substantially from non-computerized games.

Let me be clearer about what I mean when I employ the terms 'computerized' and 'non-computerized.' By 'computerized' I mean a game that cannot be performed without the assistance of a computer. Conversely, by 'non-computerized' I mean a game that can be performed without the assistance of a computer. For example, there are some simple market bid-offer games (on which more below) where it is simply convenient to hook up a labtop

[1] In this paper, I use 'games' and 'experiments' interchangeably, unless otherwise noted.

computer to an overhead screen to note the results, but the game itself can be played without requiring the computer as a *necessary* input.

Objectives

When I set out to do this paper, the special issue of the *Journal of Economic Education* was not yet published. Neither was Rendig Fels' summary of the games published in that special issue, and that is important because my idea had been to do pretty much what Fels did, i.e., to find and classify games according to which economic principle(s) or concept or subject area they address. In the process one would note which economic concepts are covered and which are not. Subsequently, one could then begin work on devising games for the areas not covered. And indeed, this is largely what I do, although in the writing of the paper an ulterior motif developed: to construct an 'ideal' principles of microeconomics course, accompanied by a single, foundational game adaptable to the topic at hand so that my students would share a common experience of a simulated economy which then we could study more abstractly.

In any event, in what follows, I provide two summary tables of the 25 games I was able to locate. Since the bulk of the games cover microeconomics topics at the principles level, the layout of Table 1 follows the 'ideal' microeconomics course as I am desiring to teach it. This layout contains what some might regard as 'oddities.' For example, I typically cover input markets (labor, capital, land and natural resources) before the chapter(s) on government regulation to impress upon my students that, of course, government regulates not only the output markets but also the input markets, especially the labor markets (a point that textbooks don't seem to make). Similarly, I regularly cover international trade and foreign

exchange as part of microeconomics. After all, the basic supply and demand framework applies.[2]

Coverage of income distribution, public choice, social welfare, and other such topics varies from course to course, depending on student interest, current events, and the like. Of course, the coverage of general equilibrium and welfare economics, once part of a course in principles, has largely been relegated to (the last chapters of) intermediate microeconomics textbooks, ordinarily leaving a mere sprinkling of 'public goods' and 'free-rider' vocabulary in hodge-podge principles chapters on government, environment, and market failure.[3]

Finally, rather than explicitly addressing opportunity costs, production/consumption possibility frontiers, and the recent rise of the economics of information, risk, and time (search costs), those topics are implicitly covered in my courses as they are (or could be) in a number of the games.

Table 1 is followed in Table 2 by the few remaining games at the post-principles microeconomics level and by the meager haul of only two macroeconomics games. The tables are followed by a classified, annotated listing of the games themselves. The games were obtained through a literature search, footnote reading and follow-ups, and by encouraging colleagues on two e-mail networks to make games available to me or point me to games they had heard of. I have no doubt that, somewhere 'out there,' there are many additional games that economists play in the classroom and hope that the present paper will serve as an embryonic game-compendium. Readers are encouraged to forward new and old games to me.

---

[2] In the macro-course, I then merely have to integrate open-macro into the closed-macro AS/AD framework and thus cover international topics in a fully integrated manner. Balance of payments accounting, incidentally, is a supplement/complement to national income accounting.

[3] I have long wondered why general equilibrium and welfare economics are not considered among the "principles of economics" anymore.

The paper concludes with a brief resource list and a list of references.

The Games

As a glance at Tables 1 and 2 instantly shows, for a principles of microeconomics course there exists a set of classroom games -- and they usually take no more time than a single classroom period (or even less) to play -- to complement nearly every topic that instructors may wish to cover. The *only* areas not covered appear to be monopolistic competition and the economic role of government.

But, as Rendig Fels writes, "the crux of the problem ... is how these [games] might fit into an overall teaching strategy ... The typical textbook covers far more economics than beginning students can hope to master ... [and the] problem is to cover a wide range of economics while teaching one important idea thoroughly enough to stick with students for years after the course ends" (Fels, 1993, p. 369).

I am in full agreement with Fels' sentiment. Indeed, my own guiding pedagogical objective when teaching a principles of economics class, micro- or macroeconomics, has been and is to teach a *single* overarching concept -- rather like, in accounting, the concept of debit and credit -- upon which all other concepts are based or to which all other concepts are related. But whereas for Fels "a strong candidate for the most important idea in an introductory micro course is allocative efficiency," and whereas for him the problem is how to teach that concept "without neglecting other important ideas like marginal analysis and supply and demand" (Fels, 1993, p. 369), I find that in microeconomics the overarching concept is marginal cost and marginal benefit, on the basis of which almost all other microeconomic concepts can be developed, such as supply and demand, consumer and producer surplus, the benefit from trade, allocative efficiency, and the social value of free

markets relative to other forms of arranging economic life. (On the macroeconomic side the overarching concepts, at least from a teaching point of view, are, of course, aggregate supply and aggregate demand.)

Studying the arrangement of Table 1 one easily notes that it is indeed the market games (4, 5, 6, and 7) that as *written* or in their stated or unstated, but possible, *variations* or in their stated or unstated, but possible, *adaptations* (e.g., to input, international, and currency markets) cover a large portion of the principles of microeconomics course. How can one adapt existing games or create new games for the remaining topics so as to maximize the topics-coverage on the basis of a single game? The derivation of demand and supply curves probably will need to remain separate; after all, those topics separately cover the underlying fundamentals of supply and demand, i.e., marginal benefit and marginal cost. But it might be possible for instructors to 'cook the numbers' such that demand and supply schedules emerge that, later on, serve as the two market-sides in the market clearing games.

Likewise, it should be possible to use an existing market clearing game to generate a monopoly outcome by gradually restricting the number of suppliers operating in the market.[4] In fact, it appears that Game #9 might be adaptable to achieve the feat of covering competitive markets, oligopolistic markets, and monopolistic markets. Game #9 presents students with a given market demand curve and students play a limited number of oligopolistic firms (the point being to discover interdependent decision-making). But if instead of *teams of students* playing a few firms one had *each* student play a different firm, one would simulate a large number of competitive firms and probably generate a competitive outcome. And if in the next step one switches to teams of students, one would generate an

[4] The monopoly game noted in Table 1, Game #8, is based on Game #1 and probably cannot be adapted.

oligopolistic, interdependent decision-making outcome, and if in a final step one either asked each student to imagine being a monopolist or asked all students to jointly come up with the monopolistic output and price, then GAME #9 could quite possibly serve as that unifying conceptual link that permits students on the basic of a single game to understand the continuum of market structure, rather than to perceive perfect competition, oligopoly, and monopoly as disapparate, seemingly unrelated topics. (Depending on time-constraints and objectives, instructors could then resort to Games #10 and #11 to cover game theoretic aspects of oligopoly.)

Thus, excepting the foundational topics of marginal benefit and marginal cost which are treated separately, *all of the basics of a course on microeconomic principles could be covered with variations of a single underlying game!* And further, the basic market clearing games can readily be adapted to the topics of international and currency markets, and, I suspect, to selected application topics as well. For example, depending on the textbook and which old or new edition one looks at, one finds coverage of 'special topics:' ten years ago, coverage of agricultural markets in a separate chapter wasn't unusual; nowadays, many textbooks contain a chapter on environmental economics. Inasmuch as these are applications of the competitive-market model, it shouldn't be impossible to construct accompanying games that mimick the features of those markets (say, rapid technological progress that shifts agricultural supply outward, but faces inelastic demand for agricultural markets whereupon price floors are instituted; or, say, mimicking steadily decreasing quantity restrictions on emitted pollutants to generate increasing prices for pollution permits; and so on).

That would leave us with the cluster of microeconomic topics I entitle "Beyond the Basics": the economic role of government, income distribution, public choice, perhaps general equilibrium/welfare economics.

As regards Table 2, I find little to say. For students of microeconomics that have progressed to the intermediate or advanced level, it seems proper to construct games to help illuminate particularly difficult topics. Among those, I agree, is probably the inverse relation between bond prices and interest rates (Game #20). But other than to nudge students' memory, it may not be worth the opportunity cost of lecture time to (re)play anything other than a basic market clearing game.

The haul on macroeconomic games at the principles level is disappointing. Although students generally seem to feel more comfortable with macroeconomics than with microeconomics, I am not at all convinced that they leave my macroeconomics course any more knowledgeable than they leave my microeconomics course, suggesting that macroeconomic games may be just as helpful as microeconomic games. I find Games #24 and #25 very useful, the latter even ingenious. But since a traditional principles of macroeconomics course, analytically, still revolves around the AS/AD framework, it shouldn't be impossible to create games that generate aggregate demand and aggregate supply (Game #25 *does* generate aggregate supply) so that a macro-market can be experimentally constructed. Of course, especially for the macro course, textbooks nowadays come with a little computer model on a PC-disk, but the pedagogical problem is the students' distance from a model whose underlying functions they probably couldn't comprehend even if those functions were revealed. And so, as these models become playthings, rather than learning-tools, their pedagogical value diminishes.

It seems to me that economics professors should be able to construct small, time-efficient games that would permit in-classroom generation of, say, a simple consumption-function. Changing the *ceteris paribus* parameters, say, different price levels, interest rates, external shocks, and so on, the students would experimentally and experientally generate

shifts in the consumption function of their classroom macroeconomy. By the same token, I suppose, savings-functions and changes therein could be generated and aggregated. To preview possible macroeconomic effects of fiscal and monetary policy, one could change the tax-rate and/or money-supply parameters. Over time, perhaps we could devise a game that would even permit the classroom generation of the microeconomics of macroeconomics. Be that as it may, the macroeconomics portion of Table 2 speaks for itself: I think there is much room for innovative, pedagogically valuable work to construct non-computerized macroeconomic games for the college classroom.

Let me conclude with two brief comments. First, the question of the opportunity cost of lecture time arises. Even though inclass experiments, by all accounts, serve as extraordinary "student-study-stimulants," classtime is lost to cover the economic theory. All of the games covered in this paper can be played within one or two classperiod of time, although often it is unspecified whether "one" classperiod means 50 or 75 minutes. Even so, I suggest that one should properly consider the *net* time-cost. After all, students do learn by means of a game. Nonetheless, depending on institutional possibilities, some instructors and their departments may wish to consider to supplement the microeconomics course with a lab requirement, a solution that appears to work at Reed College in Portland, OR (using four additional 50-minute time-slots during a semester).[5]

Second, Rendig Fels and others thinking about the cost/benefit ratio of playing classroom games propose, it seems to me, to measure those costs and benefits in an odd way. Since there are two parties involved (students and instructor), one needs to think about the

[5] Lab-session 1: double-oral auction experiment; 2: market structure experiments from many sellers to monopoly; 3: product-quality experiment; 4-public goods experiment. For details, contact Dr. Jeffrey Parker; Department of Economics; Reed College; Portland, OR 97202-8199; ph.: 1-503-771-1112 ext. 308

costs and benefits of *each* party. But that is not usually done. For example, Fels discusses the benefit to students (e.g., better test scores[6]), and he discusses costs in terms of the instructor's time commitment to set up and monitor and administer the game at hand. The missing two dimensions are the benefit to the instructor (a break from the routine; more fun in the classroom; more motivated students; a better reputation for the teaching of economics among students; and so on) as well as the cost to the student (even if test scores are not significantly different for students with games compared to students without games, perhaps the time cost needed to acquire economics knowledge is significantly reduced). It seems to me that here is an opportunity for valuable pedagogical research.

[6] But no one seems to actually have measured test scores with a controlled experiment; do students in classes with games score better than students in classes without games?

TABLE 1 -- SUMMARY OF GAMES

Principles of Microeconomics	**Game #**
THE BASICS	
1. DEMAND (FOR OUTPUT)	
● Demand; marginal and total utility; shifting demand curves	1, 2
2. SUPPY (OF OUTPUT)	
● Supply; production; cost; marginal cost; cost-curves	3
3. THE PRICE SYSTEM	
● Supply and demand; equilibrium price and quantity	4, 5
4. PERFECT and IMPERFECT MARKETS	
● The competitive market; producer and consumer surplus	6
● Elasticities of supply and demand; effects on market clearing	7
● Market imperfections; price floors and ceilings; quantity restrictions	6, 7
5. MARKET STRUCTURE, BEHAVIOR, and PERFORMANCE	
● Perfect competition	6, 7
● Monopoly	8
● Monopolistic competition	none
● Oligopoly	9, 10, 11
6. INPUT MARKETS	
● Input markets; labor; labor unions; capital; land/natural resources	4, 5, 6, 7 *
APPLYING THE BASICS	
1. INTERNATIONAL TRADE	
● International trade in goods and services	4, 5, 6, 7 *
2. CURRENCY MARKETS	
● The economics of foreign exchange markets	4, 5, 6, 7 *
3. ENVIRONMENT/(AGRICULTURE)	
● Environmental (or agricultural) economics	4, 5, 6, 7 *
BEYOND THE BASICS	
1. THE ECONOMIC ROLE OF GOVERNMENT	
● Overview; regulation of markets; antitrust legislation; etc.	none
2. INCOME DISTRIBUTION	
● Income/wealth distribution	12, 13
3. THE ECONOMICS OF POLITICS	
● Public choice; medium voter; cyclical majority; structure-conduct-performance	14, 15
4. SOCIAL WELFARE	
● Welfare economics; public goods; free-rider phenomenon; pareto-optimality	16, 17, 18

* Games 4, 5, 6, and 7 could be adapted to these topics, but to my knowledge haven't yet been adapted. (That shouldn't require much more than changing labels on axes.)

TABLE 2 -- SUMMARY OF GAMES
Post-Principles Microeconomics and Principles of Macroeconomics

POST-PRINCIPLES MICROECONOMICS	GAME #
Intermediate Microeconomics	
● Pollution trading rights	19
Money & Banking	
● Bond prices' inverse relation to interest rates	20
Graduate (?)	
● Labor markets; union-management bargaining	21
● Externalities/environment: bargaining	22, 23

PRINCIPLES OF MACROECONOMICS	GAME #
Money/Monetary Institutions/Money Creation	
● Fiat money	24
Rational Expectations	
● Expectations/adaptitve expectations/rational expectations effect on firms' ability to predict price movements and adjust output	25

THE LISTING OF ANNOTATED GAMES

In the annotated listing, the games are presented, in the order of Tables 1 and 2, along the following nine criteria:

Course:	Micro or Macro
Level:	Principles, Intermediate, Advanced/Graduate
Subject:	Subject area within micro/macroeconomics
Objective:	Pedagogical objective
Contact:	Published source or person from which game details and further information may be obtained
Abstract:	Brief game summary; on occasion, I have added some material (quoted material appears in quotation marks)
Class size:	Where possible, I indicate class size or take a guess
Time:	Time requirement where known or where I felt comfortable taking a guess
Variations:	Game variations either suggested by the source or by the present author

Note: since a number of games are drawn from published sources, I could not simply repeat instructions at will in order not to run afoul of copyright laws. Where I felt to be within the limits of the reasonable use clause of the copyright law, I quoted instructions.

GAME #1

Course:	Micro
Level:	Principles and up
Subject(s):	Demand curve
Objective:	To experimentally derive a demand curve
Contact:	Brock (1992) [adapted from Weidenaar (1972)] or contact Dr. John R. Brock; Department of Economics; U.S. Air Force Academy; CO 80840
Abstract:	On a warm day, bring two ice-cold Coke-bottles to class (on a cold day, some hot coffee). Ask how many students would be willing to pay 10c for one bottle; then 20c; and so on. Tabulate and graph the result (voilá: a demand curve). Then ask the students to assume that the day was really a whole lot hotter (or colder) and repeat the exercise (the demand curve shifts!).
Class size:	Any size (for very large classes, deal only with a couple rows or columns of students)
Time:	A few minutes
Variations:	None stated

GAME #2

Course:	Micro
Level:	Principles and up
Subject(s):	Marginal utility/dimishing marginal returns
Objective:	To teach students an intuitive understanding of total utility, marginal utility, and diminishing marginal utility
Contact:	Gillette and delMas (1992) or contact Dr. David Gillette; Division of Social Sciences; Northeast Missouri State; Kirksville, MO 63501; ph: 1-816-785-4334 or Dr. Robert delMas; General College; University of Minnesota; Minneapolis, MN 55455; ph.: 1-612-625-2076
Abstract:	Ask students to rate their present well-being on a scale of 0 (lousy) to 100 (bliss). Then feed them Hershey kisses, one at a time. After each 'kiss,' ask students to again rate their well-being. Collect the rating-sheets, tabulate, and display total utils, marginal utils, and (eventually) diminishing marginal utility. (Warning: the authors discovered at least one student whose marginal utility *never* dropped -- a chocalate addict! Perhaps better to feed them marshmellows.)
Class size:	Small to large
Time:	Within one classperiod
Variations:	None stated

GAME #3

Course:	Micro
Level:	Principles and up
Subject(s):	Short-run production/production costs
Objective:	To help students understand TPP, APP, MPP, TFC, TVC, TC, MC, AFC, AVC, AC (and the associated short-run production and cost curves)
Contact:	Neral (1993) or contact Dr. John Neral; Department of Economics; Frostburg State University; Frostburg, MD 21532; ph.: 1-301-689-4265; e-mail (internet): e2ecner@fre.fsu.umd.edu
Abstract:	Provide students with (or ask them to bring) lots of paper and a (working) stapler. Divide the class into large groups (say, eight or more per group). Provide each group with half a table of production room (the shopfloor). That plus the stapler is the fixed capital input (K=1). The group is to produce as many widgets as possible (fold the paper twice and staple it) within one workday, say, a 30-second time period. Start with no labor (L=0) to produce Q=0, never minding the stares. Then increase to L=1; have the group record total production (TPP) in the 30-second time-span. Then increase to L=2 and so on until diminishing returns set in (perhaps even negative returns if you like). Let the groups compute, tabulate, and graph their TPP, APP, and MPP. Then assign costs, e.g., K=$10, L=$5, and let the groups compute, tabulate, and graph the cost variables. They should get something more or less bizarrely similar to the nice textbook curves. (They'll learn about the convenience of abstraction pretty quickly this way.)
Class size:	Small and up. For very large classes, part of the class could watch with amusement; they'll get the point. Alternatively, part of the class could do the production runs; another part of the class to computatation, tabulation, and graphing.
Time:	One class period
Variations:	None stated

GAME #4

Course: Micro

Level: Principles and up

Subject: Simple market clearing

Objective: To demonstrate that and how supply and demand determine equilibrium market quantity and market price

Contact: See Nelson and Grimes (1991), which contains instructions, or contact Dr. Paul Grimes; College of Business and Industry; Mississipi State University; Mississipi State, MS 39762; e-mail (internet): pwg1@ra.msstate.edu

Abstract: Each student is assigned a position as a 'buyer' or a 'seller' in a fictitious market. The instructor hands out cards indicating each student's reservation price as a buyer or a seller, with unique prices on each card. For example, the buyers' cards range from $11 to $9 in steps of 10 or 25 cents, and conversely the sellers' cards reflect a similar price range (sellers' production costs).

The instructor serves as auctioneer. Ask buyers and sellers to assemble across from each other. Ask for a opening offer to buy, say "Buyer 6 will buy at $5.00." Any seller can accept ("Seller 3 accepts"). If a trade is completed, that pair of students exits the trading pit. The trade is recorded on the chalkboard. A trading round ends when no more offers to buy or sell are forthcoming. Then, all students rejoin the trading pit and a second round may be started.

In the authors' experience a "stable equilibrium will be reached in three or four trading periods, which normally occurs an average of 15-20 minutes after the instructions are read" (Nelson and Grimes, 1991, p. 371).

Class size: Not much less than 10 buyers and 10 sellers; very large classes can be 'reduced' by designating groups of 2 or 3 students as 'one' buyer or seller.

Time: 50 minutes with time for probing (after all some potential buyers won't buy and some potential sellers won't sell at equilibrium price)

Variations: You can make this a labor, international, currency, or future, or any market! You can shift demand and supply schedules by handing out a new set of cards with an appropriate explanation (e.g., as to why production costs have just shifted). You can introduce a price control, floor or ceiling, and either announce it or not announce it. Or, instead of handing out new cards, ask students to change their reservation price between, say, 10% and 30%, so that even the instructor doesn't know what is going to happen (except that an equilibrium will be reached).

GAME #5

Course: Micro
Level: Principles and up
Subject(s): Chaos and Order in Markets
Objective: To teach students (a) how apparently chaotic behavior is in fact orderly and (b) how economics makes correct predictions
Contact: Gillette and delMas (1992) or contact Dr. David Gillette; Division of Social Sciences; Northeast Missouri State; Kirksville, MO 63501; ph: 1-816-785-4334 or Dr. Robert delMas; General College; University of Minnesota; Minneapolis, MN 55455; ph.: 1-612-625-2076
Abstract: In your first lecture (first course lecture or first lecture on the price system), show students a sealed envelope, then start by asking students to write down one or two words to the question: "What comes to mind when you hear St. Louis, Kansas City, New York, or Los Angeles and 5 o'clock rush hour traffic?" (Answers usually are: headache, stress, and the like.) Without tabulating the results, go immediately to the *first* trading round of a double-oral auction market (see Game #4, #6, or #7). Then ask students to write down one or two words to the question: "If economic markets regularly behaved in this fashion, how would you describe their behavior?" (Usual answers: chaotic, confusing, unorganized, etc.) Then complete the *other* trading rounds until an equilibrium price and quantity is found. Open a sealed envelope which contains the predicted price-quantity equilibrium.
Class size: Small to large
Time: One class period
Variations: None stated

GAME #6

Course: Micro
Level: Principles and up
Subject(s): Market clearing/market efficiency
Objective: Basically the same double-oral auction game described earlier, but geared toward teachability and classroom efficiency.
Contact: DeYoung (1993)
Abstract: The game is very similar to that described earlier (Game #4), and the author's discussion primarily focuses on issues of exposition: how the instructor collects and displays the market information generated by the players so that economic concepts are more easily understood (the researcher employs experiments to 'test' theory, the teacher uses experiments to 'teach' theory, writes DeYoung). For example, by computing a market efficiency coefficient (actual surplus realized divided by potentially achievable surplus) over successive trading rounds, students see that over time they near 100% efficiency (as theory would predict). Thus, the objective is to set up the game and the information display to generate a large bundle of concepts (consumer/producer surplus, allocative efficiency, prices, equilibrium, deadweight loss, social value of free markets, and so on) that subsequently can be examined one-by-one in the theory lectures by reference to the game.
Class size: Small (10 to 30)
Time: One class period
Variations: Try a negotiated-price mechanism (i.e., a trading pit simulation) where 'buyers' and 'sellers' search one another and merely announce the completed trade to the instructor who then publicly displays the trade and price. The advantage is that there is no auctioneer involved. Further, because of search costs, it will take more trading rounds to achieve price convergence. Thus, one can easily introduce the concepts of how institutions and search (and, in another wrinkle, transaction) costs change the equilibrium dynamics of the market.

GAME #7

Course: Micro

Level: Principles and up

Subject(s): Buyer-seller auction-trading/general market-clearing exercise

Objective: To demonstrate the effect of different price elasticities on price convergence in the market (the more price elastic, the faster the convergence).

Contact: See Keating and Grace (1993) or contact Dr. Barry Keating and/or Dr. James Grace; College of Business; University of Notre Dame; Notre Dame, IN 46556; e-mail (internet): barry.p.keating.1@nd.edu

Abstract: Similar to Game #4 described earlier, in that reservation-price cards are handed out to students. For the first run, the simulation may run for ten or so "trading days," each "day" lasting about two or three minutes. Any completed trade (a buyer and seller agree on a price) is signaled to the instructor who writes the information on a board (or types it in a computer connected to a projector and display screen). Those completing a trade drop out of the market for that day. A trading day ends when no more trades occur. Play ten trading day rounds or so and plot the price per trade (or have a computer spreadsheet template prepared to quickly to do the plotting for you). Students will note that over repeated trading and trading days, the prices tend to converge toward the textbook 'equilibrium' price. Also compute (or have the spreadsheet compute and display) a convergence coefficient (the standard deviation of the actual trading prices per day divided by the predicted equilibrium price; the coefficient will likely consistently decline from day one to day n).

Now rerun the game (for the *same* price-quantity equilibrium solution), but with steeper (or flatter) demand and supply curves (i.e., supply students with a different set of reservation-price cards). The steeper the slopes, the longer it will take to achieve convergence, and the higher the coefficient will be. That is, the *same* equilibrium conditions/solution can be brought about by different markets.

Once played, the students will much better appreciate the role of economic theory and better comprehend the static textbook equilibrium story as an outcome of the dynamic game.

Class size: Small and up (a small group could play; the others observe results displayed on an overhead projector)

Time: 75-minute class period

Variations: (a) play the basic price-clearing game early in the course; replay the same game as you introduce new concepts (e.g., elasticity or price floors/ceilings); (b) vary the number of players and observe convergence speed; (c) change from perfect information to uncertain information by not displaying the individual trades until each trading day is over; (d) make buyers/sellers *pay* for the price information (market intelligence); (e) allow more than one trade per day per buyer/seller; (f) introduce price floors/ceilings; and so on.

GAME #8

Course: Micro
Level: Principles and up
Subject(s): Monopoly prices
Objective: To experimentally demonstrate monopoly power
Contact: Brock (1992) [adapted from Weidenaar (1972)] or contact Dr. John R. Brock; Department of Economics; U.S. Air Force Academy; CO 80840
Abstract: On the last lecture before your monopoly lecture, hand out a purchasing agreement on which students sign their name to agree to purchase from the instructor x-number of Coke-bottles for a range of prices (say, $1/bottle down to 20c/bottle). Students will think this recreates the earlier experiment (see Game #1), but this time for keeps. Paragraph 1 of the purchasing agreement reads innocuous enough: "1. Once the market price is determined, I am obliged to buy ...". The instructor takes the signed purchasing agreements, goes home, and computes the demand curve (using regression).

At the beginning of the monopoly lecture, tell them that you are the Coke-monopolist (assume AC=MC=50c or whatever the instructor's cost is), and now you charge according to MR=MC and the instructor is off to the lecture.

Class size: 20 and up
Time: One class-period
Variations: None indicated

GAME #9

Course: Micro
Level: Principles and up
Subject(s): Oligopoly
Objective: To illustrate the interdependence of oligopolistic decision-making
Contact: Dr. Jonathan Leightner or Dr. Jurgen Brauer; School of Business; Augusta College; Augusta, GA 30904-2200; e-mail (internet): jleightn@admin.ac.edu or jbrauer@admin.ac.edu[7]

Abstract: Students are divided into small management teams (3 or 4 students). A demand schedule for the entire market is provided as is a simple cost-function (where, for simplicity, ATC=MC throughout the entire output range). The objective is for firms to make profit. The game is played over several trading rounds. Give students five minutes to make their first output decision. The instructor collects the firms' decision and writes the sum of quantity produced (supplied) on the board. From the demand schedule, the market price can now be read, hence revenue per firm, and their profit or loss. Profit-leaders will usually jeer and try it stay on top in the subsequent trading rounds.

Over subsequent trading rounds, students will note that their profit is decidedly influenced not only by how much their own firm produces but also by how much the other few firms produce, thus generating interdependency.

Class size: 12 and up to 40 or 50; larger classes can be divided into different oligopolies, playing games independent of one another; you will need one student assistant per oligopolistic industry for large classes.

Time: In a fifty minute class-period, you will usually be able to play about five rounds or trading days and have time for discussion.

Variations: (a) As the game players become familiar with the game, maybe with trading day two or three, the game coordinator (the instructor) can permit the teams to collude with one another and coordinate output plans. Teams are free to coordinate output levels, but are not required to honor their agreements. At minimum output levels, the game reverts, of course, to a monopoly solution, but offers incentives for 'cheating.' (b) If the game goes well, permit mergers with a specified profit/loss sharing arrangement (you may need to expand the trading day to five minutes to allow time for negotiation). (c) If the game goes really well, permit acquisition (out of accumulated profit or debt-financed, i.e., out of expected, future, profits). Note that a firm with low profitability could end up winning the game by negotiating a high buy-out price. In practice, not all acquiring firms do well.

[7] This game came to us via the University of North Carolina, but we don't know its originator.

GAME #10

Course: Micro
Level: Principles and up
Subject(s): Game theoretic oligopoly/information in the marketplace
Objective: "to illustrate some of the difficulties involved in price coordination (collusion) under circumstances of imperfect competition" (Hemenway, 1987, p. 727).
Contact: Hemenway et al. (1987); contains copy for class instructions
Abstract: Students are given the following pay-off matrix:

		Other students: Compete	Other students: Collude
You	Compete	10	40
	Collude	0	20

At a snapcount, all students raise either an open hand (signaling to compete) or a fist (collude). If more than half the students vote for "compete," then "compete" wins, and each student records his/her score (and vice versa when "collude" wins). Play six rounds. If students vote to "compete" in all six rounds (the usual outcome), the highest possible score is 60 points. And here's the catch: a grade will be assigned to each student, based on the points made. >100=A+; 90-100=A; 80-89=B; 70-79=C; 60-69=D; <60=F. Thus, all students will receive a grade of D or worse.

After the initial shock, let students play a second round of six votes. Now they start the collusion road, until some student figures out that cheating "pays," (voting for "compete," when the others vote for "collude" gets you 40, rather than a mere 20, points), whereafter collusion usually collapses.

Finally, you may tell students, after the fact, that the "grading" was merely a device to get them to take the game serious.

Class size: 15 to 70
Time: 15 to 45 minutes
Variations: (a) change the pay-offs to make it easier or more difficult to get a certain grade. For example, if >120=A+ is required, then 6 x 20 is not enough for an A+ anymore. Hence, the group needs to designate 'cheaters' (who get 40 points) and change the cheaters in each round (bid-rigging). (b) Go from open eyes to closed eyes to shut of all communication and see how the outcome changes.

GAME #11

Course: Micro
Level: Principles and up
Subject(s): Oligopolistic interdependence
Objective: To demonstrate interdependence
Contact: Ray (1993) or contact Dr. Margaret Ray; Department of Economics; Mary Washington College; Fredericksburg, VA 22401-5358
Abstract: Explain the general idea of a payoff matrix. Randomly pair students. Write the following payoff matrix on the board (or a variation thereof):

		Your Choice: A	Your Choice: C
Your Partner's Choice	A	You: F Partner: F	You: F Partner: A
	C	You: A Partner: F	You: C Partner: C

Ask students in the pairs to choose a grade (incommunicado, of course), write it down, and hand it in. The dilemma of lack of information, or having to infer information about the partner becomes immediately apparent. This can then be linked to the prisoner's dilemma and other games and/or to antitrust regulations, to international cartels (that can legally communicate), and so on.

Class size: Small and up
Time: Half a classperiod and more as desired
Variations: Itself a variation on Game #10 discussed above; other variation include permitting information, varying group size (say, to 3, requiring a three-dimensional payoff matrix), changing the payoffs, etc.

GAME #12

Course: Micro/Dev.Econ/Intern.Econ (depending on variation)
Level: Principles and up (depending on variations used)
Subject(s): Endowments/market exchange/wealth distribution
Objective: "This simulation illustrates three issues: (1) the potential of market exchange to generate mutual welfare gains; (2) the role of unequal financial endowments in affecting market opportunities; and (3) the impact of differences in individual skills, effort, and creativity on the observed distribution of wealth" (Williams, 1993, p. 325)
Contact: Williams (1993) or contact Dr. Robert Williams; Department of Economics; Guilford College; Greensboro, NC 27410
Abstract: Students are randomly placed into 'poor,' 'middle class,' and 'wealthy' groups. The initial endowment for each group are differently colored M&M candies. Each color represents a different value (from Brown=1 point to Green=10 points). The total endowment across the groups is distributed 1:2:3.

Students are given 5 to 7 minutes to freely trade their M&Ms with one another, within or across their wealth group. The incentive for wealth accumulation is that accumulating the 3rd M&M of a color increases the value of the portfolio, i.e., the marginal value of the 3rd M&M of a color is higher than the inframarginal values, or values of the 1st and 2nd M&Ms.

Students are provided with a handout detailing the value of each M&M, to record their trades, and to compute the value of their portfolio after each trade. Time permitting (50 or 75 minute class period), students debrief themselves, and then play a second and perhaps a third round.

Depending on the topic at hand, the instructor may use the game to illustrate a number of economic concepts relating to pareto optimality, mutually beneficial exchange, the impact of initial wealth endowment, the influence of students 'animal spirits' and intuitive grasp of trading opportunities on wealth accumulation, the difference between absolute and relative poverty, the idea of charity (one student gave some M&Ms away to the 'poor'), and so on.

Class size: Small (can be adapted to larger classes)
Time: 50 to 75 minutes
Variations: (a) make the initial endowment more or less skewed to reflect initial income distribution in different countries; (b) let the groups represent countries rather than income-classes within a country.

GAME #13

Course: Micro
Level: Principles and up
Subject(s): Preferences for Income Distribution/Lottery/Rawls
Objective: To investigate "how much income redistribution individuals desire in society with random differences in individual incomes" (Beck, 1992, p. 2)
Contact: Beck (1992) or contact Dr. John H. Beck; School of Business Administration; Gonzaga University; Spokane, WA 99258
Abstract: The game consists of three parts with the same information but different rules for each part. The information consists of a handout with three columns: (1) lettered A to O; (2) labeled 'odd' with payoffs ranging from A=$25 to O=$7.08; (3) labeled 'even' with payoffs ranging from A=$0 to O=$7.08.

In part A, students circle a letter in column (1) indicating the desired payoff row. Once the sheets are signed and handed in, a die is rolled. If it lands on an odd number, students get the payoff in the odd-column; if it lands on an even number, students get the payoff of the even-column. The 'higher' the letter (A is highest, O is lowest), the more risk the student takes (A-odd: $25; A-even: $0), the 'lower' the letter, the more risk-averse is the student (O-odd: $7.08; O-even: $7.08). Payoffs are *not* publicly announced.

In part B, the same procedure is followed, except that a die is rolled for each individual in class and the potential payoff for that individual is publicly announced. Then all papers are put in a bowl and only one is drawn at random to determine the actual individual payoffs for the entire class.

In part C, the entire class must agree (within 15 minutes or else the payoff is $0) which payoff-row to circle, then a die will be rolled separately for each individual to determine an 'odd' or 'even' payoff for that individual.

In all parts, payoff-transfer payments are not permitted.

Class size: Small to large
Time: One class period
Variations: None stated

GAME #14

Course: Micro

Level: Principles and up

Subject(s): Public choice/industrial organization/rule-governed behavior

Objective: To discover how the structure-conduct-performance (or: rules-behavior-outcome) triplet functions, as the structure (i.e., the rules of the game or laws of society) are changed.

Contact: Copyrighted by Frederick L. Goodman and Robert Parnes; School of Education; University of Michigan, 1973; received through Dr. Kurt Schaefer; Department of Business and Economics; Calvin College; Grand Rapids, MI 49506; e-mail (internet): schk@legacy.calvin.edu

Abstract: This is a marble game, simulating a small society including legislative, executive, and judiciary bodies and many other players in society (jailers, bankers, insurance, lawyers, etc.), depending on the class size. The game-purpose is to obtain a job (either private or public) and to accumulate survival marbles. The game contains "natural laws," overseen by the GOD (Game Overall Director, i.e., the instructor), and "social laws," made by the rule-makers in the game. Natural laws cannot be broken; social laws can, and dealing with that is subject to the laws the game-society determines. During the course of the game, the social laws can be changed and the dynamics and complexity of the game unfolds from there on.

Whereas the game is not specifically designed for the teaching of an economic principle, it does relate to matters economic and serves a number of pedagogically useful functions: (a) as a powerful motivator; (b) to keep the totality of interactions in mind (general, rather than partial, equilibrium aspects); and (c) to help students experience how rules help determine behavior or shape incentives to achieve desired outcomes. Additionally, the game is flexible enough to be put through the paces from relatively simple to extraordinarily complex; to be played but once, or to be played repeatedly during a quarter or semester at increasing complexity.

Class size: 8 to 50

Time: 2 hours for a basic run (however, to set up the game for the very first time is fairly time-intensive; perhaps students can earn extra credit to do the set-up)

Variations: Numerous to endless; up to the rule-makers and the GOD.

GAME #15

Course: Micro
Level: Principles and public finance
Subject(s): Voting paradox/medium voter/cyclical majority
Objective: Time-effective games to illustrate the voting paradox
Contact: Sulock (1990) or contact Dr. Joseph M. Sulock; Department of Economics; University of North Carolina; Asheville, NC

Abstract: First game: Students are asked to preference rank three recently covered topics (say, the social security system, corporate income tax, and food stamp program) from high (A) to low (C).

Second game: students are asked to preference rank the number of exams they'd like to have in the class, either 3, 4, or 5.

In either game the vote is secret, ballots are collected and tabulated in class. Under majority-rule with two rounds of voting, one can now play through the options for game one: A against B; B against C; and A against C. In twelve times of playing, two classes actually produced a cyclical majority effect! In the other cases, the order of voting determines the outcome.

For game two, the classes have generated rankings of 3-4-5, 5-4-3, and 4-5-3, but never 5-3-4 and 3-5-4, situations in which *both* extremes (i.e., 3 and 5) are preferred to the middle option (i.e., 4).

Playing *both* games can be instructive because the 'exams' vote deals with cardinal extremes, whereas the 'topics' vote doesn't (it is unreasonable to say that, e.g., the food stamp topic is an 'extreme' preference).

Class size: Small
Time: 15 to 20 minutes
Variations: None stated

GAME #16

Course: Micro
Level: Principles and public finance
Subject(s): Free-rider problem
Objective: Time-effective game to illustrate the free rider problem
Contact: Sulock (1990) or contact Dr. Joseph M. Sulock; Department of Economics; University of North Carolina; Asheville, NC
Abstract: "The students are instructed that they may 'contribute' any amount of money from $0 to $10. I explain that I will increase the amount collected by 20 percent, and the resulting total will be divided *equally* among all class members (but not the instructor). Students are allowed to interact with one another regarding the amount each will contribute before the contributions are made. However, at the 'moment of truth,' no interaction is permitted, and anonymity is guaranteed" (Sulock, 1990, p. 66).

Dr. Sulock explains that a typical contribution ranges from $1.25 to $1.75 per student, and that the instructor can draw a number of useful lessons: (a) the optimal contribution, of course, would have been $10. Thus, each student's contribution (output) is economically inefficient; (b) economically, too little has been 'produced' (contributed) and that is the crux of the free-rider problem; (c) an efficient level of 'production' (contributions) could be achieved through taxation (an involuntary contribution); (d) if the group were smaller, a more efficient level of contributions might have emerged which is why, e.g., fire and police services in very small communities do function on the basis of voluntary contributions, rather than involuntary ones (taxes); (e) each student's contribution generates externalities (this game allows to link the topics of public goods and externalities).

Dr. Sulock lets classes play for real money. Usually around 50 percent of any one class free-rides totally (i.e., a contribution of $0). Repeating the experiment in the same class often results in *all* contributions being $0!

Class size: Any size (Dr. Sulock's classes usually range between 15-20 students)
Time: 15 to 20 minutes
Variations: None stated

GAME #17

Course: Micro
Level: Principles and public finance
Subject(s): Public goods/free-riding
Objective: To teach the concepts of free-riding/public goods/property with a minimum time requirement
Contact: Leuthold (1993) or contact Dr. Jane H. Leuthold; Department of Economics; University of Illinois; Urbana-Champaign, IL 61801
Abstract: Each student is provided with the following information: "You have one hundred (hypothetical) dollars to invest in one of two assets. Asset A pays a fixed return of 5 percent on your investment. Asset B pays a return of 10 percent on the total class investment, to be divided equally among all students in the class. So, for example, if the class decides to invest $1,000 in Asset B, each of [e.g.,] seventy students in the class will receive a (hypothetical) return of $1.43 (1/70th of 10% of $1,000) regardless of his or her investment in the asset. You may divide your money between the two assets in any way you choose. How much do you want to invest in: Asset A _____? Asset B _____? Total: $100." Then the form also asks for some demographic information (age, sex, party affiliation, etc.).

The "game" is conducted at the *end* of a lecture period. Students are not to communicate with one another. Prior to the next lecture, the instructor or an assistant compiles the results for display and discussion. Pedagogically, it is important not to mention anything about the free-rider concept until after the game. Students can compute their own free-rider index (amount invested in asset A divided by total investment of $100) and compare that to the class-index (average for the class already known to the instructor). Let students calculate their own individual return on investment as well (from private asset A and joint asset B).

Next, select a small group of students (perhaps only 3), invite them up front, and let them replay the game where they may freely discuss investment strategies with one another (usually, they will all invest only in asset B, thus maximizing their joint returns). This leads to a discussion of information and group size and contributions to or fund-raising efforts of non-profit organizations (such as public radio).

Finally, share the free-rider index by demographic breakdown with the class (do women behave differently than men; etc.)

Class size: Large (200+)
Time: Less than one class period
Variations: See Hoaas and Drouillard (1993)

GAME #18

Course: Micro
Level: Principles and up
Subject: Pareto-optimality
Objective: Motivate the study of pareto-optimality
Contact: Dr. Ken Peterson; Department of Economics; Furman University; Greenville, SC 29613; e-mail (bitnet): peterson@frmnvax1
Abstract: Offer students extra credit in the following manner: They have to write down either a 1 or a 5 on a piece of paper. As long as 3 or fewer (out of 16) students write down a 5, give 5 points to those who wrote 5 and 1 to those who wrote 1. Promise not to share the names of those writing the "5's" with the class, and tell the students that they cannot look at other students' responses and that they cannot talk with each other. [Result of a recent run: 11 five's and 5 one's (no one got points).]

Then allowed students to play the same game again, but indicated that you will write on the board who put which number down on their paper (assuming that there would be some "social punishment" for those who put 5's if more than three of them showed up). [Recent result: 8 five's and 8 one's (no extra credit); some of the change in behavior may be due to learning and some to potential social "punishment".]

Finally, allow students to play again with the opportunity to talk about their choices with each other. Expect students to first go to all choose one's, but then realize that they would 'waste' those three fives (i.e., students will recognize that strategy would not be pareto optimal). What students may end up doing to solve the problem is to devise a way to randomly select which three students get the five points (say, by a random drawing from a hat).

The game goes off very well. Students start asking what would happen if one changed the payoffs (e.g., took points away if there were more than three fives, increased the spread to 0 and 10 instead of 1 and 5, or decreased the spread to 4 and 5). They also talk about who needed the 5's the most and had those students pegged down as most likely to put 5's on their paper.
Class size: Small to large
Time: These three games take altogether about 35-40 minutes with discussion and can be extended or contracted according to the time available.
Variations: None stated

GAME #19

Course:	Micro
Level:	Intermediate and up (perhaps principles, too)
Subject(s):	Pollution rights trading
Objective:	Students often have trouble accepting, let alone understanding, the concepts of pollution rights and "optimal" pollution levels. The game teaches them that they themselves, like it or not, will arrive at that optimal level!
Contact:	Nugent (1993) or contact Dr. Rachel Nugent; Department of Economics; Pacific Lutheran University; Tacoma, WA 98447
Abstract:	Divide the class into several industries (say, software, pulpmill, steelmill). For simplicity, only one polluting substance is considered. All industries are provided with a table detailing current output, current emission, current profit, marginal cost of cleanup per unit of pollution (a constant cost for simplicity), permissible emission levels, a limited number of tradable permits, and cost information on two options: (a) pay for cleanup and (b) reduce output. A third option is to trade the permits at prices the students are to establish as they trade within a given time-period. [Nugent (1993) contains a sample table with data and optimal solutions.]
Class size:	Small
Time:	One or more classperiods
Variations:	Play several rounds; change permissible emission levels; reduce number of permits; and so on.

GAME #20

Course: Micro
Level: Upper-division finance/economics
Subject(s): Money and banking
Objective: To teach the inverse relation between interest rates and bond prices
Contact: Gillette (1993) or contact Dr. David Gillette; Division of Social Sciences; Northeast Missouri State; Kirksville, MO 63501; ph: 1-816-785-4334
Abstract: "Bond buyers (households with money to lend) have endowments of money that they can either leave in the bank and earn next to nothing on, or they can try and buy higher yielding bonds in the market. Bond sellers (firms with investment projects to finance) begin the game with an option to issue a bond on which they would have to pay some outrageous interest rate. Both buyers and sellers are given reservation interest rates that, as part of the experiment, they must convert into dollar prices. All bidding is conducted in prices, not interest rates. Bonds may be either zero-coupon or interest bearing. The buyer with the highest average yield after the final trading period and the seller with the lowest average borrowing costs [win]. Since they are required to bid in dollar prices yet win according to average interest rates, this version of the [double oral auction] experiment has been successful in driving home the inverse relationship students often find so difficult to grasp" (Gillette, 1993, p. 2).
Class size: Not stated
Time: One class period
Variations: None stated

GAME #21

Course:	Micro
Level:	Graduate?
Subject(s):	Unions/Labor-Management negotiations
Objective:	Costs of negotiating are different for each party
Contact:	Harvard Business School 1993/94 Teaching Catalog; Order number 9-186-141 Case (Gen Exp), ph: 1-800-545-7685; authored by D.A. Lax DA and T.T. Weeks
Abstract:	"This game is a highly structured exercise in labor-management bargaining. If union and management cannot reach agreement within two days, then the union will strike. The costs of a strike are not the same for the two sides. Similarly, the cost of a settlement to management differs from its benefits to the union. Union and management players frequently feel that they are more powerful, hold out, endure a strike, and do poorly relative to other players."
Class size:	Unknown
Time:	Unknown
Variations:	Unknown

GAME #22

Course:	Micro
Level:	Graduate?
Subject(s):	Game theory/externalities/government regulation
Objective:	Students come to see that joint gains must be created and divided and that the tension between competitive and cooperative urges often lead to inferior agreements.
Contact:	Harvard Business School 1993/94 Teaching Catalog; Order number 9-186-125 Case (Gen Exp), ph: 1-800-545-7685; authored by D.A. Lax DA and T.T. Weeks
Abstract:	"A negotiation exercise between Riverside Lumber Co. and the Division of Environmental Conservation about reducing the effects of effluent discharge in a river. Students are assigned to a role and receive confidential information including a scoring system detailing the costs and benefits of various proposals. Though their interests conflict, joint gains beyond simple agreement can be found. Students come to see that joint gains must be created and divided and that the tension between competitive and cooperative urges often lead to inferior agreements. Means for managing this tension can than be discussed. This game can be used as a complex example of bargaining with incomplete information."
Class size:	Unknown
Time:	Unknown
Variations:	Unknown

GAME #23

Course: Micro
Level: Graduate?
Subject(s): Externalities/Marginal Cost Pricing/Tradable Pollution Allowances
Objective: Designed to teach students about the trade-offs faced by firms exploring alternative approaches to complying with pollution control regulations. The setting is the U.S. electric utility industry in 1993.
Contact: Harvard Business School 1993/94 Teaching Catalog; Order number 9-793-072 (Exercise), ph: 1-800-545-7685; authored by W. Emmons
Abstract: "In accordance with the provisions of the 1990 Clean Air Act, coal-burning utilities must lower their emissions of SO_2 (sulfur dioxide) significantly by 1995, and then reduce their emissions by an additional 50% by the year 2000. In this stylized negotiation each utility has the option of complying with the regulations through one of three methods: 1) by installing pollution control equipment ('scrubbers'); 2) by substituting high sulfur coal; and/or 3) by purchasing tradeable SO_2 allowances from other firms that overcomply with the emission control legislation. Not only must each utility reduce its emissions by a different amount, but the costs faced by each firm with respect to scrubbing and fuel switching differ as well. Also, assumptions relating to the state regulatory environment differ across negotiating groups. Negotiations take place in groups of four utilities and separate scenarios are available for three distinct groups. (See Supplements)."
Class size: Unknown
Time: Unknown
Variations: Unknown

GAME #24

Course: Macro
Level: Principles and up
Subject(s): Fiat money/medium of exchange/introduction to the money chapters
Objective: To teach students that and how fiat value (without intrinsic value) becomes valuable
Contact: Fried and Levy (1992), which contains full instructions, or contact Dr. Harold O. Fried or Dr. Daniel Levy, both at Department of Economics; Union College; Schenectady, NY 12308
Abstract: The class is divided into small groups of 2-3 students each. Each group is supplied with a basket. The baskets contains food items and utensils, but not each basket contains both. (The items in each make for an incomplete meal or even no meal when only utensils are in it.) *Some* baskets contain some beans. There are two trading periods. At the end of period one, each group has to pay a previously announced 'tax' in the form of beans. Before play, it is also announced that at the end of period two, another tax is due, but that the size of that tax will only be announced at the beginning of period two. Students may not eat until the end of period two.

Unsurprisingly, beans obtain value as a medium of exchange.

Class size: Small, adaptable to large
Time: One class period
Variations: None stated

GAME #25

Course: Macro
Level: Principles and up
Subject(s): Rational expectations
Objective: To introduce "the concepts of rational and adaptive expectations, the Lucas supply curve, the natural rate hypothesis, and random supply shocks" (Peterson, 1990, p. 76)
Contact: Peterson (1990) or contact Dr. Norris A. Peterson; Department of Economics; Pacific Lutheran University; Tacoma, WA 98447
Abstract: The class is divided into 6 teams of students, each representating a supplier. Each team is given a handout that lists absolute price increases for each firm during the (fictitious) last eight time periods. The handout also lists the average price increase across all six firms (randomly drawn from a normal distribution with mean=5 and standard deviation=2.5). Thus, firms with below average price increases should consider lowering production, firm with above average price increases should consider expanding production, and firms with average price increases should neither expand nor contract production.

Two practice rounds (time periods 9 and 10) are played. Each team is given a card that lists the absolute price increase for its firm only. The teams have to decided whether to expand, contract, or leave production unchanged (signaled by "+," "-," and "0" cards). Unknown to the students, the mean is again set at 5, with a standard deviation of 2.5. Based on the 'last' eight rounds, typically the teams' "+"s and "-"s even out, so that aggregate supply stays unchanged.

For the first 'real' round (time period 11), the average price increase is changed, unexpectedly and unknown to the students, to 8 percent. But on the basis of the past 10 rounds and with teams only knowing their own firm's price increase, *all* six firms will typically expand production, thus increasing aggregate supply. By round 12 (mean=8 again), teams begin to show *adaptive expectations*. So, for round 13, the instructor changes the mean again (mean=11), catching the teams off-guard yet again, and by round 14, the teams probably adapt once more.

After each round, there's a bit of discussion permitted among students and instructor. By round 15, you may find students asking for additional information, and the instructor could 'publish' past and announced monetary targets (set at mean price plus 2 percentage points). "From this point on [i.e., when a monetary target is published; jb], the teams will be quite accurate in their forecasts of inflation; subsequent rounds demonstrate that the monetary authorities are powerless to influence aggregate supply. Rather, any fluctuations in output are due to random disturbances associated with imperfect correlations between the money supply ... and average price increases" (Peterson, 1990, p. 75).

Class size: Sufficient to allow for 6 teams of students (could be adapted for larger classes)
Time: One class period
Variations: None stated

Resource List
Non-Computerized Classroom-Games in College Economics

Set of Games/Experiments

Special Issue *Journal of Economic Education* Vol. 24, No. 4 (Fall 1993). The entire issue is devoted to games/experiments, some heavily computerized, some involving minor computer resources (a spreadsheet), some non-computerized. Some games are semester-long, others take a class-period or less. Games touch on the following micro topics: profit-maximization with MR=MC rule that requires finding one's demand curve; free-rider problem (2 games, 1 of which is very simple to administer); stock market experiment with speculative bubble/crash experience (2 games, one computerized, 1 not); the dynamics of competition; effects of market exchange on wealth distribution. Rendig Fels concludes the special issue with a summary evaluation of the papers.

Economic Inquiry: starting in 1987, *Economic Inquiry* contains a teaching tools section that, in turn, occasionally contains games/experiments.

Classroom Expernomics

A newsletter to which you may subscribe by contacting John Neral at

e2ecner@fre.fsu.umd.edu

or write to Dr. Neral at Department of Economics; Frostburg State University; Frostburg, MD 21532 (phone: 1-301-689-4265). The newsletter contains games and related news items. The newsletter was established after a National Science Foundation seminar on games and now has about 120 subscribers. Editors are economists Greg Delemeester and John Neral. The latest issue contains an oligopoly and a pollution-rights trading game.

Joint Council on Economic Education

The JCEE (432 Park Avenue South; New York, NY 10016) and its affiliated state-based councils offer a variety of materials aimed at the K-12 range. But a number of the High School components can be adapted/adopted for beginning College-level students.

Sanford Gordon. *Economics U$A: A Resource Guide for Teachers*. New York: Joint Council on Economic Education, 1988. Contains a resource list on games and simulations, some of which seem appropriate or adaptable to principles classes at the College level.

Reinke, Robert, Mark Schug, and Donald Wentworth. *Capstone: The Nation's High School Economics Course*. New York: Joint Council on Economic Education, 1989. Comes with a "Student Activities Book" that contains games/simulations entirely appropriate and/or adaptable to College-level work. For example, it contains complete instructions and photocopyable masters to play an ordinary bid-ask market game, a market for wheat, in Unit 2, Lesson 2.

The Harvard Business School

The *Harvard Business School 1993/94 Teaching Catalog* lists a handful of negotiation or bargaining exercises, such as the one on tradable pollution allowances included in the body of the text. Other such negotiation exercises involve the following subjects: the winner's curse (order number 9-191-133 Exercise by D.E. Bell); the 1987 NFL labor-management strike (9-189-094 Supplement, Exercise by V. Krishna); transfer pricing in which a retailer must decide how to allocate limited self space (9-189-001 Exercise by D.E. Bell); an exercise to help explain the effects of voluntary export restraints on automobile manufacturers (9-187-164 Supplement, Exercise by V. Krishna); and distributive bargaining under incomplete information exercises where sets of buyers and sellers receive 'confidential' information to negotiate the price of a used truck in one case (9-186-156 Case (Gen Exp) by D.A. Lax and J.K. Sebenius), and an automobile in another (9-179-020 Exercise by H. Raiffa).

The Harvard Business School catalog can be accessed via Internet as follows: telnet to HBSCAT.HARVARD.EDU, log in as "GOHPHER," and enter "#HBSCAT#" (in capital letters!) as your password. Alternatively, if you are connected to a gopher server, you can access the catalog by paging through Northamerica, USA, Massachusetts. The catalog can be searched by keywords (I used 'exercise' to pull out the above).

List of References

Beck, John H. "An Experimental Test of Preferences for the Distribution of Income." Classroom Expernomics. Vol. 1, No. 1 (Spring 1992), pp. 2-3.

Brock, John R. "Experimental Derivation of a Demand Curve." Classroom Expernomics. Vol. 1, No. 2 (Fall 1992), pp. 3-4.

DeYoung, Robert. "Market Experiments: The Laboratory versus the Classroom." Journal of Economic Education, Vol. 34, No. 4 (Fall 1993), pp. 335-351.

Fels, Rendig. "This Is What I Do, and I Like It," Journal of Economic Education, Vol. 34, No. 4 (Fall 1993), pp. 365-370.

Fried, Harold O. and Daniel Levy. "Beans as a Medium of Exchange." Classroom Expernomics. Vol. 1, No. 1 (Spring 1992), p. 4.

Gillette, David. "Bond Markets in Money and Banking." Classroom Expernomics. Vol. 2, No. 1 (Spring 1993), p. 2.

Gillette, David and Robert delMas. "Psycho-Economics: Studies in Decision-Making." Classroom Expernomics. Vol. 1, No. 2 (Fall 1992), pp. 5-6.

Grimes, Paul and Margaret Ray. "Economics: Microcomputers in the College Classroom: A Review of the Academic Literature." Paper presented at the Allied Social Science Association Annual Meetings, Anaheim, CA, January 1993.

Journal of Economic Education. Special Issue "Classroom Experimental Economics." Vol. 24, No. 4 (Fall 1993).

Hemenway, David, Robert Moore, and James Whitney. "The Oligopoly Game." Economic Inquiry Vol. 25 (October 1987), pp. 727-730.

Hoaas, David J. and Lori R. Drouillard. "Variations on the Public Goods Experiment." Classroom Expernomics. Vol. 2, No. 1 (Spring 1993), pp. 3-6.

Keating, Barry and James Grace. "The Walrasian Simulator." Mimeo. Notre Dame, IN: College of Business Administration, University of Notre Dame, 1993.

Leuthold, Jane H. "A Free Rider Experiment for the Large Class." Journal of Economic Education Vol. 24, No. 4 (Fall 1993), pp. 353-363.

Nelson, Paul S. and Paul W. Grimes. "Supply and Demand Analysis: Using Markets Created in the Classroom." Journal of Education for Business Vol. 66, No. 6 (July/August 1991), pp. 370-373.

Neral, John. "Widget Production in the Classroom." Classroom Expernomics. Vol. 2, No. 1 (Spring 1993), pp. 7-8.

Nugent, Rachel. "A Pollution Rights Trading Game." Classroom Expernomics. Vol. 2, No. 2 (Fall 1993), pp. 3-5.

Peterson, Norris A. "A Rational Expectations Experiment." Journal of Economic Education Vol. 21, No. 1 (Winter 1990), pp. 73-78.

Ray, Margaret. "Oligopoly and Interdependence in the Classroom." Classroom Expernomics. Vol. 2, No. 2 (Fall 1993), pp. 1-2.

Sulock, Joseph M. "The Free Rider and Voting Paradox 'Games'." Journal of Economic Education Vol. 21, No. 1 (Winter 1990), pp. 65-69.

Weidenaar, Dennis. "A Classroom Experiment Demonstrating the Generation of a Market Demand Function and the Determination of Equilibrium Price." The Journal of Economic Education Vol. ?, No. ? (Spring 1972), pp. 94-100.

Williams, Robert B. "Market Exchange and Wealth Distribution: A Classroom Simulation." Journal of Economic Education Vol. 24, No. 4 (Fall 1993), pp. 325-334.